# PM1500
# Detailed Service Manual

Mobile Radio

MOTOROLA





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# PM1500

**VHF/UHF Range 1**
**Mobile Radio**

# Detailed Service Manual

Motorola, Inc.
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# Foreword

The information contained in this manual relates to all PM1500 VHF/UHF Range 1 mobile radios. This manual provides sufficient information to enable qualified service technicians to troubleshoot and repair PM1500 radios to the component level.

For details on radio operation or basic troubleshooting, refer to the applicable manuals available separately. A list of related publications is provided in the section, “Related Publications,” on page xix.

## Product Safety and RF Exposure Compliance




**Before using this product, read the operating instructions for safe usage contained in the Product Safety and RF Exposure booklet enclosed with your radio.**

**ATTENTION!**

**This radio is restricted to occupational use only to satisfy FCC RF energy exposure requirements. Before using this product, read the RF energy awareness information and operating instructions in the Product Safety and RF Exposure booklet enclosed with your radio (Motorola Publication part number 6881095C99) to ensure compliance with RF energy exposure limits.**

**For a list of Motorola-approved antennas, batteries, and other accessories, visit the following web site which lists approved accessories: http://www.motorola.com/governmentandenterprise/**

## Manual Revisions

Changes which occur after this manual is printed are described in FMRs/PMRs (Field/Publication Manual Revisions). These FMRs/PMRs provide complete replacement pages for all added, changed, and deleted items, including pertinent parts list data, schematics, and component layout diagrams. To obtain FMRs/PMRs, contact the Radio Products and Services Division (refer to “Appendix A Replacement Parts Ordering").

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## Related Publications

PM1500 Mobile Radio User's Guide....6871239L01
PM1500 Mobile Radio Installation Manual....6871240L01
PM1500 VHF/UHF Range 1 Mobile Radio Basic Service Manual....6871241L01
PM1500 Mobile Radio User's CD....PMLN4981_

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# Notes

# Chapter 1 Introduction

## 1.1 Notations Used in This Manual

Throughout the text in this publication, you will notice the use of warnings, cautions, and notes. These notations are used to emphasize that safety hazards exist, and care must be taken and observed.

**NOTE:** The Note notation indicates an operational procedure, practice, or condition that is essential to emphasize.




CAUTION indicates a potentially hazardous situation which, if not avoided, might result in equipment damage.




**WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or injury.**




**DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or injury.**

## 1.2 General

This manual includes all the information necessary to maintain peak product performance and maximum working time. This detailed level of service (component-level) is typical of some service centers, self-maintained customers, and distributors.

Use this manual in conjunction with the *PM1500 VHF/UHF Range 1 Mobile Radio Basic Service Manual* (Motorola part number 6871241L01), which helps in troubleshooting a problem to a particular board.

Conduct the basic performance checks first to verify the need to analyze the radio and help pinpoint the functional problem area. In addition, you will become familiar with the radio test mode of operation which is a helpful tool. If any basic receiver or transmitter parameters fail to be met, the radio should be aligned using the radio alignment procedure described in the *PM1500 VHF/UHF Range 1 Mobile Radio Basic Service Manual*.

Included in other areas of this manual are functional block diagrams, detailed theory of operation, troubleshooting charts and waveforms, schematics, and parts list. You should be familiar with these sections to aid in deducing the problem circuit. Also included are component location diagrams to aid in locating individual circuit components, as well as IC diagrams, which identify some convenient probe points.

The Theory of Operation section of this manual contains detailed descriptions of operations of many circuits. Once you locate the problem area, review the Troubleshooting Chart for that circuit to fix the problem.

# Chapter 2 Product Overview

## 2.1 Introduction

The PM1500 radio is a conventional and microcontroller-based transceiver incorporating a Digital Signal Processor (DSP). The microcontroller handles the general radio control, monitors status, and processes commands input from the keypad or other user controls. The DSP processes the typical analog signals and generates the standard signaling digitally to provide compatibility with existing analog systems. In addition it provides for digital modulation techniques utilizing voice encoding techniques with error correction schemes to provide the user with enhanced range and audio quality all in a reduced bandwidth channel requirement. It allows embedded signaling which can mix system information and data with digital voice to add the capability of supporting a multitude of system features.

The PM1500 radios are wideband, synthesized, fixed-tuned radios and are available in the VHF (136–174 MHz), UHF Range 1 (380–470 MHz). All PM1500 radios are capable of analog operation (12.5 kHz and 25 kHz bandwidths).

**NOTE:** The UHF radio does not support 20 kHz bandwidth.

## 2.2 Functional Blocks

The PM1500 radios contain the following functional blocks:

- Control-Head Assembly—divided into three main sections, the controller (applications processor, RAM and FLASH), power management (Power Control Processor, and Voltage Regulators) and user interface (GCAI Accessory Connector, Keypad, STN Display, Volume and Frequency Knob) section connected remotely by the interconnect board and control cable.
- Radio Power Distribution—contains voltage-regulation circuitry for power distribution throughout the radio.
- Receiver Front-End section—contains the preselector, low-noise amplifier (LNA), and mixer.
- Receiver Back-End section—contains the receiver intermediate-frequency (IF) amplifier/filter and the digital receiver back-end integrated circuit (IC).
- Transmitter section—contains the antenna switch, directional coupler/ detector, and power amplifier circuitry.
- Frequency Generation section—contains the synthesizer, voltage controlled oscillators (VCOs), reference oscillator, and receive and transmit buffers.
- Controller section—combines a vocoder and a controller into a single section containing the following elements:

# 2.3 Control-Head Assembly

This section discusses the basic operation and components of each control-head assembly.

## 2.3.1 Controller

The controller consists of three main components, namely the OMAP Applications Processor, Flash and SDRAM. The Applications Processor is the main controller of the control head. Its main function is to receive inputs from the user and relays the command to the transceiver microprocessor for processing via Serial Synchronous Interface (SSI) link. The Applications Processor will relay back any information from the transceiver microprocessor to the user through the Liquid Crystal Display (LCD). The control head is equipped with an 8MB SDRAM and a 8MB Flash memory for storing and executing commands.

## 2.3.2 Power Management (Power Control Microcontroller and Voltage Regulators)

### 2.3.2.1 Power Control Microcontroller

ATTiny 2313 microcontroller is employed to control the power state of the radio. The power state of the radio will always follow the VOLUME/ON/OFF knob selection. Using the Customer Programming Software (CPS), the radio can be set to optionally disable or enable the radio via sensing the ignition, provided 'ON' press to momentary ON/OFF switch. Moreover, the CPS can also allow emergency footswitch to power up the radio into emergency mode without the VOLUME/ON/OFF having ON press.

### 2.3.2.2 Voltage Regulators

The control head utilizes seven different voltage levels to operate correctly, namely 13.4V, 5V, 3.3V, 3.25V, 2.8V, 1.88V and 1.55V. There are a total of three main regulator ICs to provide the needed voltages.

13.8V on the main A+ line is fed through to a low power linear regulator to obtain 3.25V. This regulator will remain powered at all times to power the ATTiny 2313 microcontroller and other logic ICs of the power control circuitry.

When the radio is in the ON state, the A+ is stepped down to 5V through a switching regulator, being the main power source supplying the standard USB 5V and power management IC for the applications processor. The power management IC provides the necessary reset and voltage sequencing to start the processor correctly. The power management IC supplies the rest of the circuits with 1.55V, 1.88V, 2.8V and 3.3V.

Moreover, 13.4V (A+) is fed to a MOSFET to supply 13.4V back to the transceiver power circuitry as a sense line to turn ON or OFF the transceiver.

## 2.3.3 User Interface (Keypad, STN Display, Volume and Frequency Knob) section

### 2.3.3.1 Display

The control head assembly utilizes a Super Twisted Nematic (STN) Liquid Crystal Display (LCD) with a dot-matrix resolution of 131x 53 pixels. The LCD is configured to display a row of eight alphanumeric characters, eight soft icons and four soft menu keys. The LCD is controlled by the applications processor through eight parallel LCD interface lines and operates off a 2.8V supply.

The trans reflective module comes with four yellow LEDs for backlighting and is capable of three steps dimming together with the backlight LEDs, namely OFF, Low and High, driven by SW_B+ at 13.4V.

### 2.3.3.2 Keypad, Volume and Frequency Knob

The control head assembly processes all menu button inputs and visual indicators through the application processor. The buttons are programmable to allow different modes of operation through the CPS. All buttons are backlit to allow operation in low light.

The volume knob allows a linear step of the volume and integrates the on/off function.

### 2.3.3.3 Status LEDs

Three LEDs (Green, Yellow, Red) are driven by the applications processor through the toggling of three transistors. The biasing voltage level is 2.8Vdc while the LEDs are driven by SW_B+ at 13.4V.

### 2.3.3.4 Backlight LEDs

The applications processor operates the backlight LEDs via two transistors controlling all the backlight LEDs, providing two different brightness levels by way of toggling the base of the transistors. The biasing voltage level is also 2.8Vdc while the LEDs are driven by SW_B+ at 13.4V. The dim feature can be activated via CPS.

## 2.3.4 Vehicle Interface Ports

The Vehicle Interface Ports (VIPs) allow the control head to activate external circuits and receive inputs from the outside world. In general, VIP outputs are used for relay control, and VIP inputs accept inputs from external switches. The VIP IN and VIP OUT lines move as the configuration changes from Dash, to Remote, to Remote plus DEK. See the cable kit section for typical connections of VIP input switches and VIP output relays.

J400 is located on the back of the control head assembly in the remote mount configuration. This connector provides the ability to utilize up to 3 VIP OUT, 3 VIP IN, the GND and SWB+ pins they require, or DEK signal lines. This connector has cable detection pins to allow the control head to determine which type of cable is being used, and therefore allow the control head to configure its pins appropriately for either VIP or DEK accessory interfacing. It is not recommend to fabricate this cable from scratch. The cable must be inserted prior to control head power-up. Please refer to the installation manual for ordering part numbers for either the VIP or DEK cable. Figure 2-1 illustrates the J400 connector while Table 2-1 describes the function of each pin.

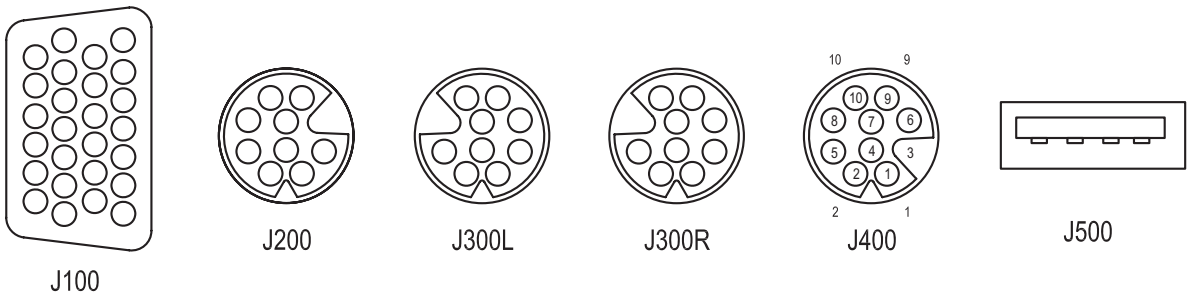



*Figure 2-1. J400 VIP and DEK Connector*

*Table 2-1. J400 VIP and DEK Connector Functionality*

| Pin | No cable | DEK cable | VIP cable | Future cable | Future cable |
|---|---|---|---|---|---|
| 1 | SWB+ | SWB+ | SWB+ | SWB+ | SWB+ |
| 2 | GND | GND | GND | GND | GND |
| 3 | no pin | no pin | no pin | no pin | no pin |
| 4 | Detect Pin 1 (Short to GND) | Detect Pin 1 (Short to GND) | Detect Pin 1 (Short to SWB+) | Detect Pin 1 (Short to GND) | Detect Pin 1 (Short to GND) |
| 5 | no pin | STROBE | VIP_OUT_1 | no pin | no pin |
| 6 | no pin | DATA-OUT | VIP_OUT_2 | no pin | no pin |
| 7 | no pin | CLOCK | VIP_OUT_3 | no pin | no pin |
| 8 | Detect Pin 2 (Short to GND) | Detect Pin 2 (Short to SWB+) | VIP_IN_1 | Detect Pin 2 (Short to GND) | Detect Pin 2 (Short to SWB+) |
| 9 | Detect Pin 3 (Short to GND) | Detect Pin 3 (Short to GND) | VIP_IN_2 | Detect Pin 3 (Short to SWB+) | Detect Pin 3 (Short to SWB+) |
| 10 | no pin | DATA-IN | VIP_IN_3 | no pin | no pin |

## 2.4 Receiver Section

This section discusses the receiver section components and basic operation for each band.

### 2.4.1 VHF Band Radios

The VHF (136–174 MHz) receiver consists of a front-end and a back-end sections.

#### 2.4.1.1 Front-End Section

The primary function of the receiver front-end is to optimize image rejection and selectivity while providing the first conversion. The front-end uses discreet filters and LNAs. The first filter reduces the IF spur, image frequency response and limits some of the out-of-band interference. The second filter following the second low-noise amplifier (LNA) provides additional image rejection and half IF spur.

The receiver front-end signal is fed to the monolithic mixer IC where it is down converted to an IF of 109.65 MHz. The mixer is driven by the receiver injection buffer that provides 20 dBm to the mixer. The VCO performs high side injection for the VHF band. The design maintains temperature stability, low insertion loss, and high out-of-band rejection.

#### 2.4.1.2 Back-End Section

The crystal filters provide IF selectivity and out-of-band signal protection to the back-end IC. Two 2-pole crystal filters centered at 109.65 MHz that are isolated from one another by a stable, high-gain low noise amplifier are used to meet the receiver specifications for gain, close-in intermodulation rejection, adjacent-channel selectivity, and second-image rejection.

The output of the IF circuit is fed directly to the Abacus III digital back-end IC. The ABACUS III is an IC with a variable-bandwidth bandpass Sigma-Delta architecture. It is capable of down-converting analog, as well as digital, RF protocols into a baseband signal transmitted on the Synchronous Serial Interface (SSI) bus. The ABACUS III IC converts the 109.65 MHz signal from the IF section down to 2.25 MHz using a second LO frequency of 107.4 MHz or 111.9 MHz. The second LO VCO is tuned to 107.4 MHz (low side), but can be modified to 75.6 MHz (high side injection) depends on known spurious interference related to the programmed received frequency.

### 2.4.2 UHF Range 1

The UHF Range 1 (380–470 MHz) receiver consists of a front-end section and a back-end section.

#### 2.4.2.1 Front-End Section

The receiver front-end consists of a switchable high pass filter and LNA, a preselector, a switchable attenuator, a second switchable low noise amplifier (always in for UHF Range 2), image filter, mixer, and injection amplifier. The preselector filter is varactor-tuned and is aligned at the factory. The radio tuner software can also be used to check and re-align the preselector. The switchable stage provides AGC capability.

The signal from the preselector is amplified by the low noise amplifier, then filtered by the image filter before it is sent to the mixer. The mixer uses the LO signal, amplified by the injection amplifier, to convert the RF signal to IF frequency of 109.65 MHz. This signal is then sent to the IF and back-end circuits.

#### 2.4.2.2 Intermediate Frequency and Back-End

The Intermediate Frequency (IF) consists of a crystal filter, amplifier, a second crystal filter, and a switchable attenuator. This provides selectivity at the IF while attenuating out-of-band signals and protecting the back-end (BE) IC.

The back-end is primarily the ABACUS III digital IC. The ABACUS III IC uses a variable-bandwidth bandpass sigma-delta architecture. It is capable of down-converting analog as well as digital RF protocols into a baseband signal, which is then transmitted over the Synchronous Serial Interface (SSI) bus to the DSP and microprocessor.

## 2.5 Transmitter Section

This section discusses the transmitter section components and basic operation for each band.

### 2.5.1 VHF Radios

The VHF (136–174 MHz) transmitter consists of an RF power amplifier (RFPA), output network (ON), and power control. See below for an overview of the transmitter sections.

### 2.5.2 UHF Range 1

The UHF Range 1 (380–470 MHz) transmitter consists of an RF power amplifier (RFPA), output network (ON), and power control.

#### 2.5.2.1 RFPA

The RFPA is a three-stage, discrete-LDMOS transistor amplifier consisting of the following stages: first, driver, and final.

The first stage acts as a variable-gain amplifier and feeds the driver stage, which, in turn, feeds the final stage. All of the stages are matched using transmission lines, capacitors, and inductors. Stage drain biases are supplied via A+ or K9.1V and DRV_9.3V (DRV_9.3V is present for UHF Range 1 and UHF Range 2 only). Stage gate biases are supplied via a digital-to-analog converter (DAC) or the RFPA control voltage.

#### 2.5.2.2 Output Network

The output network (ON) consists on the antenna switch, harmonic filter, and power detector. The antenna switch operates in two modes: RX and TX.

In TX mode, the RFPA final stage is connected to the antenna through the harmonic filter and power detector and is isolated from the RX path.

In RX mode, the antenna is connected to the RX front-end through the power detector and the harmonic filter and is isolated from the TX path. The harmonic filter attenuates harmonics generated by the RFPA when the antenna switch is in TX mode and provides extra selectivity in RX mode.

The power detector senses forward and reverse power and generates a detected voltage proportional to each.

#### 2.5.2.3 Power Control

The forward-power and reverse-power detected voltage is fed back to the power control section where it is added to a DAC voltage determined via power tuning and compared to a reference voltage. A control loop corrects the control voltage adjusting the first stage gain to maintain the reference.

#### 2.5.2.4 Circuit Protection

Final-stage current and temperature as well as radio A+ voltage and RFPA control voltage are sensed. If a fault condition is determined, power is cut back to a level that is safe for the particular conditions.

## 2.6 Frequency Generation Unit

This section discusses the frequency generation unit (FGU) components and basic operation for each band.

### 2.6.1 VHF MHz Radios

The VHF (136-174 MHz) frequency generation unit consists of the following:

- Low-voltage fractional-N synthesizer IC
- 16.8 MHz reference oscillator IC
- Two receiver (RX) voltage-controlled oscillators (VCOs)
- Two transmitter (TX) voltage-controlled oscillators (VCOs)
- VCO buffer/amplifier circuits
- Associated circuitry

The reference oscillator IC provides a frequency standard to the Fractional-N synthesizer IC, the ABACUS III digital back-end IC, and the controller section. The synthesizer turns on one of the four VCOs (determined by mode and band of operation) and tunes it to the receiver (RX) local oscillator (LO) or transmitter (TX) carrier frequency.

All four voltage-controlled oscillators (VCOs) employ a discrete Colpitts configuration with a N-channel J-FET transistor. The VCOs tank consists of a varactor diode, coupling capacitor, and a resonator. The varactor changes the oscillator frequency when the DC voltage of the steering line changes. The output of the VCOs is coupled to the second transistor for impedance buffering, and its output is coupled to respective TX/RX buffer amplifiers.

In TX mode, the transmitter VCO output is coupled to a three-stage buffer before being injected into the power amplifier. In RX mode, the receiver VCO output is buffered and amplified with a two-stages. The output of the second-stage transistor is split into two paths. One path feeds back to the synthesizer prescaler; the other path is injected into the third-stage. The output of the third-stage provides the proper signal level for the LO port of the RX front-end mixer.

The superfilter supplies the voltage to the first two stages of the TX buffer and to the first two stages transistor of the RX buffer/amplifier. The voltage for the third stage of the TX buffer is supplied by a keyed 9.1 V source to conserve current drain while the radio is receiving. The third-stage of the RX buffer/amplifier is supplied by a 9.3 V regulator.

### 2.6.2 UHF Range 1 Radios

The UHF Range 1 (380–470 MHz) frequency generation unit consists of the following:

- Low-voltage fractional-N synthesizer IC
- 16.8 MHz reference oscillator IC
- Three receive voltage-controlled oscillators (VCO)
- Two transmit VCOs
- VCO buffer/amplifier circuits
- Associated circuitry

The reference oscillator IC provides a frequency standard to the fractional-N synthesizer IC, the ABACUS III digital back-end IC, and the controller section. The synthesizer turns on one of the four VCOs (determined by mode and band of operation) and tunes it to the receiver (RX) local oscillator (LO) or transmitter (TX) carrier frequency.

The voltage-controlled oscillator (VCO) module employs a Colpitts configuration with two bipolar stages in a common-base, common-collector configuration. The LC tank circuit's capacitive portion consists of a varactor diode, coupling capacitor, and a laser-trimmed capacitor for frequency adjustment. The inductive portion consists of microstrip transmission line resonators for TX VCO and coaxial resonators for RX VCO. Tuning is performed by the module manufacturer and is not field adjustable. The varactor changes the oscillator frequency when the DC voltage of the steering line changes. The output of the common base is coupled to the second transistor for impedance buffering, and its output is coupled to respective TX/RX buffer amplifiers.

In TX mode, the transmitter VCO output is coupled to a three-stage buffer before being injected into the power amplifier. In RX mode, the receiver VCO output is buffered and amplified with a two-stage transistor/microwave monolithic IC (MMIC) circuit. The output of the first-stage transistor is split into two paths. One path feeds back to the synthesizer prescaler; the other path is injected into the second-stage MMIC. The output of the MMIC provides the proper signal level for the LO port of the RX front-end mixer.

The superfilter supplies the voltage to the first two stages of the TX buffer and to the first-stage transistor of the RX buffer/amplifier. The voltage for the third stage of the TX buffer is supplied by a keyed 9.1 V source to conserve current drain while the radio is receiving. The second-stage MMIC of the RX buffer/amplifier is supplied by a 9.3 V regulator.

# 2.7 Controller Section

This section provides an explanation of radio operating modes and an overview of the controller section components and circuits.

## 2.7.1 Analog Mode of Operation

When the radio is receiving, the signal comes from the antenna/antenna-switch to the front-end receiver. The signal is then filtered, amplified, and mixed with the first local-oscillator signal generated by the voltage-controlled oscillator (VCO). The resulting intermediate frequency (IF) signal is fed to the IF circuitry, where it is again filtered and amplified. This amplified signal is passed to the digital back-end IC, where it is mixed with the second local oscillator to create the second IF at 2.25 MHz. The analog IF is processed by an analog-to-digital (A/D) converter inside the digital back-end IC where it is converted to a digital bit stream and divided down to a baseband signal, producing digital samples. These samples are converted to TTL logic signals and sent to the DSP. The DSP digitally filters and discriminates the signal, decodes the information in the signal, and identifies the appropriate destination for it. For a voice signal, the DSP will route the digital voice data to the coder/decoder (CODEC) for conversion to an analog signal. The CODEC will then present the signal to the audio power amplifier, which drives the speaker. For signalling information, the DSP will decode the message and pass it to the microcomputer.

When the radio is transmitting, microphone audio is passed to an adjustable gain circuit, then to the CODEC where the signal is digitized. The CODEC passes digital data to the DSP where pre-emphasis and low-pass (splatter) filtering are done. The DSP sends this signal to the modulation digital-to-analog (D/A) converter where it is reconverted into an analog signal and scaled for application to the voltage-controlled oscillator as a modulation signal. Transmitted signalling information is accepted by the DSP from the microcomputer, coded appropriately, and passed to the modulation D/A converter, which handles it the same as a voice signal. Modulation information is passed to the synthesizer along the modulation line. A modulated carrier is provided to the power amplifier (PA), which transmits the signal under dynamic power control.

## 2.7.2 Controller Section Circuitry

The controller section consists of the following:

- Voltage regulators
- Data connectivity circuitry (RS-232, USB, and SB9600)
- Daughtercard module, which contains the:
  - Patriot microprocessor IC
  - 64-Mbit (8MB) FLASH IC
  - 8-Mbit (1MB) SRAM IC
- Modulation D/A conversion circuitry
- CODEC audio circuitry
- TX power-control circuitry
- Emergency circuitry
- V.I.P input/output paths
- Secure interconnect board interface

- Front connector interface for control heads and remote-mount interconnect boards (I.B)
- Rear connector for additional accessories
- DC power-in plug

The controller section controls receive/transmit frequencies, the display, and various radio functions using either direct logic control or serial communication to external devices. The connector J0701 provides interface between the encryption module and the controller for encrypting voice messages.

Connector J0402 provides the accessory interface to the outside rear connector while connector J0401 provides the control-head interface.

The controller section executes a stored program located in the FLASH ROM. Data is transferred to and from memory via an RS-232 interface on the microprocessor. The memory location from which data is read, or to which data is written, is selected by the address lines. Besides the host and DSP code, the customer-specific programming features (codeplug) and tuning parameters also are stored in the FLASH ROM. The SRAM is used as scratchpad memory for the microprocessor.

The controller section is powered by SW_B+ coming from the control head, which is regulated down to a 5 V supply. This supply powers the entire controller section and its regulators. The SW_B+ supply is removed from the board when the radio is turned off by the control-head switch.

The microprocessor is powered by a 1.55-V regulator for the microprocessor core and a 2.85-V regulator for the I/O and control lines, while the memory is powered by a 1.85-V regulator. The 2.85-V regulator also supplies almost all of the discrete controller circuitry. These three regulators are all supplied by a switched 5-V regulator, which also provides power for the SB9600 data bus and for interface to certain legacy data and control signals.

The DSP section of microprocessor performs signaling, voice encoding/decoding, audio filtering, microphone gain and tuning, Private-Line/Digital Private Line (PL/DPL) encode, and alert-tone generation. It processes all baseband audio signals, providing pre-emphasis and signaling/filtering of the digital microphone audio data, as well as other transmitted signals. It also performs de-emphasis and decoding of received digital speaker audio and other received signals. The DSP clock frequency is derived from the 16.8 MHz reference oscillator clock input using a phase-locked loop (PLL) inside the Patriot IC. The digital audio bus on the Patriot IC uses an 8 kHz clock, which provides the sampling rate, and a 512 kHz clock, which provides the data rate.

The CODEC performs analog-to-digital and digital-to-analog conversions on audio signals. The DSP controls squelch, deviation, and compensation, and it executes receiver filtering and discrimination.

The interface to the RX back-end IC (ABACUS III IC) consists of a single logic-level data line, a 1.2 MHz clock line (the discriminator data bit rate) and a 20 kHz frame-sync line (the discriminator data sample rate). These clocks are generated by the ABACUS III IC and provided to the Patriot IC.

The interface to the TX modulation/DAC consists of a single logic-level data line, a 2.4 MHz clock line (the modulation data bit rate), and a 48 kHz clock line (the modulation data sample rate). These clocks are generated by the Urchin IC and provided to the Patriot IC.

Other functions provided by the controller include SB9600 communication, IC programming, and TX power control. The SB9600 bus is used to communicate to legacy control heads and accessories. IC programming is performed via the SPI bus for ICs including the ABACUS III, LV Frac-N, A/D, D/A, and volume attenuator. The power-control circuitry receives power set and limit inputs from the D/A IC and feedback from the RF power amplifier (RFPA). Based on these inputs, the circuit produces a control voltage to maintain a fixed RF power level to the antenna.

The controller also provides detection of the On/Off and reset inputs. The reset circuits consist of the regulator power-on reset circuit, low SW_B+ voltage-detector circuit, an ignition detection circuit, an emergency detection circuit, and the external-bus system reset. The reset circuits allow the microcomputer to recover from an unstable situation; for example, no battery on the radio, battery voltage too high or too low, and remote devices on the external bus not communicating. Communication using RS-232 protocol is provided to the rear accessory connector (J2).

# Chapter 3 Theory of Operation

## 3.1 Control Head Board

This section provides a detailed circuit description of the PM1500 radio control head board for VHF/UHF Range 1 models. The control head board contains the following major sections:

- Controller (page 3-2)
- Power Management (page 3-3)
- User Interface (page 3-7)
- GCAI Accessory Interface (page 3-7)

When reading the theory of operation, refer to your appropriate schematic and component location diagrams located in "Chapter 7. Schematics, Component Location Diagrams, and Parts Lists". This detailed Theory of Operation will help isolate the problem. However, first use the *PM1500 VHF/UHF Range 1 Mobile Radio Basic Service Manual* (6871241L01-A) to troubleshoot the problem to a particular board.

## 3.2 Control Head Board Major Sections

This section contains the control head board layouts for PM1500.

The illustrations (Figure 3-1 on page 3-1 to Figure 3-2 on page 3-2) identify the location of the major sections of the control head board.

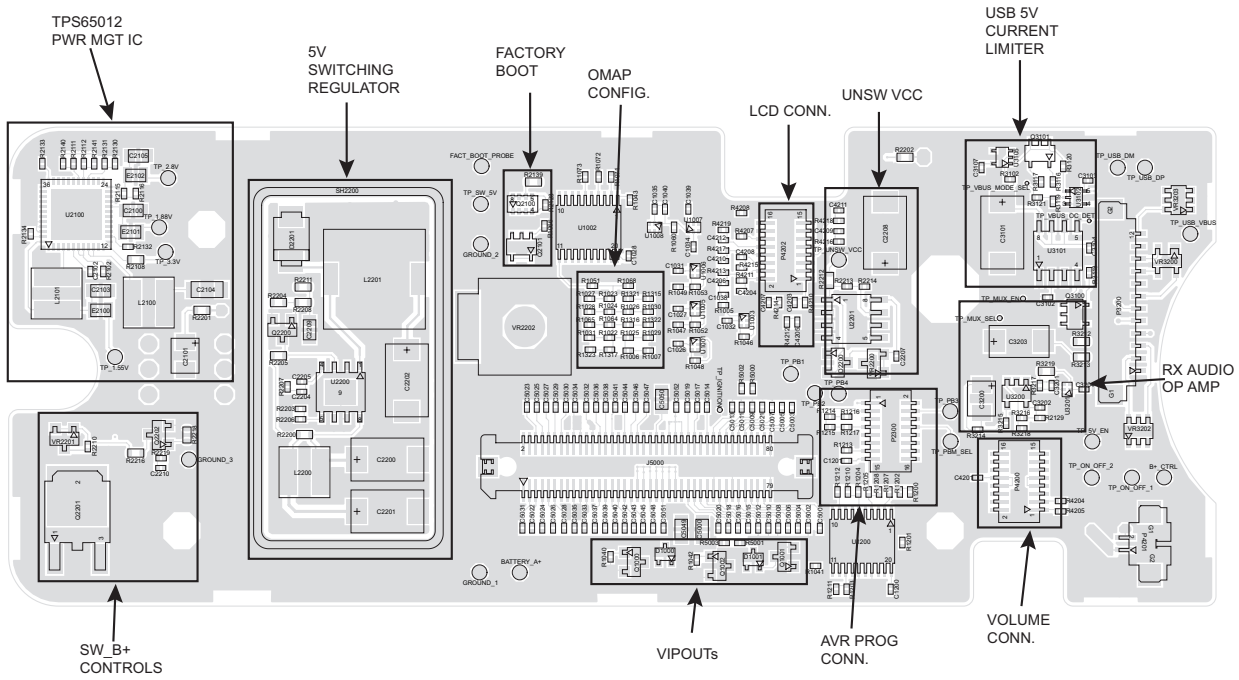



*Figure 3-1. PM1500 Control Head Board Sections — Side 1*

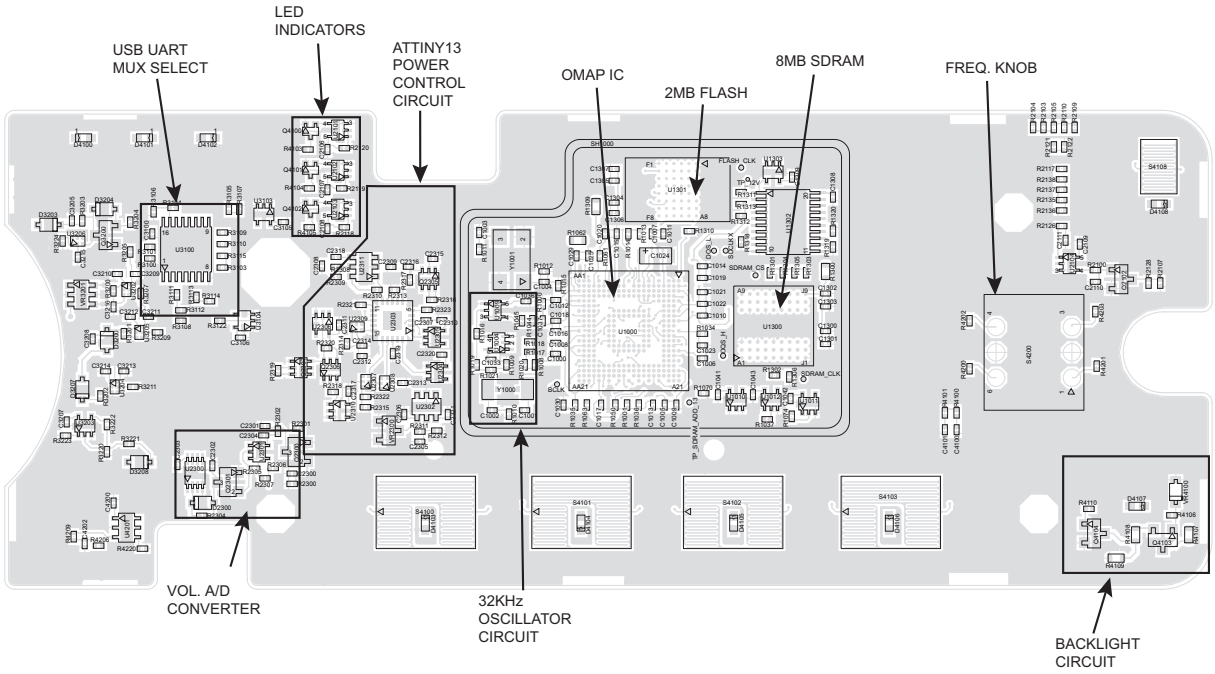



*Figure 3-2. PM1500 Control Head Board Sections — Side 2*

## 3.3 Controller Section

The controller consists of a digital logic comprising of an applications processor, the OMAP330 IC, (U1000) and memory consisting of a 4M x 16 SDRAM (U1300) and a 8Mb Flash ROM (U1301). The applications processor runs on the ARM 9 technology and is capable of processing speeds up to 200 MHz. The Flash ROM contains the programs the OMAP processor executes and is used to store error logs as well for smooth operation of the radio. The programs allows the both the software in the control head and firmware in the transceiver to be reprogrammed for future software upgrades or feature enhancements. The SDRAM is used for scratchpad memory during program execution.

The OMAP processor interacts with all the peripherals in the control head as well as maintaining constant communications with the transceiver microprocessor using Serial Synchronous Interface (SSI). Linkage between all the peripherals in the control head is done through the use of Serial Peripheral Interface (SPI), I2C, Special optimiSed Screen Interface (SoSSi) for LCD Driver, and General Purpose Input-Output (GPIO). Devices that interfaces with OMAP through these lines includes the Frequency Pot, A/D converter for volume control, ATMEL ATTiny2313 for power control functions, TPS65012 (U2100) for OMAP Power Management Control and the Solomon SSD LCD Driver.

Input from the user through the GCAI Accessory Interface, Keypad presses; Volume and Frequency knobs are received by the OMAP processor and sent back to the transceiver PATRIOT microprocessor for the processing. The information would be relayed back to the user through the LCD Display.

The ARM core of the processor requires two clocks for proper operation. A 12 MHz crystal (Y1001) is provided at pin Y2 and pin W3 of OMAP IC. The processor has the capability of running at higher clock rates, which are programmable and based on the 12 MHz reference.

The OMAP IC also requires a 32.768 kHz square-wave clock, provided at the P13 pin. This clock is generated by a 32.768 kHz crystal (Y1000), with supporting circuitry for oscillation. This clock is utilized only for the OMAP IC, and is used for reset capability and other OMAP IC functions. Note that the rise/fall time of this clock is optimum at 20ns or less.

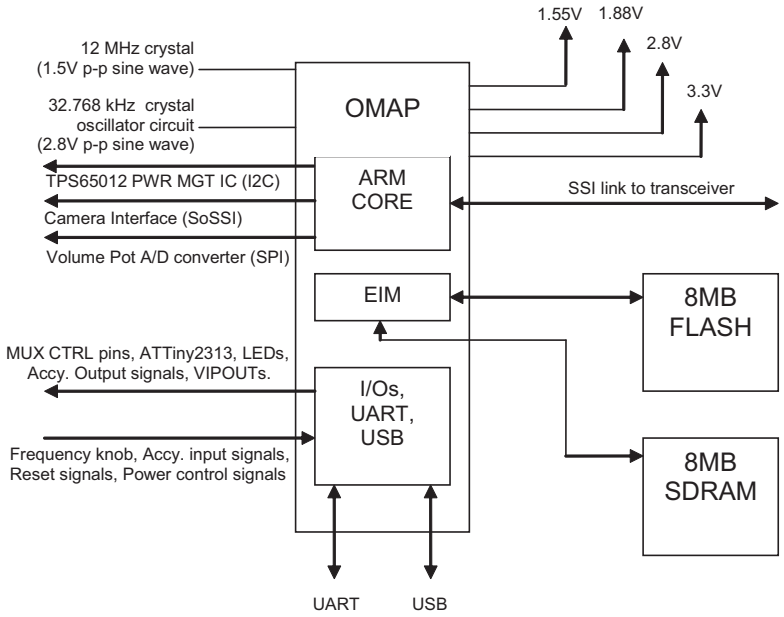



*Figure 3-3. Control Head Controller Block*

**NOTE:** The controller section (OMAP, Flash and SDRAM) are highly susceptible to ESD and moisture damage. Extreme care is advised when handling or servicing the control head board.

## 3.4 Power Management

PM1500 utilizes a smart power control system in which the 8-bit ATTiny2313 microcontroller (U2303) processes all the power up, power down, and resets of the radio. A series of commands is issued from the Patriot IC to the ATTiny2313 through BUS_PWR_OUT while the OMAP IC does that through B+_CTRL. All resets and radio power up/down is then outputted from the ATTiny2313 through 5V_EN.

The sub-sections to follow will describe in detail the power management design of the radio.

### 3.4.1 Power Distribution

The control head houses 7 different power levels for smooth operation of the complex system of PM1500. They are A+ & SW_B+ at 13.4V (nominal battery terminal voltage), UNSW_VCC (3.25V), SW_5V (5.0V), 1.55V, 1.88V, 2.8V and 3.3V.

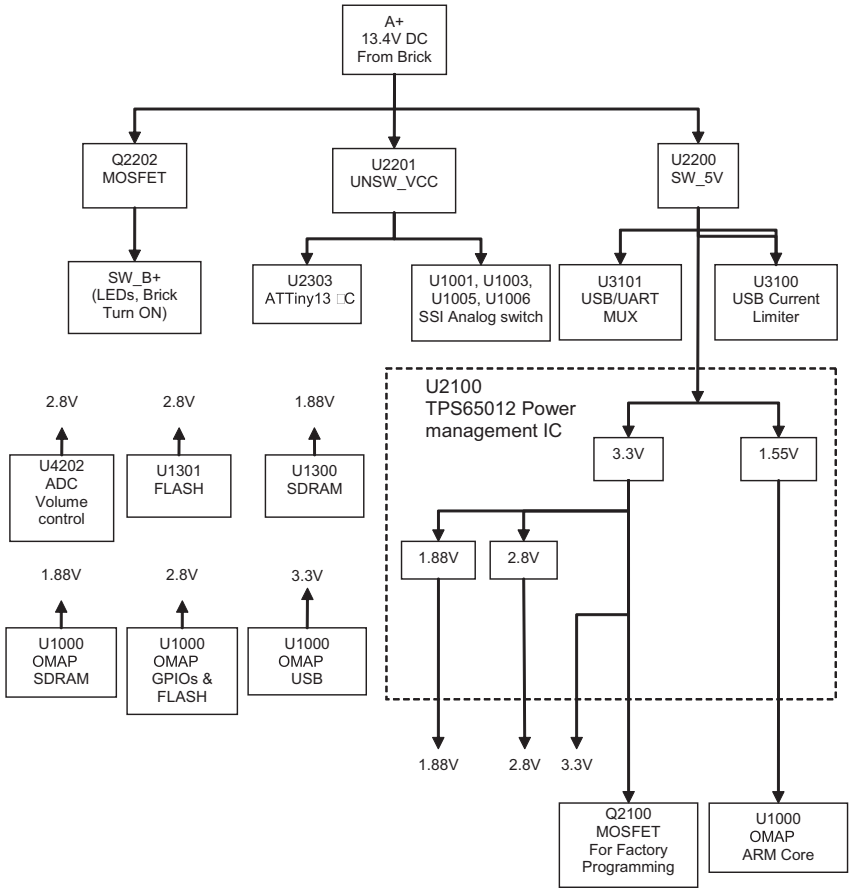



*Figure 3-4. Control Head Power Distribution*

The control head receives the main supply from A+ that comes from the brick, which is generally about 13.4V (nominal battery terminal voltage). A+ is stepped down to UNSW_VCC through a low power linear regulator IC (U2201). UNSW_VCC remains ON all the time even when the radio is in the OFF state, mainly supplying to U2303 microcontroller and other logic gates that are essential to the overall power control when the radio is OFF.

When the radio powers ON, A+ will be stepped down to 5V through the Switching Regulator IC (U2200). Both USB host and TPS65012 Power Management IC (U2100) utilize the 5V supply.

U2100 is a specific IC made for OMAP IC, consisting of two switching regulators with hardware selectable default output of 1.55V and 3.3V, and two linear regulators with default output voltage of 1.88V and one adjustable output configured to 2.8V. Input for the internal linear regulators is taken from the 3.3V supply. Furthermore, U2100 also contains GPIOs that is controllable via I2C communication with OMAP IC.

The 1.55V ensures smooth operation of OMAP's ARM core. 3.3V supplies OMAP's internal USB module and its supporting circuitry. The 1.88V supplies the 8MB SDRAM (U1300) and OMAP's SDRAM associated data, address and control lines. 2.8V is the most widely used voltage in the control head and it supplies to OMAP's GPIOs, configuration resistors and all other parts of the control head.

Please refer to "Chapter 7. Schematics, Component Location Diagrams, and Parts Lists", for detailed circuitry and power distribution information and the various voltages used by the ICs on the main board are shown in Table 3-1.

*Table 3-1. Integrated Circuits Voltages*

| Integrated Circuit | A+ | UNSW_VCC (3.25V) | SW_5V | 1.55 V | 3.3 V | 2.8 V | 1.88 V |
|---|---|---|---|---|---|---|---|
| OMAP IC | | | | U1000 | U1000 | U1000 | U1000 |
| Unbuffered inverter for 32 kHz clock | | | | | | U1004 | |
| Schmidt trigger for 32 kHz clock | | | | | | U1009 | |
| Buffer array for isolation from Unswitched supplies to OMAP | | | | | | U1002 | |
| SSI line analog switches | | U1001<br>U1003<br>U1005<br>U1007 | | | | | |
| 8MB SDRAM | | | | | | | U1300 |
| 8MB Flash | | | | | | U1301 | |
| TPS65012 PWR MGT IC | | | U2100 | | | | |
| Indicator LEDs NAND Gates | | | | | | U2101<br>U2102<br>U2103 | |
| USB Enable MOSFET | | | | | Q2100 | | |
| UNSW_VCC Linear Voltage Regulator | U2201 | | | | | | |
| SW_5V Switching Voltage Regulator | U2200 | | | | | | |
| ATTiny2313 Microcontroller | | U2302 | | | | | |
| USB / UART MUX IC | | | U3100 | | | | |
| USB Current Limiter IC | | | U3101 | | | | |
| Volume Knob ADC IC | | | | | | U4201 | |
| All LEDs | D4100<br>D4101<br>D4102<br>D4103<br>D4104<br>D4105<br>D4106<br>D4107<br>D4108 | | | | | | |

### 3.4.2 Power Up / Power Down Sequence

Powering up the radio can be initiated by creating 'ON' push to ON/OFF switch or an ON command from the Patriot IC through BUS_PWR_OUT line. These actions will trigger the ATTiny2313 microcontroller to start the power up sequence by asserting the 5V_EN. Once 5V_EN is high, the U2200 will turn ON and MOSFET Q2202 that will turn ON the transceiver via SW_B+.

Supply from 5V will power up Power Management IC U2100 which has its own defined sequencing for its 4 output voltages. The 1.55V supply will start to ramp and once the peak is reached the other voltages (3.3V, 1.88V and 2.8V) will start. The reset lines, POR and MPU_RESET from the U2200 will remain low for 1 second to hold OMAP in the reset mode the moment 5V is applied to U2100. Once the Reset lines are asserted high, the OMAP IC will start and software will commence. The OMAP will send a 1ms low true signal to the ATTiny2313 through line B+_CTRL to indicate OMAP's software has started so as to cancel a reset pulse from ATTiny2313. The assumption is that if OMAP IC failed to start within 8 seconds from the assertion of 5V_EN, ATTiny2313 will force a reset on the system.

For powering down, the trigger would begin by creating 'OFF' push to ON/OFF switch or an OFF command from Patriot IC through BUS_PWR_OUT. ATTiny2313 microcontroller and OMAP IC's ON_OFF_SENSE will be triggered to initiate the shutdown sequence. ATTiny2313 microcontroller would de-assert 5V_EN which would turn OFF the 5V Regulator IC (U2200) and turns OFF MOSFET Q2202 in which SW_B+ will drop and initiate a shutdown of the transceiver section.

### 3.4.3 Reset Circuits

A reset will occur when OMAP IC or Patriot IC sends a reset command to the ATTiny2313 microcontroller through B+_CTRL or BUS_PWR_OUT respectively. To reset, ATTiny2313 microcontroller will drop 5V_EN low for 2 seconds, in which the whole radio system will reset.

When 5V_EN is dropped, POR will be high, 5V switching regulator (U2200) will go off and SW_B+ will be low. When 5V_EN is back to high after 2 seconds, the whole system will power up again.

### 3.4.4 ATTiny2313 Microcontroller Programming

As with all microcontrollers, software resides in the ATTiny2313 microcontroller. If upgrade is necessary, programming can be accomplished through the use of a specially made ATTiny2313 Flex cable.

The flex is to be connected to P2300 and at ALL TIMES the volume knob must be in the OFF position. ATMEL's AVRISP programming kit is to be attached on the other end of the flex. A+ must be supplied to the control head for UNSW_VCC in order to power the AVRISP and ATTiny2313 microcontroller.

For a list of programming kits needed, please refer to Table 3-2.

*Table 3-2. ATTiny2313 Programming Kit*

| Part Number | Description | Application |
|---|---|---|
| 8416228H01 (Motorola Part Number) | AVR ATTiny2313 Programming Flex | To be used with PM1500 control head to reprogram the ATTiny2313. |
| ATAVRISP (ATMEL Part Number) | AVR ISP Programmer | Device used to program ATMEL range of ATTiny Microcontrollers. |

## 3.5 User Interface

The User Interface consists of 2 main sections, the LCD display as well as user activated menu buttons and frequency and volume knob.

### 3.5.1 LCD Display

The LCD of PM1500 provides 1 line / 8 alphanumeric characters with 1 upper row of 8 soft icons and 4 programmable soft menus on the bottom. The LCD is backlit with 4 LEDs. Solomon SSD1805 Driver is used to drive the LCD and interfaces to the OMAP processor through 8 parallel SoSSI lines. The LCD operates off 2.8V while the LEDs are powered by SW_B+.

### 3.5.2 Keypad, Volume and Frequency Knob

Five keypad buttons configured as column/row matrix is used in PM1500. One button is default programmed as emergency while the other four activates the user programmed soft menus.

The volume knob provides a linear increase in volume and is converted to digital signals through the A/D converter (U4201) which connects through SPI to OMAP IC.

The frequency knob is configured to provide a standard 48 frequency channel selection with a maximum of 256 channel selection (software dependent) and uses 4 GPIs for frequency selection.

## 3.6 GCAI Accessory Interface

GCAI or Global Core Accessory Interface is the new Motorola accessory interface standard that provides the user the ability of retaining GCAI compatible accessories when migrating to new radio platforms. PM1500 is one of the first Motorola products to implement this standard and is GCAI Class 0 compliant. The accessory interface port (J7000) incorporates USB Host and Client, 2-wire RS232 UART transmission, GPIOs and One Wire device detect capability.

Note that the GCAI accessory connector, J7000 resides on a small GCAI board (“Chapter 7. Schematics, Component Location Diagrams, and Parts Lists”) due to limited space on the main control head board. They are connected together via a 12- wire bridge cable.

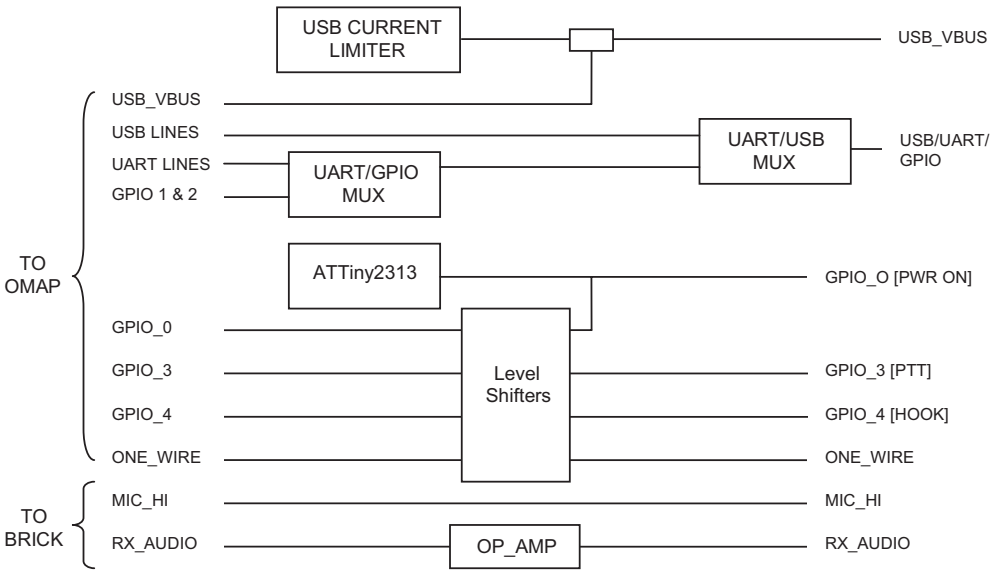



*Figure 3-5. GCAI Block Diagram*

All GCAI Outputs are configured to be at nominal 3.3V High with 15KΩ pull-ups on GPIO lines and 2.2KΩ pullup on ONE_WIRE line while UART is pullup with 100KΩ. USB is configured to comply with international USB standard.

The one-wire detection will provide the radio with information on what accessory has been plugged in and will configure the radio correctly to allow smooth operation of smart accessories such as the keypad microphone and the RS232 programming cable.

Please refer to section 3.14.12, "Flash Programming," on page 3-50 for details on Flash programming using GCAI's RS232 UART.

## 3.7 Main Board

This section provides a detailed circuit description of the PM1500 radio main board for VHF/UHF Range 1 models. The main board contains the following major sections:

- Radio Power (page 3-13)
- Receiver Front-End (page 3-14)
- Receiver Back-End (page 3-18)
- Transmitter (page 3-21)
- Frequency Generation Unit (page 3-29)
- Controller (page 3-37)

When reading the theory of operation, refer to your appropriate schematic and component location diagrams located in "Chapter 7. Schematics, Component Location Diagrams, and Parts Lists". This detailed Theory of Operation will help isolate the problem. However, first use the *PM1500 VHF/UHF Range 1 Mobile Radio Basic Service Manual* to troubleshoot the problem to a particular board.

## 3.8 Main Board Major Sections

This section contains the main board layouts for each radio frequency band.

### 3.8.1 VHF (136–174 MHz) Band

The illustrations (Figure 3-6 on page 3-9 to Figure 3-7 on page 3-10) and their accompanying tables (Table 3-5 on page 3-11 to Table 3-4 on page 3-10) identify the location of the major sections of the main board.

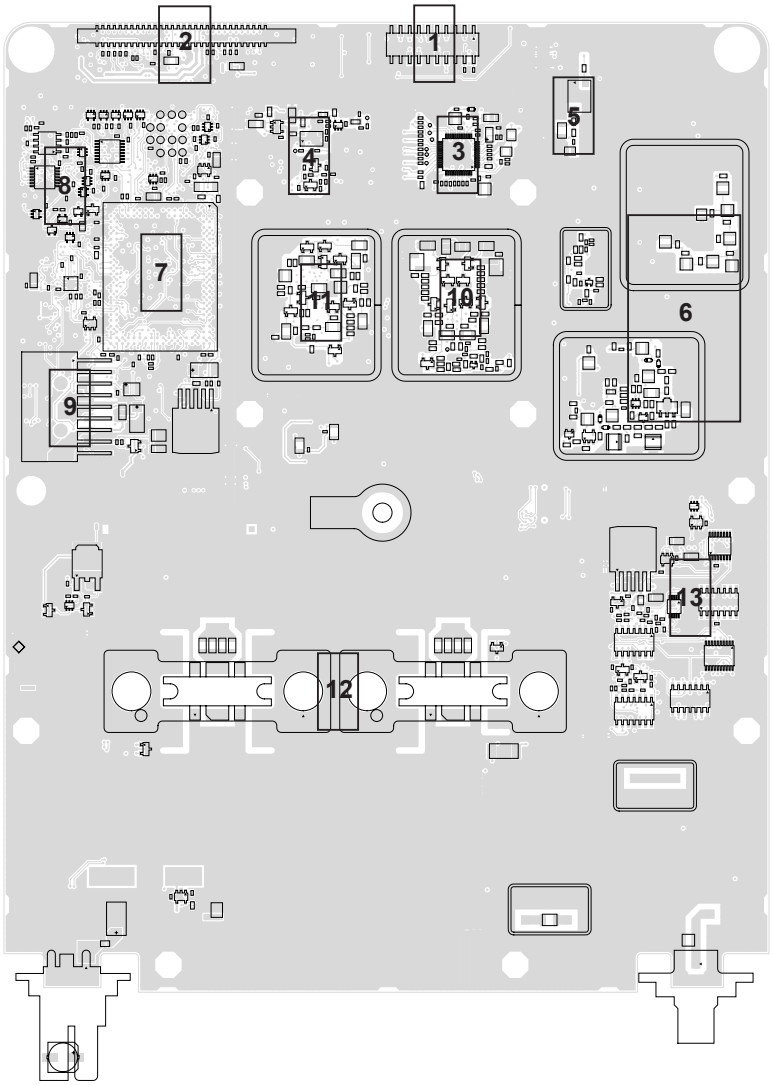



*Figure 3-6. PM1500 Main Board Sections (VHF High Power)—Side 1*

*Table 3-3. PM1500 Main Board Sections (VHF High Power)—Side 1*

| | | | |
|---|---|---|---|
| 1 | Secure Connector (J0501) | 8 | Controller Section |
| 2 | Front Connector (J0401) | 9 | Audio Power Amplifier (PA) |
| 3 | RX Back-End (ABACUS III) | 10 | RX VCO |
| 4 | 16.8 MHz Reference Oscillator | 11 | TX VCO |
| 5 | IF Filter | 12 | TX PA |
| 6 | RX Front-End | 13 | TX Power Control |
| 7 | Daughtercard | | |

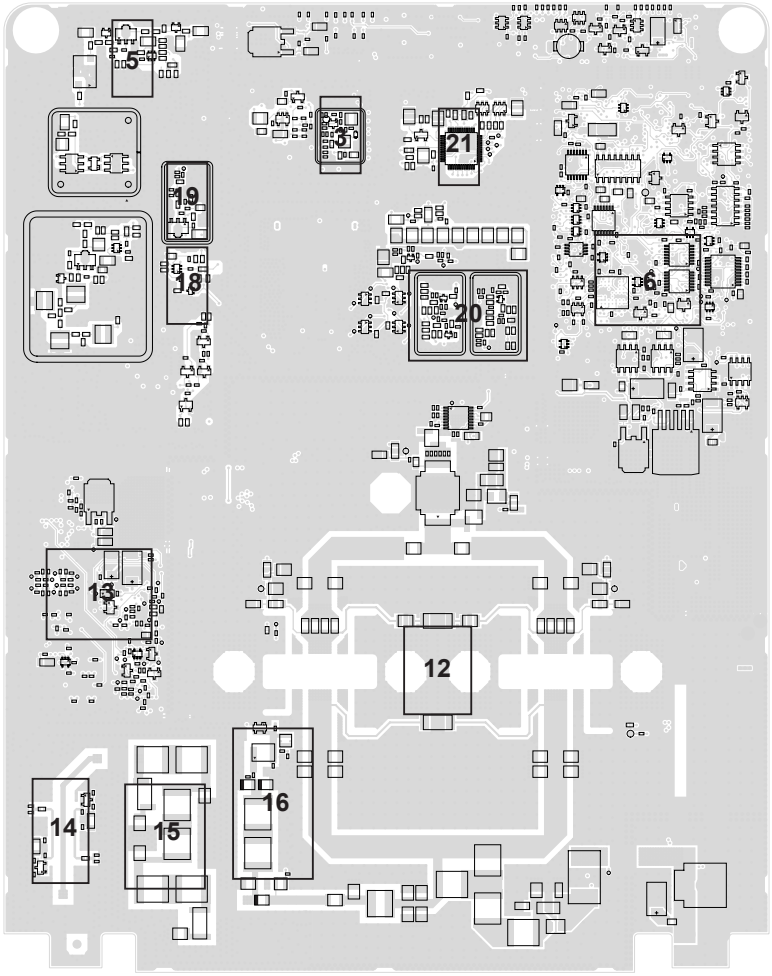



*Figure 3-7. PM1500 Main Board Sections (VHF High Power)—Side 2*

*Table 3-4. PM1500 Main Board Sections (VHF High Power)—Side 2*

| | | | |
|---|---|---|---|
| 3 | RX Back-End | 16 | Antenna Switch |
| 5 | IF Filter | 17 | Rear Connector (J0402) |
| 6 | Controller Section | 18 | RX Front-End Biasing |
| 12 | TX PA | 19 | RX VCO Injection Stage |
| 13 | TX Power Control | 20 | TX VCO Injection Stage |
| 14 | Power Detector | 21 | FGU (Synthesizer) |
| 15 | Harmonic Filter | | |

### 3.8.2 UHF Range 1 (380-470 MHz)

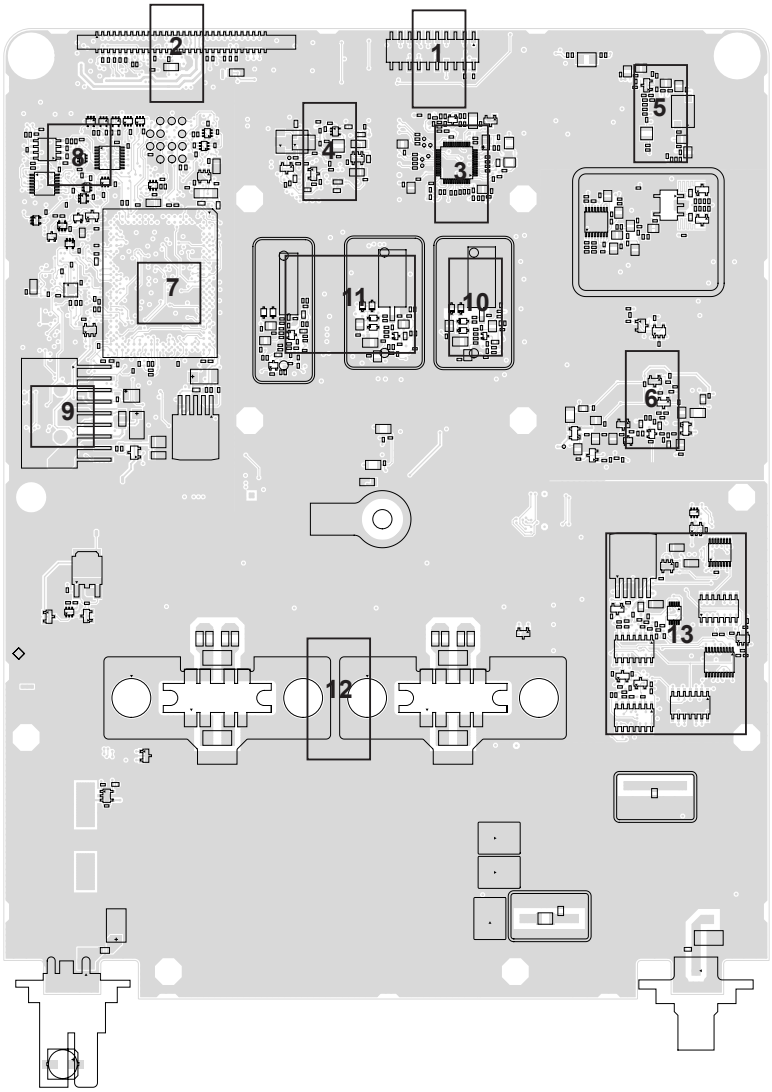



*Figure 3-8. PM1500 Main Board Sections (UHF Range 1 High Power)—Side 1*

*Table 3-5. PM1500 Main Board Sections (UHF Range 1 High Power)—Side 1*

| | | | |
|---|---|---|---|
| 1 | Secure Connector (J0501) | 8 | Controller Section |
| 2 | Front Connector (J0401) | 9 | Audio Power Amplifier (PA) |
| 3 | RX Back-End (ABACUS III) | 10 | RX VCO |
| 4 | 16.8 MHz Reference Oscillator | 11 | TX VCO |
| 5 | IF Filter | 12 | TX PA |
| 6 | RX Front-End | 13 | TX Power Control |
| 7 | Daughtercard | | |

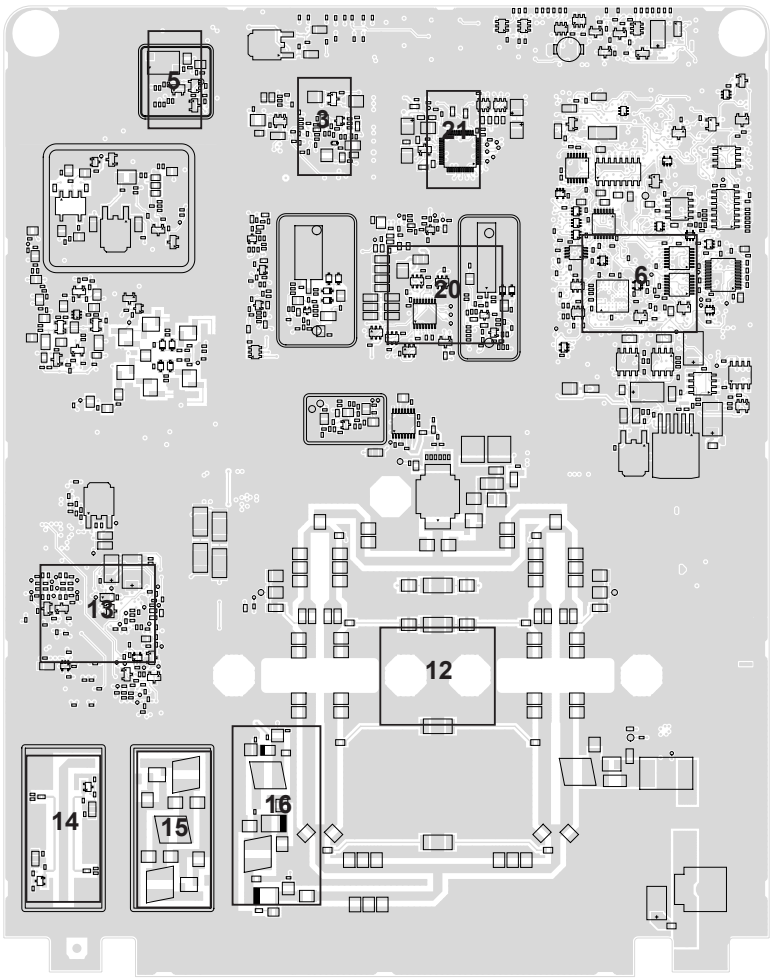



*Figure 3-9. PM1500 Main Board Sections (UHF Range 1 High Power)—Side 2*

*Table 3-6. PM1500 Main Board Sections (UHF Range 1 High Power)—Side 2*

| | | | |
|---|---|---|---|
| 3 | RX Back-End | 13 | TX Power Control |
| 5 | IF Filter | 14 | Power Detector |
| 6 | RX Front-End | 15 | Harmonic Filter |
| 8 | Controller Section | 16 | Antenna Switch |
| 10 | RX VCO | 17 | Rear Connector (J0402) |
| 11 | TX VCO | 18 | RX VCO Injection Stage |
| 12 | TX PA | 19 | FGU (Synthesizer) |

## 3.9 Radio Power Distribution

This section provides information on DC power distribution in PM1500 radios. In the PM1500 radio, power is distributed to three boards: the main board, control head, and secure interface board.

Power for the radio is supplied by the vehicle's 12-V battery. When using a desktop adapter unit, an external DC power supply can be connected to replace the vehicle's battery source.

A+ (referred to as incoming unswitched battery voltage) enters the radio through the rear RF power amplifier connector (J0950) and is the main entry for DC power. The second path, through J2, pin 25, provides ignition sense to inhibit radio turn-on when the ignition switch is off.

When the control-head On/Off button is turned on, the three 9.3-V regulators power on the controller section, the RX/frequency generation unit (FGU) section, and the TX section. See Figure 3-10 for the UHF Range 1 and UHF Range 2 bands or Figure 3-11 on page 3-14 for the VHF and 700-800 MHz bands.

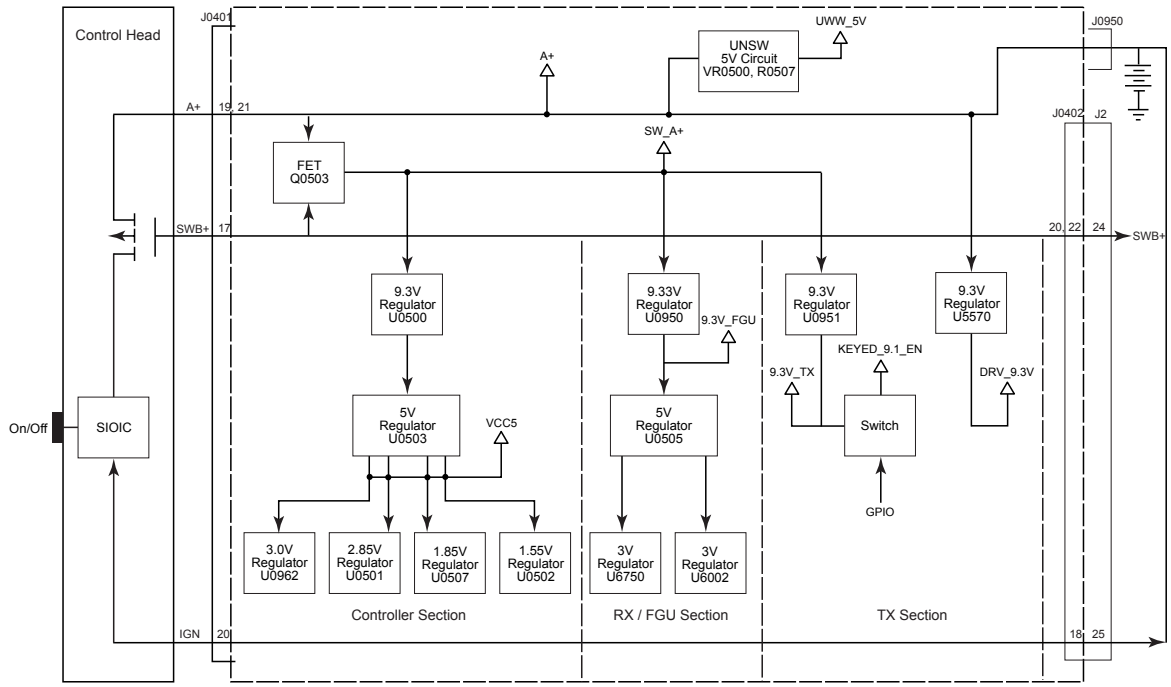



*Figure 3-10. DC Voltage Routing Block Diagram (UHF Range 1 and UHF Range 2)*

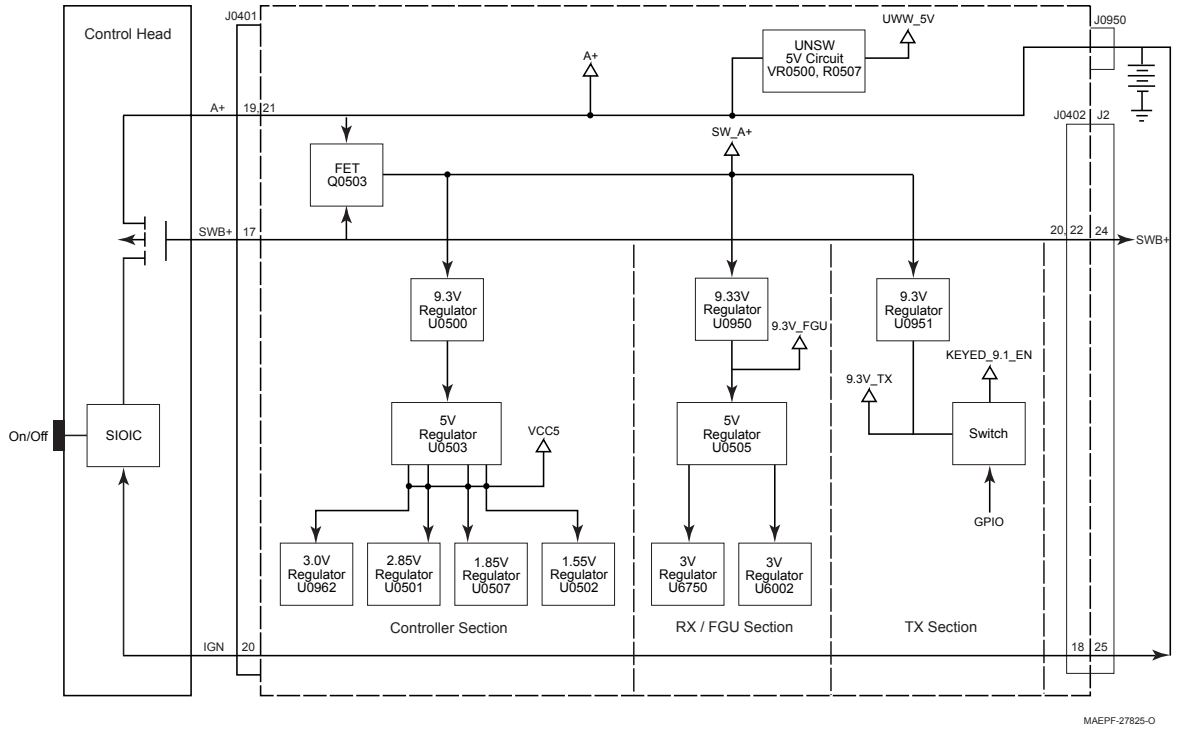



*Figure 3-11. DC Voltage Routing Block Diagram (VHF and 700–800 MHz)*

The 9.3 V and the A+ voltage are the main DC power for the RF section. The 9.1 V (referred to as “keyed 9.1 V”) is controlled by the VOCON board through P501, pin 45. This DC voltage enables the transmitter’s RF power amplifier when the VOCON board senses a lock detect from the synthesizer.

## 3.10 Receiver Front-End

This section provides a detailed circuit description of receiver front-end (RXFE). When reading the Theory of Operation, refer to your appropriate schematic and component location diagrams located in “Chapter 7. Schematics, Component Location Diagrams, and Parts Lists”. This detailed theory of operation will help isolate the problem to a particular component.

### 3.10.1 VHF (136–174 MHz) Band

The receiver circuits primary duties are to detect, filter, amplify, and demodulate RF signals in the presence of strong interfering noise and unintended signals. The receiver is broken down into the following blocks (Figure 3-12 on page 3-15):

- Front-end, which includes:
  - 15 dB step attenuator
  - PIN diode switches
  - Three discrete filters
  - Two low-noise amplifiers
  - Mixer
- Back-end, which includes:
  - Two crystal filters

- Low-noise IF amplifier
- ABACUS III digital back-end IC

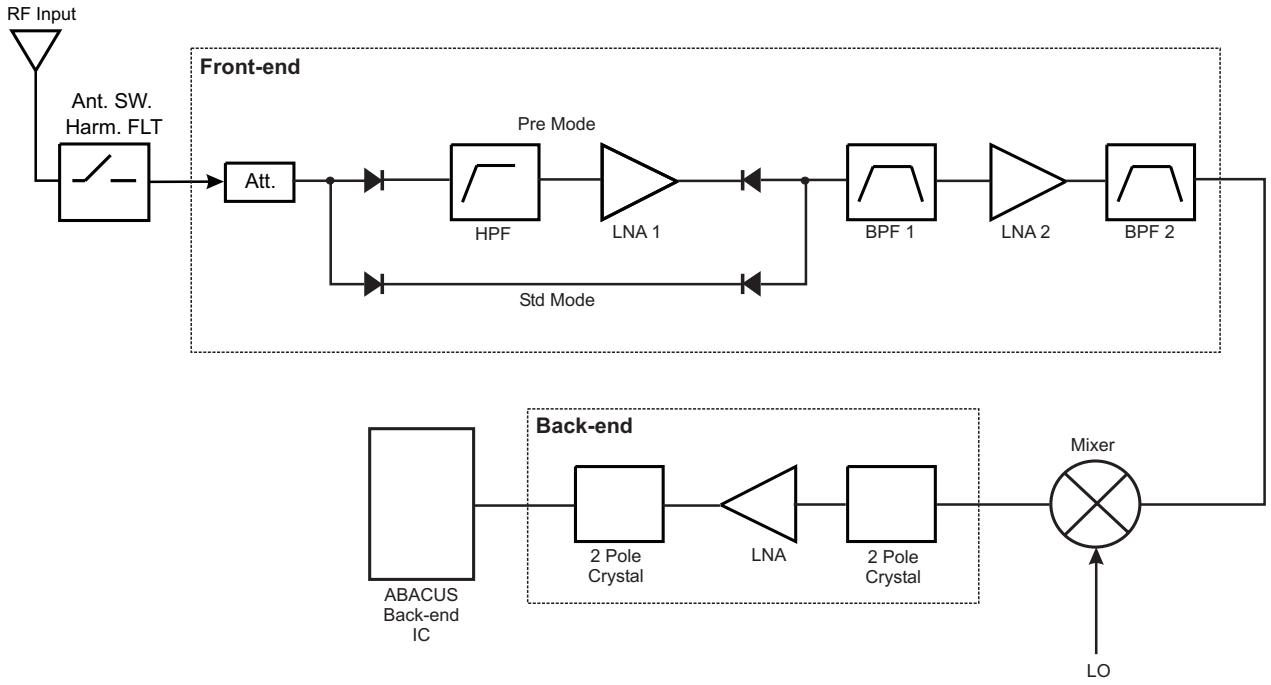



*Figure 3-12. Receiver Block Diagram (VHF)*

### 3.10.1.1 15 dB Step Attenuator (U3250)

The 15 dB step attenuator provides protection from strong on-channel signals and interferences.

### 3.10.1.2 PIN Diode Switches

The VHF front end operates in two modes: Standard mode and Preamp mode. The PIN diode switches select between the two modes. In standard mode the intermodulation performance is improved by bypassing the first HPF and LNA. Preamp mode is characterized by higher sensitivity.

### 3.10.1.3 Preselector Filters

The front-end operates in the 136-174 MHz band. The front-end filters primary function is to provide protection against out-of-band spurious responses such as image, IF, half-IF, etc. while providing flat, low-loss response in the receive band. The front-end uses discrete LC filter technology. The first filter is a high-pass filter that protects the first LNA from strong out-of-band signals at frequencies which are below the receive band and is used in preamp mode only. The second and third filters are band-pass filters that provide additional out-of-band spurious rejection.

### 3.10.1.4 Low-Noise Amplifiers (Q3255, Q3252)

The function of the Low-Noise Amplifiers (LNA) is to amplify the received signal with minimal noise contribution. The first LNA (Q3255) has 10 dB of gain and is activated in Preamp mode only. A clamping diode pair (D3256) located after the High Pass and before the first LNA protects the receiver from strong RF signals by limiting the signal amplitude going into the amplifier. The second LNA (Q3252) has 15 dB of gain. Both LNAs are biased with 9.3V.

### 3.10.1.5 Mixer (D3258)

The received signal is down-converted by a double-balanced mixer to an Intermediate Frequency (IF) of 109.65 MHz. The mixer is designed to provide low conversion loss and high intermodulation performance. The injection buffer provides a 20 dBm LO signal to the mixer. High-side injection is used.

## 3.10.2 UHF Range 1 (380–470 MHz) Band

The receiver circuits primary duties are to detect, filter, amplify, and demodulate RF signals in the presence of strong interfering noise and unintended signals. The receiver (see Figure 3-13) is broken down into the following blocks:

- Front-end, which includes:
  - High pass fIlter and first low-noise amplifier (LNA)
  - Preselector filter
  - Switchable 15 dB attenuator
  - Second LNA
  - Image Filter
  - First mixer
- Back-end, which includes:
  - Intermediate Frequency (IF)
  - ABACUS III IC

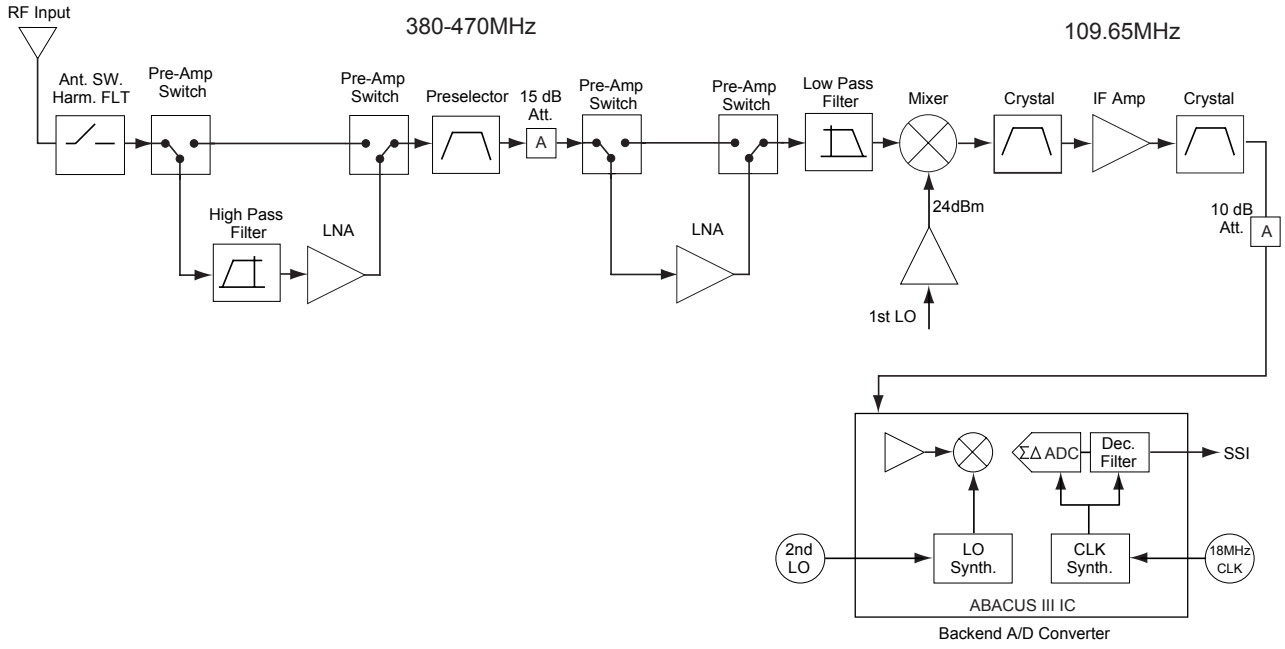



*Figure 3-13. Receiver Front-End and Back-End (UHF Range 1)*

### 3.10.2.1 Highpass Filter and First Low-Noise Amplifier

The highpass filter and first low-noise amplifier (LNA) (11 dB gain) can be switched in and out of the signal path by diode switches. When switched into the signal path, the sensitivity of the radio is improved at the cost of degraded intermodulation performance. This can be necessary in fringe areas when strong interference that can lead to intermodulation problems are not present and the desired signal is weak.

The preamplifier version of the radio must be purchased to be able to control this option. If it has not been purchased, the direct path created by the diode switches is the only one available, giving the radio standard model performance with enhanced intermodulation rejection. Purchasing the preamplifier option allows the user to select either mode with the CPS.

### 3.10.2.2 Preselector Filter

The front-end operates in the 380 to 470 MHz band. The front-end's primary function is to optimize half IF rejection, image rejection, and selectivity while providing the first conversion. The front-end uses a varactor-tuned filter that is tuned by the controller. The tuning signal is a DC control voltage between 0 and 9V that come from the PA power control section. Low voltages are for lower frequencies and higher voltages correspond to the higher frequencies. This filter is aligned in the factory and can also be aligned using the Tuner software.

### 3.10.2.3 Switchable 15 dB Attenuator

This circuit block can provide 0 dB or 15 dB of attenuation in the signal path. Normally, it is set for 0 dB and does not affect the received signal. When strong signals are detected, the radio controller can choose to activate this attenuator to provide protection to the back end circuits, and to enhance high level intermodulation performance. Proprietary algorithms are used to control the switching.

### 3.10.2.4 Low-Noise Amplifier (LNA, U5302)

A diode (D5281) located after the varactor preselector and before the LNA protects the receiver from strong RF signals by limiting the signal amplitude going into the amplifier. The LNA is a low-noise monolithic IC providing ~ 15 dB of gain to the receiver. It is biased with 5 V and can be bypassed by the radio software under very strong signal conditions.

The UHF receiver also has a second LNA based on Q5252 that can be activated or bypassed by the radio software. This amplifier is protected by D5280 and provides 11 dB of gain. This is available only if the preamplifier option has been purchased.

### 3.10.2.5 Image Filter

Following the LNA (U5302), the signal goes through a bandpass filter before it is sent to the mixer. The passband is from 380 to 470 MHz with an insertion loss of about 2 dB, while the image rejection is 55 dB. There is a trap on the input side of this filter to attenuate the 109.65 MHz IF.

### 3.10.2.6 Mixer

A passive double-balanced diode ring mixer is used to down-convert the received signal to an Intermediate Frequency (IF) of 109.65 MHz. The mixer is designed to provide low conversion loss (< 7.0 dBm) and high intermodulation performance and requires a strong injection signal. The mixer is driven by the receiver injection buffer, a two-stage LDMOS IC design, that amplifies the +3 dBm high-side injection signal from the Frequency Generation Unit (FGU) to +24 dBm.

# 3.11 Receiver Back-End

This section discusses the receiver back-end (RXBE) components and detailed theory of operation. The receiver back-end processes the down-converted, filtered IF signal to produce digital data for final processing by the Patriot microcontroller IC.

## 3.11.1 VHF (136-174 MHz) Band

The receiver back-end contains the following major components:

- Intermediate frequency (IF) section.
- ABACUS III IC

### 3.11.1.1 Intermediate Frequency (IF) Section

The PM1500 radio uses two leadless, surface-mount, two-pole, third-overtone, quartz crystal filters (Y3400, Y3401) separated by a 21 dB gain IF amplifier. The filters are centered at 109.65 MHz. This narrowband bandpass filter contributes to the radio's adjacent-channel and alternate-channel rejection performance. Components L3401, L3403, L3404, L3405, C3421, C3414, C3409, C3416, C3420, C3418 and C3415 are used as impedance-matching networks. Components Q3400, R3409, R3401, R3402, R3405, R3407, and R3413 are used for biasing and stabilizing the transistor Q3400. Components C3424, C3404 bypass the DC supply. L3400 is RF choke. Diode D3400 and Inductor L3408 protect the Abacus and the second IF filter from strong In-band signals.

### 3.11.1.2 ABACUS III IC

The receiver back-end is designed around the ABACUS III (AD9874 IF digitizing subsystem) IC and its associated circuitry. The AD9874 (Figure 3-14 on page 3-19) is a general-purpose, IF subsystem that digitizes a low-level, 10–300 MHz IF input with a bandwidth up to 270 kHz. The signal chain of the AD9874 consists of a variable gain, low-noise amplifier, a mixer; a bandpass, sigma-delta, A/D converter; and a decimation filter with programmable decimation factor. An automatic gain control (AGC) circuit provides the AD9874 with 12 dB of continuous gain adjustment. The high dynamic range and inherent anti-aliasing provided by the bandpass, sigma-delta converter allow the AD9874 to cope with blocking signals 80 dB stronger than the desired signal. Auxiliary blocks include clock and LO synthesizers, as well as an SPI port. Input signal RXIF is the 109.65 MHz IF from the IF section in the receiver front-end.

Components C3000, C3038, and L3002 match the input impedance from 50 ohms (IF Filter terminating impedance) to the ABACUS III IC input IFIN. Formatted SSI data is output to the Patriot microcontroller IC for DSP processing on ports FS, DOUTA, and CLKOUT. Control logic is sent to the ABACUS III IC from the Patriot microcontroller via the SPI lines (PC, PD, PE).

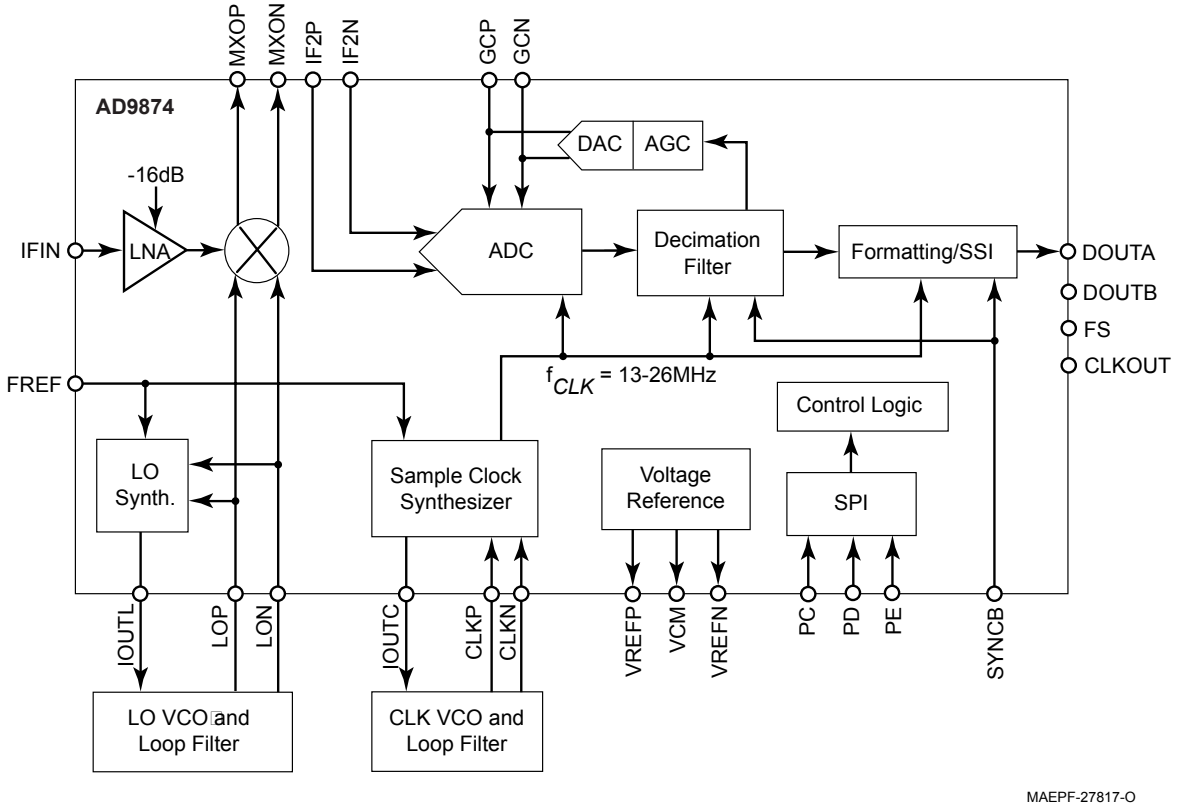



*Figure 3-14. ABACUS III (AD9874) IC Functional Block Diagram from Data Sheet (VHF)*

3.11.1.2.1 Second Local Oscillator

The ABACUS III IC local oscillator (LO) synthesizer controls the second LO. Signal FREF is the 16.8 MHz reference from the frequency generation unit (FGU). The second LO frequency is 107.4 MHz by default, or 111.9 MHz in special cases as necessary to avoid radio self-quieters. The second LO signal mixes with IFIN to produce a 109.65 MHz final IF. The external VCO consists of transistor Q3000, together with its bias and instability network and tank elements. Darlington transistor Q3001 along with C3035 and C3017 form an active DC filter. The second-order loop filter is comprised of C3044, C3005, and R3009.

3.11.1.2.2 Sampling Clock Oscillator

The ABACUS III IC sampling clock synthesizer, at Fclk=18 MHz (IF2=Fclk/8, where Fclk is the clock rate), utilizes a negative-resistance core that is internal to the ABACUS III IC which, when used in conjunction with an external LC tank (made up of L3003 and C3039) and a varactor (D3001), serves as the VCO.

## 3.11.2 UHF Range 1 (380-470 MHz) Band

The receiver back-end (see Figure 3-13 on page 3-16) contains the following major components:

- Intermediate frequency (IF) filter
- ABACUS III IC

### 3.11.2.1 Intermediate Frequency (IF) Filter

The PM1500 radio uses two leadless, surface-mount, two-pole, third-overtone, quartz crystal filters (Y5400, Y5401) separated by a 20 dB gain IF amplifier. The filter is centered at 109.65 MHz. This narrow-bandpass filter gives the radio part of its adjacent-channel and alternate-channel rejection performance. Impedance-matching networks are located at the input and output of each crystal. The IF amplifier is made with Q5401. The 10 dB attenuator (U5400) located after the second crystal filter is controlled by the software to limit the signal gain in front of the ABACUS III IC.

### 3.11.2.2 ABACUS III IC (U5002)

The receiver back-end is designed around the ABACUS III (AD9874 IF digitizing subsystem) IC and its associated circuitry. The AD9874 (Figure 3-15) is a general-purpose, IF subsystem that digitizes a low-level, 10-300 MHz IF input with a bandwidth up to 270 kHz. The signal chain of the AD9874 consists of a variable gain, low-noise amplifier, a mixer; a bandpass, sigma-delta, A/D converter; and a decimation filter with programmable decimation factor. An automatic gain control (AGC) circuit provides the AD9874 with 12 dB of continuous gain adjustment. The high dynamic range and inherent anti-aliasing provided by the bandpass, sigma-delta converter allow the AD9874 to cope with blocking signals 80 dB stronger than the desired signal. Auxiliary blocks include clock and LO synthesizers, as well as an SPI port. Input signal RXIF is the 109.65 MHz IF from the IF filter.

Components C5002, C5007, and L5002 match the input impedance from 50 ohms (IF Filter terminating impedance) to the ABACUS III IC input IFIN. Formatted SSI (synchronous serial interface) data is output to the Patriot microcontroller IC for DSP processing on ports FS, DOUTA, and CLKOUT. Control logic is sent to the ABACUS III IC from the Patriot microcontroller via the SPI lines (PC, PD, PE).

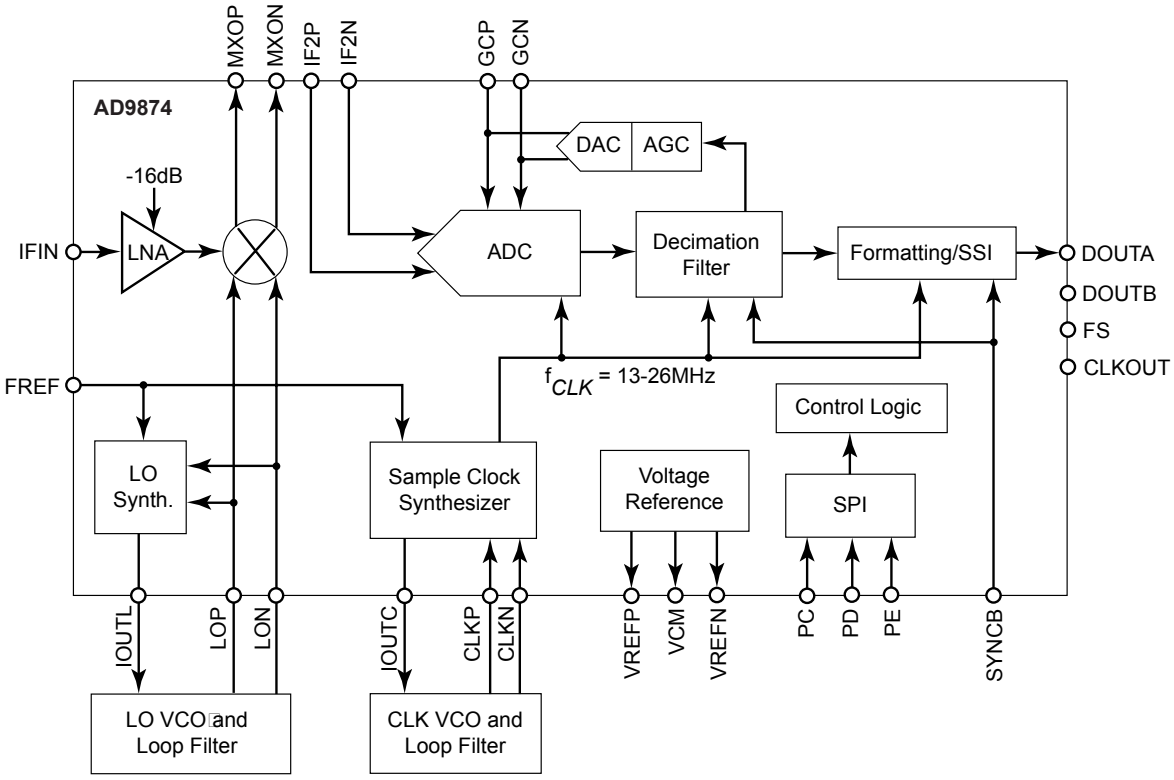



*Figure 3-15. ABACUS III (AD9874) IC Functional Block Diagram from Data Sheet (UHF Range 1)*

3.11.2.2.1 Second Local Oscillator (LO)

The ABACUS III IC local oscillator (LO) synthesizer controls the second LO. Signal FREF is the 16.8 MHz reference from the frequency generation unit (FGU). The second LO frequency is 107.4 MHz by default, or 111.9 MHz in special cases as necessary to avoid radio self-quieters. The second LO signal mixes with IFIN to produce a 2.25 MHz final IF. The external VCO consists of transistor Q5002, together with its bias and instability network and tank elements. Darlington transistor Q5001 along with C5018 and C5050 form an active DC filter. The 2nd order loop filter is comprised of C5044, C5045, and R5013.

3.11.2.2.2 Sampling Clock Oscillator

The ABACUS III IC sampling clock synthesizer, at Fclk=18 MHz (IF2=Fclk/8, where Fclk is the clock rate), utilizes the clock VCO built around Q5003.

# 3.12 Transmitter

This section of the theory of operation provides a detailed circuit description of the transmitter, which includes the RF power amplifier (RFPA), output network (ON), and power control.

When reading the theory of operation, refer to the appropriate schematic and component location diagrams located in "Chapter 7. Schematics, Component Location Diagrams, and Parts Lists". This detailed theory of operation will help isolate the problem to a particular component. However, first use the *ASTRO Digital PM1500 VHF/UHF Range 1/UHF Range 2/700–800 MHz Mobile Radio Basic Service Manual* to troubleshoot the problem to a particular section.

## 3.12.1 VHF (136-174 MHz) Band

### 3.12.1.1 100-Watt Transmitter

The following text discusses the 100-W transmitter.

3.12.1.1.1 RF Power Amplifier (RFPA)

The RFPA consists of three gain stages, which are shown in Figure 3-16.

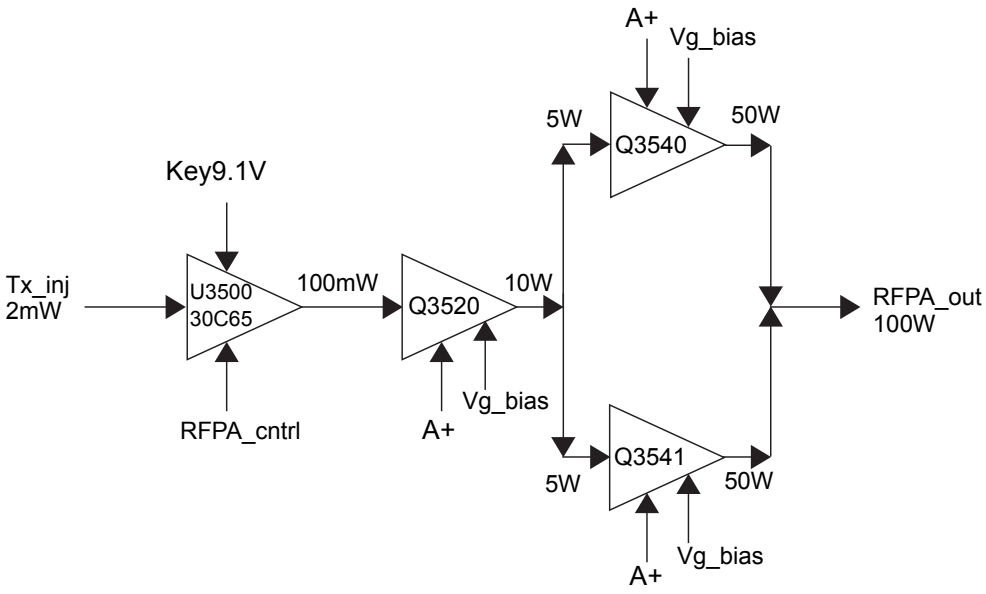



*Figure 3-16. 100-Watt RF Power Amplifier (RFPA) Gain Stages (VHF)*

### First Stage

The RFPA first stage provides gain that is determined by the control voltage, RFPA_CNTRL. This control voltage is generated in the power control section and is a function of the final-stage output power, temperature, and current, as well as the control and A+ voltage levels. See "3.12.1.3. Power Control (100W Transmitter)" on page 3-23 for a detailed explanation of the power control section.

The 2 mW TX_INJ signal is routed to the U3500 first-stage device (Pin 16, RFIN) via C3500 to an integrated, wide-band input match. U3550 is a two-stage LDMOS device with a bandpass interstage match consisting of C3502 and L3501 routed between VD1 (pin 14) and G2 (pin 11). L3501 and L3500 provide the K9.1V drain bias voltage for the first and second stages to VD1 (pin 14) and RFOUT1/2 (pins 6 and 7), respectively. The RFPA_CNTRL gate bias is provided to both stages internally via VCNTRL (pin 1). Both U3500 stages are operated Class A.

### Driver Stage

C3521, L3520, C3520, and a transmission line form a low-pass, interstage match that transfers power to the Q3520 LDMOS transistor. R3520-5 provide device stability, and R3526 and C3522 supply the VGBIAS2 gate bias. L3521, R3528, C3525, C3524, C3536, L3522 and R3527 form the A+ drain bias circuit. Q3520 is operated Class AB.

### Dual Final Stage

C3540-1, C3543-4 and transmission lines form a bandpass. R3541-8 provide stability for Q3540. R3550-7 provide stability for Q3541. R3540 and R3568 supply the VGBIAS1 gate bias to Q3540. R3569 and R3558 supply the VGBIAS2 gate bias to Q3541. L3540-4 and C3560-1 form the A+ drain bias circuit. C3548-55 and transmission lines form a low-pass. Q3540-1 operate Class AB.

R3560-1, C3561, and U3561 comprise the final-stage, current-sense circuit that generates the VCURRENT voltage proportional to the final stage current. R3564 sets the circuit gain. U3560 generates the VTEMP voltage, which is proportional to the final-stage temperature.

## 3.12.1.2 Output Network (ON) - (for 100W Transmitter)

The ON consists of the antenna switch, harmonic filter, and power detector (see Figure 3-17).

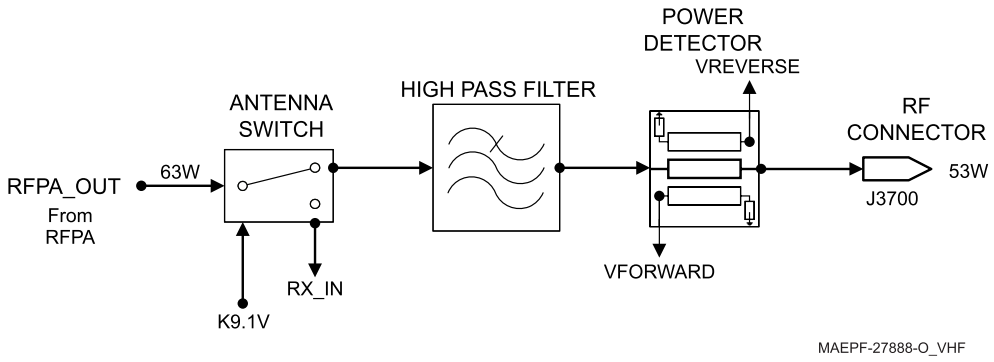



*Figure 3-17. Output Network Components (VHF)*

### Antenna Switch

The antenna switch functions in two modes, which are determined by the presence of K9.1V. The K9.1V switch bias is applied via L3700, L3731-2, and C3702. When K9.1V is present, the switch is in TX mode. D3701-2 and D3704 are forward biased forming a low-loss path from the RFPA final stage to the harmonic filter and a 60 dB isolation path between the RFPA final stage and the RX front-end. Isolation is achieved via a quarter-wave transmission line between D3701 and D3702. D3701-4 serves as an ESD protection circuit against ESD discharge on the antenna connector.

When K9.1V is absent, the switch is in RX mode. D3701 and D3702 are reverse biased forming a low-loss path from the harmonic filter to the RX front-end and a 60 dB isolation path from the harmonic filter to the RFPA final stage. Isolation is achieved via the D3701 off resistance.

**Harmonic Filter**

L3720-7, C3720-3, form the twelve-element, low-pass harmonic filter. The filter attenuates harmonics generated by the RFPA when the antenna switch is in TX mode and provides extra selectivity when the antenna switch is in RX mode.

**Power Detector**

The power detector consists of two asymmetric, coupled transmission lines and detection circuitry that detects forward and reverse power. C3730-1, D3730, L3730, R3730-3, and R3735-6 form the forward-power detector (VFORWARD), which is used for power leveling. C3732-3, D3731, L3731, R3737-9, and R3733-4 form the reverse-power detector (VREVERSE). L3737 provides an electrostatic discharge path to protect the RFPA final stage device.

## 3.12.1.3 Power Control (100W Transmitter)

The power control section is comprised of a control loop to level forward power and protection mechanisms to reduce power to a safe level for the given environmental conditions (see Figure 3-18).

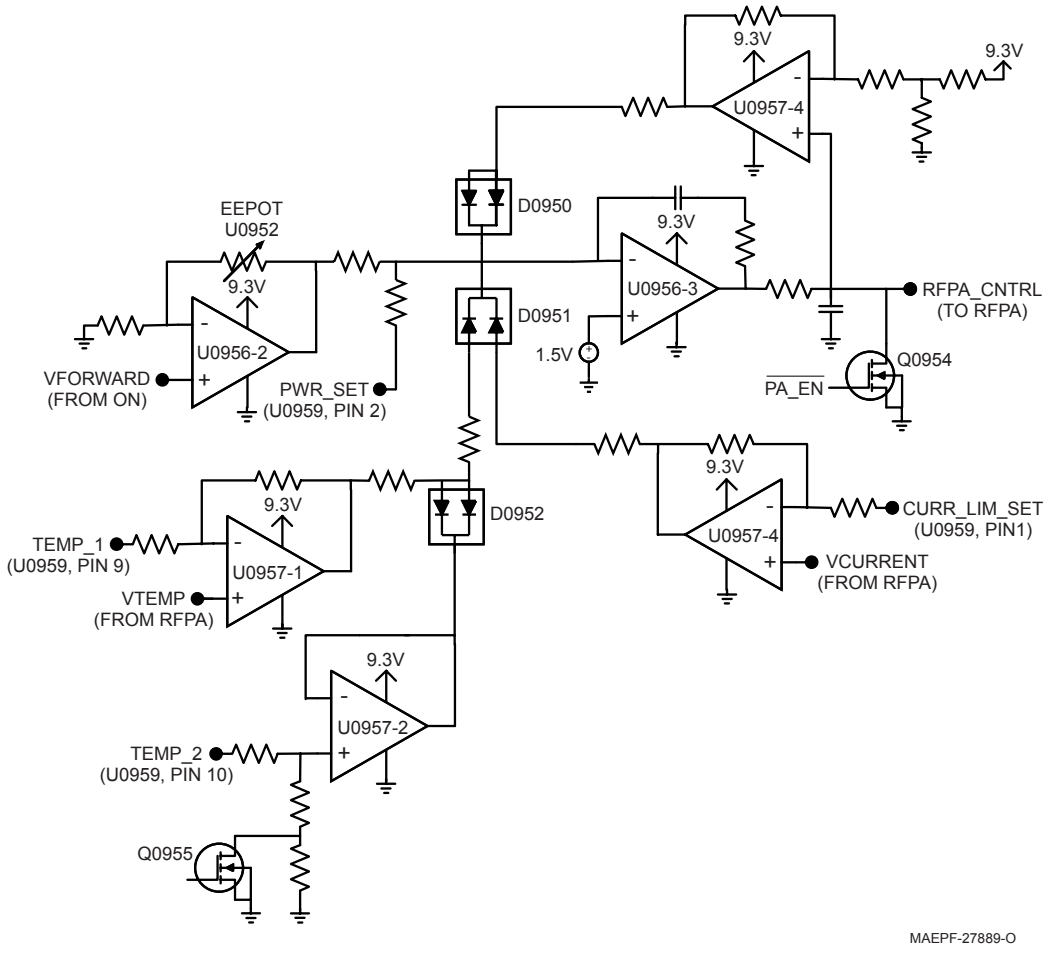



*Figure 3-18. Power Control Components (VHF)*

### Power Control Loop

VFORWARD from the ON is buffered via the non-inverting, variable-gain stage U0956-2 whose gain is set by EPOT U0952. The proper gain is determined during power-detection calibration tuning. Buffered VFORWARD (U0956-2, Pin 7) is added to PWR_SET via R0971, R0972, and R0947 and then compared to a reference determined by R0974 and R0975. PWR_SET is supplied by the digital-to-analog converter (DAC) U0959, Pin 2. Comparator stage U0956-3 increases or decreases RFPA_CNTRL so that the voltage at U0956-3, Pin 9 in the same at the reference voltage at U0956-3, Pin 10. When the PWR_SET voltage is decreased, U0956-3 increases RFPA_CNTRL to increase VFORWARD which is proportional to forward power thus increasing the power level. When the PWR_SET voltage is increased, U0956-3 decreases RFPA_CNTRL to decrease VFORWARD, thus decreasing the power level. The microprocessor initiates the loop through U0958-1 and Q0954. Loop timing is set via software together with R0977, and C0973.

### Protection Mechanisms

Final-stage temperature is sensed in the RFPA resulting in VTEMP, which is proportional to temperature. VTEMP is compared against a reference voltage TEMP_1 (U0959, pin 9) via U0957-1. When VTEMP exceeds TEMP_1, the U0957-1, pin 1, voltage increases and forward biases one of the D0951 diodes, which cuts back power. Power continues to cut back with rising temperature until the voltage level at the junction of R0978 and R0983 is high enough to forward bias D0952, thus clamping the cut back so that the radio meets its duty cycle specification while providing protection against high-temperature conditions. The clamping level is set via TEMP_2 (U0959, pin 10) and U0957-2. U0957-3 is used to sense if a high A+ battery voltage condition exists and, if it does, the Q0955 gate is biased on, which increases the clamp voltage allowing for additional power cutback for a high A+, high temperature condition.

Final-stage current is also monitored via VCURRENT, which is proportional to current. VCURRENT is compared against a reference CURR_LIM_SET (U0959, pin 1) which is tuned after power characterization. If VCURRENT exceeds CURR_LIM_SET, then U0957-4, pin 14, voltage rises and forward biases one of the D0951 diodes, which limits power.

Finally, control voltage is limited by U0956-4 and D0950. RFPA_CNTRL can rise to the control voltage limit set by R0942-4.

## 3.12.2 UHF Range 1 (380-470 MHz) Band

### 3.12.2.1 100-Watt Transmitter

The following text discusses the 100-W transmitter.

#### 3.12.2.1.1 RF Power Amplifier (RFPA)

The RFPA consists of three gain stages, which are shown in Figure 3-19.

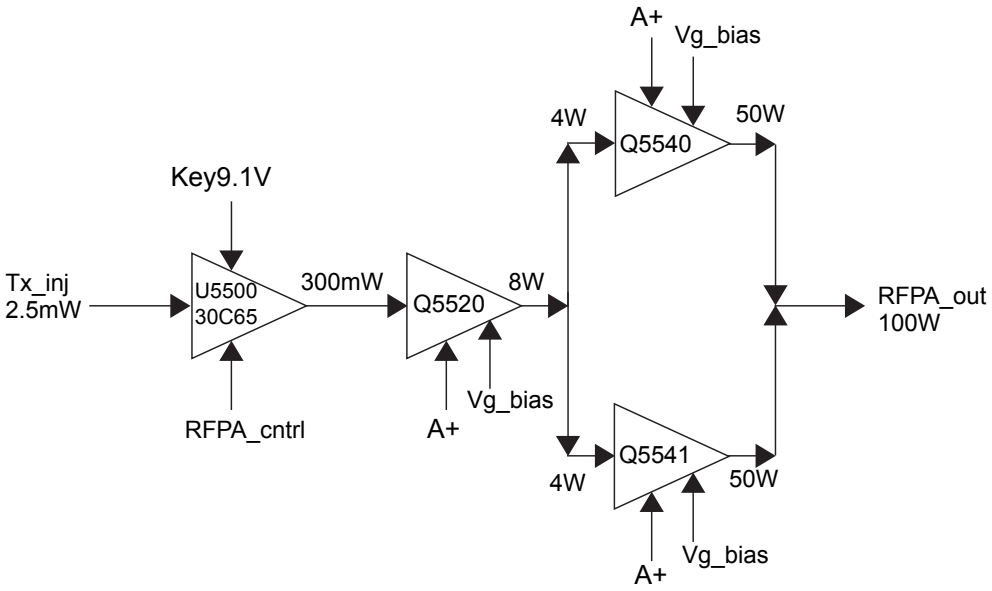



*Figure 3-19. 100-Watt RF Power Amplifier (RFPA) Gain Stages (UHF Range 1)*

**First Stage**

The RFPA first stage provides gain that is determined by the control voltage, RFPA_CNTRL. This control voltage is generated in the power control section and is a function of the final-stage output power, temperature, and current, as well as the control and A+ voltage levels. See "3.12.2.3. Power Control (100W Transmitter)" on page 3-28 for a detailed explanation of the power control section.

The 2.5 mW TX_INJ signal is routed to the U5500 first stage device (Pin 16, RFIN) via C5524 to an integrated, wide-band input match. U5500 is a two-stage LDMOS device with a bandpass interstage match consisting of L5511, L5510, C5511 routed between VD1 (pin 14) and G2 (pin 11). L5510 and R5510 provide the K9.1V drain bias voltage for the first and second stages to VD1 (pin 14) and RFOUT1/2 (pins 6 and 7), respectively. The RFPA_CNTRL gate bias is provided to both stages internally via VCNTRL (pin 1). Both U5501 stages are operated Class A and the second-stage output power is approximately 300 mW.

**Driver Stage**

C5525, L5514, C5516, C5518, C5519, C5523 and a transmission line form a low-pass, interstage match that transfers power to the Q5502 LDMOS transistor. R5520-R5525 provide device stability, and R5526, C5520 and C5529 supply the VGBIAS3 gate bias. L5520, C5521, R5527, L5521, R5528 and C5522 form the A+ drain bias circuit. Q5520 is operated Class AB and its output power is approximately 8 W.

**Dual Final Stage**

C5530, C5531, C5532, C5533, C5536, C5537-41 and transmission lines form a low pass, splitter match that transfers power to the LDMOS dual final-stage transistors Q5541 and Q5540. Q5540 and Q5541 contain two transistors in a single package, each with it's own gate and drain lead. R5542-5, R5548-51 provide stability for Q5540. R5552-5, R5557-60 provide stability for Q5541. R5546, C5602 and C5542 supply the VGBIAS1 gate bias to Q5540. R5581, C5550 and C5603 supply the VGBIAS2 gate bias to Q5541. L5543, L5544, R5574, C5567 and C5568 form the A+ drain bias circuit to Q5540 and Q5541. C5551-56, C5559-66, C5584, C5587, C5589 and transmission lines form a low -pass combiner match that transfers approximately 100 W to the antenna switch. R5562 provides stability for Q5540. R5573 provides stability for Q5541. Both Q5540 and Q5541 operate Class AB.

R5575 and U5561 comprise the final-stage, current-sense circuit that generates the VCURRENT voltage proportional to the final stage current. R5578 sets the circuit gain. U5560 generates the VTEMP voltage, which is proportional to the final-stage temperature.

## 3.12.2.2 Output Network (ON) - (100W Transmitter)

The ON consists of the antenna switch, harmonic filter, and power detector (see Figure 3-20).

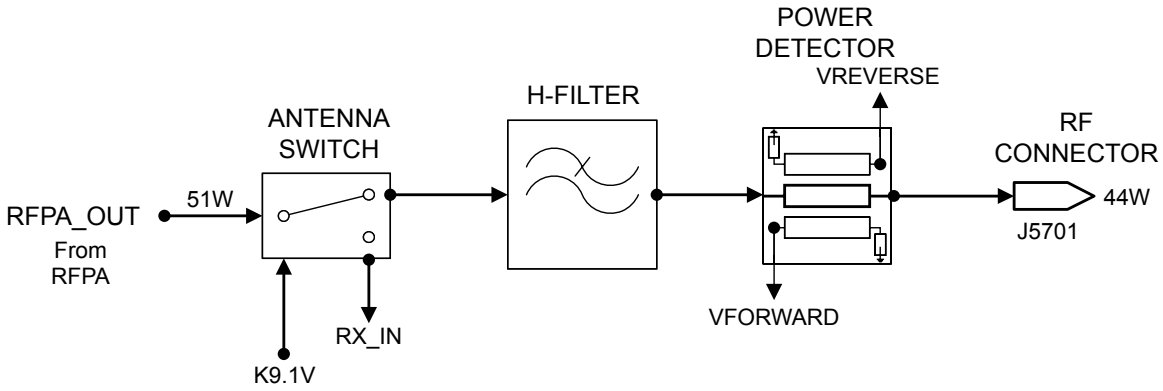



*Figure 3-20. Output Network Components (UHF Range 1)*

**Antenna Switch**

The antenna switch functions in two modes determined by the presence of K9.1V. The K9.1V switch bias is applied via L5701and C5702. When K9.1V is present, the switch is in TX mode. D5701, D5702 and D5703 are forward biased forming a low-loss path from the RFPA final stage to the harmonic filter and a 20 dB isolation path between the RFPA final stage and the RX front-end. Isolation is achieved via a quarter-wave transmission lines between D5701 - D5702 and between D5702 - D5703. C5709-10 resonates out the D5702-3 on inductance improving the isolation. When K9.1V is absent, the switch is in RX mode. D5701, D5702 and D5703 are reverse biased forming a low-loss path from the harmonic filter to the RX front-end and a 20 dB isolation path from the harmonic filter to the RFPA final stage. Isolation is achieved via the D5701 off resistance. L5702 resonates out the D5701 off capacitance improving the isolation.

### Harmonic Filter

The harmonic filter is a 7-element, equal-L Zolotarev quasi-lowpass filter consisting of C5712 and C5713, C5719 thru C5721 and L5706 thru L5708. L5712, C5711 and L5713, C5714 form two shunt zeros for extra attenuation at the second harmonic. C5708 acts as a DC block between the filter and the antenna switch. The filter provides approximately 60 dB of harmonic rejection. The harmonic filter together with the antenna switch provides approximately 0.7 dB insertion loss between the transmitter power amplifier and the antenna.

### Power Detector

The power detector consists of a main microstrip transmission line that transfers power from the harmonic filter to the antenna and two parallel lines that are used to detect the forward and reverse power. The forward power detection line is terminated via R5707 and R5708. RF energy coupled onto this line is rectified and filtered via D5704 and C5715 to provide a DC voltage to the power control circuitry that is proportional to the forward transmitted power level. The detected forward voltage is approximately 1.5 Vdc when the radio is putting out 44 watts. Thermister R5704 compensates for temperature changes in D5704 to maintain constant DC voltage versus detected forward power over temperature.

The reverse power detection line is terminated via R5705-06. RF energy coupled onto this line is rectified and filtered via D5705 and C5718 to provide a DC voltage to the power control circuitry that is proportional to the reverse power level reflected back from the antenna. Thermister R5712 compensates for temperature changes in D5705 to maintain constant DC voltage versus detected reverse power over temperature.

### 3.12.2.3 Power Control (100W Transmitter)

The power control section is comprised of a control loop to level forward power, and protection mechanisms to reduce power to a safe level for the given environmental conditions (see Figure 3-21 on page 3-28).

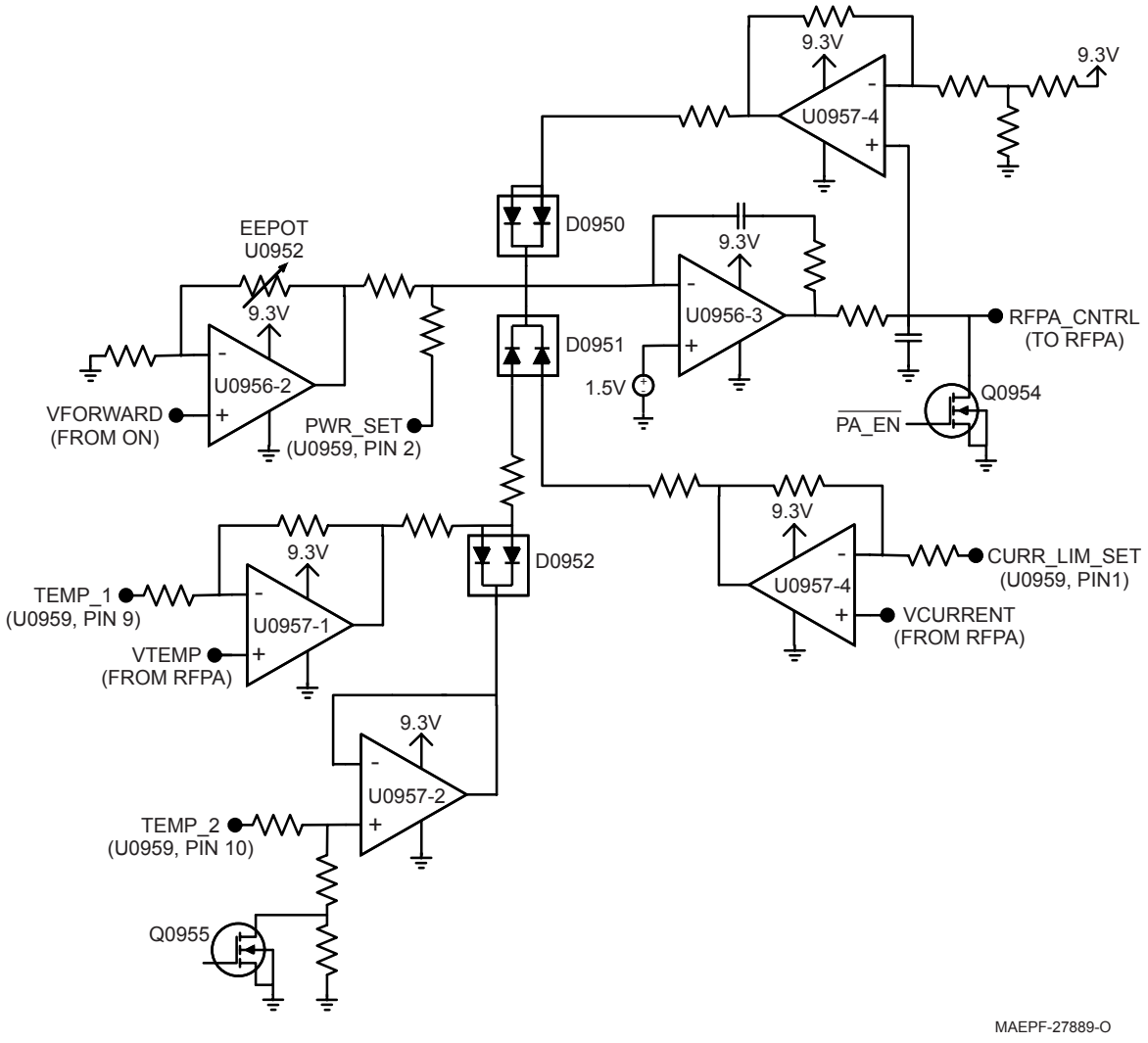



*Figure 3-21. Power Control Components (UHF Range 1)*

**Power Control Loop**

VFORWARD from the ON is buffered via the non-inverting, variable-gain stage U0956-2 whose gain is set by EPOT U0952. The proper gain is determined during power-detection calibration tuning. Buffered VFORWARD (U0956-2, Pin 7) is added to PWR_SET via R0971 and R0972 and then compared to a reference determined by R0974 and R0975. PWR_SET is supplied by the digital-to-analog converter (DAC) U0959, Pin 2. Comparator stage U0956-3 increases or decreases RFPA_CNTRL so that the voltage at U0956-3, Pin 9 in the same at the reference voltage at U0956-3, Pin 10. When the PWR_SET voltage is decreased, U0956-3 increases RFPA_CNTRL to increase VFORWARD which is proportional to forward power thus increasing the power level. When the PWR_SET voltage is increased, U0956-3 decreases RFPA_CNTRL to decrease VFORWARD, thus decreasing the power level. The microprocessor initiates the loop through U0958-1 and Q0954. Loop timing is set via software together with R0977 and C0973.

**Protection Mechanisms**

Final-stage temperature is sensed in the RFPA resulting in VTEMP, which is proportional to temperature. VTEMP is compared against a reference voltage TEMP_1 (U0959, pin 9) via U0957-1. When VTEMP exceeds TEMP_1, the U0957-1, pin 1, voltage increases and forward biases one of the D0951 diodes, which cuts back power. Power continues to cut back with rising temperature until the voltage level at the junction of R0978 and R0983 is high enough to forward bias D0952, thus clamping the cut back so that the radio meets its duty cycle specification while providing protection against high-temperature conditions. The clamping level is set via TEMP_2 (U0959, pin 10) and U0957-2. U0957-3 is used to sense if a high A+ battery voltage condition exists and, if it does, the Q0955 gate is biased on, which increases the clamp voltage allowing for additional power cutback for a high A+, high temperature condition.

Final-stage current is also monitored via VCURRENT, which is proportional to current. VCURRENT is compared against a reference CURR_LIM_SET (U0959, pin 1) which is tuned after power characterization. If VCURRENT exceeds CURR_LIM_SET, then U0957-4, pin 14, voltage rises and forward biases one of the D0951 diodes, which limits power.

Finally, control voltage is limited by U0956-4 and D0950. RFPA_CNTRL can rise to the control voltage limit set by R0942-4. U0965 provides protection against supply voltage transients. When transients on the A+ voltage exceed 24 volts U0965 pin 1 is pulled high thus turning on Q0954 via TX_DISABLE, R0932, U0958 disabling the control voltage to the PA first stage and momentarily turning off the transmitter. In addition, Q0900 is turned on, forward biasing one of the D0950 diodes and thus reducing the control voltage. When the voltage transient drops back below 20 volts, U0965 pin 1 goes low thus enabling the control loop and turning the transmitter on again.

## 3.13 Frequency Generation Unit (FGU)

This section of the theory of operation provides a detailed circuit description of the frequency generation unit (FGU).

### 3.13.1 VHF (136-174 MHz) Band

The FGU (Figure 3-22 on page 3-30) provides the PM1500 radio with a 16.8 MHz reference frequency, receiver 1st local oscillator, and a modulated transmitter RF carrier that is further amplified by the power amplifier section of the radio.

The FGU consists of the following:

- Reference oscillator (Y3750)
- Low-voltage Fractional-N (LV Frac-N) synthesizer (U3751)
- Two transmitter VCOs
- Three transmitter buffer/amplifier stages
- Two Receiver VCOs
- Three receiver buffer/amplifier stages

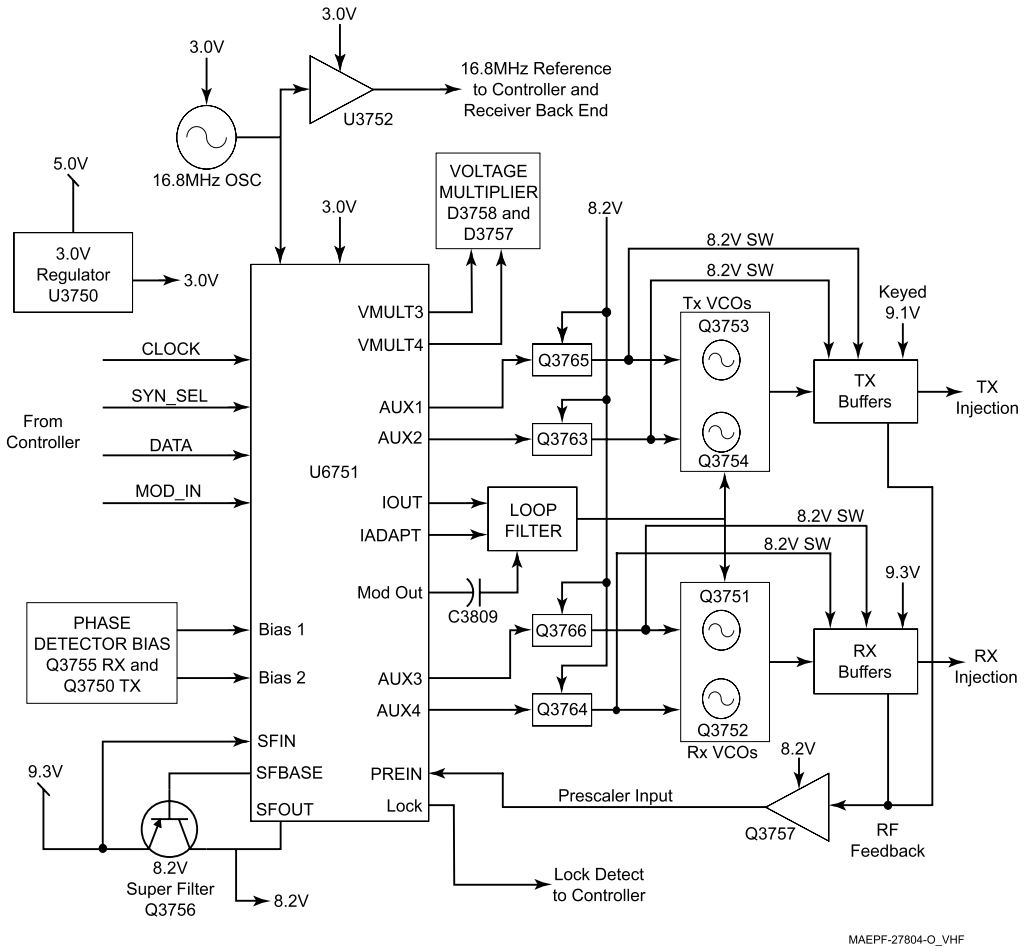



*Figure 3-22. Frequency Generation Unit Block Diagram (VHF)*

### 3.13.1.1 Reference Oscillator

The radio's frequency stability and accuracy is derived from the 16.8 MHz reference oscillator (Y3750). The 16.8 MHz reference oscillator circuitry provides a 16.8 MHz reference to the LV Frac-N (U3751), receiver backend IC (U3000), and the controller section of the PM1500 radio. The reference oscillator circuitry consists of the reference oscillator Y3750 and the inverter/buffer circuitry containing the active device U3752. Y3750 is a voltage-controlled, temperature-compensated crystal oscillator (VCTCXO). Circuitry internal to Y3750 compensates for frequency error over temperature. Warping of the oscillator on frequency is accomplished via a programmable DAC in the LV Frac-N. The warp voltage is present at pin 25 (WARP) of U3751 and is applied to pin 1 of Y3750. The 16.8 MHz output frequency of Y3750 is capacitor-coupled to pin 23 of the LV Frac-N (U3751) and also to the inverter/buffer stage U3752. L3754and C3824 at the output of U3752 filter the 16.8 MHz signal, and R3768 along with C3830 set the appropriate amplitude of the signal for the receiver back-end and controller sections.

### 3.13.1.2 LV Frac-N Synthesizer IC

The LV Frac-N IC (U3751) functions include frequency synthesis, modulation control, voltage multiplication and filtering, and auxiliary logic outputs for VCO selection.

U3751 is a mixed-mode IC containing digital and analog circuits. Separate power supply inputs are used for the various functional blocks on the IC. Inductors L3757 and L3756 provide isolation between supply pin 20 (AVDD - analog supply input) and pin 36 (DVDD - digital supply input) connected to F3.0v. This 3.0 V DC supply is provided by U3750, a 3-V regulator IC.

All programmable variables on the synthesizer IC, such as the synthesizer frequency; reference-oscillator warping; adapt-timer duration; modulation-attenuator setting; and auxiliary-control outputs, which select one of four voltage-controlled oscillators, can be programmed through a serial peripheral interface (SPI). The SPI is connected to the controller microcomputer via three programming lines, namely the data (pin 7), clock (pin 8), and the chip enable (pin 9) of U3751 (Figure 3-23).

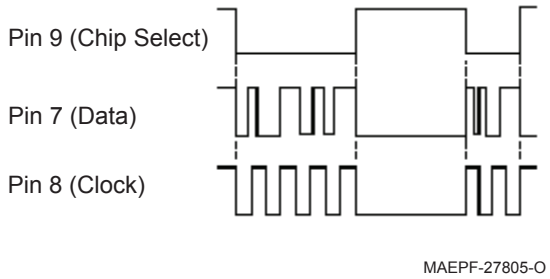



*Figure 3-23. Waveform Representation During Programming of the LV Frac-N IC (VHF)*

### 3.13.1.3 Voltage Multiplier

Pin 12 (VMULT3) and pin 11 (VMULT4) of U3751, together with diode arrays D3757 and D3758 and their associated capacitors C3763, C3764, C3765 and C3767, form the voltage multiplier. The voltage multiplier generates 12.0 Vdc from the 3.0-V supply to supply the phase detector and charge-pump output stage at pin 47 (VCP) of U3751. This voltage multiplier is basically a stacked, multiple-diode capacitor network driven by two 1.05 MHz, 180 degrees out of phase signals from pins 12 and 11 of U3751.

### 3.13.1.4 Superfilter

The superfilter is an active filter that provides a low-noise supply for the VCOs, receiver and transmitter injection amplifiers. Regulator U0950, located in the controller section, supplies 9.3 Vdc to the FGU section thru the filtering network consisting of L3752, C3811, C3751, and C3820. This voltage is applied to pin 30 (SFIN) of U3751 and the emitter of Q3756. The output is a superfiltered 8.2 Vdc at the junction of pin 28 (SFOUT) of U3751 and the collector of Q3756. Filtering is accomplished with capacitors C3821, C3753, and C3752 at the output of this circuit and C3823 at pin 26 of U3751.

### 3.13.1.5 Modulation

To support many voice, data, and signaling protocols, PM1500 radios must modulate the transmitter carrier frequency over a wide audio-frequency range, from less than 10 Hz up to more than 6 kHz. The LV Frac-N IC supports audio frequencies down to zero Hz by using dual-port modulation. The audio signal at pin 10 (MODIN) is internally divided into high- and low-frequency components, which modulate both the synthesizer dividers and the external VCOs through signal MODOUT (pin 41). The IC is adjusted to achieve flat modulation frequency response during transmitter modulation balance calibration using a built-in modulation attenuator.

The Digital-to-Analog Converter (DAC) IC (U0900), and switched-capacitor filter (SCF) IC (FL0900) form the interface between the radio's DSP and the analog input of the LV Frac-N IC.

### 3.13.1.6 Charge Pump Bias

External circuitry connected to pin 39 (Bias 2) and pin 40 (Bias 1) of U3751 determine the current that is applied to the charge-pump circuitry. During receive mode, resistors R3778, R3763, and R3758 set the current supplied to pin 40 (Bias 1). Transistor Q3755 and resistors R3779, R3756, and capacitor C3808 form a circuit that momentarily increases the current to pin 40 (Bias 1) during receiver programming of U3751. This circuit is activated by pin 46 (ADAPTSW) of U3751 during the transition of programming U3751 to frequency and effectively decreases the length of time for the synthesizer to lock on frequency. Similarly, during transmitter mode, resistors R3778, R3763, and R3776 set the current supplied to pin 39 (Bias 2). Transistor Q3750 and resistors R3759, R3776, and capacitor C3825 form a circuit that momentarily increases the current to pin 39 (Bias 2) during transmitter programming of U3751.

### 3.13.1.7 Loop Filter

The loop filter operates in synchronization with the phase detector of U3751 in two modes, normal and adapt. In normal mode, the loop filter forms a third-order loop filter consisting of components R3765, R3773, R3770, C3833, C3810, C3834, C3855 to C3861 and C3881 to C3883.

Pin 43 (IOUT) of U3751 provides the charge-pump current for steering of the control voltage line to the VCOs. During normal mode, pin 45 (IADAPT) is set to a high impedance and has no effect on the loop filter. When U3751 is programmed to a new frequency, the IC is initially operated in adapt mode. In this mode the loop filter is reconfigured for a wider bandwidth allowing the synthesizer to lock faster. The charge-pump output is supplied through pin 45 (IADAPT) in this mode, and this reconfigures the loop filter to behave like a second-order filter.

### 3.13.1.8 Lock Detect

Lock status of the synthesizer loop is provided to the microprocessor by pin 4 (LOCK) of U3751. A high level (3.0 Vdc) indicates that the loop is stable. A low voltage indicates that the loop is not locked and will result in a Fail 001 to be displayed on the control head display.

### 3.13.1.9 Transmitter Injection

The transmit (TX) injection string consists of three amplifier stages (Q3760, Q3759, and Q3758) whose main purpose is to maintain a constant output to drive the RF power amplifier and supply the TX feedback signal to the FGU synthesizer loop. The first two stages are powered by the superfiltered 8.2 Vdc, which is decreased by 0.7 Vdc via the dual diode D3750, resulting in a 7.5 Vdc supply. The third stage is powered by the keyed 9.1 Vdc and the TX injection string is on only with keyed 9.1 Vdc activated during transmit mode. The TX VCO output is attenuated 3 dB via resistors R3840, R3833, and R3839. This output is coupled to the first-stage amplifier Q3760, further attenuated 3 dB via resistors R3803, R3809, and R3803, and then coupled to the second-stage amplifier Q3759. This output is tapped to supply the TX feedback signal to the synthesizer prescaler, and the balance is further attenuated 5 dB via resistors R3818, R3823, and R3824. This output is coupled to the third- stage amplifier Q3758, further attenuated 3 dB via resistors R3858, R3863, and R3859, routed to the 7-pole Cow Chebychev low-pass filter C3917 through C3921, L3785, and L3787 in order to attenuate harmonics. The output is, again, attenuated 3 dB via resistors R3842, R3834, and R3841 and coupled to the input of the RF power amplifier section. The five sets of resistive attenuators provide increased isolation between the TX VCO and RF power amplifier.

#### 3.13.1.10 Receiver Injection

The receiver (RX) injection string is a three-stage amplifier that supplies the RX feedback signal to the FGU synthesizer loop and supplies the first local oscillator (LO) signal to the RX front-end mixer. The RX VCO output is attenuated 3 dB via resistors R3825 through R3827 to increase isolation. This buffered signal is amplified by the first-stage amplifier Q3761, which is supplied by the 8.2-V superfilter for a gain of approximately 6 dB. Resistors R3790, R3798, R3800, and R3801 bias Q3761. L3774 serves as a choke inductor; C3779 and C3868 are added for filtering. The output of Q3761 is attenuated 9.5 dB via resistors R3854, R3865, and R3855. This output is coupled to Q3769 which gain of approximately 3 dB. The output of Q3769 is split into two paths. The first path feeds back to the synthesizer prescaler through blocking capacitor C3913. The second path, which supplies the LO signal to the RX front-end mixer, is attenuated 3 dB via resistors R3857, R3864, and R3856 to increase isolation. This buffered signal is amplified by the second-stage amplifier Q3762, which is supplied by the 9.3-V regulator for a gain of approximately 15 dB. Resistors R3843, R3851, and R3852 biases Q3762. L3783 serves as a choke inductor; C3873, C3870, and C3925 are added for filtering. The output of Q3762 is passed through blocking capacitor C3759, then, routed to C3804, L3781, C3786, and L3782 which form a low pass filter and attenuated 1 dB via resistors R3821, R3794, and R3802 to increase isolation and supply approximately 20 dBm to the LO port of the mixer.

#### 3.13.1.11 Transmitter VCOs

Transmitter frequencies are generated from two external, discrete, Colpits VCOs, low band (136-155 MHz) and high band (155-174 MHz), based on Q3753 and Q3754 respectively. The VCOs are switched On and Off by transistors Q3765 and Q3763, which are controlled by the Frac-N outputs AUX1 and AUX2 respectively when turned high.

#### 3.13.1.12 Receiver VCOs

The receiver first local oscillator frequencies are generated from two external, discrete, Colpits VCOs, low band (245.65-264.65) and high band (264.65-283.65), based on Q3751 and Q3752 respectively. The VCOs are switched On and Off by transistors Q3766 and Q3764, which are controlled by the Frac-N outputs AUX3 and AUX4 respectively when turned high.

#### 3.13.1.13 Prescaler Feedback

RF feedback for the synthesizer loop is provided by prescaler amplifier Q3757. Feedback from both the transmitter and receiver injection strings are coupled to this amplifier through resistor networks that both balance and attenuate the levels prior to amplification by Q3757. The output of Q3757 is coupled to U3751 at pin 32 (PREIN), which is the prescaler input for the synthesizer.

### 3.13.2 UHF Range 1 (380–470 MHz) Band

The FGU (Figure 3-24 on page 3-34) provides the PM1500 radio with a 16.8 MHz reference frequency, receiver 1st local oscillator, and a modulated transmitter RF carrier that is further amplified by the power amplifier section of the radio.

The FGU consists of the following:

- Reference oscillator (Y5750)
- Low-voltage Fractional-N (LV Frac-N) synthesizer (U5752)
- Three receiver voltage-controlled oscillators (VCOs)
- Two transmitter VCOs
- Three receiver LO amplifiers (Q5904, Q5902 and Q5906)
- Two transmitter injection amplifiers (Q5828, and Q5829)

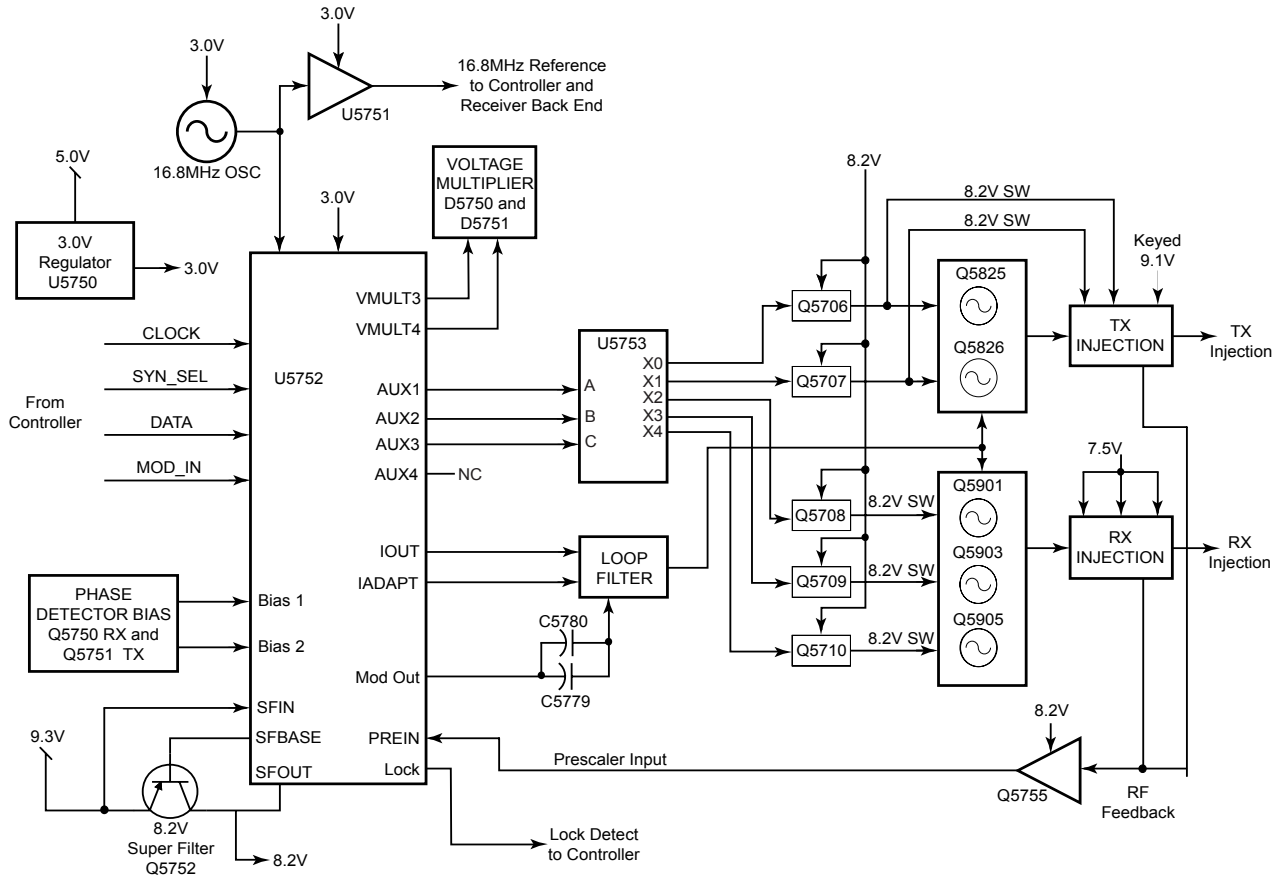



*Figure 3-24. Frequency Generation Unit Block Diagram (UHF Range 1)*

## 3.13.2.1 Reference Oscillator

The radio's frequency stability and accuracy is derived from the 16.8 MHz reference oscillator (Y5750). The 16.8 MHz reference oscillator circuitry provides a 16.8 MHz reference to the LV Frac-N (U5752), receiver back-end IC (U5002), and the controller section of the PM1500 radio. The reference oscillator circuitry consists of the reference oscillator Y5750 and the inverter/buffer circuitry containing the active device U5751. Y5750 is a voltage-controlled, temperature-compensated crystal oscillator (VCTCXO). Circuitry internal to Y5750 compensates for frequency error over temperature. Warping of the oscillator on frequency is accomplished via a programmable DAC in the LV Frac-N. The warp voltage is present at pin 25 (WARP) of U5752 and is applied to pin 1 of Y5750. The 16.8 MHz output frequency of Y5750 is capacitor-coupled to pin 23 of the LV Frac-N (U5752) and also to the inverter/buffer stage U5751. L5753 and C5768 at the output of U5751 filter the 16.8 MHz signal, and R5768 along with C5763 set the appropriate amplitude of the signal for the receiver back-end and controller sections.

## 3.13.2.2 LV Frac-N Synthesizer IC

The LV Frac-N IC (U5752) functions include frequency synthesis, modulation control, voltage multiplication and filtering, and auxiliary logic outputs for VCO selection.

U5752 is a mixed-mode IC containing digital and analog circuits. Separate power supply inputs are used for the various functional blocks on the IC. Inductors L5755 and L5756 provide isolation between supply pin 20 (AVDD - analog supply input) and pin 36 (DVDD - digital supply input) connected to F3.0v. This 3.0 V DC supply is provided by U5750, a 3-V regulator IC.

All programmable variables on the synthesizer IC, such as the synthesizer frequency; reference-oscillator warping; adapt-timer duration; modulation-attenuator setting; and auxiliary-control outputs, which select one of five voltage-controlled oscillators, can be programmed through a serial peripheral interface (SPI). The SPI is connected to the controller microcomputer via three programming lines, namely the data (pin 7), clock (pin 8), and the chip enable (pin 9) of U5752 (Figure 3-25).

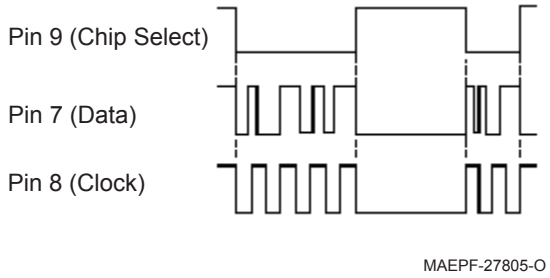



*Figure 3-25. Waveform Representation During Programming of the LV Frac-N IC (UHF Range 1)*

### 3.13.2.3 Voltage Multiplier

Pin 12 (VMULT3) and pin 11 (VMULT4) of U5752, together with diode arrays D5750 and D5751 and their associated capacitors C5775, C5776, C5777 and C5778, form the voltage multiplier. The voltage multiplier generates 13.4 Vdc from the 5.0-V supply to supply the phase detector and charge-pump output stage at pin 47 (VCP) of U5752. This voltage multiplier is basically a stacked, multiple-diode capacitor network driven by two 1.05 MHz, 180 degrees out of phase signals from pins 12 and 11 of U5752.

### 3.13.2.4 Superfilter

The superfilter is an active filter that provides a low-noise supply for the VCOs, receiver and transmitter injection amplifiers. Regulator U0950, located in the controller section, supplies 9.3 Vdc to the FGU section thru the filtering network consisting of L5750, C5751, C5753, and C5755. This voltage is applied to pin 30 (SFIN) of U5752 and the emitter of Q5752. The output is a superfiltered 8.2 Vdc at the junction of pin 28 (SFOUT) of U5752 and the collector of Q5752. Filtering is accomplished with capacitors C5766, C5769, and C5772 at the output of this circuit and C5770 at pin 26 of U5752.

### 3.13.2.5 Modulation

To support many voice, data, and signaling protocols, PM1500 radios must modulate the transmitter carrier frequency over a wide audio-frequency range, from less than 10 Hz up to more than 6 kHz. The LV Frac-N IC supports audio frequencies down to zero Hz by using dual-port modulation. The audio signal at pin 10 (MODIN) is internally divided into high- and low-frequency components, which modulate both the synthesizer dividers and the external VCOs through signal MODOUT (pin 41). The IC is adjusted to achieve flat modulation frequency response during transmitter modulation balance calibration using a built-in modulation attenuator.

The Digital-to-Analog Converter (DAC) IC (U0900), and switched-capacitor filter (SCF) IC (FL0900) form the interface between the radio's DSP and the analog input of the LV Frac-N IC.

### 3.13.2.6 Charge Pump Bias

External circuitry connected to pin 39 (Bias 2) and pin 40 (Bias 1) of U5752 determine the current that is applied to the charge-pump circuitry. During receive mode, resistors R5754, R5759, and R5765 set the current supplied to pin 40 (Bias 1). Transistor Q5750 and resistors R5752, R5753, and capacitor C5759 form a circuit that momentarily increases the current to pin 40 (Bias 1) during receiver programming of U5752. This circuit is activated by pin 46 (ADAPTSW) of U5752 during the transition of programming U5752 to frequency and effectively decreases the length of time for the synthesizer to lock on frequency. Similarly, during transmitter mode, resistors R5764, R5759, and R5753 set the current supplied to pin 39 (Bias 2). Transistor Q5752 and resistors R5767, R5764, and capacitor C5762 form a circuit that momentarily increases the current to pin 39 (Bias 2) during transmitter programming of U5752.

### 3.13.2.7 Loop Filter

The loop filter operates in synchronization with the phase detector of U5752 in two modes, normal and adapt. In normal mode, the loop filter forms a third-order loop filter consisting of components R5772, R5774, R5775, C5781 to C5787, C5790 to C5792, and C5809 to C5812.

Pin 43 (IOUT) of U5752 provides the charge-pump current for steering of the control voltage line to the VCOs. During normal mode, pin 45 (IADAPT) is set to a high impedance and has no effect on the loop filter. When U5752 is programmed to a new frequency, the IC is initially operated in adapt mode. In this mode the loop filter is reconfigured for a wider bandwidth allowing the synthesizer to lock faster. The charge-pump output is supplied through pin 45 (IADAPT) in this mode, and this reconfigures the loop filter to behave like a second-order filter.

### 3.13.2.8 Lock Detect

Lock status of the synthesizer loop is provided to the microprocessor by pin 4 (LOCK) of U5752. A high level (3.0 Vdc) indicates that the loop is stable. A low voltage indicates that the loop is not locked and will result in a Fail 001 to be displayed on the control head display.

### 3.13.2.9 Transmitter Injection

The transmit (TX) injection string consists of three amplifier stages (Q5828, Q5829, and Q5501) whose main purpose is to maintain a constant output to drive the RF power amplifier chain and supply the TX feedback signal to the FGU synthesizer loop. The first two stages are powered by the superfiltered 8.2 Vdc, which is decreased by 0.7 Vdc via the dual diode D5833, resulting in a 7.5 Vdc supply. The third stage is powered by the keyed 9.1 Vdc and the TX injection string is on only with keyed 9.1 Vdc activated during transmit mode.

The output of the second stage amplifier Q5829 is tapped via capacitor C5863 to supply the TX feedback signal to the synthesizer prescalar via the amplifier Q5755.

### 3.13.2.10 Receiver Injection

The receiver (RX) injection string is a four-stage amplifier that supplies the RX feedback signal to the FGU synthesizer loop and supplies the first local oscillator (LO) signal to the RX front-end mixer. Each RX VCO output is attenuated via resistive pads to increase isolation. The VCO signals are buffered by the RX injection amplifier string Q5904, Q5902 and Q5906. The output of Q5906 is tapped via C5957 and fed back to the synthesizer prescaler through amplifier Q5755. The main path at the output of Q5906 is amplified by U5303 to a level of 24 dBm to provide the first LO signal to the RX front end mixer in the receiver chain.

### 3.13.2.11 Transmitter VCOs

Transmitter frequencies are generated from two VCOs, Q5825 and Q5826.

- Q5825 supplies frequencies in the range 380 MHz up to (but not including) 425 MHz.
- Q5826 supplies frequencies in the range from 425 MHz to 470 MHz.

### 3.13.2.12 Receiver VCOs

Receiver first local-oscillator frequencies are generated from three VCOs, Q5901, Q5903 and Q5905.

- Q5901 supplies frequencies in the range 489.65 MHz up to (but not including) 519.65 MHz.
- Q5903 supplies frequencies in the range 519.65 MHz up to (but not including) 549.65 MHz.
- Q5905 supplies frequencies in the range 549.65 MHz up to 579.65 MHz.

The RX VCOs operate at frequencies which are 109.65 MHz higher than the radio channel selected frequency since the receiver is high side injected, and the first IF frequency is 109.65 MHz.

The five VCOs are selected by the following pattern of logic levels on the AUX pins from the synthesizer chip U5752 (Table 3-7):

*Table 3-7. VCO AUX Pin Logic UHF Range 1*

| VCO | AUX1 | AUX2 | AUX3 |
|---|---|---|---|
| RX VCO Q5901 | 0 | 1 | 0 |
| RX VCO Q5903 | 1 | 1 | 0 |
| RX VCO Q5905 | 0 | 0 | 1 |
| TX VCO Q5825 | 0 | 0 | 0 |
| TX VCO Q5826 | 1 | 0 | 0 |

### 3.13.2.13 Prescaler Feedback

RF feedback for the synthesizer loop is provided by prescaler amplifier Q5755. Feedback from both the transmitter and receiver injection strings are coupled to this amplifier through capacitors C5863 and C5957. The output of Q5755 is coupled to U5752 at pin 32 (PREIN), which is the prescaler input for the synthesizer.

## 3.14 Controller Section

The controller section consists of a daughtercard module and associated circuitry to which it interfaces. It is the central interface between the various subsystems of the radio. Its main task is to interpret user input, provide user feedback, and schedule events in the radio operation, which include programming ICs, performing digital signal processing (DSP) on baseband audio and data, and sending messages to the control head display. Figure 3-26 on page 3-38 illustrates the components of the controller section.

The DSP section of the microprocessor performs digital vocoder (voice coder-decoder) functions previously performed by analog circuitry. This includes all tone signaling, trunking signaling, and conventional analog voice processing.

All analog signal processing is accomplished digitally using the Patriot IC microprocessor (U100). This microprocessor consists of a microcontroller, as well as a DSP. In addition, it provides a digital voice plus data capability utilizing IMBE voice-compression algorithms. *Vocoder* is the general term used to refer to these DSP-based systems.

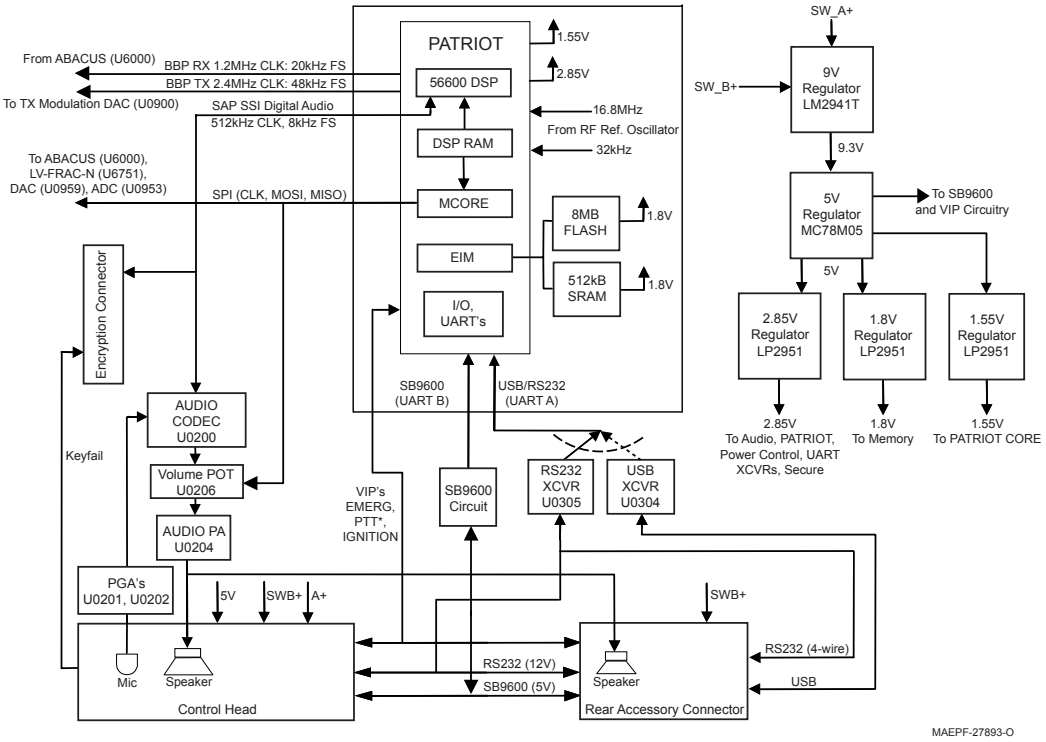



*Figure 3-26. PM1500 Controller Section*

The controller consists of digital logic comprised of a microprocessor (the Patriot IC, U100) and memory consisting of a 512K x 16 SRAM (U103) and a 4M x 16 FLASH ROM (U102). The microprocessor is a dual-core processor that contains a DSP56600 core and an MCORE microcontroller with custom peripherals. The term, *MCU*, refers to the MCORE controller section of the Patriot IC. The FLASH ROM contains the programs that the Patriot microprocessor executes and is used to store customer-specific information and radio-personality features that, together, constitute the *codeplug*. It allows the controller firmware to be reprogrammed for future software upgrades or feature enhancements. The SRAM is used for scratchpad memory during program execution.

The controller performs the programming of all peripheral ICs. This is done via a serial peripheral interface (SPI) bus and through General-Purpose Input/Outputs (GPIO) from the Patriot IC. ICs programmed through this interface include the LV Frac-N synthesizer, ABACUS III IC, D/A converter (DAC), A/-D converter (ADC), and volume digital potentiometer.

In addition to the SPI bus, the controller also maintains two asynchronous serial busses: the SB9600 bus and an RS-232/USB serial bus. The SB9600 bus interfaces the controller section to different hardware accessories, some of which may be external to the radio, including the control head. The RS-232/USB bus is used as a common data interface for external devices and for programming/ flashing the radio.

User input is from the control head and is sent to the controller through the SB9600 bus. Feedback to the user is provided by the control-head display.

The controller schedules the activities of the DSP, including setting operational modes and parameters. The DSP section of the processor contains an 84K x 24 program RAM, 2K x 24 program ROM, and 62K x 16 data RAM, which are all integrated into the Patriot IC. The vocoder subsystem consists of this DSP core, the modulation DAC (U0900), and the voice CODEC (U0200).

In receive mode, the ABACUS III IC provides data samples directly to the DSP for processing. In transmit mode, the DAC provides a serial D/A converter. The data generated by the DSP is filtered and reconstructed as an analog signal to present a modulation signal to the VCO (voltage-controlled oscillator) at the LV Frac-N synthesizer. Both the transmit and receive digital data paths between the DSP and the CODEC are through the Patriot IC BBP (Baseband Interface Port) SSI port.

The CODEC provides A/D conversion of the analog microphone signal and D/A conversion of the analog speaker output. During transmit, the microphone audio is passed through the gain/filtering analog circuitry to the CODEC, which translates the analog waveform to serial SSI data. This data is made available to the DSP through the Serial Audio Port (SAP) of the Patriot IC. Conversely, the DSP writes speaker data samples to the D/A in the CODEC through the SAP port. The CODEC provides an analog speaker output audio signal to the audio power amplifier, U0204.

## 3.14.1 Daughtercard Module

The daughtercard module (Figure 3-27) contains the central processing unit (CPU) of the radio. This module interfaces with other parts of the main board. This module primarily contains three sections:

- Microprocessor (Patriot IC: U100): consists of a controller and a DSP whose functions are described above in “3.14. Controller Section” on page 3-37.
- FLASH IC (U102): the firmware storage IC
- SRAM IC (U103): used by the microprocessor to perform its memory operations

**NOTE:** The three sections of the daughtercard module are highly susceptible to ESD and moisture damage. Extreme care is advised when handling or servicing the main board.

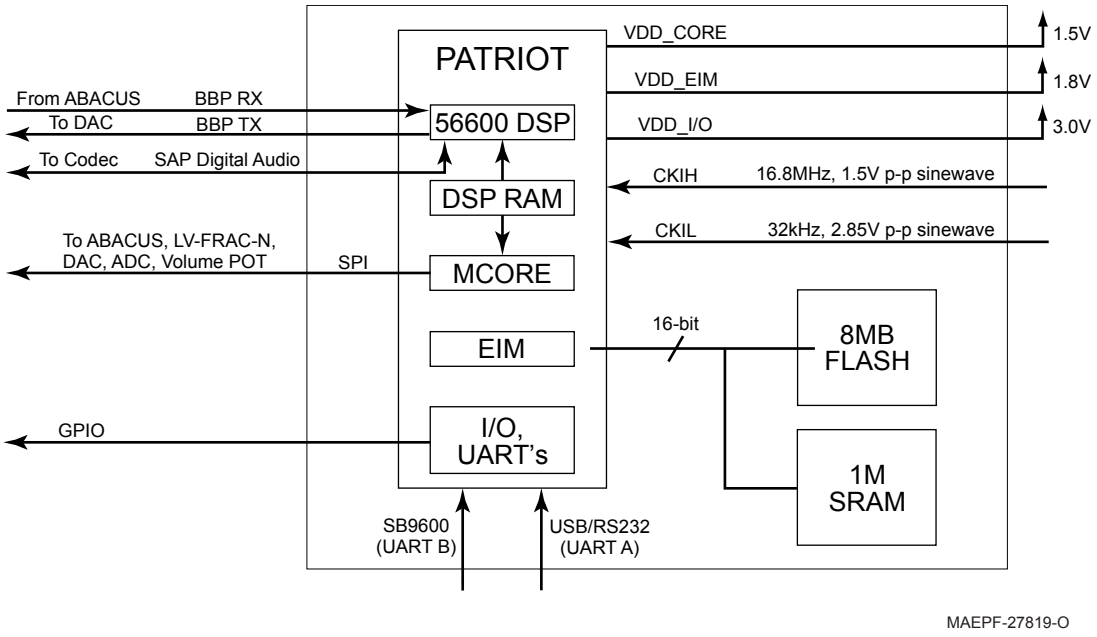



*Figure 3-27. PM1500 Daughtercard Module*

## 3.14.2 Controller DC Power Distribution

Figure 3-28 illustrates the controller DC power distribution circuitry.

The A+ power for the radio is derived from the 12-V battery, which is applied to the main board through connector J0950. This A+ voltage is routed to the control-head connector, J0401, pins 19 and 21, to the control head.

A power FET (Q51) provides the means of controlling the main power source (SWB+) by the on/off switch. SWB+ is routed back to the main board through connector J0401-17 and out the rear connector, J2-24.

SW_B+ turns on controller FET switch Q0503, which supplies SW_A+ to regulator U0500. This 9.3-V regulator powers up the main 5-V controller regulator U0503. The 5-V supply powers on all four controller regulators:

- U0962 (3.0 V) for the power control section
- U0503 (2.85 V) for the controller and daughtercard I/O
- U0507 (1.85 V) for the memory
- U0502 (1.55 V) for the microprocessor core.

The SW+5-V regulator is the main power source for the controller.

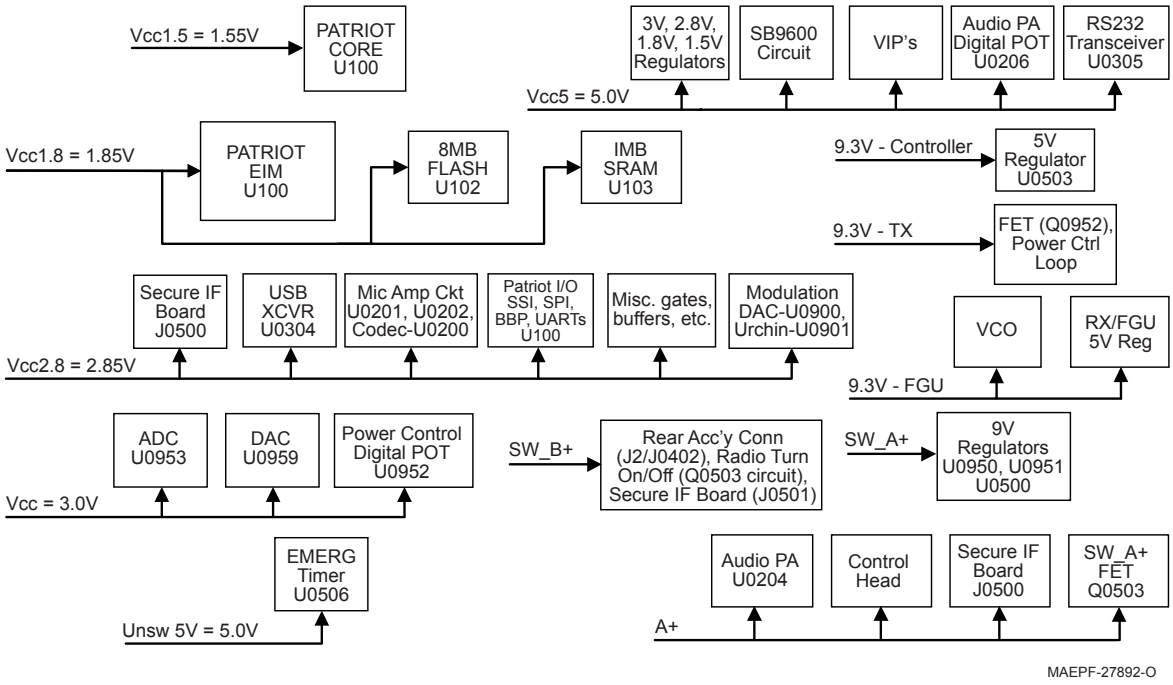



*Figure 3-28. B+ Routing for Controller Section*

On the secure interface board, U800, Q802, and Q803 provide SWB+ to the encryption module (if equipped). The SWB+ and UNSWB+ encryption voltages both originate from the secure interface board and are fed to the encryption module via J0701 and J0501.

It should also be noted that a system reset is provided by the undervoltage detector, U0504. This device brings the system out of reset on power-up, and provides a system reset to the microcomputer on power-down.

The various voltages used by the ICs on the main board are shown in Table 3-8.

*Table 3-8. Integrated Circuits Voltages*

| Integrated Circuit | UNSW5V | SW 5V | A+ | 3.0 V | 2.85 V | 9.3 V_TX | 1.85 V | 1.55 V |
|---|---|---|---|---|---|---|---|---|
| Patriot Microprocessor | | | | | U100 | | U100 | U100 |
| Flash | | | | | | | U102 | |
| SRAM | | | | | | | U103 | |
| A/D | | | | U0953-28 | | | | |
| D/A | | | | U0959-4 | | | | |
| Modulation D/A | | | | | U0900-3<br>FL0900-4 | | | |
| Urchin | | | | | U0901 | | | |
| RS-232 XCVR | | U0305-16 | | | | | | |
| USB XCVR | | | | | U0304-7 | | | |
| Audio PA | | | U0204-7 | | | | | |
| CODEC | | | | | U200-6 | | | |
| Amplifiers, EPOTs | | | | | U0201-4<br>U0202-3 | | | |
| 555 Timer | U0506-4 | | | | | | | |
| SB9600 MUX | | U606-16 | | | | | | |
| Volume Pot | | U0206-7 | | | | | | |
| 32K Crystal | | | | | Y0100-5 | | | |
| Modulation MUX | | | | | U0902-16 | | | |
| Power Control | | | | | | U0956-4<br>U0957-4<br>U0960-4 | | |
| Keyed 9.1 V Switch | | | | | | Q0952 | | |

## 3.14.3 Encryption Voltages

The secure interface board produces two voltages sourced by A+ and SW_B+ through J0501, pins 10 and 9, that are used by the encryption module: UNSW_B+_ENC (7 V) and SW_B+_ENC (7 V). The constant 7 V is generated using U800, Q802, and Q803 and is fed to J0701. At the secure interface board, the 7 V provides continuous unswitched voltage when the vehicular battery is connected to the radio and is also switched to provide SWB+ to the encryption module. A 5-V storage circuit, C810 (0.47-farad capacitor), provides +5 Vdc to the encryption module via J0701, pin 12, to hold encryption keys for a period of three days with no A+ voltage present. The 5 V and 2.85 V controller supplies are used to provide logic translation between the legacy keyloader data (5 V) and the universal crypto module (UCM) (3 V). The secure interface board also supplies the UCM chip-select logic line and the other control lines, clocks, and other components, to the main board microprocessor.

## 3.14.4 Reset Circuits

The reset circuits consist of the power-on reset (POR*) circuit (Figure 3-29), SW_B+ sense circuit, and SB9600 bus reset circuit. These circuits allow the microprocessor to recover from an unstable condition, such as removing battery A+ from the radio while it is on, battery voltage too low, and miscommunication to remote devices on the SB9600 bus, as well as generally monitoring the power on/off condition.

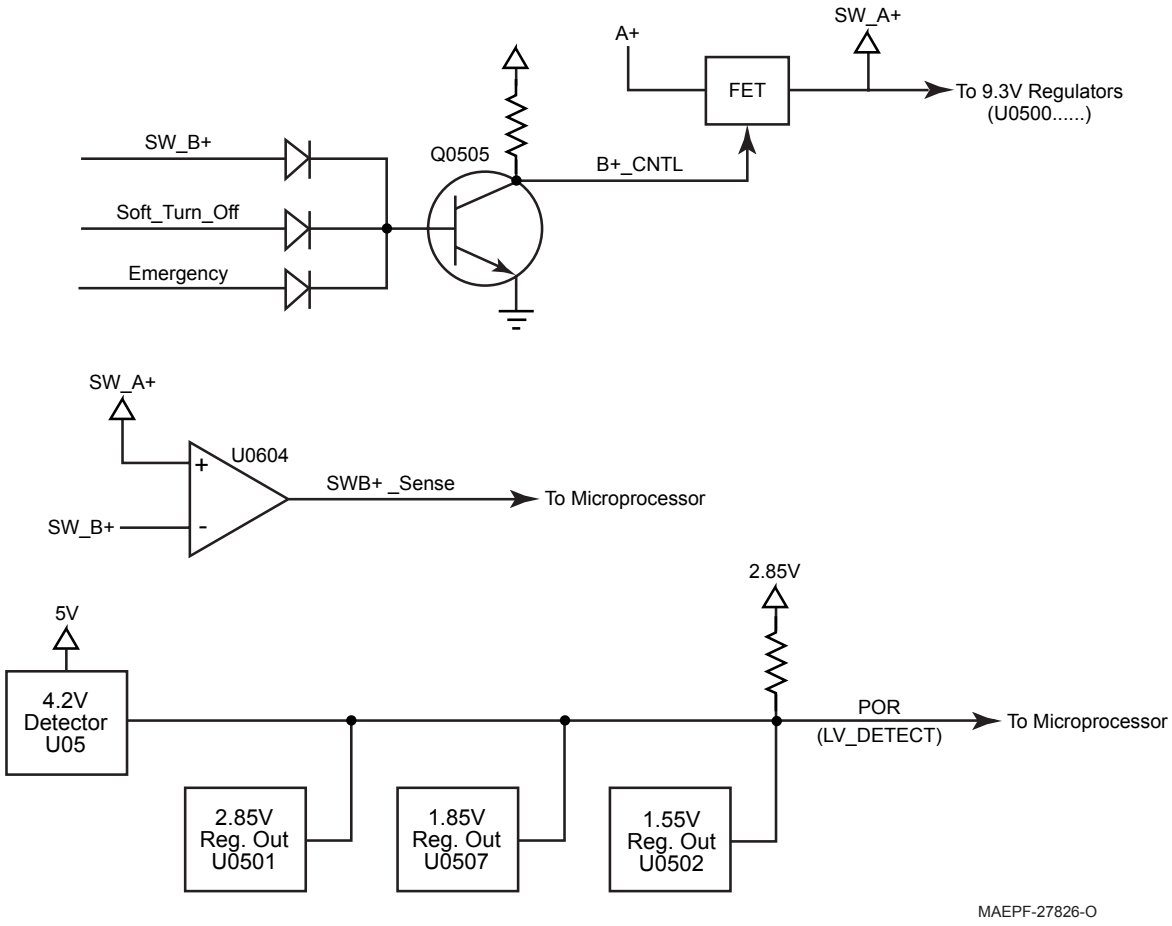



*Figure 3-29. Power-On Reset Circuit*

The SW_B+ and A+ voltage levels are sensed by the comparator circuit consisting of U0604, Q0505, and R0505, R0506, R0508, and R0509. When SW_B+ goes below 8.5 V or SW_A+ goes below 10 V, U0604-7, SW B+ Sense, goes low. When this occurs, the radio completes its soft power-down and eventually drives the Soft_Turn_Off line low, which turns off Q0502 and FET Q0503. This turns off SW_A+ and eventually turns off the 9-V, 5-V, 3-V, 2.85-V, 1.85-V, and 1.55-V regulators.

The POR* circuit consists of a wired-OR circuit of the error output lines from the 2.85-V, 1.85-V, and 1.55-V regulators, which indicates a failure of either of these regulators; and a reset output from a 4.2-V detector IC U0504. When either of the regulators fails or the 5-V supply begins to drop below 4.2 V, POR* is asserted low, resetting the microprocessor U100 at U001, LV_DETECT.

When the radio is operating correctly (A+ > 10 V and SW_B+ > 8.5 V), SW_A+ and VOCON regulators U0501, U0502, and U05007 are at normal voltage. The POR* line and SW_B+_Sense are high (2.85 V).

The other signal that can cause a processor/radio reset is the SB9600 RESET line. The RESET line is driven high (5 V) by a remote device that is having problems communicating with the processor.

## 3.14.5 Power-Up/Power-Down Sequence

The PM1500 radio power is cycled via SW_B+ (battery voltage level). This voltage is supplied by the control head via J0401, pin 17, when the On/Off button is cycled.SW_B+ is derived from the battery A+ voltage via a power FET in the control head (W5 and W7 models).

### 3.14.5.1 Power Turn-On

When SW_B+ is active at turn-on time, the voltage turns on Q0501, Q0504, and Q0505, which then turns on SW_A+ via the power FET Q0503. SW_A+ then supplies all radio power (9.3-V regulators and controller regulators). SW_A+ is derived the same way SW_B+ is at the control head.

SW_B+ is also sent to the comparator circuit, U0604, which allows the processor to monitor its level via SW_B+_Sense (active high). When SW_B+ is sensed “on” by the processor, it asserts high an output line, Soft_Turn_Off, to the wired-OR turn-on circuit at Q0502. This active-high processor output is required for performing a soft power-down.

### 3.14.5.2 Power Turn-Off

At turn-off, SW_B+ becomes inactive at the control heads. As this voltage falls below 8.5 V, the U0604 comparator circuit drives SW_B+_Sense low, telling the processor to power down the radio. The processor eventually de-asserts low the SOFT_TURN_OFF signal after keeping the wired-OR turn-on circuit, and thus SW_A+ and all radio power, on long enough to perform a soft power-down, which includes deaffiliating on a trunked system, saving radio status parameters, etc. Once the SW_B+ and SOFT_TURN_ON lines are both low, Q0502 and Q0504 turn off, which provides a low at power FET Q0503. This turns off SW_A+, which removes all radio power.

### 3.14.5.3 Emergency Power-Up/-Down Sequence

The emergency input is provided to enable the radio transceiver to be activated, regardless of the state of the control head’s On/Off switch. The emergency input is activated by opening the normally grounded footswitch connected to either J0401, pin 18, or J0402, pin 28, of the controller. This input is routed to Q0501 and to the same wired or turn-on circuit and SW_A+ FET.

Under normal configurations, the output of Q0501 goes low to trigger pin 2 of a monostable vibrator U0506 causing the output pin 3 to go high. This enables the regulators through D0501 and Q0502. It also enables the EMERG_SENSE line to the MCU through U0508-1. The monostable vibrator is a timeout timer that holds the regulators on for 300 ms. This delay is required to allow the MCU to initiate its start-up vectors and poll the EMEG_SENSE line J17 of U0001. The MCU takes control of the regulators through D0501 and Q0502 by holding SOFT_TURN_OFF high.

The emergency active state depends on the emergency polarity into the timer. Normally with Q0501 present, emergency is active with the footswitch open. Removing Q0501 and adding R0527 causes the emergency to go active with the switch closed.

## 3.14.6 MCU and DSP System Clocks

The MCU within the Patriot IC (U100) needs two clocks for proper operation. A 16.8 MHz sine-wave reference is provided at the CKIH (A6) pin of the Patriot IC. The source of this clock is a 16.8 MHz oscillator and its associated filtering circuitry. This clock is also provided to the Urchin IC (U0901). The MCU has the capability of running at higher clock rates, which are programmable and based on this 16.8 MHz reference. The DSP within the Patriot IC also uses the 16.8 MHz provided at the CKIH (A6) pin as a reference.

The Patriot IC also requires a 32 kHz square-wave clock, provided at the CKIL (J7) pin. This clock is generated by a 32 kHz crystal (Y0100), with supporting circuitry for oscillation. This clock is utilized only for the Patriot IC, and is used for reset capability and other Patriot IC functions.

Four additional clocks are also supplied to the daughtercard: a 20 kHz RX frame-sync clock, a 48 kHz TX frame-sync clock, a 1.2 MHz RX data clock, and a 2.4 MHz TX data clock. The microprocessor also generates the digital audio bus clocks: a 512 kHz data clock and an 8 kHz frame-sync clock.

## 3.14.7 RS-232 USB Bus

The PM1500 microcontroller in the Patriot IC (U100) has two internal UARTS that can be configured for RS-232 data communication: UARTA and UARTB (Figure 3-30).

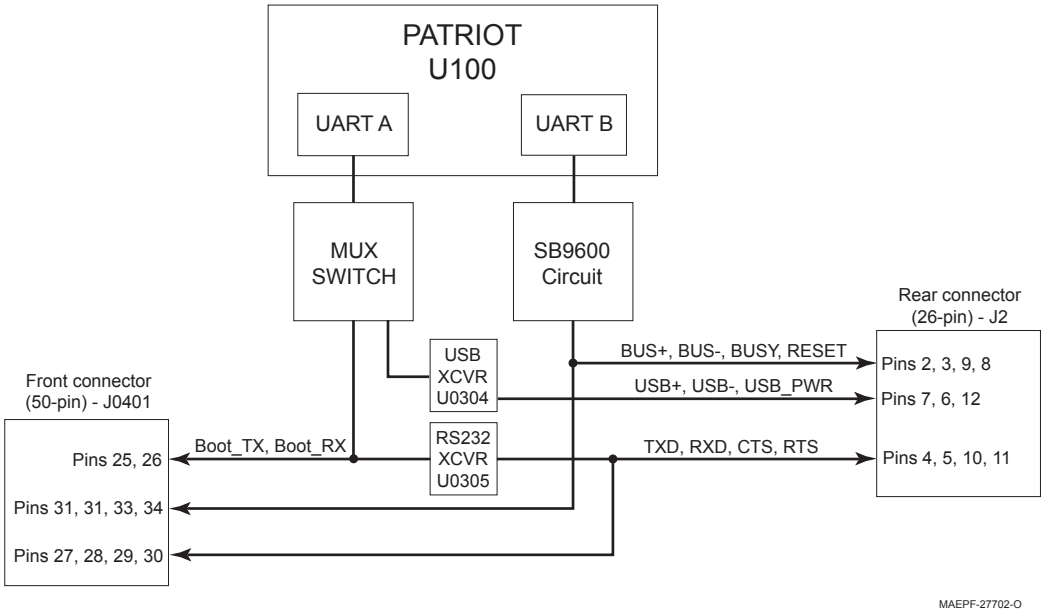



*Figure 3-30. Patriot IC (U100) UART Configuration*

UARTA is configured for RS-232 data transmission by default, and its data transmission is routed through an on-board RS-232 transceiver (U0305) to bring the data voltage levels up to EIA RS-232 standards before the data exits the front and rear of the radio. The U0305 is a two-driver, two-receiver device, protected against ±15 kV electrostatic discharges.

For data output, UARTA transmits data from the microcontroller at 0-V and 2.85-V levels. This data is sent on an asynchronous serial bus, which is routed to an on-board RS-232 transceiver (U0305) that converts these low-voltage levels to -9 V and +9 V signal levels. This RS-232-formatted data is routed out the front of the radio (J0401-27, J0401-28, J0401-29, J0401-30) and to the rear of the radio (J0402-7, J0402-8, J0402-9, J0402-10).

For data input, U0305 can accept up to ±30-V signal levels. These high levels are converted inside the U0305 down to 0-V and 5-V levels. Next these data levels are routed thru a buffer stage (U0303) which lowers the data to 0-V and 2.85-V levels. This is the required voltage levels for the input into the microcontroller.

This radio meets EIA compatibility with external data accessory devices. The naming scheme (see Table 3-9 and Table 3-10) used for the microcontroller's RS-232 lines sometimes conflict with EIA RS-232 naming schemes. This is due to the microcontroller's pin names versus I/O direction, compared to the EIA pin names versus I/O direction. Therefore, a matching naming scheme has been developed. If the pin is coming from the UART, the pin name has UART in the name. However, if you want to know how the EIA standard identifies the pin, a chart exists that provides the naming conversion. The shipping rear data cable automatically routes the pins according to the EIA standard, so interfacing to external data devices, such as computers, is done correctly. The naming scheme information is only needed when the rear connector is opened and the wires need to be identified for connection to a custom device. Note that the correct interfacing of RS-232 lines is "output line" to "input line". For example, the TX pin of one device connects to the RX pin of the other device, and the RTS pin of one device connects to the CTS pin of the other device. Never connect TX to TX, RX to RX, and so on.

*Table 3-9. Rear Connector Naming Scheme*

| Radio Pin Direction | J2 Pin No. | J2 Pin Name | Pin Alternate Name | EIA-Compatible Name at Rear Conn. J2 | P2 Rear Accessory Cable DB9 (Female) = DCE Interface | | DB9 (Male) Serial Port Connector = DTE Interface | Data Device Pin Direction |
|---|---|---|---|---|---|---|---|---|
| Output | 4 | UARTA_TX | No Change | TX_DCE | TX_DCE = pin 2 | <--> | pin 2 = RX_DTE | Input |
| Input | 5 | UARTA_RX | No Change | RX_DCE | RX_DCE = pin 3 | <--> | pin 3 = TX_DTE | Output |
| Output | 10 | UARTA_CTS | Becomes RTS | RTS_DCE | RTS_DCE = pin 8 | <--> | pin 8 = CTS_DTE | Input |
| Input | 11 | UARTA_RTS | Becomes CTS | CTS_DCE | CTS_DCE = pin 7 | <--> | pin 7 = RTS_DTE | Output |

**Note:** Connecting to a computer = DTE device
TX to RX and RTS to CTS

*Table 3-10. Remote-Mount Interconnect Board Connector Naming Scheme*

| Radio Pin Direc-tion | J6 Pin No. | J2 Pin Name | Pin Alternate Name | EIA-Compatible Name at Rear Conn. J2 | P2 Rear Accessory Cable DB9 (Female) = DCE Interface | HKN6122 Data Cable DB9 (Female) = DCE Interface | | DB9 (Male) Serial Port Connector = DTE Interface | Data Device Pin Direc-tion |
|---|---|---|---|---|---|---|---|---|---|
| Output | 2 | RS232_RXD | Becomes TX | TX_DCE | pin 2 = TX_DCE | TX_DCE = pin 2 | <--> | pin 2 = RX_DTE | Input |
| Input | 3 | RS232_TXD | Becomes RX | RX_DCE | pin 3 = RX_DCE | RX_DCE = pin 3 | <--> | pin 3 = TX_DTE | Output |
| Output | 17 | RS232_CTS | Becomes RTS | RTS_DCE | pin 17 = RTS_DCE | RTS_DCE = pin 8 | <--> | pin 8 = CTS_DTE | Input |
| Input | 4 | RS232_RTS | Becomes CTS | CTS_DCE | pin 4 = CTS_DCE | CTS_DCE = pin 7 | <--> | pin 7 = RTS_DTE | Output |

**Note:** Connecting to a computer = DTE device
TX to RX and RTS to CTS

### 3.14.8 Serial Communications on the External Bus (SB9600)

The SB9600 bus is an asynchronous serial communication bus using a Motorola-proprietary protocol. It provides a means for the microcontroller within the Patriot IC (U100) to communicate with other hardware devices. In the radio, it communicates with hardware accessories connected to the accessory connector and the remote interface board. Serial communications on this external bus uses three of the four SB9600 lines: BUS+ (J0401-31), BUS- (J0401-32), and BUSY (J0401-33) data lines originating from the microcontroller's secondary UART.

These three lines are bidirectional; therefore, numerous devices can be in parallel on the bus. All devices monitor the bus while data is being transmitted at a 9600-baud rate. The transmitted data includes the address of the device for which the data is intended. Examples of the different types of data are: Button press/release data, sent to and from the radio's microprocessor; control-head display data; and the existence of accessories on the bus, such as Siren or VRS. The use of these accessories requires the existence of SB9600 protocol on one of the radio's data buses.

The microcontroller sends the data transmission from UARTB, onto the bus at 0-V and 2.85-V levels. Next, the software sets microcontroller SB96_RS232_EN to a logic HIGH. Buffers (U0602 and U0603) are now powered and the data is changed to the SB9600 format via pull-up and pull-down logic circuitry. SB96_RS232_EN also sets the data MUX (U0606) to route the new SB9600-formatted data to the correct lines at the front of the radio (J0401-31, J0401-32, J0401-33, and J0401-34) and to the rear of the radio (J0402-3, J0402-4, J0402-5, and J0402-6). Since SB96_RS232_EN is kept HIGH as the default state, the UARTB default function is for SB9600 data traffic only. This is true for the radio in either dash- or remote-mount configuration.

When the microcontroller sends data onto the bus, the microcontroller monitors the transmitted data as a collision-detection measure. If a collision is detected as a result of receiving a different data pattern, the microcontroller will stop transmission and try again; that is, when the RESET line (J0401-34) is used.

Data bus drivers for the BUS+ and BUS- lines are differentially driven, having BUS- inverted from the state of BUS+. The drivers are so designed that any of the devices on the bus can drive these lines to their non-idle state without loading problems.

In a typical data transmission, the microcontroller examines the BUSY line. If the BUSY line is in the idle state, the microcontroller sets the BUSY line HIGH, and then it transmits using BUS+ and BUS-. At the end of the transmission, the microcontroller returns the BUSY line to idle.

The idle states for the SB9600 lines are: BUS+ = logic HIGH, BUS- = logic LOW, BUSY = logic LOW, and RESET = logic LOW.

### 3.14.9 Serial Peripheral Interface (SPI) Bus

The microcontroller (U100) utilizes an SPI bus for configuring and operating specific ICs in the controller and RF sections of the radio. The SPI bus is a synchronous serial bus made up of four lines (see Figure 3-31 on page 3-47). The CLK line is used to control the speed of the data to/from the IC and the microcontroller. If necessary, this clock speed can be adjusted to a different value for each IC.

The Data-OUT pin receives a data string from the microcontroller. The Data-IN pin sends a serial data string to the microcontroller, usually to indicate what the current programmed values are of the IC. The Chip Select pin is used to select which single IC is currently being programmed. Each ICs Chip Select pin is hardwired to a specific SPI bus and can only be controlled by that bus. The microcontroller pulls the ICs chip-select line LOW to enable the IC for receiving configuration data, for programming, or for sending out its existing configuration state. Additional SPI buses allow chip selecting to occur in parallel. Therefore, the operations on each SPI bus do not add any delay to the activities occurring on another SPI bus.

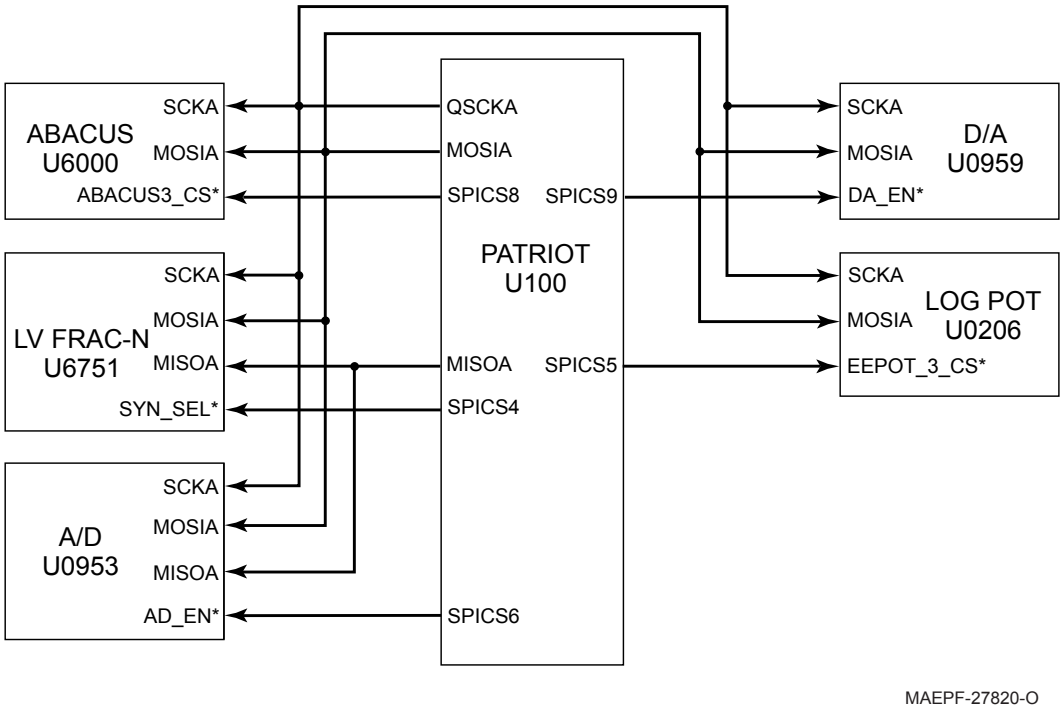



*Figure 3-31. Serial Peripheral Interface (SPI) Block Diagram*

The following ICs are controlled and programmed by SPI_A:

- ABACUS III (U6000): Sigma Delta A/D converter and 2nd LO frequency adjust. The ABACUS III IC has a single pin for both input and output. Therefore, additional circuitry (U0103 and U0105) handles the SPI_MISO or the SPI_MOSI data lines from the microcontroller and allows a read or write operation to occur with the ABACUS III IC via a single bidirectional data line.
- A/D (U0953): monitors temperature, source voltage, PA current, feedback-voltage loop, forward-detected voltage, and reverse-detected voltage
- D/A (U0959) (microcontroller only writes to IC): controls bias stages 1-4, sets current limit, monitor thermistors, tuner overall RF power, and adjusts RX filter
- LV Frac-N (U6751) (microcontroller only writes to IC): scales the frequency from the VCO, control RX, and TX feedback loops
- EPOT (U0206) (microcontroller only writes to IC): controls the 32 steps of audio volume (vol=0: low to 15: high) that is routed to audio PA

## 3.14.10Receive Audio

The controller processes all received signals digitally. This requires a unique back-end from a standard analog radio. This unique functionality is provided by the ABACUS III IC as the interface to the DSP. The ABACUS III IC (in the receive back-end section of the transceiver) provides a digital back-end for the receiver. It provides digital output data words at a 20 kHz sampling rate (refer to section “3.11. Receiver Back-End” for more details on ABACUS III IC operation). This data is passed to the DSP through the RX Baseband Interface Port (BBP). The SPI bus is used to configure the operation of the ABACUS III IC and is driven by the Patriot IC. ABACUS_DIN is the data line on which the RX data words are transferred from ABACUS III IC to the Patriot IC (refer to Figure 3-32 on page 3-48).

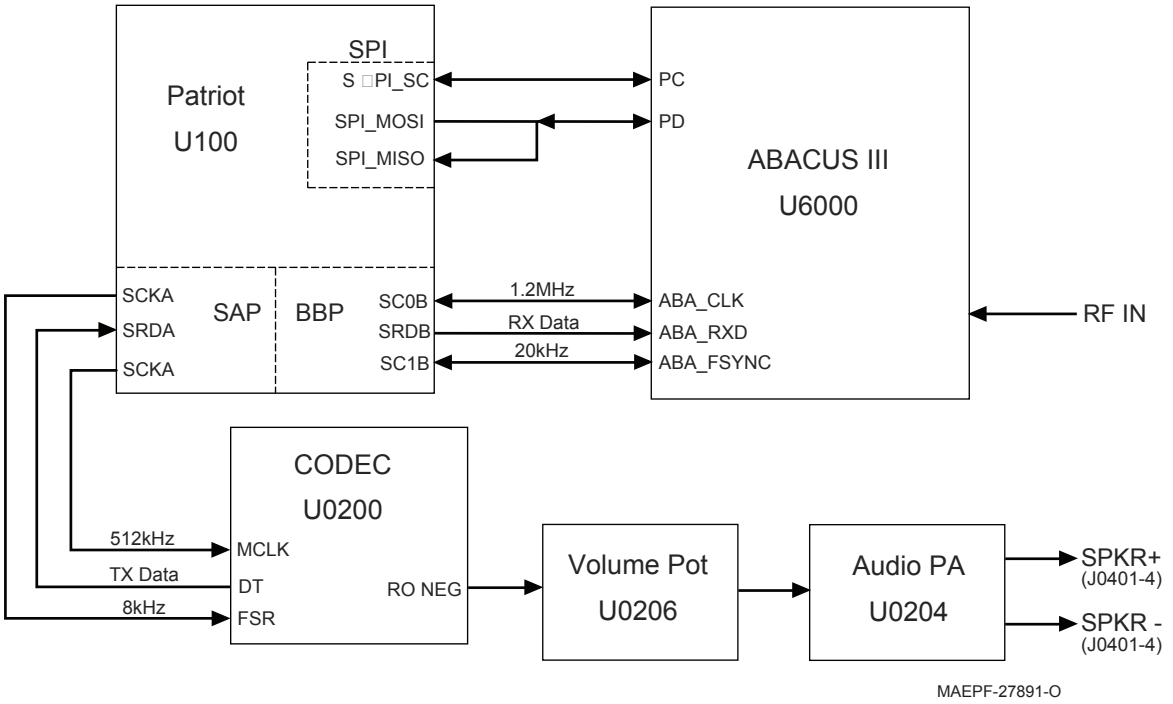



*Figure 3-32. PM1500 RX Signal Path*

The ABACUS III data is transferred to the Patriot IC at a 1.2 MHz bit rate, which is a synchronous clock provided by the ABACUS III IC. The 20 kHz interrupt clock, also provided by the ABACUS III IC, signals the arrival of a data packet and represents the sampling rate of the received data.

The DSP then processes this data to extract audio and signaling, perform filtering, alert-tone generation, etc. The DSP performs de-emphasis and discrimination before sending the discriminator data to the audio CODEC (U0200) via the SAP SSI bus. This bus is the digital audio bus consisting of the 512 kHz master bit clock (SAP_DCLK), and the 8 kHz frame sync (SAP_FSYNC). These clocks represent the data bit rate and sampling rate, respectively, for both the transmit and receive digital audio. For secure messages, the digital signal data must be passed to the secure module for decryption prior to DSP processing of the speaker data. The DSP transfers the data to and from the secure module through the SAP SSI port TXD and RXD signals. Configuration and mode control of the secure module is performed by the MCU through this bus.

The CODEC D/A analog output signal is routed to the RX_FILT_AUDIO line at both J0401 and J0402/J2 for legacy accessories and special applications products at an amplitude of 100 mV per kHz of deviation. The signal amplitude is independent of volume setting. This output is also routed to a multiplex switch, U0210, which is one source of audio to the audio PA speaker output. The alternate PA source, AUX_RX, is an input from J0401 and is used with vehicular repeater systems (VRS). The multiplexer output, normally received speaker audio, is routed to a volume control digital programmable potentiometer, U0206, and then to the audio PA (U0204) input. The audio PA output then drives the external speaker.

The audio power amplifier (U0204), is a DC-coupled-output, bridge-type amplifier. The gain is internally fixed at 40 dB. Speaker audio leaves U0204 on pins 4 and 6. For dash-mount radios, the audio is routed to the speaker via J0402, pins 19, 21, 23, and 25, and then to J2, pins 20 and 26. The amplifier is biased to one-half of the A+ voltage. An audio isolation transformer must be used if grounded test equipment, such as an audio analyzer or service monitor, is to be connected to the speaker outputs.



**Caution**

The speaker outputs must NOT be grounded in any way.

Normally, R0220 pulls up U0204, pin 8, to SW_B+ to enable the audio PA. When the radio is squelched, the audio PA is muted by the microprocessor. Q0200 is enabled to provide approximately 4.5 V through a voltage divider (Q0200 and R0222) to U0204, pin 8, which mutes the audio PA. When SW_B+ is turned off, the voltage from SW_A+ on U0204 falls below 2 V, placing the audio PA in standby, which turns off the U0204 output transistors to the speaker. Table 3-11 shows the voltages present at U0204, pin 8, during its various conditions.

*Table 3-11. PA Condition Voltages at U0204, Pin 8*

| Power Amplifier Condition | U0204 Pin 8 (Vdc) |
|---|---|
| Standby | 0-2 |
| Mute | 3.3-6.4 |
| Enabled | 8.5-17 |

## 3.14.11 Transmit Audio

The mobile microphone connects to the front of the control head through connector P104. Microphone audio (MIC_HI) enters the main board via J0401, pin 4, and is routed to multiplexer U0209 (refer to Figure 3-33 on page 3-50). Resistors R0200 and R0204 provide 9.6 Vdc bias voltage for the microphone's internal circuitry.

The multiplexer allows TX modulation audio to be routed from one of 3 possible sources: mobile microphone (MIC_HI), AUX_MIC (audio sourced from the J2 rear accessory connector in motorcycle configuration), or AUX_TX (audio from a VRS). The resulting audio source is then sent to a two-stage, programmable gain/attenuation circuit comprised of U0201 and U0202. The gain is accomplished via a programmable digital potentiometer in the amplifier circuit. This gain is adjustable via CPS and is programmed in ±3 dB steps. After passing through an anti-aliasing filter, audio is sent to the input of the CODEC (U0200) where it is digitized via its internal A/D converter. The digital audio data is then sent via the SAP SSI bus to the DSP at the Patriot IC. As with speaker data samples, the DSP reads the microphone audio samples and processes, pre-emphasizes, filters, and adds signaling information to this data. As with the received trunking data, low-speed transmit data is processed by the MCU and returned to the DSP. For secure messages, the digital signal data can be passed to the secure module prior to DSP processing and modulation. The DSP transfers the data to and from the secure module through the SAP SSI transmit (TXD) and receive (RXD) lines.

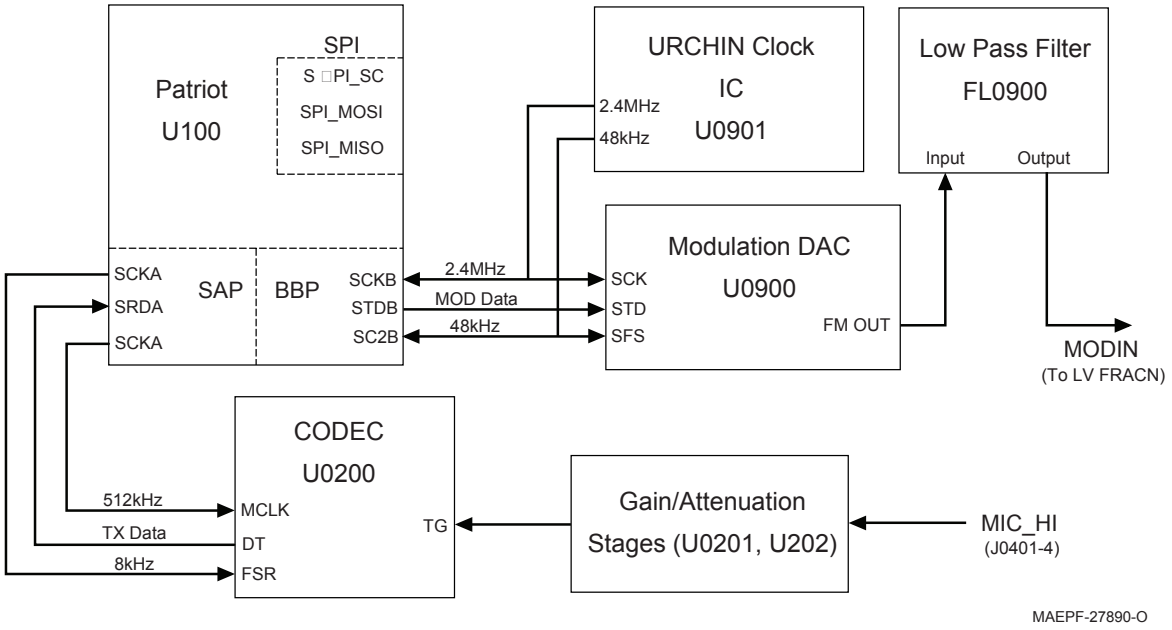



*Figure 3-33. PM1500 TX Signal Path*

After the DSP has finished its processing, filtering, and signaling on the audio data samples, it then sends this data to the modulation DAC (U0900) on the BBP SSI port, where it is converted to the analog modulation signal. The data is clocked over to the modulation DAC at a 2.4 MHz bit rate, with a frame sync (representing the transmit data sample rate) of 48 kHz. Both of these clocks are generated by the Urchin IC (U0901).

The modulation DAC audio output signal is sent to a switched capacitor low-pass filter (FL0900) that performs anti-aliasing filtering. The filter output is sent through a multiplexer switch, U0902, and finally on to the FGU/LV Frac-N synthesizer for modulation of the RF carrier signal.

## 3.14.12Flash Programming

When the radio needs new program code, this can often be done by reflashing the FLASH ROM (U102) located on the daughtercard. Reflashing is accomplished by using a programming cable (HKN6155 for Mid Power or HKN6183 for High Power) and the Motorola Customer Programming Software (CPS) FLASHport tool. The technique to flash the radio is the same as when using CPS or the TUNER software to change features on your radio. Two data lines are utilized on the programming cable to allow the computer to communicate with the microcontroller. These two lines are called BOOT TX (J0401-25), and BOOT RX (J0401-26) (see Figure 3-34).

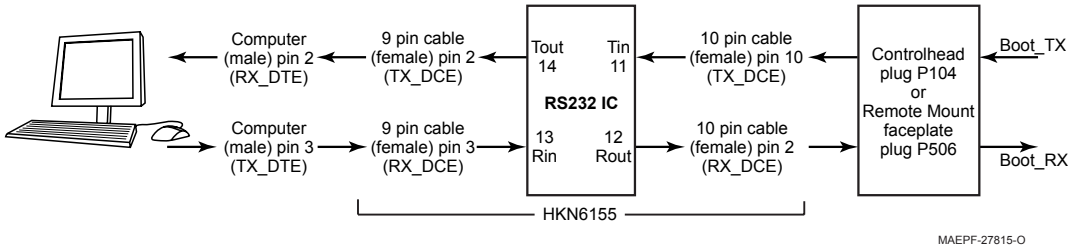



*Figure 3-34. Boot RX and Boot TX Data Lines*

The standard method of upgrading a radio's software and communicating between a computer and the radio microcontroller involves the use of the UART path via the programming cable. The radio is placed in a bootstrap mode whenever the programming cable is inserted into either the control- head microphone connector (P104) or the remote-mount interconnect board data connector (P506). This cable applies SW_B+ to the MIC_HI line (J0401-4), which forward biases Q0404 and asserts the CABLE_DET* input low to the Patriot microprocessor. This tells the processor to switch MUX U0401 to route the BOOT_TX line to J0401-25, rather than the default mode, which routes KEYFAIL* to the pin. This allows the level-shifted BOOT_TX data signal to route directly from the processor's UART port thru U0308 and out J0401-25 to the microphone/programming connector and to the PC.

On the BOOT_RX side, the CABLE_DET* input also drives BOOT_DATA_EN* low, which switches off buffers U0303-4 and U0303-3, routing the level-shifted BOOT_RX data from J0401-26 and to the processor's UART port. This data is level-shifted from 5 V to 2.85 V through U0303-2.

When interfacing with CPS, the TUNER software, and during a flash operation, the control-head display does not go blank. SB9600 messaging continues and, upon removal of the programming cable, the radio usually undergoes a reset operation as part of the normal cable detection and removal process.

High power is different from the mid power radios in several ways. High power is always configured for remote and on the remote TIB there is a GCAI connector instead of a programming port (P104). The GCAI connector is the only USB port on a high power “brick” and unlike mid power, it shares these lines with BOOT_RX and BOOT_TX. For this reason, there is no U0401 MUX and Keyfail is not shared by any other line. The GCAI standard requires that the type of cables are determined by a one-wire memory device, so “CABLE_DET” is not connected to the MIC_HI line. On all radios the default condition of the UART is four-wire RS232 either through the rear J2 connector on mid power or J6 on the TIB of all remote configurations. For this reason, data cables can also be used with CPS. High power does not have a rear connector so the only way to access USB is through the GCAI connector. USB is the default condition of the GCAI, but one-wire is always read any time that a cable is detected.

Programming high power with a GCAI RS232 cable is done the following way. The cable is detected by grounding GP1O0 on the GCAI connector and in turn the processor reads the one-wire memory in the same attached cable. If it determines from one-wire that a two-wire RS232 cable is attached, GCAI_USB-RS232 is lowered to allow 5 volt power on the TIB to supply current to USB_PWR on the GCAI and to turn off the passive FET Q801 which normally allows power to be supplied to the USB interface. On the “brick”, GCAI_USB-RS232 line also drives CABLE_DET and BOOT_DATA_EN*. This line also drives U0303-2, which has now been enabled to receive BOOT_RX on the USB-line. With USB_PWR off U0308 is allowed to drive the BOOT_TX on the USB+ line.

## 3.14.13Reflashing/Upgrading Firmware

The FLASH IC is the firmware storage IC. Programming this IC is accomplished using one of the following input paths:

- Two-wire RS-232 directly from a computer’s srial port to the radio’s rear connector data cable HKN6160 (Mid Power only)
- Two-wire RS-232 through an HKN6155 programming cable at the control head’s 10-pin microphone port (Mid Power only)
- Two-wire RS-232 through an HKN6155 programming cable at the Remote Mount Interconnect board’s 10-pin flash port (Mid Power only)
- Two-wire RS-232 through an HKN6183 programming cable at the High Power Remote Mount Interconnect board’s 10-pin GCAI port (High Power only)

For a list of all available programming cables, refer to the table below.

*Table 3-12. Programming Cables*

| Motorola Part Number | Description | Application |
|---|---|---|
| HKN6155 | Programming Flash Cable | Used with Tuner software, Customer Programming Software (CPS), and FLASHport |
| RVN4185 | Customer Programming Software and Tuner Software | Programming and radio alignment software on CD |
| HKN6182 | High Power GCAI Cable Adapter for Keyloader | Used for keyloading PM1500 High Power |
| HKN6183 | High Power GCAI to RS232 Programming Cable | Used for programming PM1500 High Power |
| HKN6184 | High Power GCAI to USB Programming Cable | Used for programming PM1500 High Power |
| HKN6122 | 4-wire data cable, J6 remote TIB | Used for programming PM1500 |




If you choose to reflash the radio (reflash the IC), DO NOT interrupt the process; otherwise, you might corrupt the FLASH IC and need advanced technical support to revive your radio.

**NOTE:** In remote-mount configurations, the control head 10-pin microphone port is disabled for any kind of programming.

**NOTE:** FLASH IC replacement is not supported as a field repair option. If the FLASH IC is removed, the radio cannot be reflashed by a customer or radio depot. This is because the FLASH IC must be hard-boot loaded at the factory to allow the programming of a unique file.

# Chapter 4 Troubleshooting Procedures

## 4.1 Introduction

This section will aid you in troubleshooting a malfunctioning PM1500 radio. It is intended to be detailed enough to localize the malfunctioning circuit and isolate the defective component.



**Caution**

Most of the ICs are static-sensitive devices. Do not attempt to troubleshoot or disassemble a board without first referring to the following Handling Precautions section.

## 4.2 Handling Precautions

Complementary metal-oxide semiconductor (CMOS) devices and other high-technology devices, are used in the PM1500 radio. While the attributes of these devices are many, their characteristics make them susceptible to damage by electrostatic discharge (ESD) or high-voltage charges. Damage can be latent, resulting in failures occurring weeks or months later. Therefore, special precautions must be taken to prevent device damage during disassembly, troubleshooting, and repair. Handling precautions are mandatory for this radio, and are especially important in low-humidity conditions. DO NOT attempt to disassemble the radio without observing the following handling precautions.

1. Eliminate static generators (plastics, Styrofoam, etc.) in the work area.
2. Remove nylon or double-knit polyester jackets, roll up long sleeves, and remove or tie back loose hanging neckties.
3. Store and transport all static-sensitive devices in ESD-protective containers.
4. Disconnect all power from the unit before ESD-sensitive components are removed or inserted unless otherwise noted.
5. Use a static-safeguarded workstation, which can be accomplished through the use of an anti-static kit (Motorola part number 01-80386A82). This kit includes a wrist strap, two ground cords, a static-control table mat and a static-control floor mat.
6. Always wear a conductive wrist strap when servicing this equipment. The Motorola part number for a replacement wrist strap that connects to the table mat is 42-80385A59.

### 4.2.1 Parts Replacement and Substitution

Special care should be taken to ensure that a suspected component is actually the one at fault. This special care will eliminate unnecessary unsoldering and removal of parts, which could damage or weaken other components or the printed circuit board (PCB) itself.

When damaged parts are replaced, identical parts should be used. If the identical replacement component is not locally available, check the parts list for the proper Motorola part number and order the component from the nearest Motorola Communications Parts facility.

### 4.2.2 Rigid Circuit Boards

The PM1500 radio uses bonded, multi-layer, printed circuit boards. Since the inner layers are not accessible, special considerations are required when soldering and unsoldering components. The printed-through holes might interconnect multiple layers of the printed circuit. Therefore, care should be exercised to avoid pulling the plated circuit out of the hole.

When soldering near module socket pins, be careful to avoid accidentally getting solder in the socket. Also, be careful not to form solder bridges between module socket pins. Closely examine your work for shorts caused by solder bridges. When removing modules with metal enclosures, be sure to unsolder the enclosure ground tabs as well as the module parts.

### 4.2.3 Heat-Related Precautions

During all repair procedures, heating neighboring components can be minimized by:

- Using upper heat only
- Using the correct size of heat-focus head, which should be approximately the same size as the carrier being replaced
- Keeping the heat-focus head approximately 1/8 in. (3-6 mm) above the printed circuit board when removing or replacing the device



**Caution**

Moisture-sensitive devices (MSD) are subject to die-bond (or other interface) delamination if heated above 185°C. To ensure that delamination does not occur, the PCB should be baked for eight hours at 125°C prior to repair if an adjacent MSD could potentially be exposed to 185°C or greater temperature during repair. Use 0.250 in. as the determining distance between the component being repaired and the MSD.

### 4.2.4 Daughtercard Module

The daughtercard module can be removed by desoldering. However, this only should be done as a last resort since the module cannot be reliably reattached to the main board, except with a new module, and contains extremely small parts that can be easily lost. Therefore, it is recommended that when troubleshooting an PM1500 radio, avoid removing and replacing large sections for an expected quick fix.

#### 4.2.4.1 SRAM

Each of the daughtercard module's three sections are attached to the module using BGA (Ball Grid Array) solder-attachment technology, and once removed, cannot be reliably reattached. Also, because of the dense grouping of the solder balls, heating of the part and doing a slight tap to fix presumed cold-solder joints usually only results in smearing the solder and shorting the solder balls.

#### 4.2.4.2 Testing

The daughtercard module is tested prior to placement on the main board. However, this is done with proprietary software that is not available outside Motorola. Also, because of the high density of the solder balls, the pins of the three ICs are not exposed to the outside world for test probing.

## 4.3 Voltage Measurement and Signal Tracing

In most situations, the problem circuit may be identified using a DC voltmeter, RF millivoltmeter, and oscilloscope (preferably with 100 MHz bandwidth or more). The “Recommended Test Equipment, Service Aids, and Tools” section in the *PM1500 VHF/UHF Range 1 Mobile Radio Basic Service Manual* (6871241L01-A) outlines the recommended tools and service aids which would be useful. Of special note are:

- 30-80370E06 Extender Cable which provides an extension cable for VOCON board connector J501 and command board connector P501
- RPX-4725C Command and Control Service Cable Kit which provides extension cables for servicing digital and analog circuits
- RPX-4724B RF Service Cable Kit which provides interface cables needed to service the RF boards

In some cases DC voltages at probe points are shown in red on the schematics. In other areas diagrams are included to show time-varying signals, which should be present under the indicated circumstances. It is recommended that a thorough check be made prior to replacement of any IC or part. If the probe point does not have a signal reasonably close to the indicated one, a check of the surrounding components should be made prior to replacing any parts.




When checking a transistor or module, either in or out of circuit, do not use an ohmmeter having more than 1.5 Vdc appearing across test leads or use an ohms scale of less than x100.

## 4.4 Power-Up Self-Check Errors

When the radio is turned on (power-up), the radio performs cursory tests to determine if its basic electronics and software are in working order. Problems detected during these tests are presented as error codes on the radio’s display. The presence of an error should prompt the user that a problem exists and that a service technician should be contacted.

Self-test errors are classified as either fatal or non-fatal. Fatal errors inhibit user operation; non-fatal errors do not. Table 4-1 will aid in understanding particular power-up error code displays.

*Table 4-1. Power-Up Self-Check Error Codes*

| Error Code | Description | Error Type | Corrective Action |
|---|---|---|---|
| ERROR 01/02 | FLASH ROM Codeplug Checksum | NON-FATAL | Re-flash the entire codeplug. |
| ERROR 01/12 | Security Partition Checksum | NON-FATAL | Re-flash the codeplug sections. |
| ERROR 01/20 | ABACUS Tune Failure | NON_FATAL | • Turn the radio off, then on.<br>• Re-flash tuning (codeplug).<br>• Replace ABACUS IC / resolder. |
| ERROR 01/22 | Tuning Codeplug Checksum | NON-FATAL | • Re-flash tuning (codeplug).<br>• Retune the radio using CPS. |
| FAIL 01/81 | FLASH ROM Checksum | FATAL | Re-flash the firmware. |
| FAIL 01/82 | FLASH ROM Codeplug Checksum | FATAL | Re-flash the codeplug or firmware. |

*Table 4-1. Power-Up Self-Check Error Codes (Continued)*

| Error Code | Description | Error Type | Corrective Action |
|---|---|---|---|
| FAIL 01/88 | External RAM Error | FATAL | • Turn the radio off, then on.<br>• Hard bootstrap and flash the firmware.<br>• Replace the daughtercard. |
| FAIL 01/90 | General Hardware | FATAL | • Turn the radio off, then on.<br>• Replace the control head or flex. |
| FAIL 01/92 | Security Partition Checksum | FATAL | Re-flash the codeplug sections. |
| FAIL 01/93 | FlashPORT AUTHENT CODE Failure | FATAL | Re-flash the appropriate base codeplug to match the radio feature set. |
| FAIL 01/98 | Internal RAM Failure | FATAL | • Turn the radio off, then on.<br>• Hard bootstrap and flash the firmware.<br>• Replace the daughtercard. |
| FAIL 01/AO | ABACUS IC Failure/Wrong ABACUS IC Version | FATAL | • Re-flash tuning (codeplug).<br>• Retune the radio using CPS. |
| FAIL 01/A2 | Tuning Codeplug Checksum | FATAL | • Re-flash tuning (codeplug).<br>• Retune the radio using CPS. |
| FAIL 02/81 | DSP ROM Checksum | FATAL | • Turn the radio off, then on.<br>• Re-flash the DSP firmware (DSP is processor-dependent). |
| FAIL 02/88 | DSP RAM Error | FATAL | • Turn the radio off, then on.<br>• Re-flash the DSP firmware (DSP is processor-dependent). |
| FAIL 02/90 | General DSP Hardware Failure | FATAL | • Turn the radio off, then on.<br>• Re-flash the DSP firmware (DSP is processor-dependent).<br>• Replace daughtercard. |
| FAIL 02/CO | Wrong Microprocessor Version | FATAL | • Re-flash the firmware.<br>• Hard bootstrap and flash the firmware.<br>• Replace the daughtercard. |
| ERROR 05/10 | Control Head Hardware Error | NON-FATAL | • Turn the radio off, then on.<br>• Replace the control head or flex. |
| FAIL 05/81 | Control Head ROM Checksum Error | FATAL | Replace the control head. |
| ERROR 06/10 | Aux Control Head Hardware Error | NON-FATAL | • Turn the radio off, then on.<br>• Replace the control head or flex. |
| FAIL 06/81 | Aux Control Head ROM Checksum Error | FATAL | Replace the auxiliary control head. |
| ERROR 08/10 | Siren Hardware Error | NON-FATAL | • Turn the radio off, then on.<br>• Check the siren cable connection. |
| FAIL 08/81 | Siren ROM Checksum Error | FATAL | Replace the siren. |
| ERROR 09/10 | Secure Hardware Error | NON-FATAL | Replace the secure module. |

*Table 4-1. Power-Up Self-Check Error Codes (Continued)*

| Error Code | Description | Error Type | Corrective Action |
|---|---|---|---|
| FAIL 09/90 | Secure Hardware Fatal Error | FATAL | Replace the secure module. |
| ERROR 12/10 | VRS Hardware Error | NON-FATAL | • Turn the radio off, then on.<br>• Check the VRS cable connection. |
| FAIL 12/81 | VRS ROM Checksum Error | FATAL | Replace the VRS. |
| ERROR 1C/10 | Tone Remote Control (TRC) Hardware Error | NON-FATAL | • Turn the radio off, then on.<br>• Check the TRC cable connection. |
| FAIL 1C/81 | TRC ROM Checksum Error | FATAL | Replace the TRC. |
| **Note:**<br>• Firmware=Radio HOST and DSP software files<br>• Codeplug=Radio configuration software files. | | | |

## 4.5 Operational Error Codes

During radio operation, the radio performs dynamic tests to determine if the radio is working properly. Problems detected during these tests are presented as error codes on the radio's display. The presence of an error code should prompt a user that a problem exists and that a service technician should be contacted. Table 4-2 will aid in understanding particular operational error codes.

*Table 4-2. Operational Error Codes*

| Error Code | Description | Error Type | Corrective Action |
|---|---|---|---|
| FAIL 001 | Synthesizer Out of Lock/ Radio band mismatch | NON-FATAL | • Re-flash the tuning (codeplug)<br>• Re-flash the entire codeplug.<br>• Replace the daughtercard. |
| FAIL 002 | Personality Checksum or System Block Error | NON-FATAL | Re-flash the entire codeplug. |

## 4.6 VHF (136–174 MHz) Band Main Board Troubleshooting

This information will help you troubleshoot the RF section of the VHF (136–174 MHz) band PM1500 radio. Use this information, along with the theory of operation and troubleshooting charts, to diagnose and isolate the cause of failures.

Prior to troubleshooting, it is important to review the theory of operation, including specific precautions and troubleshooting methods. Because much of the radio's circuitry operates at high frequencies, measurements must be taken very carefully. Notes and cautions are added to the text to alert you to this need in areas of greatest sensitivity. However, the need for extreme care does exist in all measurements and tests.

### 4.6.1 Display Flashes "FAIL 001"

This display indicates a synthesizer "out-of-lock" condition. The following information will help to trouble shoot the frequency generation unit to the component level. Perform the following checks to determine the mode of the Fail 001:

1. Determine if the "out-of-lock" condition occurs in either receive mode, transmit mode, or both. Also, check other frequencies programmed in the unit if available.

2. To determine if the "out-of-lock" is frequency or VCO dependant, place the unit into RF TEST Mode, as described in the *ASTRO Digital PM1500 VHF/UHF Range 1/UHF Range 2/700–800 MHz Mobile Radio Basic Service Manual* (6881096C73) and step through each test channel. Table 4-3 indicates the frequency and Aux logic level for each test mode channel. In addition, Table 4-4 provides information about the frequency of operation for each VCO.

*Table 4-3. Test Mode Channels*

| Test MODE | LV Frac-N TX Logic | TX Freq MHz | LV Frac-N RX Logic | RX Freq MHz |
|---|---|---|---|---|
| CHAN 1 | AUX 2 | 136.0125 | AUX 3 | 245.7125 |
| CHAN 2 | AUX 2 | 140.7625 | AUX 3 | 250.4625 |
| CHAN 3 | AUX 2 | 145.5125 | AUX 3 | 255.2125 |
| CHAN 4 | AUX 2 | 150.2625 | AUX 3 | 259.9625 |
| CHAN 5 | AUX 2 | 154.9875 | AUX 3 | 264.5875 |
| CHAN 6 | AUX 1 | 155.0125 | AUX 4 | 264.7125 |
| CHAN 7 | AUX 1 | 159.7625 | AUX 4 | 269.4625 |
| CHAN 8 | AUX 1 | 164.5125 | AUX 4 | 274.2125 |
| CHAN 9 | AUX 1 | 169.2625 | AUX 4 | 278.9625 |
| CHAN 10 | AUX 1 | 173.9875 | AUX 4 | 283.5875 |

*Table 4-4. VCO Frequency and Switching Logic*

| MODE | Frequency (MHz) | AUX1 | AUX2 | AUX3 | AUX4 |
|---|---|---|---|---|---|
| RX | 245.65–264.65 | LOW | LOW | HIGH | LOW |
| RX | 264.65–283.65 | LOW | LOW | LOW | HIGH |
| TX | 155–174 | HIGH | LOW | LOW | LOW |
| TX | 136–155 | LOW | HIGH | LOW | LOW |

3. Continue troubleshooting by using the Fail 001 troubleshooting chart in Chapter 5.

## 4.6.2 VCO Hybrid Assembly

The VCO hybrid substrate is glued to the carrier board. The hybrid is not a field-repairable assembly. If a failure is indicated in this assembly, replace the entire carrier board.

### 4.6.3 Out-of-Lock Condition

The probable cause of an out-of-lock condition is a failure in the synthesizer circuit. If the voltages on the AUX 1*, AUX 2*, AUX3*, and AUX4* lines do not conform to required output frequency in Table 4-5, troubleshoot the synthesizer.

If the AUX 1* to AUX 4* voltages are correct but the synthesizer feedback level is not within the range indicated, troubleshoot the feedback path.

If the AUX 1* to AUX 4* voltages are correct and the synthesizer feedback level is correct but an out-of-lock condition persists, troubleshoot the synthesizer.

*Table 4-5. AUX Output Frequency Requirements*

| Frequency Range | AUX 1 | AUX 2 | AUX 3 | AUX 4 | Output Frequency |
|---|---|---|---|---|---|
| | HI | LOW | LOW | LOW | 136–155 MHz |
| | LOW | HI | LOW | LOW | 155–174 MHz |
| | LOW | LOW | HI | LOW | 245.65–264.65 MHz |
| | LOW | LOW | LOW | HIGH | 264.65–283.65 MHz |

### 4.6.4 FGU Troubleshooting Aids

The following illustrations are additional service aids for troubleshooting the frequency generation unit.

- Figure 4-1 on page 4-8 is a block diagram of the DC distribution for the frequency generation unit.
- Figure 4-2 on page 4-9 is a block diagram of the frequency generation unit.
- Table 4-6 on page 4-9 describes the function of pins on the LV Frac-N IC U3751.
- Figure 4-3 on page 4-11 is a waveform representation during programming of the LV Frac-N IC U3751.

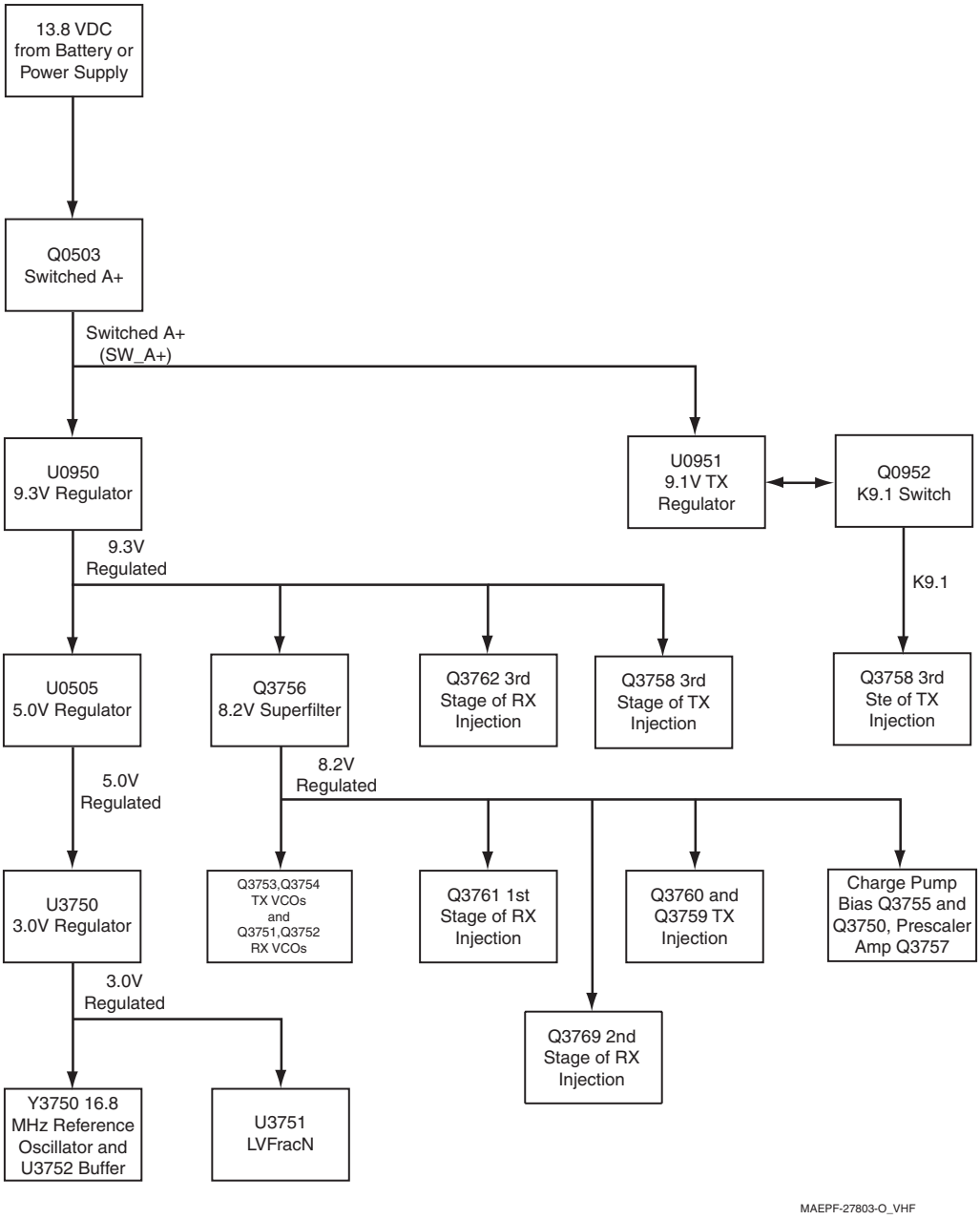



*Figure 4-1. Frequency Generator Unit DC Power Supply Distribution (VHF)*

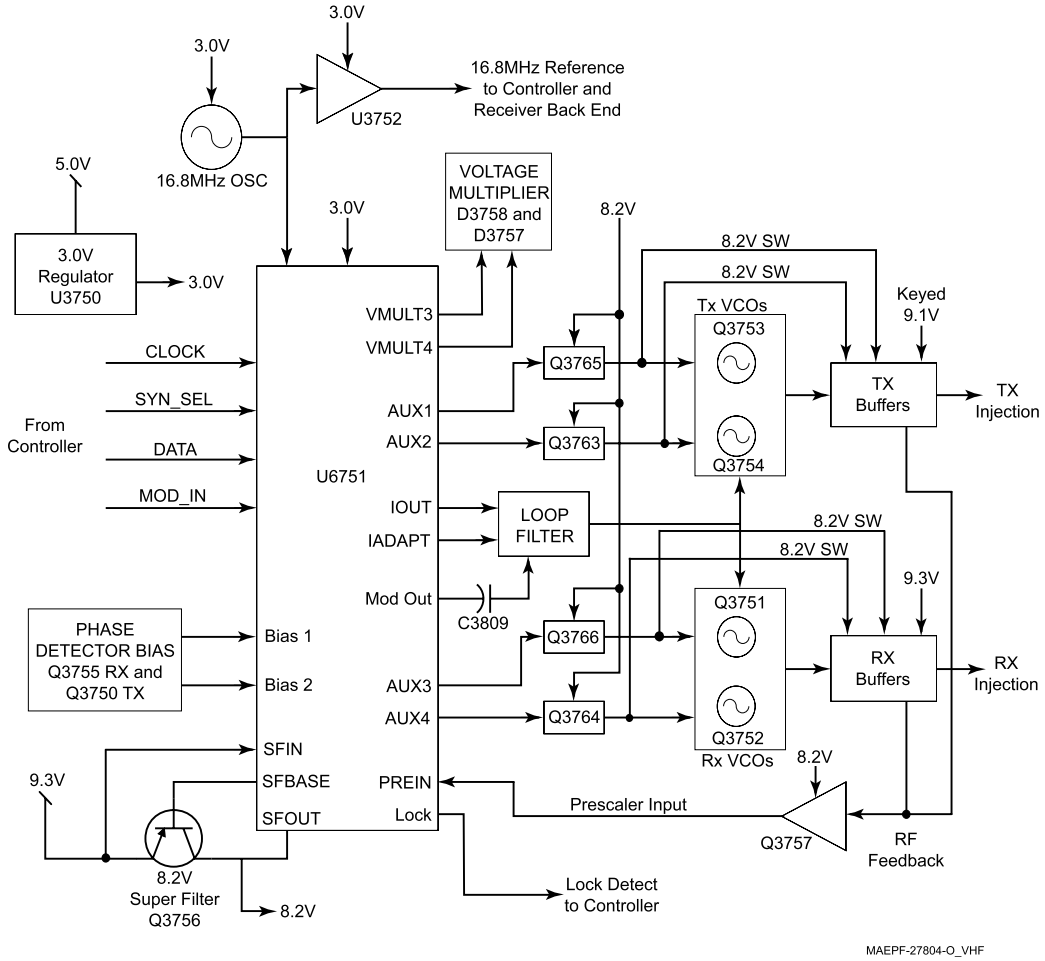



*Figure 4-2. Frequency Generation Unit Block Diagram (VHF)*

*Table 4-6. LV Frac-N U3751 Pin Descriptions (VHF)*

| Pin No. | Pin Name | Description |
|---|---|---|
| 1 | AUX2 | Auxiliary logic output, high selects Low TX VCO |
| 2 | AUX3 | Auxiliary logic output, high selects Low RX VCO |
| 3 | AUX4 | Auxiliary logic output, high selects High RX VCO |
| 4 | LOCK | Lock detect—logic high indicates in-lock condition |
| 5 | PD_VDD | 3.0-V supply (phase detector) |
| 6 | GROUND | Ground (digital) |
| 7 | DATA | SPI data I/O |
| 8 | CLK | SPI clock |
| 9 | CEX | SPI enable line—active low |
| 10 | MODIN | Modulation input from controller |
| 11 | VMULT4 | Multiplier clock output |
| 12 | VMULT3 | Multiplier clock output |

*Table 4-6. LV Frac-N U3751 Pin Descriptions (VHF) (Continued)*

| Pin No. | Pin Name | Description |
|---|---|---|
| 13 | VRO | 3.0-V supply for reference oscillator warp circuitry |
| 14 | VMULT2 | Not used |
| 15 | VMULT1 | Not used |
| 16 | INDMULT | Not used |
| 17 | — | No connection |
| 18 | REFSEL | Not used |
| 19 | FREFOUT | Not used |
| 20 | AVDD | 3.0-V supply (analog) |
| 21 | VBPASS | Not used |
| 22 | GND | Ground (analog) |
| 23 | XTAL1 | 16.8 MHz reference oscillator input |
| 24 | XTAL2 | Not used |
| 25 | WARP | Reference oscillator warp output |
| 26 | SFCAP | Superfilter bypass node |
| 27 | SFBASE | Superfilter control node for Q6759 |
| 28 | SFOUT | Superfilter output |
| 29 | — | No connection |
| 30 | SFIN | Superfilter supply input |
| 31 | — | No connection |
| 32 | PREIN | Prescalar input |
| 33 | GROUND | Ground (prescalar) |
| 34 | PRE_VDD | 3.0-V supply |
| 35 | PVREF | Not used |
| 36 | DVDD | 3.0-V supply (digital) |
| 37 | TEST1 | Not used |
| 38 | TEST2 | Not used |
| 39 | CPB2 | Phase detector bias input |
| 40 | CPB1 | Phase detector bias input |
| 41 | MODOUT | Modulation output |
| 42 | CCOMP | Not used |
| 43 | IOUT | Phase detector normal mode output |
| 44 | GND | Ground (phase detector) |
| 45 | IADAPT | Phase detector adapt mode output |
| 46 | ADAPTSW | Phase detector adapt switch |
| 47 | VCP | High-voltage supply for phase detector |
| 48 | AUX1 | Auxiliary logic output, high selects Low TX VCO |

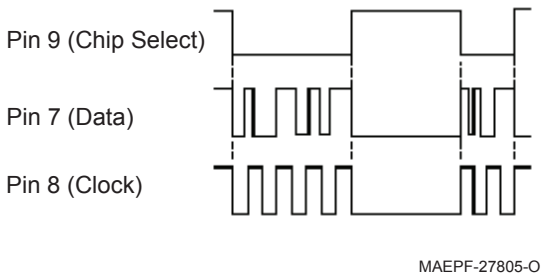



*Figure 4-3. Waveform Representation During Programming of the LV Frac-N IC (U3751)*

**NOTE:** The above waveforms are representations only.

### 4.6.5 No or Low Output Power (TX or RX Injection)

In addition to the schematic and theory of operation, refer to the transmitter injection troubleshooting flowchart and the receiver injection trouble shooting flowchart in Chapter 5. The charts will guide you through a sequence of tests and checks designed to isolate problems in the Transmitter or receiver injection strings.

### 4.6.6 No or Low Modulation

In addition to the schematic and theory of operation, refer to the transmitter no TX Audio troubleshooting flowchart in Chapter 5. The chart will guide you through a sequence of tests and checks designed to isolate problems in the Transmitter Audio section of the FGU.

### 4.6.7 Troubleshooting the Back-End

Refer to "5.6.4 RX Back-End—Poor SINAD or No Audio (136–174 MHz)—Part 1 of 3" on page 5-13.

## 4.7 UHF Range 1 (380–470 MHz) Band Main Board Troubleshooting

This information will help you troubleshoot the RF section of the UHF Range 1 (380–470 MHz) band PM1500 radio. Use this information, along with the theory of operation and troubleshooting charts, to diagnose and isolate the cause of failures.

Prior to troubleshooting, it is important to review the theory of operation, including specific precautions and troubleshooting methods. Because much of the radio's circuitry operates at high frequencies, measurements must be taken very carefully. Notes and cautions are added to the text to alert you to this need in areas of greatest sensitivity. However, the need for extreme care does exist in all measurements and tests.

### 4.7.1 Display Flashes "FAIL 001"

This display indicates a synthesizer "out-of-lock" condition. The following information will help to trouble shoot the frequency generation unit to the component level. Perform the following checks to determine the mode of the Fail 001:

1. Determine if the "out-of-lock" condition occurs in either receive mode, transmit mode, or both. Also, check other frequencies programmed in the unit if available.
2. To determine if the "out-of-lock" is frequency or VCO dependant, place the unit into RF TEST Mode, as described in the *ASTRO Digital PM1500 VHF/UHF Range 1/UHF Range 2/700–800 MHz Mobile Radio Basic Service Manual* (6881096C73) and step through each test channel. Table 4-7 on page 4-12 indicates the frequency and Aux logic level for each test mode channel. In addition, Table 4-8 on page 4-12 provides information about the frequency of operation for each VCO.

*Table 4-7. Test Mode Channels UHF Range 1 (AUX 4 is not used for VCO selection in UHF)*

| Test Mode | AUX (TX Logic) | | | TX VCO | TX Freq (MHz) | AUX (RX Logic) | | | RX VCO | RX Freq (MHz) | RX VCO Freq (MHz) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | | | 1 | 2 | 3 | | | |
| Chan 1 | 0 | 0 | 0 | Q5825 | 380.0250 | 0 | 1 | 0 | Q5901 | 380.0750 | 489.7250 |
| Chan 2 | 0 | 0 | 0 | Q5825 | 391.4750 | 0 | 1 | 0 | Q5901 | 391.4250 | 501.0750 |
| Chan 3 | 0 | 0 | 0 | Q5825 | 408.9750 | 0 | 1 | 0 | Q5901 | 408.9250 | 518.5750 |
| Chan 4 | 0 | 0 | 0 | Q5825 | 424.9375 | 1 | 1 | 0 | Q5903 | 424.9875 | 534.6375 |
| Chan 5 | 1 | 0 | 0 | Q5826 | 425.0250 | 1 | 1 | 0 | Q5903 | 425.0750 | 534.7250 |
| Chan 6 | 1 | 0 | 0 | Q5826 | 436.0250 | 1 | 1 | 0 | Q5903 | 436.0750 | 545.7250 |
| Chan 7 | 1 | 0 | 0 | Q5826 | 455.8750 | 0 | 0 | 1 | Q5905 | 455.8250 | 565.4750 |
| Chan 8 | 1 | 0 | 0 | Q5826 | 469.9375 | 0 | 0 | 1 | Q5905 | 469.9875 | 579.5750 |

**NOTE:** The UHF band radios use high-side injection with an IF frequency of 109.65 MHz; therefore, the receive VCO frequencies are 109.65 MHz higher than the selected radio channel frequencies.

*Table 4-8. VCO Frequency Calculation and Switching Logic (UHF Range 1)*

| VCO | AUX1 | AUX2 | AUX3 | VCO Frequency |
|---|---|---|---|---|
| RX VCO Q5901 | 0 | 1 | 0 | 489.65 <= f < 519.65 |
| RX VCO Q5903 | 1 | 1 | 0 | 519.65 <= f < 549.65 |
| RX VCO Q5905 | 0 | 0 | 1 | 549.65 <= f < 579.65 |
| TX VCO Q5825 | 0 | 0 | 0 | 380 <= f < 425 |
| TX VCO Q5826 | 1 | 0 | 0 | 425 <= f <= 470 |

**NOTE:** If a failure is indicated in any of the VCOs, whose operation is defined in the table above, then the respective circuit should be checked to ensure proper bias is being applied to the transistor. Specifically, the transistor collector pin should be at 8.2 V and base-emitter voltage should be on the order of 0.8 V. The steering line voltage should be in the range of 2 V for the lower frequency end of operation, and on the order of 11V at the upper frequency end of operation. There could be typically +/- 1 V deviation from the above quoted numbers, which allow for tolerances in the components. A clean, steady, frequency spike should be observed on a spectrum analyzer of typically -18 dBm at the end of the resistive pad in the collector circuitry of a properly working VCO.

3. Continue troubleshooting by using the Fail 001 troubleshooting chart in Chapter 5.

## 4.7.2 FGU Troubleshooting Aids

The following illustrations are additional service aids for troubleshooting the frequency generation unit.

- Figure 4-4 is a block diagram of the DC distribution for the frequency generation unit.
- Figure 4-5 on page 4-14 is a block diagram of the frequency generation unit.
- Table 4-9 on page 4-14 describes the function of pins on the LV Frac-N IC U5752.
- Figure 4-6 on page 4-16 is a waveform representation during programming of the LV Frac-N IC U5752.

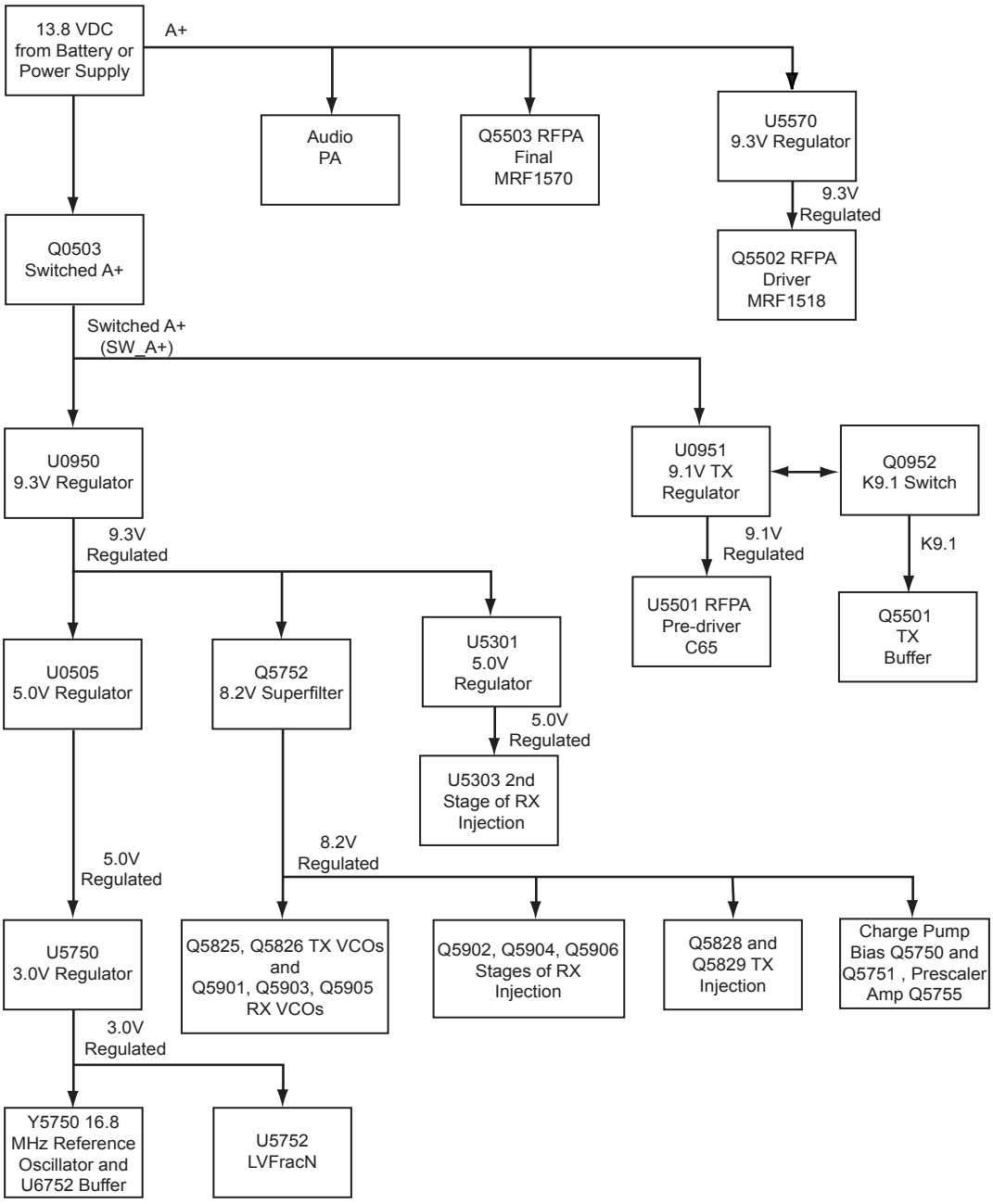



*Figure 4-4. Frequency Generation Unit DC Power Supply Distribution (UHF Range 1)*

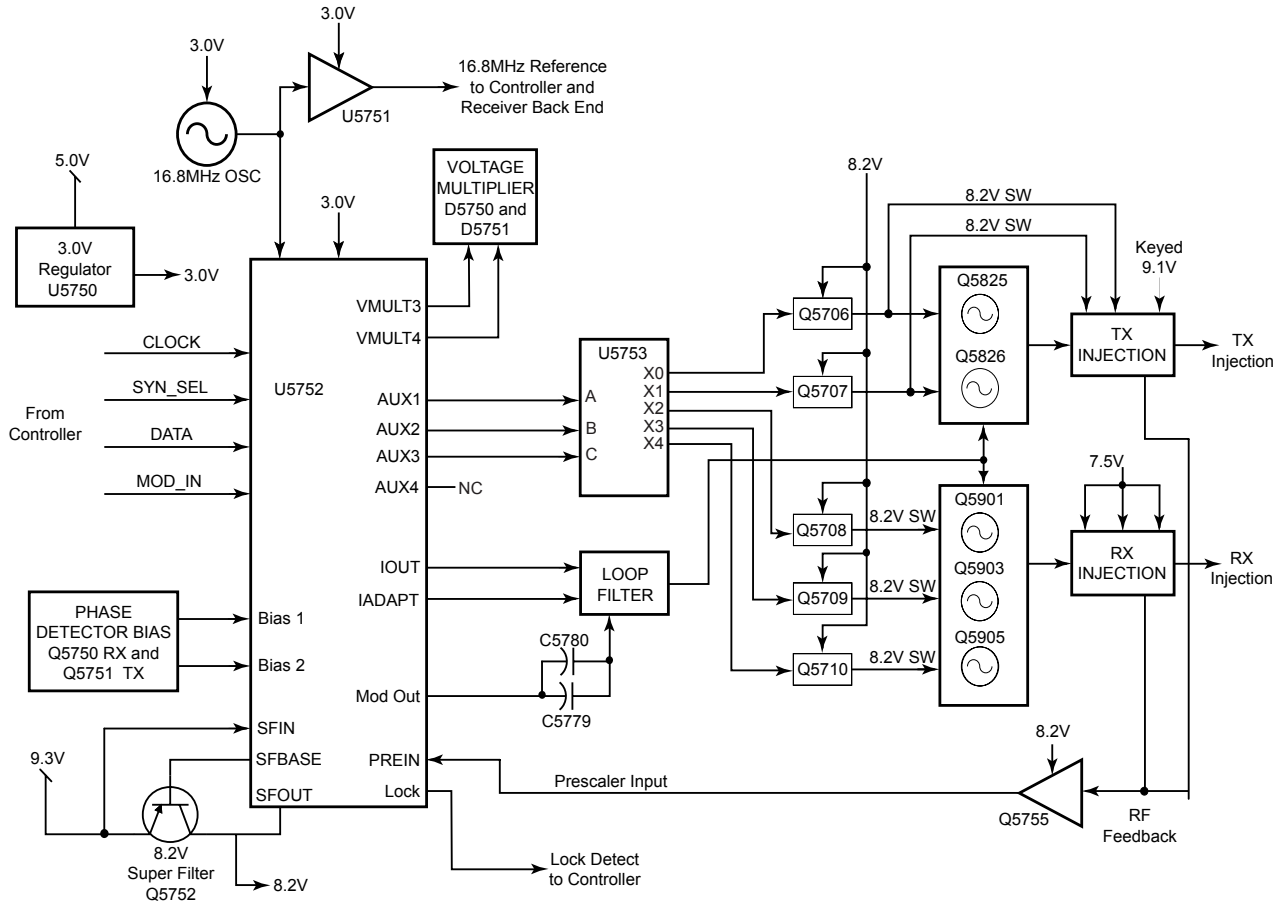



*Figure 4-5. Frequency Generation Unit Block Diagram (UHF Range 1)*

*Table 4-9. LV Frac-N U6751 Pin Descriptions (UHF Range 1)*

| Pin No. | Pin Name | Description |
|---|---|---|
| 1 | AUX2 | Auxiliary logic output |
| 2 | AUX3 | Auxiliary logic output |
| 3 | AUX4 | Auxiliary logic output |
| 4 | LOCK | Lock detect—logic high indicates in-lock condition |
| 5 | PD_VDD | 3.0-V supply (phase detector) |
| 6 | GROUND | Ground (digital) |
| 7 | DATA | SPI data I/O |
| 8 | CLK | SPI clock |
| 9 | CEX | SPI enable line—active low |
| 10 | MODIN | Modulation input from controller |
| 11 | VMULT4 | Multiplier clock output |
| 12 | VMULT3 | Multiplier clock output |
| 13 | VRO | 3.0-V supply for reference oscillator warp circuitry |
| 14 | VMULT2 | Not used |

*Table 4-9. LV Frac-N U6751 Pin Descriptions (UHF Range 1) (Continued)*

| Pin No. | Pin Name | Description |
|---|---|---|
| 15 | VMULT1 | Not used |
| 16 | INDMULT | Not used |
| 17 | — | No connection |
| 18 | REFSEL | Not used |
| 19 | FREFOUT | Not used |
| 20 | AVDD | 3.0-V supply (analog) |
| 21 | VBPASS | Not used |
| 22 | GND | Ground (analog) |
| 23 | XTAL1 | 16.8 MHz reference oscillator input |
| 24 | XTAL2 | Not used |
| 25 | WARP | Reference oscillator warp output |
| 26 | SFCAP | Superfilter bypass node |
| 27 | SFBASE | Superfilter control node for Q5752 |
| 28 | SFOUT | Superfilter output |
| 29 | — | No connection |
| 30 | SFIN | Superfilter supply input |
| 31 | — | No connection |
| 32 | PREIN | Prescalar input |
| 33 | GROUND | Ground (prescalar) |
| 34 | PRE_VDD | 3.0-V supply |
| 35 | PVREF | Not used |
| 36 | DVDD | 3.0-V supply (digital) |
| 37 | TEST1 | Not used |
| 38 | TEST2 | Not used |
| 39 | CPB2 | Phase detector bias input |
| 40 | CPB1 | Phase detector bias input |
| 41 | MODOUT | Modulation output |
| 42 | CCOMP | Not used |
| 43 | IOUT | Phase detector normal mode output |
| 44 | GND | Ground (phase detector) |
| 45 | IADAPT | Phase detector adapt mode output |
| 46 | ADAPTSW | Phase detector adapt switch |
| 47 | VCP | High-voltage supply for phase detector |
| 48 | AUX1 | Auxiliary logic output |

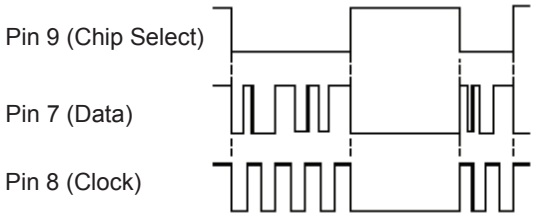



*Figure 4-6. Waveform Representation During Programming of the LV Frac-N IC (U5752)*

**NOTE:** The above waveforms are representations only.

### 4.7.3 Out-of-Lock Condition

The probable cause of an out-of-lock condition is a failure in the synthesizer circuit. If the voltages on the AUX lines do not conform to Table 4-8 on page 4-12, troubleshoot the synthesizer. If the AUX pins are correct, but the supply switch (Q5706, Q5707, Q5708, Q5709 or Q5710) to the in question VCO is not active with 8.2V at the VCO end, then troubleshoot the 3 to 8 multiplexer U5753 or the switch transistor packages.

If the AUX voltages are correct but the synthesizer feedback level is not within the range indicated at TP5783 (-6 to -11dBm), troubleshoot the buffer stages after the VCO. If the AUX voltages are correct and the synthesizer feedback level is correct but an out-of-lock condition persists, troubleshoot the synthesizer.

### 4.7.4 No or Low Output Power (TX or RX Injection)

In addition to the schematic and theory of operation, refer to the transmitter injection troubleshooting flowchart and the receiver injection trouble shooting flowchart in Chapter 5. The charts will guide you through a sequence of tests and checks designed to isolate problems in the Transmitter or receiver injection strings.

### 4.7.5 No or Low Modulation

In addition to the schematic and theory of operation, refer to the transmitter no TX Audio troubleshooting flowchart in Chapter 5. The chart will guide you through a sequence of tests and checks designed to isolate problems in the Transmitter Audio section of the FGU.

### 4.7.6 Troubleshooting the Back-End

Refer to “5.6.18 RX Back-End—Poor SINAD or No Audio (380–470 MHz)—Part 1 of 3” on page 5-27.

## 4.8 Standard Bias Tables

Table 4-10, below, outlines some standard supply voltages and system clocks that should be present during normal operation. These should be checked as a first step to any troubleshooting procedure.

*Table 4-10. Standard Operating Bias: Power Lines*

| Nominal Value | Signal Name | Range/State | Probe Locations |
|---|---|---|---|
| 13.8 V | A+ (at DC connector) | 11.0 to 16.6 V | J0401-20, TP0414 |
| 13.8 V | IGNITION | 11.0 to 16.6 V | J0401-19, J0401-21 |

*Table 4-10. Standard Operating Bias: Power Lines (Continued)*

| Nominal Value | Signal Name | Range/State | Probe Locations |
|---|---|---|---|
| 13.8 V | SW_A+<br>(on board only) | 11.0 to 16.6 V | U0500-4, Q0503 |
| 13.8 V | SW_B+ (from C.H.) | 11.0 to 16.6 V | TP0413, J0401-17 |
| 2.83 V | SW_B+_SENSE | No change | U0604-7 |
| 2.5 V | SW_B+_ON_OFF<br>(on board only) | 2 to 3 V | Q0505-1, Q0504-1 |
| 9.1 V | 9.3V_ABACUS | No change | U0505-1 |
| 9.1 V | 9.3V | No change | TP0951, TP0950 |
| 9.18 V | 9V | No change | U0500-5 |
| 5 V | 5V_ABACUS | No change | U0505-3 |
| 5 V | VCC_5 | No change | J0401-23, U0507-8, U0503-3, U0502-8, U0501-8 |
| 3 V | VCC_3 | No change | U0962-5 |
| 2.85 V | LV_DETECT | When A+ drops too far below 9 V, this line goes to 0 V | U0504-1 |
| 2.85 V | STO<br>(at microprocessor) | No change | TP0500 |
| 2.85 V | VCC_2.85 | No change | U0501-1 |
| 1.86 V | Vpp | No change | TP0400 |
| 1.85 V | VCC_1.8 | 1.84 to 1.87 V | U0507-1 |
| 1.55 V | VCC_1.55 | No change | U0502-1 |
| 1.42 V | VAG | No change | U0206-1, U0201-3 |

**Note**: Do not KEY UP unless the board is inside a chassis.

.

*Table 4-11. Standard Operating Bias: Clock and Control Lines*

| Nominal Value | Signal Name | Range/State | Probe Locations |
|---|---|---|---|
| (See "Chapter 6 Troubleshooting Waveforms" on page 6-1) | SB9600__BUS + | Idle=High (4 V to 5 V) | J0402-3, J2-2 |
| | SB9600__BUS - | Idle=Low (0 V) | J0402-5, J2-3 |
| | SB9600__BUSY | Idle=Low (0 V) | J0402-4, J2-9 |
| | SB9600__RESET | Idle=Low (0 V) | J0402-6, J2-8 |
| **Note**: Use chassis as GND when measuring on an oscilloscope. | | | |

*Table 4-11. Standard Operating Bias: Clock and Control Lines (Continued)*

| Nominal Value | Signal Name | Range/State | Probe Locations |
|---|---|---|---|
| (See "Chapter 6 Troubleshooting Waveforms" on page 6-1) | USB_PWR | 5.1 V | J0402-12, J2-12 |
| | USB_DATA + | | J0402-11, J2-7 |
| | USB_DATA - | | J402-13, J2-6 |
| **Note**: Use chassis as GND when measuring on an oscilloscope. | | | |
| (See "Chapter 6 Troubleshooting Waveforms" on page 6-1) | RS232__UARTA_TX | Output voltage level is the same as BOOT TX | TP0407, J2-7 |
| | RS232__UARTA_RX | Input level depends on inputting device's levels | TP0408, J2-9 |
| | RS232__UARTA_CTS | Flow control line—not used always | TP0409, J2-8 |
| | RS232__UARTA_RTS | Flow control line—not used always | TP0410, J2-10 |
| **Note**: Use chassis as GND when measuring on an oscilloscope. | | | |
| Approx. 0 V | Emergency | Idle = deactivated = grounded | J2-15, J0402-28, TP0403 |
| 1.88 V | Emergency | Activated = ungrounded | J2-15, J0402-28, TP0403 |
| Approx. 0 V | Emergency_sense | Deactivated | U508-4 |
| 2.85 V | Emergency_sense | Activated | U508-4 |
| (See "Chapter 6 Troubleshooting Waveforms" on page 6-1) | Boot_TX | Same as UARTA_TX | J0401-26, P502-10 |
| | Boot_RX | Same as UARTA_RX | J0401-25, P502-2 |
| 2.85 V | Cable_Detect | No prog. cable inserted | U0402-4 |
| 0 V | Cable_Detect | Prog. cable inserted at P502 | U0402-4 |
| 3.5 V | Boot_Data_enable | No prog. cable inserted | |
| 0 V | Boot_Data_enable | Prog. cable inserted at P502 | U0402-2 |
| 0 V | Opt_B+_bootsel_Vpp | No prog. cable inserted | J0401-22, TP0401 |
| 8 V | Opt_B+_bootsel_Vpp | Prog. cable inserted @ P502 | J0401-22, TP0401 |
| (See "6.2.5 32 kHz Clock Waveform" on page 6-4) | 32 kHz | | U0102-4 |

*Table 4-11. Standard Operating Bias: Clock and Control Lines (Continued)*

| Nominal Value | Signal Name | Range/State | Probe Locations |
|---|---|---|---|
| (See "6.2.4 16.8 MHz Clock Waveform" on page 6-3) | 16.8 Mhz | | C0911 near U0903 |

**Note**: Do not KEY UP unless the board is inside a chassis.

*Table 4-12. Standard Operating Bias: Audio Lines*

| Nominal Value | Signal Name | Range/State | Probe Locations |
|---|---|---|---|
| 9.2 V | Mic_Hi | When microphone connected (expects 80 mV input) (line has microphone bias) | TP0402, J0401-4 |
| 9.2 V | Mic_Hi | When microphone disconnected | TP0402, J0401-4 |
| 13 V to 16 V | Mic_Hi | When programming cable inserted | TP0402, J0401-4 |
| **Note**: Do not press the PTT unless the PCB is inside a chassis even for a moment to check a line. Permanent RF hardware damage can occur to the board due to no heatsinking. | | | |
| 9.2 V | Aux_Mic = [ A(tx) ] (transmit audio) | Expects 300 mV input (APCO default)<br>Expects 80 mV input (motorcycle use) | J0401-6, J2-23 |
| 2.84 V | Aux_PTT = [ PTT ] | Idle = High<br>Active = Low<br>Hard-wired PTT, which will mute or unmute Aux_Mic line | J0402-24, J2-16 |
| 1.4 Vdc to 25 Vdc (needs ext. cap) | Aux_TX (audio input) | 300 mV line-level (no mic bias) | J0401-7 |
| 0 V | Aux_RX (audio input) | 300 mV line-level (Audio PA In) | J0401-8 |
| **Note**: The Mic_Hi audio overrides Aux_TX/Aux_Mic audio, and the speaker is always muted. | | | |
| 0 V | Speaker + | Muted (output) | J2-21, U204-4 |
| | Speaker - | Muted (output) | J2-20, U204-6 |
| 26v peak-to-peak @volume= 15+ | Speaker + | Unmuted (output) | J2-21, U204-4 |
| | Speaker - | Unmuted (output) | J2-20, U204-6 |
| **Note**: Never ground speaker lines. They are differential, not single-sided. Use an oscilloscope probe on "Spk+" and oscilloscope-probe GND on "Spk-". | | | |
| 2.85 V | Monitor | Idle = High<br>Activate = Low | J2-22 |

*Table 4-12. Standard Operating Bias: Audio Lines (Continued)*

| Nominal Value | Signal Name | Range/State | Probe Locations |
|---|---|---|---|
| 2.84 V | Audio_PA_Enable | | Q0200-1 |
| 1.3 V | RX_Filt_Audio = [A(rx) ] (receive audio/audio output) | 300 mV line-level output | J2-21, TP0204 |
| 0 V or 5 V | Chan_Act = [A(p) ] (qualified audio presence) | Idle = Low (0v)<br>Active = High (5 V) | J2-13 |
| | HUB | This pin causes the control head to send SB9600 message to the radio, indicating when HUB is attached | P502-3 |

**Note**: Do not KEY UP unless the board is inside a chassis.

*Table 4-13. Standard Operating Bias: VIP Lines (Standard Remote Configuration)*

| Nominal Value | Signal Name | Range/State | Probe Locations |
|---|---|---|---|
| | VIP_OUT_1_5v | Access only by custom pin-out | J0401-13 |
| | VIP_OUT_2_5v | Access only by custom pin-out | J0401-14 |
| 5 V | VIP_IN_1_5v | Idle = deactivate = 5 V bias | J0401-15 |
| 0 V | | Activate = ground | |
| 5 V | VIP_IN_2_5v | Idle = deactivate = 5 V bias | J0401-16 |
| 0 V | | Activate = ground | |
| SW_B+ level | VIP_OUT_1_12v | Deactivate = relay closed | J0401-11, J2-18 |
| 0.3 V to 0.5 V | | Activate = relay open | |
| SW_B+ level | VIP_OUT_2_12v | Deactivate = relay closed | J0401-12, J2-19 |
| 0.3 V to 0.5 V | | Activate = relay open | |

**Note**: VIP_IN programmed by CPS. Requires custom pin-out to gain access.

# 4.9 Receiver Front-End (RXFE)

This section provides band-specific troubleshooting procedures for the receiver front-end.

## 4.9.1 VHF (136–174 MHz) Band

Use this information, along with the theory of operation, to diagnose and isolate the cause of failures. The principle tools needed to troubleshoot a circuit to the component level are the schematic and the theory of operation.

In addition to the schematic and theory, you can use the troubleshooting flowcharts in "Chapter 5. Troubleshooting Charts" that will guide you through a sequence of tests and checks designed to isolate problems.

Prior to troubleshooting, it is important to review the theory of operation including specific precautions and troubleshooting methods. Because much of the radio's circuitry operates at a high frequency, measurements must be taken carefully.

## 4.9.2 UHF Range 1 (380–470 MHz) Band

Use this information, along with the theory of operation, to diagnose and isolate the cause of failures. The principle tools needed to troubleshoot a circuit to the component level are the schematic and the theory of operation.

In addition to the schematic and theory, you can use the troubleshooting flowcharts in "Chapter 5. Troubleshooting Charts" that will guide you through a sequence of tests and checks designed to isolate problems.

Prior to troubleshooting, it is important to review the theory of operation including specific precautions and troubleshooting methods. Because much of the radio's circuitry operates at 400 MHz, measurements must be taken carefully.

# 4.10 Power Amplifier Procedures

This section provides band-specific troubleshooting procedures for the RF power amplifier (RFPA).

## 4.10.1 VHF (136–174 MHz) Band

Use this information, along with the theory of operation, to diagnose and isolate the cause of failures. The principle tools needed to troubleshoot a circuit to the component level are the schematic and the theory of operation.

Prior to troubleshooting, be sure to review the theory of operation including any precautions and troubleshooting methods.

### 4.10.1.1 General Troubleshooting and Repair Notes

Most of the common transmitter symptoms are caused by either failure of the power amplifier or a failure in the control circuitry. The initial troubleshooting effort should be toward isolating the problem to one of those two areas. If either the control voltage or keyed 9.4 V are zero, then the problem is likely to be in the control circuit. If those voltages are present, then the problem is more likely in the power amplifier circuit.

If for diagnostic reasons, a chip component needs to be removed to facilitate testing, such as a series capacitor removed to allow for signal insertion, then the component(s) returned to the circuit should be new parts. The application of a soldering iron to many chip components will tend to cause leaching which could lead to failure.

After a PA board is replaced, or if any power control circuitry components are replaced, readjust the power according to instructions in the *PM1500 VHF/UHF Range 1 Mobile Radio Basic Service Manual*.

**NOTE:** Due to the high frequency of operation, it is imperative that you use specified Motorola parts when component replacement is necessary. At these frequencies, second and third order properties of the components are very important and are part of the circuit's design. Substitute components may not work. It is also critical that you use great care when replacing parts. Excessive solder or flux, longer than original leads on coax connectors, misorientation of parts, and other commonly benign imperfections may cause the radio's performance to degrade.

### 4.10.2 UHF Range 1 (380–470 MHz) Band

In addition to the schematic and theory of operation ("3.12.2 UHF Range 1 (380-470 MHz) Band" on page 3-25), refer to the RFPA troubleshooting flowcharts in "5.6.23 No TX Audio (380–470 MHz)" on page 5-32. These flowcharts will guide you through a sequence of tests and checks designed to isolate problems in the RFPA stages.

# Notes

# Chapter 5 Troubleshooting Charts

## 5.1 Introduction

This chapter contains detailed troubleshooting flowcharts and tables. These should be used as a guide in determining the problem areas. They are not a substitute for knowledge of circuit operation and astute troubleshooting techniques. It is advisable to refer to the related detailed circuit descriptions in the theory of operation chapter prior to troubleshooting a radio.

## 5.2 List of Troubleshooting Charts

Most troubleshooting flowcharts (see Table 5-1) end by pointing to an IC to replace. Before replacing any IC, it is good practice to verify power supplies and grounds to the affected IC and trace continuity to the malfunctioning signal and related circuitry. For example, if a clock signal is not available at a destination IC, continuity from the source IC should be checked before replacing the source IC.

*Table 5-1. List of Troubleshooting Charts*


| Description | Page |
|---|---|
| **VHF (136–174 MHz)** | |
| Poor RX Sensitivity or No RX Audio | 5-10 |
| RX IF—Poor SINAD or No Audio | 5-12 |
| RX Back-End—Poor SINAD or No Audio | 5-13 |
| Low or No RX Injection Signal | 5-16 |
| Low or No TX Injection Signal | 5-17 |
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| No Output Power at TX Mode | 5-20 |
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*Table 5-1. List of Troubleshooting Charts (Continued)*

| Description | Page |
|---|---|
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**NOTE:** The term μC might be used in some of the following troubleshooting charts; μC = MCU or microprocesor.

# 5.3 Troubleshooting Tables

## 5.3.1 For High Power models

This section contains troubleshooting tables that can help you isolate a problem in your radio.

*Table 5-2. PM1500 Troubleshooting Table (136-174 MHz, 380-470 MHz)*

| Symptom | Check Section | Troubleshooting Procedure | Component |
|---|---|---|---|
| No TX Modulation | Controller Block | With 80 mV rms, 1 kHz injected to the MIC_HI line and CPS mic gain level set to 0 (default), check the following levels. | |
| | | • 80 mVrms at TP0200, U0209-4, J0401-57. | • Absence of signal may indicate failure with U0209 (MUX), or U0201 (Op-Amp) |
| | | • 80 mV rms at TP0201. | • Absence of signal may indicate failure with U0209 (MUX), or U0201 (Op-Amp) |
| | | • 2.5 Vdc at U0201-8. | • Absence of DC bias may indicate failure with U0201 (Op-Amp) |
| | | • 80 mV rms at U0201-7, U0201-7, TP0203. | • Absence of signal may indicate failure with U0202 (EPOT), or U0201 (Op-Amp) |
| | | • 36 mV rms at U0200-17. | • Absence of signal may indicate failure with U0200 (Codec) |
| | | • > 150 mV rms at U0900-1. | • Absence of signal may indicate failure with U0901 (Urchin), U0900 (Modulation DAC), or U0001 (Microprocessor Board) |
| | | • > 150 mV rms at FL0900-5. | • Absence of signal may indicate failure with U0901 (Urchin), or FL0900 (Filter) |
| | | • > 150 mV rms at U0902-14 | • Absence of signal may indicate failure with U0902 (MUX) |
| | | • > 150 mV rms at R6782 | • Presence of signal may indicate a aproblem in RF section |
| | Flex/Control Head | Check that MIC_HI is getting to controller at VR0412, VR0421, C0438, C0207, C0234, or R0204 | Absence of signal may indicate failure with flex, control head, VR0412 |

*Table 5-2. PM1500 Troubleshooting Table (136-174 MHz, 380-470 MHz) (Continued)*

| Symptom | Check Section | Troubleshooting Procedure | Component |
|---|---|---|---|
| No Keyloading | Controller | Connect proper KVL keyloader and cable and begin keyloading by pressing the PTT on the keyloader<br>• Check data activity (5 V levels) on Boot_TX/Keyfail* line - J0401-44.<br>• Check data activity (5 V levels) at J0501-14 | • Absence of data may indicate failure with keyloader, cable, control head, control head flex, J0401.<br>• Absence of signal may indicate failure with J0501; Presence of signal may indicate failure of secure interface board or UCM/ Secure module, which would need replacing |
| Radio Dead, Display Does Not Light Up | Blown Fuse | Check fuse in red lead of power cable (or green lead if used) | Absence of signal may indicate failure with J0401, J0402, VR0412, or VR0402 |
| | Controller Section | • Check for IGNITION at J0401-27, 28<br>• Check for A+ at Q0503, VR0950, J0401-19,21, or TP0414 | • Absence of signal may indicate failure with J0401<br>• Absence of signal may indicate failure with J0950, J0401 or VR0950 |
| | Flex/Control Head | Check for SW_B+_CH at J0401-33,34, TP0413, or pin 21 of P502 (on control head) | Absence of signal may indicate failure with flex, control head |
| Radio Dead, Display Lights Up | Regulators | • Check for SW_B+ at Q0503, U0500-4, U0950-4, U0951-4<br>• Check for 9.3 V at U0500-5, U0950-5, U0951-5.<br>• Check for 5 V at U0503-5, 3 V at U0962-3, 2.85 V at U0501-1, 1.85 V at U0507-1, 1.55 V at U0502-1 | • Absence of signal may indicate failure with Q0503<br>• Absence of signal may indicate failure with U0500, U0950, or U0951 (9 V Regulators)<br>• Absence of signal may indicate failure with U0503, U0962, U0501, U0507, or U0502 (5 V, 3 V, 2.85 V, 1.85 V, and 1.55 V Regulators) |
| | Flex/Control Head | Check for SW_B+_CH at J0401-33,34, TP0413, or pin 21 of P502 (on control head) | Absence of signal may indicate failure with flex, control head |
| | SB9600 | Check for logic transitions at J0401-13 thru 16, or U0606-4,7,9,12 | Absence of signal may indicate failure with U0606 MUX), VR0408, VR0418, Q0610-Q0613, U0001 (Microprocessor Board), control-head flex, or rear accessory flex |

*Table 5-2. PM1500 Troubleshooting Table (136-174 MHz, 380-470 MHz) (Continued)*

| Symptom | Check Section | Troubleshooting Procedure | Component |
|---|---|---|---|
| Radio Dead, Display Lights Up | Clocks | Check for 32 kHz clock at U0102-4, and 16.8 MHz clock at C0106, C0911 | Presence of signals may indicate failure with U0001 (Microprocessor Board). Absence of signals may indicate failure with U0102 (Inverter) or with FGU reference oscillator circuit |
| | Remote | Check for A+ at J6 | Check F0400.<br>Check the flex. |
| No RX Audio/ Receive Does not Unsquelch | Controller Block | (Inject 1 kHz tone, 3 kHz deviation into radio antenna, set volume to rated audio. | |
| | | • Check for speaker leads shorted to ground, or at U0204-4, 6. | • Short may indicate failure with VR0400, VR0412, or U0204 |
| | | • Check for > 30 mV rms audio at audio PA input, U0204-1,9. | • Presence of signal may indicate failure with U0204 (Audio PA) |
| | | • Check for > 30 mV rms audio at U0206-8 or TP0205. | • Presence of signal may indicate failure with U0206 (Log-POT) |
| | | • Check for > 30 mV rms audio at U0210-6 or U0200-2. | • Presence of signal may indicate failure with U0210 (MUX); Absence of signal may indicate failure with U0200 (CODEC), or U0001 (Microprocessor Board) |
| | | • Check that U0204-8 is >10 V | • Absence of >10V may indicate failure with Q0200 or U0001 |
| | Regulators | See description for *No VOCON Powerup* | |
| | ABACUS Circuit (380-470 MHz, 450-520 MHz) | • Check for 20 kHz Frame Sync pulse signal at testpoint FS (U5002-31) | • Absence of signal causes no receive. Possible U5002 (ABACUS) failure or U0001 (Microprocessor Board) failure |
| | | • Check for 1.2 MHz Clock square wave at testpoint CLKOUT (U5002-28) | • Absence of signal causes no receive. Possible U5002 (ABACUS) failure or U0001 (Microprocessor Board) failure |
| | | • Check for random data pattern at testpoint DOUTA (U5002-29) | • Absence of signal causes no receive. Possible U5002 (ABACUS) failure or U0001 (Microprocessor Board) failure |
| | | • Check for Clock Oscillator at R5025 (18 MHz) | • Absence of Clock signal causes no receive. Possible U5002 (ABACUS), Clock VCO, or U0001 (Microprocessor Board) failure |
| | | • Check for Local Oscillator at C5058 (71.1 MHz or 75.6 MHz) | • Absence of LO signal causes no receive. Possible U5002 (ABACUS), or LO VCO |

*Table 5-2. PM1500 Troubleshooting Table (136-174 MHz, 380-470 MHz) (Continued)*

| Symptom | Check Section | Troubleshooting Procedure | Component |
|---|---|---|---|
| No RX Audio/ Receive Does not Unsquelch (cont.) | ABACUS Circuit (700-800 MHz) | • Check for 20 kHz Frame Sync pulse signal at testpoint FS (U6000-31)<br>• Check for 1.2 MHz Clock square wave at testpoint CLKOUT (U6000-28)<br>• Check for random data pattern at testpoint DOUTA (U6000-29)<br>• Check for Clock Oscillator at R6003 (18 MHz)<br>• Check for Local Oscillator at C6026 (71.1 MHz or 75.6 MHz) | • Absence of signal causes no receive. Possible U6000 (ABACUS) failure or U0001 (Microprocessor Board) failure<br>• Absence of signal causes no receive. Possible U6000 (ABACUS) failure or U0001 (Microprocessor Board) failure<br>• Absence of signal causes no receive. Possible U6000 (ABACUS) failure or U0001 (Microprocessor Board) failure<br>• Absence of Clock signal causes no receive. Possible U6000 (ABACUS), Clock VCO, or U0001 (Microprocessor Board) failure<br>• Absence of LO signal causes no receive. Possible U6000 (ABACUS), or LO VCO |
| Radio Will Not Turn Off | On/Off Switch (Control Head) | Check for SW_B+_CH at 0 V at J0401-17, TP0413 | A high voltage may indicate failure with the control head |
| Radio Will Not Turn Off (continued) | Emergency Circuit | Check for 0 V at Timer U0506-3, U0508-2,4 | A high voltage may indicate failure with U0506, or that the EMERGENCY line is not grounded by the rear accessory cable |
| | SW_B+ Sense Circuit | Check that U0604-7 is low (0 V) and that SOFT TURN OFF is low (0 V) at D0501 | Absence of this voltage may indicate failure with U0604 (Op-Amp) or with U0001 (Microprocessor Board) |

*Table 5-3. PM1500 Receiver Troubleshooting Table (VHF Band)*

| Symptom | Check Section | Troubleshooting Procedure | Component |
|---|---|---|---|
| Poor Sensitivity | Front-end | • Check 2.85 V on pin 4 and 0 V on pin 5 of U3250 | • U3250. |
| | | • Check transistors Q3250, Q3252 VCE levels. Levels should be ~ 5 V | • Q3250, Q3252 (only Q3252 in STD mode). |
| | | • Using a RF probe, check for 20 dBm on TP6771 | • FGU section. |
| | | • Verify that all Front-end components are well soldered | • Visual inspection of soldering. |
| | Back-end | • Check for VCE level of 8 V at IF amplifier | • Q3401. |
| | | • Verify that ABACUS is well soldered | • Visual inspection of U3000 leads soldering. |
| | | Check ABACUS for:<br>• Reference clock 16.8 MHz<br>• Synthesizer frequency 107.4 MHz or 111.9 MHz | <br>• R3822.<br>• C3846. |
| Poor Reception | Back-end | Check ABACUS DC voltages:<br>• 2.7-3 V on pins 1, 2, 6, 9, 14, 17, 40<br>• 5 V at on 39 | • U3000. |
| | | • Check Second Local Oscillator for voltage of 0.5-4.7 V | • U3000 pin 38. |
| | | • Check second IF for 2.25 MHz | • C3047. |

## 5.4 Troubleshooting Test Points

The following figures show the location of the main board test points for measuring voltages and viewing waveforms.

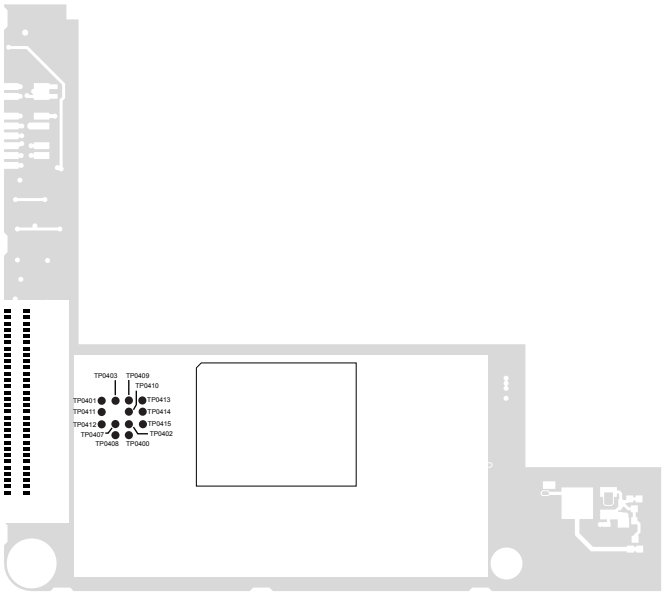



*Figure 5-1. Main Board Test Points—Top Side (for High Power)*

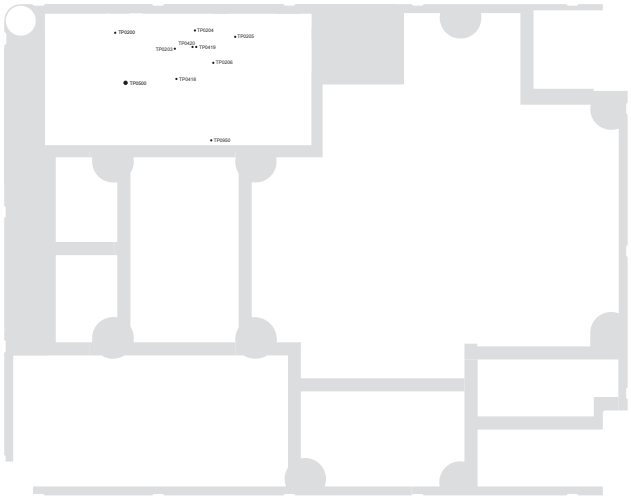


*Figure 5-2. Main Board Test Points—Bottom Side (for High Power)*

## 5.5 Board ID Jumper Configuration

The following jumper table (Table 5-4 on page 5-9) is provided for troubleshooting and determining what board revision you have. This can be helpful in the event a jumper was placed incorrectly or was removed during a repair and the radio is not functioning correctly.

This table provides two types of information:

- RF band of the radio
- Overall revision of the main board and controller section

The table indicates what the logic levels are, as well as how they correlate to the placement or removal of a jumper to accomplish the logic level. This is because some of the board ID resistors are on Pull-Up I/O pins and some are on Pull-Down I/O pins. Therefore, the placement or removal of a resistor for a Pull-Up I/O is the opposite of what must be done for the placement or removal of a resistor for a Pull-Down I/O.

Refer to the troubleshooting testpoints chapter for a general idea of where the board ID pins are located. Refer to the board layout for the exact location with respect to all nearby components before attempting to place or remove any jumpers.

*Table 5-4. Board ID Jumper Configuration*

| Board ID2 R0103 Pull-Up | Board ID1 R0102 Pull-Up | Board ID0 R0101 Pull-Up | | Band |
|---|---|---|---|---|
| 1 = Place | 0 = NP | 0 = NP | <--> | UHF_R1_100W |
| 1 = Place | 0 = NP | 1 = Place | <--> | VHF_R1_100W |

**Note**: NP = Not Placed

## 5.6 Flowcharts

This section contains troubleshooting flowcharts that can help you isolate a problem in your radio.

## 5.6.1 Poor RX Sensitivity or No RX Audio (136–174 MHz)—Part 1 of 2

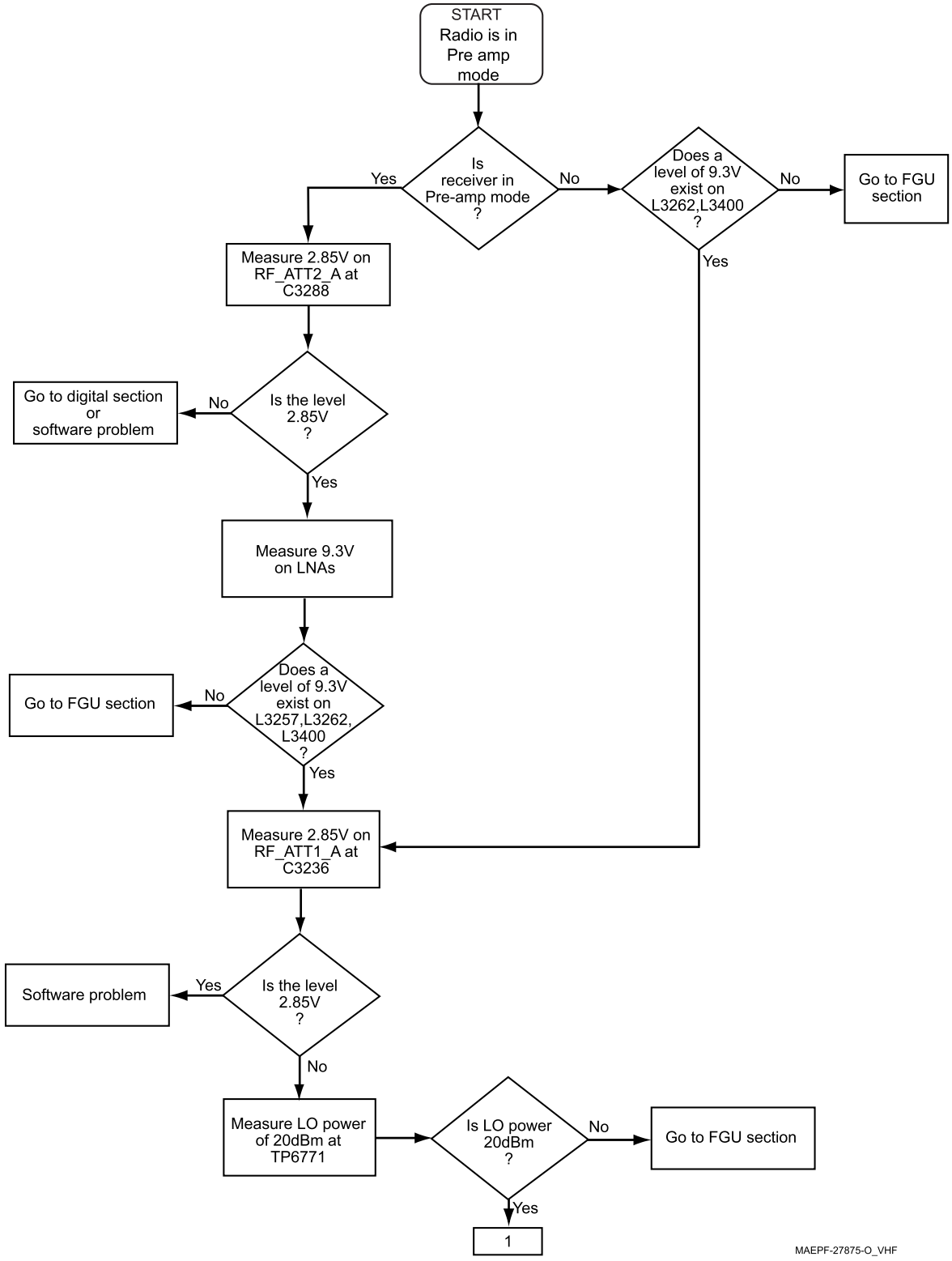



*Figure 5-3. Poor RX Sensitivity or No RX Audio (136–174 MHz)—Part 1 of 2*

## 5.6.2 Poor RX Sensitivity or No RX Audio (136–174 MHz)—Part 2 of 2

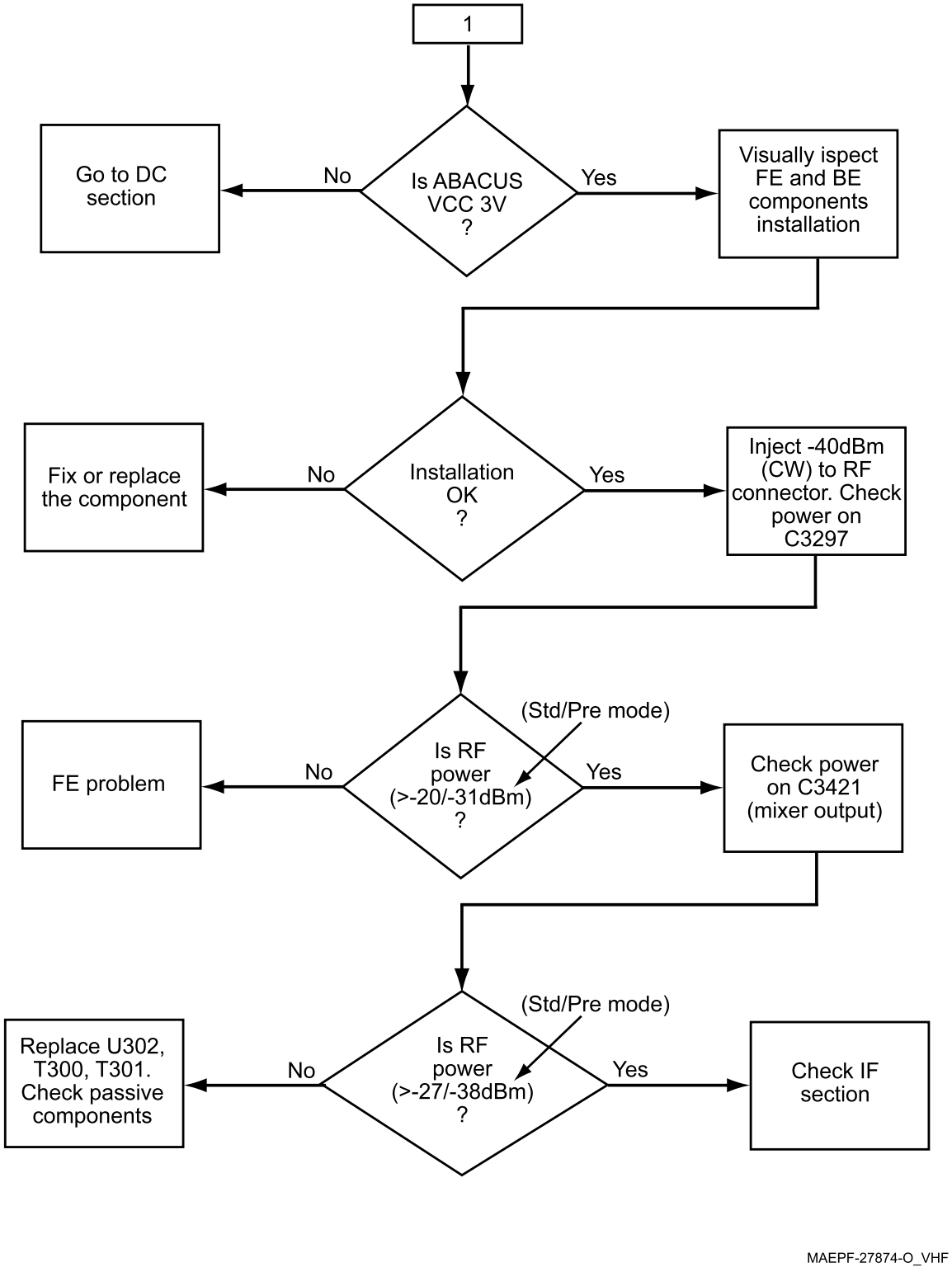



*Figure 5-4. Poor RX Sensitivity or No RX Audio (136–174 MHz)—Part 2 of 2*

## 5.6.3 RX IF—Poor SINAD or No Audio (136–174 MHz)

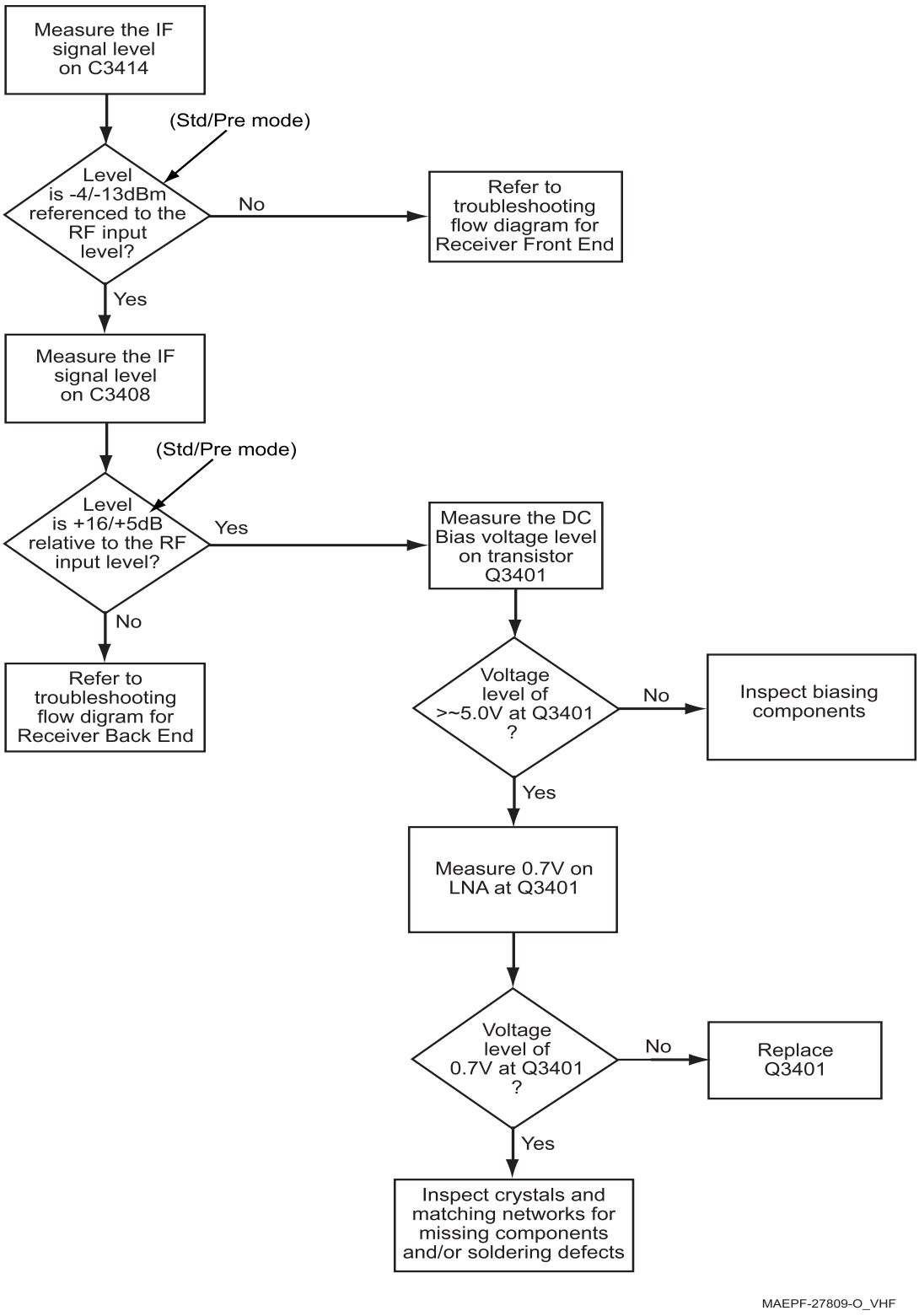



*Figure 5-5. RX IF—Poor SINAD or No Audio (136–174 MHz)*

## 5.6.4 RX Back-End—Poor SINAD or No Audio (136–174 MHz)—Part 1 of 3

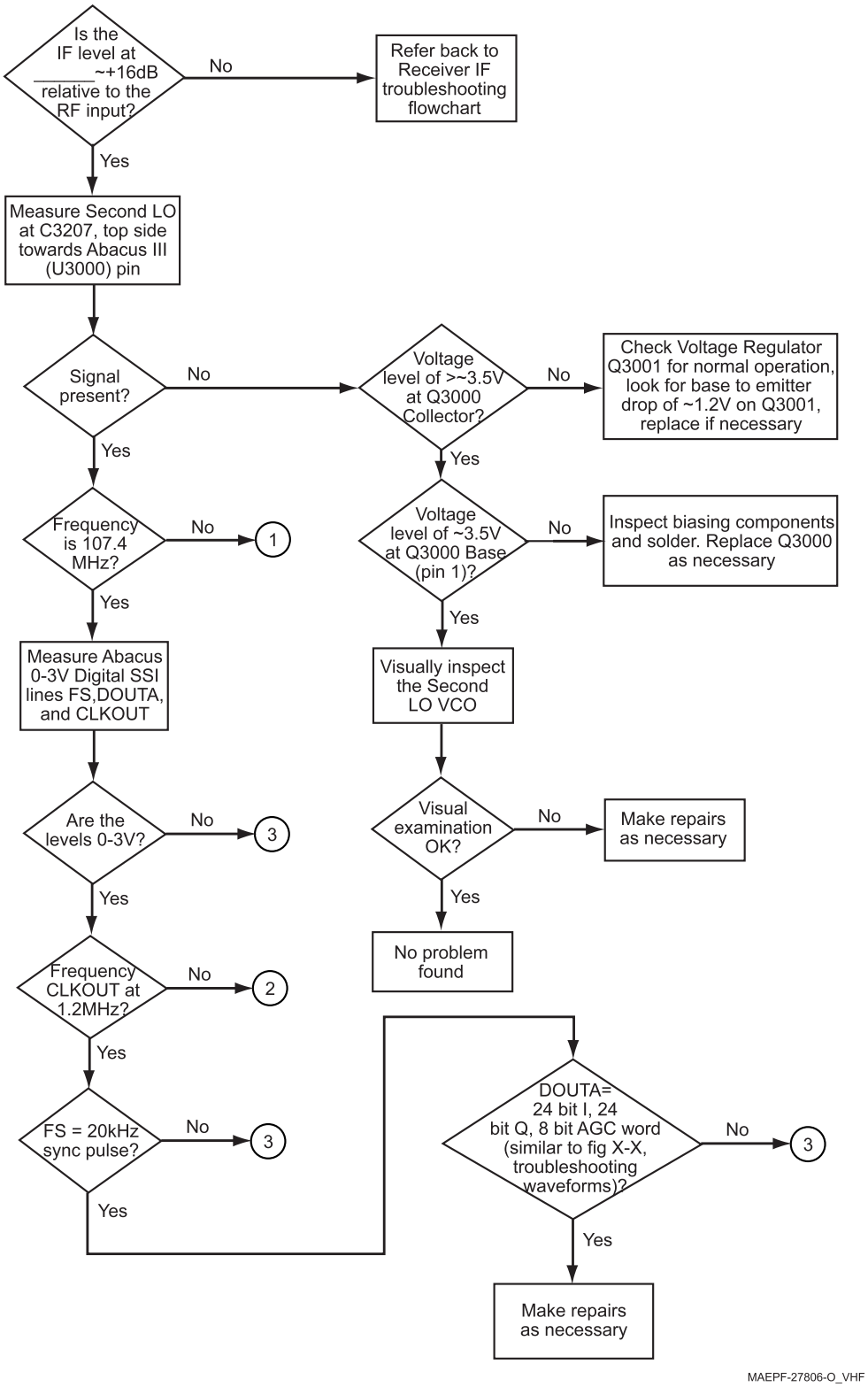



*Figure 5-6. RX Back-End—Poor SINAD or No Audio (136–174 MHz)—Part 1 of 3*

## 5.6.5 RX Back-End—Poor SINAD or No Audio (136–174 MHz)—Part 2 of 3

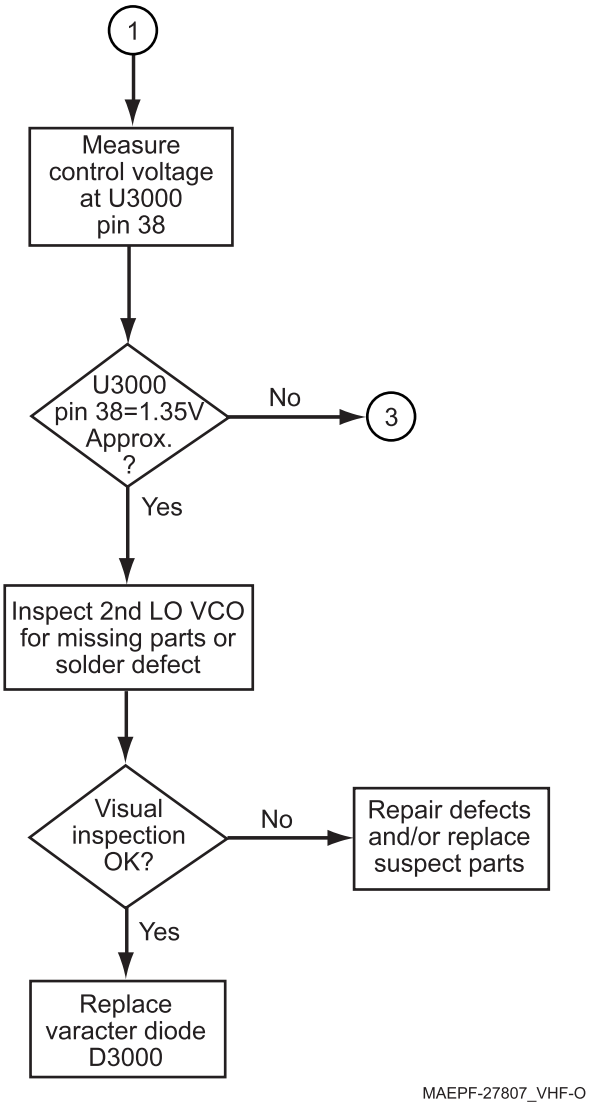



*Figure 5-7. RX Back-End—Poor SINAD or No Audio (136–174 MHz)—Part 2 of 3*

## 5.6.6 RX Back-End—Poor SINAD or No Audio (136–174 MHz)—Part 3 of 3

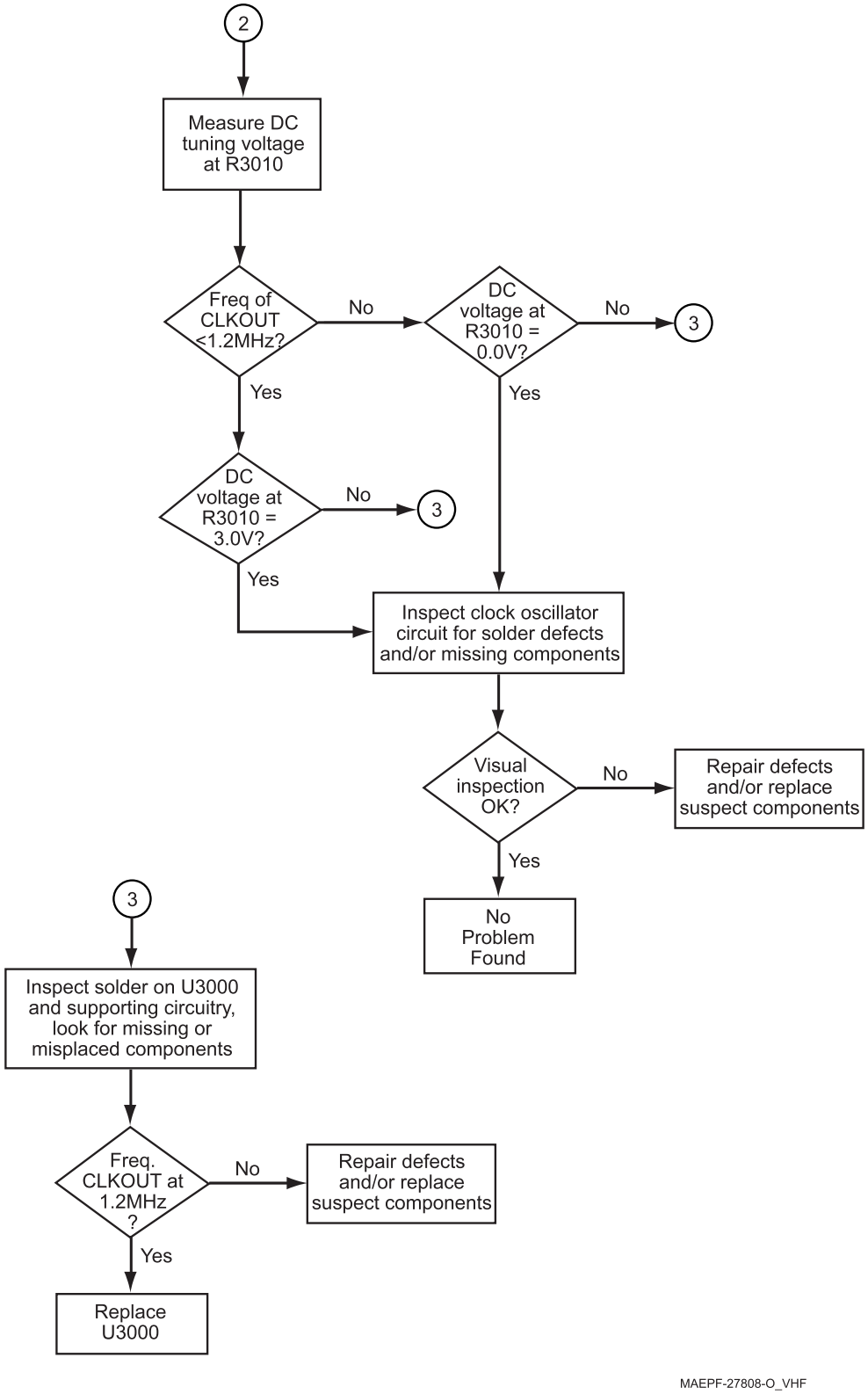



*Figure 5-8. RX Back-End—Poor SINAD or No Audio (136–174 MHz)—Part 3 of 3*

## 5.6.7 Low or No RX Injection Signal (136–174 MHz)

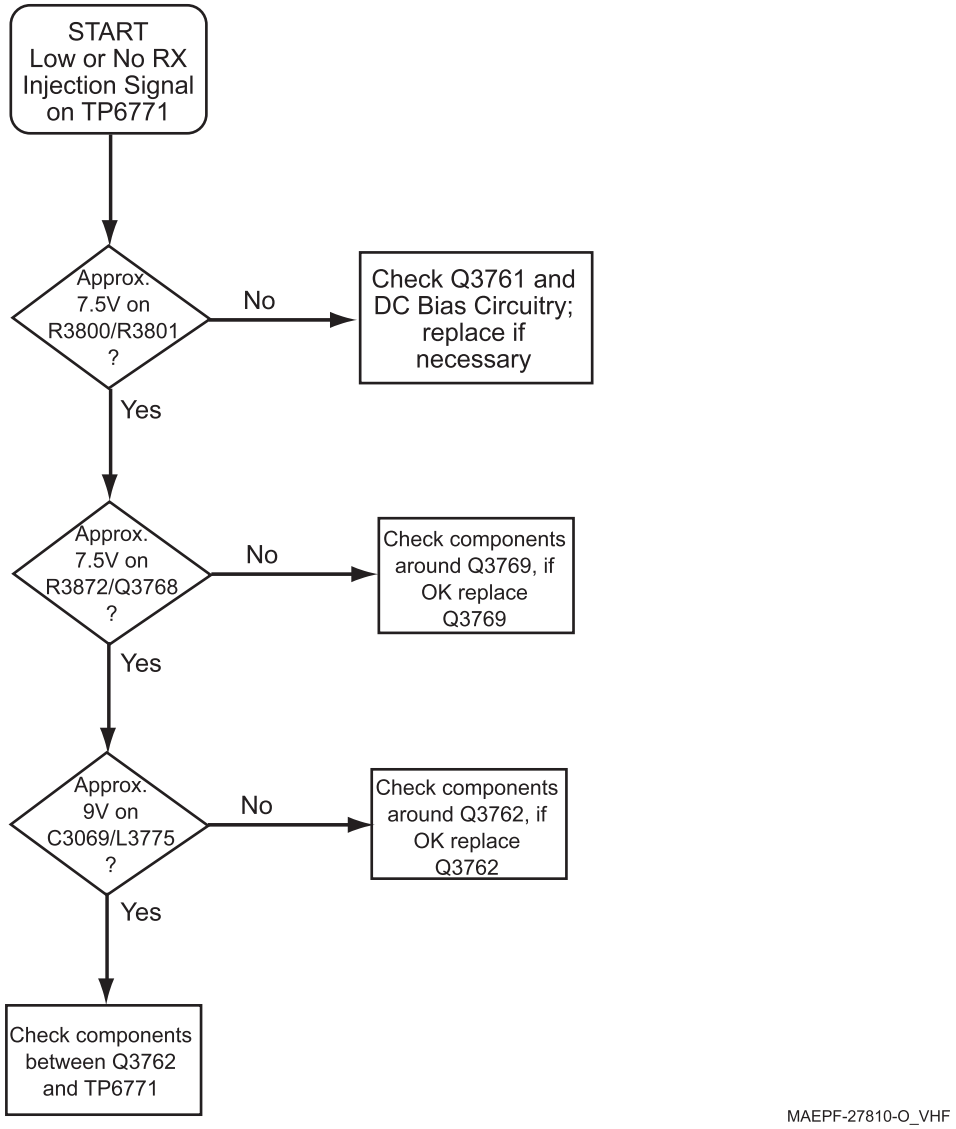



*Figure 5-9. Low or No RX Injection Signal (136–174 MHz)*

## 5.6.8 Low or No TX Injection Signal (136–174 MHz)

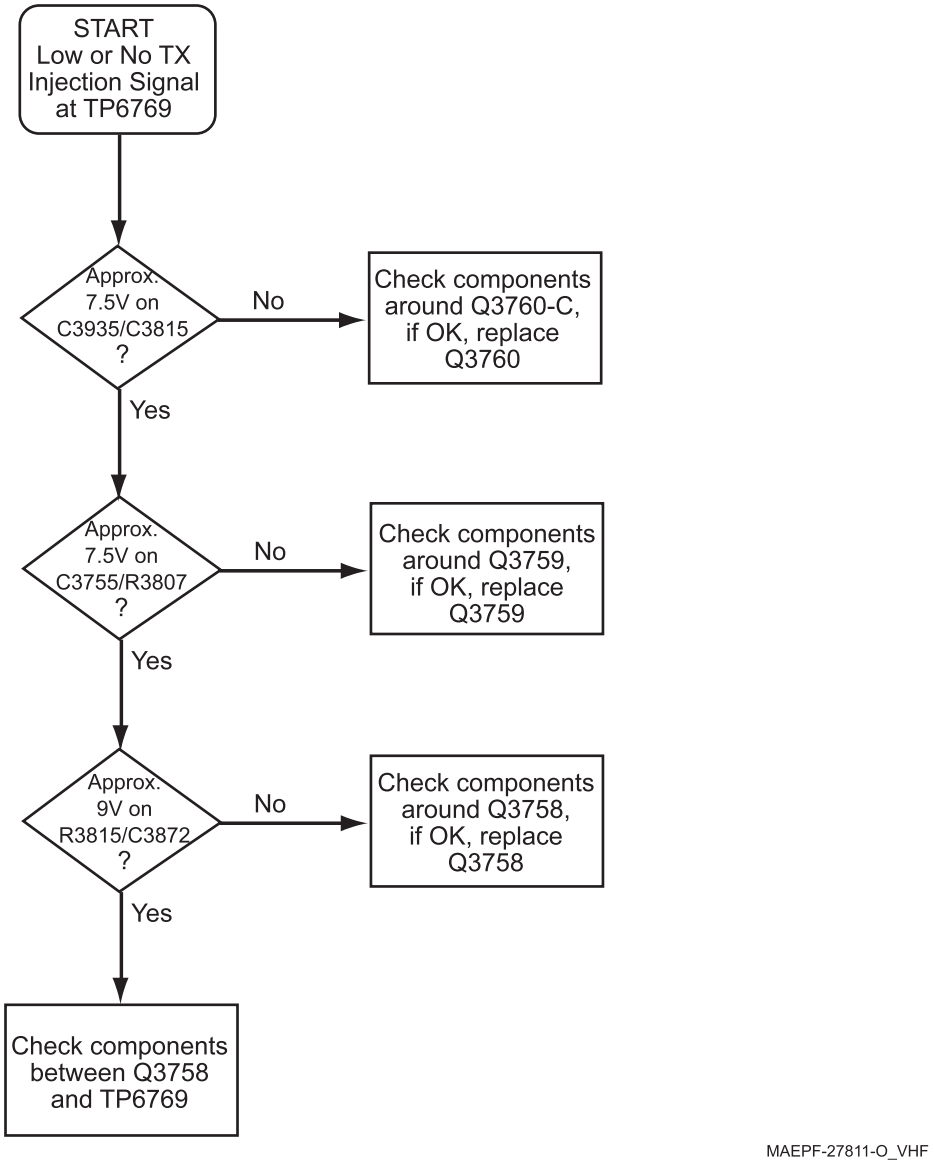



*Figure 5-10. Low or No TX Injection Signal (136–174 MHz)*

## 5.6.9 TX or RX VCO Unlock (Fail 001) (136–174 MHz)—Part 1 of 2

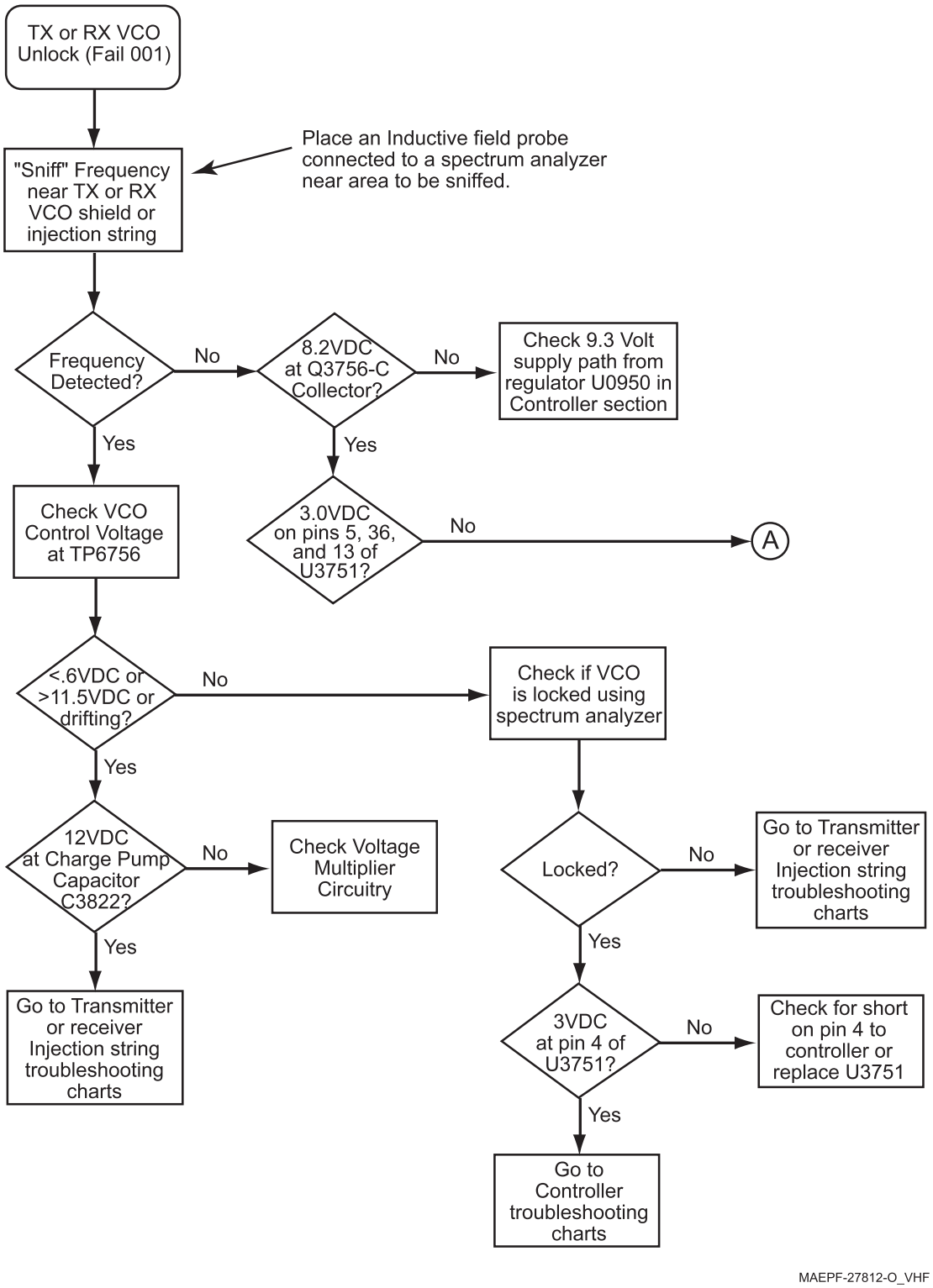



*Figure 5-11. TX or RX VCO Unlock (Fail 001) (136–174 MHz)—Part 1 of 2*

## 5.6.10 TX or RX VCO Unlock (Fail 001) (136–174 MHz)—Part 2 of 2

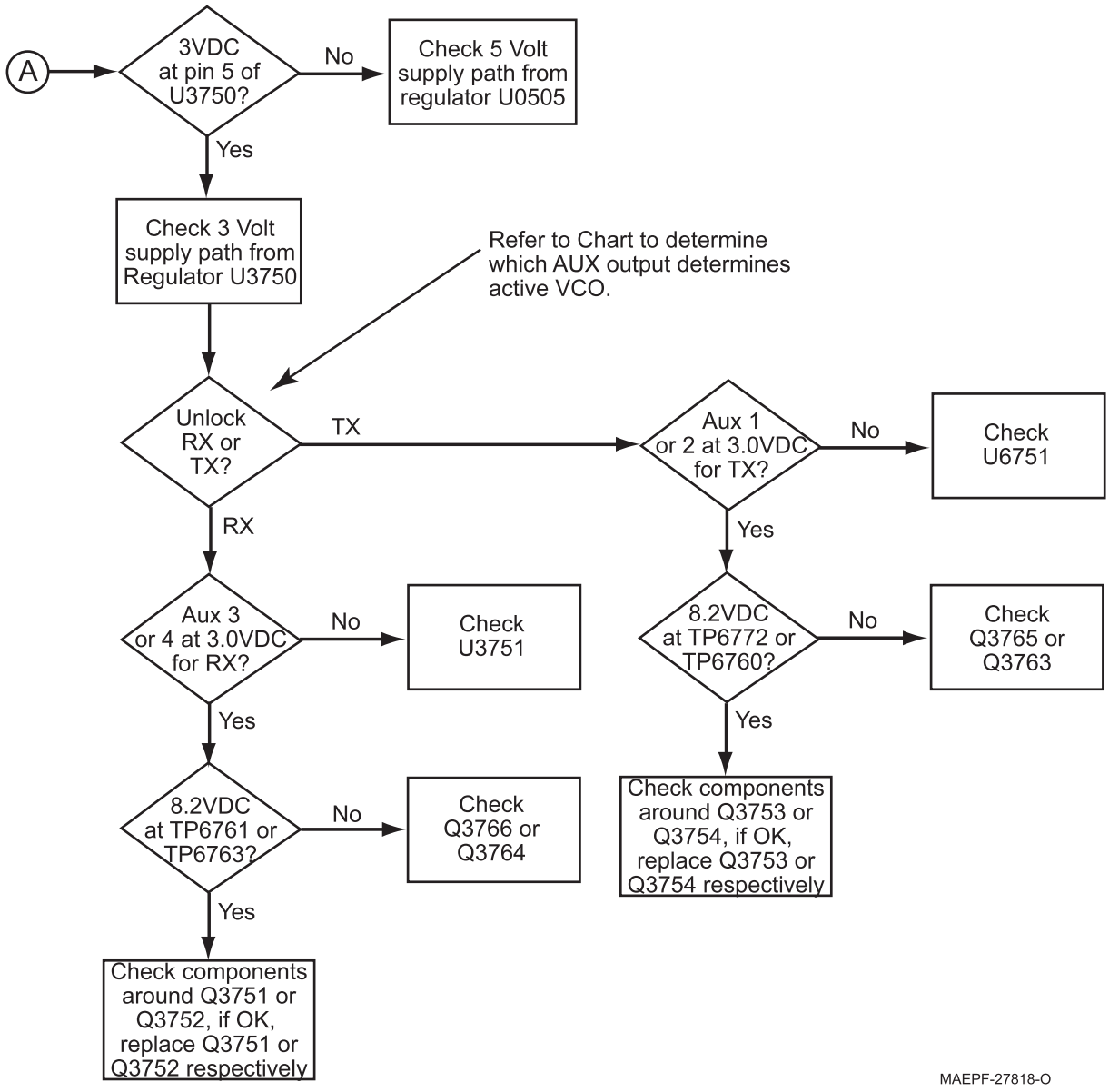



*Figure 5-12. TX or RX VCO Unlock (Fail 001) (136–174 MHz)—Part 2 of 2*

## 5.6.11 No Output Power at TX Mode (136–174 MHz)

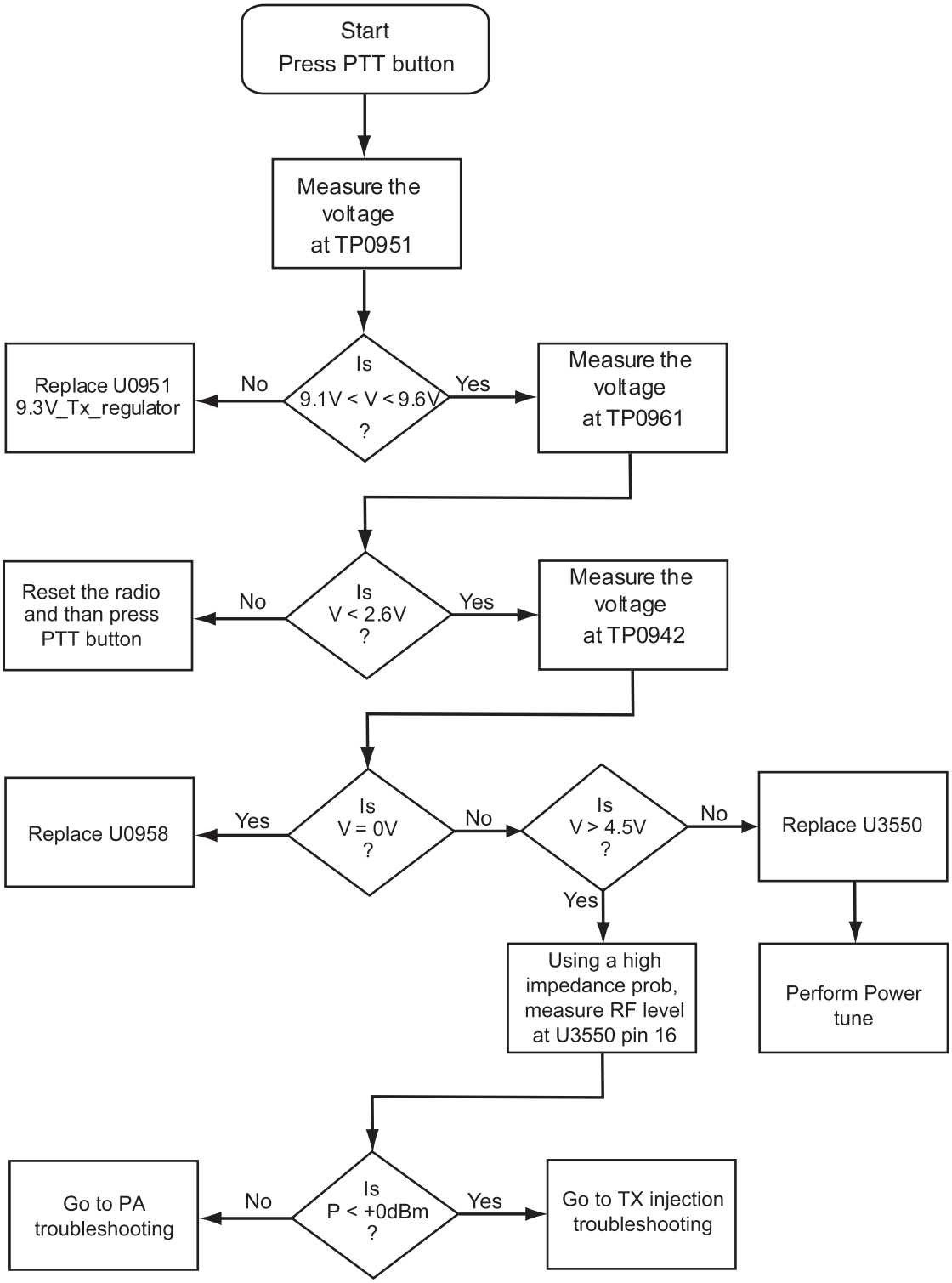



*Figure 5-13. No Output Power at TX Mode (136–174 MHz)*

## 5.6.12 No Output Power and IDC < 2A at TX Mode (136–174 MHz)

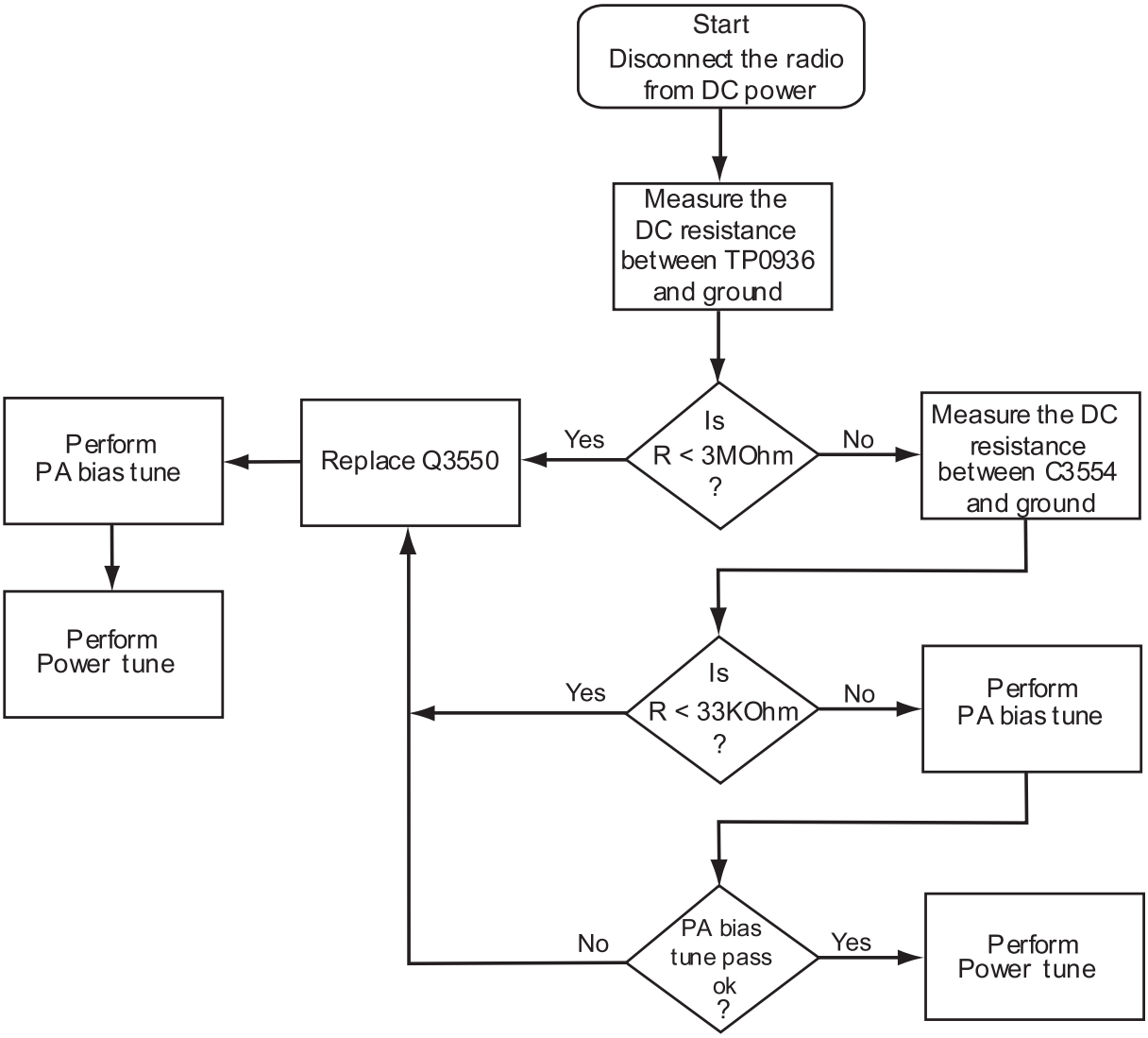
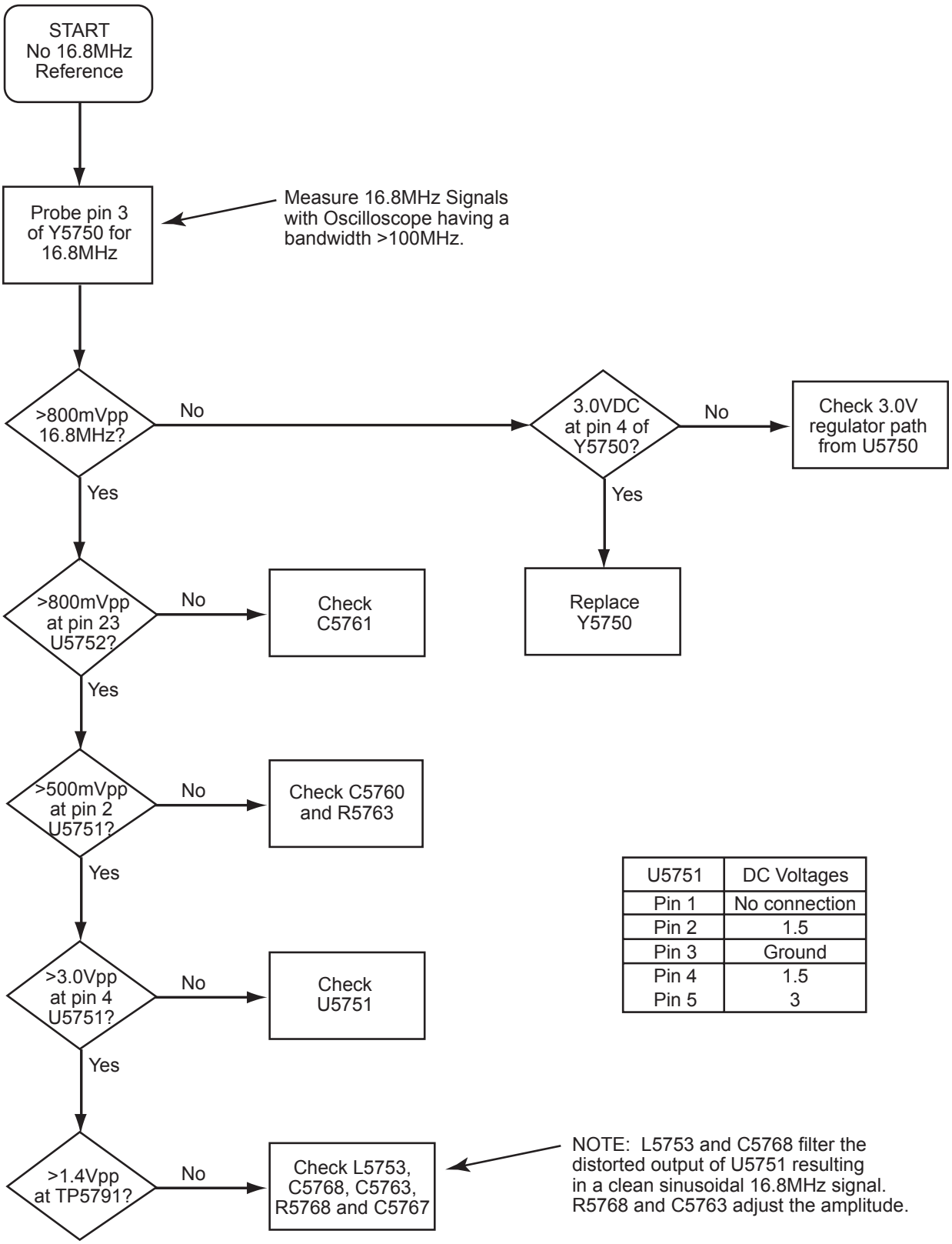



*Figure 5-14. No Output Power and IDC < 2A at TX Mode (136–174 MHz)*

## 5.6.13 No 16.8 MHz Reference Oscillator Frequency (380–470 MHz)




| U5751 | DC Voltages |
|---|---|
| Pin 1 | No connection |
| Pin 2 | 1.5 |
| Pin 3 | Ground |
| Pin 4 | 1.5 |
| Pin 5 | 3 |

*Figure 5-15. No 16.8 MHz Reference Oscillator Frequency (380–470 MHz and 450–520 MHz)*

## 5.6.14 Poor RX Sensitivity or No RX Audio (380–470 MHz)—Part 1 of 2

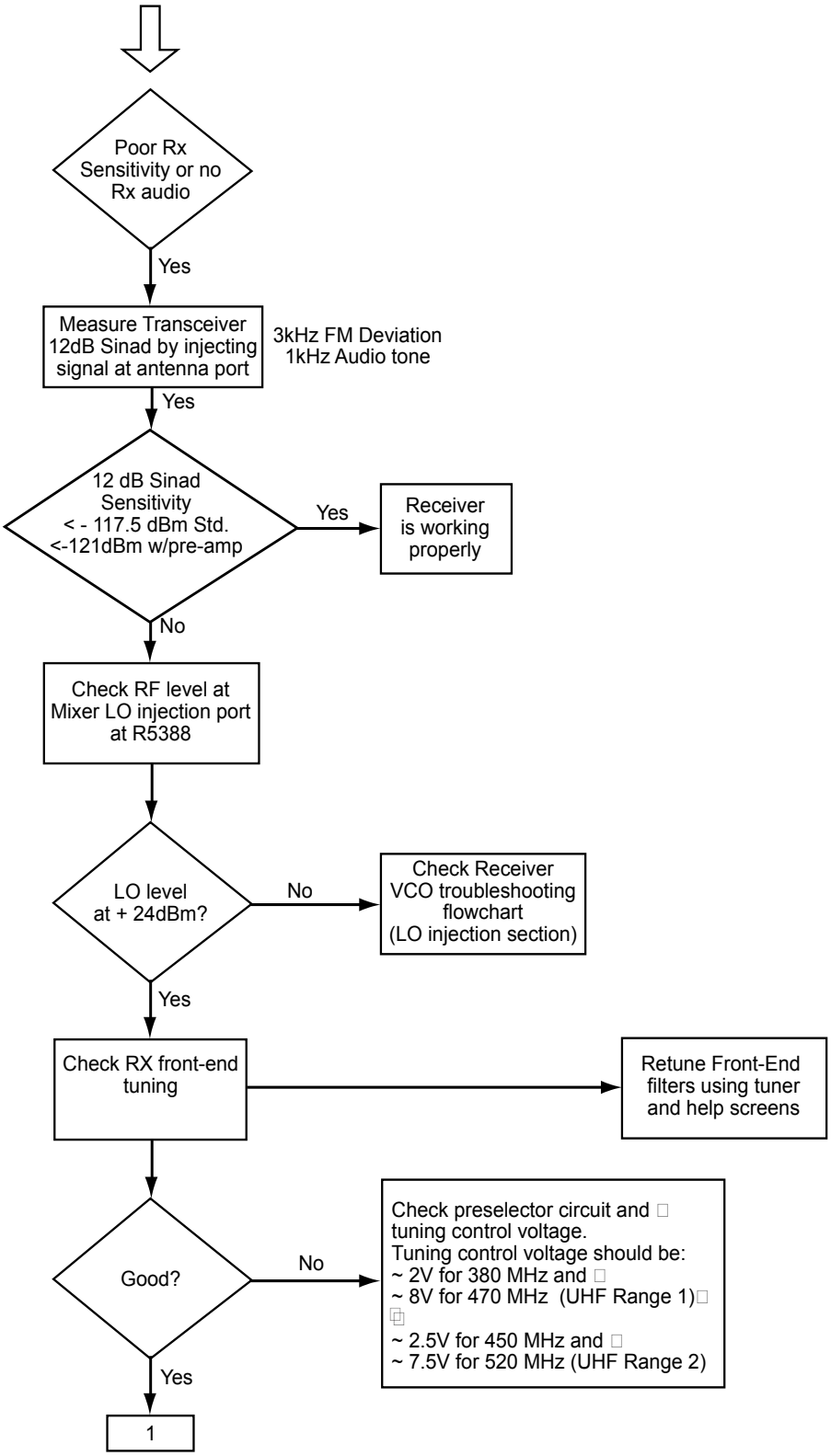



*Figure 5-16. Poor RX Sensitivity or No RX Audio (380–470 MHz and 450–520 MHz)—Part 1 of 2*

## 5.6.15 Poor RX Sensitivity or No RX Audio (380–470 MHz)—Part 2 of 2

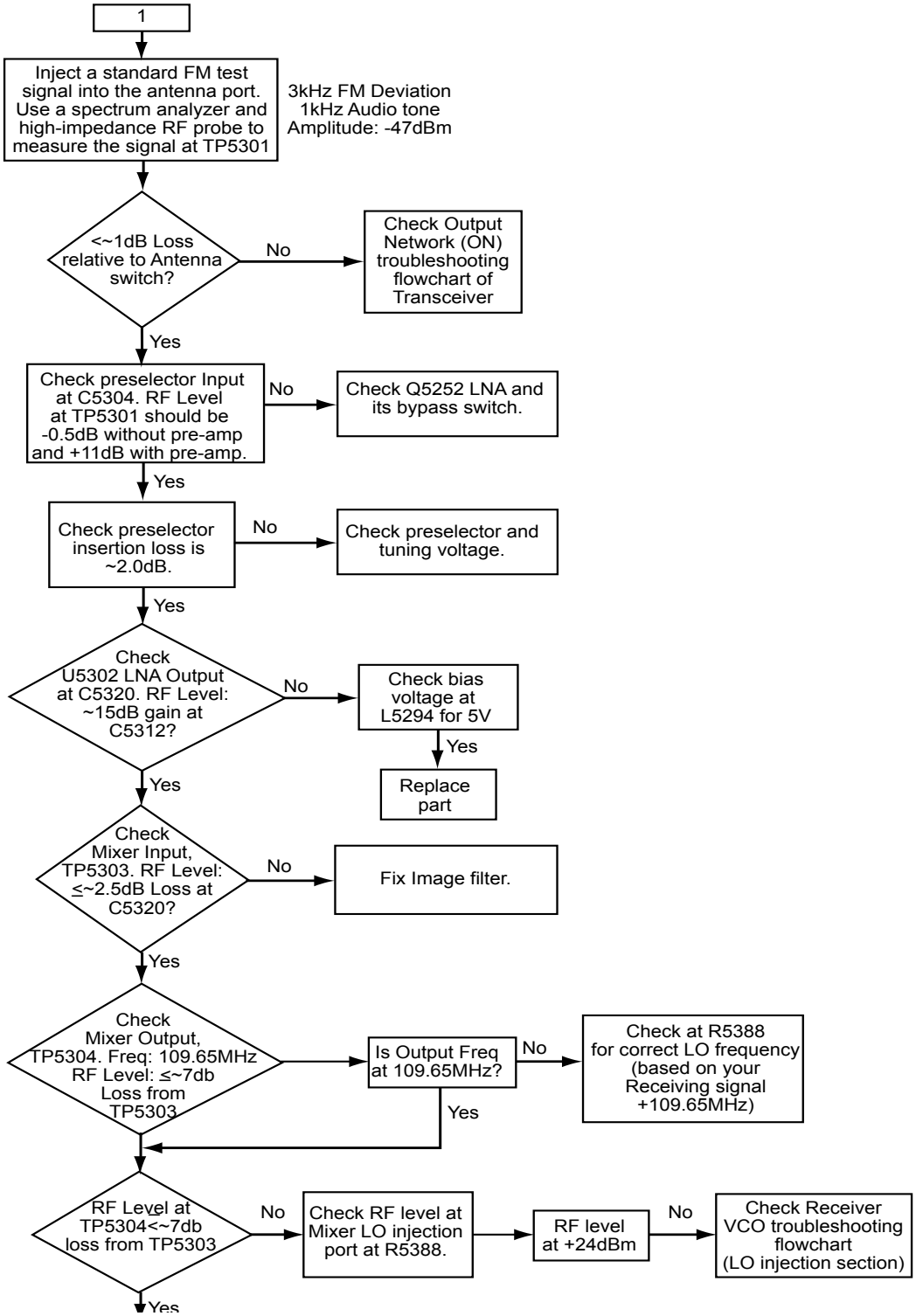



*Figure 5-17. Poor RX Sensitivity or No RX Audio (380–470 MHz and 450–520 MHz)—Part 2 of 2*

## 5.6.16 RX IF—Poor SINAD or No Audio (380–470 MHz)—Part 1 of 2

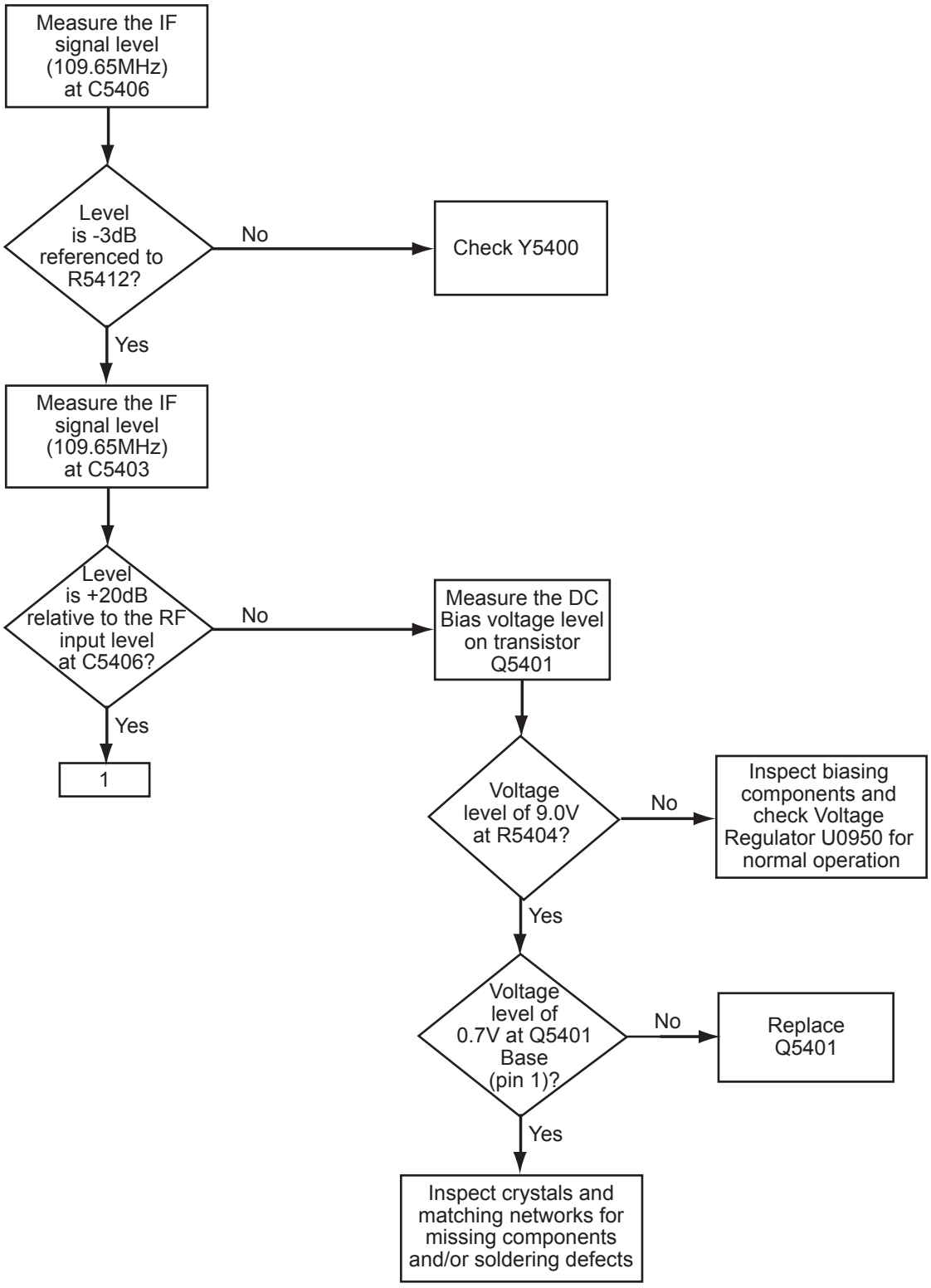



*Figure 5-18. RX IF—Poor SINAD or No Audio (380–470 MHz and 450–520 MHz)—Part 1 of 2*

## 5.6.17 RX IF—Poor SINAD or No Audio (380–470 MHz)—Part 2 of 2

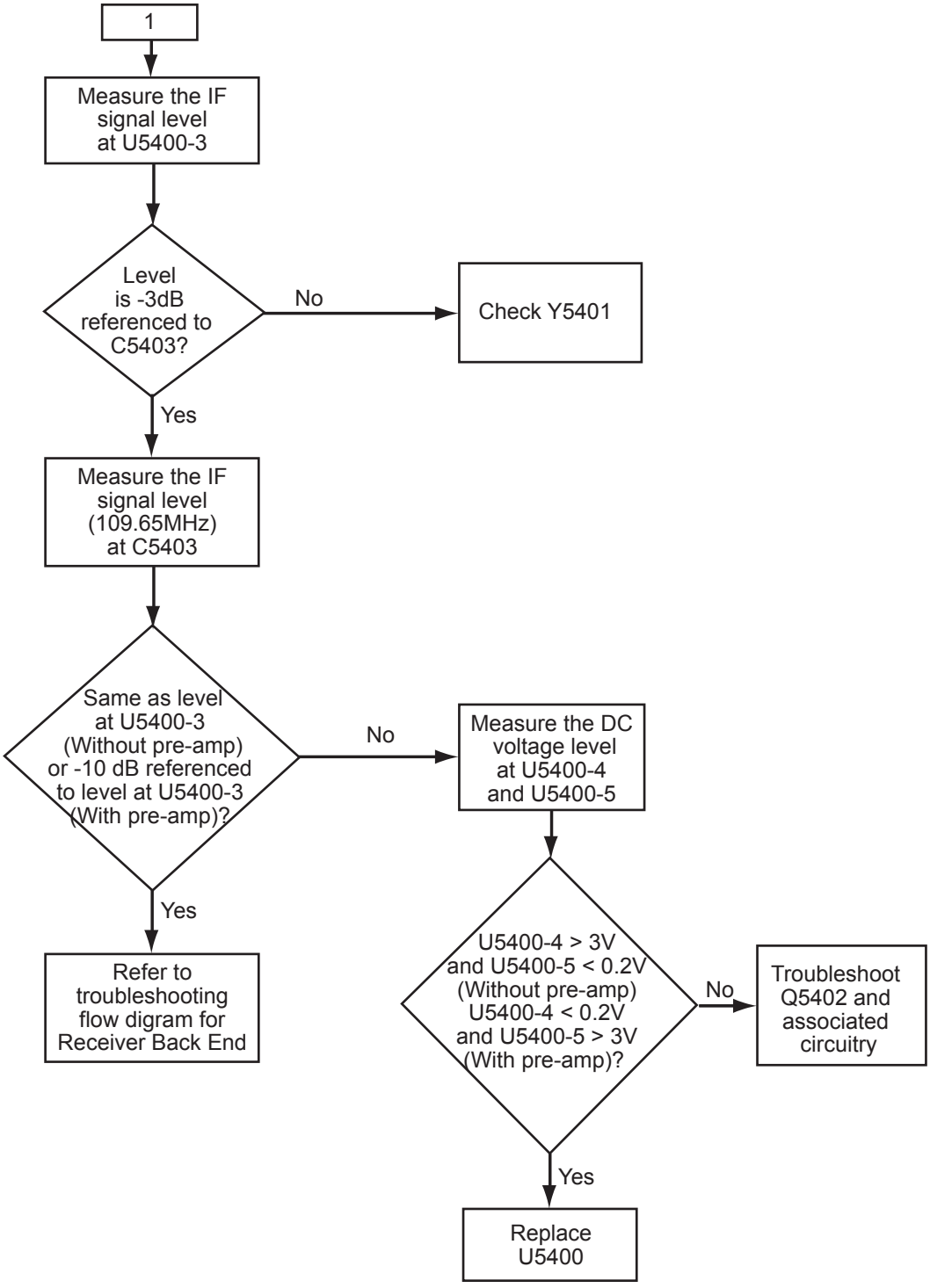



*Figure 5-19. RX IF—Poor SINAD or No Audio (380–470 MHz and 450–520 MHz)—Part 2 of 2*

## 5.6.18 RX Back-End—Poor SINAD or No Audio (380–470 MHz)—Part 1 of 3

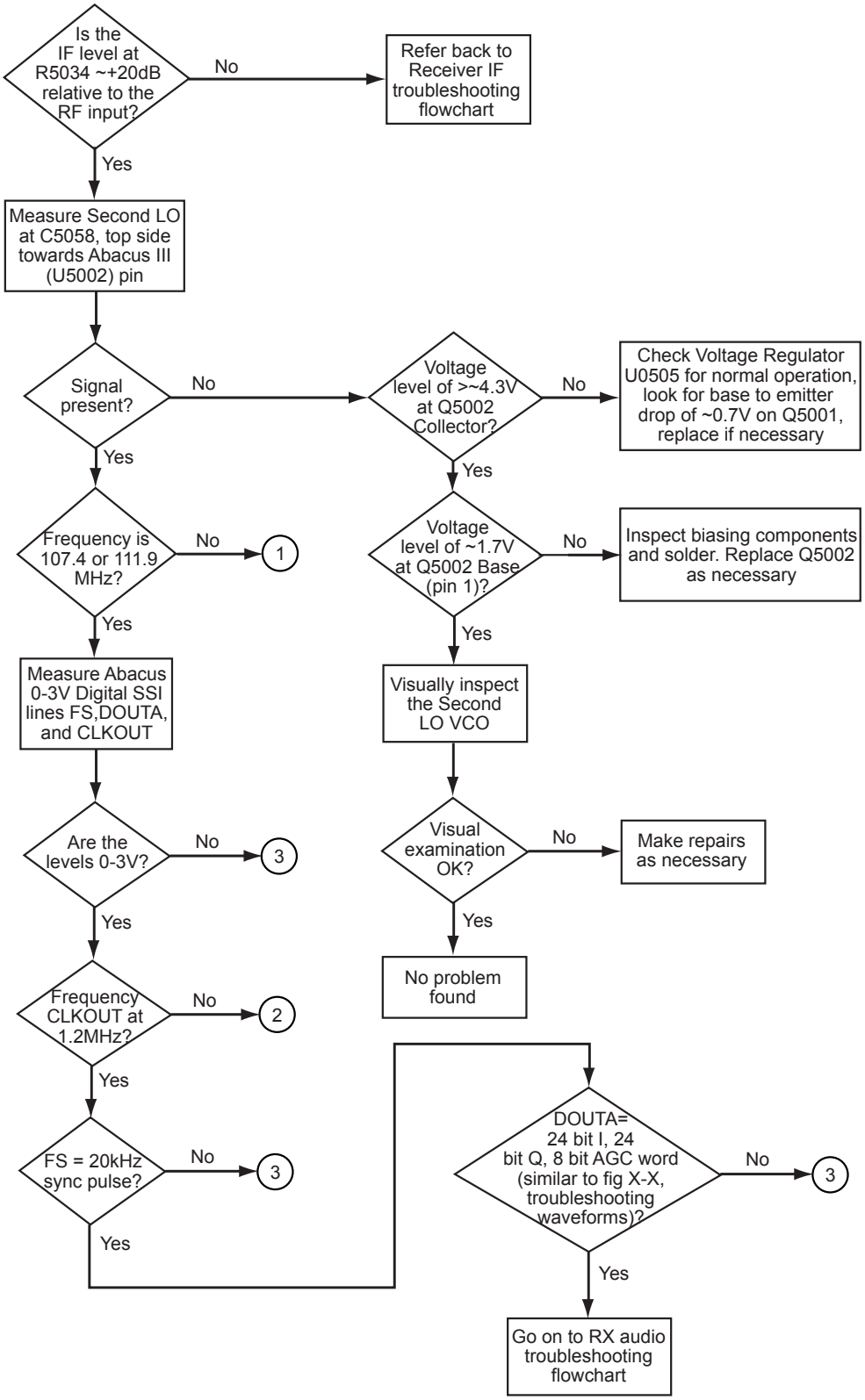
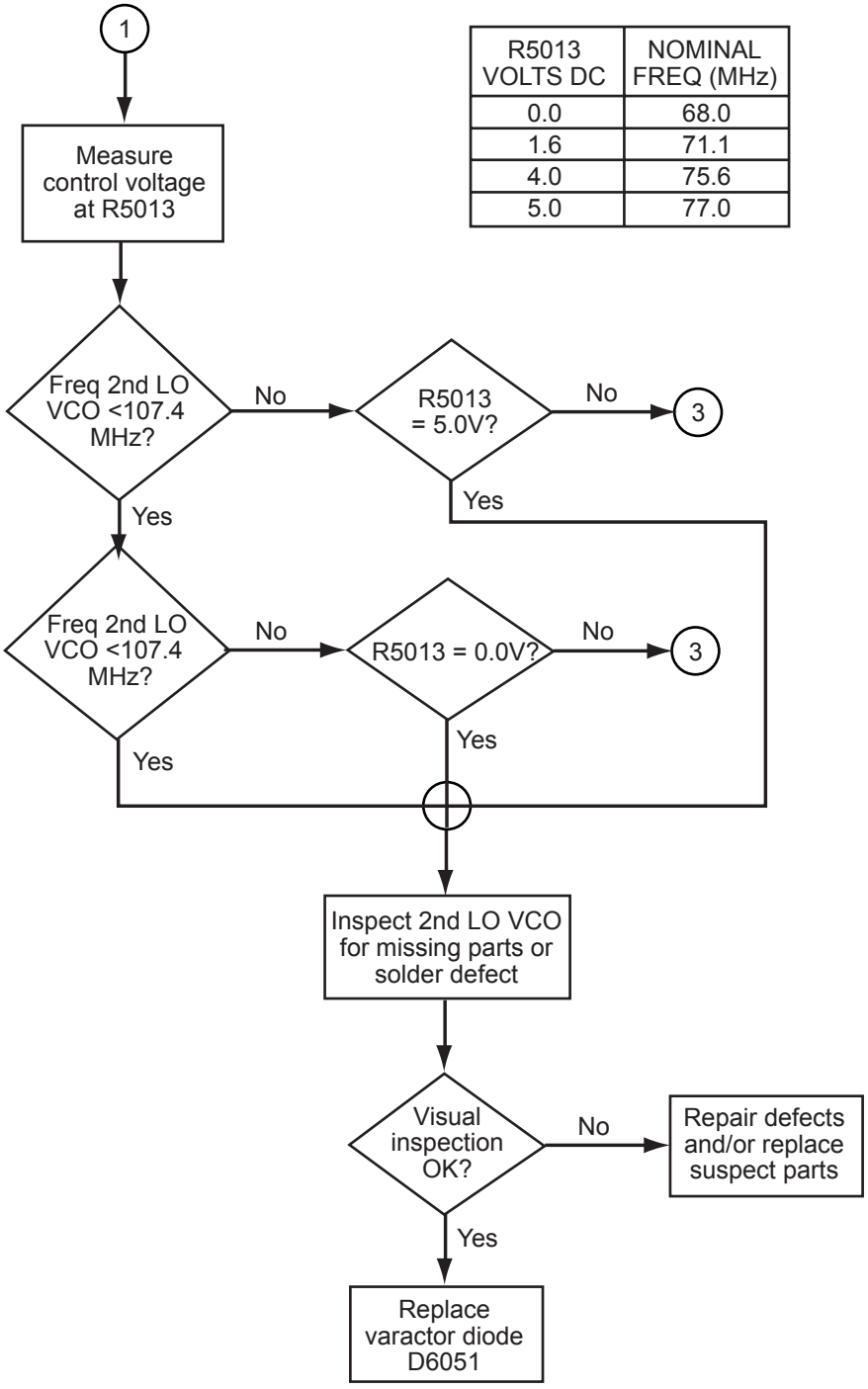



*Figure 5-20. RX Back-End—Poor SINAD or No Audio (380–470 MHz and 450–520 MHz)—Part 1 of 3*

## 5.6.19 RX Back-End—Poor SINAD or No Audio (380–470 MHz)—Part 2 of 3




| R5013 VOLTS DC | NOMINAL FREQ (MHz) |
|---|---|
| 0.0 | 68.0 |
| 1.6 | 71.1 |
| 4.0 | 75.6 |
| 5.0 | 77.0 |

*Figure 5-21. RX Back-End—Poor SINAD or No Audio (380–470 MHz and 450–520 MHz)—Part 2 of 3*

## 5.6.20 RX Back-End — Poor SINAD or No Audio (380–470 MHz)—Part 3 of 3

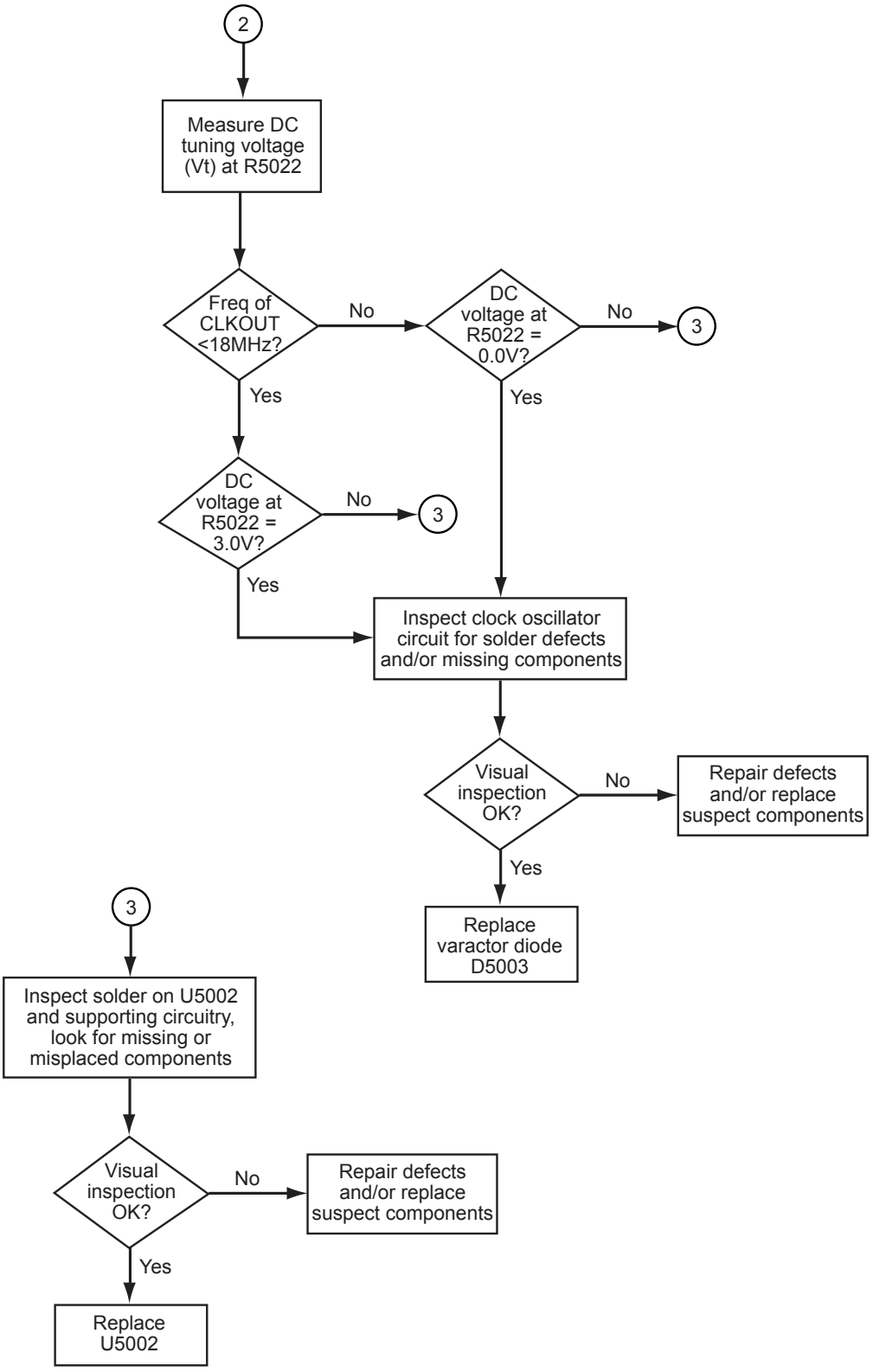



*Figure 5-22. RX Back-End—Poor SINAD or No Audio (380–470 MHz and 450–520 MHz)—Part 3 of 3*

## 5.6.21 Low or No RX Injection Signal (380–470 MHz)

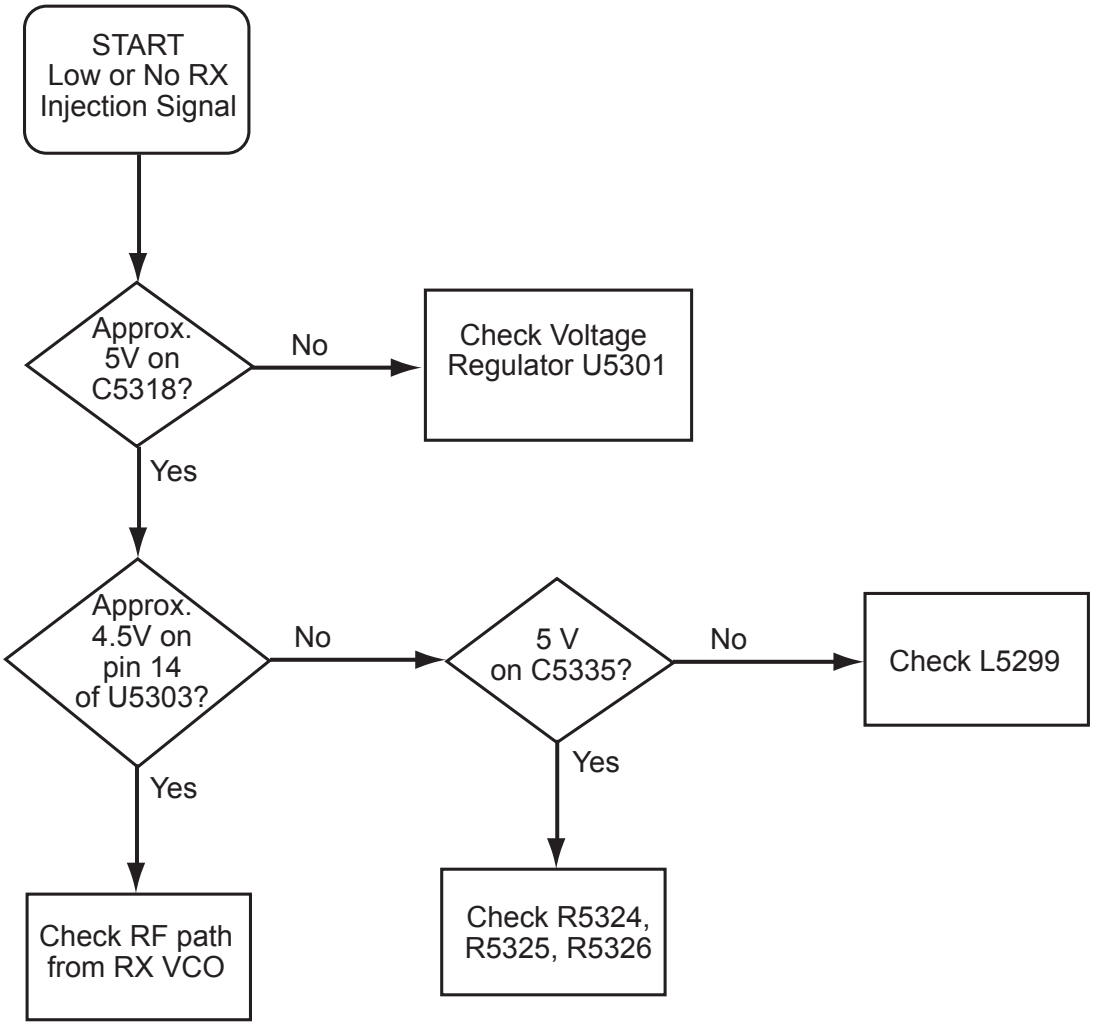



*Figure 5-23. Low or No RX Injection Signal (380–470 MHz)*

## 5.6.22 Low or No TX Injection Signal (380–470 MHz)

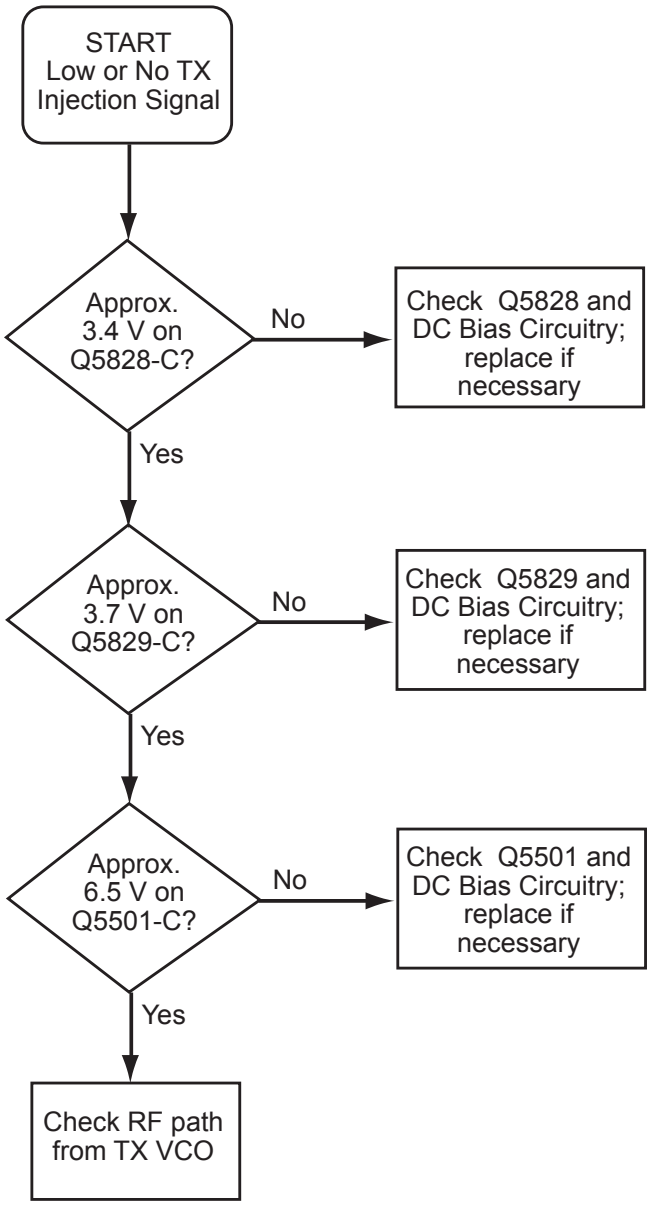



*Figure 5-24. Low or No TX Injection Signal (380–470 MHz)*

## 5.6.23 No TX Audio (380–470 MHz)

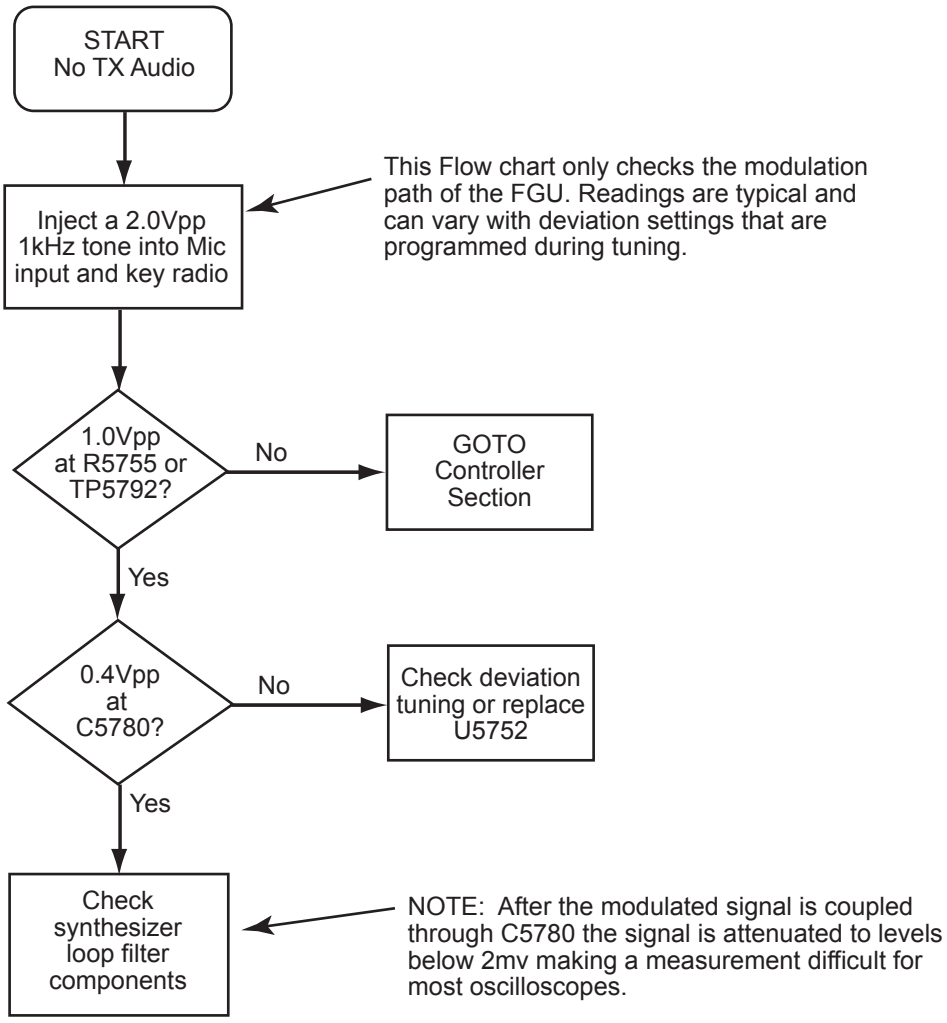



*Figure 5-25. No TX Audio (380–470 MHz)*

## 5.6.24 TX or RX VCO Unlock (Fail 001) (380–470 MHz)—Part 1 of 2

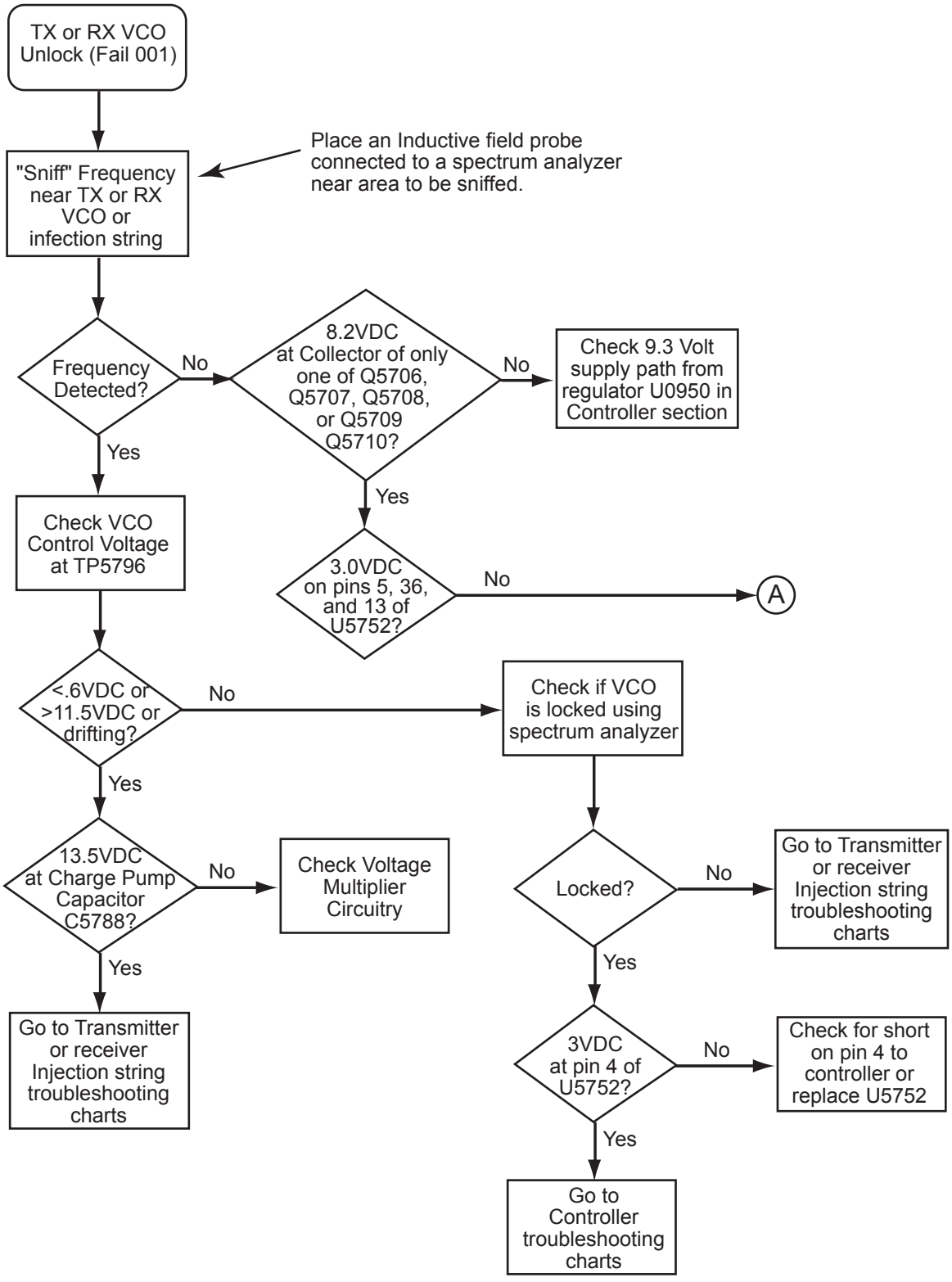



*Figure 5-26. TX or RX VCO Unlock (Fail 001) (380–470 MHz)—Part 1 of 2*

## 5.6.25 TX or RX VCO Unlock (Fail 001) (380–470 MHz)—Part 2 of 2

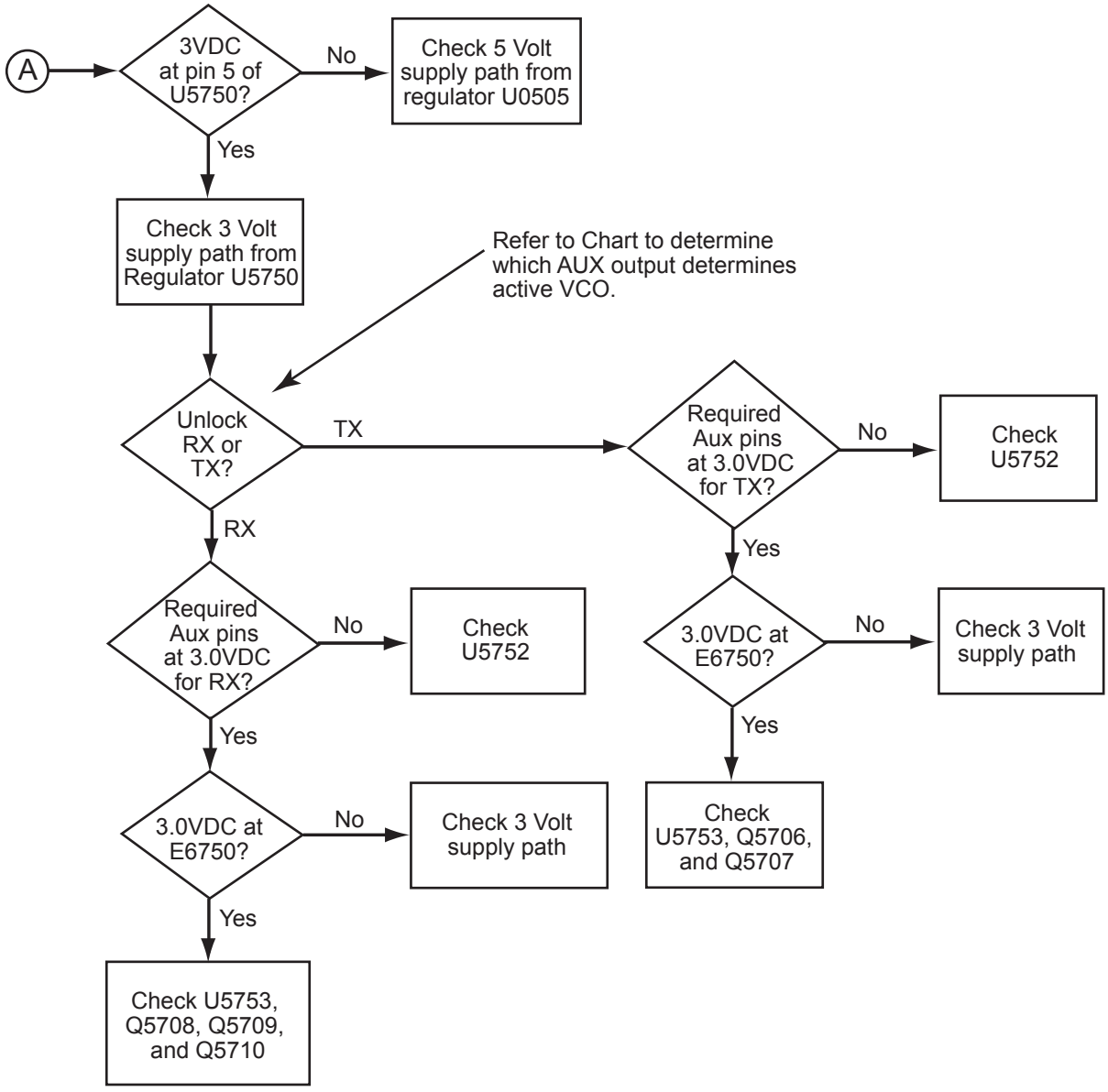



*Figure 5-27. TX or RX VCO Unlock (Fail 001) (380–470 MHz)—Part 2 of 2*

## 5.6.26 RF Power Amplifier (RFPA)—No or Low TX Power Output (380–470 MHz)—Part 1 of 5

**NOTE:** For each flowchart step in which reference is made to a note, be sure to refer to that specific note (located on Figure 5-15 of this flowchart) for guidance in performing the actual troubleshooting procedure. Also, RFPA DC voltages are shown in Table 5-5 on page 5-39.

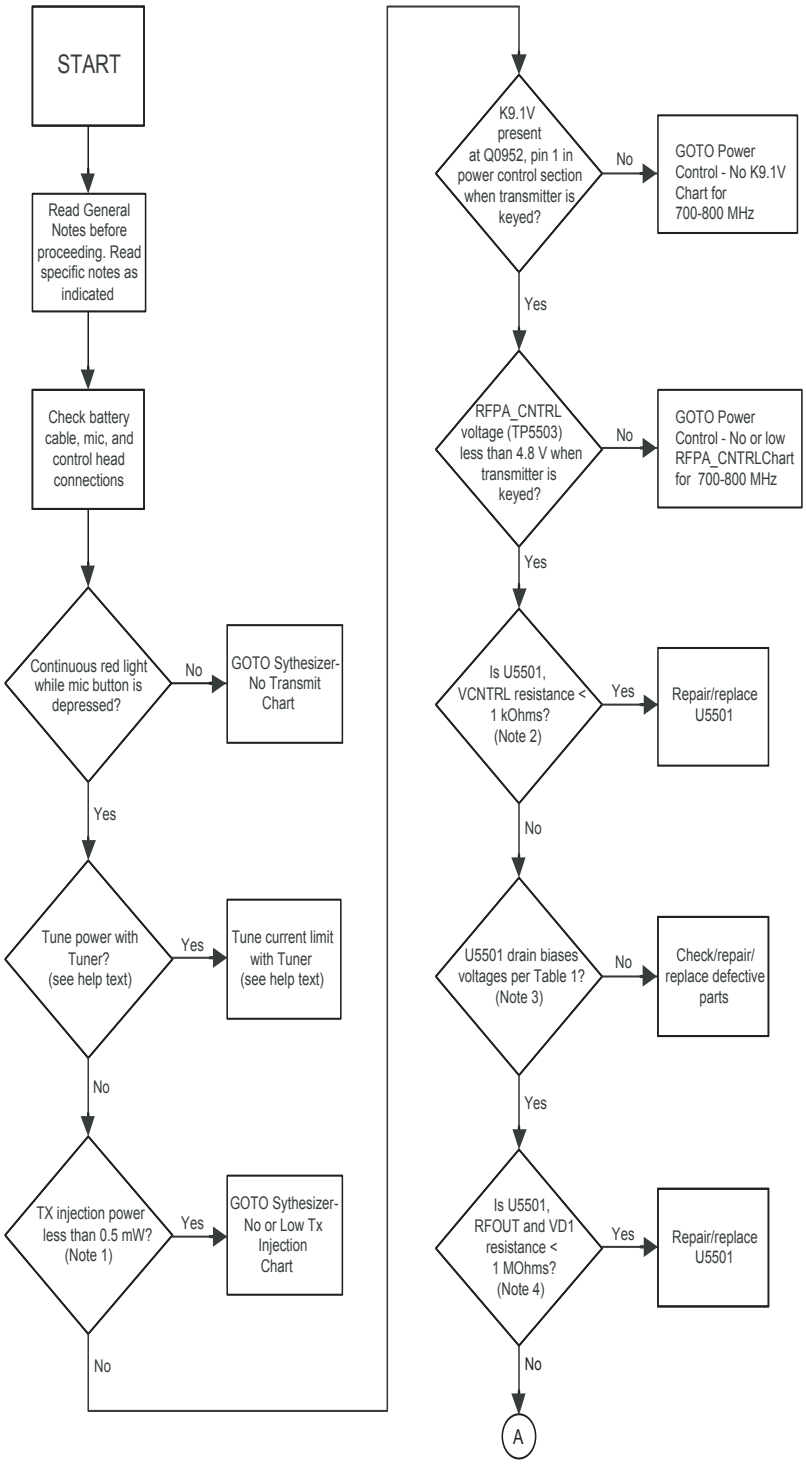



*Figure 5-28. RF Power Amplifier (RFPA)—No or Low TX Power Output (380–470 MHz)—Part 1 of 5*

## 5.6.27 RF Power Amplifier (RFPA)—No or Low TX Power Output (380–470 MHz)—Part 2 of 5

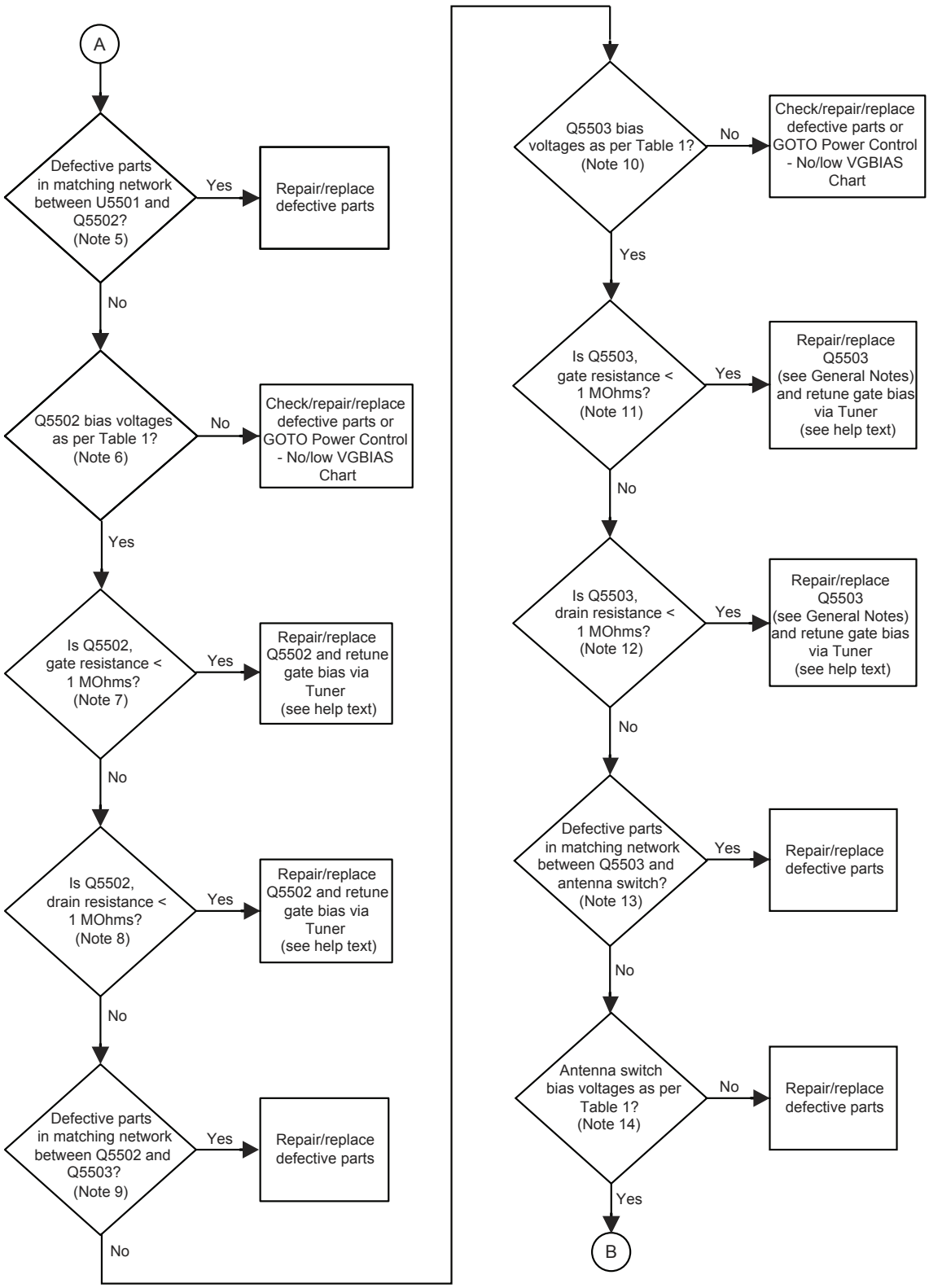



*Figure 5-29. RF Power Amplifier (RFPA)—No or Low TX Power Output (380–470 MHz)—Part 2 of 5*

## 5.6.28 RF Power Amplifier (RFPA)—No or Low TX Power Output (380–470 MHz)—Part 3 of 5

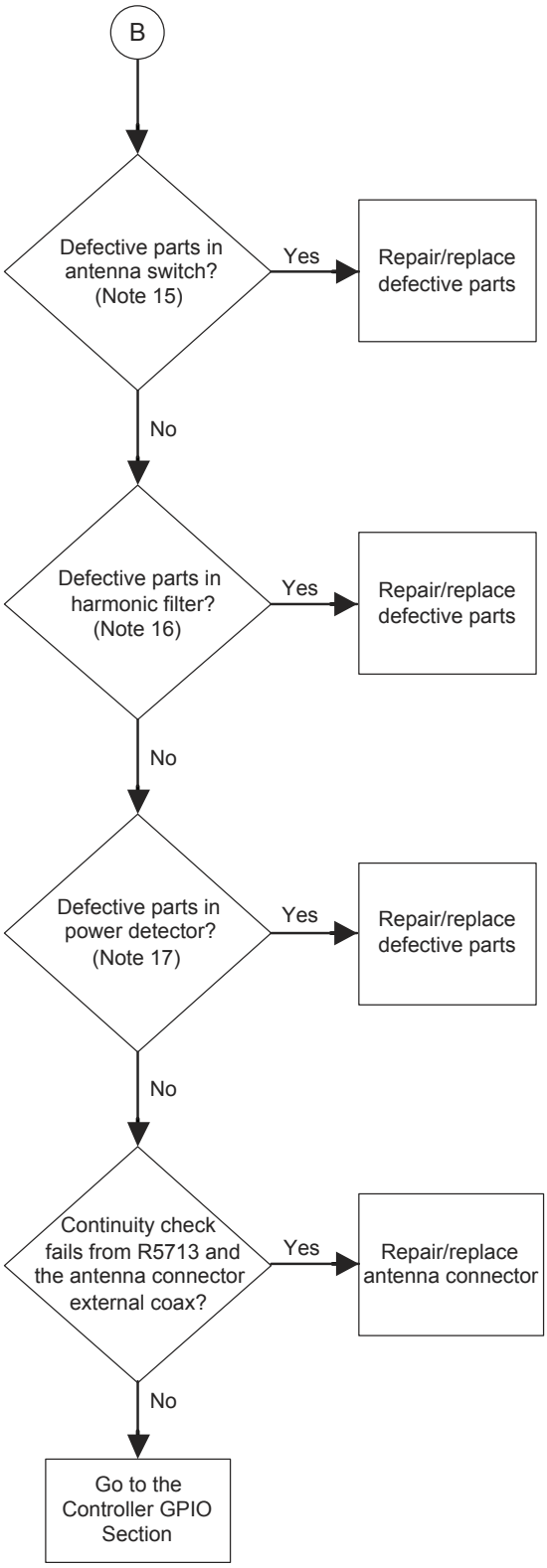



*Figure 5-30. RF Power Amplifier (RFPA)—No or Low TX Power Output (380–470 MHz)—Part 3 of 5*

## 5.6.29 RF Power Amplifier (RFPA)—No or Low TX Power Output (380–470 MHz)—Part 4 of 5

**Specific Notes:**

1. Remove C5508 and solder the center conductor of a small 50-ohm, coaxial cable to TP5502. Solder ground to the gold shield track adjacent to TP5502. Attach an RF milliwatt meter, key the transmitter, and measure TX_INJ power. Then, remove the coaxial cable and replace C5508. Remove the solder added to shield track.
2. Remove R0977 in the power control section, and measure the resistance between VCNTRL (TP5503) and ground. Replace R0977.
3. If U5501, VD1, is incorrect, inspect the bias feed circuitry (L5502 and C5505) and interstage match components (L5503, C5509, and C5507). If U5501, RFOUT, is incorrect, inspect the bias feed circuitry (L5505 and C5517).
4. Remove L5502 and measure the resistance between VD1 (U5501 pin 14) and ground. Replace L5502. Remove L5505 and measure the resistance between RFOUT (U5501 pin 6) and ground. Replace L5505.
5. Inspect C5566, C5516, C5518, and R5511-15.
6. If the Q5502 gate bias is incorrect, inspect the bias feed circuitry (R5516, L5525, C5556, and R5527). If the bias feed circuitry is functional, then go to the Power Control—No or low VGBIAS flowchart. If the Q5502 drain bias is incorrect, inspect the bias feed circuitry (L5508, C5526-27, R5517, E5501, and R5574). Check U5570, Q5770, and associated circutry.
7. Remove R5516 and measure the resistance between Q5502 gate and ground. Replace R5516.
8. Remove L5508 and measure the resistance between Q5502 drain and ground. Replace L5508.
9. Inspect C5559-60, C5535, C5538, R5530, R5533-34, and R5536.
10. If the Q5503 pin 7 gate bias is incorrect, inspect the bias feed circuitry (R5520, C5539, C5557, and R5525). If the gate bias feed circuitry is functional, then go to the Power Control—No or low VGBIAS flowchart. If the Q5503 pin 6 gate bias is incorrect, inspect the bias feed circuitry (R5521, C5540, C5558, and R5526). If the bias feed circuitry is functional, then go to the Power Control—No or low VGBIAS flowchart. If the Q5503 pins 2 and 3 common drain bias is incorrect, inspect the bias feed circuitry (L5510, C5549-50, R5522-23, and E5502).
11. Remove R5520 and measure the resistance between Q5503 pin 7 gate and ground. Replace R5520. Remove R5521 and measure the resistance between Q5503 pin 6 gate and ground. Replace R5521.
12. Remove L5510 and measure the resistance between Q5503 pins 2 and 3 drain and ground. Replace L5510.
13. Inspect R5535, C5542-43, C5545-48, and C5551-53.
14. If the antenna switch bias voltages are incorrect, inspect R5524, L5701-4, and R5701, as well as perform diode checks on D5701-3.
15. Inspect the remaining antenna switch parts (C5701-10).
16. Inspect L5706-8, L5712-13, C5708, C5711-14, C5719-20, R5713, and R5718.
17. Inspect D5704, R5707-8, R5702-4, and C5715-16.

## 5.6.30 RF Power Amplifier (RFPA)—No or Low TX Power Output (380–470 MHz)—Part 5 of 5

*Table 5-5. RFPA DC Voltages*

| Description | Location | Voltage (Vdc) (380–470 MHz) |
|---|---|---|
| A+ = 13.6 Vdc | | |
| U5501, VD1 | U5501 pin 14 | 9.0–9.3 |
| U5501, RFOUT | U5501 pins 6 and 7 | 9.0–9.3 |
| Q5502 Gate Bias | R5516/C5525 node | 1.8–2.0 |
| Q5502 Drain Bias | L5508/R5517 Node | 9.0–9.3 |
| Q5503 Gate Bias 1 | R5520/C5539 node | 2.0–2.2 |
| Q5503 Gate Bias 2 | R5521/C5540 node | 2.0–2.2 |
| Q5503 Drain Bias | L5510/R5523 Node | 13.0–13.6 |
| Antenna Switch Bias Voltage 1 | L5701/C5702 node | ~4.7 |
| Antenna Switch Bias Voltage 2 | D5701/D5702 node | ~4.0 |
| Antenna Switch Bias Voltage 3 | D5703/R5701 node | ~3.3 |

## 5.6.31 RFPA Power Control—No VGBIAS (380–470 MHz)

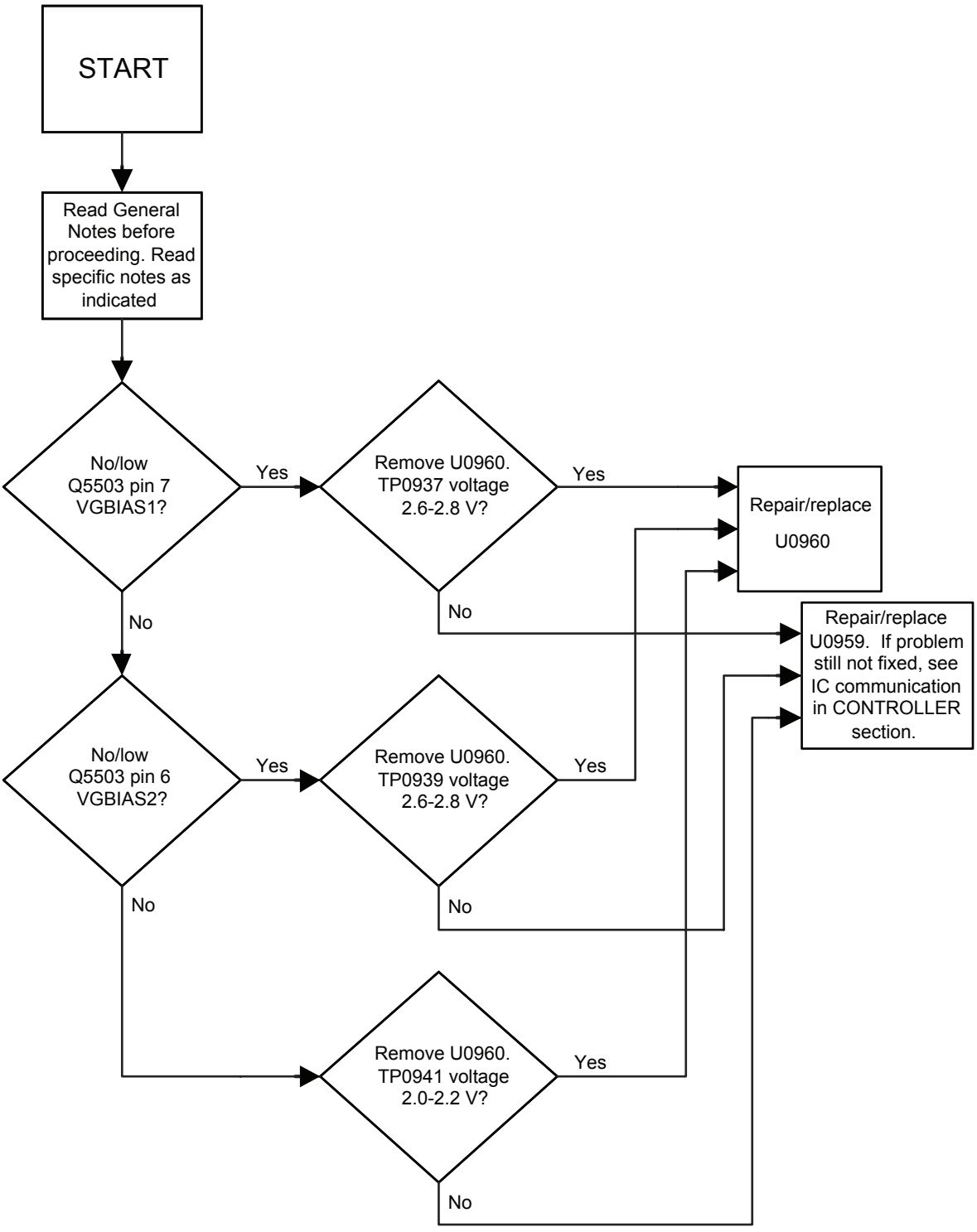



*Figure 5-31. RFPA Power Control—No VGBIAS (380–470 MHz and 450–520 MHz)*

# Chapter 6 Troubleshooting Waveforms

## 6.1 Introduction

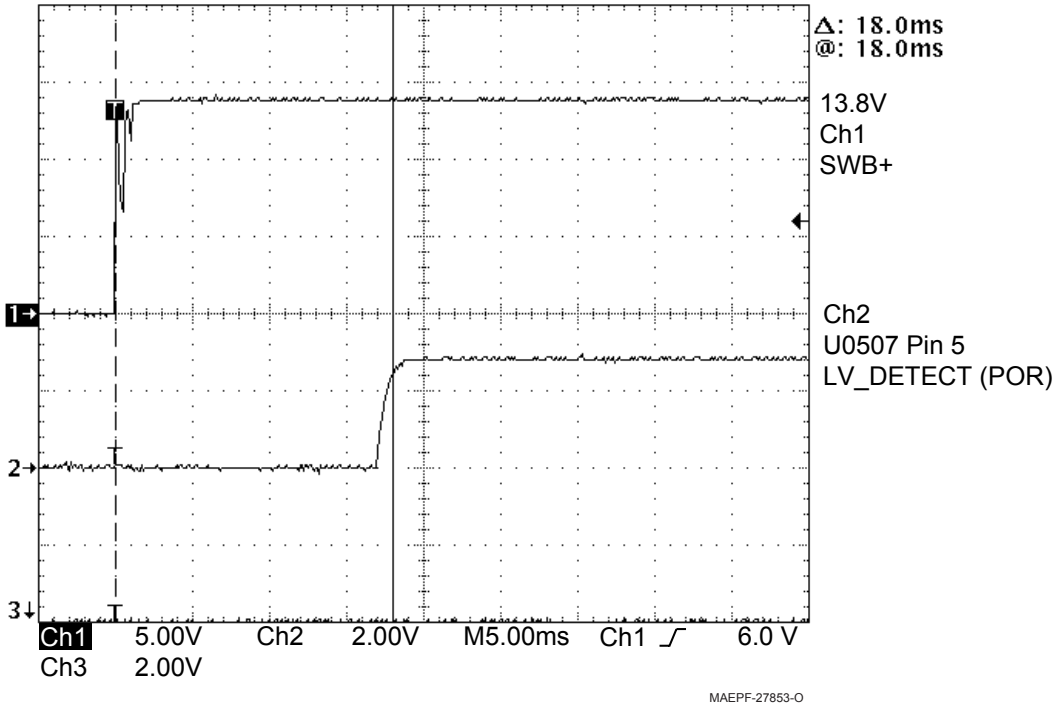
This chapter contains images of waveforms that might be useful in verifying operation of certain parts of the circuitry. These waveforms are for reference only; the actual data depicted will vary depending upon the operating conditions.

*Table 6-1. List of Troubleshooting Waveforms*

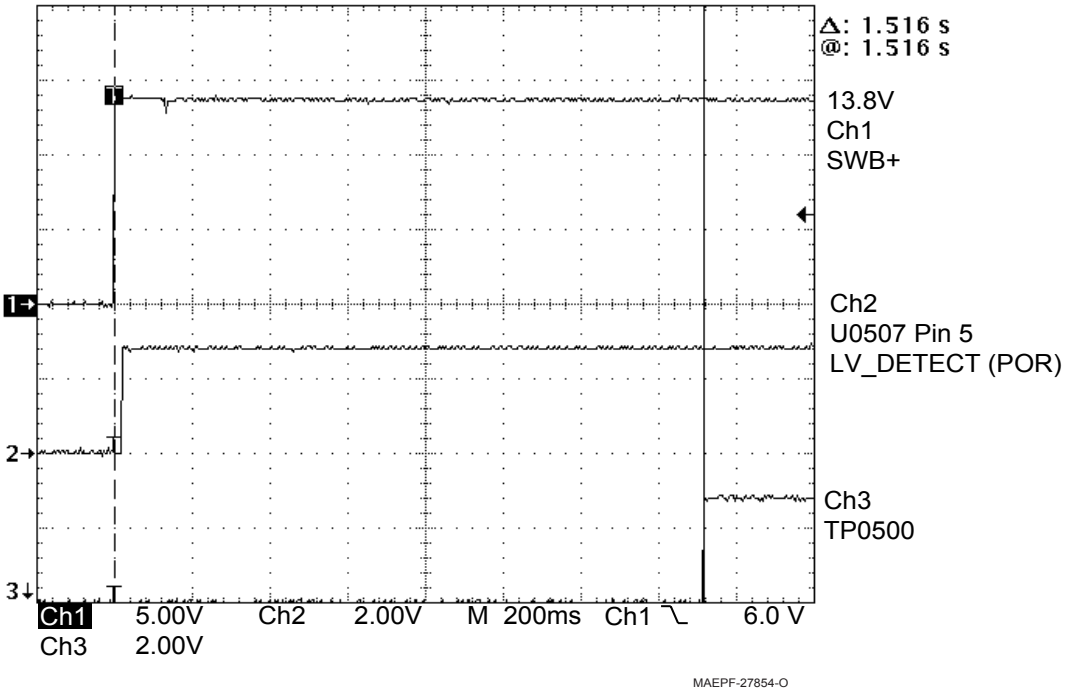

| Waveform | Page |
|---|---|
| Power-On Reset Timing | 6-2 |
| Power-On to Soft Turn-On Timing | 6-2 |
| Power-Down Reset | 6-3 |
| 16.8 MHz Clock Waveform | 6-3 |
| 32 kHz Clock Waveform | 6-4 |
| DSP SSI Port RX Mode | 6-4 |
| DSP SSI Port TX Mode CSQ | 6-5 |
| SPI Bus Waveform | 6-5 |
| SB9600 Waveform | 6-6 |
| SB9600 BUS+ and BUS- Waveforms | 6-6 |
| SB9600 BUS+ and RESET Waveforms | 6-7 |
| SB9600 BUSY and BUS- Waveforms | 6-7 |
| RS-232 RX Waveforms | 6-8 |
| RS-232 TX Waveforms | 6-8 |
| RS-232 RX/TX Waveforms | 6-9 |
| USB Waveforms | 6-9 |
| Serial Audio Port Waveforms | 6-10 |
| Secure Interface Waveforms | 6-10 |
| 8 kHz Frame Sync Waveform | 6-11 |
| RX Audio Waveforms | 6-11 |
| TX Audio Waveforms | 6-12 |
| TX and RX 1 kHz Audio Path Sinewave and Chart | 6-12 |

# 6.2 PM1500 Waveforms

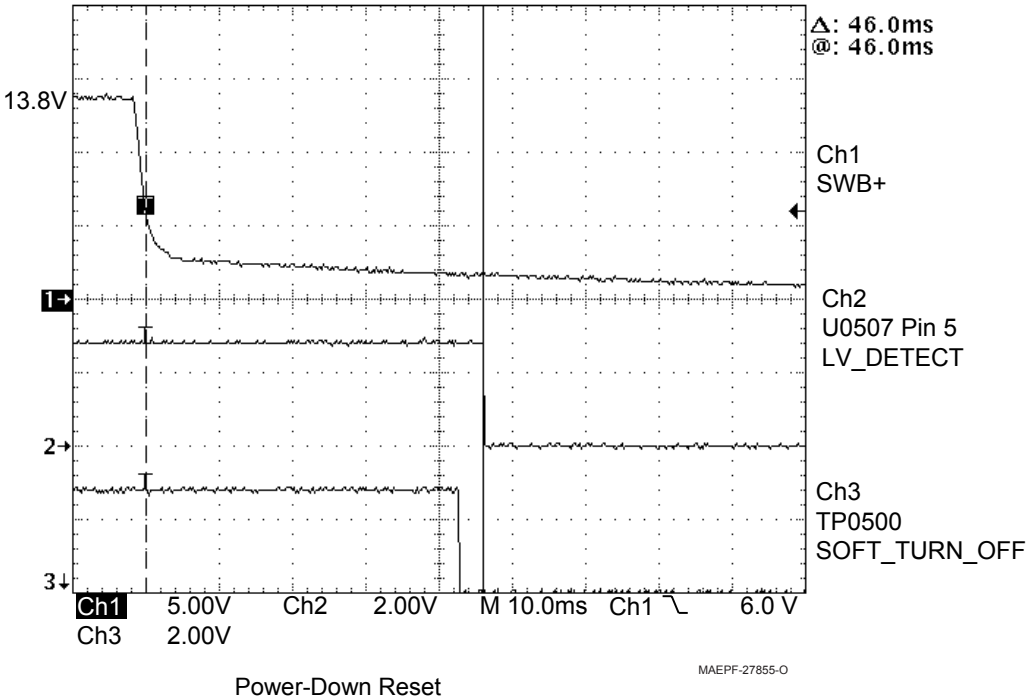
## 6.2.1 Power-On Reset Timing




## 6.2.2 Power-On to Soft Turn-On Timing

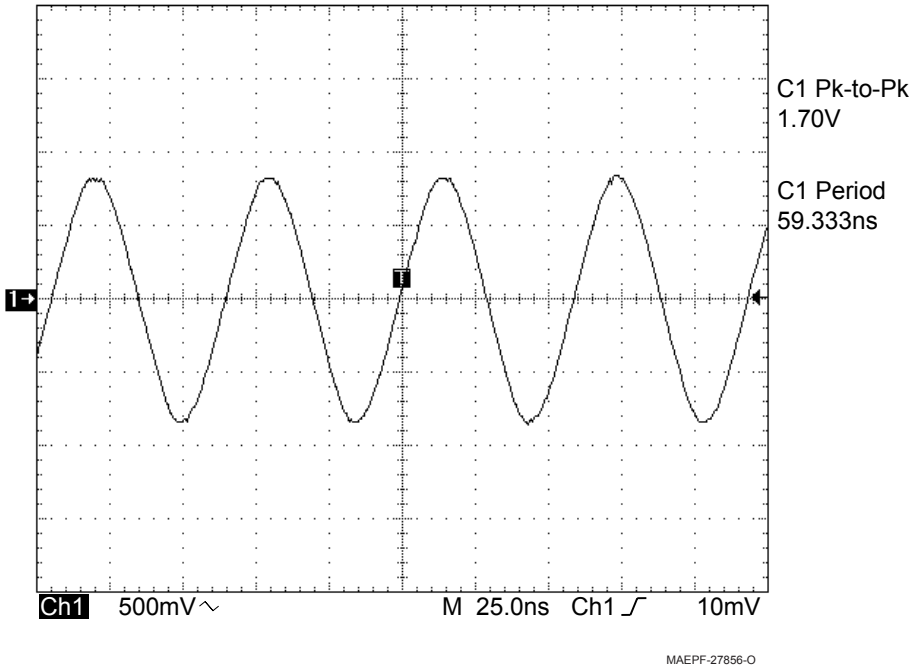


## 6.2.3 Power-Down Reset



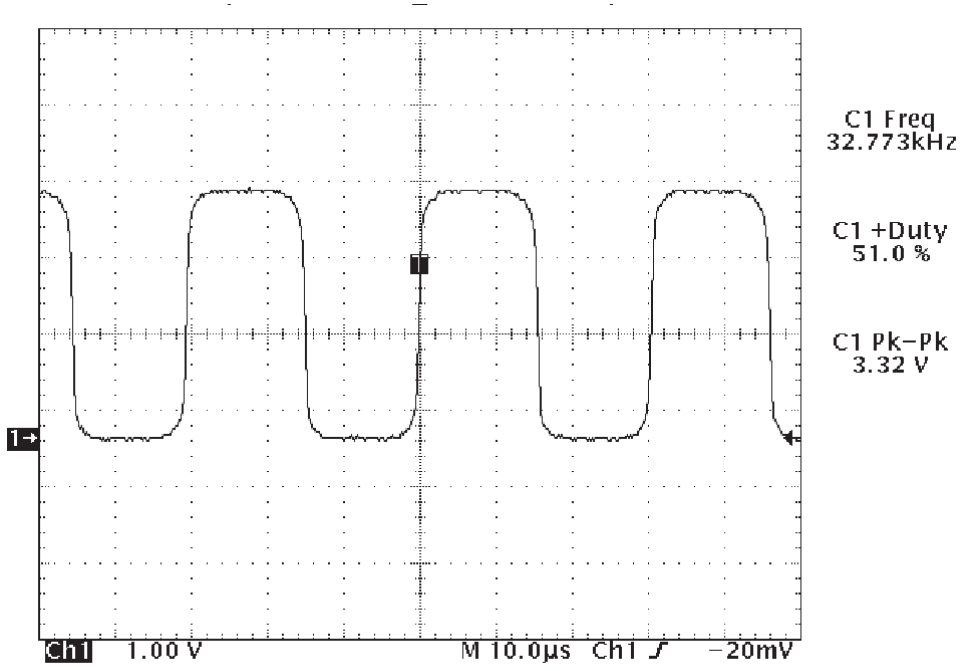

Power-Down Reset
Trace 1 — SWB+
Trace 2 — LV_DETECT — U0507 Pin 5
Trace 3 — SOFT_TURN_OFF — TP0500

## 6.2.4 16.8 MHz Clock Waveform




Trace 1 — U0903 Pin 3 — 16.8 MHz Clock

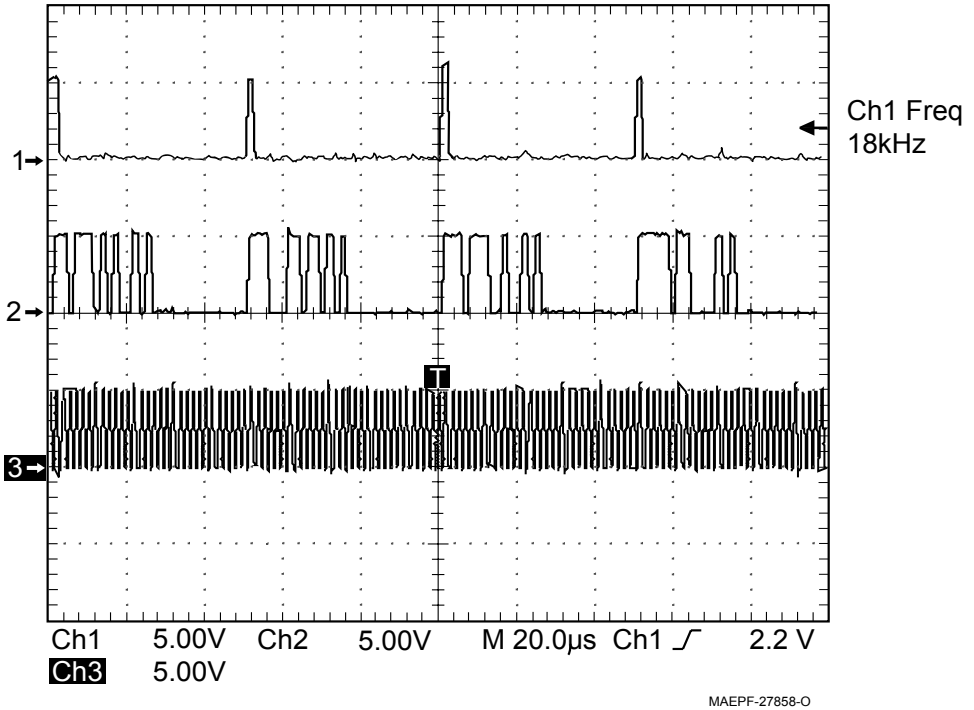
### 6.2.5 32 kHz Clock Waveform




Trace 1 — R428 — 32 kHz Clock

MAEPF-27857-O

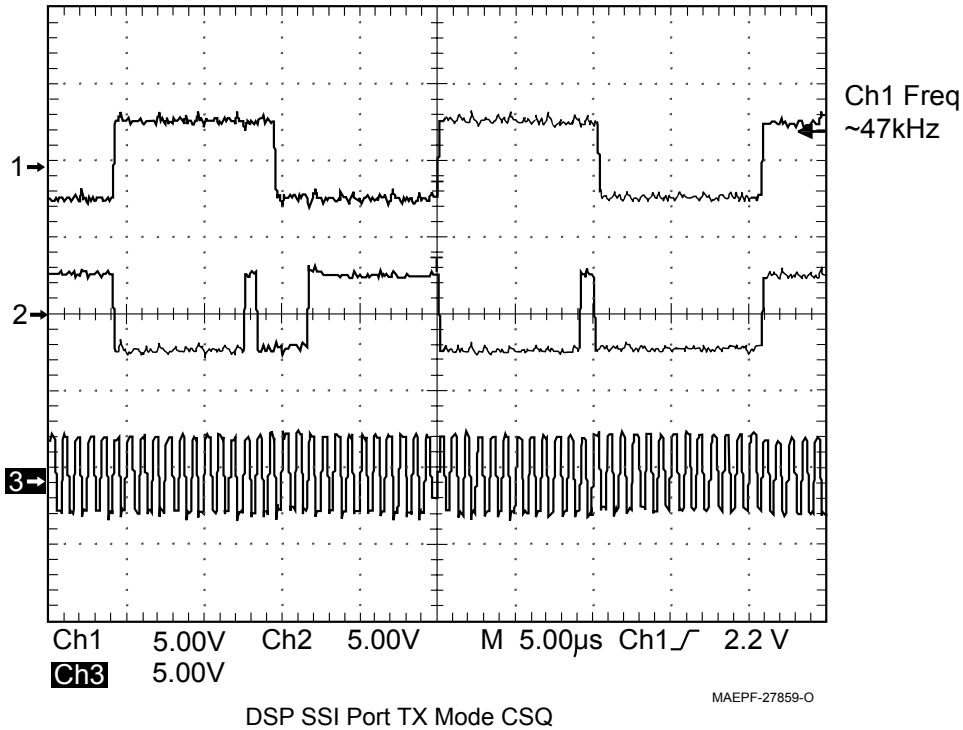
### 6.2.6 DSP SSI Port RX Mode




MAEPF-27858-O

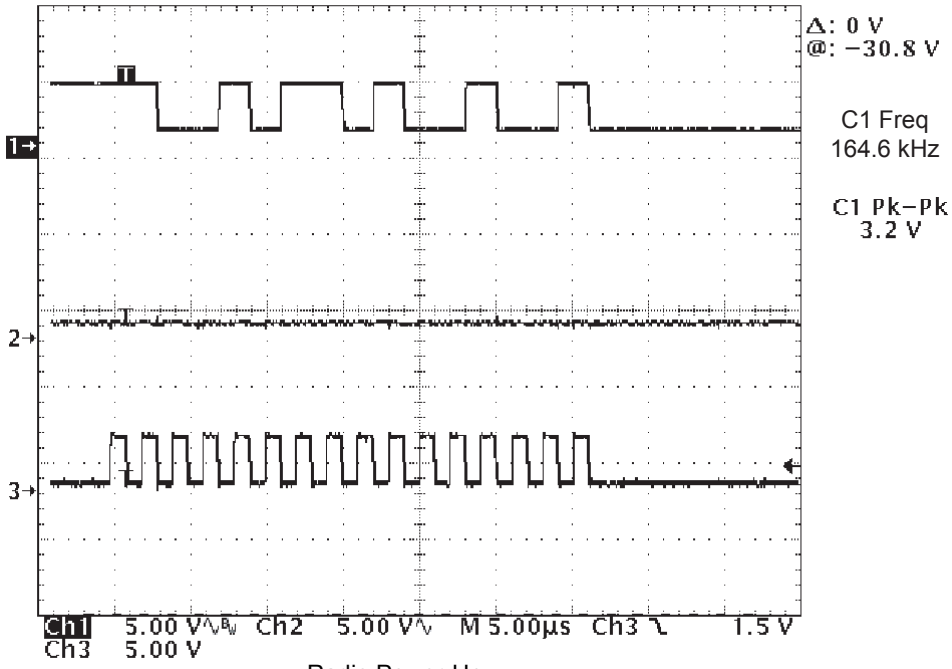
DSP SSI Port RX Mode CSQ
Trace 1 — ABACUS_SSI_FSYNC
Trace 2 — ABACUS_SSI_RXD
Trace 3 — ABACUS_SSI_CLK (1.2 MHz)

## 6.2.7 DSP SSI Port TX Mode CSQ



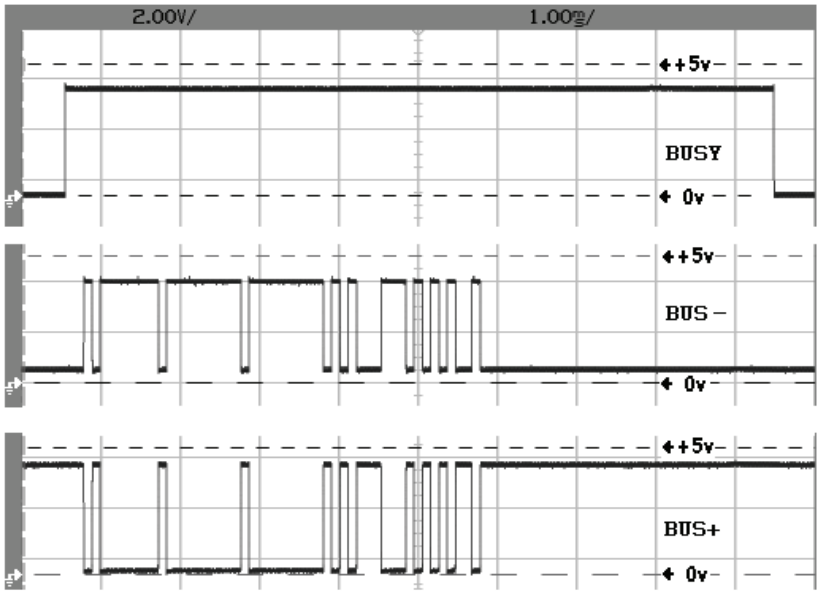

DSP SSI Port TX Mode CSQ
Trace 1 — DAC_SSI_FSYNC
Trace 2 — DAC_SSI_TXD
Trace 3 — DAC_SSI_CLK (2.4 MHz)

## 6.2.8 SPI Bus Waveform



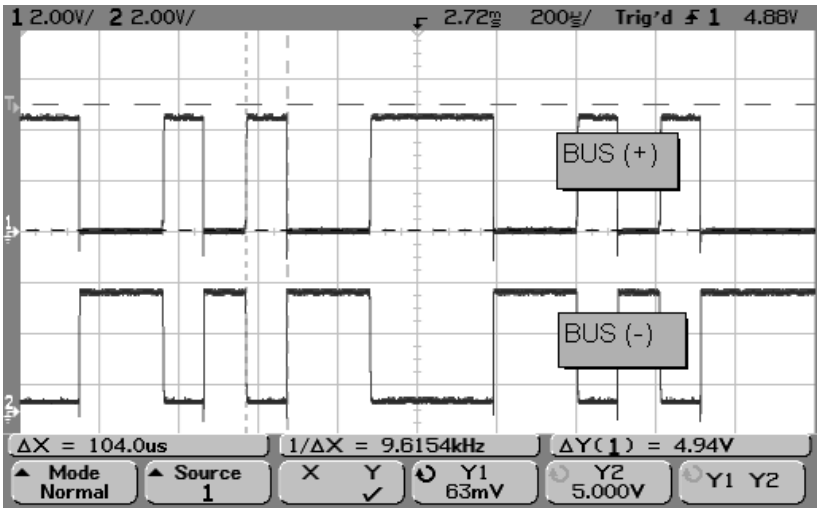

Radio Power-Up
Trace 1 — Data
Trace 2 — Chip Select
Trace 3 — Clock

### 6.2.9 SB9600 Waveforms



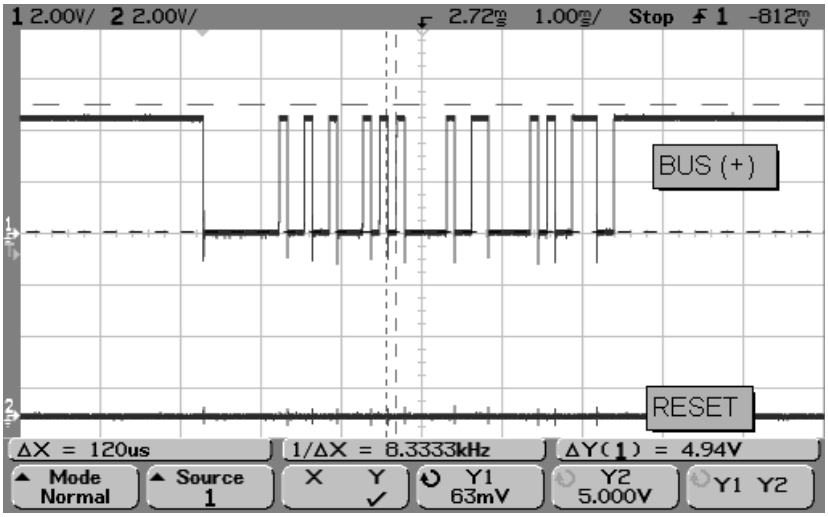

MAEPF-27781-O

### 6.2.10 SB9600 BUS+ and BUS- Waveforms



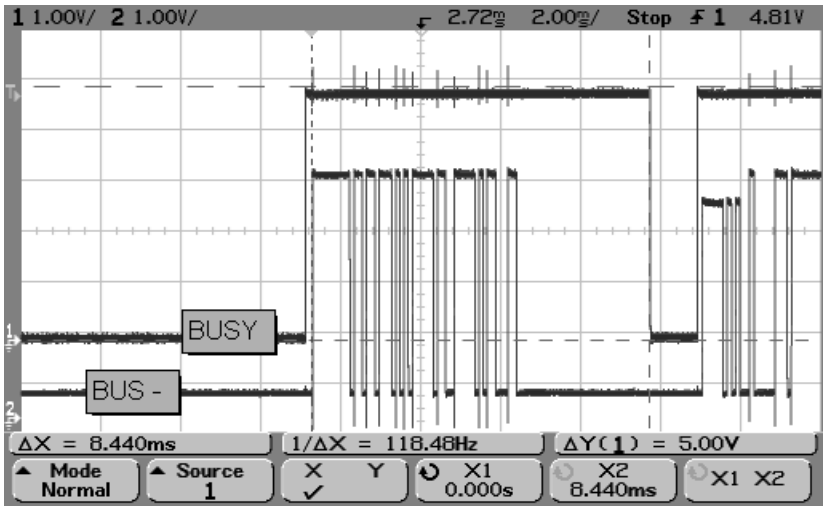

MAEPF-27871-O

## 6.2.11 SB9600 BUS+ and RESET Waveforms



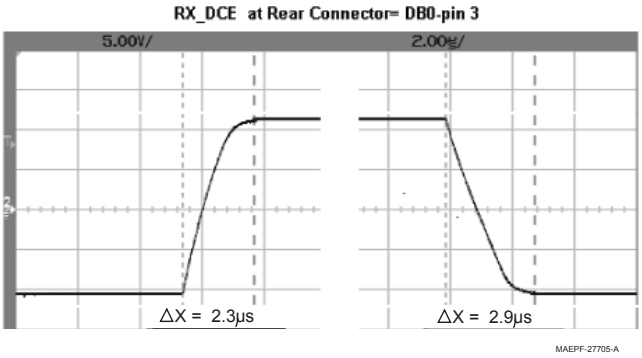

MAEPF-27872-O

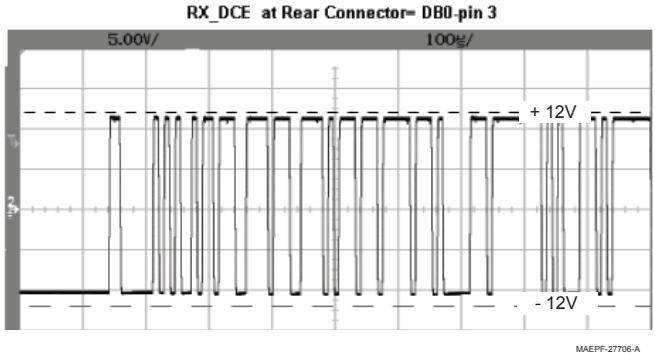
## 6.2.12 SB9600 BUSY and BUS- Waveforms



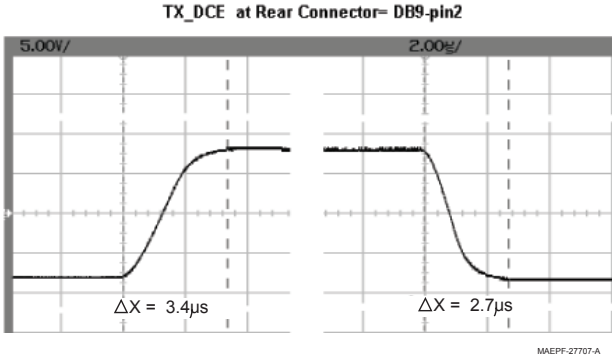

MAEPF-27873-O

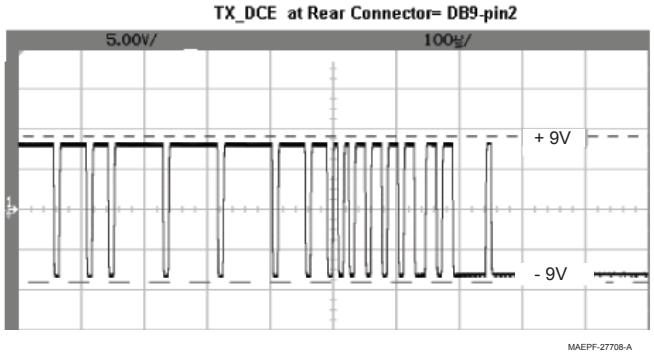
## 6.2.13 RS-232 RX Waveforms



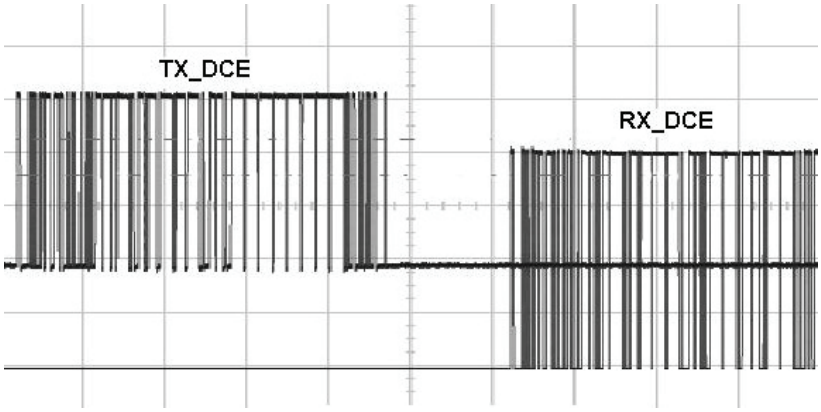




## 6.2.14 RS-232 TX Waveforms

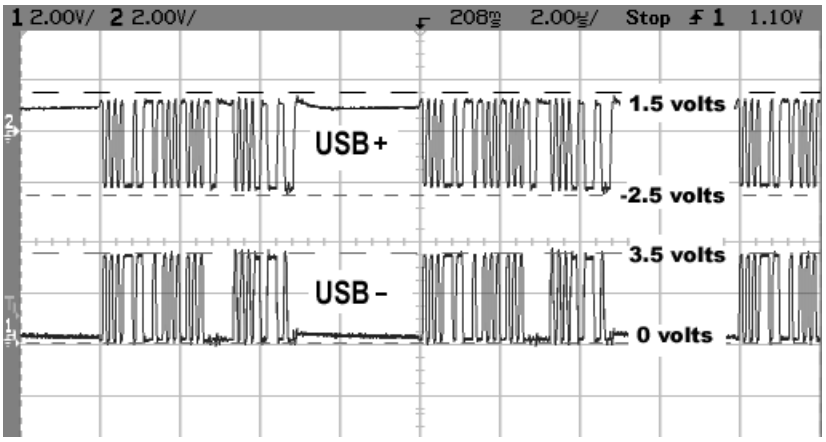


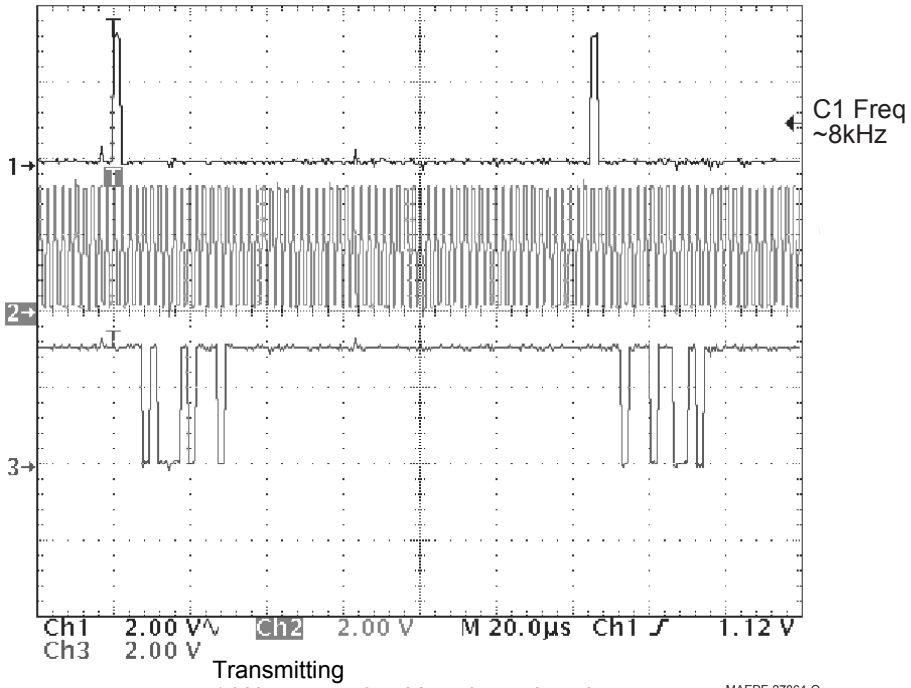
## 6.2.15 RS-232 RX/TX Waveforms




## 6.2.16 USB Waveforms

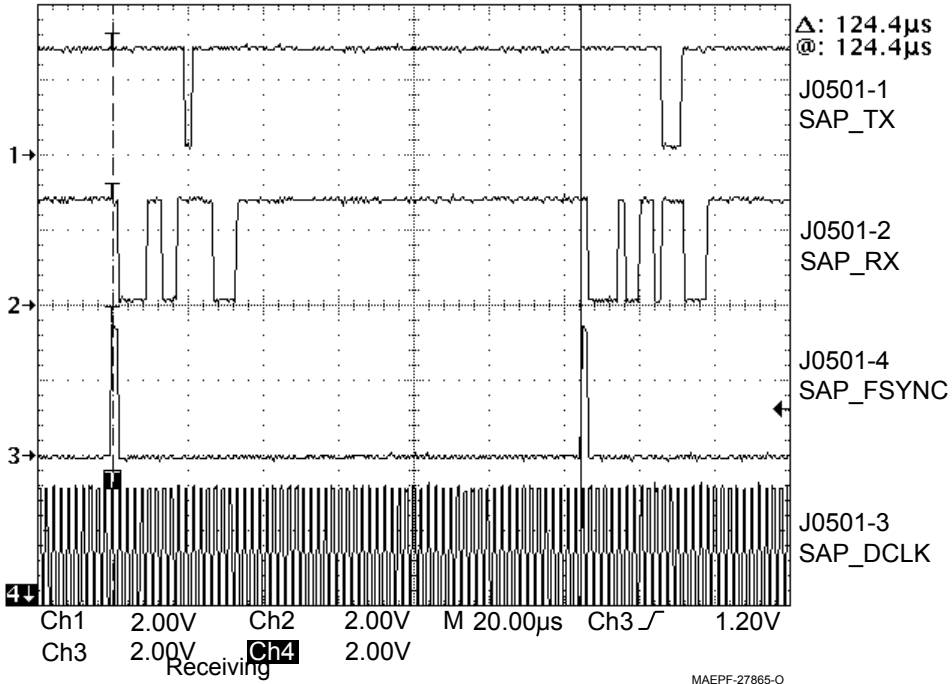


## 6.2.17 Serial Audio Port Waveforms



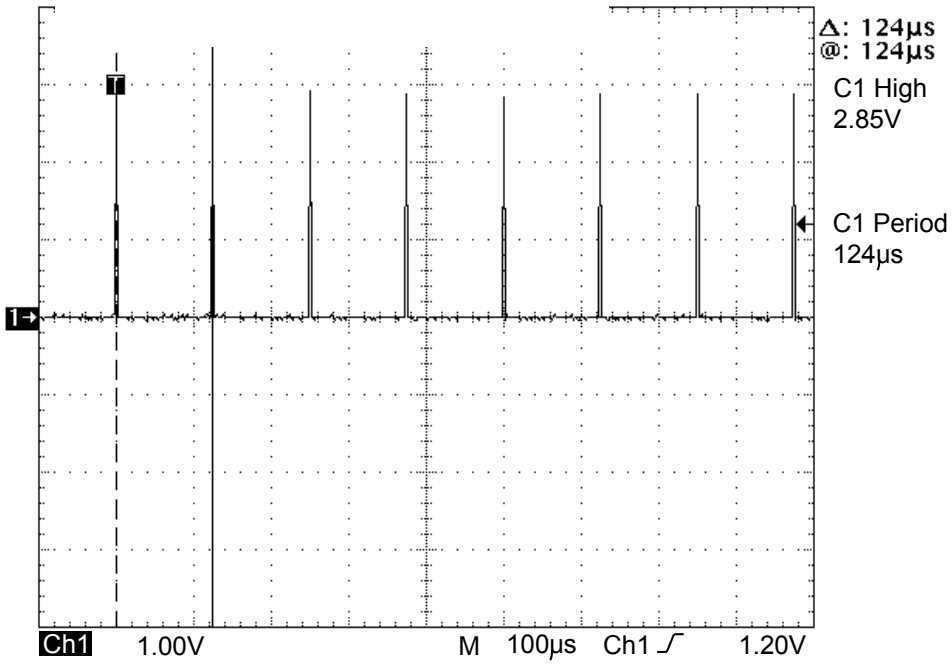

Transmitting
1 kHz tone at 85mVrms into microphone
Trace 1 — Frame Sync — SAP_FSYNC
Trace 2 — Clock — SAP_DCLK
Trace 3 — Data — SAP_TX

## 6.2.18 Secure Interface Waveforms




Receiving
1 kHz tone at 3 kHz Dev, -47dBm Secure Mode
Trace 1 — J0501 — 1 - SAP TX
Trace 2 — J0501 — 2 - SAP RX
Trace 3 — J0501 — 3 - SAP DCLK

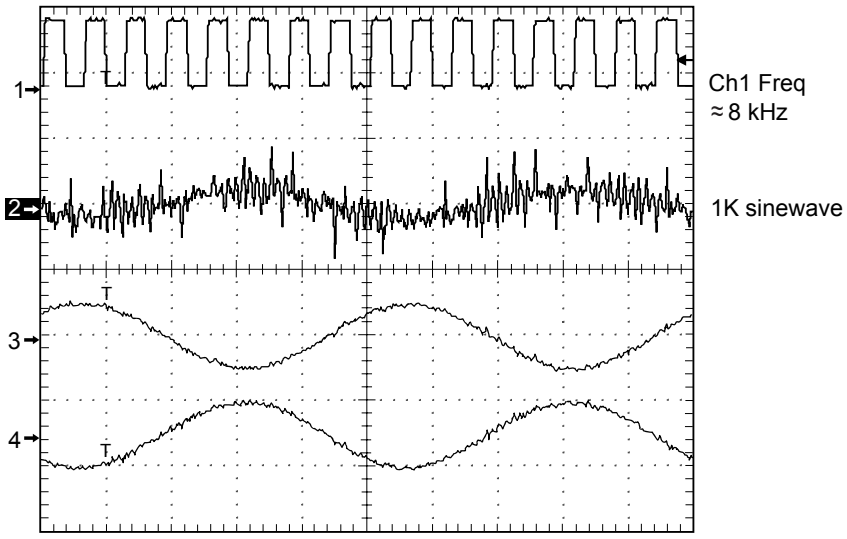
## 6.2.19 8 kHz Frame Sync Waveform




MAEPF-27866-O

Receiving
1 kHz tone at 3 kHz Dev, -47dBm Secure Mode
Trace 1 — J0501 — 4

## 6.2.20 RX Audio Waveforms

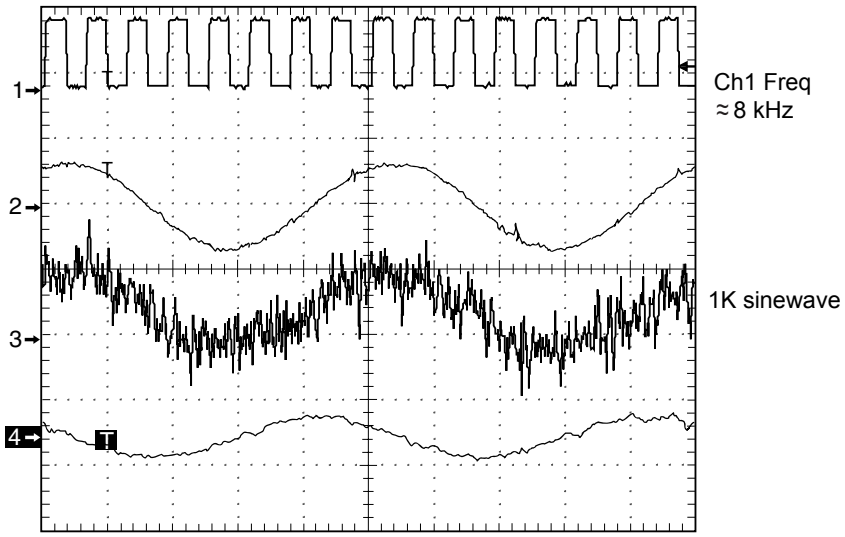



Ch2, Ch3, Ch4: See 1K sinewave chart

MAEPF-27867-O

Receiving
1 kHz tone @ 3 kHz deviation, -60 dBm. Volume set to rated audio.
Trace 1 — SAP_DCLK (8 kHz)
Trace 2 — TP0205
Trace 3 — SPKR_LOW out of U0204
Trace 4 — SPKR_HI out of U0204
Note 3: Actual level is dependent upon volume setting.

## 6.2.21 TX Audio Waveforms

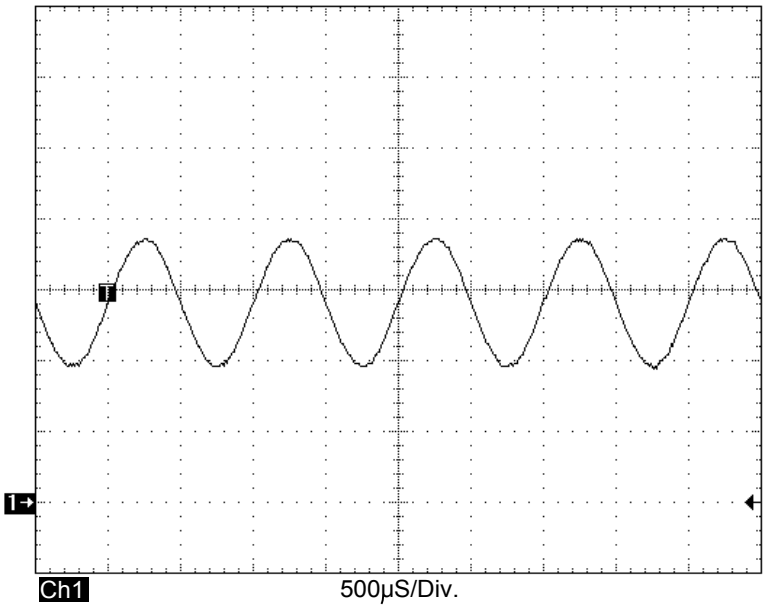



Ch2, Ch3, Ch4: See 1K sinewave chart

MAEPF-27868-O

Transmit Audio
1 kHz tone which provides 3 kHz deviation
Trace 1 — SAP_DCLK (8 kHz)
Trace 2 — MODIN R6782
Trace 3 — MIC TP0200
Trace 4 — TP0203
Note 3: Actual level is dependent upon volume setting.

## 6.2.22 TX and RX 1 kHz Audio Path Sinewave and Chart




**Refer to** Table 6-2 **for test point data**

MAEPF-27869-O

*Table 6-2. TX and RX Audio Path Test Points for 1 kHz Sine Wave (for all High Power)*

| | | Typical | O-Scope | Measured mV p-p | | Volts |
|---|---|---|---|---|---|---|
| **Test Point** | **Description** | **mV RMS** | **mV/div** | **LL [1]** | **UL [2]** | **DC Bias** |
| **TX Audio Path** | | | | | | |
| MIC_HI | 80 mV RMS input | 80 mV | 20 | 226 | 227 | 3 to 9 |
| TP0200 | MIC_PREAMP_IN | 80 mV | 20 | 220 | 227 | 2.5 |
| U0201-8 | 1st op amp out [3] | 0 mV | 10 | 0 | 10 | 2.5 |
| U0201-7 | 2nd op amp out | 80 mV | 10 | 210 | 227 | 2.5 |
| U0201-1 | 3rd op amp and filter out | 80 mV | 10 | 210 | 227 | 2.5 |
| U0201-14 | 4th op amp and filter out | 80 mV | 10 | 210 | 227 | 2.5 |
| TP0203 | CODEC op amp in | 36 mV | 10 | 85 | 117 | 1.42 |
| U0200-17 | Buffered CODEC in | 36 mV | 10 | 82 | 116 | 1.42 |
| C0904 | 5 CF Out | 150 mV | 50 | 400 | 700 | 1.42 |
| R6782 | MOD_IN at 3 kHz dev. [3] | 150 mV | 50 | 400 | 700 | 1.5 |
| **RX Audio Path [4]** | | | | | | |
| TP0204 | RX_FILT_AUDIO | 318 | 500 | 849 | 953 | 1.42 |
| TP0205 | RX_AUDIO_IN | 318 | 500 | 849 | 953 | 1.42 |
| TP0206 | AUDIO_PA_IN | 39 | 10 | 92 | 130 | 1/2 A+ |
| SPKR+ | NON INVERTED PA out | 7.74 Vbtl [5] | 2 V | 9.5 Vpp | 12.4 Vpp | 1/2 A+ |
| SPKR- | INVERTED PA out | 7.74 Vbtl [5] | 2 V | 9.5 Vpp | 12.4 Vpp | 1/2 A+ |

[1] LL = lower limit

[2] UL = upper limit

[3] Measurement depends on tuning parameters

[4] 1 kHz tone at 3 kHz deviation, -47 dBm

[5] “btl” = bridge to load

# Notes

# Chapter 7 Schematics, Component Location Diagrams, and Parts Lists

## 7.1 List of Schematics, Component Location Diagrams, and Parts Lists

The following table lists the schematics, component location diagrams, and parts lists contained in this chapter.

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*Table 7-1. List of Schematics and Parts Lists (Continued)*


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## 7.2 PMLN 4864A Main Board

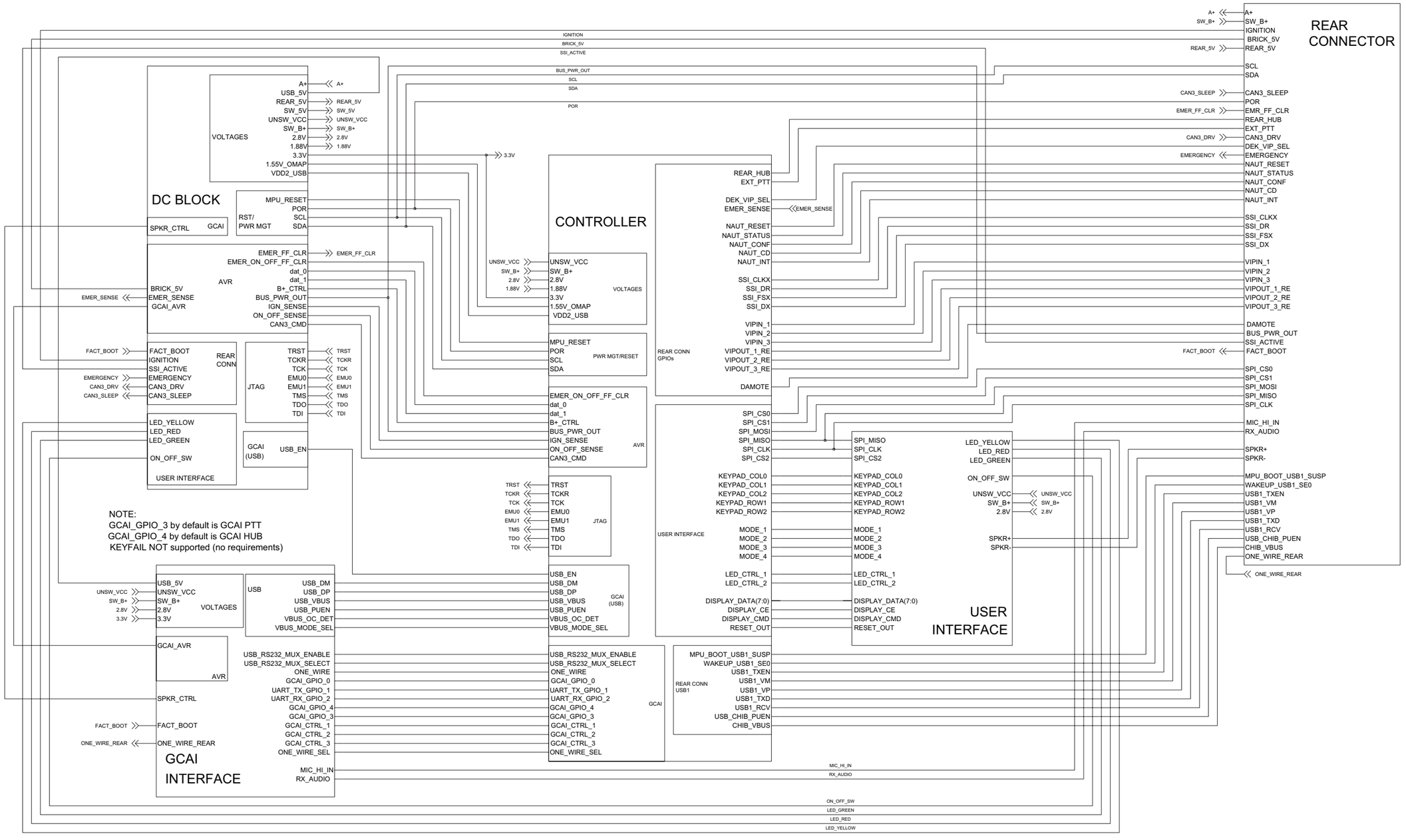



*Figure 7-1. PMLN 4864A Main Board Overall Block Diagram and Interconnections*

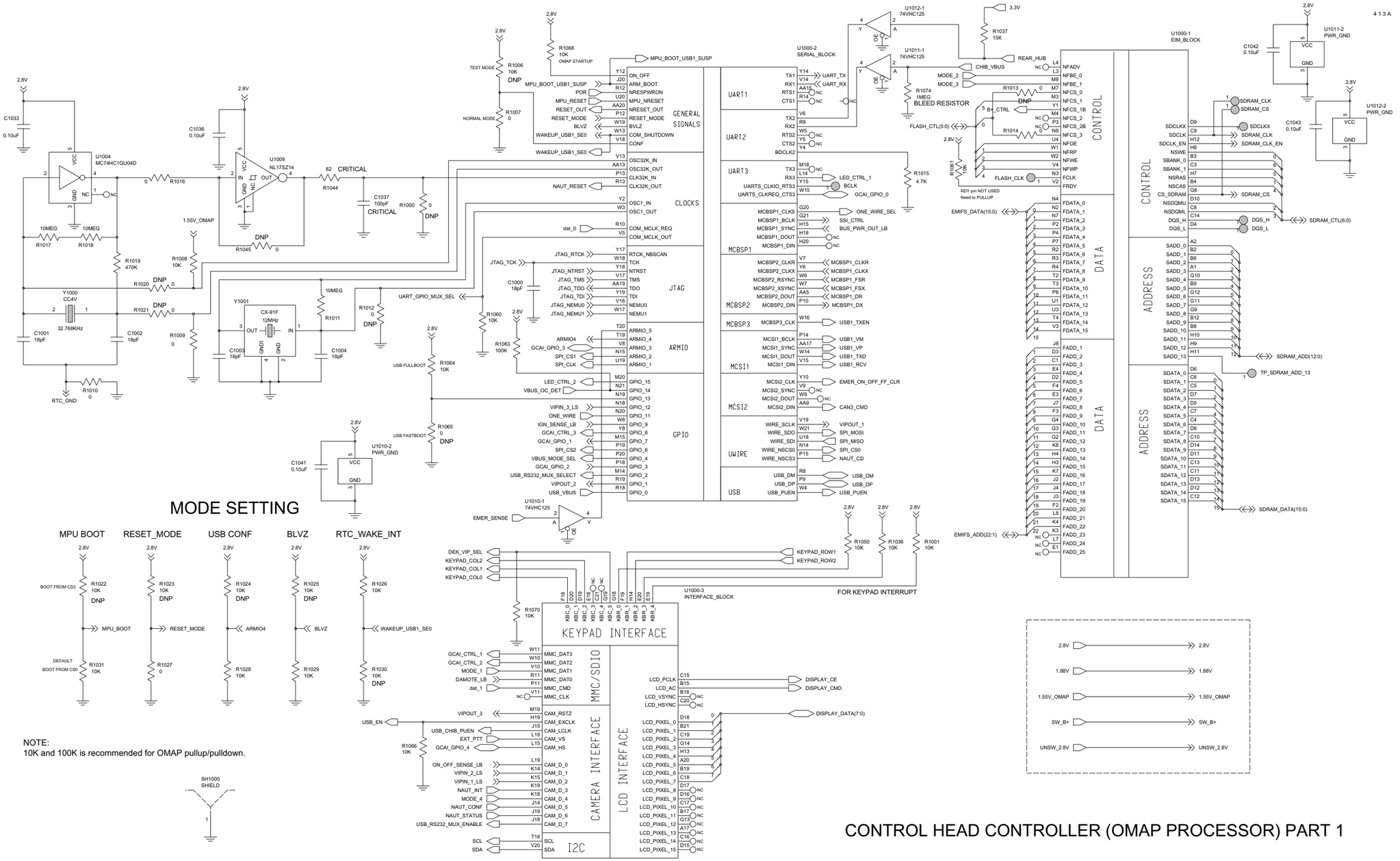



*Figure 7-2. Control Head Controller (OMAP Processor) (Sheet 1 of 2)*

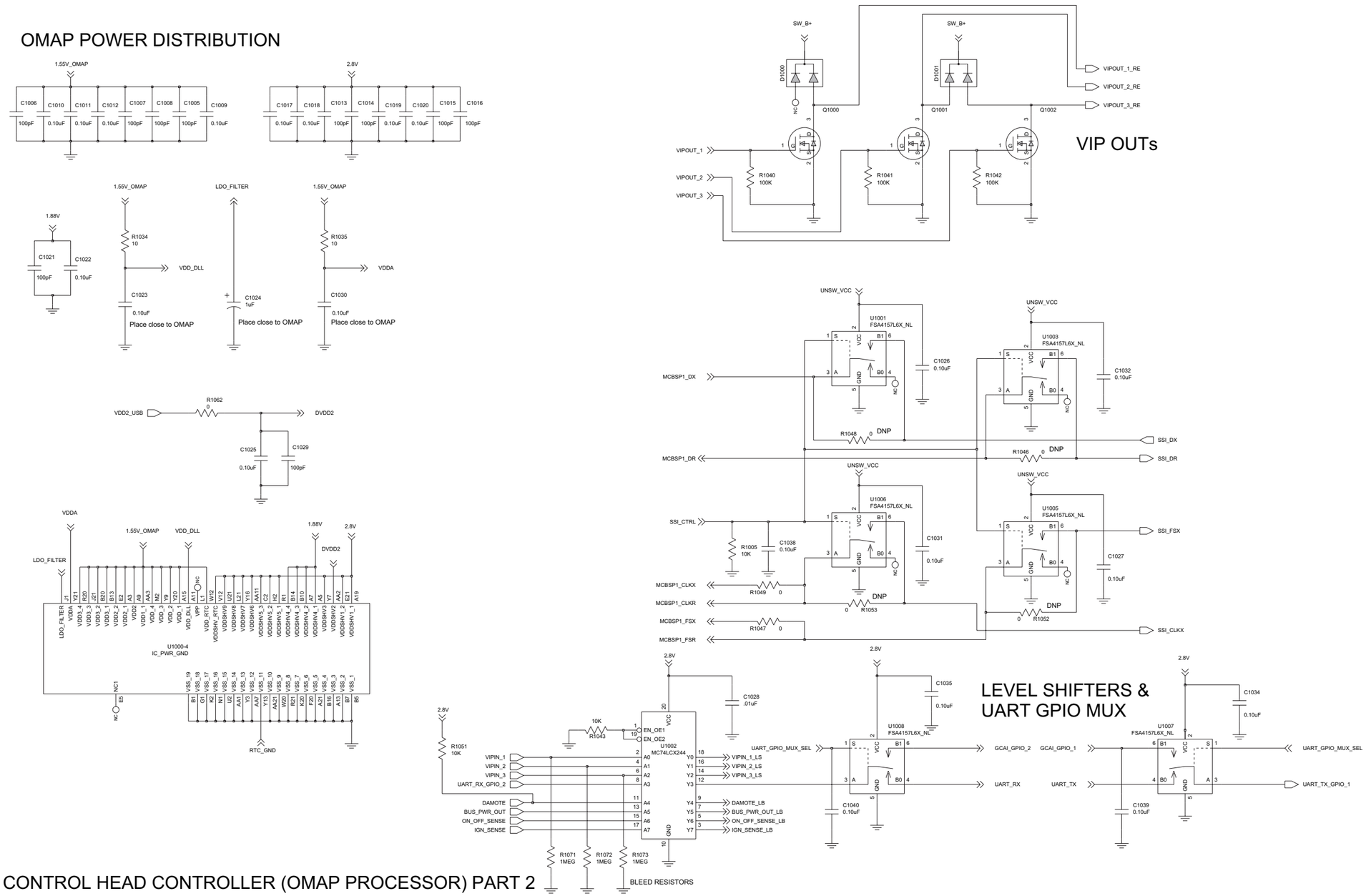
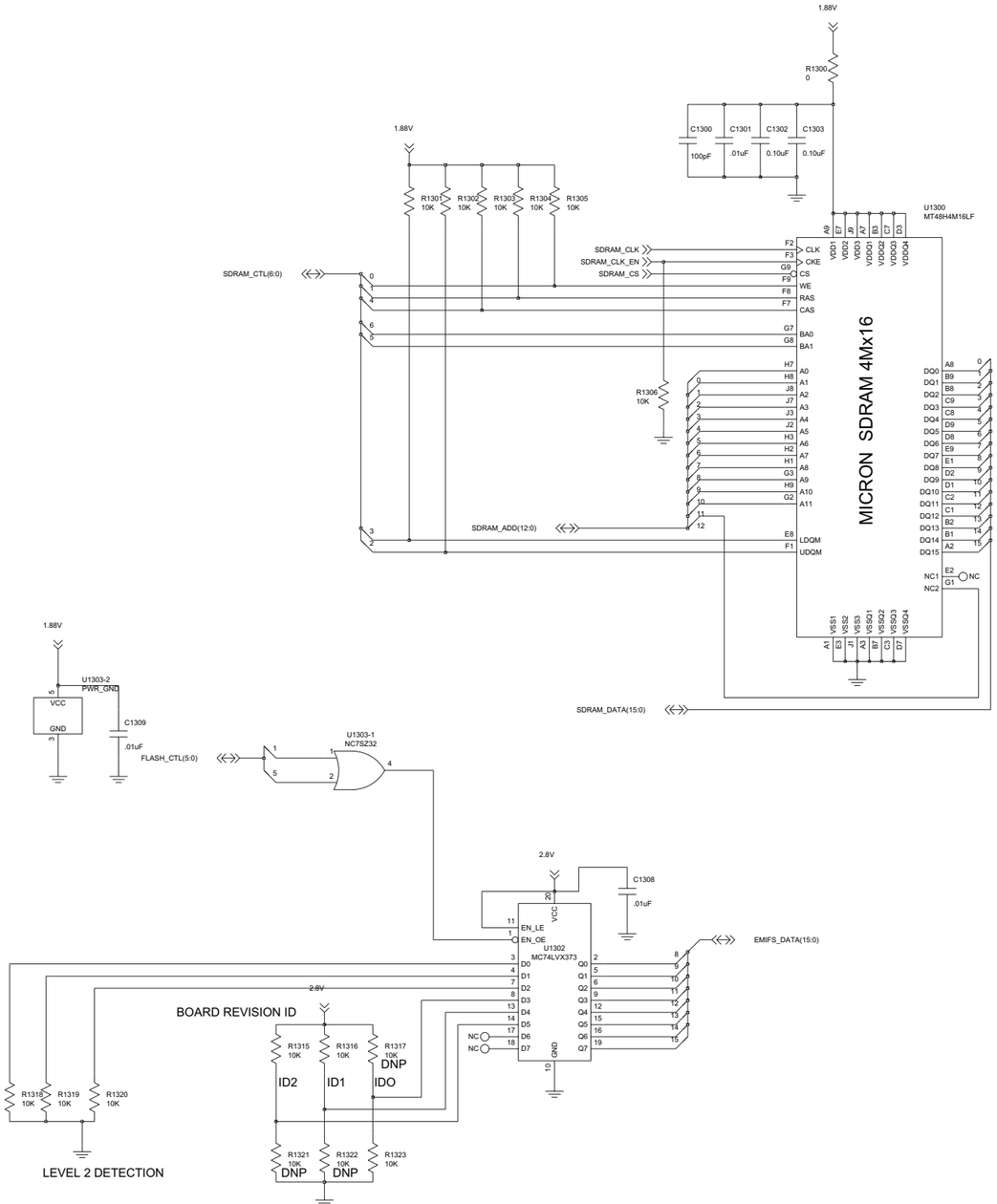
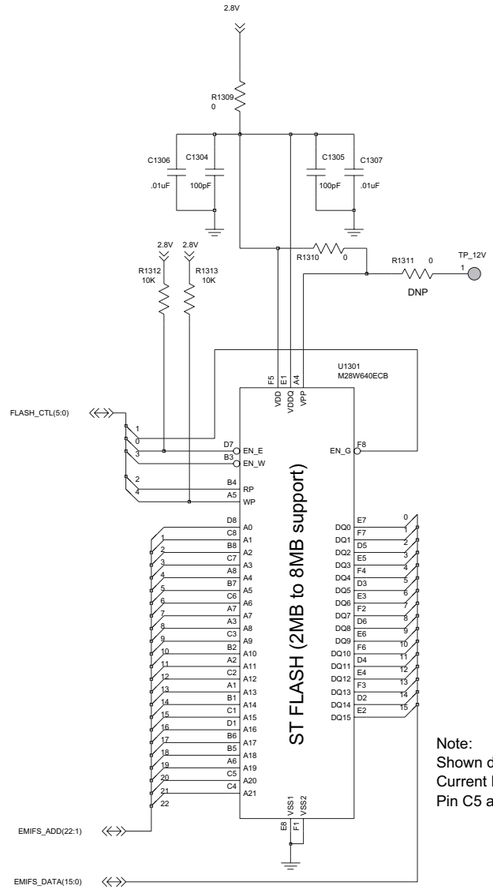



*Figure 7-3. Control Head Controller (OMAP Processor) (Sheet 2 of 2)*



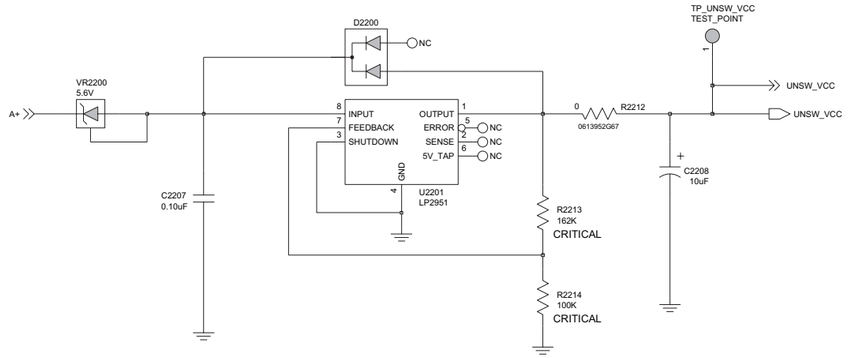

Note:
Shown diagram is 8MB.
Current Flash in use is 2MB with Mot P/N: 5115836H01
Pin C5 and C4 is No Connect.

*Figure 7-4. Control Head Controller (SDRAM and FLASH Memory)*

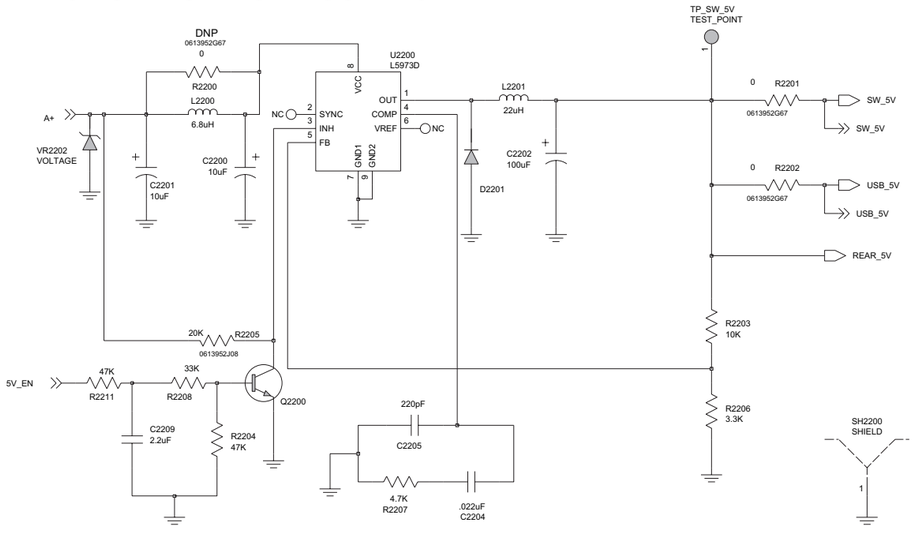
CONTROL HEAD CONTROLLER (SDRAM AND FLASH MEMORY)

## UNSW_VCC LINEAR REGULATOR

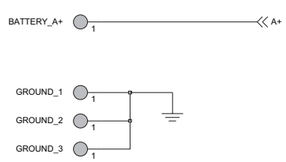
CURRENTLY CONFIGURED TO OUTPUT 3.25V




## 5V SWITCHING REGULATOR




## FACTORY PROBE POINTS




## SW_B+ CONTROL

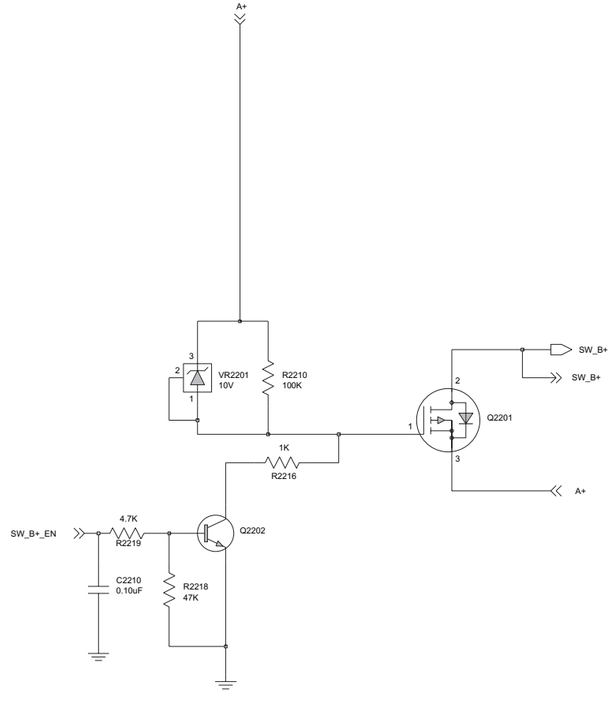
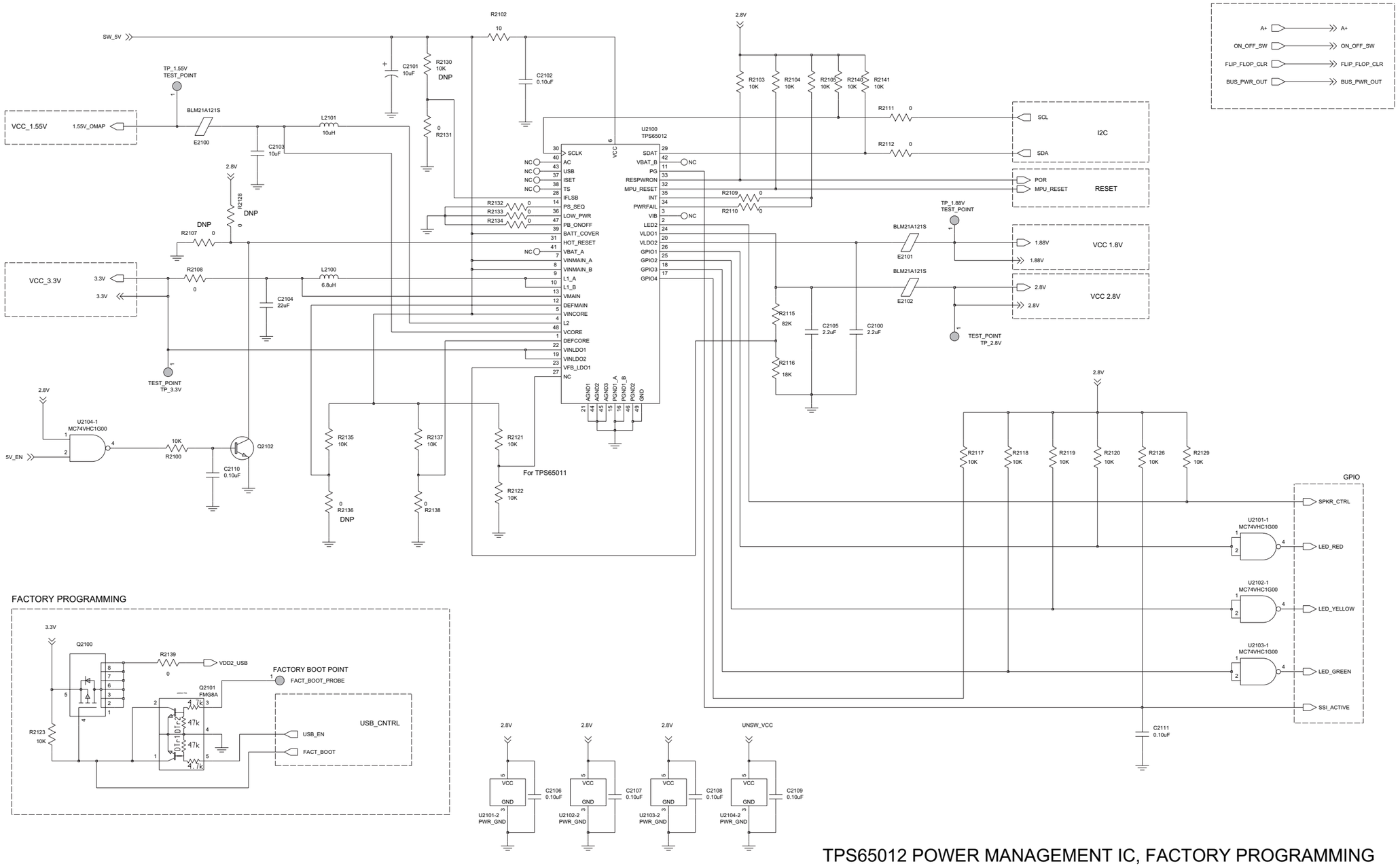



*Figure 7-5. Voltage Regulators*




TPS65012 POWER MANAGEMENT IC, FACTORY PROGRAMMING

*Figure 7-6. TPS65012 Power Management IC, Factory Programming*

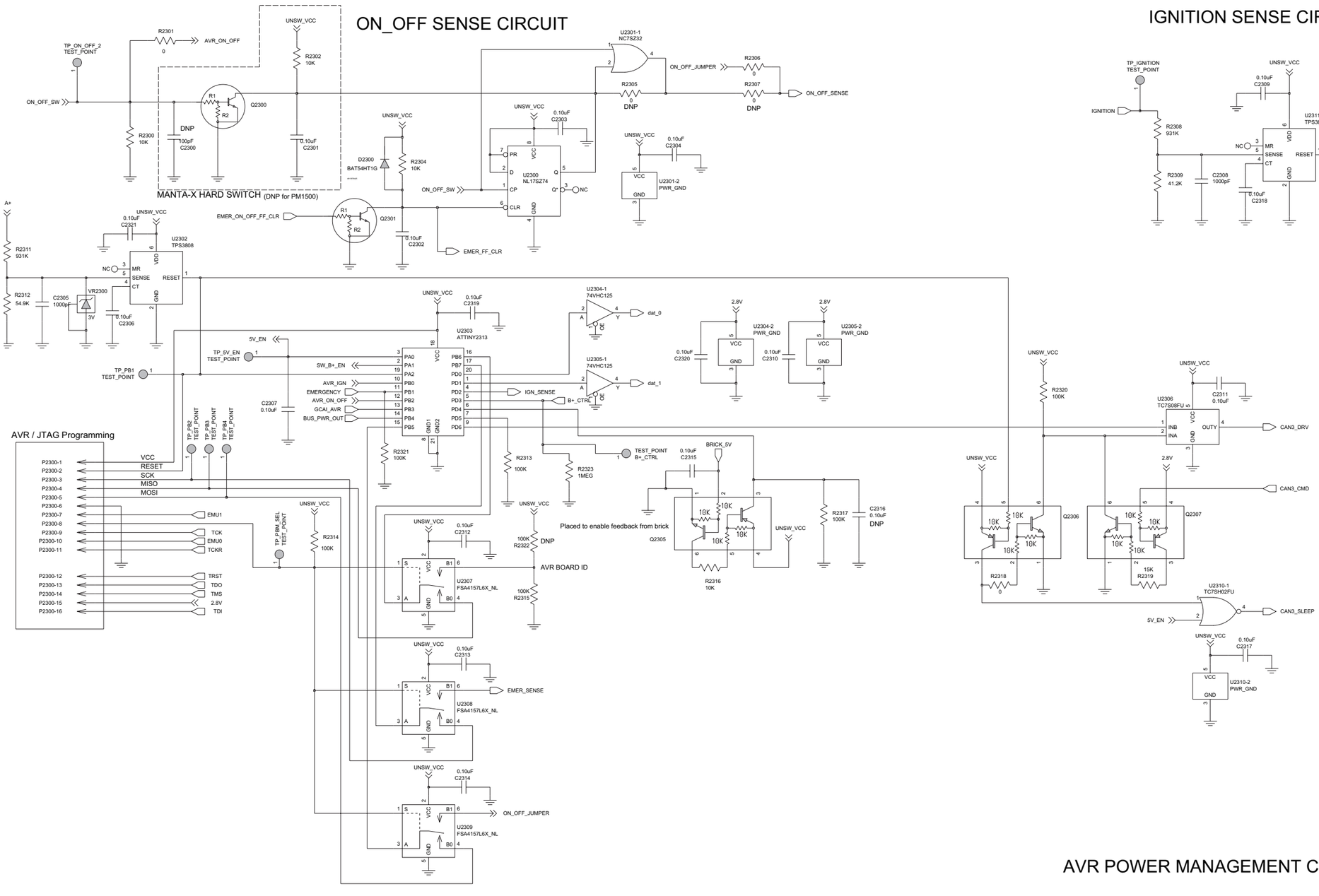



*Figure 7-7. AVR Power Management Control*

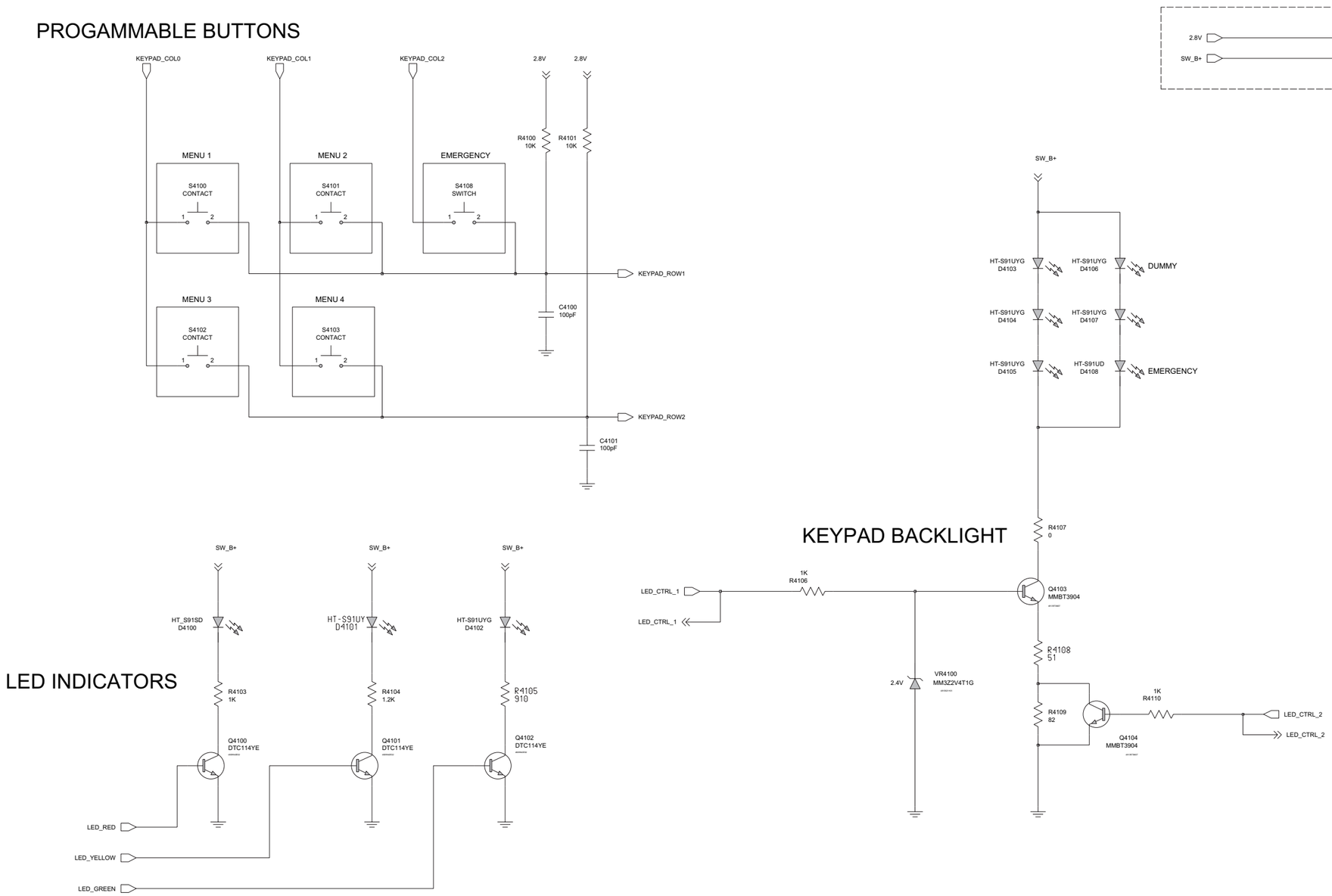
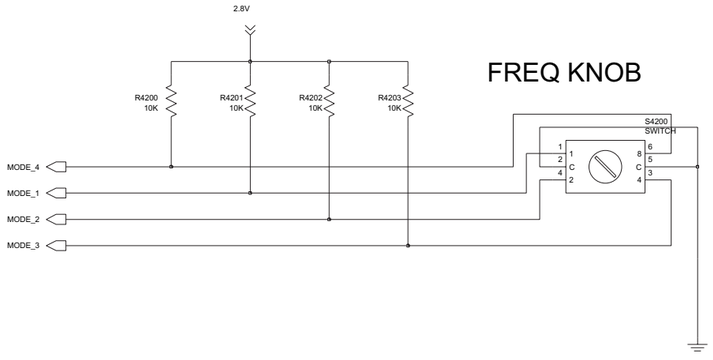
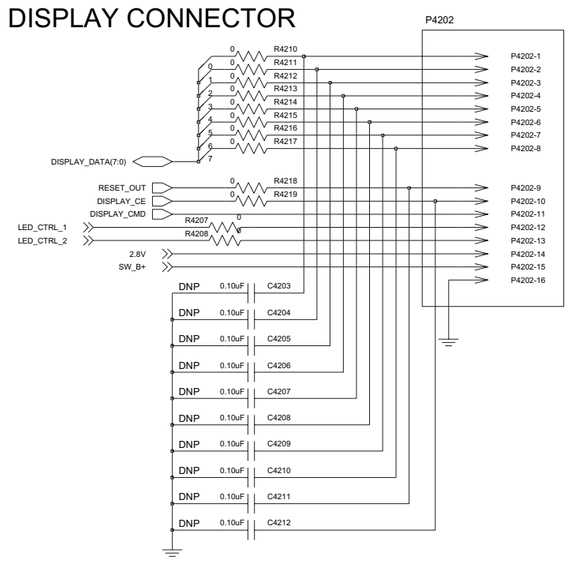
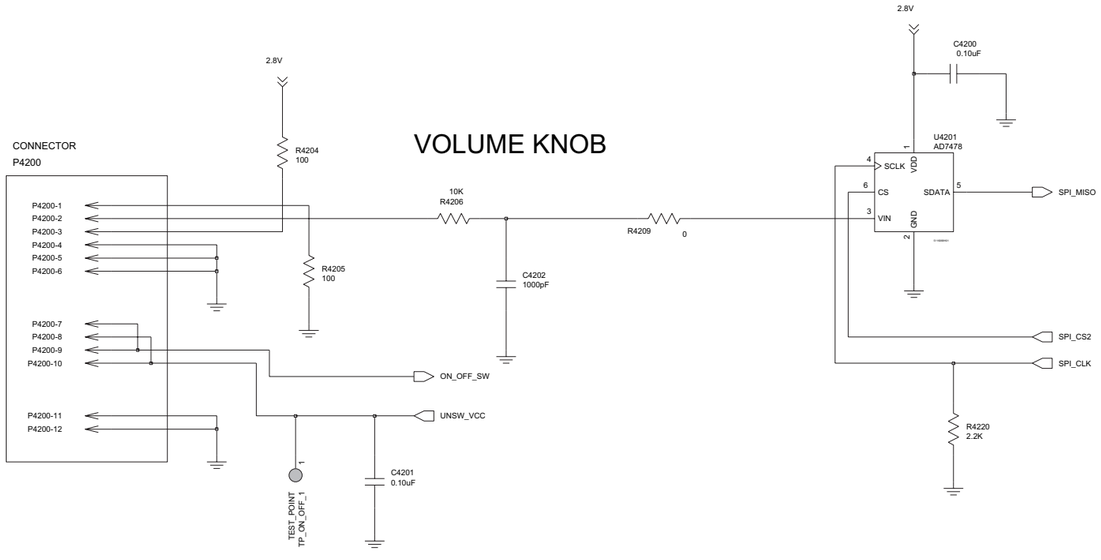
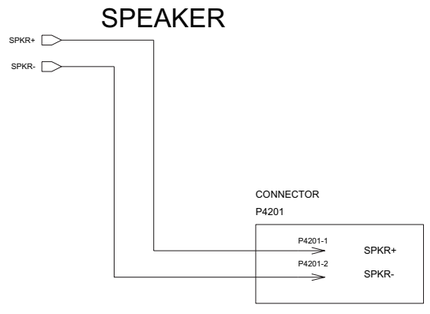



*Figure 7-8. User Interface (Sheet 1 of 2)*



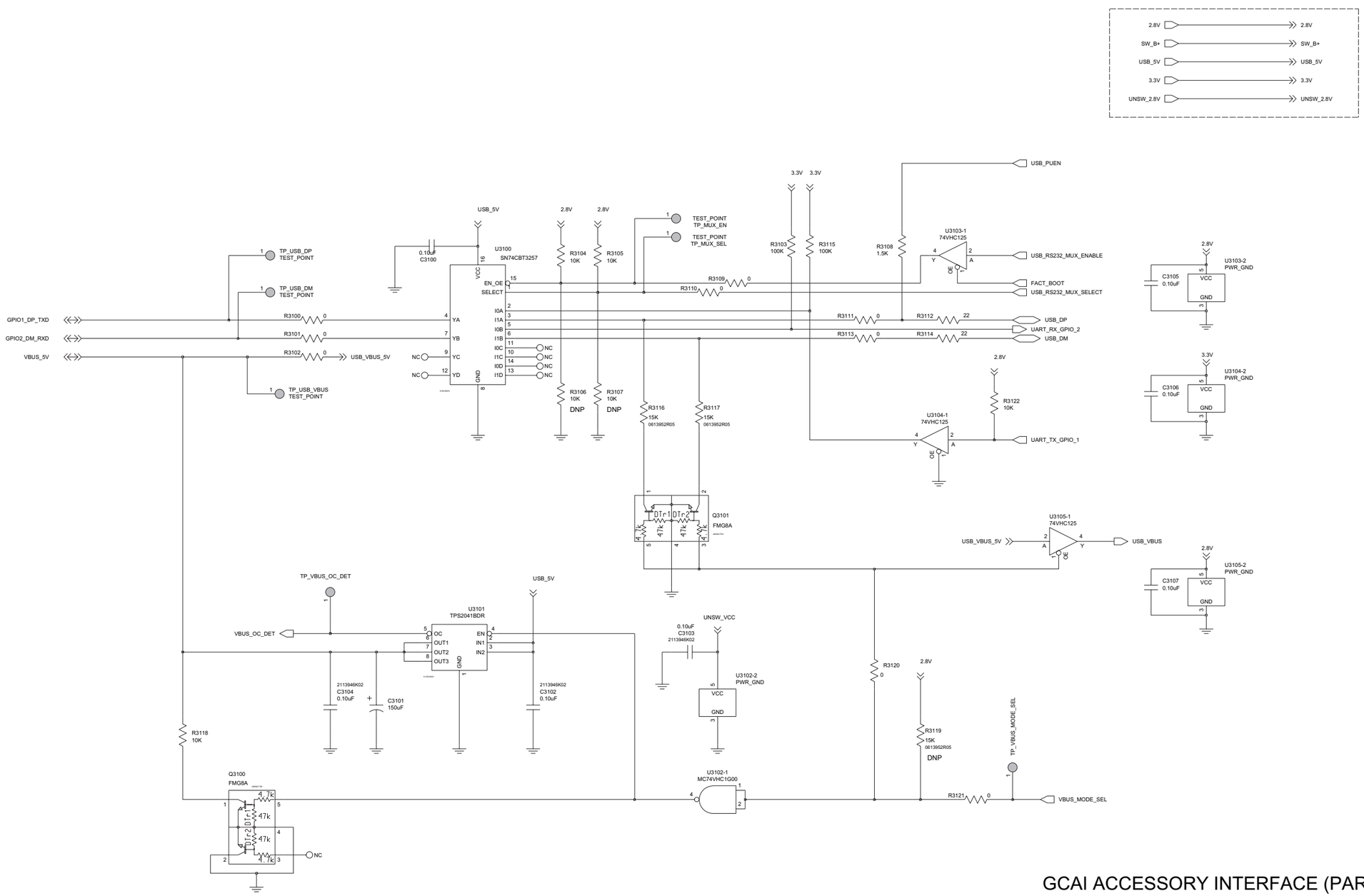




USER INTERFACE (PART 2)

*Figure 7-9. User Interface (Sheet 2 of 2)*




GCAI ACCESSORY INTERFACE (PART 1)

*Figure 7-10. GCAI Accessory Interface (Sheet 1 of 2)*

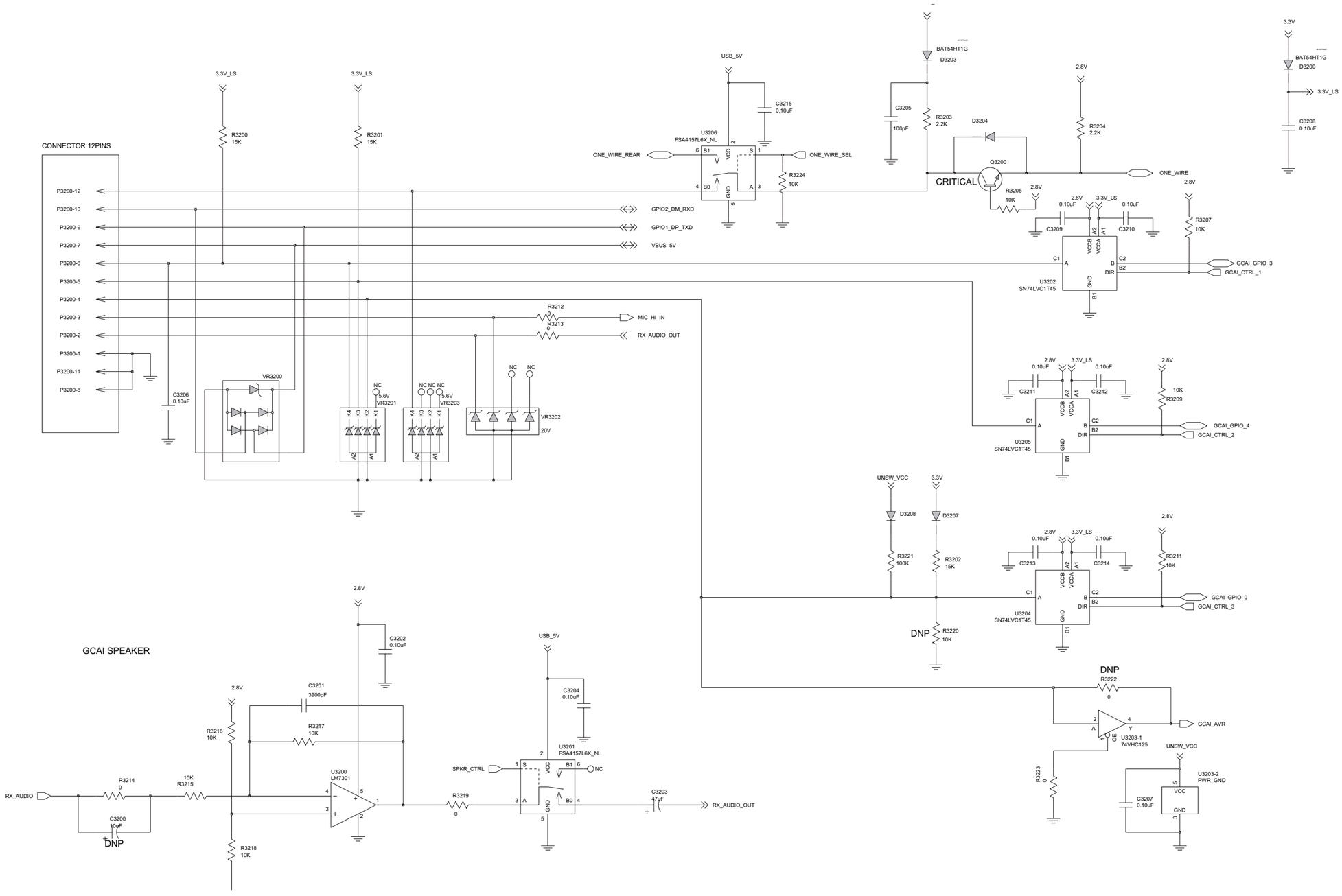



*Figure 7-11. GCAI Accessory Interface (Sheet 2 of 2)*

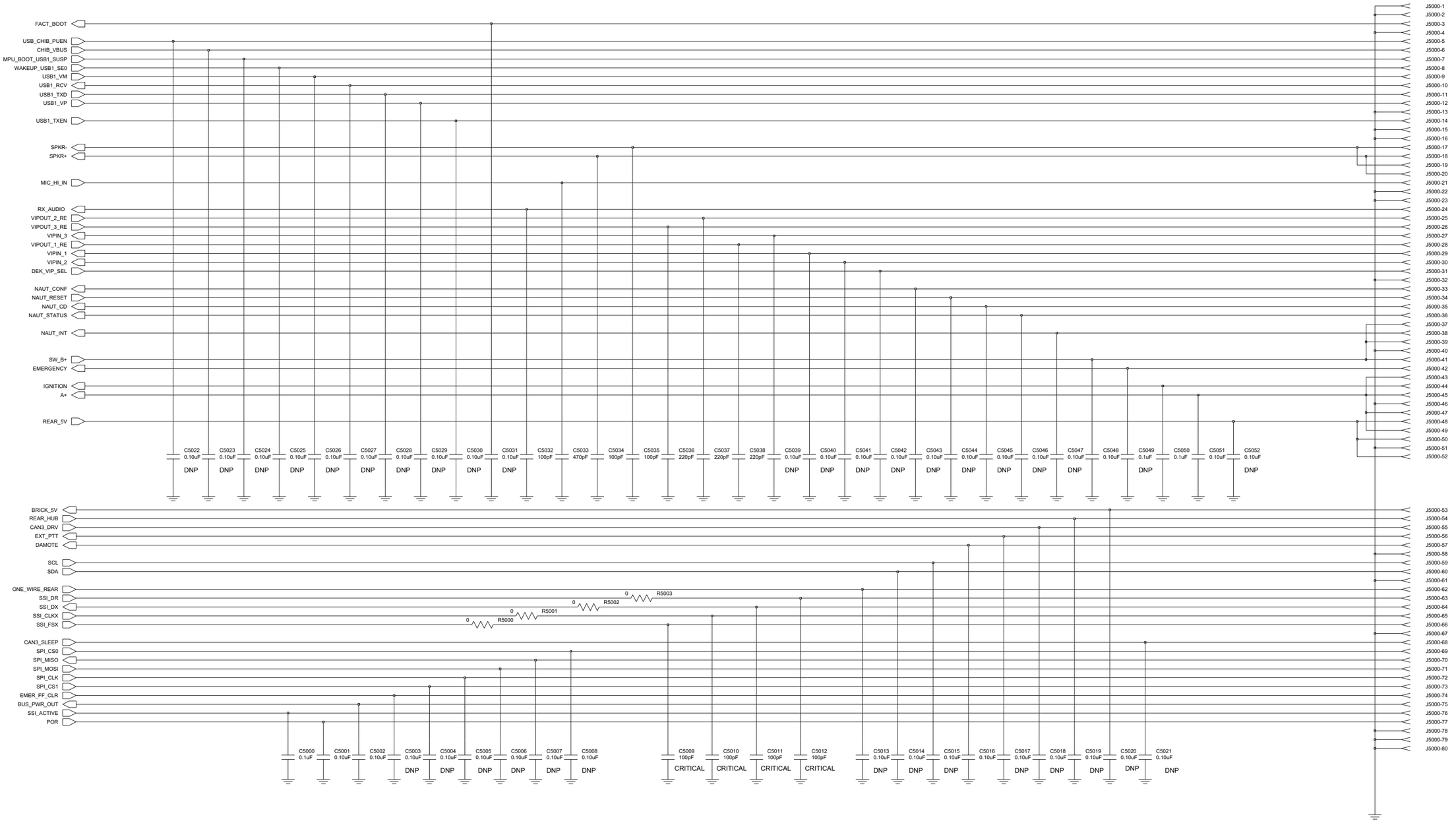



*Figure 7-12. Rear Connector*

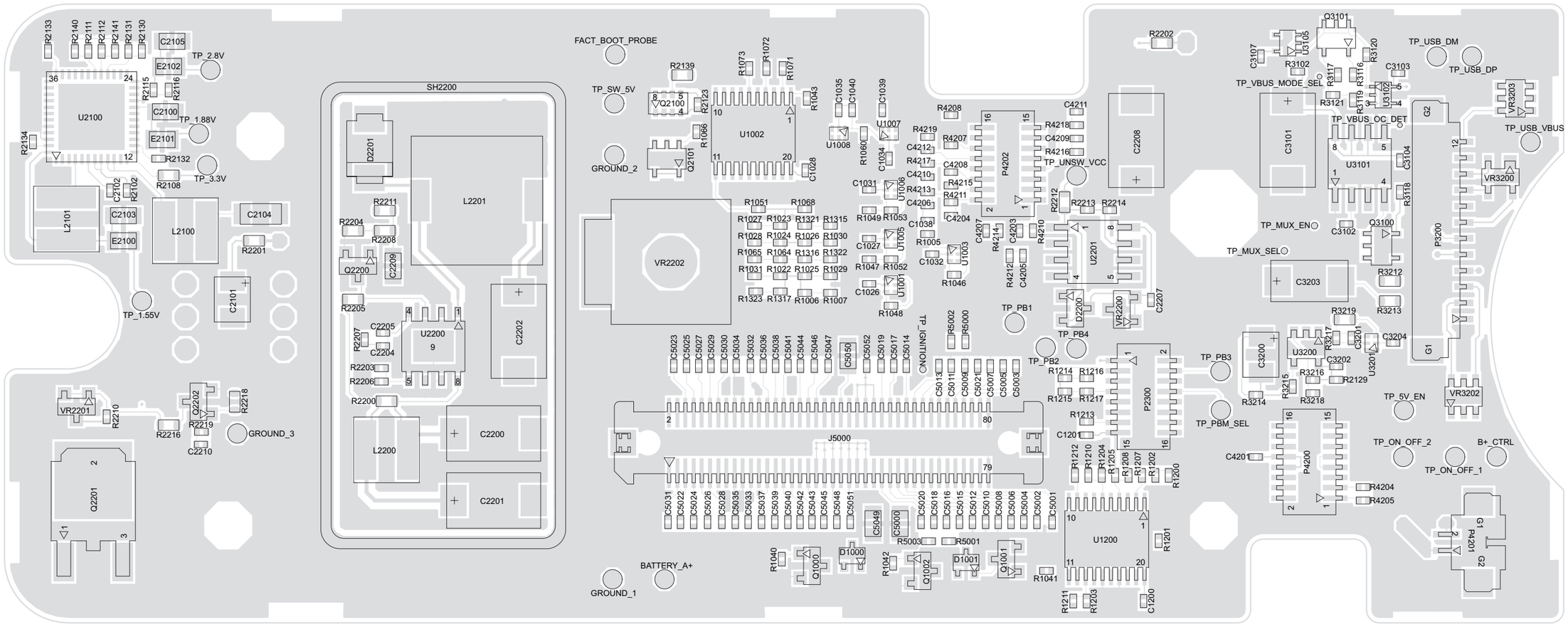



*Figure 7-13. PMLN 4864A Main Board Layout - Side 1*

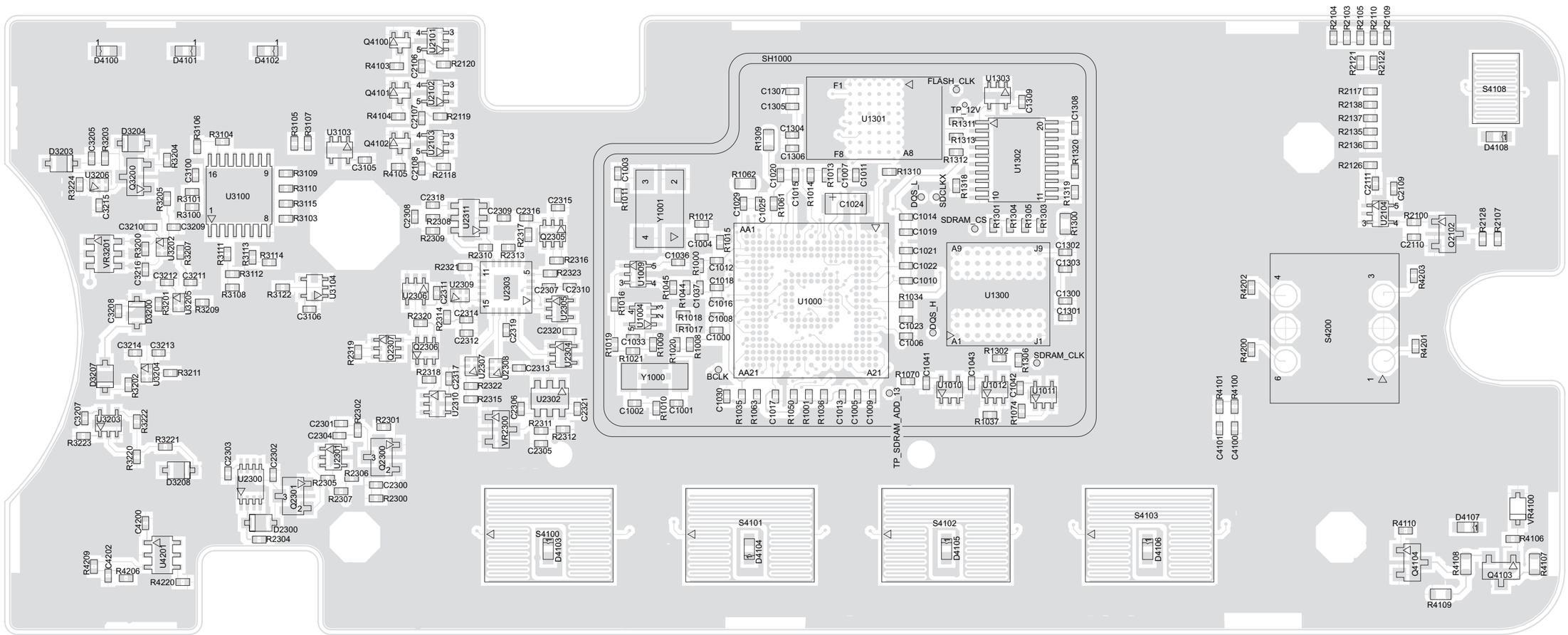



*Figure 7-14. PMLN 4864A Main Board Layout - Side 2*

## PMLN 4864A Control Head Board Pilot Parts List

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C1000 | 2113944A28 | CAP CER CHP 18.0PF 50V 5% |
| C1001 | 2113944A28 | CAP CER CHP 18.0PF 50V 5% |
| C1002 | 2113944A28 | CAP CER CHP 18.0PF 50V 5% |
| C1003 | 2113944A28 | CAP CER CHP 18.0PF 50V 5% |
| C1004 | 2113944A28 | CAP CER CHP 18.0PF 50V 5% |
| C1005 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C1006 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C1007 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C1008 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C1009 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1010 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1011 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1012 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1013 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C1014 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C1015 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C1016 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C1017 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1018 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1019 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1020 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1021 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C1022 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1023 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1024 | 2313960B01 | CAP TANT 1.0 UF 10% 16V 3216-18 |
| C1025 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1026 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1027 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1028 | 2113945B02 | CAP CER CHP 10,000PF 25V 10% |
| C1029 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C1030 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1031 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1032 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1033 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1034 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1035 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1036 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1037 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C1038 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1039 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1040 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1041 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1042 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1043 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1200 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1201 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1300 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C1301 | 2113945B02 | CAP CER CHP 10,000PF 25V 10% |
| C1302 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1303 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1304 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C1305 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C1306 | 2113945B02 | CAP CER CHP 10,000PF 25V 10% |
| C1307 | 2113945B02 | CAP CER CHP 10,000PF 25V 10% |
| C1308 | 2113945B02 | CAP CER CHP 10,000PF 25V 10% |
| C1309 | 2113945B02 | CAP CER CHP 10,000PF 25V 10% |
| C2100 | 2113946N03 | CAP CER CHP 2.2UF 16V |
| C2101 | 2313960D07 | CAP TANT 10 UF 10% 16V 3528-21 |
| C2102 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2103 | 2113946F05 | CAP,CHIP,10UF,,+10%,-10%,6.3V-DC,08 |
| C2104 | 2188155V02 | CAP,CERAMIC CHIP,22UF,,+10%,-10%,10 |
| C2105 | 2113946N03 | CAP CER CHP 2.2UF 16V |
| C2106 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2107 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2108 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2109 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2110 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2111 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2200 | 2313960G32 | CAP,FXD,10UF,+10%,-10%,35V-DC,SM,,- |
| C2201 | 2313960G32 | CAP,FXD,10UF,+10%,-10%,35V-DC,SM,,- |
| C2202 | 2314030H07 | CAP TANT CHIP 100 UF 10% 16V |
| C2204 | 2113945B04 | CAP,FXD,.022UF,,+10%,-10%,25V-DC,04 |
| C2205 | 2113945A01 | CAP CER CHP 220PF 50V 10% |
| C2207 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2208 | 2313960G32 | CAP,FXD,10UF,+10%,-10%,35V-DC,SM,,- |
| C2209 | 2113946N03 | CAP CER CHP 2.2UF 16V |
| C2210 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2300 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C2301 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2302 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2303 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2304 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2305 | 2113945A09 | CAP CER CHP 1000PF 50V 10% |
| C2306 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2307 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2308 | 2113945A09 | CAP CER CHP 1000PF 50V 10% |
| C2309 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2310 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2311 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2312 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2313 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2314 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2315 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2316 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2317 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2318 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2319 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2320 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C2321 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3100 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3101 | 2360567A07 | CAP TANTALUM |
| C3102 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3103 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3104 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3105 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3106 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3107 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3200 | 2313960D07 | CAP TANT 10 UF 10% 16V 3528-21 |
| C3201 | 2113945A69 | CAP,FXD,3900PF,,+10%,-10%,50V-DC,04 |
| C3202 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3203 | 2313960F30 | CAP TANT 47 UF 10% 10V 6032-28 |
| C3204 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3205 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C3207 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3208 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3209 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3210 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3211 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3212 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3213 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3214 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3215 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C3216 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C4100 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C4101 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C4200 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C4201 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C4202 | 2113945A09 | CAP CER CHP 1000PF 50V 10% |
| C4203 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C4204 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C4205 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C4206 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C4207 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C4208 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C4209 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C4210 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C4211 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C4212 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5000 | 2113945G91 | CAP,FXD,.1UF,,+10%,-10%,50V-DC,0805 |
| C5001 | 2113946K03 | CAP CER CHP 0.22UF 16V |
| C5002 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5003 | 2113946K03 | CAP CER CHP 0.22UF 16V |
| C5004 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5005 | 2113946K02 | CAP CER CHP 0.10UF 16V |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C5006 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5007 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5008 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5009 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C5010 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C5011 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C5012 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C5013 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5014 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5015 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5016 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5017 | 2113946K03 | CAP CER CHP 0.22UF 16V |
| C5018 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5019 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5020 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5021 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5022 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5023 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5024 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5025 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5026 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5027 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5028 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5029 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5030 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5031 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5032 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C5033 | 2113945A05 | CAP CER CHP 470PF 50V 10% |
| C5034 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C5035 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C5036 | 2113945A01 | CAP CER CHP 220PF 50V 10% |
| C5037 | 2113945A01 | CAP CER CHP 220PF 50V 10% |
| C5038 | 2113945A01 | CAP CER CHP 220PF 50V 10% |
| C5039 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5040 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5041 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5042 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5043 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5044 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5045 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5046 | 2113946K02 | CAP CER CHP 0.10UF 16V |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C5047 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5048 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5049 | 2113945G91 | CAP,FXD,.1UF,,+10%,-10%,50V-DC,0805 |
| C5050 | 2113945G91 | CAP,FXD,.1UF,,+10%,-10%,50V-DC,0805 |
| C5051 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C5052 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| D1000 | 4888722V03 | DIODE,SWG,,SM,SOT-323/SC-70,30MA,40 |
| D1001 | 4888722V03 | DIODE,SWG,,SM,SOT-323/SC-70,30MA,40 |
| D2200 | 4813978C02 | PB FREE, NOT COMPLETELY ENRICHED |
| D2201 | 4813978B17 | DIODE SCHOTTKY 2.0A 30V |
| D2300 | 4813978A25 | DIODE, SCHOTTKY 30V SOD-323 T&R |
| D3200 | 4813978A25 | DIODE, SCHOTTKY 30V SOD-323 T&R |
| D3203 | 4813978A25 | DIODE, SCHOTTKY 30V SOD-323 T&R |
| D3204 | 4813978A25 | DIODE, SCHOTTKY 30V SOD-323 T&R |
| D3207 | 4813978A25 | DIODE, SCHOTTKY 30V SOD-323 T&R |
| D3208 | 4813978A25 | DIODE, SCHOTTKY 30V SOD-323 T&R |
| D4100 | 4815813H01 | CHIP LED |
| D4101 | 4815818H02 | CHIP LED |
| D4102 | 4815809H01 | CHIP LED |
| D4103 | 4815809H01 | CHIP LED |
| D4104 | 4815809H01 | CHIP LED |
| D4105 | 4815809H01 | CHIP LED |
| D4106 | 4815809H01 | CHIP LED |
| D4107 | 4815809H01 | CHIP LED |
| D4108 | 4815814H02 | CHIP LED |
| E2100 | 2480067M02 | CHK RF CHIP BEAD INDUCTOR |
| E2101 | 2480067M02 | CHK RF CHIP BEAD INDUCTOR |
| E2102 | 2480067M02 | CHK RF CHIP BEAD INDUCTOR |
| J5000 | 0916344H01 | 80 Pin Connector Receptacle |
| L2100 | 2416090H01 | POWER INDUCTOR |
| L2101 | 2416089H01 | POWER INDUCTOR |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| L2200 | 2416090H01 | POWER INDUCTOR |
| L2201 | 2416086H01 | POWER INDUCTOR |
| P2300 | 2815146H01 | PLUG 0.8MM BTB CONNECTOR |
| P3200 | 2815159H01 | 1.25 WTB WAFER ASSY 12CKT VERT MOUN |
| P4200 | 2815146H01 | PLUG 0.8MM BTB CONNECTOR |
| P4201 | 2815162H01 | HEADER SMT HORZ MOUNT LEAD-FREE |
| P4202 | 2815146H01 | PLUG 0.8MM BTB CONNECTOR |
| Q1000 | 4813972A17 | PB-FREE,NOT COMPLETELY ENRICHED |
| Q1001 | 4813972A17 | PB-FREE,NOT COMPLETELY ENRICHED |
| Q1002 | 4813972A17 | PB-FREE,NOT COMPLETELY ENRICHED |
| Q2100 | 4813970A62 | XSTR,FET GP PWR,MOSFET,P-CH,ENHN,,C |
| Q2101 | 4805921T28 | XSTR DUAL ROHM FMG8 |
| Q2102 | 4813973M07 | TSTR NPN 40V .2A GEN PURP |
| Q2200 | 4813973M07 | TSTR NPN 40V .2A GEN PURP |
| Q2201 | 4815332H01 | NTD2955T4G |
| Q2202 | 4813973M07 | TSTR NPN 40V .2A GEN PURP |
| Q2300 | 4813973A42 | XSTR,BIP GP SS,,NPN,,SM,SC-59,,SMT, |
| Q2301 | 4813973A42 | XSTR,BIP GP SS,,NPN,,SM,SC-59,,SMT, |
| Q2305 | 4813973A81 | XSTR,BIP GP SS,DIG,NPN AND PNP,,SOT |
| Q2306 | 4813973A81 | XSTR,BIP GP SS,DIG,NPN AND PNP,,SOT |
| Q2307 | 4813973A81 | XSTR,BIP GP SS,DIG,NPN AND PNP,,SOT |
| Q3100 | 4805921T28 | XSTR DUAL ROHM FMG8 |
| Q3101 | 4805921T28 | XSTR DUAL ROHM FMG8 |
| Q3200 | 4813973M07 | TSTR NPN 40V .2A GEN PURP |
| Q4100 | 4816000H01 | TSTR DIG NPN DTC114YE |
| Q4101 | 4816000H01 | TSTR DIG NPN DTC114YE |
| Q4102 | 4816000H01 | TSTR DIG NPN DTC114YE |
| Q4103 | 4813973M07 | TSTR NPN 40V .2A GEN PURP |
| Q4104 | 4813973M07 | TSTR NPN 40V .2A GEN PURP |
| R1000 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R1001 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1005 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1006 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1007 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1008 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1009 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1010 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1011 | 0613952R74 | RES,MF,10MOHM,5%,.0625W,SM,0402,,PB |
| R1012 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1013 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1014 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1015 | 0613952Q89 | CER CHIP RES 4700 OHM 5% 0402 |
| R1016 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1017 | 0613952R74 | RES,MF,10MOHM,5%,.0625W,SM,0402,,PB |
| R1018 | 0613952R74 | RES,MF,10MOHM,5%,.0625W,SM,0402,,PB |
| R1019 | 0613952R41 | CER CHIP RES 470K OHM 5% 0402 |
| R1020 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1021 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1022 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1023 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1024 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1025 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1026 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R1027 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1028 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1029 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1030 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1031 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1034 | 0613952Q25 | CER CHIP RES 10.0 OHM 5% 0402 |
| R1035 | 0613952Q25 | CER CHIP RES 10.0 OHM 5% 0402 |
| R1036 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1037 | 0613952R05 | CER CHIP RES 15K OHM 5% 0402 |
| R1040 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R1041 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R1042 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R1043 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1044 | 0613952Q47 | CER CHIP RES 82.0 OHM 5% 0402 |
| R1045 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1046 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1047 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1048 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1049 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1050 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1051 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1052 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1053 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R1060 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1061 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1062 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1063 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R1064 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1065 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1066 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1068 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1070 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1071 | 0613952R49 | RES. CHIP 1.0 MEG 5% 20×40 |
| R1072 | 0613952R49 | RES. CHIP 1.0 MEG 5% 20×41 |
| R1073 | 0613952R49 | RES. CHIP 1.0 MEG 5% 20×42 |
| R1074 | 0613952R49 | RES. CHIP 1.0 MEG 5% 20×42 |
| R1200 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1201 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1202 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1203 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R1204 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R1205 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R1207 | 0613952Q37 | CER CHIP RES 33.0 OHM 5% 0402 |
| R1208 | 0613952Q37 | CER CHIP RES 33.0 OHM 5% 0402 |
| R1210 | 0613952Q37 | CER CHIP RES 33.0 OHM 5% 0402 |
| R1211 | 0613952Q37 | CER CHIP RES 33.0 OHM 5% 0402 |
| R1212 | 0613952Q37 | CER CHIP RES 33.0 OHM 5% 0402 |
| R1213 | 0613952Q37 | CER CHIP RES 33.0 OHM 5% 0402 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R1214 | 0613952Q89 | CER CHIP RES 4700 OHM 5% 0402 |
| R1215 | 0613952Q89 | CER CHIP RES 4700 OHM 5% 0402 |
| R1216 | 0613952Q37 | CER CHIP RES 33.0 OHM 5% 0402 |
| R1217 | 0613952Q37 | CER CHIP RES 33.0 OHM 5% 0402 |
| R1300 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1301 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1302 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1303 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1304 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1305 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1306 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1309 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1310 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1311 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1312 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1313 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1315 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1316 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1317 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1318 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1319 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1320 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1321 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R1322 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R1323 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2100 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2102 | 0613952Q25 | CER CHIP RES 10.0 OHM 5% 0402 |
| R2103 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2104 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2105 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2107 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2108 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2109 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2110 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2111 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2112 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2115 | 0613952R23 | CER CHIP RES 82K OHM 5% 0402 |
| R2116 | 0613952R07 | CER CHIP RES 18K OHM 5% 0402 |
| R2117 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2118 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2119 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2120 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2121 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2122 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2123 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2126 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R2128 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2129 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2130 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2131 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2132 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2133 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2134 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2135 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2136 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2137 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2138 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2139 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2140 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2141 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2200 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2201 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2202 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2203 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2204 | 0613952J17 | CER CHIP RES 47K OHM 5% 0603 |
| R2205 | 0613952J08 | CER CHIP RES 20K OHM 5% 0603 |
| R2206 | 0613952Z44 | CER CHIP RES 20K OHM 5% 0603 |
| R2207 | 0613952Q89 | CER CHIP RES 4700 OHM 5% 0402 |
| R2208 | 0613952J13 | CER CHIP RES 33K OHM 5% 0603 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R2210 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R2211 | 0613952J17 | CER CHIP RES 47K OHM 5% 0603 |
| R2212 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2213 | 0613952P21 | RES, 162K |
| R2214 | 0613952P01 | CER CHIP RES 100K OHM 1% 0402 |
| R2216 | 0613952H73 | CER CHIP RES 1000 OHM 5% 0603 |
| R2218 | 0613952J17 | CER CHIP RES 47K OHM 5% 0603 |
| R2219 | 0613952Q89 | CER CHIP RES 4700 OHM 5% 0402 |
| R2300 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2301 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2302 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2304 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R2305 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2306 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2307 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2308 | 0613952P94 | CER CHIP RES 931k OHM 1% 0402 |
| R2309 | 0613952N60 | CER CHIP RES 41.2k OHM 1% 0402 |
| R2310 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R2311 | 0613952P94 | CER CHIP RES 931k OHM 1% 0402 |
| R2312 | 0613952N72 | CER CHIP RES 54.9k OHM 1% 0402 |
| R2313 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R2314 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R2315 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R2316 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R2317 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R2318 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R2319 | 0613952R05 | CER CHIP RES 15K OHM 5% 0402 |
| R2320 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R2321 | 0613952R49 | RES. CHIP 1.0 MEG 5% 20×40 |
| R2322 | 0613952R25 | CER CHIP RES 100K OHM 5% |
| R2323 | 0613952R49 | RES. CHIP 1.0 MEG 5% 20×40 |
| R3100 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R3101 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R3102 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R3103 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R3104 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R3105 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R3106 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R3107 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R3108 | 0613952Q77 | CER CHIP RES 1500 OHM 5% 0402 |
| R3109 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R3110 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R3111 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R3112 | 0613952Q33 | CER CHIP RES 22.0 OHM 5% 0402 |
| R3113 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R3114 | 0613952Q33 | CER CHIP RES 22.0 OHM 5% 0402 |
| R3115 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R3116 | 0613952R05 | CER CHIP RES 15K OHM 5% 0402 |
| R3117 | 0613952R05 | CER CHIP RES 15K OHM 5% 0402 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R3118 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R3119 | 0613952R05 | CER CHIP RES 15K OHM 5% 0402 |
| R3120 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R3121 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R3122 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R3200 | 0613952R05 | CER CHIP RES 15K OHM 5% 0402 |
| R3201 | 0613952R05 | CER CHIP RES 15K OHM 5% 0402 |
| R3202 | 0613952R05 | CER CHIP RES 15K OHM 5% 0402 |
| R3203 | 0613952Q81 | CER CHIP RES 2200 OHM 5% 0402 |
| R3204 | 0613952Q81 | CER CHIP RES 2200 OHM 5% 0402 |
| R3205 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R3207 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R3209 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R3211 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R3212 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| R3213 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| R3214 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R3215 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R3216 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R3217 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R3218 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R3219 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| R3220 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R3221 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R3222 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R3223 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R3224 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R4100 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R4101 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R4103 | 0613952Q73 | CER CHIP RES 1000 OHM 5% 0402 |
| R4104 | 0613952Q75 | CER CHIP RES 1200 OHM 5% 0402 |
| R4105 | 0613952Q72 | CER CHIP RES 910 OHM 5% 0402 |
| R4106 | 0613952Q73 | CER CHIP RES 1000 OHM 5% 0402 |
| R4107 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| R4108 | 0613952H42 | CER CHIP RES 51.0 OHM 5% 0603 |
| R4109 | 0613952H47 | CER CHIP RES 82.0 OHM 5% 0603 |
| R4110 | 0613952Q73 | CER CHIP RES 1000 OHM 5% 0402 |
| R4200 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R4201 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R4202 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R4203 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R4204 | 0613952Q49 | CER CHIP RES 100 OHM 5% 0402 |
| R4205 | 0613952Q49 | CER CHIP RES 100 OHM 5% 0402 |
| R4206 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R4207 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R4208 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R4209 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R4210 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R4211 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R4212 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R4213 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R4214 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R4215 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R4216 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R4217 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R4218 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R4219 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R4220 | 0613952Q81 | CER CHIP RES 2200 OHM 5% 0402 |
| R5000 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R5001 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R5002 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R5003 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| S4200 | 4015133H01 | FREQUENCY SWITCH |
| SH1000 | 2615260H01 | SHIELD, PCB |
| SH2200 | 2615259H01 | SHIELD, PCB |
| U1000 | 5185941F53 | IC,OMAP 1610 DUAL CORE PROCESSOR |
| U1001 | 5102836C11 | IC,ANLG SW,,FSA4157,SM,,,,SPDT,,PB |
| U1002 | 5114007A07 | IC,LINE DRIVER,8PER PKG,,,,3ST,,TSS |
| U1003 | 5102836C11 | IC,ANLG SW,,FSA4157,SM,,,,SPDT,,PB |
| U1004 | 5114000A48 | IC,INVTR,,1GU04,1PER PKG,SOT-353,,,, |
| U1005 | 5102836C11 | IC,ANLG SW,,FSA4157,SM,,,,SPDT,,PB |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| U1006 | 5102836C11 | IC,ANLG SW,,FSA4157,SM,,,,SPDT,,PB |
| U1007 | 5102836C11 | IC,ANLG SW,,FSA4157,SM,,,,SPDT,,PB |
| U1008 | 5102836C11 | IC,ANLG SW,,FSA4157,SM,,,,SPDT,,PB |
| U1009 | 5114007A43 | IC, SCHMITT TRIGGER INVERTER, SC70 |
| U1010 | 5114000B39 | IC 1 GATE 2-INPUT NOR |
| U1011 | 5114000B39 | IC 1 GATE 2-INPUT NOR |
| U1012 | 5114000B39 | IC 1 GATE 2-INPUT NOR |
| U1200 | 5114007A07 | IC,LINE DRIVER,8PER PKG,,,,3ST,,TSS |
| U1300 | 5115004H02 | MT48H4M16LFB4-8 IT MICRON SDRAM |
| U1301 | 5164852H43 | 64 Mbit (4Mb×16,Boot Block) Flash Memory |
| U1302 | 5114019M15 | IC LATCH OCT 3-ST NON-INV |
| U1303 | 5114007A47 | IC 1.8V SN LOGIC GATE |
| U2100 | 5115331H01 | TPS65012RGZR |
| U2101 | 5114000B34 | IC,NAND,,,1PER PKG,,SOT-353,,PB-FRE |
| U2102 | 5114000B34 | IC,NAND,,,1PER PKG,,SOT-353,,PB-FRE |
| U2103 | 5114000B34 | IC,NAND,,,1PER PKG,,SOT-353,,PB-FRE |
| U2104 | 5114000B34 | IC,NAND,,,1PER PKG,,SOT-353,,PB-FRE |
| U2200 | 5115808H01 | SWITCHING REGULATOR |
| U2201 | 5116021H01 | MICROPOWER VOLTAGE REGULATOR |
| U2300 | 5114007M28 | IC HEX D FLIP-FLOP SINGLE US8, T&R |
| U2301 | 5114007A47 | IC 1.8V SN LOGIC GATE |
| U2302 | 5187904J03 | IC TPS3808 |
| U2303 | 5116332H01 | 8-BIT AVR MICROCONTROLLER |
| U2304 | 5114000B39 | IC 1 GATE 2-INPUT NOR |
| U2305 | 5114000B39 | IC 1 GATE 2-INPUT NOR |
| U2306 | 5109522E99 | IC,AND,,TC7S08FU,,,SSOP5,,SNGL |
| U2307 | 5102836C11 | IC,ANLG SW,,FSA4157,SM,,,,SPDT,,PB |
| U2308 | 5102836C11 | IC,ANLG SW,,FSA4157,SM,,,,SPDT,,PB |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| U2309 | 5102836C11 | IC,ANLG SW,,FSA4157,SM,,,,SPDT,,PB |
| U2310 | 5105492X02 | IC SNG HI SPD L-MOSNOR GATE |
| U2311 | 5187904J03 | IC TPS3808 |
| U3100 | 5105109Z31 | IC QUAD 2:1 MUX/DEMUX |
| U3101 | 5115810H01 | CURRENT-LIMITED ANALOG SWITCH |
| U3102 | 5114000B34 | IC,NAND,,,1PER PKG,,SOT-353,,PB-FRE |
| U3103 | 5114000B39 | IC 1 GATE 2-INPUT NOR |
| U3104 | 5114000B39 | IC 1 GATE 2-INPUT NOR |
| U3105 | 5114000B39 | IC 1 GATE 2-INPUT NOR |
| U3200 | 5185941F22 | IC,OPAMP,SGL,OPA237,SOT23,NOPB |
| U3201 | 5102836C11 | IC,ANLG SW,,FSA4157,SM,,,,SPDT,,PB |
| U3202 | 5115007H01 | IC,XCVR,,,,,,,DSBGA |
| U3203 | 5114000B39 | IC 1 GATE 2-INPUT NOR |
| U3204 | 5115007H01 | IC,XCVR,,,,,,,DSBGA |
| U3205 | 5115007H01 | IC,XCVR,,,,,,,DSBGA |
| U3206 | 5102836C11 | IC,ANLG SW,,FSA4157,SM,,,,SPDT,,PB |
| U4201 | 5116068H01 | 8-BIT ADC 1MSPS LEAD FREE |
| VR2200 | 4813977M11 | DIODE 5.6V ZENER _5232_ |
| VR2201 | 4813977M19 | DIODE,ZEN,,,SOT-23,10V,,,.225W,,PB- |
| VR2202 | 4813979C17 | DIODE,SUPR,,SM,,,,32V,,AVALANCHE,PB-FREE |
| VR2300 | 4813977M04 | 3V ZENER DIODE |
| VR3200 | 4866544A01 | DIODE ARRAY,ZEN,SR05.TCT,SM,,,5V,,, |
| VR3201 | 4813979P10 | TRANS SUP 5.6V QUAD |
| VR3202 | 4813979C11 | TRAN SUP QUAD 20V SC59 |
| VR3203 | 4813979P10 | TRANS SUP 5.6V QUAD |
| VR4100 | 4815821H01 | ZENER VOLTAGE REGULATOR 2.4V 200MW |
| Y1000 | 4809995L05 | XTAL QUARTZ 32.768KHZ CC4V-T1 |
| Y1001 | 4809612J45 | FLTR,XTAL,12MHZMAX,SM |

## 7.3 HUD4025B (VHF) Main Board

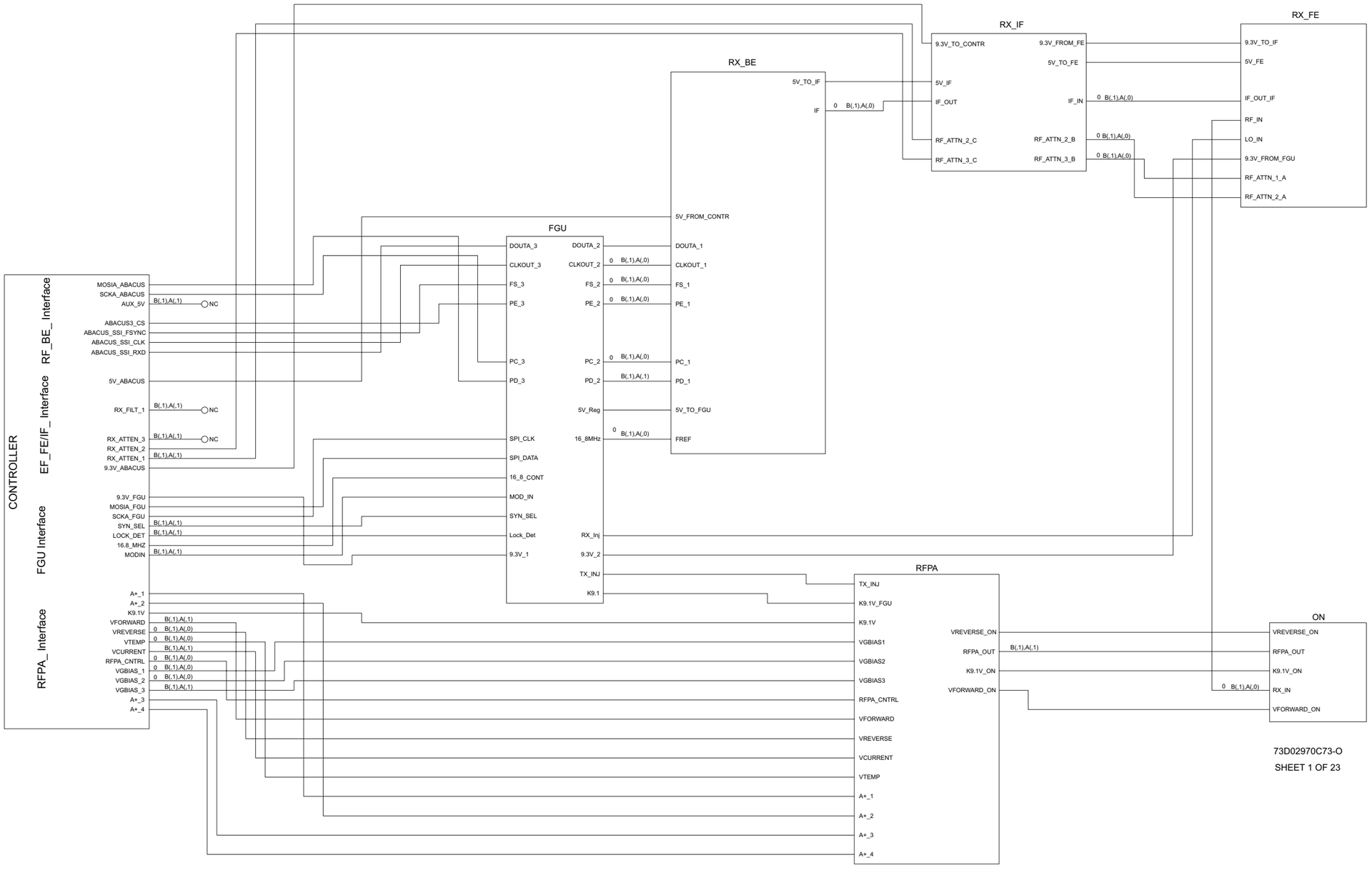



*Figure 7-15. HUD4025B Main Board Overall Block Diagram and Interconnections*

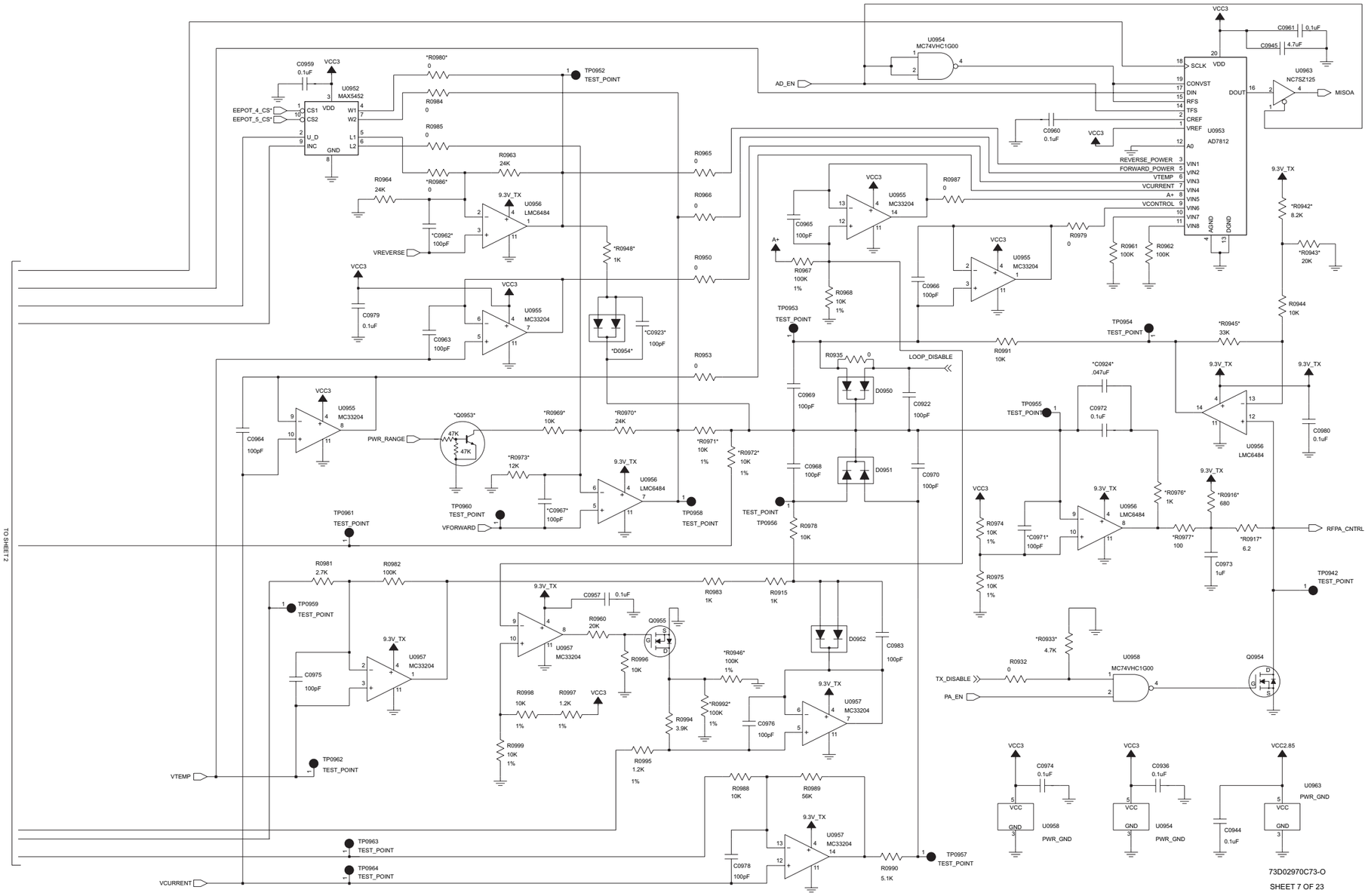



*Figure 7-16. HUD4025B Controller Power Control (Sheet 1 of 2)*

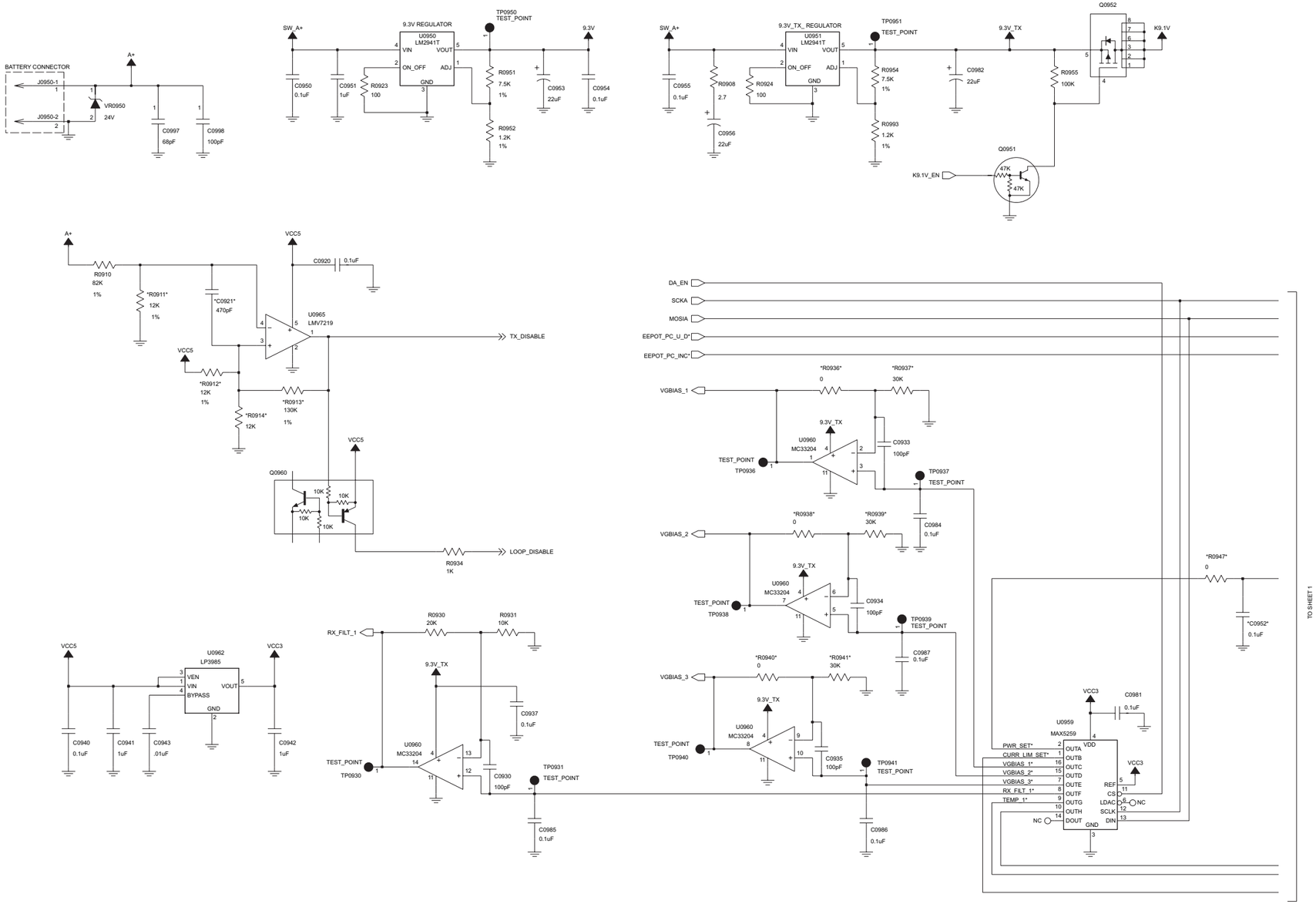



*Figure 7-17. HUD4025B Controller Power Control (Sheet 2 of 2)*

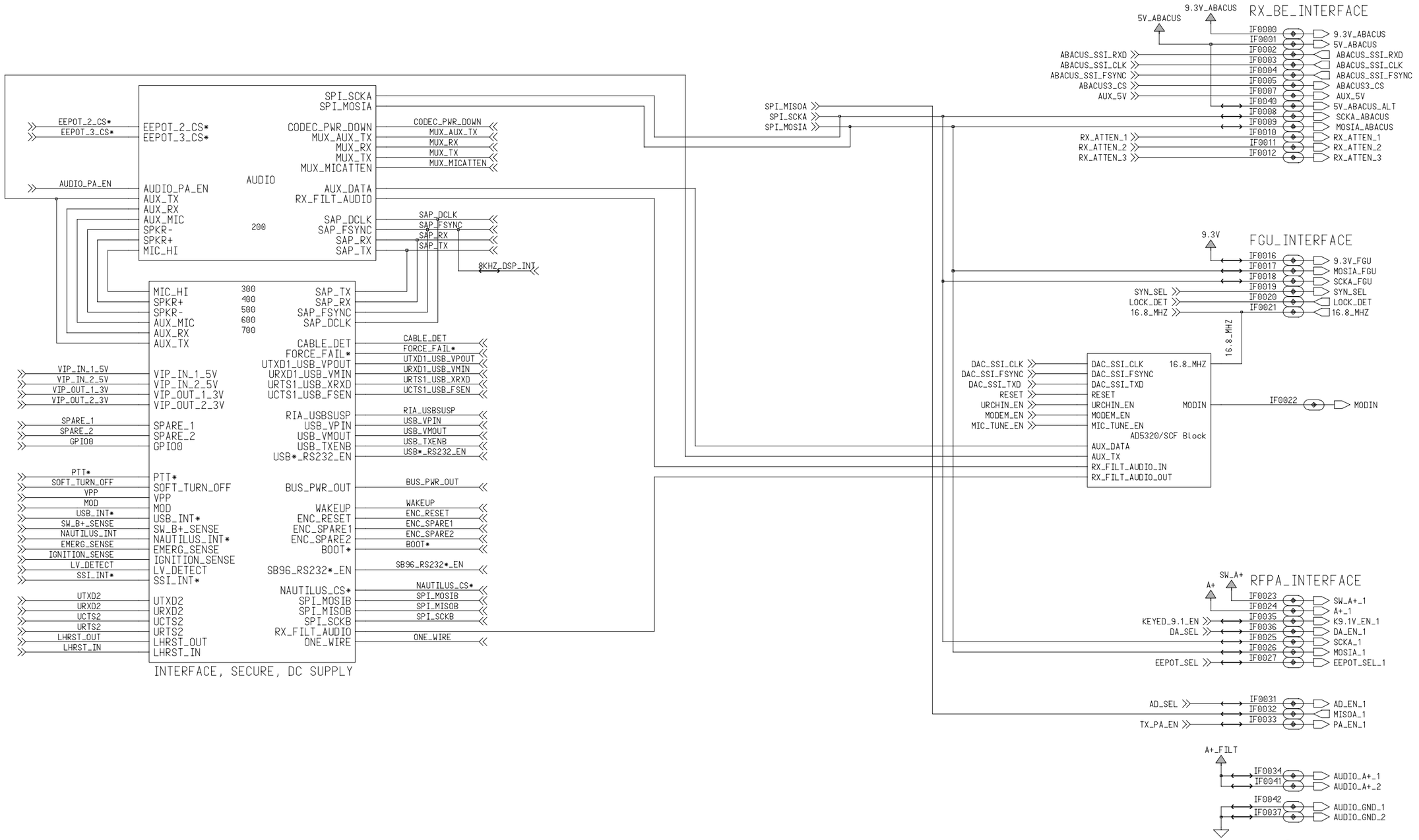



*Figure 7-18. HUD4025B/HUE4043A Controller Block Diagram)*

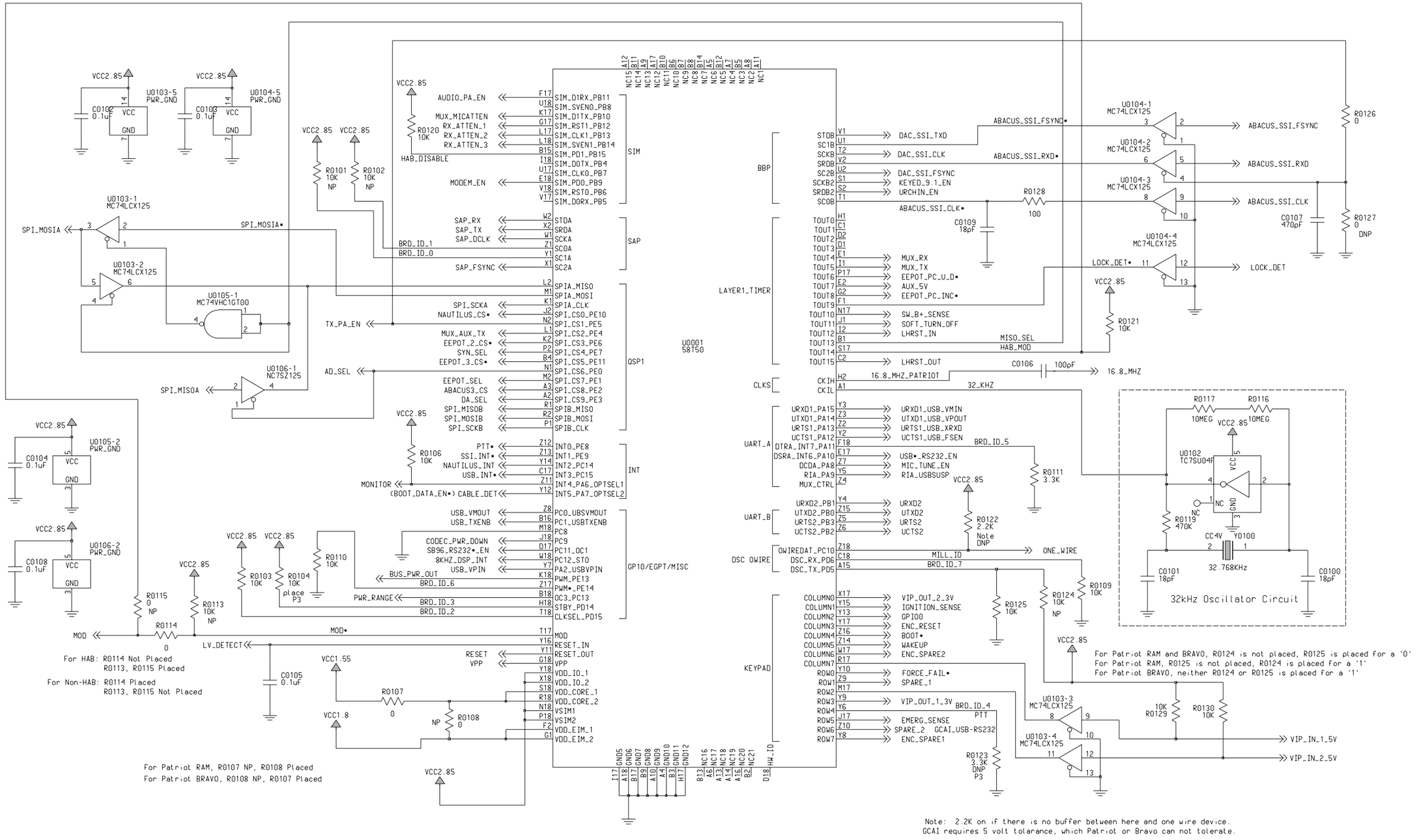



*Figure 7-19. HUD4025B/HUE4043A Controller Daughter Board Interface*

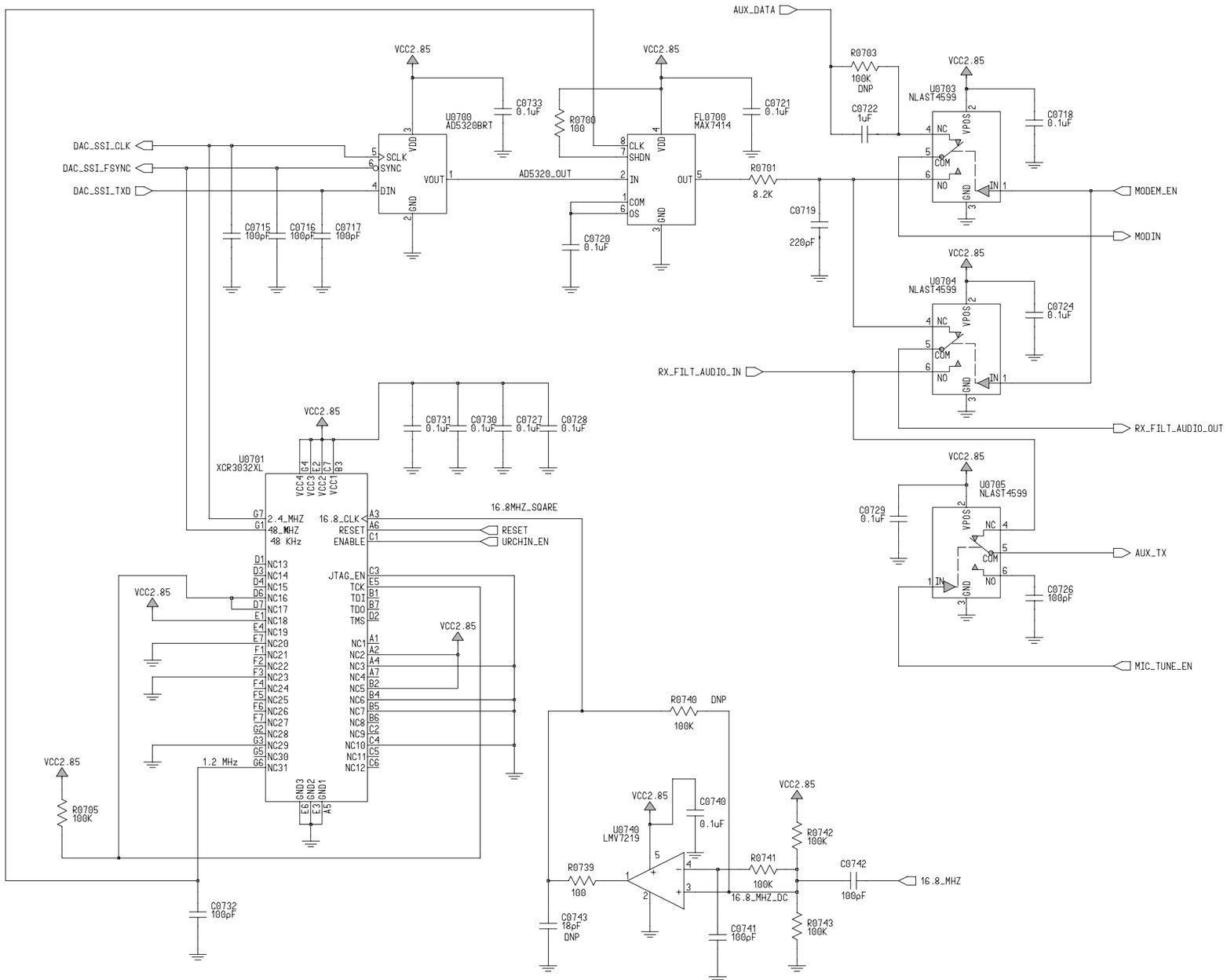



*Figure 7-20. HUD4025B/HUE4043A Controller Urchin IC, MUX and AD5320 DAC*

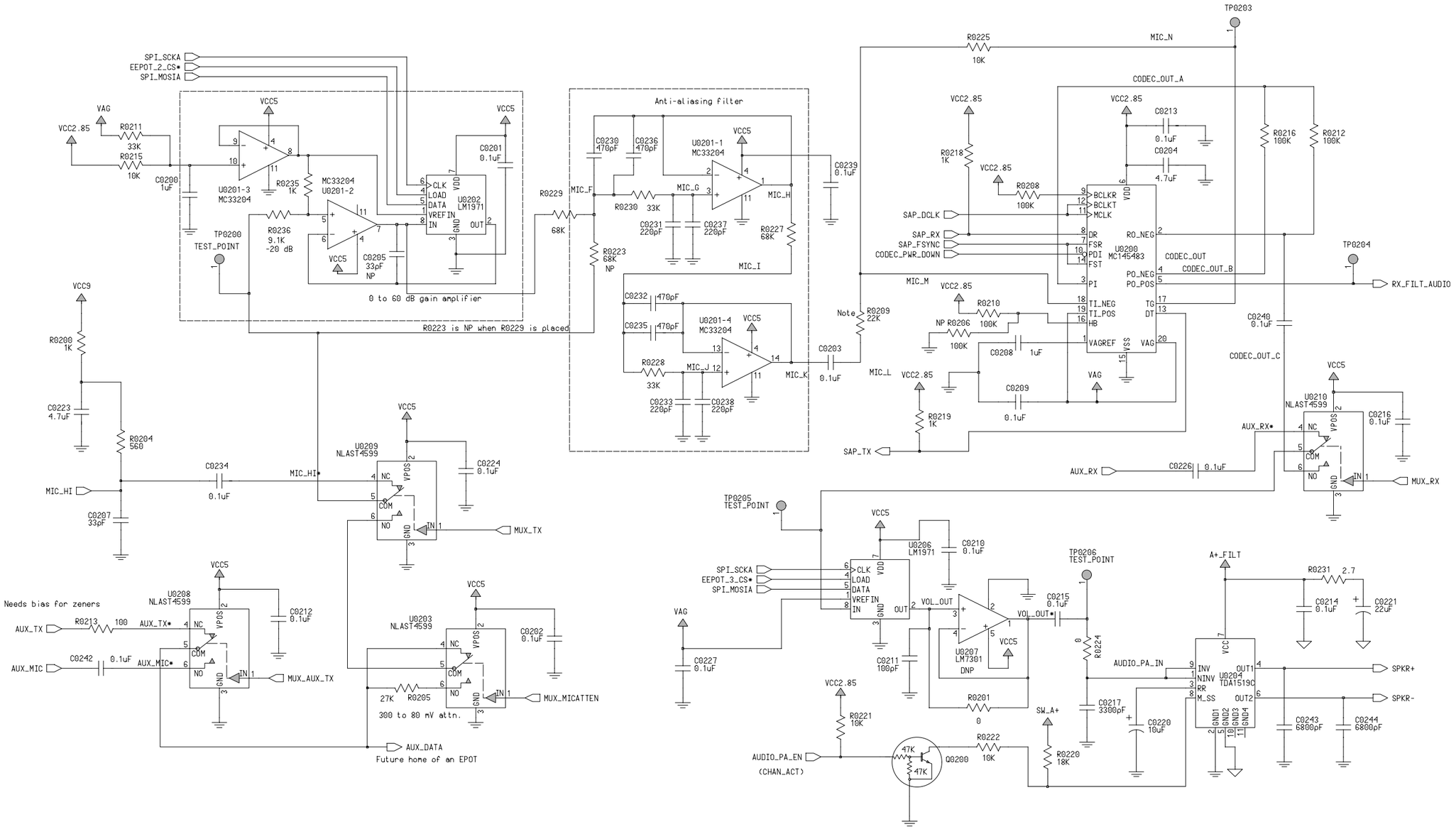



*Figure 7-21. HUD4025B/HUE4043A Controller Audio*

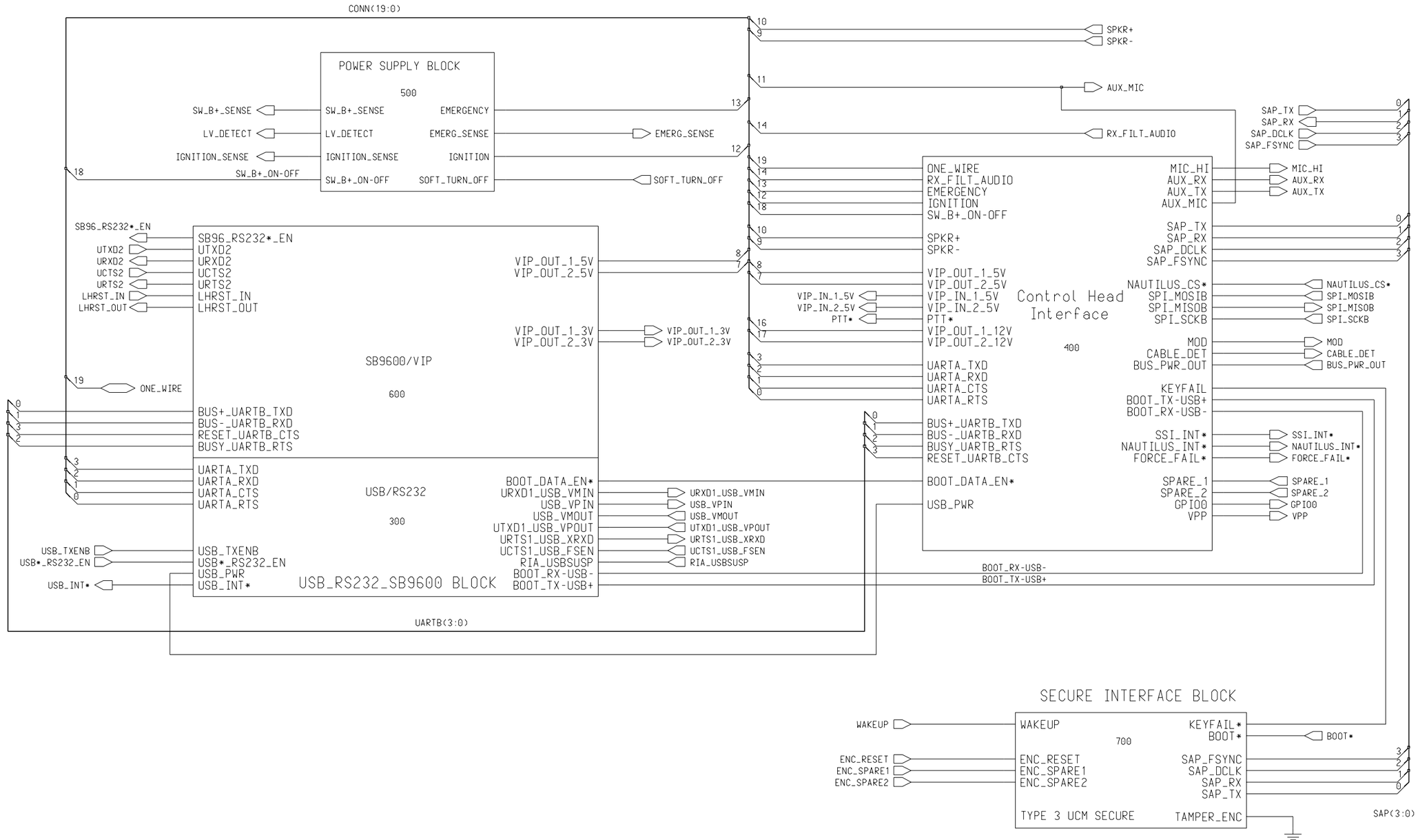



*Figure 7-22. HUD4025B/HUE4043A Controller Interface, Secure and Power Block Diagram*

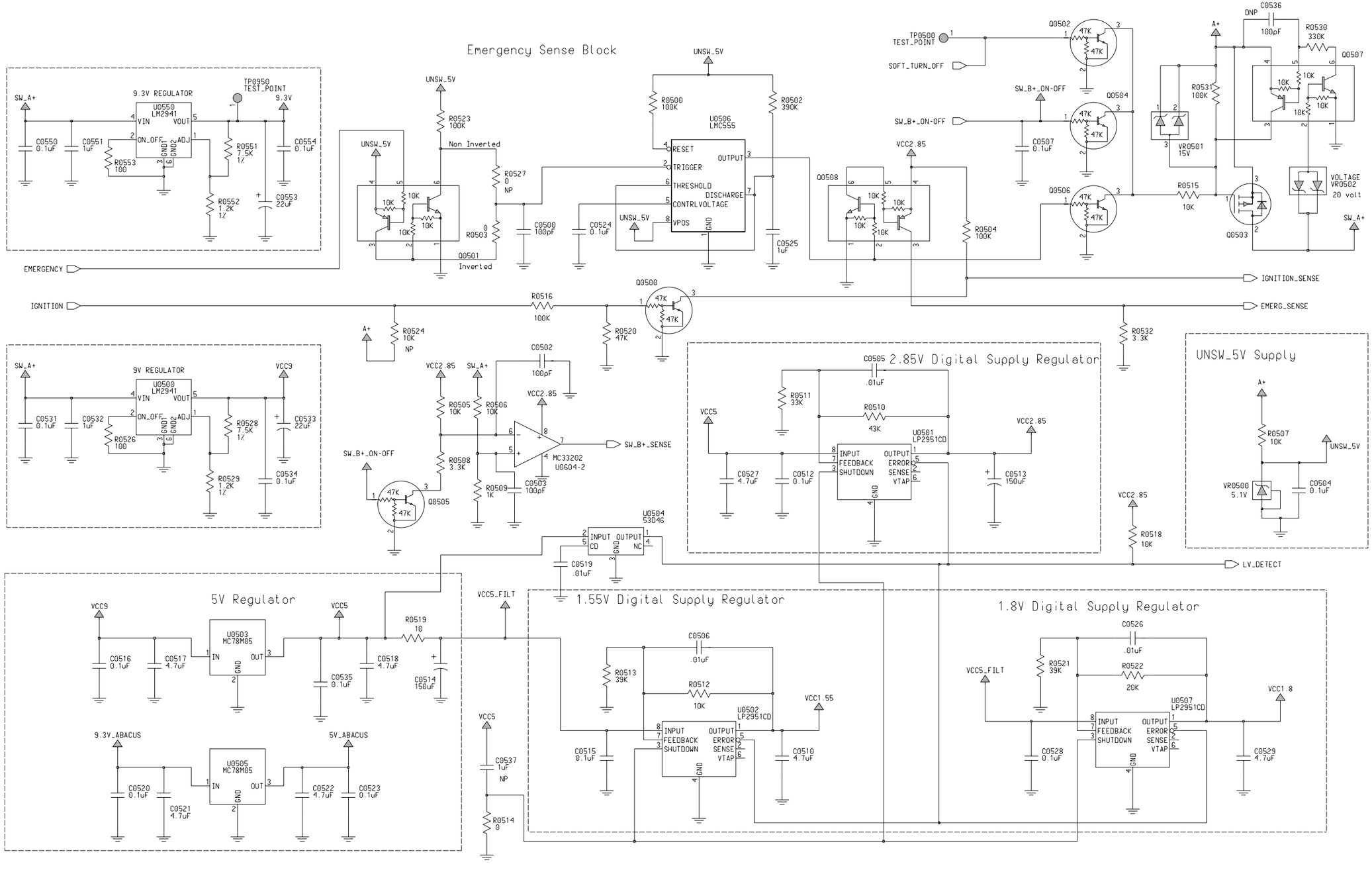
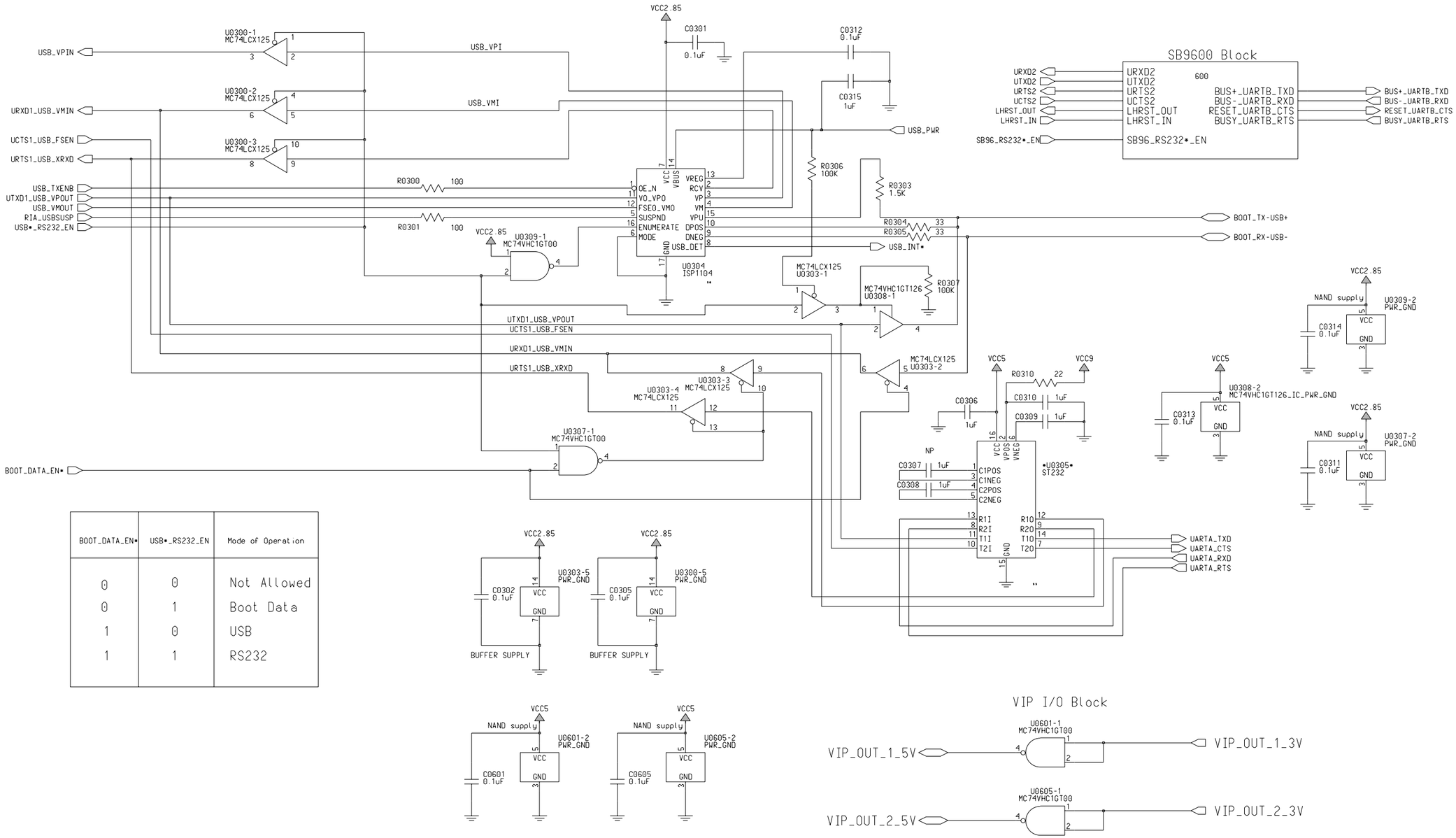



*Figure 7-23. HUD4025B/HUE4043A Controller Power Supply*




| BOOT_DATA_EN* | USB*_RS232_EN | Mode of Operation |
|---|---|---|
| 0 | 0 | Not Allowed |
| 0 | 1 | Boot Data |
| 1 | 0 | USB |
| 1 | 1 | RS232 |

*Figure 7-24. HUD4025B/HUE4043A USB/RS232 Interface*

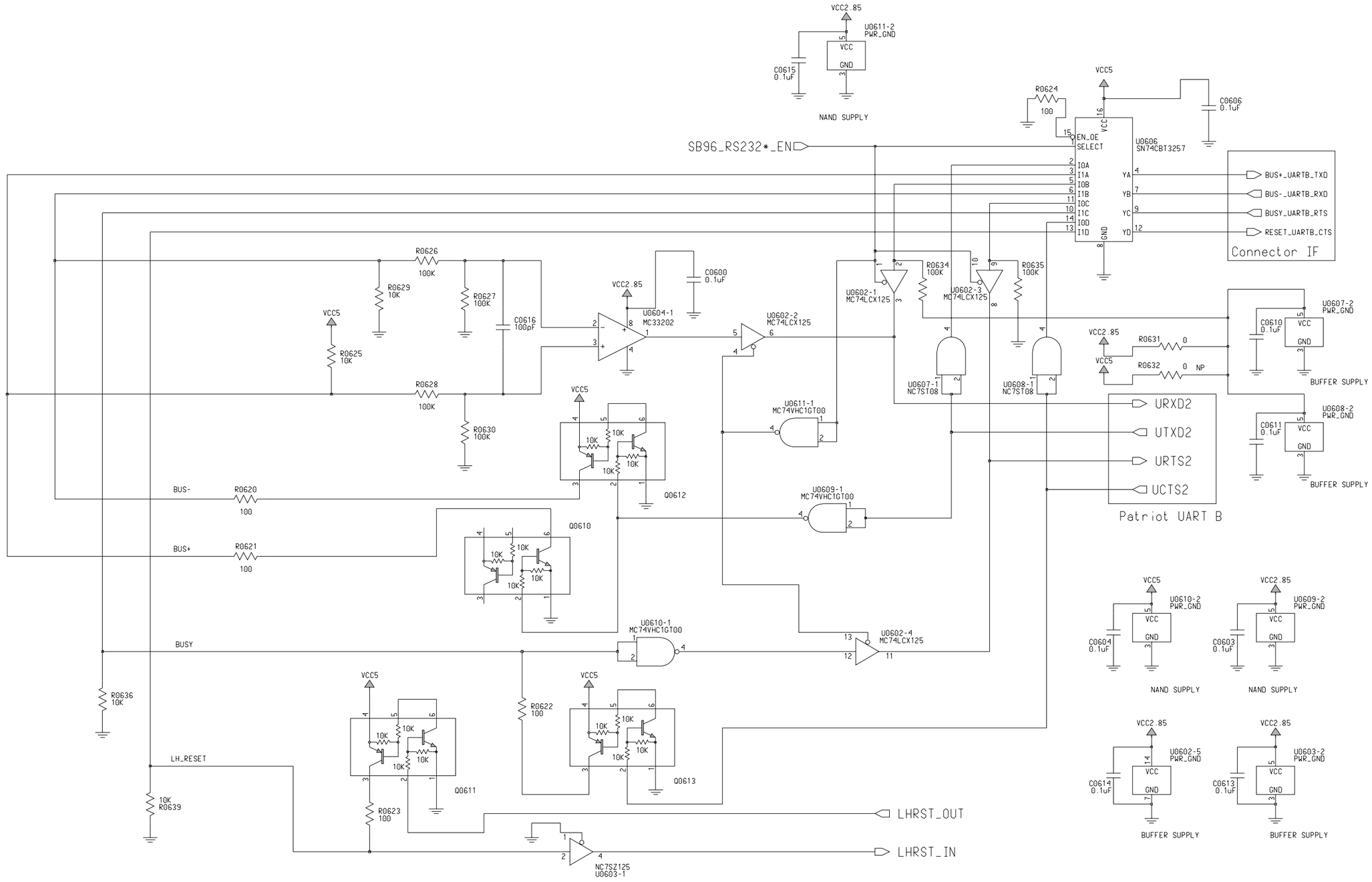



*Figure 7-25. HUD4025B/HUE4043A SB9600*

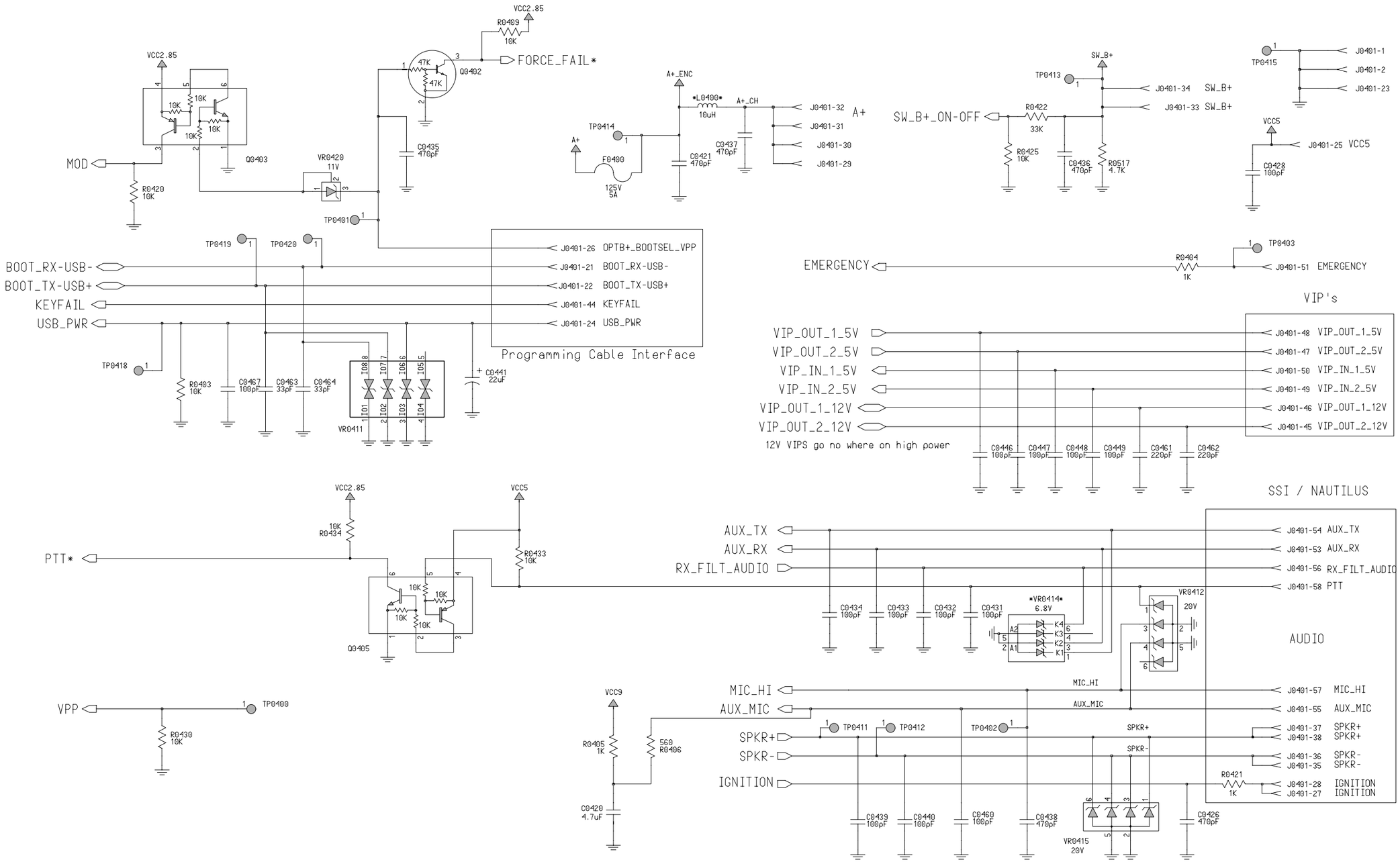



*Figure 7-26. HUD4025B/HUE4043A Control Head Connector 1 of 2*

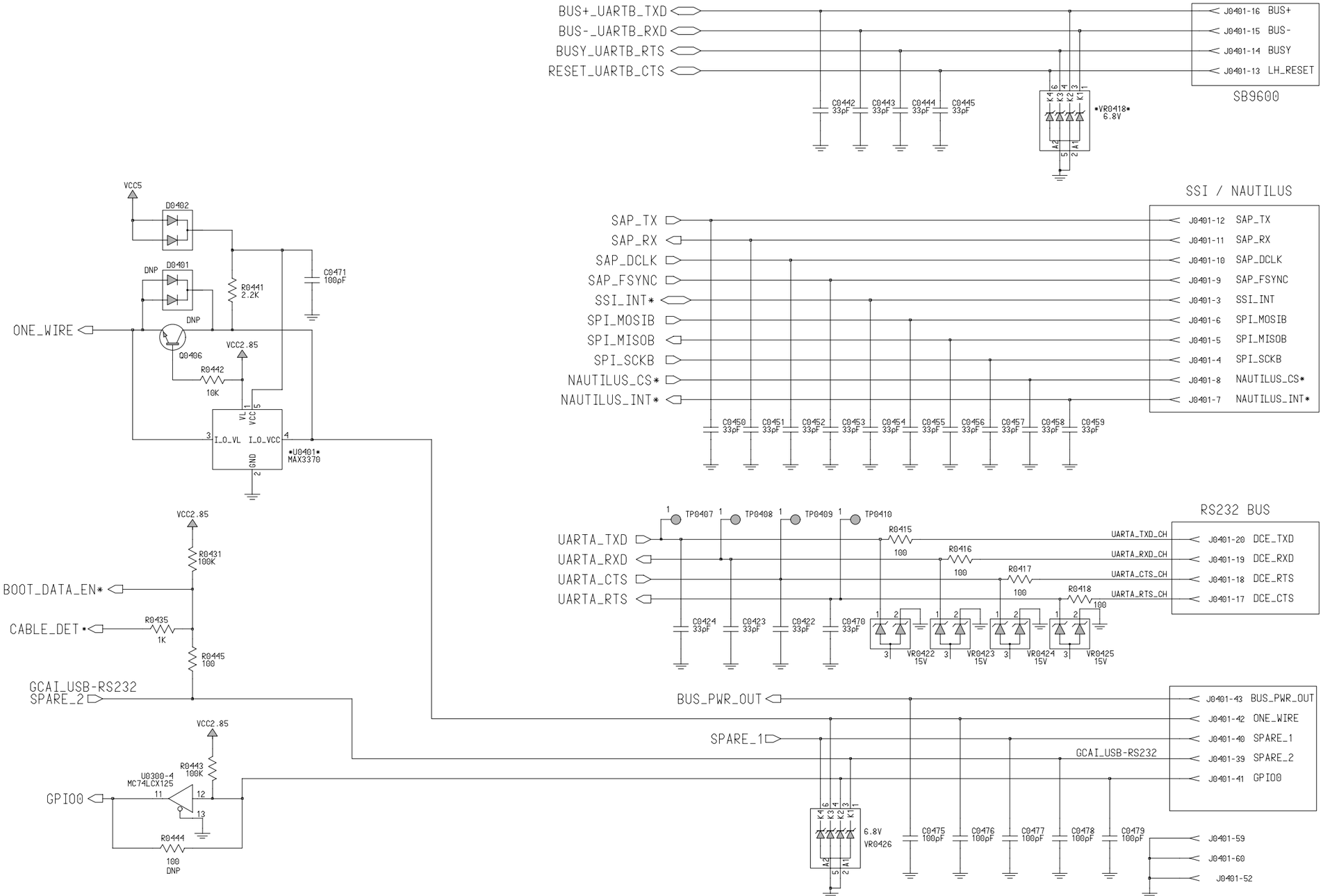



*Figure 7-27. HUD4025B/HUE4043A Control Head Connector 2 of 2*

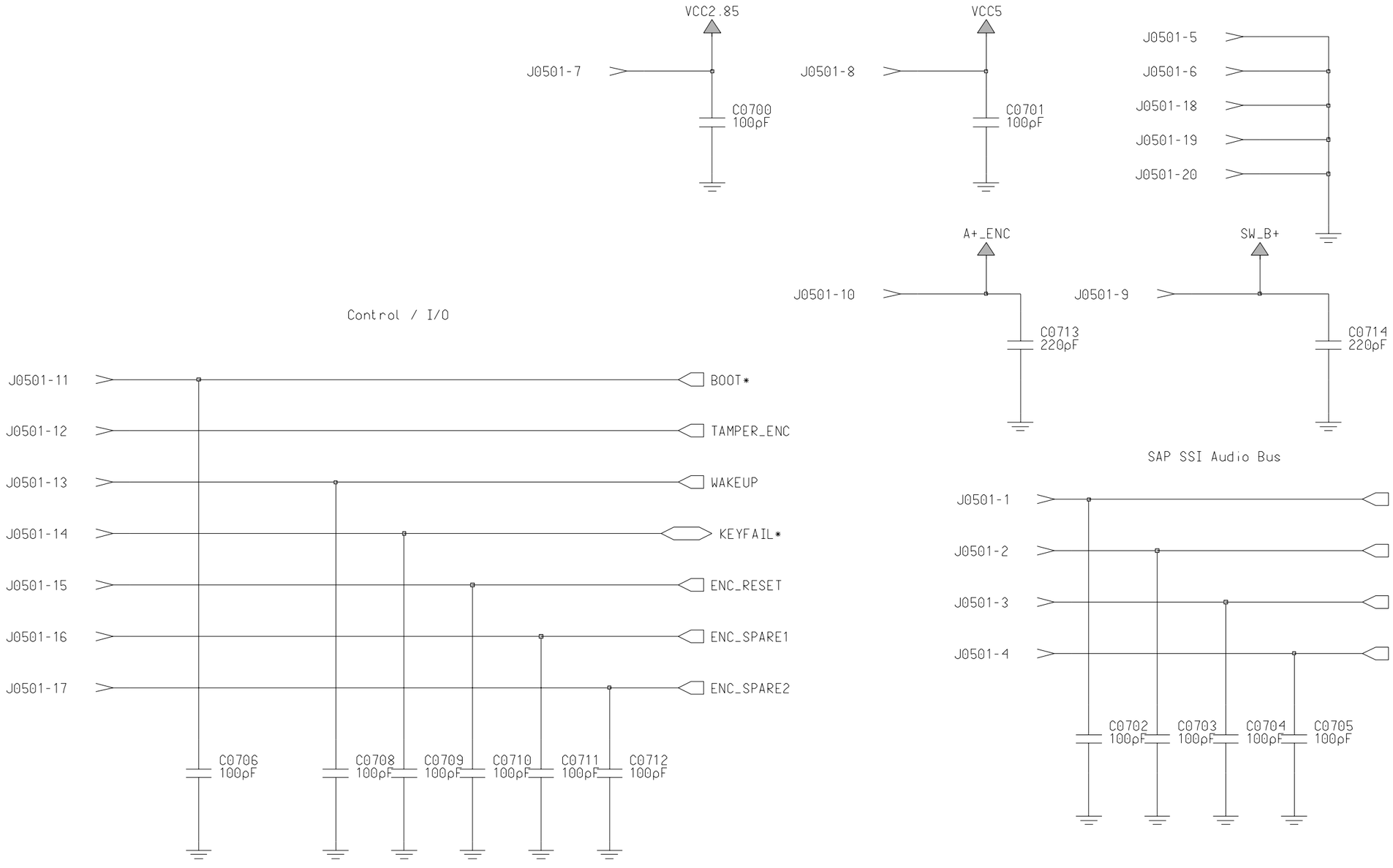



*Figure 7-28. HUD4025B/HUE4043A Secure Interface Connector Schematic*

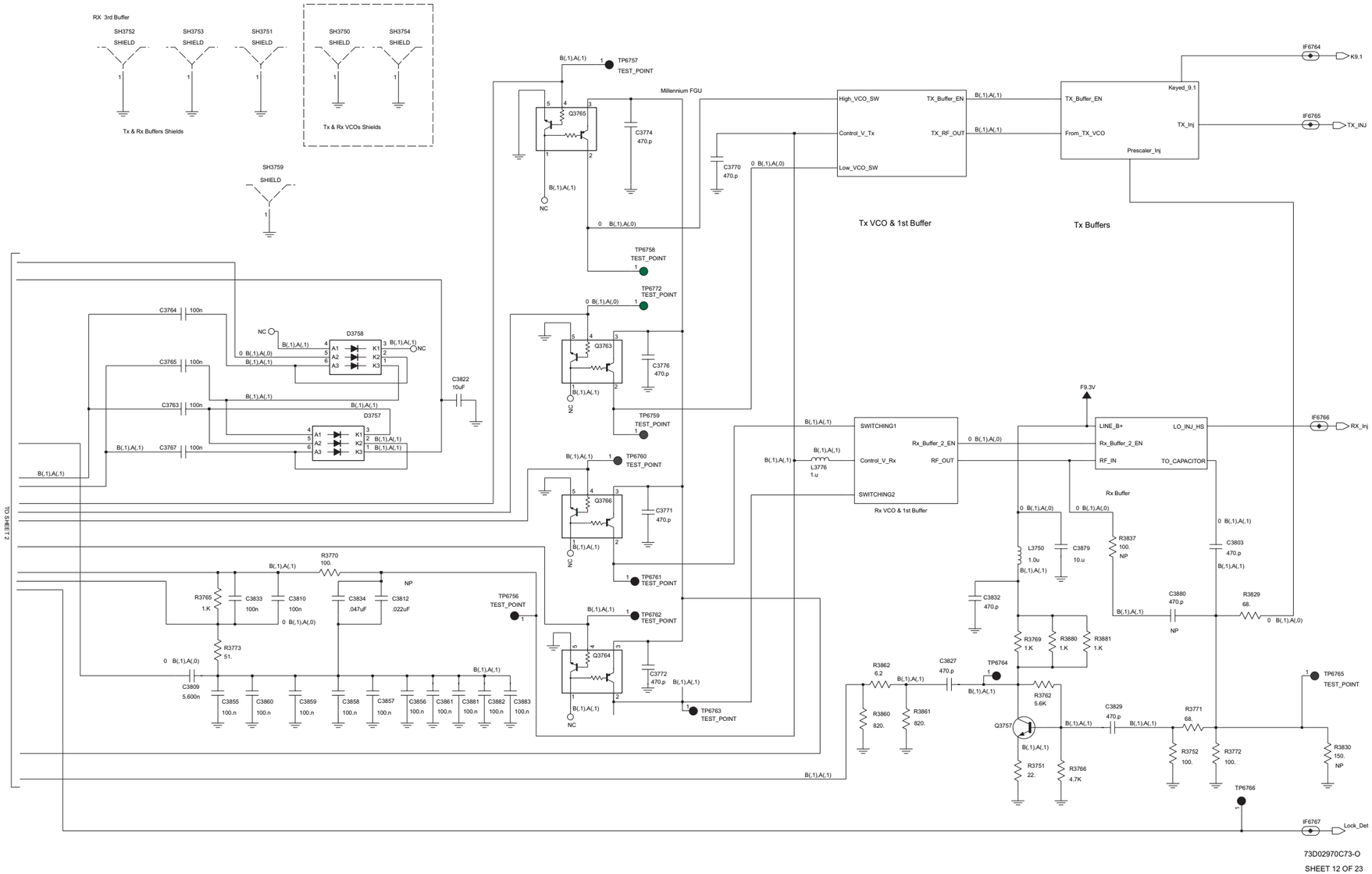



*Figure 7-29. HUD4025B Frequency Generation Unit Overall Schematic (Sheet 1 of 2)*

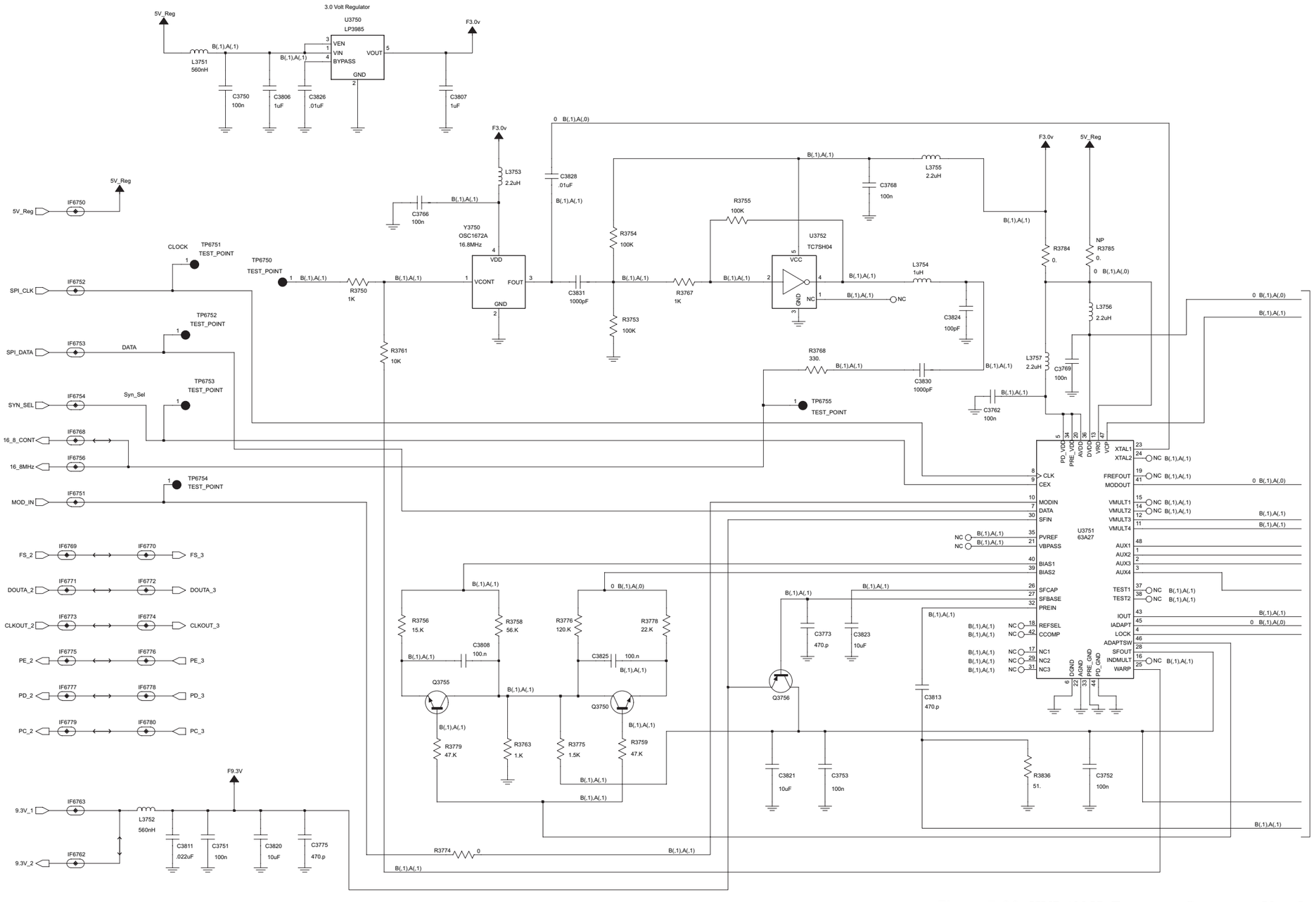



*Figure 7-30. HUD4025B Frequency Generation Unit Overall Schematic (Sheet 2 of 2)*

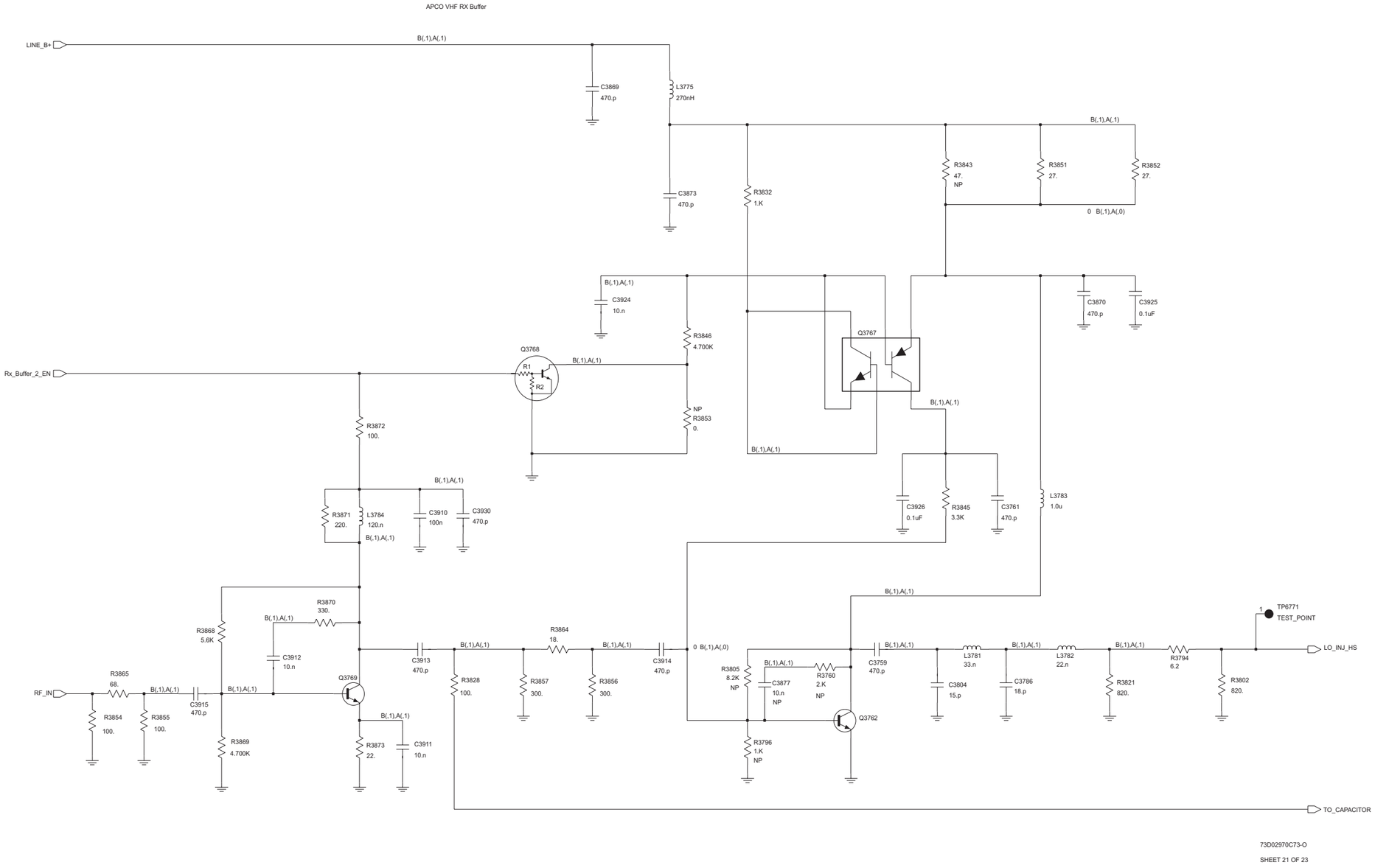



*Figure 7-31. HUD4025B Frequency Generation Unit VHF Receive Injection Schematic*

APCO VHF TX Buffers

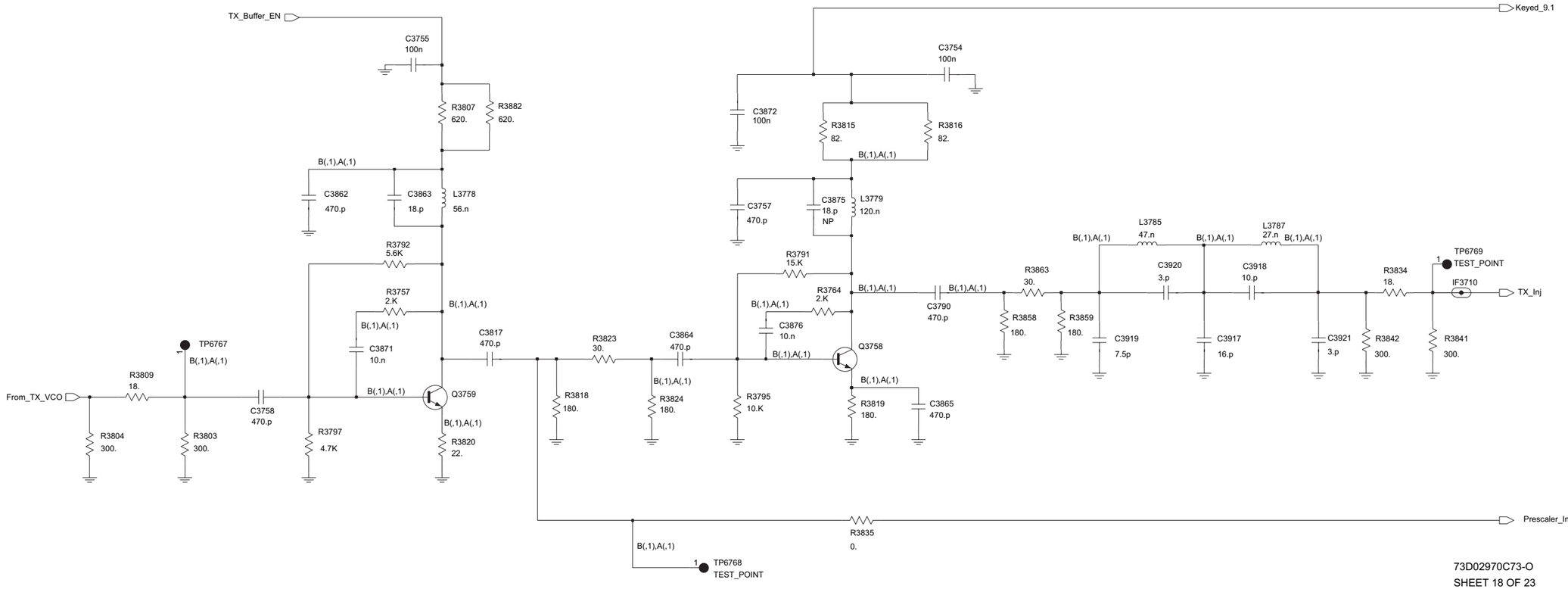



*Figure 7-32. HUD4025B Frequency Generation Unit VHF Transmit Injection Schematic*

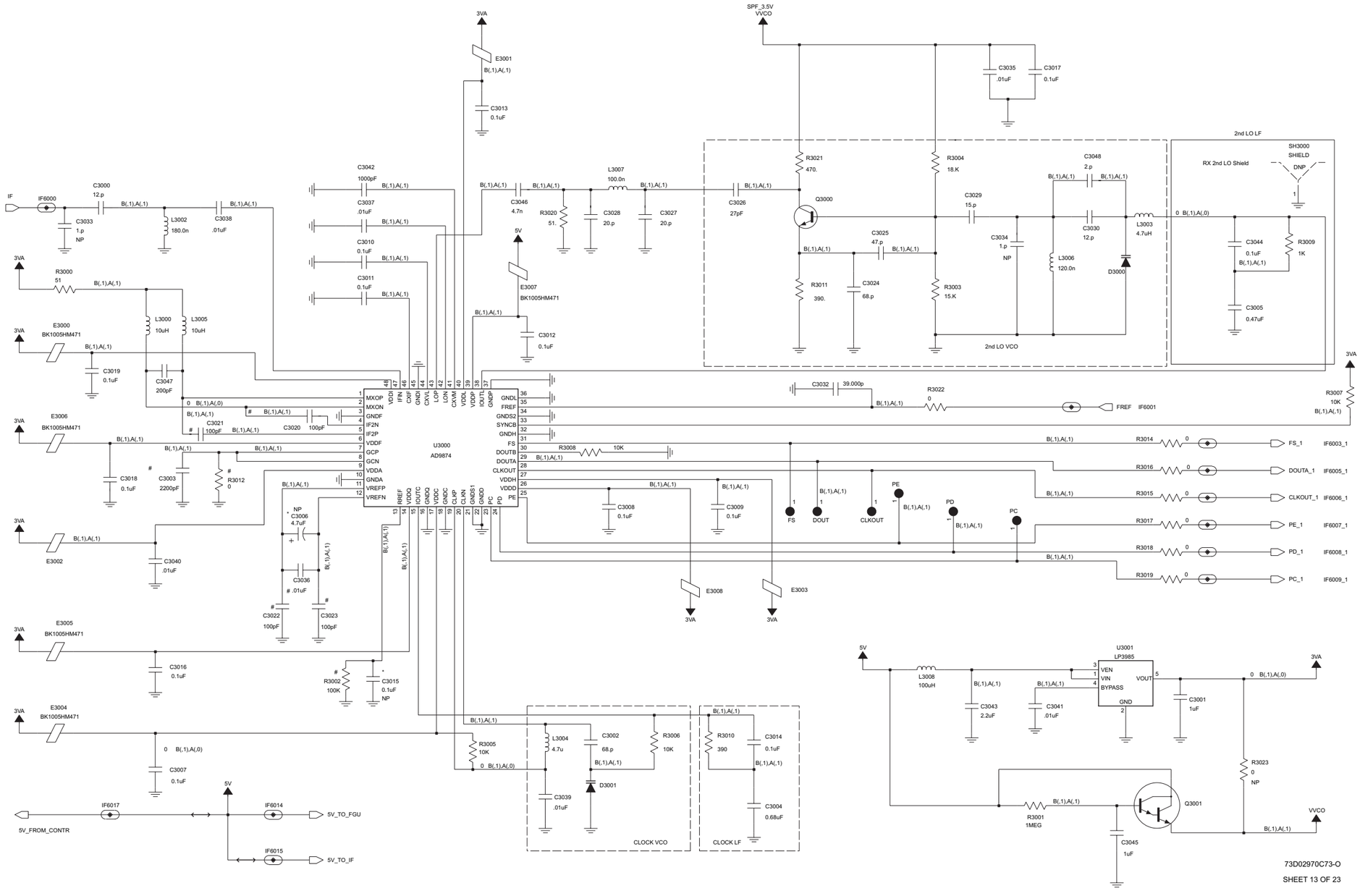



*Figure 7-33. HUD4025B Receiver Back-End Schematic*

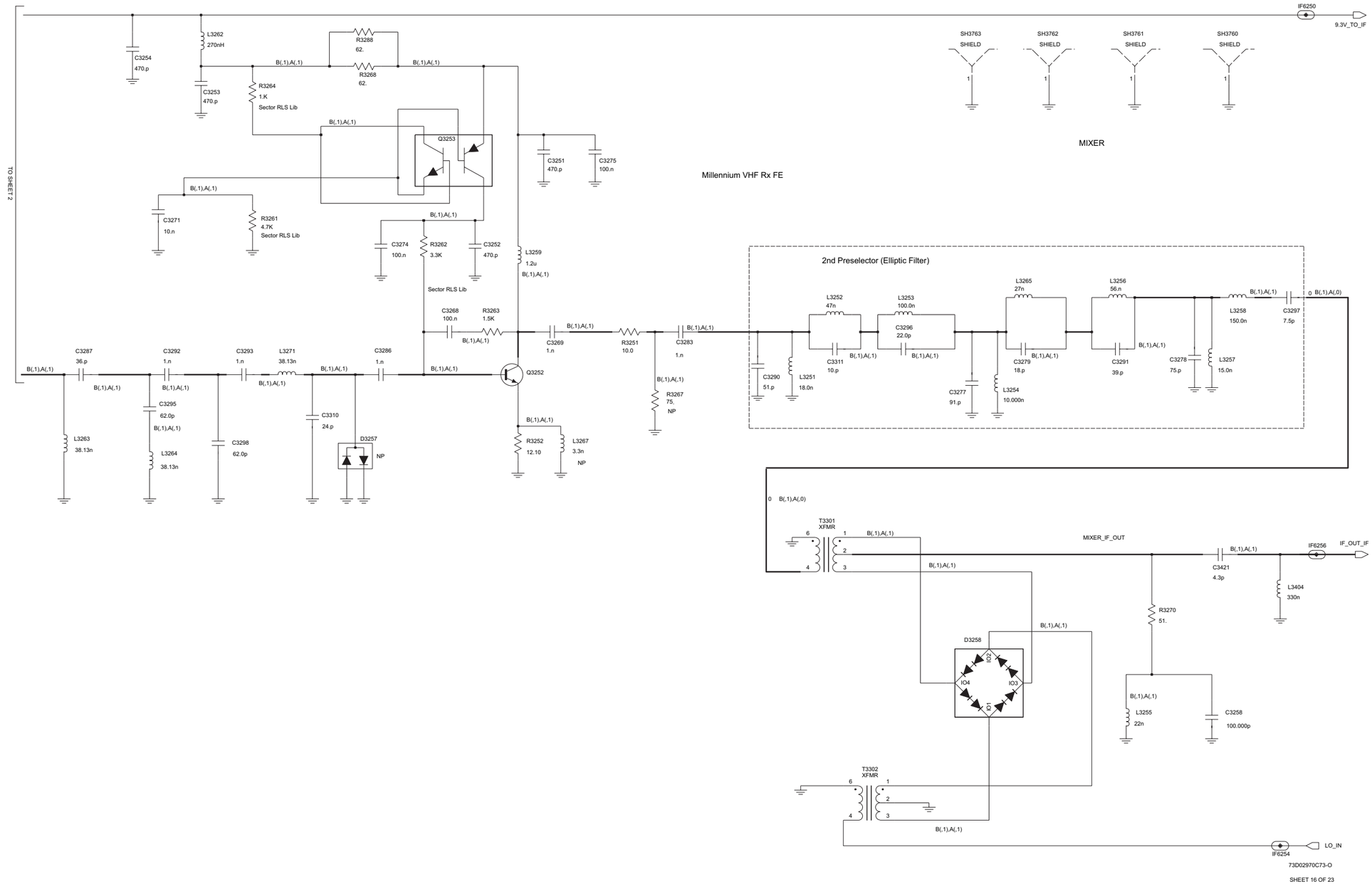



*Figure 7-34. HUD4025B Receiver Front-End Schematic (Sheet 1 of 2)*

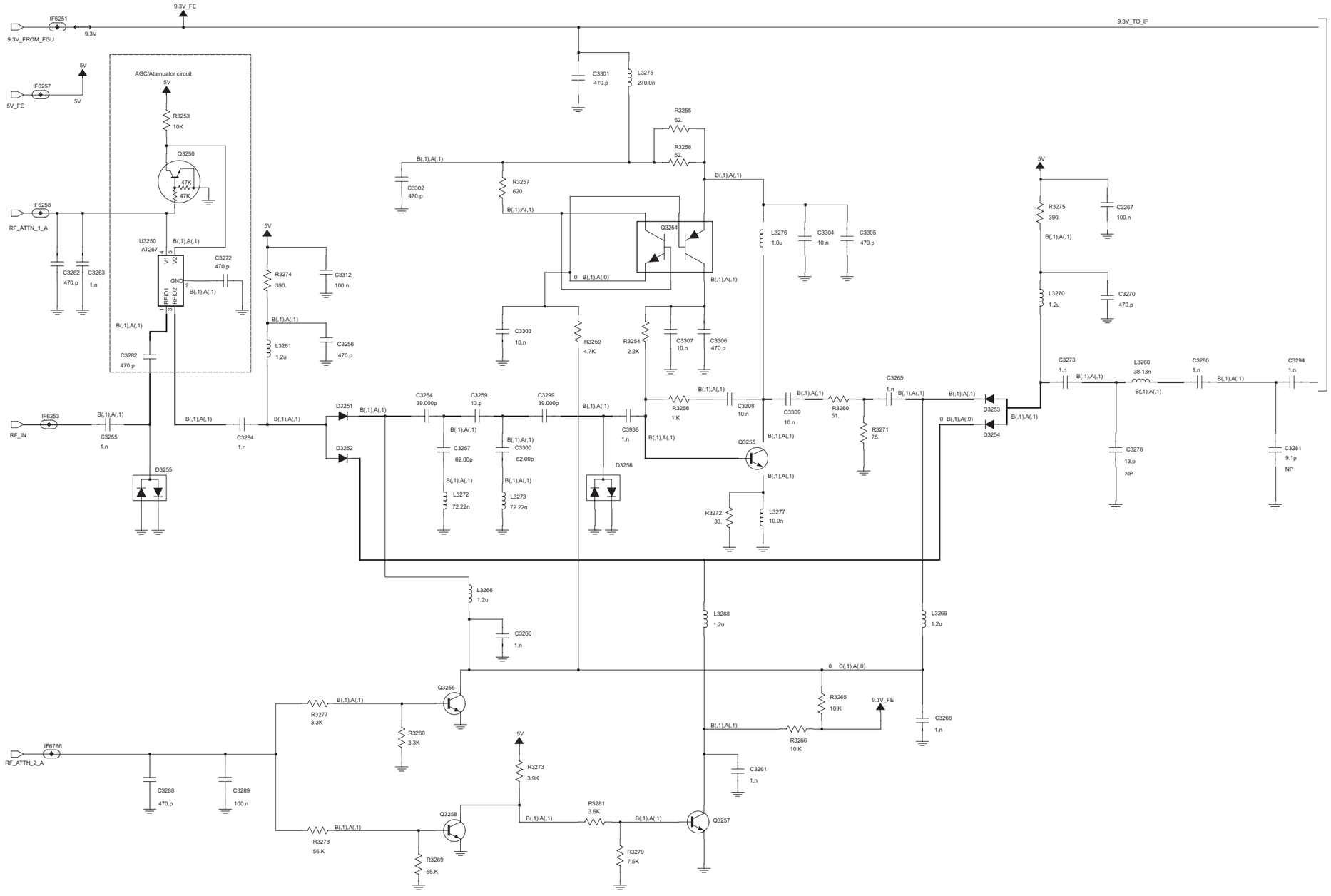



*Figure 7-35. HUD4025B Receiver Front-End Schematic (Sheet 2 of 2)*

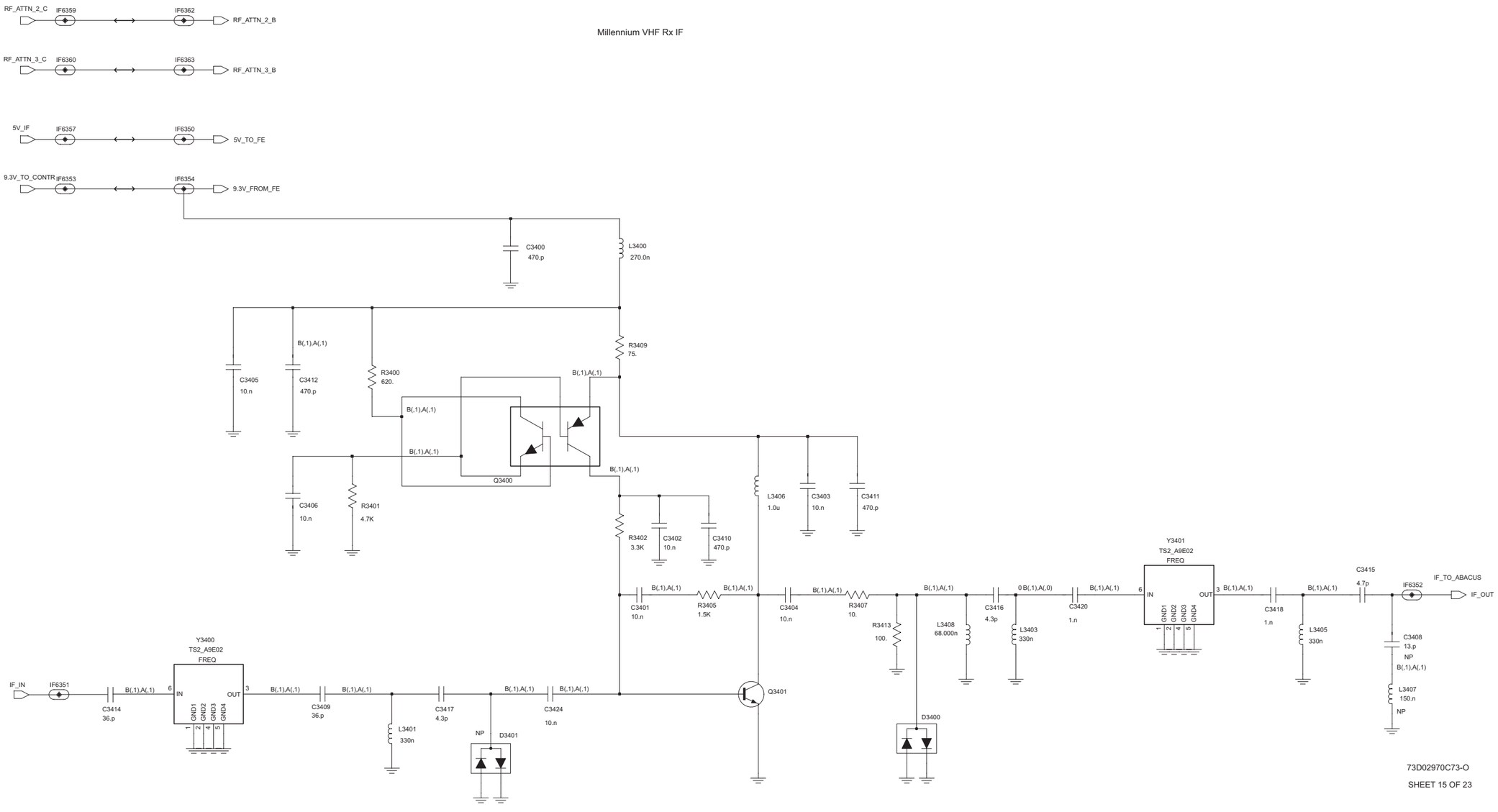



*Figure 7-36. HUD4025B Receiver IF Schematic*

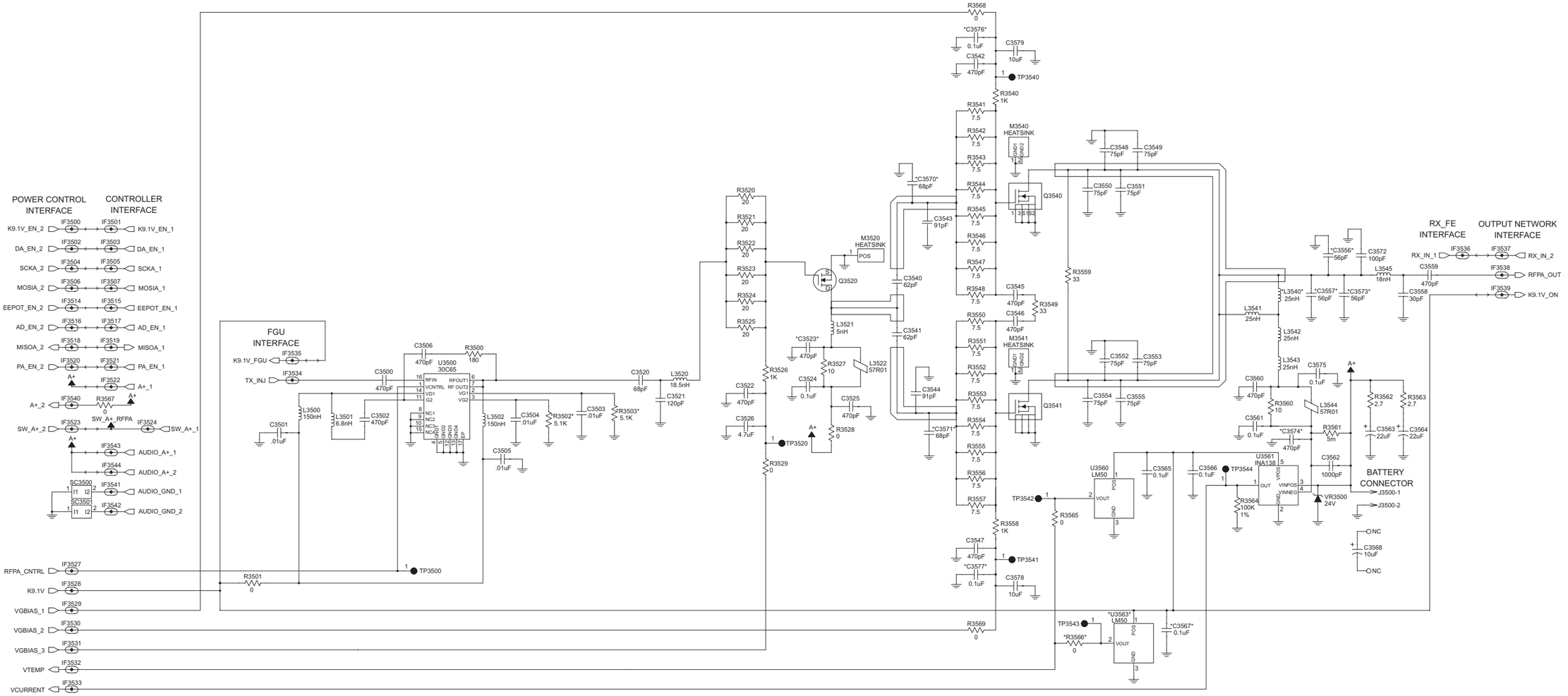



*Figure 7-37. HUD4025B RF 100W Power Amplifier (RF PA) Schematic (Sheet 1 of 2)*

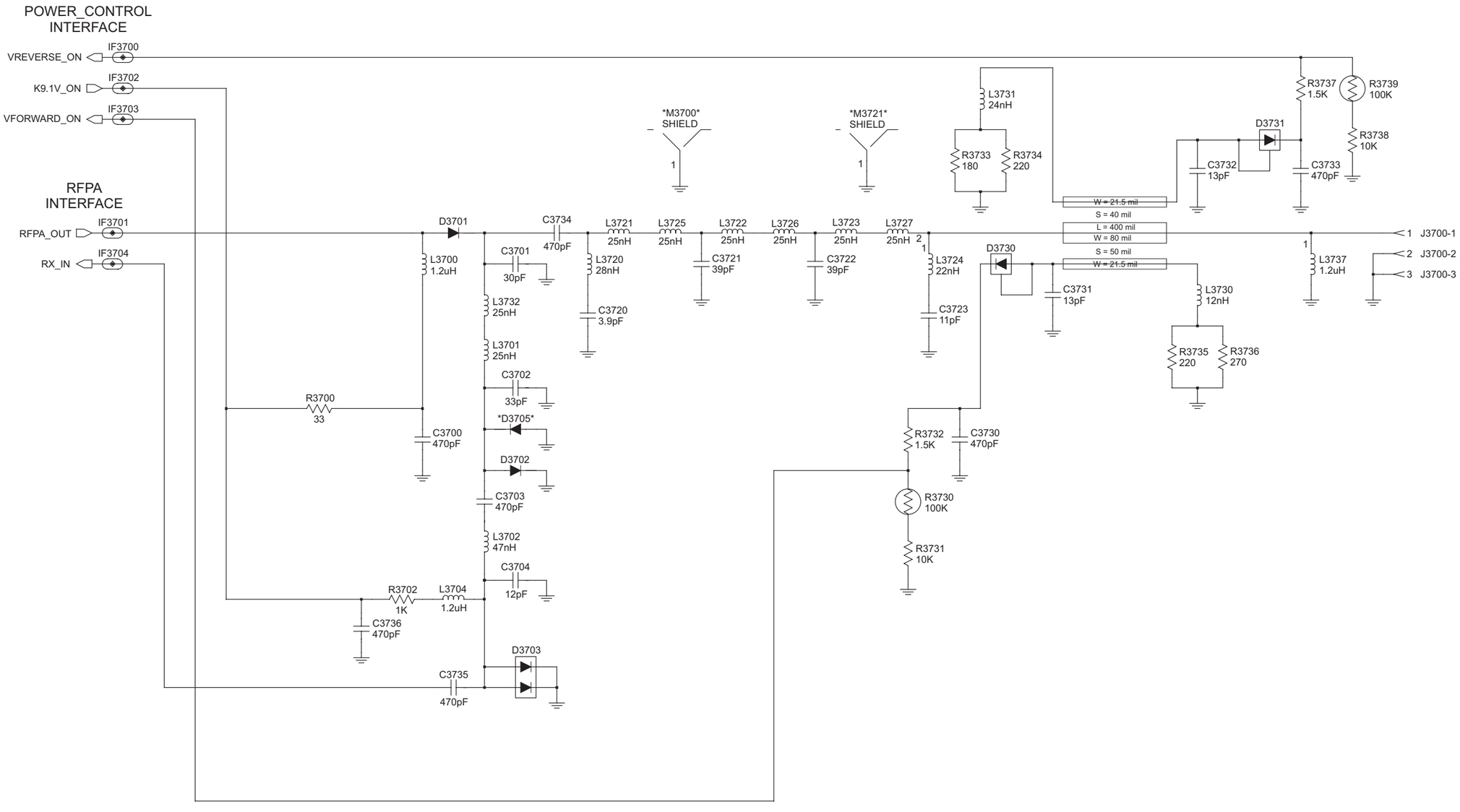
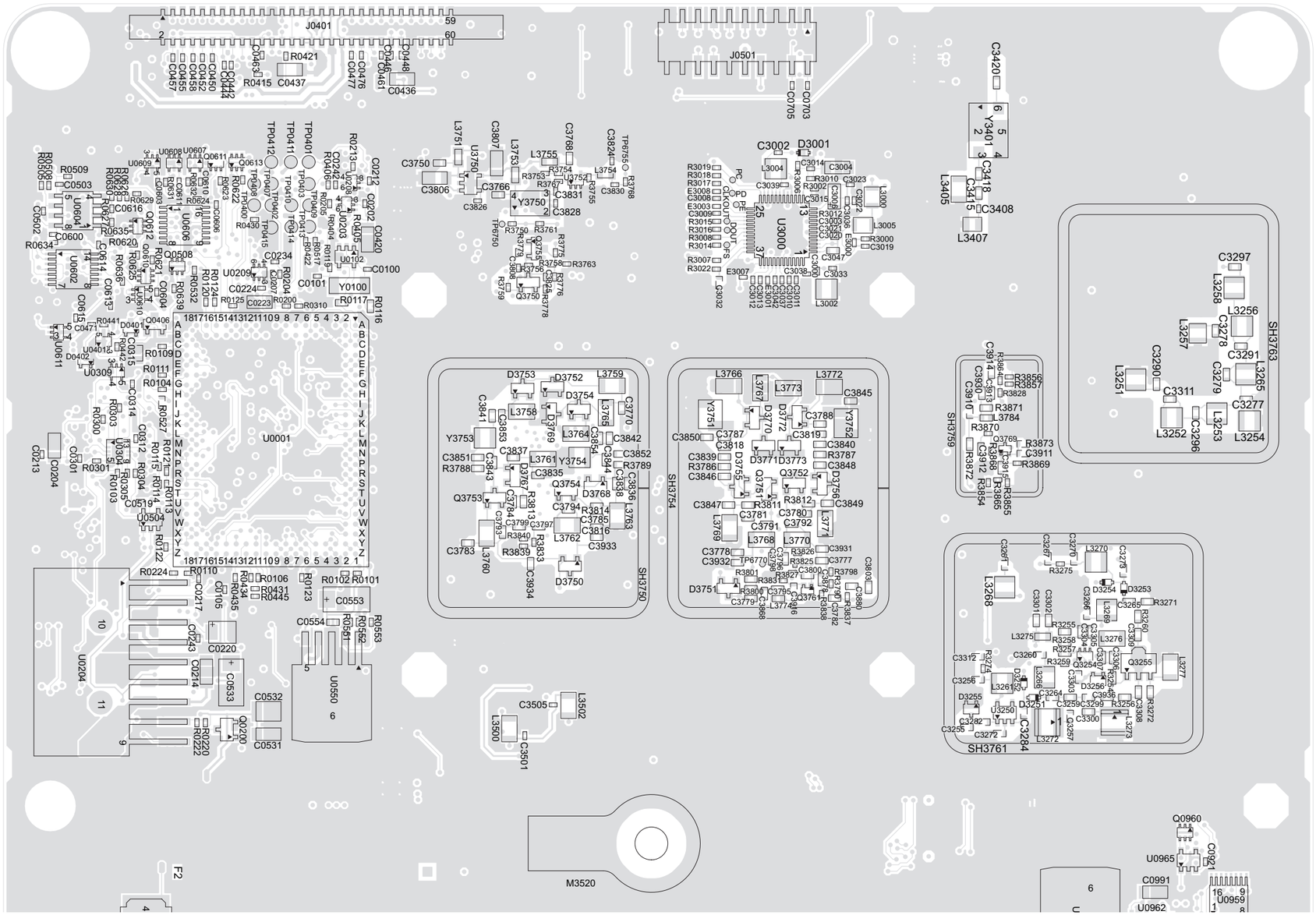



*Figure 7-38. HUD4025B RF 100W Power Amplifier (RF PA) Schematic (Sheet 2 of 2)*


J0401
J0501
U0001
U0204
U0550
U3000
SH3754
SH3750
SH3763
SH3761
M3520
Y0100
Y3401
Y3750
U0309
U0504
U0602
U0604
U0606
U0607
U0608
U0611
U0612
U0613
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U0657
U0658
U0659
U0660
U0661
U0662
U0663

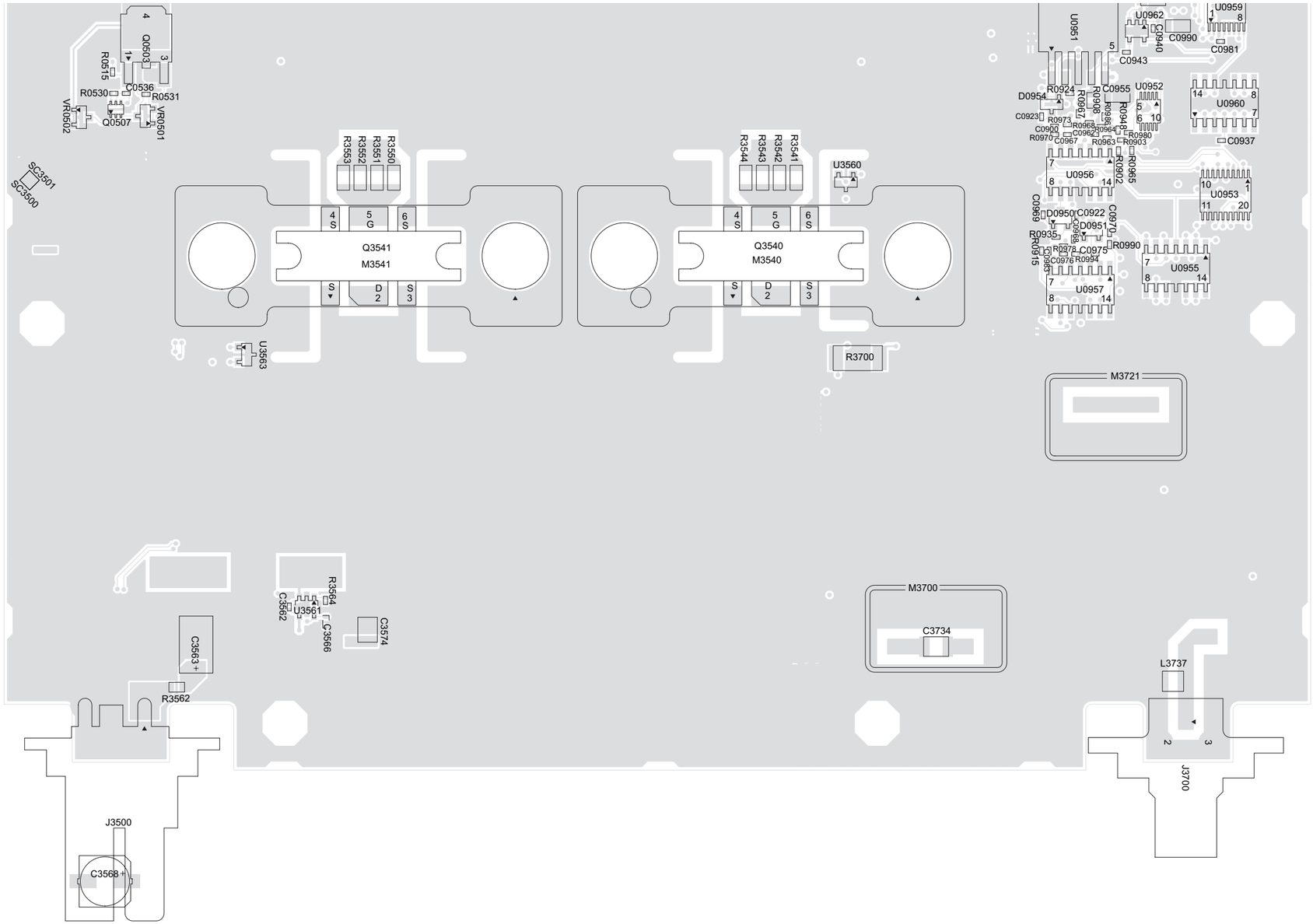



*Figure 7-40. HUD4025B Main Board Layout—Side 1 Bottom*

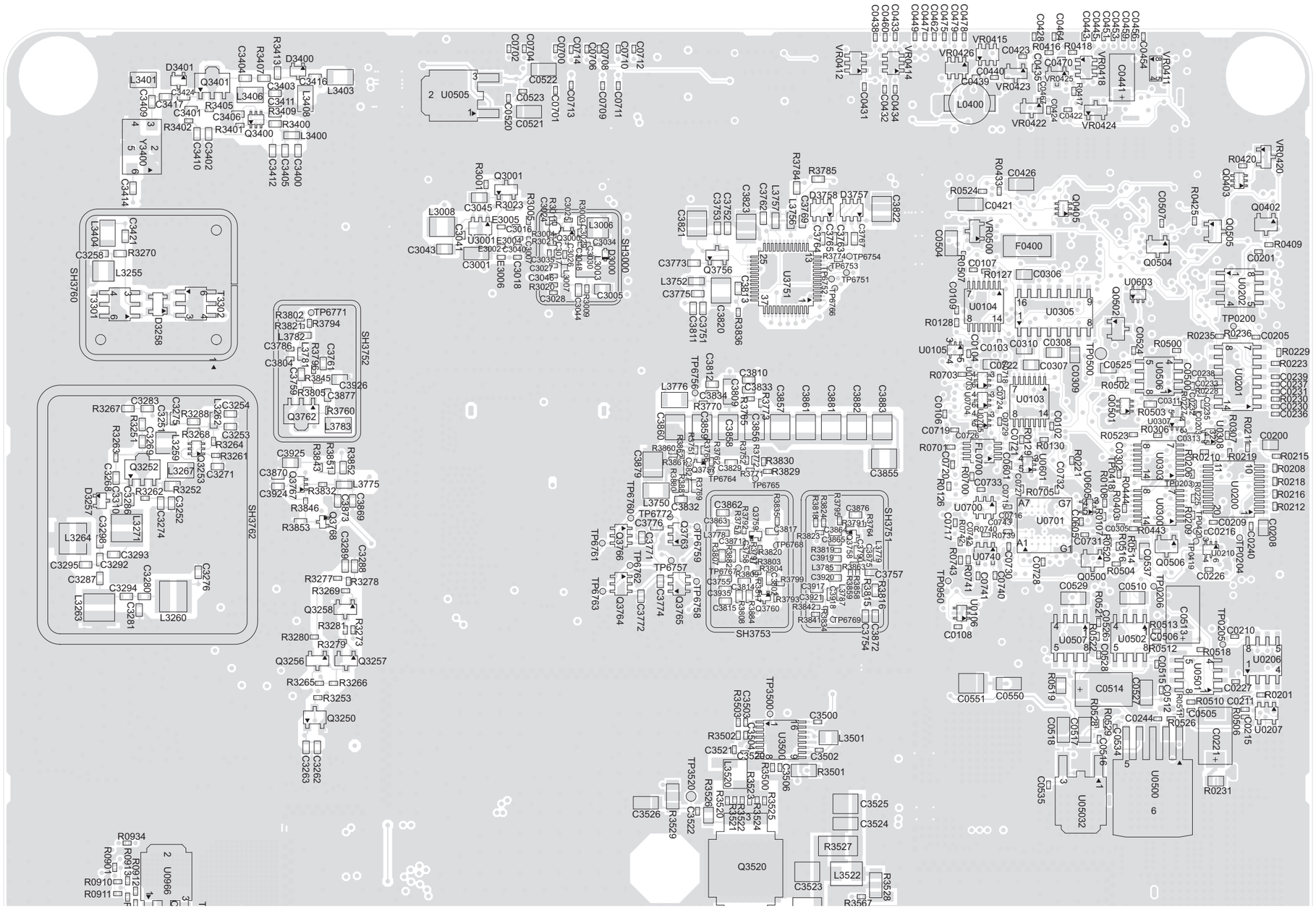


*Figure 7-41. HUD4025B Main Board Layout—Side 2 Top*

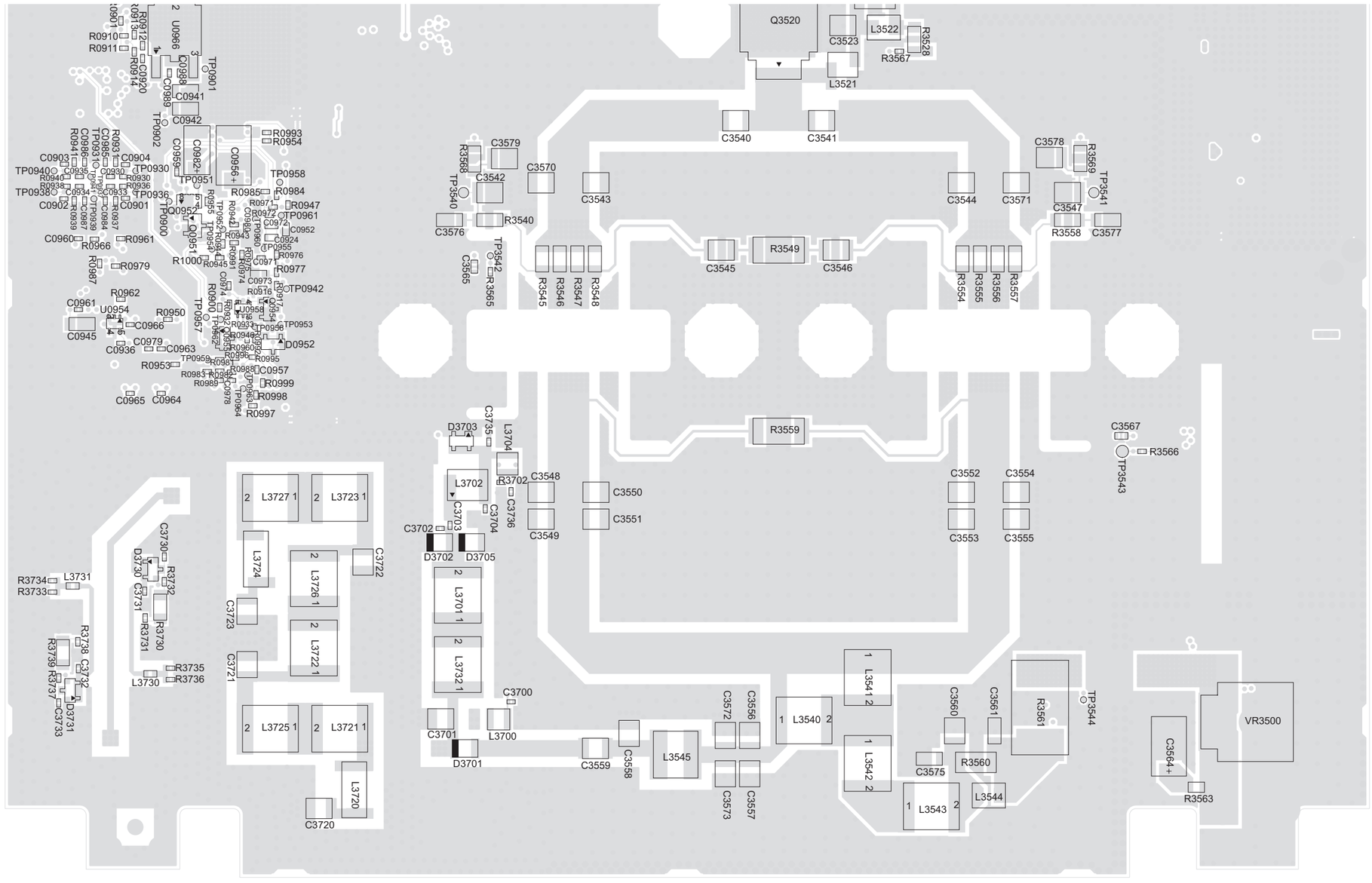



*Figure 7-42. HUD4025B Main Board Layout—Side 2 Bottom*

## HUD4025B (VHF) Main Board Parts List

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C0100 | 2113743N32 | CAP CHIP 18.0 PF 5% COG |
| C0101 | 2113743N32 | CAP CHIP 18.0 PF 5% COG |
| C0102 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0103 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0104 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0105 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0106 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0107 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C0108 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0109 | 2113743N32 | CAP CHIP 18.0 PF 5% COG |
| C0200 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0201 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0202 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0203 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C0204 | 2185802B01 | CAP 10V 4.7UF |
| C0207 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0208 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0209 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0210 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0211 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0212 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0213 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0214 | 2113741N69 | CAP CHIP CL2 X7R 10% 100000 |
| C0215 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C0216 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0217 | 2113743L29 | CAP CHIP 3300 PF 10% X7R |
| C0220 | 2311049A57 | CAP TANT CHIP A/P 10UF 10% 16V |
| C0221 | 2311049C06 | CAP TANT CHIP 22 UF 35V 20% |
| C0223 | 2185802B01 | CAP 10V 4.7UF |
| C0224 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0226 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C0227 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0230 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C0231 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C0232 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C0233 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C0234 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C0235 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C0236 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C0237 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C0238 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C0239 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0240 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C0242 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C0243 | 2113945B01 | CAP CER CHIP 6800 PF 25V 10% |
| C0244 | 2113945B01 | CAP CER CHIP 6800 PF 25V 10% |
| C0301 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0302 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0305 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0306 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0308 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0309 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0310 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0311 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0312 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0313 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0314 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0315 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0420 | 2185802B01 | CAP 10V 4.7UF |
| C0421 | 2113741B13 | CAP CHIP CL2 X7R REEL 470 |
| C0422 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0423 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0424 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0426 | 2113741B13 | CAP CHIP CL2 X7R REEL 470 |
| C0428 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0431 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0432 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0433 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0434 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0435 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C0436 | 2113741B13 | CAP CHIP CL2 X7R REEL 470 |
| C0437 | 2113741B13 | CAP CHIP CL2 X7R REEL 470 |
| C0438 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C0439 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0440 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0441 | 2311049C47 | CAP TANT CHIP 22.0UF 10% 16V |
| C0442 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0443 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0444 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0445 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0446 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0447 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0448 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0449 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0450 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0451 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0452 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0453 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0454 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0455 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0456 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0457 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0458 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0459 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0460 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0461 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C0462 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C0463 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0464 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0467 | 2113743N50 | CAP CHIP 100 PF 5% COG |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C0470 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0471 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0475 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0476 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0477 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0478 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0479 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0500 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0502 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0503 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0504 | 2113741N69 | CAP CHIP CL2 X7R 10% 100000 |
| C0505 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C0506 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C0507 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0510 | 2185802B01 | CAP 10V 4.7UF |
| C0512 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0513 | 2311049A43 | CAP TANT CHIP 150 10 6 |
| C0514 | 2311049A43 | CAP TANT CHIP 150 10 6 |
| C0515 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0516 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0517 | 2185802B01 | CAP 10V 4.7UF |
| C0518 | 2185802B01 | CAP 10V 4.7UF |
| C0519 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C0520 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0521 | 2185802B01 | CAP 10V 4.7UF |
| C0522 | 2185802B01 | CAP 10V 4.7UF |
| C0523 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0524 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0525 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0526 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C0527 | 2185802B01 | CAP 10V 4.7UF |
| C0528 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0529 | 2185802B01 | CAP 10V 4.7UF |
| C0531 | 2113741N69 | CAP CHIP CL2 X7R 10% 100000 |
| C0532 | 2113741Y32 | CAP CER 1,000,000 10% 50V |
| C0533 | 2311049C47 | CAP TANT CHIP 22.0UF 10% 16V |
| C0534 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0535 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0550 | 2113741N69 | CAP CHIP CL2 X7R 10% 100000 |
| C0551 | 2113741Y32 | CAP CER 1,000,000 10% 50V |
| C0553 | 2311049C47 | CAP TANT CHIP 22.0UF 10% 16V |
| C0554 | 2113743E20 | CAP CHIP .10 UF 10% |
| C0600 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0601 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0603 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0604 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0605 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0606 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0610 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0611 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0613 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0614 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0615 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0616 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0700 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0701 | 2113743N50 | CAP CHIP 100 PF 5% COG |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C0702 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0703 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0704 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0705 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0706 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0708 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0709 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0710 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0711 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0712 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0713 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C0714 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C0715 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0716 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0717 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0718 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0719 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C0720 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0721 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0722 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0724 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0726 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0727 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0728 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0729 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0730 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0731 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0732 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0733 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0740 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C0741 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0742 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0903 | 2113743N26 | CAP CHIP 10.0 PF 5% COG |
| C0920 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0922 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0923 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0936 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0937 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0940 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0941 | 2113743S01 | CAP CER CHIP 1.0 UF 10% 16V |
| C0942 | 2113743S01 | CAP CER CHIP 1.0 UF 10% 16V |
| C0943 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C0945 | 2185802B01 | CAP 10V 4.7UF |
| C0955 | 2113741N69 | CAP CHIP CL2 X7R 10% 100000 |
| C0956 | 2311049C06 | CAP TANT CHIP 22 UF 35V 20% |
| C0957 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0959 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0960 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0961 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0963 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0964 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0965 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0966 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0968 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0969 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0970 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0972 | 2113743E20 | CAP CHIP .10 UF 10% |
| C0973 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0974 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C0975 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0976 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0978 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0979 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0980 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0981 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0982 | 2311049C47 | CAP TANT CHIP 22.0UF 10% 16V |
| C0983 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0984 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0985 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0986 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0987 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0988 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0989 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0990 | 2185802B01 | CAP 10V 4.7UF |
| C0991 | 2185802B01 | CAP 10V 4.7UF |
| C3000 | 2113743N28 | CAP CHIP 12.0 PF 5% COG |
| C3001 | 2113743S01 | CAP CER CHIP 1.0 UF 10% 16V |
| C3002 | 2113743N46 | QAP CHIP 68.0 PF 5% COG |
| C3003 | 2113743L25 | CAP CHIP 2200 PF 10% X7R |
| C3004 | 2113743B27 | CAP CHIP .680 UF 10% X7R |
| C3005 | 2113743A27 | CAP CHIP .470 UF 10% 16V |
| C3007 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C3008 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C3009 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C3010 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C3011 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C3012 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C3013 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C3014 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C3016 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C3017 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C3018 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C3019 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C3020 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C3021 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C3022 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C3023 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C3024 | 2113743N46 | QAP CHIP 68.0 PF 5% COG |
| C3025 | 2113743N42 | CAP CHIP 47.0 PF 5% COG |
| C3026 | 2113743N36 | CAP CHIP 27.0 PF 5% COG |
| C3027 | 2113743N33 | CAP CHIP 20.0 PF 5% COG |
| C3028 | 2113743N33 | CAP CHIP 20.0 PF 5% COG |
| C3029 | 2113743N30 | CAP CHIP 15.0 PF 5% COG |
| C3030 | 2113743N28 | CAP CHIP 12.0 PF 5% COG |
| C3032 | 2113740L32 | CAP 39.0 PF 50V 2.0 % |
| C3035 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C3036 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C3037 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C3038 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C3039 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C3040 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C3041 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C3042 | 2113743L17 | CAP CHIP 1000 PF 10% X7R |
| C3043 | 2113743F18 | CAP CHIP 2.2 UF 16V +80-20% |
| C3044 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3045 | 2113743A31 | CAP CHIP 1.0 UF 10% X7R |
| C3046 | 2113743L33 | CAP CHIP 4700 PF 10% X7R |
| C3047 | 2113740F58 | CAP CHIP REEL CL1 +/-30 200 |
| C3048 | 2113743N09 | CAP CHIP 2.0 PF +-.25PF COG |
| C3251 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3252 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3253 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3254 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3255 | 2113741F25 | CAP CHIP CL2 X7R REEL 1000 |
| C3256 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3257 | 2113740L37 | CAP 62.0 PF 50V 2.0 % |
| C3258 | 2113740L42 | CAP 100.0 PF 50V 2.0 % |
| C3259 | 2113740L21 | CAP 13.0 PF 50V 2.0 % |
| C3260 | 2113741F25 | CAP CHIP CL2 X7R REEL 1000 |
| C3261 | 2113741F25 | CAP CHIP CL2 X7R REEL 1000 |
| C3262 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3263 | 2113741F25 | CAP CHIP CL2 X7R REEL 1000 |
| C3264 | 2113740L32 | CAP 39.0 PF 50V 2.0 % |
| C3265 | 2113741F25 | CAP CHIP CL2 X7R REEL 1000 |
| C3266 | 2113741F25 | CAP CHIP CL2 X7R REEL 1000 |
| C3267 | 2113743K15 | CER CHIP CAP .100UF |
| C3268 | 2113743K15 | CER CHIP CAP .100UF |
| C3269 | 2113741F25 | CAP CHIP CL2 X7R REEL 1000 |
| C3270 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3271 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3272 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3273 | 2113741F25 | CAP CHIP CL2 X7R REEL 1000 |
| C3274 | 2113743K15 | CER CHIP CAP .100UF |
| C3275 | 2113743K15 | CER CHIP CAP .100UF |
| C3277 | 2113740L41 | CAP 91.0 PF 50V 2.0 % |
| C3278 | 2113740L39 | CAP 75.0 PF 50V 2.0 % |
| C3279 | 2113740L24 | CAP 18.0 PF 50V 2.0 % |
| C3280 | 2113741F25 | CAP CHIP CL2 X7R REEL 1000 |
| C3282 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3283 | 2113741F25 | CAP CHIP CL2 X7R REEL 1000 |
| C3284 | 2113741F25 | CAP CHIP CL2 X7R REEL 1000 |
| C3286 | 2113741F25 | CAP CHIP CL2 X7R REEL 1000 |
| C3287 | 2113740L31 | CAP 36.0 PF 50V 2.0 % |
| C3288 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3289 | 2113743K15 | CER CHIP CAP .100UF |
| C3290 | 2113740L35 | CAP 51.0 PF 50V 2.0% |
| C3291 | 2113740F41 | CAP CHIP REEL CL1 +/-30 39 |
| C3292 | 2113741F25 | CAP CHIP CL2 X7R REEL 1000 |
| C3293 | 2113741F25 | CAP CHIP CL2 X7R REEL 1000 |
| C3294 | 2113741F25 | CAP CHIP CL2 X7R REEL 1000 |
| C3295 | 2113740L37 | CAP 62.0 PF 50V 2.0 % |
| C3296 | 2113740L26 | CAP 22.0 PF 50V 2.0 % |
| C3297 | 2113740L15 | CAP CER CHIP 7.5 PF +-0.1PF |
| C3298 | 2113740L37 | CAP 62.0 PF 50V 2.0 % |
| C3299 | 2113740L32 | CAP 39.0 PF 50V 2.0 % |
| C3300 | 2113740L37 | CAP 62.0 PF 50V 2.0 % |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C3301 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3302 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3303 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3304 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3305 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3306 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3307 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3308 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3309 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3310 | 2113740L27 | CAP 24.0 PF 50V 2.0 % |
| C3311 | 2113740L18 | CAP CER CHIP 10.0 PF +/- .25PF |
| C3312 | 2113743K15 | CER CHIP CAP .100UF |
| C3400 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3401 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3402 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3403 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3404 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3405 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3406 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3409 | 2113740L31 | CAP 36.0 PF 50V 2.0 % |
| C3410 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3411 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3412 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3414 | 2113740L31 | CAP 36.0 PF 50V 2.0 % |
| C3415 | 2113740F19 | CAP CHIP REEL CL1 +/-30 4.7 |
| C3416 | 2113740L09 | CAP CER CHIP 4.3 PF +-0.1PF |
| C3417 | 2113740L09 | CAP CER CHIP 4.3 PF +-0.1PF |
| C3418 | 2113741F25 | CAP CHIP CL2 X7R REEL 1000 |
| C3420 | 2113741F25 | CAP CHIP CL2 X7R REEL 1000 |
| C3421 | 2113740L10 | CAP CER CHIP 4.7 PF +-0.1PF |
| C3424 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3500 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C3501 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C3502 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C3503 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C3504 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C3505 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C3506 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C3520 | 2113743N46 | QAP CHIP 68.0 PF 5% COG |
| C3521 | 2113743N52 | CAP CHIP 120 PF 5% COG |
| C3522 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C3524 | 2113741N69 | CAP CHIP CL2 X7R 10% 100000 |
| C3525 | 2111078B59 | CAP CHIP RF 470 5 NPO 100V |
| C3526 | 2185802B01 | CAP 10V 4.7UF |
| C3540 | 2111078B37 | CAP CHIP RF 62 5 NPO 100V |
| C3541 | 2111078B37 | CAP CHIP RF 62 5 NPO 100V |
| C3542 | 2111078B59 | CAP CHIP RF 470 5 NPO 100V |
| C3543 | 2111078B41 | CAP CHIP RF 91 5 NPO 100V |
| C3544 | 2111078B41 | CAP CHIP RF 91 5 NPO 100V |
| C3545 | 2111078B59 | CAP CHIP RF 470 5 NPO 100V |
| C3546 | 2111078B59 | CAP CHIP RF 470 5 NPO 100V |
| C3547 | 2111078B59 | CAP CHIP RF 470 5 NPO 100V |
| C3548 | 2111078B39 | CAP CHIP RF 75 5 NPO 100V +/-5% |
| C3549 | 2111078B39 | CAP CHIP RF 75 5 NPO 100V +/-5% |
| C3550 | 2111078B39 | CAP CHIP RF 75 5 NPO 100V +/-5% |
| C3551 | 2111078B39 | CAP CHIP RF 75 5 NPO 100V +/-5% |
| C3552 | 2111078B39 | CAP CHIP RF 75 5 NPO 100V +/-5% |
| C3553 | 2111078B39 | CAP CHIP RF 75 5 NPO 100V +/-5% |
| C3554 | 2111078B39 | CAP CHIP RF 75 5 NPO 100V +/-5% |
| C3555 | 2111078B39 | CAP CHIP RF 75 5 NPO 100V +/-5% |
| C3558 | 2111078B27 | CAP CHIP RF 30 5 NPO 100V |
| C3559 | 2111078B59 | CAP CHIP RF 470 5 NPO 100V |
| C3560 | 2111078B59 | CAP CHIP RF 470 5 NPO 100V |
| C3561 | 2113741N69 | CAP CHIP CL2 X7R 10% 100000 |
| C3562 | 2113743L17 | CAP CHIP 1000 PF 10% X7R |
| C3563 | 2311049C06 | CAP TANT CHIP 22 UF 35V 20% |
| C3564 | 2311049C06 | CAP TANT CHIP 22 UF 35V 20% |
| C3565 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3566 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3568 | 2380090M24 | CAP ALU 10 20 50V SURF MT |
| C3572 | 2111078B42 | CAP CHIP RF 100 5 NPO 100V |
| C3575 | 2113741N69 | CAP CHIP CL2 X7R 10% 100000 |
| C3578 | 2113743T19 | CAP 10UF 16V CER 3225 X5R |
| C3579 | 2113743T19 | CAP 10UF 16V CER 3225 X5R |
| C3700 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C3701 | 2111078B27 | CAP CHIP RF 30 5 NPO 100V |
| C3702 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C3703 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C3704 | 2113743N28 | CAP CHIP 12.0 PF 5% COG |
| C3720 | 2111078B03 | CAP CHIP RF 3.9 .25 NPO 100V |
| C3721 | 2111078B32 | CAP CHIP RF 39 5 NPO 100V |
| C3722 | 2111078B32 | CAP CHIP RF 39 5 NPO 100V |
| C3723 | 2111078B14 | CAP CHIP RF 11 5 NPO 100V |
| C3730 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C3731 | 2113743N29 | CAP 13PF 20X40 |
| C3732 | 2113743N29 | CAP 13PF 20X40 |
| C3733 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C3734 | 2111078B59 | CAP CHIP RF 470 5 NPO 100V |
| C3735 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C3736 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C3750 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3751 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3752 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3753 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3754 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3755 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3757 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3758 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3759 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3761 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C3762 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3763 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3764 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3765 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3766 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3767 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3768 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3769 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3770 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3771 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3772 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3773 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3774 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3775 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3776 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3777 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3778 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3779 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3780 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3781 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3782 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3783 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3784 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3785 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3786 | 2113743N32 | CAP CHIP 18.0 PF 5% COG |
| C3787 | 2113740F32 | CAP CHIP REEL CL1 +/-30 16 |
| C3788 | 2113740F31 | CAP CHIP REEL CL1 +/-30 15 |
| C3790 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3791 | 2113740F29 | CAP CHIP REEL CL1 +/-30 12 |
| C3792 | 2113740F29 | CAP CHIP REEL CL1 +/-30 12 |
| C3793 | 2113740F29 | CAP CHIP REEL CL1 +/-30 12 |
| C3794 | 2113740F29 | CAP CHIP REEL CL1 +/-30 12 |
| C3796 | 2113740F25 | CAP CHIP REEL CL1 +/-30 8.2 |
| C3797 | 2113740F25 | CAP CHIP REEL CL1 +/-30 8.2 |
| C3798 | 2113740L15 | CAP CER CHIP 7.5 PF +-0.1PF |
| C3799 | 2113740L15 | CAP CER CHIP 7.5 PF +-0.1PF |
| C3800 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3802 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3803 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3804 | 2113743N30 | CAP CHIP 15.0 PF 5% COG |
| C3806 | 2113743S01 | CAP CER CHIP 1.0 UF 10% 16V |
| C3807 | 2113743S01 | CAP CER CHIP 1.0 UF 10% 16V |
| C3808 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C3809 | 2113740B88 | CAP CHIP 5600PF 5% |
| C3810 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3811 | 2113932E07 | CAP CER CHP .022 UF 10% 16V |
| C3813 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3814 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3815 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3816 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3817 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3818 | 2113740L09 | CAP CER CHIP 4.3 PF +-0.1PF |
| C3820 | 2113743T19 | CAP 10UF 16V CER 3225 X5R |
| C3821 | 2113743T19 | CAP 10UF 16V CER 3225 X5R |
| C3822 | 2113743T19 | CAP 10UF 16V CER 3225 X5R |
| C3823 | 2113743T19 | CAP 10UF 16V CER 3225 X5R |
| C3824 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C3825 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C3826 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C3827 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3828 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C3829 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3830 | 2113743L17 | CAP CHIP 1000 PF 10% X7R |
| C3831 | 2113743L17 | CAP CHIP 1000 PF 10% X7R |
| C3832 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3833 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3834 | 2113743E12 | CAP CHIP .047 UF 10% X7R |
| C3835 | 2113740L15 | CAP CER CHIP 7.5 PF +-0.1PF |
| C3836 | 2113740L15 | CAP CER CHIP 7.5 PF +-0.1PF |
| C3837 | 2113740L13 | CAP CER CHIP 6.2 PF +-0.1PF |
| C3838 | 2113740L13 | CAP CER CHIP 6.2 PF +-0.1PF |
| C3839 | 2113740F33 | CAP CHIP REEL CL1 +/-30 18 |
| C3840 | 2113740F33 | CAP CHIP REEL CL1 +/-30 18 |
| C3841 | 2113740L26 | CAP 22.0 PF 50V 2.0 % |
| C3842 | 2113740L26 | CAP 22.0 PF 50V 2.0 % |
| C3843 | 2113740F33 | CAP CHIP REEL CL1 +/-30 18 |
| C3844 | 2113740F33 | CAP CHIP REEL CL1 +/-30 18 |
| C3845 | 2113740L13 | CAP CER CHIP 6.2 PF +-0.1PF |
| C3846 | 2113740L13 | CAP CER CHIP 6.2 PF +-0.1PF |
| C3847 | 2113740L13 | CAP CER CHIP 6.2 PF +-0.1PF |
| C3848 | 2113740L13 | CAP CER CHIP 6.2 PF +-0.1PF |
| C3849 | 2113740L13 | CAP CER CHIP 6.2 PF +-0.1PF |
| C3850 | 2113740L14 | CAP CER CHIP 6.8 PF +-0.1PF |
| C3854 | 2113740F19 | CAP CHIP REEL CL1 +/-30 4.7 |
| C3855 | 2104263L01 | CAPACITOR 0.1UF FILM |
| C3856 | 2104263L01 | CAPACITOR 0.1UF FILM |
| C3857 | 2104263L01 | CAPACITOR 0.1UF FILM |
| C3858 | 2104263L01 | CAPACITOR 0.1UF FILM |
| C3859 | 2104263L01 | CAPACITOR 0.1UF FILM |
| C3860 | 2104263L01 | CAPACITOR 0.1UF FILM |
| C3861 | 2104263L01 | CAPACITOR 0.1UF FILM |
| C3862 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3863 | 2113740F33 | CAP CHIP REEL CL1 +/-30 18 |
| C3864 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3865 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3868 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3869 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3870 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3871 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3872 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3873 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3876 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3878 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C3879 | 2113743T19 | CAP 10UF 16V CER 3225 X5R |
| C3881 | 2104263L01 | CAPACITOR 0.1UF FILM |
| C3882 | 2104263L01 | CAPACITOR 0.1UF FILM |
| C3883 | 2104263L01 | CAPACITOR 0.1UF FILM |
| C3910 | 2113743E20 | CAP CHIP .10 UF 10% |
| C3911 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3912 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3913 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3914 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3915 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3916 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3917 | 2113740F32 | CAP CHIP REEL CL1 +/-30 16 |
| C3918 | 2113740L18 | CAP CER CHIP 10.0 PF +/-.25PF |
| C3919 | 2113740L15 | CAP CER CHIP 7.5 PF +-0.1PF |
| C3920 | 2113740F14 | CAP CHIP REEL CL1 +/-30 3.0 |
| C3921 | 2113740F14 | CAP CHIP REEL CL1 +/-30 3.0 |
| C3924 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3925 | 2113743A19 | CAP CHIP .100 UF 10% X7R |
| C3926 | 2113743A19 | CAP CHIP .100 UF 10% X7R |
| C3930 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3931 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3932 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3933 | 2113740F67 | CAP CHIP CL1 +/-30 470 5% |
| C3934 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |
| C3935 | 2113741F49 | CAP CHIP CL2 X7R REEL 10000 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C3936 | 2113741F25 | CAP CHIP CL2 X7R REEL 1000 |
| D0402 | 4805218N57 | DIODE DUAL |
| D0950 | 4813833C02 | DIODE DUAL 70V ‘5B’ COMM CATH |
| D0951 | 4813833C02 | DIODE DUAL 70V ‘5B’ COMM CATH |
| D0952 | 4813833C02 | DIODE DUAL 70V ‘5B’ COMM CATH |
| D0954 | 4813833C02 | DIODE DUAL 70V ‘5B’ COMM CATH |
| D3000 | 4809877C13 | DIODE VARACTOR ISV305 SMD |
| D3001 | 4805656W28 | DIODE VARACTOR 18PF@1V +6PF@4V |
| D3251 | 4808115L23 | DIODE,PIN,SMP1322,,,,100MA,1V,.25W, |
| D3252 | 4808115L23 | DIODE,PIN,SMP1322,,,,100MA,1V,.25W, |
| D3253 | 4808115L23 | DIODE,PIN,SMP1322,,,,100MA,1V,.25W, |
| D3254 | 4808115L23 | DIODE,PIN,SMP1322,,,,100MA,1V,.25W, |
| D3255 | 4808115L17 | PIN DIODE |
| D3256 | 4813825A19 | DIODE SCHOTTKY BARRIER SERIES |
| D3258 | 4802245J92 | QUAD CROSSOVER RING MIXER DIODES |
| D3400 | 4813833B24 | DIODE SCHOTIK Y DL SERIES 30V |
| D3701 | 4802482J02 | PIN DIODE SMD |
| D3702 | 4802482J02 | PIN DIODE SMD |
| D3703 | 4880154K06 | DIODE PIN SCHOTTKY |
| D3730 | 4813825A05 | DIODE 30V HOT CARRIER MMBD301L |
| D3731 | 4813825A05 | DIODE 30V HOT CARRIER MMBD301L |
| D3750 | 4813833C02 | DIODE DUAL 70V ‘5B’ COMM CATH |
| D3751 | 4813833C02 | DIODE DUAL 70V ‘5B’ COMM CATH |
| D3752 | 4805649Q13 | DIODE VCTR ISV 228 |
| D3753 | 4805649Q13 | DIODE VCTR ISV 228 |
| D3754 | 4805649Q13 | DIODE VCTR ISV 228 |
| D3755 | 4813825A08 | DIODE 70V HOT CARRIER MMBD701L |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| D3756 | 4813825A08 | DIODE 70V HOT CARRIER MMBD701L |
| D3757 | 4802233J09 | DIODE TRIPLE SOT25-RH |
| D3758 | 4802233J09 | DIODE TRIPLE SOT25-RH |
| D3767 | 4813825A08 | DIODE 70V HOT CARRIER MMBD701L |
| D3768 | 4813825A08 | DIODE 70V HOT CARRIER MMBD701L |
| D3769 | 4805649Q13 | DIODE VCTR ISV 228 |
| D3770 | 4805649Q13 | DIODE VCTR ISV 228 |
| D3771 | 4805649Q13 | DIODE VCTR ISV 228 |
| D3772 | 4805649Q13 | DIODE VCTR ISV 228 |
| D3773 | 4805649Q13 | DIODE VCTR ISV 228 |
| E3000 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| E3001 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| E3002 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| E3003 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| E3004 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| E3005 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| E3006 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| E3007 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| E3008 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| F0400 | 6583049X16 | FUSE 5A FAST ACT |
| FL0700 | 9185130D01 | FLTR SW CAP 3 POLE BUTTERW |
| J0401 | 0964495H01 | CONN, 60 PIN RECEPT |
| J0501 | 0985473E01 | CONN SECURE 20 POS FM SMT RT ANG |
| J3500 | 0905902V07 | CONNECTOR DC |
| J3700 | 0905901V11 | CONNECTOR RF |
| L0400 | 2485821C07 | IND RF 10UH |
| L3000 | 2405769X05 | COIL INDUCTOR |
| L3002 | 2462587N56 | CHIP IND 180 NH 5% |
| L3003 | 2462587N76 | CHIP IND 4700 NH 5% |
| L3004 | 2462587N76 | CHIP IND 4700 NH 5% |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| L3005 | 2405769X05 | COIL INDUCTOR |
| L3006 | 2413923A05 | IND CHIP 120 NH 2% |
| L3007 | 2413926N24 | IND CER CHIP 100.0 NH 5% |
| L3008 | 2462587L50 | FERRITE INDUCTOR 100UH |
| L3251 | 2413923A32 | IND CHIP 18 NH 2% |
| L3252 | 2413923A24 | IND CHIP 47 NH 2% |
| L3253 | 2413923A04 | IND CHIP 100 NH 2% |
| L3254 | 2413923A36 | IND CHIP 10 NH 2% |
| L3255 | 2413923A20 | IND CHIP 22 NH 2% |
| L3256 | 2413923A01 | IND CHIP 56 NH 2% |
| L3257 | 2413923A35 | IND CHIP 15 NH 2% |
| L3258 | 2413923A06 | IND CHIP 150 NH 2% |
| L3259 | 2462587N69 | CHIP IND 1200 NH 5% |
| L3260 | 2460591M77 | COIL AIR WOUND INDUC 38.13 |
| L3261 | 2462587N69 | CHIP IND 1200 NH 5% |
| L3262 | 2462587Q40 | IND CHIP 270 NH 10% |
| L3263 | 2460591M77 | COIL AIR WOUND INDUC 38.13 |
| L3264 | 2460591M77 | COIL AIR WOUND INDUC 38.13 |
| L3265 | 2413923A21 | IND CHIP 27 NH 2% |
| L3266 | 2462587N69 | CHIP IND 1200 NH 5% |
| L3268 | 2462587N69 | CHIP IND 1200 NH 5% |
| L3269 | 2462587N69 | CHIP IND 1200 NH 5% |
| L3270 | 2462587N69 | CHIP IND 1200 NH 5% |
| L3271 | 2460591M77 | COIL AIR WOUND INDUC 38.13 |
| L3272 | 2460591P75 | COIL AIR WOUND INDUC 72.22 |
| L3273 | 2460591P75 | COIL AIR WOUND INDUC 72.22 |
| L3275 | 2462587Q40 | IND CHIP 270 NH 10% |
| L3276 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3277 | 2462587T03 | IND CHIP 10NH 10% LOW PRO |
| L3400 | 2462587Q40 | IND CHIP 270 NH 10% |
| L3401 | 2462587T59 | IND CHIP 330NH 2% LOW PRO |
| L3403 | 2462587T59 | IND CHIP 330NH 2% LOW PRO |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| L3404 | 2462587T59 | IND CHIP 330NH 2% LOW PRO |
| L3405 | 2462587T59 | IND CHIP 330NH 2% LOW PRO |
| L3406 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3408 | 2462587T13 | IND CHIP 68NH 5% LOW PRO |
| L3500 | 2462587T17 | IND CHIP 150NH 5% LOW PRO |
| L3501 | 2462587V21 | CHIP IND 6.8 NH 5% 0805 |
| L3502 | 2462587T17 | IND CHIP 150NH 5% LOW PRO |
| L3520 | 2484562T05 | COIL SURFACE MOUNT AIR WOUND |
| L3521 | 2484562T02 | COIL SURFACE MOUNT AIR WOUND |
| L3522 | 2484657R01 | INDUCTOR BEAD CHIP |
| L3541 | 2485873L02 | ENCAPSULATED AIR WOUND 25NH |
| L3542 | 2485873L02 | ENCAPSULATED AIR WOUND 25NH |
| L3543 | 2485873L02 | ENCAPSULATED AIR WOUND 25NH |
| L3544 | 2484657R01 | INDUCTOR BEAD CHIP |
| L3545 | 2485873L01 | ENCAPSULATED AIR WOUND COIL |
| L3700 | 2462587N69 | CHIP IND 1200 NH 5% |
| L3701 | 2485873L02 | ENCAPSULATED AIR WOUND 25NH |
| L3702 | 2408384A05 | 47NH 5% COILCRAFT 1812SMS-47NJ |
| L3704 | 2462587N69 | CHIP IND 1200 NH 5% |
| L3720 | 2484562T17 | COIL SURFACE MNT AIR WOUND |
| L3721 | 2485873L02 | ENCAPSULATED AIR WOUND 25NH |
| L3722 | 2485873L02 | ENCAPSULATED AIR WOUND 25NH |
| L3723 | 2485873L02 | ENCAPSULATED AIR WOUND 25NH |
| L3724 | 2484562T16 | COIL SURFACE MNT AIR WOUND |
| L3725 | 2485873L02 | ENCAPSULATED AIR WOUND 25NH |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| L3726 | 2485873L02 | ENCAPSULATED AIR WOUND 25NH |
| L3727 | 2485873L02 | ENCAPSULATED AIR WOUND 25NH |
| L3730 | 2488428L07 | COIL 12 NH |
| L3731 | 2409377M30 | IDCTR,CHIP,24NH,5%,700 MA,.135OHM,SM |
| L3732 | 2485873L02 | ENCAPSULATED AIR WOUND 25NH |
| L3737 | 2462587N69 | CHIP IND 1200 NH 5% |
| L3750 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3751 | 2462587Q44 | IND CHIP 560 NH 10% |
| L3752 | 2462587Q44 | IND CHIP 560 NH 10% |
| L3753 | 2462587Q20 | IND CHIP 2,200 NH 20% |
| L3754 | 2462587Q47 | IND CHIP 1,000 NH 10% |
| L3755 | 2462587Q20 | IND CHIP 2,200 NH 20% |
| L3756 | 2462587Q20 | IND CHIP 2,200 NH 20% |
| L3757 | 2462587Q20 | IND CHIP 2,200 NH 20% |
| L3758 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3759 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3760 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3761 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3762 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3763 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3764 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3765 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3766 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3767 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3768 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3769 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3770 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| L3771 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3772 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3773 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3774 | 2409377M13 | IDCTR,CHIP,56NH,5%,600 MA,.31OHM,SM, |
| L3775 | 2462587Q40 | IND CHIP 270 NH 10% |
| L3776 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3778 | 2409377M13 | IDCTR,CHIP,56NH,5%,600 MA,.31OHM,SM, |
| L3779 | 2409377M19 | IDCTR,CHIP,120NH,5%,300MA,.65OHM,SM |
| L3781 | 2409377M10 | IDCTR,CHIP,33NH,5%,600 MA,.22OHM,SM, |
| L3782 | 2409377M08 | IDCTR,CHIP,22NH,5%,700 MA,.19OHM,SM, |
| L3783 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L3784 | 2409377M19 | IDCTR,CHIP,120NH,5%,300MA,.65OHM,SM |
| L3785 | 2409377M12 | IDCTR,CHIP,47NH,5%,600 MA,.28OHM,SM, |
| L3787 | 2409377M09 | IDCTR,CHIP,27NH,5%,600 MA,.22OHM,SM, |
| M3520 | 2685838C01 | HEATSINK PLD1.5 TRANSISTOR ASSY |
| M3540 | 2685837C06 | HEATSINK, CARRIER XTSR ASSY, VHF |
| M3541 | 2685837C06 | HEATSINK, CARRIER XTSR ASSY, VHF |
| PCB | 8485930F02 | PCB, MAIN VHF HP |
| Q0200 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q0402 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q0403 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0405 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0500 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q0501 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0502 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q0503 | 4813970A66 | XSTR,FET GP PWR,MOSFET,P-CH,ENHN |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| Q0504 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q0505 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q0506 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q0507 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0508 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0610 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0611 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0612 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0613 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0951 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q0952 | 4885844C01 | XSTR FET |
| Q0954 | 4809579E16 | TSTR MOSFET N-CHAN TN0200T |
| Q0955 | 4809579E16 | TSTR MOSFET N-CHAN TN0200T |
| Q0960 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q3000 | 4805218N63 | RF TRANS SOT 323 BFQ67W |
| Q3001 | 4805128M19 | TSTR SOT23 MMBTA13 RH |
| Q3250 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q3252 | 4804188K01 | TSTR NPN RF NE85634 |
| Q3253 | 4805921T11 | XSTR DUAL PNP |
| Q3254 | 4805921T11 | XSTR DUAL PNP |
| Q3255 | 4804188K01 | TSTR NPN RF NE85634 |
| Q3256 | 4813824A10 | TSTR NPN 40V .2A GEN PURP |
| Q3257 | 4813824A10 | TSTR NPN 40V .2A GEN PURP |
| Q3258 | 4813824A10 | TSTR NPN 40V .2A GEN PURP |
| Q3400 | 4805921T11 | XSTR DUAL PNP |
| Q3401 | 4804188K01 | TSTR NPN RF NE85634 |
| Q3520 | 4864006H01 | TRANSISTOR, RF POWER |
| Q3540 | 4813976A05 | TSTR, VHF 50 W, 12.5 V LDMOS |
| Q3541 | 4813976A05 | TSTR, VHF 50 W, 12.5 V LDMOS |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| Q3750 | 4813824A10 | TSTR NPN 40V .2A GEN PURP |
| Q3751 | 4880141L06 | TSTR NC MOS FET SOT23 TGR MMBF |
| Q3752 | 4880141L06 | TSTR NC MOS FET SOT23 TGR MMBF |
| Q3753 | 4880141L06 | TSTR NC MOS FET SOT23 TGR MMBF |
| Q3754 | 4880141L06 | TSTR NC MOS FET SOT23 TGR MMBF |
| Q3755 | 4813824A10 | TSTR NPN 40V .2A GEN PURP |
| Q3756 | 4813824A17 | XSTR PNP40V .2A GENP B=100-300 |
| Q3757 | 4809527E41 | TRANSISTOR UHF PRF949 SC75 |
| Q3758 | 4809527E41 | TRANSISTOR UHF PRF949 SC75 |
| Q3759 | 4809527E41 | TRANSISTOR UHF PRF949 SC75 |
| Q3760 | 4809527E41 | TRANSISTOR UHF PRF949 SC75 |
| Q3761 | 4809527E41 | TRANSISTOR UHF PRF949 SC75 |
| Q3762 | 4804188K14 | TSTR RF POWER SLCN NPN SM SOT-89 |
| Q3763 | 4885316E10 | XSTR,DUAL DIGI-TAL,IMD6AT108 |
| Q3764 | 4885316E10 | XSTR,DUAL DIGI-TAL,IMD6AT108 |
| Q3765 | 4885316E10 | XSTR,DUAL DIGI-TAL,IMD6AT108 |
| Q3766 | 4885316E10 | XSTR,DUAL DIGI-TAL,IMD6AT108 |
| Q3767 | 4805921T11 | XSTR DUAL PNP |
| Q3768 | 4880048M03 | TRST NPN DIG 47K/47K |
| Q3769 | 4809527E41 | TRANSISTOR UHF PRF949 SC75 |
| R0101 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0103 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0104 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0106 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0107 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0109 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0110 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0111 | 0662057M86 | RES CHIP 3300 5% 20X40 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R0114 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0116 | 0662057B46 | CHIP RES 10.0 MEG OHMS 5% |
| R0117 | 0662057B46 | CHIP RES 10.0 MEG OHMS 5% |
| R0119 | 0662057N39 | RES. CHIP 470K 5% 20X40 |
| R0120 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0121 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0125 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0126 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0128 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0129 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0130 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0200 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0201 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0204 | 0662057M68 | RES CHIP 560 5% 20X40 |
| R0205 | 0662057N09 | RES. CHIP 27K 5% 20X40 |
| R0208 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0209 | 0662057N07 | RES. CHIP 22K 5% 20X40 |
| R0210 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0211 | 0662057N11 | RES. CHIP 33K 5% 20X40 |
| R0212 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0213 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0215 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0216 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0218 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0219 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0220 | 0662057N05 | RES. CHIP 18K 5% 20X40 |
| R0221 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0222 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0224 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0225 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0227 | 0662057N19 | RES. CHIP 68K 5% 20X40 |
| R0228 | 0662057N11 | RES. CHIP 33K 5% 20X40 |
| R0229 | 0662057N19 | RES. CHIP 68K 5% 20X40 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R0230 | 0662057N11 | RES. CHIP 33K 5% 20X40 |
| R0231 | 0662057C13 | CHIP RES 2.7 OHMS 5% |
| R0235 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0236 | 0662057M97 | RES CHIP 9100 5% 20X40 |
| R0300 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0301 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0303 | 0662057M78 | RES. CHIP 1500 5% 20X40 |
| R0304 | 0662057M34 | RES. CHIP 22 5% 20X40 |
| R0305 | 0662057M34 | RES. CHIP 22 5% 20X40 |
| R0306 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0307 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0310 | 0662057M34 | RES. CHIP 22 5% 20X40 |
| R0403 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0404 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0405 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0406 | 0662057M68 | RES CHIP 560 5% 20X40 |
| R0409 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0415 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0416 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0417 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0418 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0420 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0421 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0422 | 0662057V15 | RES CHIP 33K 1% 1/16W |
| R0425 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0431 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0433 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0434 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0435 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0441 | 0662057M82 | RES. CHIP 2200 5% 20X40 |
| R0443 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0445 | 0662057M50 | RES. CHIP 100 5% 20X40 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R0500 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0502 | 0662057N37 | RES CHIP 390K 5% 20X40 |
| R0503 | 0662057B47 | CHIP RES 0 OHMS +-.050 OHMS |
| R0504 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0505 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0506 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0507 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0508 | 0662057M86 | RES CHIP 3300 5% 20X40 |
| R0509 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0510 | 0662057V18 | RES CHIP 43K 1% 1/16W |
| R0511 | 0662057V15 | RES CHIP 33K 1% 1/16W |
| R0512 | 0662057V02 | RES CHIP 10K 1% 1/16W |
| R0513 | 0662057V17 | RES CHIP 39K 1% 1/16W |
| R0514 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0515 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0516 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0517 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R0518 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0519 | 0662057C27 | CHIP RES 10 OHMS 5% |
| R0520 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R0521 | 0662057V17 | RES CHIP 39K 1% 1/16W |
| R0522 | 0662057V10 | RES CHIP 20K 1% 1/16W |
| R0523 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0526 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0528 | 0662057U98 | RES CHIP 7.5K 1% 1/16W |
| R0529 | 0662057U78 | RES CHIP 1.2K 1% 1/16W |
| R0530 | 0662057N35 | RES. CHIP 330K 5% 20X40 |
| R0531 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0532 | 0662057M86 | RES CHIP 3300 5% 20X40 |
| R0551 | 0662057U98 | RES CHIP 7.5K 1% 1/16W |
| R0552 | 0662057U78 | RES CHIP 1.2K 1% 1/16W |
| R0553 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0620 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0621 | 0662057M50 | RES. CHIP 100 5% 20X40 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R0622 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0623 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0624 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0625 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0626 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0627 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0628 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0629 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0630 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0631 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0634 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0635 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0636 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0639 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0700 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0701 | 0662057M96 | RES. CHIP 8200 5% 20X40 |
| R0705 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0739 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0741 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0742 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0743 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0901 | 0662057V25 | RES CHIP 82K 1% 1/16 |
| R0903 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0908 | 0662057C13 | CHIP RES 2.7 OHMS 5% |
| R0911 | 0662057V06 | RES CHIP 14K 1% 1/16W |
| R0912 | 0662057V06 | RES CHIP 14K 1% 1/16W |
| R0913 | 0662057V43 | RES CHIP 330K 1% |
| R0914 | 0662057V06 | RES CHIP 14K 1% 1/16W |
| R0915 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0917 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0924 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0930 | 0662057N06 | RES. CHIP 20K 5% 20X40 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R0931 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0932 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0934 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0935 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0936 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0938 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0940 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0941 | 0662057N10 | RES. CHIP 30K 5% 20X40 |
| R0942 | 0662057N03 | RES. CHIP 15K 5% 20X40 |
| R0943 | 0662057N07 | RES. CHIP 22K 5% 20X40 |
| R0944 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0945 | 0662057N37 | RES CHIP 390K 5% 20X40 |
| R0947 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0948 | 0662057M66 | RES. CHIP 470 5% 20X40 |
| R0950 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0953 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0954 | 0662057U98 | RES CHIP 7.5K 1% 1/16W |
| R0955 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0960 | 0662057N06 | RES. CHIP 20K 5% 20X40 |
| R0961 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0962 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0963 | 0662057N16 | RES. CHIP 51K 5% 20X40 |
| R0964 | 0662057N08 | RES CHIP 24K 5% 20X40 |
| R0965 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0966 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0967 | 0662057V27 | RES CHIP 100K 1% 1/1 6W |
| R0968 | 0662057V02 | RES CHIP 10K 1% 1/16W |
| R0971 | 0662057V02 | RES CHIP 10K 1% 1/16W |
| R0972 | 0662057V02 | RES CHIP 10K 1% 1/16W |
| R0973 | 0662057N09 | RES. CHIP 27K 5% 20X40 |
| R0974 | 0662057V02 | RES CHIP 10K 1% 1/16W |
| R0975 | 0662057V02 | RES CHIP 10K 1% 1/16W |
| R0976 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0977 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0978 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0979 | 0662057M01 | RES. CHIP 0 5% 20X40 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R0981 | 0662057M84 | RES. CHIP 2700 5% 20X40 |
| R0982 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0983 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0984 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0985 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0987 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0988 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0989 | 0662057N17 | RES. CHIP 56K 5% 20X40 |
| R0990 | 0662057M91 | RES CHIP 5100 5% 20X40 |
| R0992 | 0662057N09 | RES. CHIP 27K 5% 20X40 |
| R0993 | 0662057U78 | RES CHIP 1.2K 1% 1/16W |
| R0994 | 0662057M88 | RES. CHIP 3900 5% 20X40 |
| R0995 | 0662057U78 | RES CHIP 1.2K 1% 1/16W |
| R0996 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0997 | 0662057U78 | RES CHIP 1.2K 1% 1/16W |
| R0998 | 0662057V02 | RES CHIP 10K 1% 1/16W |
| R0999 | 0662057V01 | RES CHIP 9.1K 1% 1/16W |
| R1000 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R3000 | 0662057M43 | RES. CHIP 51 5% 20X40 |
| R3001 | 0662057N47 | RES. CHIP 1.0 MEG 5% 20X40 |
| R3002 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R3003 | 0662057N03 | RES. CHIP 15K 5% 20X40 |
| R3004 | 0662057N05 | RES. CHIP 18K 5% 20X40 |
| R3005 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R3006 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R3007 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R3008 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R3009 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R3010 | 0662057M64 | RES. CHIP 390 5% 20X40 |
| R3011 | 0662057M64 | RES. CHIP 390 5% 20X40 |
| R3012 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R3014 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R3015 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R3016 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R3017 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R3018 | 0662057M01 | RES. CHIP 0 5% 20X40 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R3019 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R3020 | 0662057M43 | RES. CHIP 51 5% 20X40 |
| R3021 | 0662057M66 | RES. CHIP 470 5% 20X40 |
| R3022 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R3251 | 0662057A01 | CHIP RES 10 OHMS 5% |
| R3252 | 0662057R02 | RES CHIP 10 .1W 1% |
| R3253 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R3254 | 0662057A57 | CHIP RES 2200 OHMS 5% |
| R3255 | 0662057A20 | CHIP RES 62 OHMS 5% |
| R3256 | 0662057A49 | CHIP RES 1000 OHMS 5% |
| R3257 | 0662057A44 | CHIP RES 620 OHMS 5% |
| R3258 | 0662057A20 | CHIP RES 62 OHMS 5% |
| R3259 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R3260 | 0662057A18 | CHIP RES 51 OHMS 5% |
| R3261 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R3262 | 0662057M86 | RES CHIP 3300 5% 20X40 |
| R3263 | 0662057M78 | RES. CHIP 1500 5% 20X40 |
| R3264 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R3265 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R3266 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R3268 | 0662057A20 | CHIP RES 62 OHMS 5% |
| R3269 | 0662057N17 | RES. CHIP 56K 5% 20X40 |
| R3270 | 0662057A18 | CHIP RES 51 OHMS 5% |
| R3271 | 0662057A22 | CHIP RES 75 OHMS 5% |
| R3272 | 0662057A13 | CHIP RES 33 OHMS 5% |
| R3273 | 0662057M88 | RES. CHIP 3900 5% 20X40 |
| R3274 | 0662057M64 | RES. CHIP 390 5% 20X40 |
| R3275 | 0662057M64 | RES. CHIP 390 5% 20X40 |
| R3277 | 0662057M86 | RES CHIP 3300 5% 20X40 |
| R3278 | 0662057N17 | RES. CHIP 56K 5% 20X40 |
| R3279 | 0662057M95 | RES. CHIP 7500 5% 20X40 |
| R3280 | 0662057M86 | RES CHIP 3300 5% 20X40 |
| R3281 | 0662057M87 | RES. CHIP 3600 5% 20X40 |
| R3288 | 0662057A20 | CHIP RES 62 OHMS 5% |
| R3400 | 0662057A44 | CHIP RES 620 OHMS 5% |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R3401 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R3402 | 0662057M86 | RES CHIP 3300 5% 20X40 |
| R3405 | 0662057M78 | RES. CHIP 1500 5% 20X40 |
| R3407 | 0662057A01 | CHIP RES 10 OHMS 5% |
| R3409 | 0662057A22 | CHIP RES 75 OHMS 5% |
| R3413 | 0662057A25 | CHIP RES 100 OHMS 5% |
| R3500 | 0662057M56 | RES. CHIP 180 5% 20X40 |
| R3501 | 0611077A01 | RES CHIP JUMPER |
| R3520 | 0662057M33 | RES CHIP 20 5% 20X40 |
| R3521 | 0662057M33 | RES CHIP 20 5% 20X40 |
| R3522 | 0662057M33 | RES CHIP 20 5% 20X40 |
| R3523 | 0662057M33 | RES CHIP 20 5% 20X40 |
| R3524 | 0662057M33 | RES CHIP 20 5% 20X40 |
| R3525 | 0662057M33 | RES CHIP 20 5% 20X40 |
| R3526 | 0662057C75 | CHIP RES 1000 OHMS 5% |
| R3527 | 0680195M01 | RES CHIP 10 OHMS 5% .5W |
| R3528 | 0611077A01 | RES CHIP JUMPER |
| R3529 | 0611077A01 | RES CHIP JUMPER |
| R3540 | 0611077A74 | RES CHIP 1000 5 1/8 |
| R3541 | 0611077A23 | RES CHIP 7.5 5 1/8W |
| R3542 | 0611077A23 | RES CHIP 7.5 5 1/8W |
| R3543 | 0611077A23 | RES CHIP 7.5 5 1/8W |
| R3544 | 0611077A23 | RES CHIP 7.5 5 1/8W |
| R3545 | 0611077A23 | RES CHIP 7.5 5 1/8W |
| R3546 | 0611077A23 | RES CHIP 7.5 5 1/8W |
| R3547 | 0611077A23 | RES CHIP 7.5 5 1/8W |
| R3548 | 0611077A23 | RES CHIP 7.5 5 1/8W |
| R3549 | 0680194M13 | RES 33 OHMS 5% 1W |
| R3550 | 0611077A23 | RES CHIP 7.5 5 1/8W |
| R3551 | 0611077A23 | RES CHIP 7.5 5 1/8W |
| R3552 | 0611077A23 | RES CHIP 7.5 5 1/8W |
| R3553 | 0611077A23 | RES CHIP 7.5 5 1/8W |
| R3554 | 0611077A23 | RES CHIP 7.5 5 1/8W |
| R3555 | 0611077A23 | RES CHIP 7.5 5 1/8W |
| R3556 | 0611077A23 | RES CHIP 7.5 5 1/8W |
| R3557 | 0611077A23 | RES CHIP 7.5 5 1/8W |
| R3558 | 0611077A74 | RES CHIP 1000 5 1/8 |
| R3559 | 0680194M13 | RES 33 OHMS 5% 1W |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R3560 | 0680195M01 | RES CHIP 10 OHMS 5% .5W |
| R3561 | 0685934D02 | RES,,5MOHM,1%,3W,SM,, 180PPM |
| R3562 | 0662057C13 | CHIP RES 2.7 OHMS 5% |
| R3563 | 0662057C13 | CHIP RES 2.7 OHMS 5% |
| R3564 | 0662057V27 | RES CHIP 100K 1% 1/1 6W |
| R3565 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R3567 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R3568 | 0611077A01 | RES CHIP JUMPER |
| R3569 | 0611077A01 | RES CHIP JUMPER |
| R3700 | 0680194M13 | RES 33 OHMS 5% 1W |
| R3702 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R3730 | 0680149M02 | THERMISTOR CHIP 100K OHM |
| R3731 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R3732 | 0662057M78 | RES. CHIP 1500 5% 20X40 |
| R3733 | 0662057M56 | RES. CHIP 180 5% 20X40 |
| R3734 | 0662057M58 | RES. CHIP 220 5% 20X40 |
| R3735 | 0662057M58 | RES. CHIP 220 5% 20X40 |
| R3736 | 0662057M60 | RES. CHIP 270 5% 20X40 |
| R3737 | 0662057M78 | RES. CHIP 1500 5% 20X40 |
| R3738 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R3739 | 0680149M02 | THERMISTOR CHIP 100K OHM |
| R3750 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R3751 | 0662057M34 | RES. CHIP 22 5% 20X40 |
| R3752 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R3753 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R3754 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R3755 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R3756 | 0662057N03 | RES. CHIP 15K 5% 20X40 |
| R3757 | 0662057M81 | RES. CHIP 2000 5% 20X40 |
| R3758 | 0662057N17 | RES. CHIP 56K 5% 20X40 |
| R3759 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R3761 | 0662057M98 | RES. CHIP 10K 5% 20X40 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R3762 | 0662057M92 | RES. CHIP 5600 5% 20X40 |
| R3763 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R3764 | 0662057M81 | RES. CHIP 2000 5% 20X40 |
| R3765 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R3766 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R3767 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R3768 | 0662057M62 | RES. CHIP 330 5% 20X40 |
| R3769 | 0662057A49 | CHIP RES 1000 OHMS 5% |
| R3770 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R3771 | 0662057M46 | RES. CHIP 68 5% 20X40 |
| R3772 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R3773 | 0662057M43 | RES. CHIP 51 5% 20X40 |
| R3774 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R3775 | 0662057M78 | RES. CHIP 1500 5% 20X40 |
| R3776 | 0662057N25 | RES. CHIP 120K 5% 20X40 |
| R3778 | 0662057N07 | RES. CHIP 22K 5% 20X40 |
| R3779 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R3784 | 0662057B47 | CHIP RES 0 OHMS +-.050 OHMS |
| R3786 | 0662057A83 | CHIP RES 27K OHMS 5% |
| R3787 | 0662057A83 | CHIP RES 27K OHMS 5% |
| R3788 | 0662057A83 | CHIP RES 27K OHMS 5% |
| R3789 | 0662057A83 | CHIP RES 27K OHMS 5% |
| R3790 | 0662057M94 | RES. CHIP 6800 5% 20X40 |
| R3791 | 0662057N03 | RES. CHIP 15K 5% 20X40 |
| R3792 | 0662057M92 | RES. CHIP 5600 5% 20X40 |
| R3793 | 0662057M92 | RES. CHIP 5600 5% 20X40 |
| R3794 | 0662057M21 | RES CHIP 6.2 5% 20X40 |
| R3795 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R3797 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R3798 | 0662057M74 | RES. CHIP 1000 5% 20X40 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R3799 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R3800 | 0662057A23 | CHIP RES 82 OHMS 5% |
| R3801 | 0662057A23 | CHIP RES 82 OHMS 5% |
| R3802 | 0662057M72 | RES. CHIP 820 5% 20X40 |
| R3803 | 0662057M61 | RES. CHIP 300 5% 20X40 |
| R3804 | 0662057M61 | RES. CHIP 300 5% 20X40 |
| R3807 | 0662057A44 | CHIP RES 620 OHMS 5% |
| R3808 | 0662057A44 | CHIP RES 620 OHMS 5% |
| R3809 | 0662057M32 | RES. CHIP 18 5% 20X40 |
| R3811 | 0662057A21 | CHIP RES 68 OHMS 5% |
| R3812 | 0662057A21 | CHIP RES 68 OHMS 5% |
| R3813 | 0662057A23 | CHIP RES 82 OHMS 5% |
| R3814 | 0662057A23 | CHIP RES 82 OHMS 5% |
| R3815 | 0662057A23 | CHIP RES 82 OHMS 5% |
| R3816 | 0662057A23 | CHIP RES 82 OHMS 5% |
| R3817 | 0662057M34 | RES. CHIP 22 5% 20X40 |
| R3818 | 0662057M56 | RES. CHIP 180 5% 20X40 |
| R3819 | 0662057M56 | RES. CHIP 180 5% 20X40 |
| R3820 | 0662057M34 | RES. CHIP 22 5% 20X40 |
| R3821 | 0662057M72 | RES. CHIP 820 5% 20X40 |
| R3823 | 0662057M37 | 20X40 30 OMH 5% CHIP RESISTOR |
| R3824 | 0662057M56 | RES. CHIP 180 5% 20X40 |
| R3825 | 0662057M32 | RES. CHIP 18 5% 20X40 |
| R3826 | 0662057M61 | RES. CHIP 300 5% 20X40 |
| R3827 | 0662057M61 | RES. CHIP 300 5% 20X40 |
| R3828 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R3829 | 0662057M46 | RES. CHIP 68 5% 20X40 |
| R3831 | 0662057M21 | RES CHIP 6.2 5% 20X40 |
| R3832 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R3833 | 0662057M32 | RES. CHIP 18 5% 20X40 |
| R3834 | 0662057M32 | RES. CHIP 18 5% 20X40 |
| R3835 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R3836 | 0662057M43 | RES. CHIP 51 5% 20X40 |
| R3838 | 0662057M81 | RES. CHIP 2000 5% 20X40 |
| R3839 | 0662057M61 | RES. CHIP 300 5% 20X40 |
| R3840 | 0662057M61 | RES. CHIP 300 5% 20X40 |
| R3841 | 0662057M56 | RES. CHIP 180 5% 20X40 |
| R3842 | 0662057M56 | RES. CHIP 180 5% 20X40 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R3843 | 0662057M37 | 20X40 30 OMH 5% CHIP RESISTOR |
| R3845 | 0662057M86 | RES CHIP 3300 5% 20X40 |
| R3846 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R3851 | 0662057A11 | CHIP RES 27 OHMS 5% |
| R3852 | 0662057A11 | CHIP RES 27 OHMS 5% |
| R3854 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R3855 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R3856 | 0662057M61 | RES. CHIP 300 5% 20X40 |
| R3857 | 0662057M61 | RES. CHIP 300 5% 20X40 |
| R3858 | 0662057M56 | RES. CHIP 180 5% 20X40 |
| R3859 | 0662057M56 | RES. CHIP 180 5% 20X40 |
| R3860 | 0662057M72 | RES. CHIP 820 5% 20X40 |
| R3861 | 0662057M72 | RES. CHIP 820 5% 20X40 |
| R3862 | 0662057M21 | RES CHIP 6.2 5% 20X40 |
| R3863 | 0662057M37 | 20X40 30 OMH 5% CHIP RESISTOR |
| R3864 | 0662057M32 | RES. CHIP 18 5% 20X40 |
| R3865 | 0662057M46 | RES. CHIP 68 5% 20X40 |
| R3868 | 0662057M92 | RES. CHIP 5600 5% 20X40 |
| R3869 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R3870 | 0662057M62 | RES. CHIP 330 5% 20X40 |
| R3871 | 0662057A33 | CHIP RES 220 OHMS 5% |
| R3872 | 0662057A25 | CHIP RES 100 OHMS 5% |
| R3873 | 0662057A09 | CHIP RES 22 OHMS 5% |
| R3880 | 0662057A49 | CHIP RES 1000 OHMS 5% |
| R3881 | 0662057A49 | CHIP RES 1000 OHMS 5% |
| R3882 | 0662057A44 | CHIP RES 620 OHMS 5% |
| R3884 | 0662057A44 | CHIP RES 620 OHMS 5% |
| SH3750 | 2687874V01 | SHIELD,RFI/EMI,NI-AG,33.3MMLG,28.3M |
| SH3751 | 2602660J02 | SHLD 18.13 X 11.14 |
| SH3752 | 2602660J02 | SHLD 18.13 X 11.14 |
| SH3753 | 2602660J02 | SHLD 18.13 X 11.14 |
| SH3754 | 2687874V01 | SHIELD,RFI/EMI,NI-AG,33.3MMLG,28.3M |
| SH3759 | 2602660J02 | SHLD 18.13 X 11.14 |
| SH3760 | 2689589U01 | VCO SHEILD |
| SH3762 | 2605782V04 | SHLD |
| SH3763 | 2605782V04 | SHLD |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| T3301 | 2580541Z02 | BALUN TRANSFORMER (NEW) |
| T3302 | 2580541Z02 | BALUN TRANSFORMER (NEW) |
| U0001 | 0105958T50 | XTL5000 DAUGHTER BD W/ BRAVO |
| U0102 | 5185623B01 | HIGH SPEED CMOS INVERTER |
| U0103 | 5113837A15 | IC 3.3V QUAD BUFFER |
| U0104 | 5113837A15 | IC 3.3V QUAD BUFFER |
| U0105 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0106 | 5109522E53 | IC SNGL BUF NC7S125P5X SC70 |
| U0200 | 5105109Z38 | 3 VOLT LINEAR PCM CODEC FILTER |
| U0201 | 5113819A14 | IC QD OP AMP _33204_ |
| U0202 | 5185143E67 | IC LM1971-62 DB LOG POT |
| U0203 | 5162852A79 | IC MOS TTL SPDT ANA-LOG SC70 |
| U0204 | 5185794L01 | AUDIO AMP TAPE AND REEL |
| U0206 | 5185143E67 | IC LM1971-62 DB LOG POT |
| U0208 | 5162852A79 | IC MOS TTL SPDT ANA-LOG SC70 |
| U0209 | 5162852A79 | IC MOS TTL SPDT ANA-LOG SC70 |
| U0210 | 5162852A79 | IC MOS TTL SPDT ANA-LOG SC70 |
| U0300 | 5113837A15 | IC 3.3V QUAD BUFFER |
| U0303 | 5113837A15 | IC 3.3V QUAD BUFFER |
| U0304 | 5187970L15 | IC USB TRANS FULL-SPEED |
| U0305 | 5185353D94 | IC RS232 TRANSCEIVER |
| U0307 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0308 | 5113805B88 | IC HCMOS NON-INV BUFFER W/TTL |
| U0309 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0401 | 5189290U41 | PRPHL INTFC,PRPHL INTFC,,,MAX3370 |
| U0500 | 5183308X01 | IC, LM2941, TO DRPOUT RGTR |
| U0501 | 5185353D55 | IC VOLTAGE REGULA-TOR 100MZ ADJ |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| U0502 | 5185353D55 | IC VOLTAGE REGULA-TOR 100MZ ADJ |
| U0503 | 5113816A07 | REG 5V POS 500MA MC78M05BDTRK |
| U0504 | 5185353D46 | IF 4.3V VOLTAGE DETEC-TOR |
| U0505 | 5113816A07 | REG 5V POS 500MA MC78M05BDTRK |
| U0506 | 5185143E57 | CMOS TIMER-LMC555CM |
| U0507 | 5185353D55 | IC VOLTAGE REGULA-TOR 100MZ ADJ |
| U0550 | 5183308X01 | IC, LM2941, TO DRPOUT RGTR |
| U0601 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0602 | 5113837A15 | IC 3.3V QUAD BUFFER |
| U0603 | 5109522E53 | IC SNGL BUF NC7S125P5X SC70 |
| U0604 | 5113818A14 | IC DL OP AMP RAIL TO RAIL |
| U0605 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0606 | 5105109Z31 | IC QUAD 2:1 MUX/DEMUX |
| U0607 | 5109522E74 | IC 2-INPUT AND GATE |
| U0608 | 5109522E74 | IC 2-INPUT AND GATE |
| U0609 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0610 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0611 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0700 | 5185368C83 | IC 12 BIT DAC |
| U0701 | 5164015H66 | IC, 64 MACROCELL CPLD |
| U0703 | 5162852A79 | IC MOS TTL SPDT ANA-LOG SC70 |
| U0704 | 5162852A79 | IC MOS TTL SPDT ANA-LOG SC70 |
| U0705 | 5162852A79 | IC MOS TTL SPDT ANA-LOG SC70 |
| U0740 | 5185143E68 | IC LM7219 HIGH SPEED COMPARATOR |
| U0951 | 5183308X01 | IC, LM2941, TO DRPOUT RGTR |
| U0952 | 5185956E99 | IC, DUAL DIGITAL POTEN-TIOMETER, 256-TAP SPI |
| U0953 | 5185143E16 | IC ANALOG TO DIGITAL CONVERTER |
| U0954 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0955 | 5113819A14 | IC QD OP AMP _33204_ |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| U0956 | 5185956E24 | QUAD OP AMP RAIL TO RAIL 14 |
| U0957 | 5113819A14 | IC QD OP AMP _33204_ |
| U0958 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0959 | 5185143E05 | IC DAC OCTAL 8 BIT |
| U0960 | 5113819A14 | IC QD OP AMP _33204_ |
| U0962 | 5185353D14 | IC SOT23-5 HI PRECISION REG 3V |
| U0965 | 5185143E68 | IC LM7219 HIGH SPEED COMPARATOR |
| U0966 | 5113816A07 | REG 5V POS 500MA MC78M05BDTRK |
| U3000 | 5185963A85 | IC-ABACUS III-LP |
| U3001 | 5185353D14 | IC SOT23-5 HI PRECISION REG 3V |
| U3250 | 5185130C83 | IC 15DB DIGITAL ATTEUA-TOR SOT25 PKG |
| U3500 | 5185130C65 | IC VHF/UHF/800 MHZ LDMOS DRIVER |
| U3560 | 5185963A15 | IC TEMPERTURE SEN-SOR 1M50C |
| U3561 | 5185353D92 | IC CURRENT SHUNT MONITOR |
| U3750 | 5185353D14 | IC SOT23-5 HI PRECISION REG 3V |
| U3751 | 5185963A27 | IC TESTED AT25016 48 PIN GFP |
| U3752 | 5105492X03 | IC SNG HI SPD L-MOS NOT GATE |
| VR0411 | 4805656W39 | QUAD ESD SUPPRES-SOR ARRAY -41206ESD |
| VR0412 | 4805656W09 | DIODE QUAD 20 VOLT ZENER |
| VR0414 | 4813832C75 | DIODE ZENER QU O |
| VR0415 | 4805656W09 | DIODE QUAD 20 VOLT ZENER |
| VR0418 | 4813832C75 | DIODE ZENER QU O |
| VR0420 | 4813830A24 | DIODE 11V 5% 225MW MMBZ5241B_ |
| VR0422 | 4805656W10 | DIODE DUAL 15 VOLT ZENER |
| VR0423 | 4805656W10 | DIODE DUAL 15 VOLT ZENER |
| VR0424 | 4805656W10 | DIODE DUAL 15 VOLT ZENER |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| VR0425 | 4805656W10 | DIODE DUAL 15 VOLT ZENER |
| VR0426 | 4813832C75 | DIODE ZENER QU O |
| VR0500 | 4813830A14 | DIODE 5.1V 5% 225MW MMBZ5231B_ |
| VR0501 | 4805656W10 | DIODE DUAL 15 VOLT ZENER |
| VR0502 | 4813830A75 | DIODE DUAL COM ANODE |
| VR3500 | 4813832C77 | TRANS SUP .24V HIGH PWR |
| Y0100 | 4809995L05 | XTAL QUARTZ 32.768KHZ CC4V-T1 |
| Y3400 | 4885230C01 | 109.65MHZ FILTER 3RD OVERTONE |
| Y3401 | 4885230C01 | 109.65MHZ FILTER 3RD OVERTONE |
| Y3750 | 5185143E07 | IC 16.8 MHZ REF OSC .8 PPM |
| Y3751 | 2484562T11 | COIL SURF MNT AIR WOUND |
| Y3752 | 2484562T11 | COIL SURF MNT AIR WOUND |
| Y3753 | 2413923A24 | IND CHIP 47 NH 2% |
| Y3754 | 2413923A01 | IND CHIP 56 NH 2% |

## 7.4 HUE4043A (UHF Range 1) Main Board

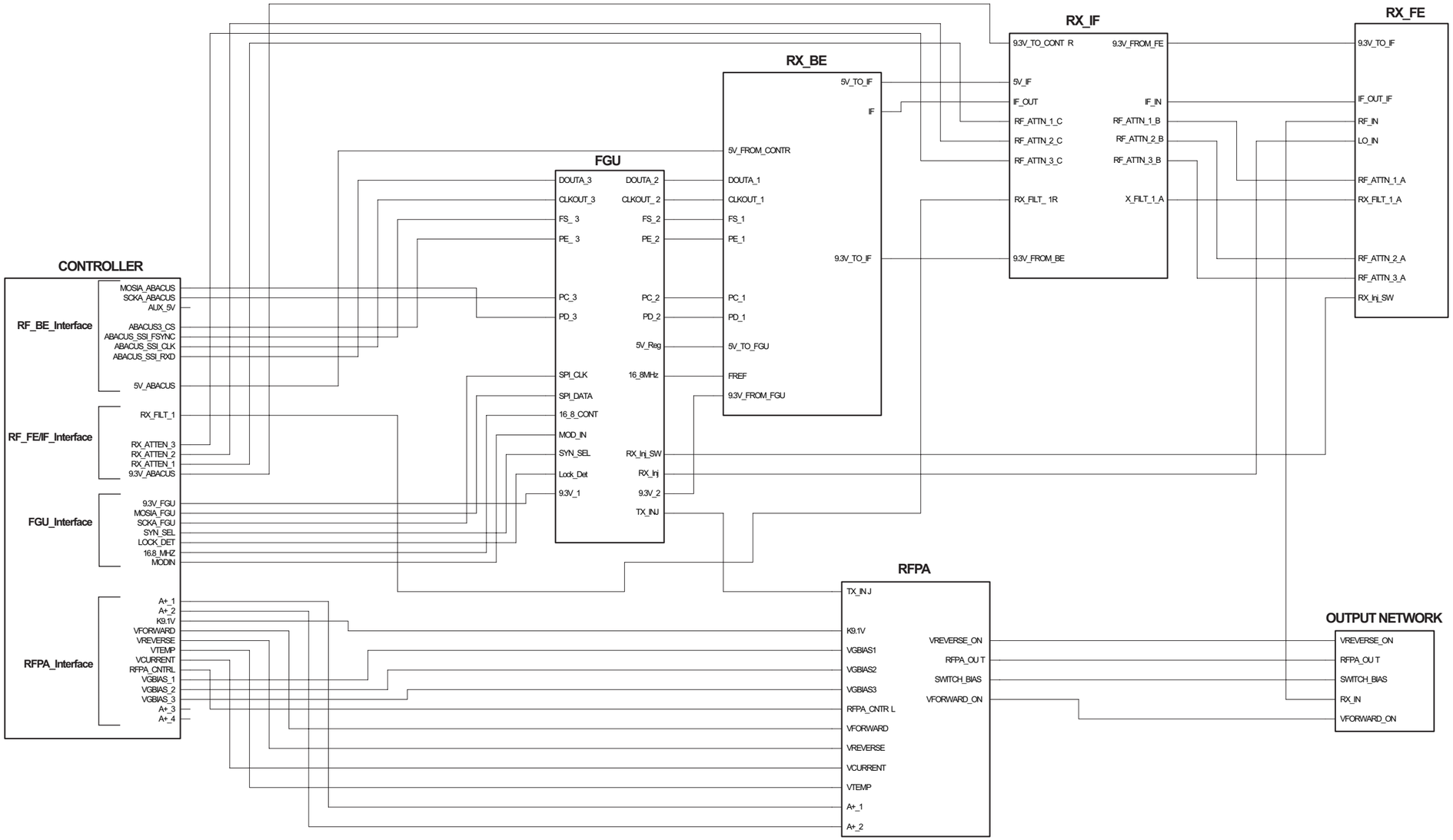



*Figure 7-43. HUE4043A Main Board Overall Block Diagram and Interconnections*

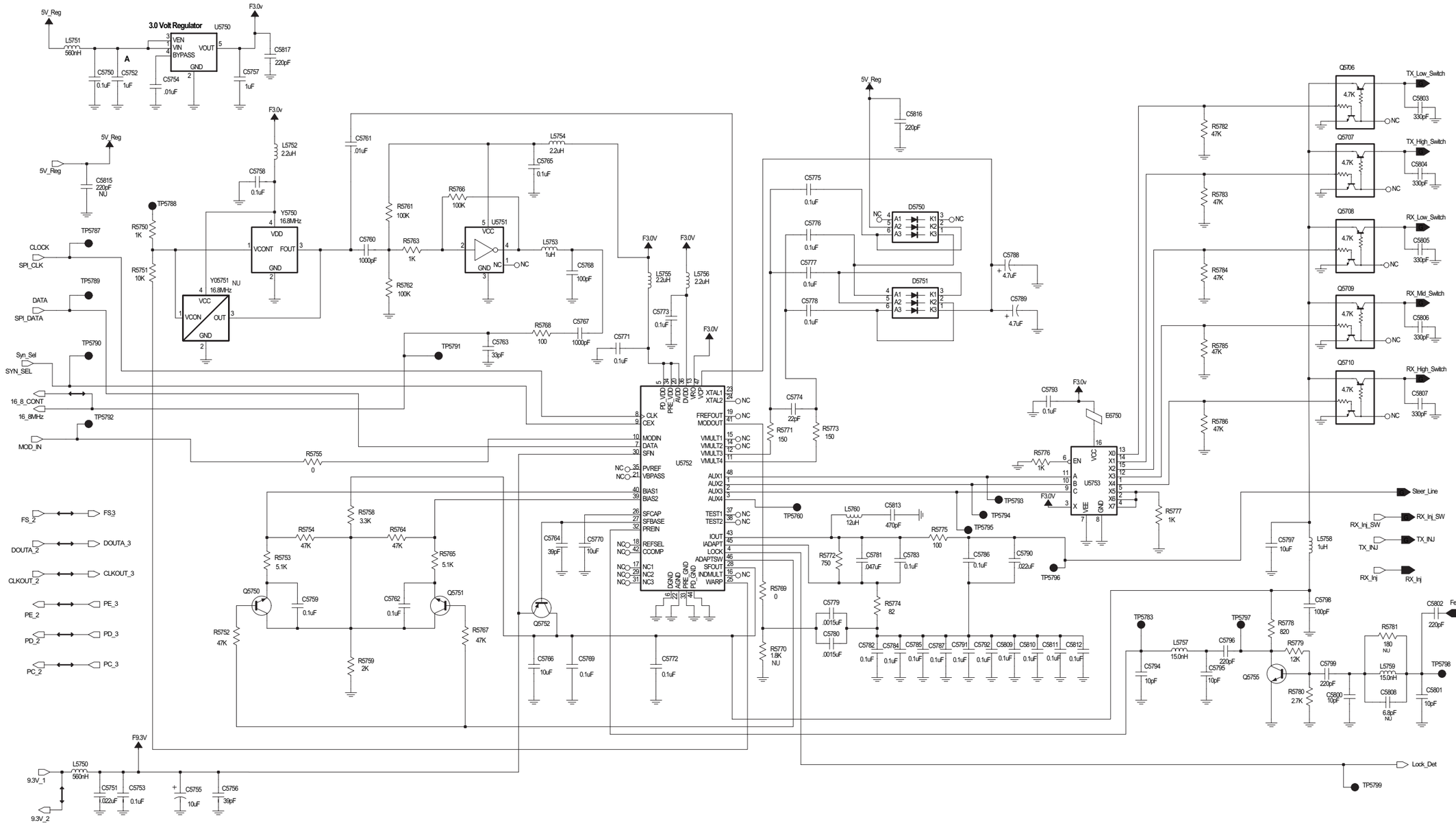



*Figure 7-44. HUE4043A Frequency Generation Unit*

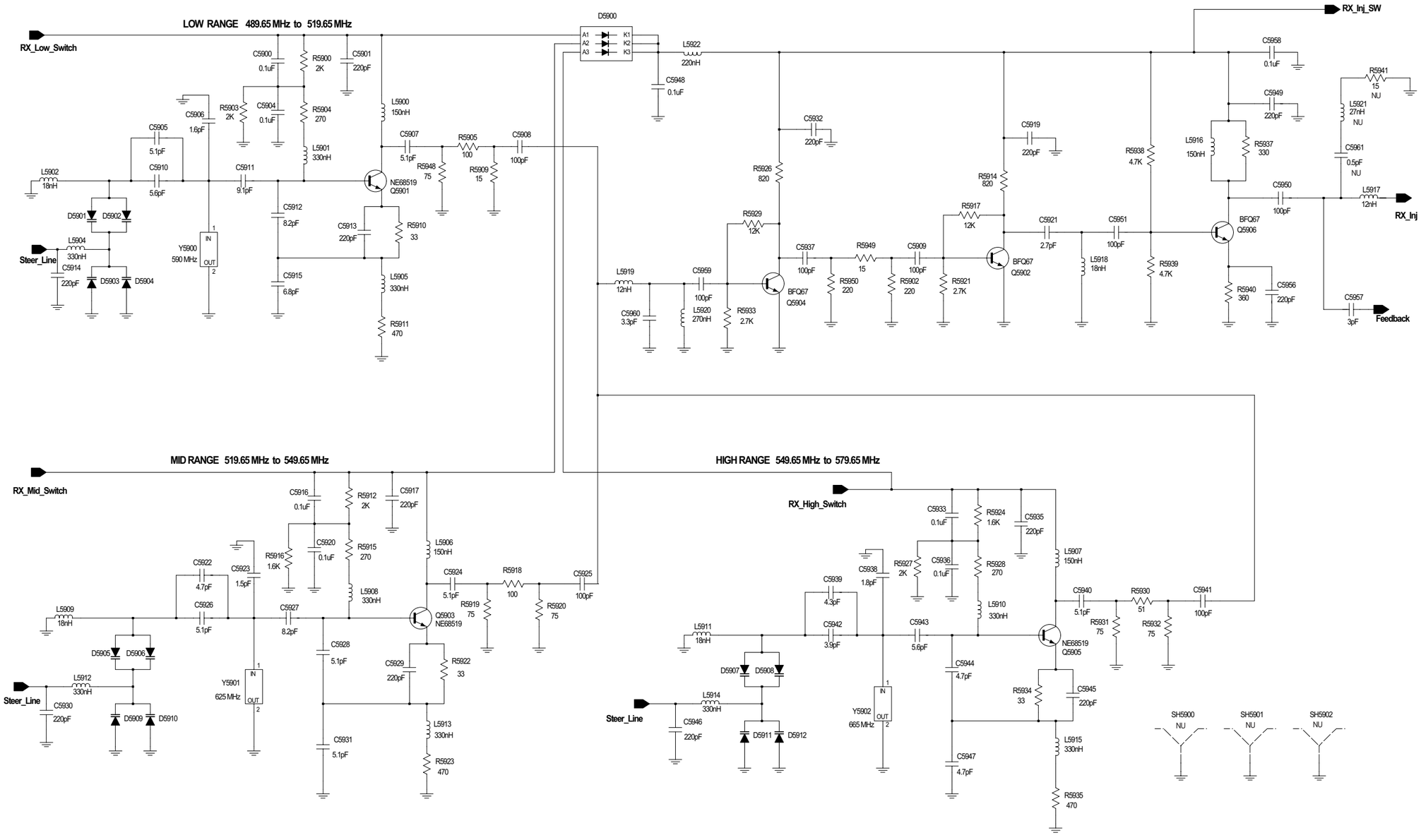



*Figure 7-45. HUE4043A Receive VCO Schematic*

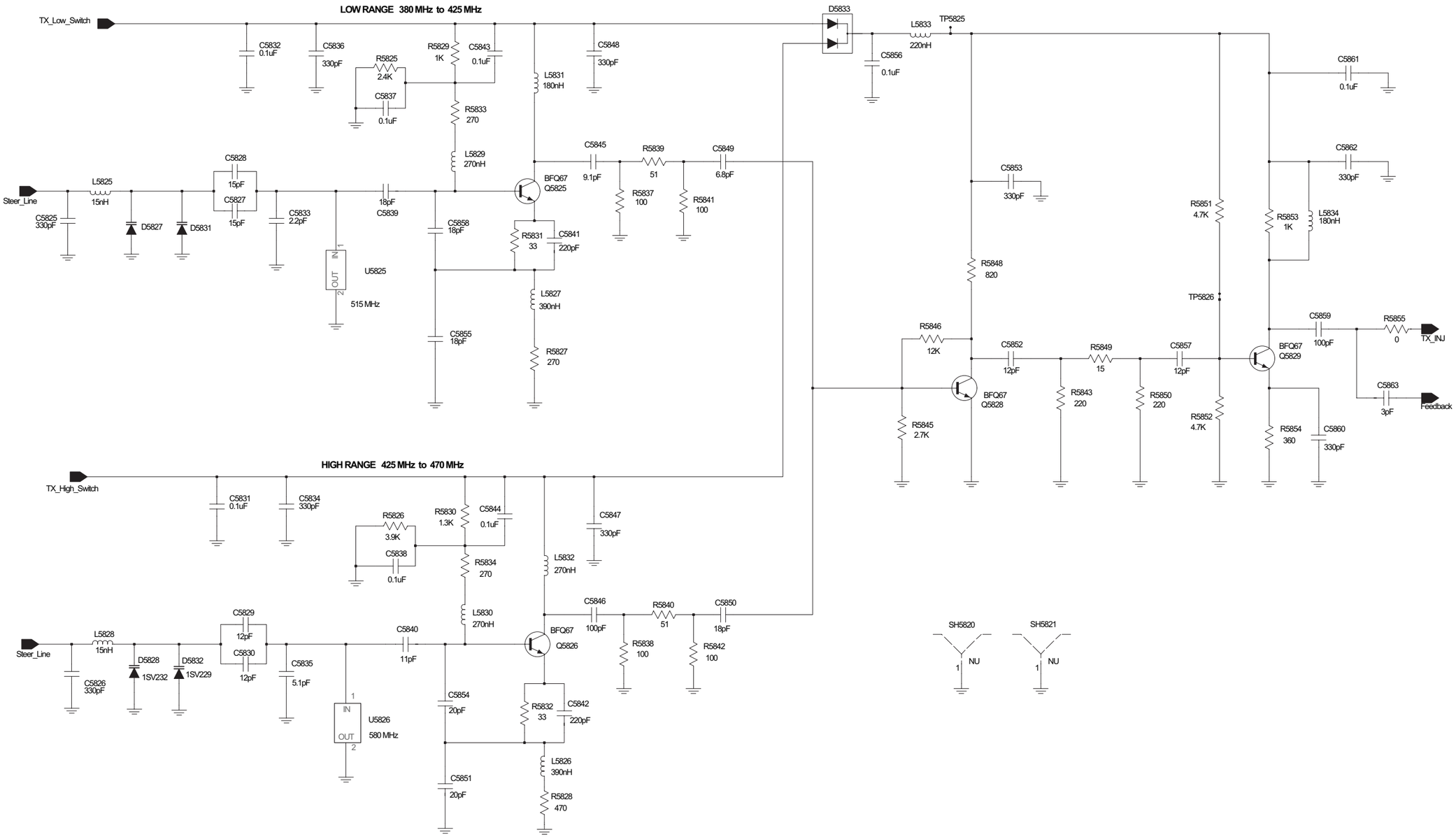



*Figure 7-46. HUE4043A Transmit VCO Schematic*

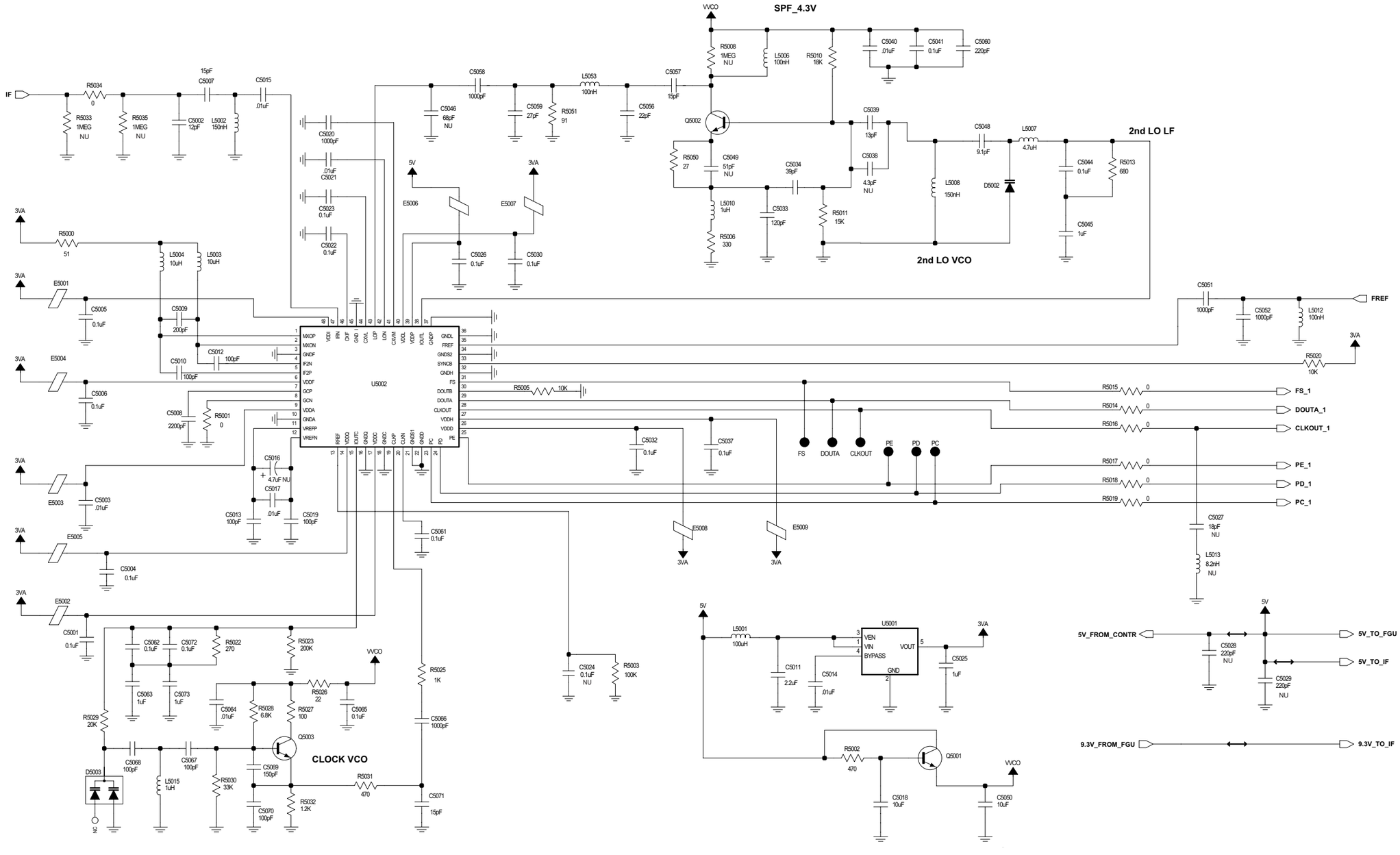



*Figure 7-47. HUE4043A Receiver Back-End Schematic*

| RX switching voltages | | |
|---|---|---|
| Test points | RX Receive 700 MHz | RX Receive 800 MHz |
| TP6254 | 0V | 3V |
| TP6255, 57, 59, 61 | 7.7V | 4.3V |
| TP6256, 58, 60, 62 | 2.3V | 7.7V |

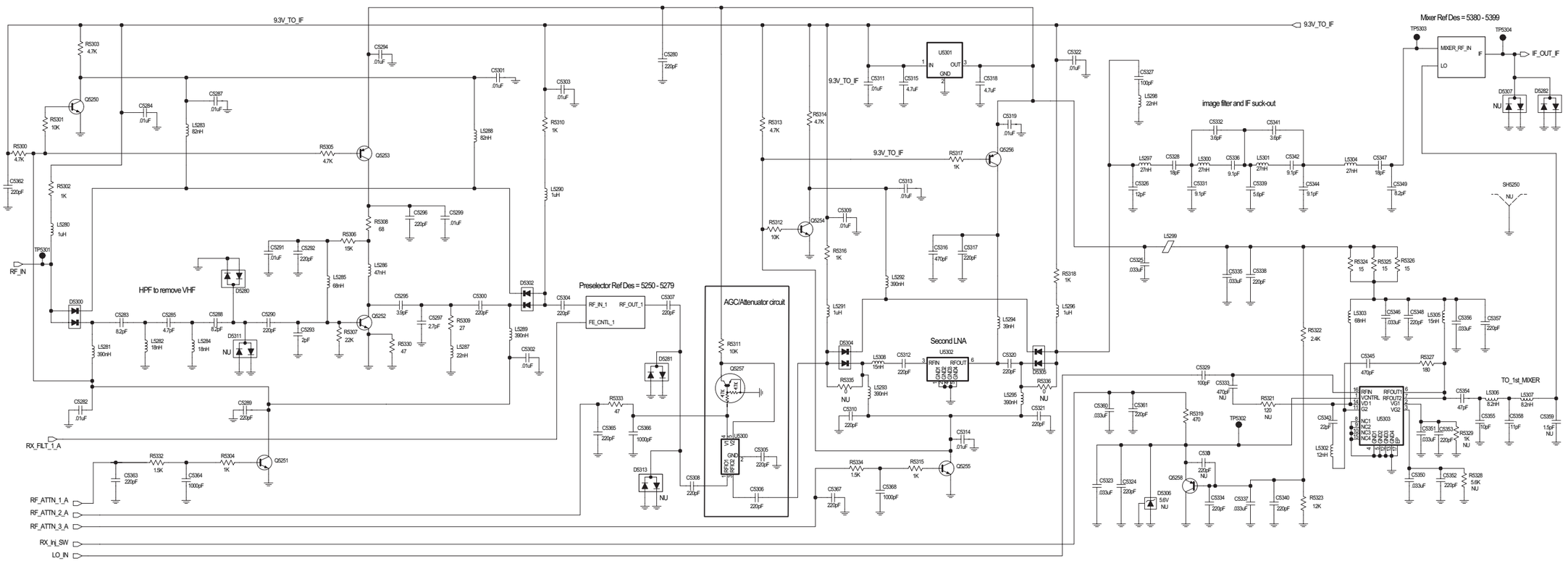



*Figure 7-48. HUE4043A Receiver Front-End Schematic*

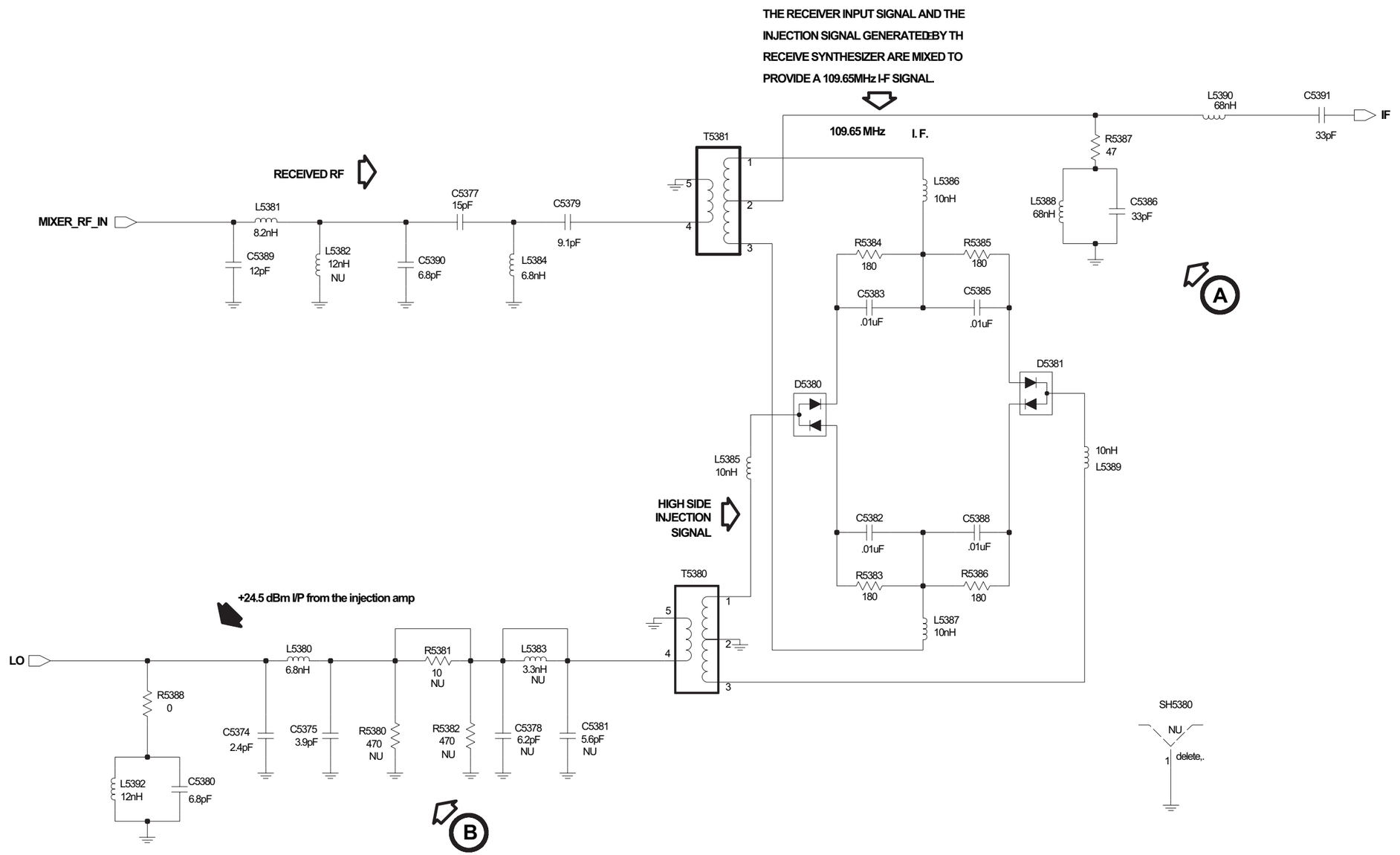



*Figure 7-49. HUE4043A Receiver Mixer Schematic*

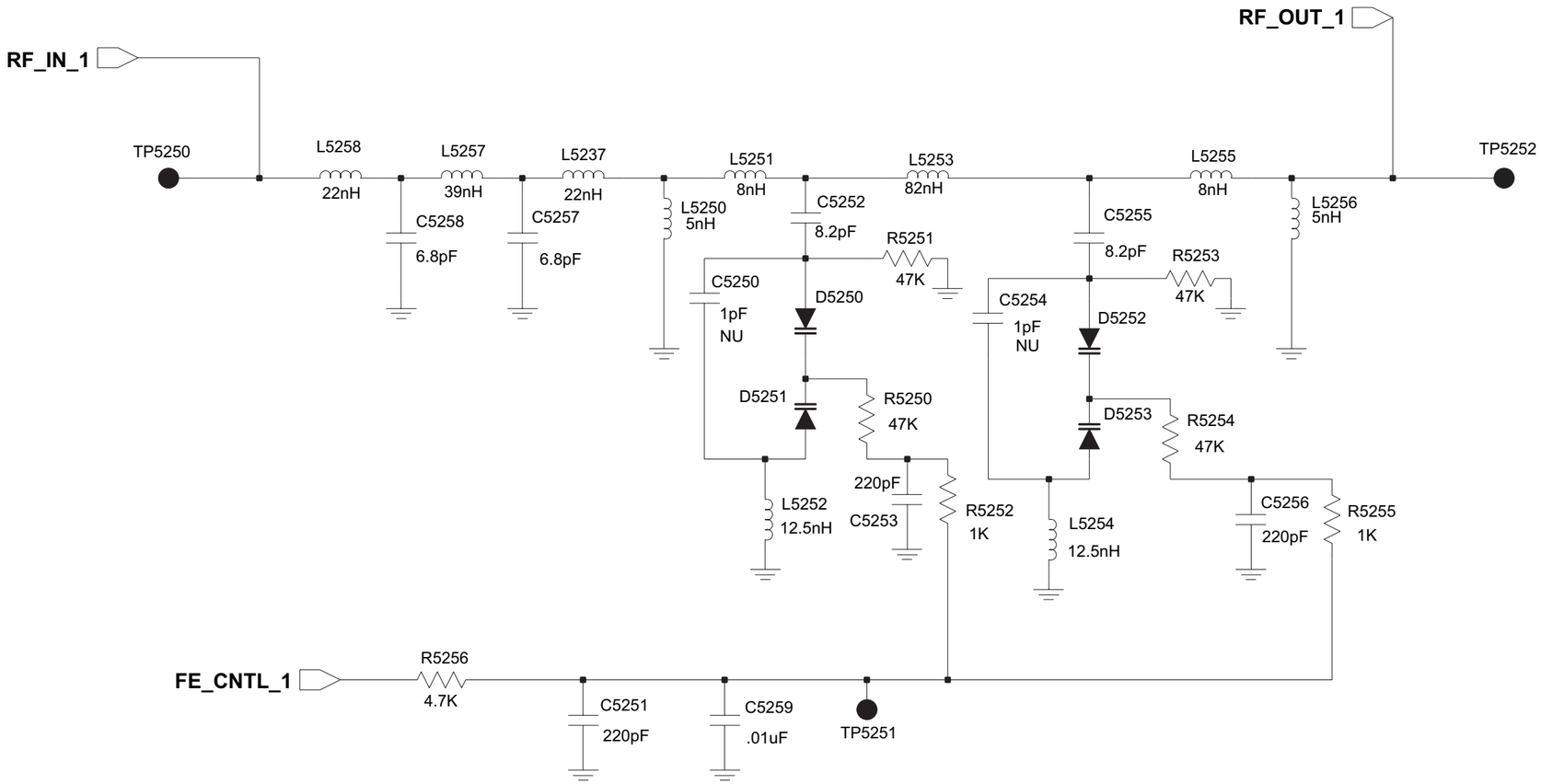



*Figure 7-50. HUE4043A Receiver Preselector Schematic*

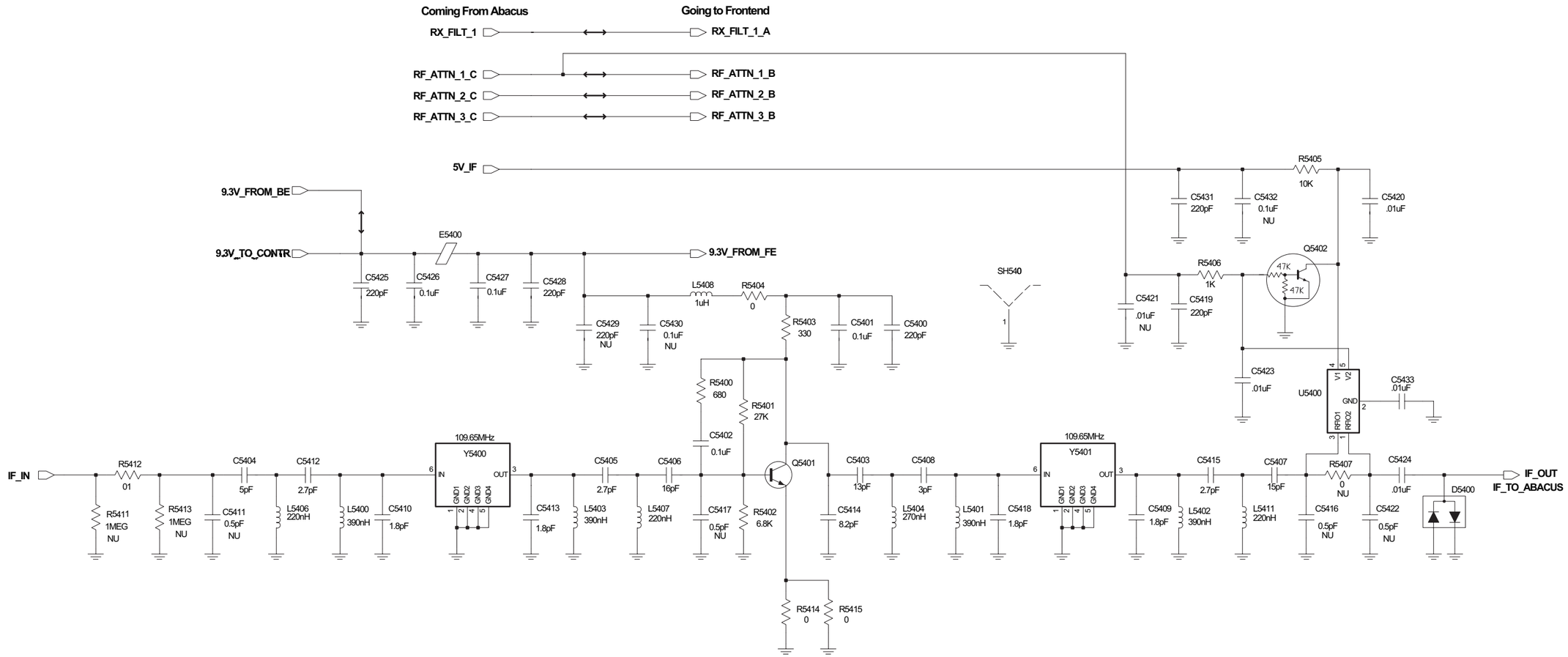



*Figure 7-51. HUE4043A Receiver IF Schematic*

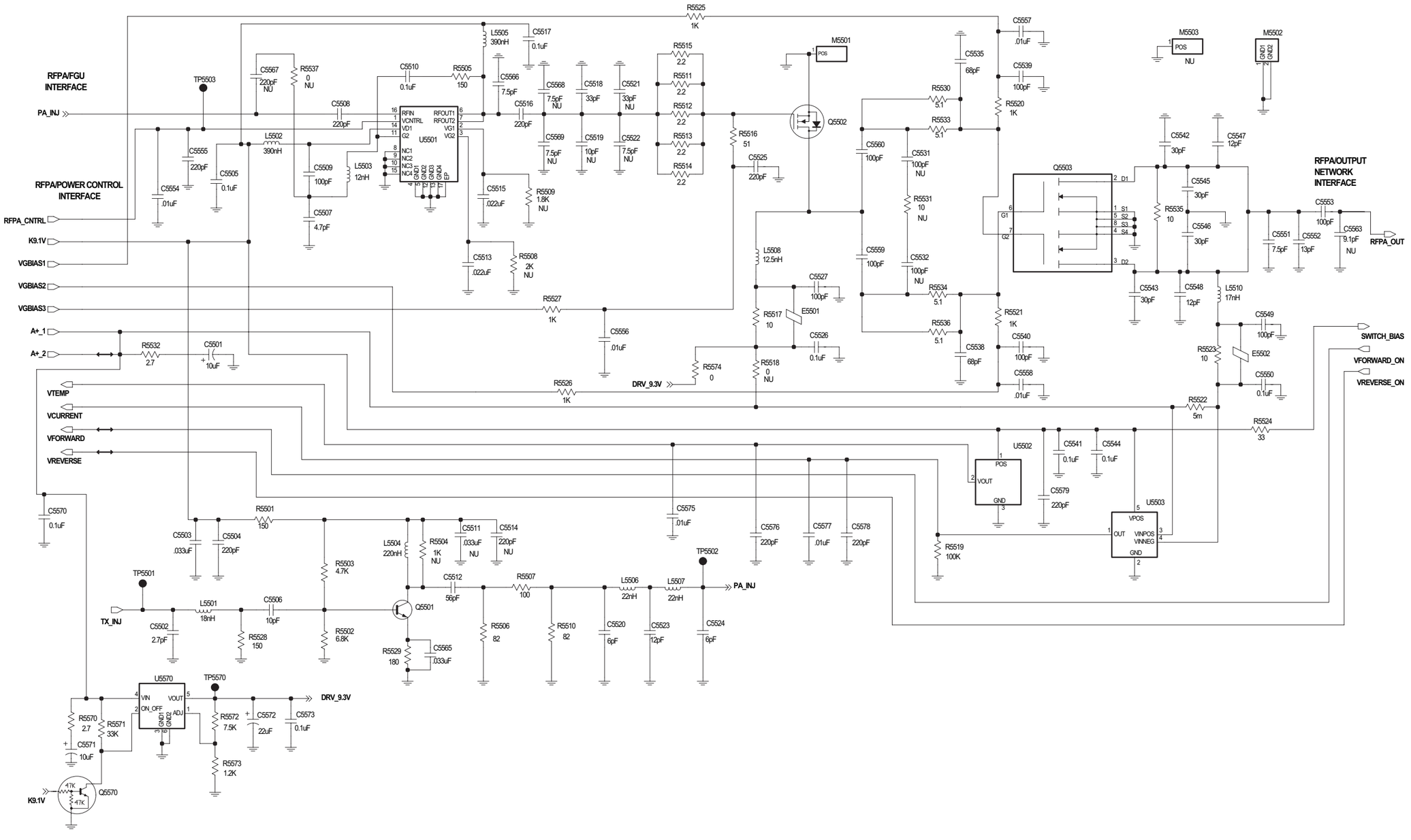



*Figure 7-52. HUE4039A RF Power Amplifier (RF PA) Schematic*

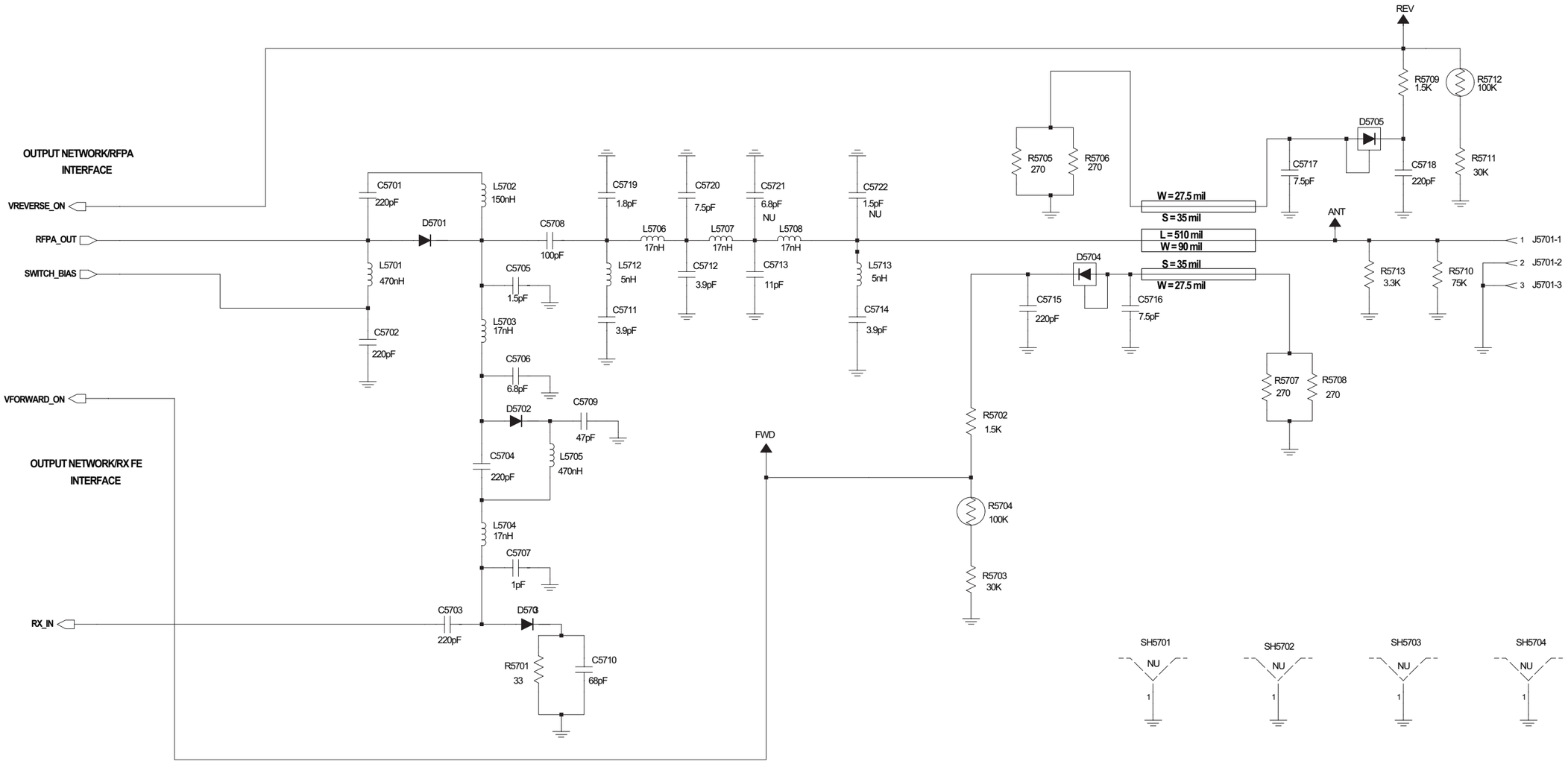



*Figure 7-53. HUE4043A Output Network (ON) Schematic*

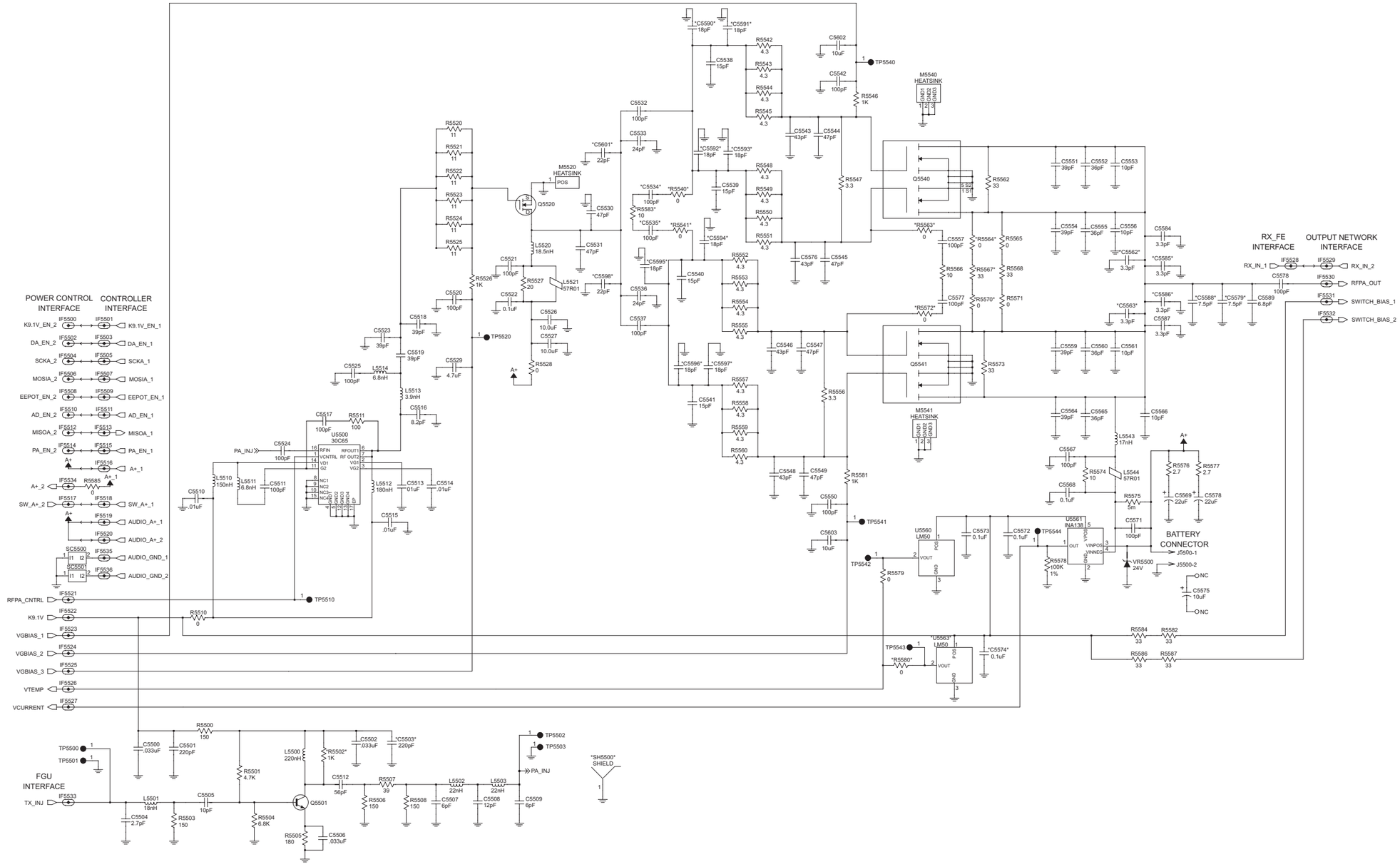



*Figure 7-54. HUE4043A RF 100W Power Amplifier (RF PA) Schematic (Sheet 1 of 2)*

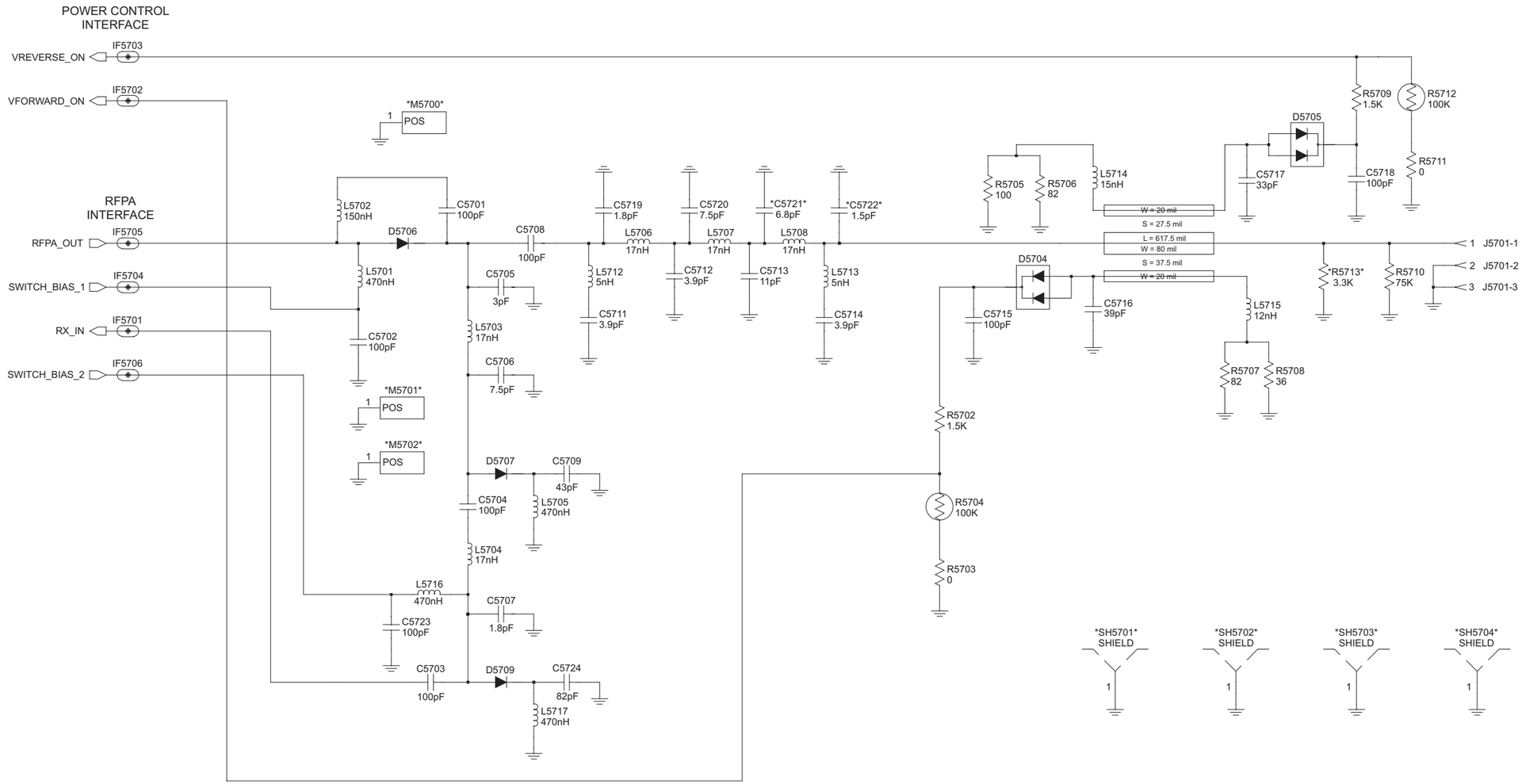
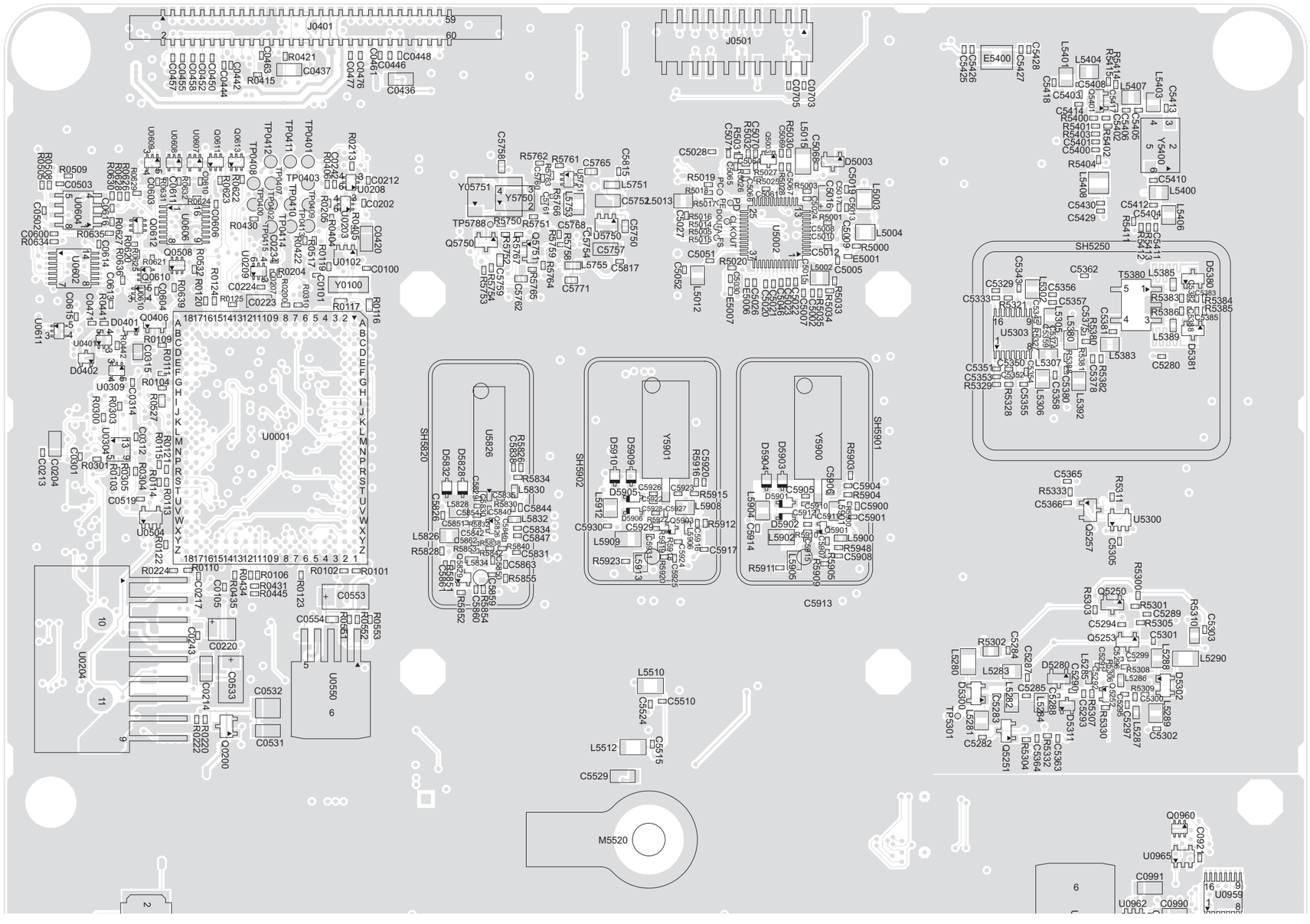



*Figure 7-55. HUE4043A RF 100W Power Amplifier (RF PA) Schematic (Sheet 2 of 2)*


J0401
J0501
SH5250
SH5820
SH5901
SH5902
U0001
U0204
U0550
U5826
U5300
U0965
U0962
U0959
Y0100
Y5751
Y5901
Y5900
M5520
TP5788
TP5301
Q5750
Q0406
Q0610
Q0508
Q0200
Q5257
Q5251
Q0960
D0401
D0402
E5400
C5913
C5510
C5529
L5510
L5512
C0703
C0705
C0436
C0446
C0448
C0437
C0415
C0421
C0463
C0476
C0477
C0461
C0457
C0458
C0455
C0452
C0450
C0444
C0442
R0509
R0508
R0505
C0503
C0502
C0603
C0604
C0606
C0607
C0608
C0609
C0610
C0611
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C0744
C0745

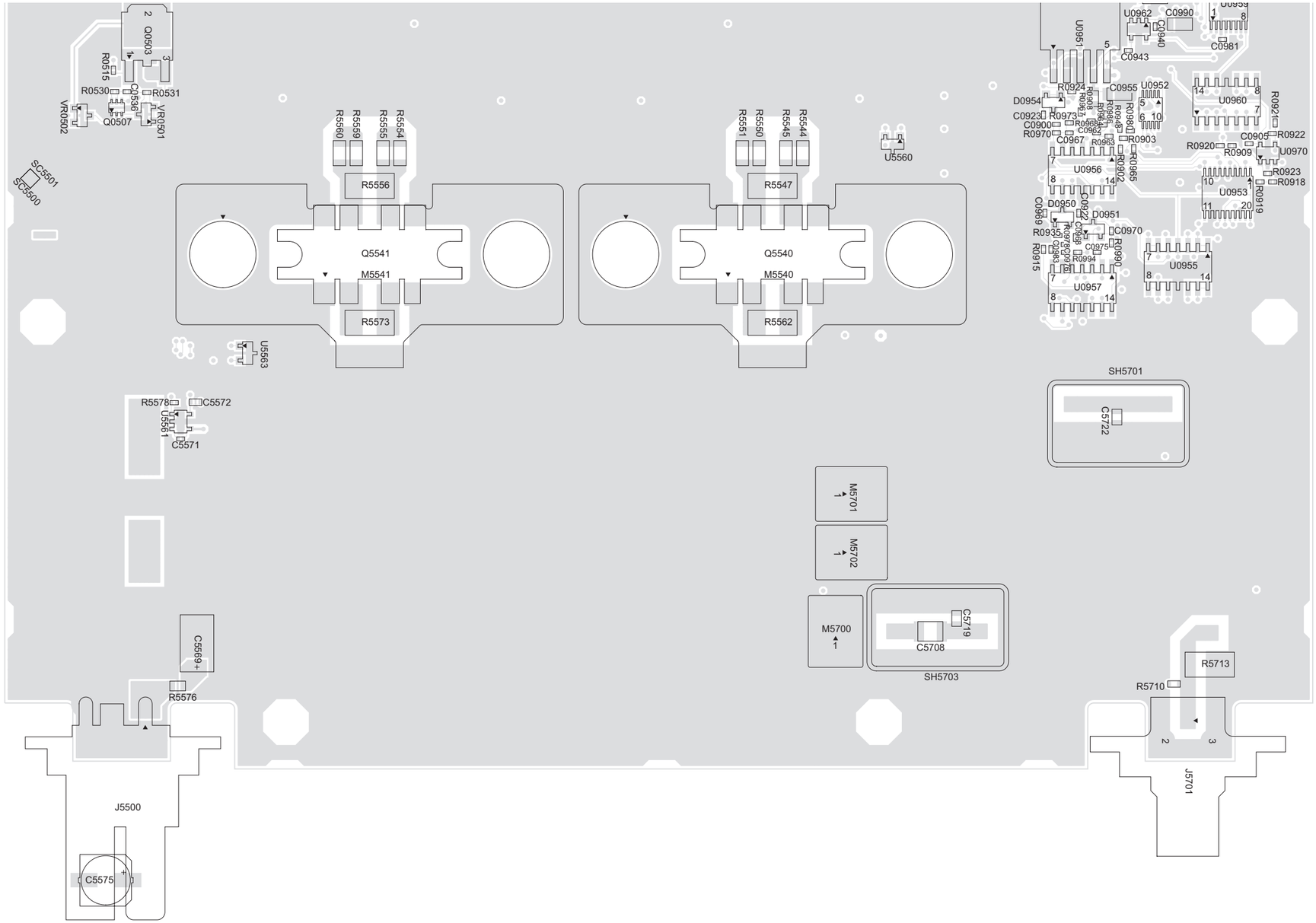



*Figure 7-57. HUE4043A Main Board Layout—Side 1 Bottom*



*Figure 7-58. HUE4043A Main Board Layout—Side 2 Top*

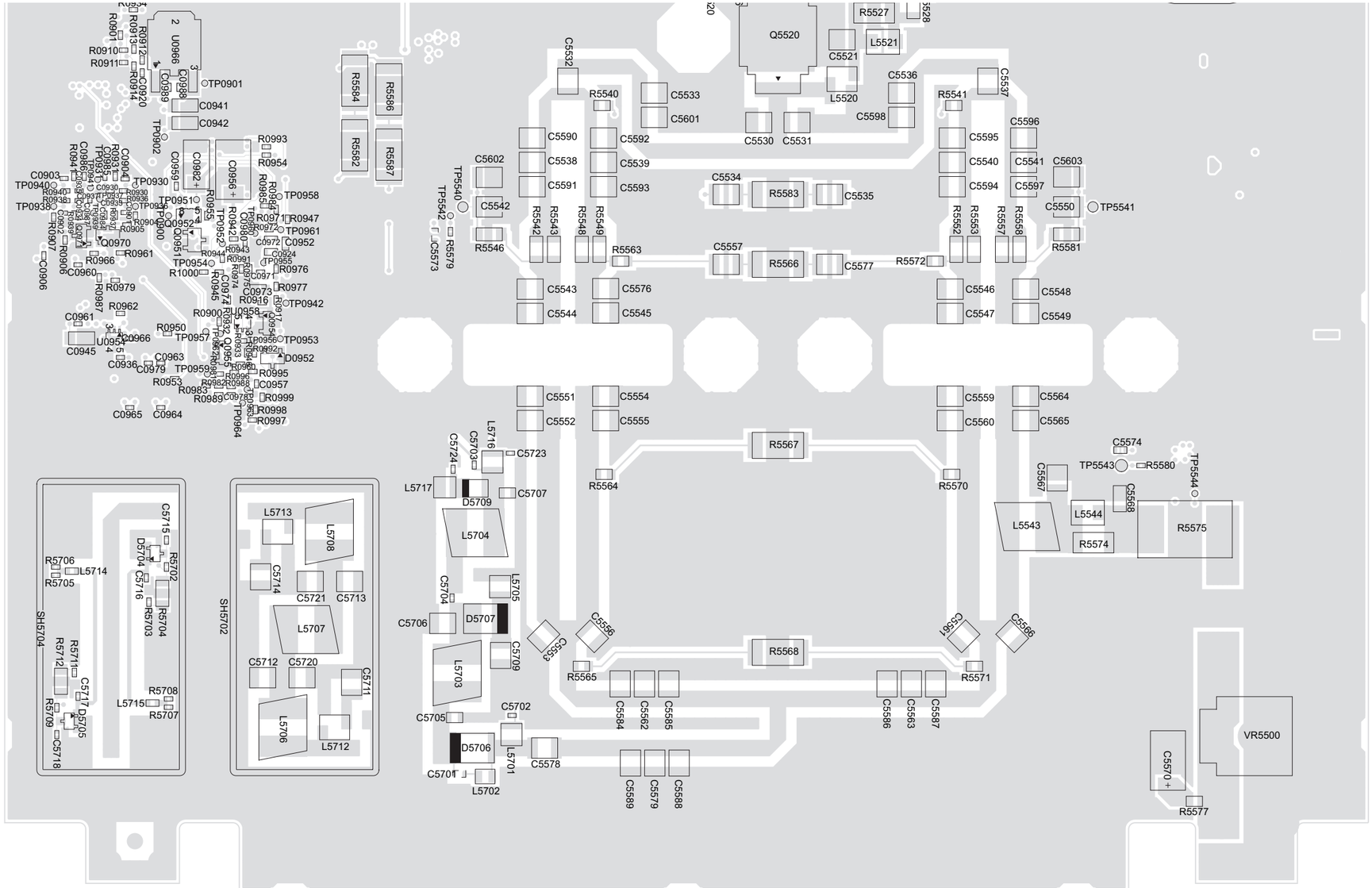



*Figure 7-59. HUE4043A Main Board Layout—Side 2 Bottom*

## HUE4043A Main Board Parts List

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C0100 | 2113743N32 | CAP CHIP 18.0 PF 5% COG |
| C0101 | 2113743N32 | CAP CHIP 18.0 PF 5% COG |
| C0102 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0103 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0104 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0105 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0106 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0107 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C0108 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0109 | 2113743N32 | CAP CHIP 18.0 PF 5% COG |
| C0200 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0201 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0202 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0203 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C0204 | 2185802B01 | CAP 10V 4.7UF |
| C0207 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0208 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0209 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0210 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0211 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0212 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0213 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0214 | 2113741N69 | CAP CHIP CL2 X7R 10% 100000 |
| C0215 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C0216 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0217 | 2113743L29 | CAP CHIP 3300 PF 10% X7R |
| C0220 | 2311049A57 | CAP TANT CHIP A/P 10UF 10% 16V |
| C0221 | 2311049C06 | CAP TANT CHIP 22 UF 35V 20% |
| C0223 | 2185802B01 | CAP 10V 4.7UF |
| C0224 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0226 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C0227 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0230 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C0231 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C0232 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C0233 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C0234 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C0235 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C0236 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C0237 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C0238 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C0239 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0240 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C0242 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C0243 | 2113945B01 | CAP CER CHIP 6800 PF 25V 10% |
| C0244 | 2113945B01 | CAP CER CHIP 6800 PF 25V 10% |
| C0301 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0302 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0305 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0306 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0308 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0309 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0310 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0311 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0312 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0313 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0314 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0315 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0420 | 2185802B01 | CAP 10V 4.7UF |
| C0421 | 2113741B13 | CAP CHIP CL2 X7R REEL 470 |
| C0422 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0423 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0424 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0426 | 2113741B13 | CAP CHIP CL2 X7R REEL 470 |
| C0428 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0431 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0432 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0433 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0434 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0435 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C0436 | 2113741B13 | CAP CHIP CL2 X7R REEL 470 |
| C0437 | 2113741B13 | CAP CHIP CL2 X7R REEL 470 |
| C0438 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C0439 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0440 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0441 | 2311049C47 | CAP TANT CHIP 22.0UF 10% 16V |
| C0442 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0443 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0444 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0445 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0446 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0447 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0448 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0449 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0450 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0451 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0452 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0453 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0454 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0455 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0456 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0457 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0458 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0459 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0460 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0461 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C0462 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C0463 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0464 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0467 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0470 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C0471 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0475 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0476 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0477 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0478 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0479 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0500 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0502 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0503 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0504 | 2113741N69 | CAP CHIP CL2 X7R 10% 100000 |
| C0505 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C0506 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C0507 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0510 | 2185802B01 | CAP 10V 4.7UF |
| C0512 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0513 | 2311049A43 | CAP TANT CHIP 150 10 6 |
| C0514 | 2311049A43 | CAP TANT CHIP 150 10 6 |
| C0515 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0516 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0517 | 2185802B01 | CAP 10V 4.7UF |
| C0518 | 2185802B01 | CAP 10V 4.7UF |
| C0519 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C0520 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0521 | 2185802B01 | CAP 10V 4.7UF |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C0522 | 2185802B01 | CAP 10V 4.7UF |
| C0523 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0524 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0525 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0526 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C0527 | 2185802B01 | CAP 10V 4.7UF |
| C0528 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0529 | 2185802B01 | CAP 10V 4.7UF |
| C0531 | 2113741N69 | CAP CHIP CL2 X7R 10% 100000 |
| C0532 | 2113741Y32 | CAP CER 1,000,000 10% 50V |
| C0533 | 2311049C47 | CAP TANT CHIP 22.0UF 10% 16V |
| C0534 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0535 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0536 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0550 | 2113741N69 | CAP CHIP CL2 X7R 10% 100000 |
| C0551 | 2113741Y32 | CAP CER 1,000,000 10% 50V |
| C0553 | 2311049C47 | CAP TANT CHIP 22.0UF 10% 16V |
| C0554 | 2113743E20 | CAP CHIP .10 UF 10% |
| C0600 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0601 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0603 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0604 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0605 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0606 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0610 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0611 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0613 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0614 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0615 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0616 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0700 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0701 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0702 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0703 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0704 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0705 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0706 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0708 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0709 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0710 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0711 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0712 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0713 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C0714 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C0715 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0716 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0717 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0718 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0719 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C0720 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0721 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0722 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0724 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0726 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0727 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0728 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0729 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0730 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0731 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0732 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0733 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0740 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0741 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0742 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0903 | 2113743N26 | CAP CHIP 10.0 PF 5% COG |
| C0905 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0920 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0922 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0923 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0936 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0937 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0940 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0941 | 2113743S01 | CAP CER CHIP 1.0 UF 10% 16V |
| C0942 | 2113743S01 | CAP CER CHIP 1.0 UF 10% 16V |
| C0943 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C0945 | 2185802B01 | CAP 10V 4.7UF |
| C0952 | 2113743E20 | CAP CHIP .10 UF 10% |
| C0955 | 2113741N69 | CAP CHIP CL2 X7R 10% 100000 |
| C0956 | 2311049C06 | CAP TANT CHIP 22 UF 35V 20% |
| C0957 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0959 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0960 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0961 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0963 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0964 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0965 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0966 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0968 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0969 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0970 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0972 | 2113743E20 | CAP CHIP .10 UF 10% |
| C0973 | 2113928E01 | CAP CER CHIP 1.0 UF 10 % 10V |
| C0974 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0975 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0976 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0978 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0979 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0980 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0981 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0982 | 2311049C47 | CAP TANT CHIP 22.0UF 10% 16V |
| C0983 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C0984 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0985 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0986 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0987 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0988 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0989 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C0990 | 2185802B01 | CAP 10V 4.7UF |
| C0991 | 2185802B01 | CAP 10V 4.7UF |
| C5001 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C5002 | 2113743N28 | CAP CHIP 12.0 PF 5% COG |
| C5003 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5004 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C5005 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C5006 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C5007 | 2113743N30 | CAP CHIP 15.0 PF 5% COG |
| C5008 | 2113743L25 | CAP CHIP 2200 PF 10% X7R |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C5009 | 2113740F58 | CAP CHIP REEL CL1 +/-30 200 |
| C5010 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5011 | 2113743F18 | CAP CHIP 2.2 UF 16V +80-20% |
| C5012 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5013 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5014 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5015 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5017 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5018 | 2113743T19 | CAP 10UF 16V CER 3225 X5R |
| C5019 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5020 | 2113743L17 | CAP CHIP 1000 PF 10% X7R |
| C5021 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5022 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C5023 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C5025 | 2113743S01 | CAP CER CHIP 1.0 UF 10% 16V |
| C5026 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C5030 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C5032 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C5033 | 2113743N52 | CAP CHIP 120 PF 5% COG |
| C5034 | 2113743N40 | CAP CHIP 39.0 PF 5% COG |
| C5037 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C5039 | 2113743N29 | CAP 13PF 20X40 |
| C5040 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5041 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C5044 | 2113743A19 | CAP CHIP .100 UF 10% X7R |
| C5045 | 2113743A31 | CAP CHIP 1.0 UF 10% X7R |
| C5048 | 2113743N25 | CAP CHIP 9.1 PF + -.5PF COG |
| C5050 | 2113743T19 | CAP 10UF 16V CER 3225 X5R |
| C5051 | 2113743L17 | CAP CHIP 1000 PF 10% X7R |
| C5052 | 2113743L17 | CAP CHIP 1000 PF 10% X7R |
| C5056 | 2113743N34 | CAP CHIP 22.0 PF 5% COG |
| C5057 | 2113743N30 | CAP CHIP 15.0 PF 5% COG |
| C5058 | 2113743L17 | CAP CHIP 1000 PF 10% X7R |
| C5059 | 2113743N36 | CAP CHIP 27.0 PF 5% COG |
| C5060 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5061 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C5062 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C5063 | 2113743A31 | CAP CHIP 1.0 UF 10% X7R |
| C5064 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5065 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C5066 | 2113743L17 | CAP CHIP 1000 PF 10% X7R |
| C5067 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5068 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5069 | 2113743N54 | CAP CHIP 150 PF 5% COG |
| C5070 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5071 | 2113743N30 | CAP CHIP 15.0 PF 5% COG |
| C5072 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C5073 | 2113743A31 | CAP CHIP 1.0 UF 10% X7R |
| C5251 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5252 | 2113743N24 | CAP CHIP 8.2 PF + -.5PF COG |
| C5253 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5255 | 2113743N24 | CAP CHIP 8.2 PF + -.5PF COG |
| C5256 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5257 | 2113743N22 | CAP CHIP 6.8 PF + -.5PF COG |
| C5258 | 2113743N22 | CAP CHIP 6.8 PF + -.5PF COG |
| C5259 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5280 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5282 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5283 | 2113743N24 | CAP CHIP 8.2 PF + -.5PF COG |
| C5284 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5285 | 2113743N18 | CAP CHIP 4.7 PF +-.25PF COG |
| C5287 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5288 | 2113743N24 | CAP CHIP 8.2 PF + -.5PF COG |
| C5289 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5290 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5291 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5292 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5293 | 2113743N09 | CAP CHIP 2.0 PF +-.25PF COG |
| C5294 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5295 | 2113743N16 | CAP CHIP 3.9 PF +-.25PF COG |
| C5296 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5297 | 2113743N12 | CAP CHIP 2.7 PF +-.25PF COG |
| C5299 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5300 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5301 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5302 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5303 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5304 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5305 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5306 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5307 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5308 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5309 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5310 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5311 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5312 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5313 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5314 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5315 | 2185802B01 | CAP 10V 4.7UF |
| C5316 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C5317 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5318 | 2185802B01 | CAP 10V 4.7UF |
| C5319 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5320 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5321 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5322 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5323 | 2113743L50 | CAP CHIP 33000 PF 10% |
| C5324 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5325 | 2113743L50 | CAP CHIP 33000 PF 10% |
| C5326 | 2113743N28 | CAP CHIP 12.0 PF 5% COG |
| C5327 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5328 | 2113743N32 | CAP CHIP 18.0 PF 5% COG |
| C5329 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5331 | 2113743N25 | CAP CHIP 9.1 PF + -.5PF COG |
| C5332 | 2113743N15 | CAP CHIP 3.6 PF +-.25PF COG |
| C5334 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5335 | 2113743L50 | CAP CHIP 33000 PF 10% |
| C5336 | 2113743N25 | CAP CHIP 9.1 PF + -.5PF COG |
| C5337 | 2113743L50 | CAP CHIP 33000 PF 10% |
| C5338 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5339 | 2113743N20 | CAP CHIP 5.6 PF + -.5PF COG |
| C5340 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5341 | 2113743N15 | CAP CHIP 3.6 PF +-.25PF COG |
| C5342 | 2113743N25 | CAP CHIP 9.1 PF + -.5PF COG |
| C5343 | 2113743N34 | CAP CHIP 22.0 PF 5% COG |
| C5344 | 2113743N25 | CAP CHIP 9.1 PF + -.5PF COG |
| C5345 | 2113743L09 | CAP CHIP 470 PF 10% X7R |
| C5346 | 2113743L50 | CAP CHIP 33000 PF 10% |
| C5347 | 2113743N32 | CAP CHIP 18.0 PF 5% COG |
| C5348 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5349 | 2113743N24 | CAP CHIP 8.2 PF + -.5PF COG |
| C5350 | 2113743L50 | CAP CHIP 33000 PF 10% |
| C5351 | 2113743L50 | CAP CHIP 33000 PF 10% |
| C5352 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5353 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5354 | 2113743N42 | CAP CHIP 47.0 PF 5% COG |
| C5355 | 2113743N26 | CAP CHIP 10.0 PF 5% COG |
| C5356 | 2113743L50 | CAP CHIP 33000 PF 10% |
| C5357 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5358 | 2113743N27 | CAP CHIP 11.0 PF 5% COG |
| C5360 | 2113743L50 | CAP CHIP 33000 PF 10% |
| C5361 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5362 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5363 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5364 | 2113743L17 | CAP CHIP 1000 PF 10% X7R |
| C5365 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5366 | 2113743L17 | CAP CHIP 1000 PF 10% X7R |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C5367 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5368 | 2113743L17 | CAP CHIP 1000 PF 10% X7R |
| C5374 | 2113743N11 | CAP CHIP 2.4 PF +-.25PF COG |
| C5375 | 2113743N16 | CAP CHIP 3.9 PF +-.25PF COG |
| C5377 | 2113743N30 | CAP CHIP 15.0 PF 5% COG |
| C5379 | 2113743N25 | CAP CHIP 9.1 PF + -.5PF COG |
| C5380 | 2113743N22 | CAP CHIP 6.8 PF + -.5PF COG |
| C5382 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5383 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5385 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5386 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C5388 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5389 | 2113743N28 | CAP CHIP 12.0 PF 5% COG |
| C5390 | 2113743N22 | CAP CHIP 6.8 PF + -.5PF COG |
| C5391 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C5400 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5401 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C5402 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C5403 | 2113743N29 | CAP 13PF 20X40 |
| C5404 | 2113743N30 | CAP CHIP 15.0 PF 5% COG |
| C5405 | 2113743N12 | CAP CHIP 2.7 PF +-.25PF COG |
| C5406 | 2113743N31 | CAP 16PF 20X40 |
| C5407 | 2113743N30 | CAP CHIP 15.0 PF 5% COG |
| C5408 | 2113743N13 | CAP CHIP 3.0 PF +-.25PF COG |
| C5409 | 2113743N69 | CAP CHIP 1.8PF 16V +/-.25PF |
| C5410 | 2113743N69 | CAP CHIP 1.8PF 16V +/-.25PF |
| C5412 | 2113743N12 | CAP CHIP 2.7 PF +-.25PF COG |
| C5413 | 2113743N69 | CAP CHIP 1.8PF 16V +/-.25PF |
| C5414 | 2113743N24 | CAP CHIP 8.2 PF + -.5PF COG |
| C5415 | 2113743N12 | CAP CHIP 2.7 PF +-.25PF COG |
| C5418 | 2113743N69 | CAP CHIP 1.8PF 16V +/-.25PF |
| C5419 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5420 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5423 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5424 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5425 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5426 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C5427 | 2113743M24 | CAP CHIP 100000 PF +80-20% Y5V |
| C5428 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5431 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5433 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5500 | 2113743L50 | CAP CHIP 33000 PF 10% |
| C5501 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5504 | 2113743N12 | CAP CHIP 2.7 PF +-.25PF COG |
| C5505 | 2113743N26 | CAP CHIP 10.0 PF 5% COG |
| C5506 | 2113743L50 | CAP CHIP 33000 PF 10% |
| C5507 | 2113743N62 | CAP CHIP 6.0PF 16V .5PF COG |
| C5508 | 2113743N28 | CAP CHIP 12.0 PF 5% COG |
| C5509 | 2113743N62 | CAP CHIP 6.0PF 16V .5PF COG |
| C5510 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5511 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5512 | 2113743N44 | CAP CHIP 56.0 PF 5% COG |
| C5513 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5514 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5515 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5516 | 2113743N24 | CAP CHIP 8.2 PF + -.5PF COG |
| C5517 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5518 | 2113743N40 | CAP CHIP 39.0 PF 5% COG |
| C5519 | 2113743N40 | CAP CHIP 39.0 PF 5% COG |
| C5520 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5521 | 2111078B42 | CAP CHIP RF 100 5 NPO 100V |
| C5522 | 2113741N69 | CAP CHIP CL2 X7R 10% 100000 |
| C5523 | 2113743N40 | CAP CHIP 39.0 PF 5% COG |
| C5524 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5525 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5526 | 2109822S04 | CAP CHIP CER 10UF 35V 2220 |
| C5527 | 2109822S04 | CAP CHIP CER 10UF 35V 2220 |
| C5529 | 2185802B01 | CAP 10V 4.7UF |
| C5530 | 2111078B34 | CAP CHIP RF 47 5 NPO 100V |
| C5531 | 2111078B34 | CAP CHIP RF 47 5 NPO 100V |
| C5532 | 2111078B42 | CAP CHIP RF 100 5 NPO 100V |
| C5533 | 2111078B23 | CAP CHIP RF 24 5 NPO 100V |
| C5536 | 2111078B23 | CAP CHIP RF 24 5 NPO 100V |
| C5537 | 2111078B42 | CAP CHIP RF 100 5 NPO 100V |
| C5538 | 2111078B18 | CAP CHIP RF 15 5 NPO 100V |
| C5539 | 2111078B18 | CAP CHIP RF 15 5 NPO 100V |
| C5540 | 2111078B18 | CAP CHIP RF 15 5 NPO 100V |
| C5541 | 2111078B18 | CAP CHIP RF 15 5 NPO 100V |
| C5542 | 2111078B42 | CAP CHIP RF 100 5 NPO 100V |
| C5543 | 2111078B33 | CAP CHIP RF 43 5 NPO 100V |
| C5544 | 2111078B34 | CAP CHIP RF 47 5 NPO 100V |
| C5545 | 2111078B34 | CAP CHIP RF 47 5 NPO 100V |
| C5546 | 2111078B33 | CAP CHIP RF 43 5 NPO 100V |
| C5547 | 2111078B34 | CAP CHIP RF 47 5 NPO 100V |
| C5548 | 2111078B33 | CAP CHIP RF 43 5 NPO 100V |
| C5549 | 2111078B34 | CAP CHIP RF 47 5 NPO 100V |
| C5550 | 2111078B42 | CAP CHIP RF 100 5 NPO 100V |
| C5551 | 2111078B32 | CAP CHIP RF 39 5 NPO 100V |
| C5552 | 2111078B31 | CAP CHIP RF 36 5 NPO 100V |
| C5553 | 2111078B13 | CAP CHIP RF 10 .5 NPO 100V |
| C5554 | 2111078B32 | CAP CHIP RF 39 5 NPO 100V |
| C5555 | 2111078B31 | CAP CHIP RF 36 5 NPO 100V |
| C5556 | 2111078B13 | CAP CHIP RF 10 .5 NPO 100V |
| C5557 | 2111078B42 | CAP CHIP RF 100 5 NPO 100V |
| C5559 | 2111078B32 | CAP CHIP RF 39 5 NPO 100V |
| C5560 | 2111078B31 | CAP CHIP RF 36 5 NPO 100V |
| C5561 | 2111078B13 | CAP CHIP RF 10 .5 NPO 100V |
| C5564 | 2111078B32 | CAP CHIP RF 39 5 NPO 100V |
| C5565 | 2111078B31 | CAP CHIP RF 36 5 NPO 100V |
| C5566 | 2111078B13 | CAP CHIP RF 10 .5 NPO 100V |
| C5567 | 2111078B42 | CAP CHIP RF 100 5 NPO 100V |
| C5568 | 2113741N69 | CAP CHIP CL2 X7R 10% 100000 |
| C5569 | 2311049C06 | CAP TANT CHIP 22 UF 35V 20% |
| C5570 | 2311049C06 | CAP TANT CHIP 22 UF 35V 20% |
| C5571 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5572 | 2113743E20 | CAP CHIP .10 UF 10% |
| C5573 | 2113743E20 | CAP CHIP .10 UF 10% |
| C5575 | 2380090M24 | CAP ALU 10 20 50V SURF MT |
| C5576 | 2111078B33 | CAP CHIP RF 43 5 NPO 100V |
| C5577 | 2111078B42 | CAP CHIP RF 100 5 NPO 100V |
| C5578 | 2111078B42 | CAP CHIP RF 100 5 NPO 100V |
| C5584 | 2111078B01 | CAP CHIP RF 3.3 .25 NPO 100V |
| C5587 | 2111078B01 | CAP CHIP RF 3.3 .25 NPO 100V |
| C5589 | 2111078B09 | CAP CHIP RF 6.8 .25 NPO 100V |
| C5602 | 2113743T19 | CAP 10UF 16V CER 3225 X5R |
| C5603 | 2113743T19 | CAP 10UF 16V CER 3225 X5R |
| C5701 | 2113740F51 | CAP CHIP REEL CL1 +/-30 100 |
| C5702 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5703 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5704 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5705 | 2111078A16 | CAP CHIP RF 3.0 .25 NPO 100V |
| C5706 | 2111078B10 | CAP CHIP RF 7.5 .25 NPO 100V |
| C5707 | 2111078A09 | CAP CHIP RF 1.8 .25 NPO 100V |
| C5708 | 2111078B42 | CAP CHIP RF 100 5 NPO 100V |
| C5709 | 2111078B33 | CAP CHIP RF 43 5 NPO 100V |
| C5711 | 2111078B03 | CAP CHIP RF 3.9 .25 NPO 100V |
| C5712 | 2111078B03 | CAP CHIP RF 3.9 .25 NPO 100V |
| C5713 | 2111078B14 | CAP CHIP RF 11 5 NPO 100V |
| C5714 | 2111078B03 | CAP CHIP RF 3.9 .25 NPO 100V |
| C5715 | 2113743N50 | CAP CHIP 100 PF 5% COG |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C5716 | 2113743N40 | CAP CHIP 39.0 PF 5% COG |
| C5717 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C5718 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5719 | 2111078A09 | CAP CHIP RF 1.8 .25 NPO 100V |
| C5720 | 2111078B10 | CAP CHIP RF 7.5 .25 NPO 100V |
| C5723 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5724 | 2113743N48 | CAP CHIP 82.0 PF 5% COG |
| C5750 | 2113932E20 | CAP CER CHP .10 UF 10% 16V |
| C5751 | 2113932E07 | CAP CER CHP .022 UF 10% 16V |
| C5752 | 2113743S01 | CAP CER CHIP 1.0 UF 10% 16V |
| C5753 | 2113743K15 | CER CHIP CAP .100UF |
| C5754 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5755 | 2311049A57 | CAP TANT CHIP A/P 10UF 10% 16V |
| C5756 | 2113743N40 | CAP CHIP 39.0 PF 5% COG |
| C5757 | 2113743S01 | CAP CER CHIP 1.0 UF 10% 16V |
| C5758 | 2113932E20 | CAP CER CHP .10 UF 10% 16V |
| C5759 | 2113743E20 | CAP CHIP .10 UF 10% |
| C5760 | 2113743L17 | CAP CHIP 1000 PF 10% X7R |
| C5761 | 2113743L41 | CAP CHIP 10000 PF 10% X7R |
| C5762 | 2113743E20 | CAP CHIP .10 UF 10% |
| C5763 | 2113743N38 | CAP CHIP 33.0 PF 5% COG |
| C5764 | 2113743N40 | CAP CHIP 39.0 PF 5% COG |
| C5765 | 2113932E20 | CAP CER CHP .10 UF 10% 16V |
| C5766 | 2113743T19 | CAP 10UF 16V CER 3225 X5R |
| C5767 | 2113743L17 | CAP CHIP 1000 PF 10% X7R |
| C5768 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5769 | 2113743K15 | CER CHIP CAP .100UF |
| C5770 | 2113743T19 | CAP 10UF 16V CER 3225 X5R |
| C5771 | 2113932E20 | CAP CER CHP .10 UF 10% 16V |
| C5772 | 2113743K15 | CER CHIP CAP .100UF |
| C5773 | 2113932E20 | CAP CER CHP .10 UF 10% 16V |
| C5774 | 2113743N34 | CAP CHIP 22.0 PF 5% COG |
| C5775 | 2113932E20 | CAP CER CHP .10 UF 10% 16V |
| C5776 | 2113932E20 | CAP CER CHP .10 UF 10% 16V |
| C5777 | 2113932E20 | CAP CER CHP .10 UF 10% 16V |
| C5778 | 2113932E20 | CAP CER CHP .10 UF 10% 16V |
| C5779 | 2185419D10 | CAP CER SUPER L/D 0.0015UF |
| C5780 | 2185419D10 | CAP CER SUPER L/D 0.0015UF |
| C5781 | 2113743E12 | CAP CHIP .047 UF 10% X7R |
| C5782 | 2185419D06 | CAP CER SUPER L/D 0.1UF |
| C5783 | 2113743E20 | CAP CHIP .10 UF 10% |
| C5784 | 2185419D06 | CAP CER SUPER L/D 0.1UF |
| C5785 | 2185419D06 | CAP CER SUPER L/D 0.1UF |
| C5786 | 2113743E20 | CAP CHIP .10 UF 10% |
| C5787 | 2185419D06 | CAP CER SUPER L/D 0.1UF |
| C5788 | 2311049J11 | CAP TANT CHIP 4.7 10 16 |
| C5789 | 2311049J11 | CAP TANT CHIP 4.7 10 16 |
| C5790 | 2113932E07 | CAP CER CHP .022 UF 10% 16V |
| C5791 | 2185419D06 | CAP CER SUPER L/D 0.1UF |
| C5792 | 2185419D06 | CAP CER SUPER L/D 0.1UF |
| C5793 | 2113928N01 | CAP CER CHIP 0.1UF 10% 6.3 |
| C5794 | 2113743N26 | CAP CHIP 10.0 PF 5% COG |
| C5795 | 2113743N26 | CAP CHIP 10.0 PF 5% COG |
| C5796 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5797 | 2113743T19 | CAP 10UF 16V CER 3225 X5R |
| C5798 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5799 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5800 | 2113743N26 | CAP CHIP 10.0 PF 5% COG |
| C5801 | 2113743N26 | CAP CHIP 10.0 PF 5% COG |
| C5802 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5803 | 2113743L05 | CAP CHIP 330 PF 10% X7R |
| C5804 | 2113743L05 | CAP CHIP 330 PF 10% X7R |
| C5805 | 2113743L05 | CAP CHIP 330 PF 10% X7R |
| C5806 | 2113743L05 | CAP CHIP 330 PF 10% X7R |
| C5807 | 2113743L05 | CAP CHIP 330 PF 10% X7R |
| C5809 | 2185419D06 | CAP CER SUPER L/D 0.1UF |
| C5810 | 2185419D06 | CAP CER SUPER L/D 0.1UF |
| C5811 | 2185419D06 | CAP CER SUPER L/D 0.1UF |
| C5812 | 2185419D06 | CAP CER SUPER L/D 0.1UF |
| C5813 | 2113741F17 | CAP CHIP CL2 X7R REEL 470 |
| C5816 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5817 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5825 | 2113743L05 | CAP CHIP 330 PF 10% X7R |
| C5826 | 2113743L05 | CAP CHIP 330 PF 10% X7R |
| C5827 | 2113743N30 | CAP CHIP 15.0 PF 5% COG |
| C5828 | 2113743N30 | CAP CHIP 15.0 PF 5% COG |
| C5829 | 2113743N28 | CAP CHIP 12.0 PF 5% COG |
| C5830 | 2113743N28 | CAP CHIP 12.0 PF 5% COG |
| C5831 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C5832 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C5833 | 2113743N10 | CAP CHIP 2.2 PF +-.25PF COG |
| C5834 | 2113743L05 | CAP CHIP 330 PF 10% X7R |
| C5835 | 2113743N19 | CAP CHIP 5.1 PF + -.5PF COG |
| C5836 | 2113743L05 | CAP CHIP 330 PF 10% X7R |
| C5837 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C5838 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C5839 | 2113743N32 | CAP CHIP 18.0 PF 5% COG |
| C5840 | 2113743N27 | CAP CHIP 11.0 PF 5% COG |
| C5841 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5842 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5843 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C5844 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C5845 | 2113743N25 | CAP CHIP 9.1 PF + -.5PF COG |
| C5846 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5847 | 2113743L05 | CAP CHIP 330 PF 10% X7R |
| C5848 | 2113743L05 | CAP CHIP 330 PF 10% X7R |
| C5849 | 2113743N22 | CAP CHIP 6.8 PF + -.5PF COG |
| C5850 | 2113743N32 | CAP CHIP 18.0 PF 5% COG |
| C5851 | 2113743N33 | CAP CHIP 20.0 PF 5% COG |
| C5852 | 2113743N28 | CAP CHIP 12.0 PF 5% COG |
| C5853 | 2113743L05 | CAP CHIP 330 PF 10% X7R |
| C5854 | 2113743N33 | CAP CHIP 20.0 PF 5% COG |
| C5855 | 2113743N32 | CAP CHIP 18.0 PF 5% COG |
| C5856 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C5857 | 2113743N28 | CAP CHIP 12.0 PF 5% COG |
| C5858 | 2113743N32 | CAP CHIP 18.0 PF 5% COG |
| C5859 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5860 | 2113743L05 | CAP CHIP 330 PF 10% X7R |
| C5861 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C5862 | 2113743L05 | CAP CHIP 330 PF 10% X7R |
| C5863 | 2113743N13 | CAP CHIP 3.0 PF +-.25PF COG |
| C5900 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C5901 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5904 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C5905 | 2113743N19 | CAP CHIP 5.1 PF + -.5PF COG |
| C5906 | 2113743N08 | CAP CHIP 1.6 PF +-.25PF COG |
| C5907 | 2113743N19 | CAP CHIP 5.1 PF + -.5PF COG |
| C5908 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5909 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5910 | 2113743N20 | CAP CHIP 5.6 PF + -.5PF COG |
| C5911 | 2113743N25 | CAP CHIP 9.1 PF + -.5PF COG |
| C5912 | 2113743N24 | CAP CHIP 8.2 PF + -.5PF COG |
| C5913 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5914 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5915 | 2113743N22 | CAP CHIP 6.8 PF + -.5PF COG |
| C5916 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C5917 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5919 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5920 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C5921 | 2113743N12 | CAP CHIP 2.7 PF +-.25PF COG |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C5922 | 2113743N18 | CAP CHIP 4.7 PF +-.25PF COG |
| C5923 | 2113743Q07 | CAP CHIP 1.5 PF +/-1PF 20*40 |
| C5924 | 2113743N19 | CAP CHIP 5.1 PF + -.5PF COG |
| C5925 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5926 | 2113743N19 | CAP CHIP 5.1 PF + -.5PF COG |
| C5927 | 2113743N24 | CAP CHIP 8.2 PF + -.5PF COG |
| C5928 | 2113743N19 | CAP CHIP 5.1 PF + -.5PF COG |
| C5929 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5930 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5931 | 2113743N19 | CAP CHIP 5.1 PF + -.5PF COG |
| C5932 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5933 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C5935 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5936 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C5937 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5938 | 2113743Q08 | CAP CHIP 1.8PF +/-1PF 20*40 |
| C5939 | 2113743N17 | CAP CHIP 4.3 PF +-.25PF COG |
| C5940 | 2113743N19 | CAP CHIP 5.1 PF + -.5PF COG |
| C5941 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5942 | 2113743N16 | CAP CHIP 3.9 PF +-.25PF COG |
| C5943 | 2113743N20 | CAP CHIP 5.6 PF + -.5PF COG |
| C5944 | 2113743N18 | CAP CHIP 4.7 PF +-.25PF COG |
| C5945 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5946 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5947 | 2113743N18 | CAP CHIP 4.7 PF +-.25PF COG |
| C5948 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C5949 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5950 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5951 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5956 | 2113743L01 | CAP CHIP 220 PF 10% X7R |
| C5957 | 2113743N13 | CAP CHIP 3.0 PF +-.25PF COG |
| C5958 | 2113928S04 | CAP CER CHIP 0.100UF 10V 0402 |
| C5959 | 2113743N50 | CAP CHIP 100 PF 5% COG |
| C5960 | 2113743N14 | CAP CHIP 3.3 PF +-.25PF COG |
| D0402 | 4805218N57 | DIODE DUAL |
| D0950 | 4813833C02 | DIODE DUAL 70V ‘5B’ COMM CATH |
| D0951 | 4813833C02 | DIODE DUAL 70V ‘5B’ COMM CATH |
| D0952 | 4813833C02 | DIODE DUAL 70V ‘5B’ COMM CATH |
| D0954 | 4813833C02 | DIODE DUAL 70V ‘5B’ COMM CATH |
| D5002 | 4809877C13 | DIODE VARACTOR ISV305 SMD |
| D5003 | 4805649Q13 | DIODE VCTR ISV 228 |
| D5250 | 4862824C01 | DIODE VARACTOR |
| D5251 | 4862824C01 | DIODE VARACTOR |
| D5252 | 4862824C01 | DIODE VARACTOR |
| D5253 | 4862824C01 | DIODE VARACTOR |
| D5280 | 4880154K03 | DIODE DUAL SCHOTTKY MIXER |
| D5281 | 4880154K03 | DIODE DUAL SCHOTTKY MIXER |
| D5282 | 4880154K03 | DIODE DUAL SCHOTTKY MIXER |
| D5300 | 4880154K06 | DIODE PIN SCHOTTKY |
| D5302 | 4880154K06 | DIODE PIN SCHOTTKY |
| D5304 | 4880154K06 | DIODE PIN SCHOTTKY |
| D5305 | 4880154K06 | DIODE PIN SCHOTTKY |
| D5380 | 4882290T04 | DIODE SI HOT CARRIER HSMS 2812 |
| D5381 | 4882290T04 | DIODE SI HOT CARRIER HSMS 2812 |
| D5400 | 4880154K03 | DIODE DUAL SCHOTTKY MIXER |
| D5704 | 4805218N57 | DIODE DUAL |
| D5705 | 4805218N57 | DIODE DUAL |
| D5706 | 4880121R01 | PWR PIN DIODE SMD TAPE & REEL |
| D5707 | 4880121R01 | PWR PIN DIODE SMD TAPE & REEL |
| D5709 | 4802482J02 | PIN DIODE SMD |
| D5750 | 4802233J09 | DIODE TRIPLE SOT25-RH |
| D5751 | 4802233J09 | DIODE TRIPLE SOT25-RH |
| D5827 | 4862824C03 | DIODE VARACTOR |
| D5828 | 4862824C03 | DIODE VARACTOR |
| D5831 | 4862824C03 | DIODE VARACTOR |
| D5832 | 4862824C01 | DIODE VARACTOR |
| D5833 | 4813833C02 | DIODE DUAL 70V ‘5B’ COMM CATH |
| D5900 | 4802233J09 | DIODE TRIPLE SOT25-RH |
| D5901 | 4862824C01 | DIODE VARACTOR |
| D5902 | 4862824C01 | DIODE VARACTOR |
| D5903 | 4862824C01 | DIODE VARACTOR |
| D5904 | 4862824C01 | DIODE VARACTOR |
| D5905 | 4862824C01 | DIODE VARACTOR |
| D5906 | 4862824C01 | DIODE VARACTOR |
| D5907 | 4862824C01 | DIODE VARACTOR |
| D5908 | 4862824C01 | DIODE VARACTOR |
| D5909 | 4862824C01 | DIODE VARACTOR |
| D5910 | 4862824C01 | DIODE VARACTOR |
| D5911 | 4862824C01 | DIODE VARACTOR |
| D5912 | 4862824C01 | DIODE VARACTOR |
| E5001 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| E5002 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| E5003 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| E5004 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| E5005 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| E5006 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| E5007 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| E5008 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| E5009 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| E5400 | 2484657R01 | INDUCTOR BEAD CHIP |
| E6750 | 2480640Z01 | SURFACE MOUNT FERRITE BEAD |
| F0400 | 6583049X16 | FUSE 5A FAST ACT |
| FL0700 | 9185130D01 | FLTR SW CAP 3 POLE BUTTERW |
| J0401 | 0964495H01 | CONN, 60 PIN RECEPT |
| J0501 | 0985473E01 | CONN SECURE 20 POS FM SMT RT ANG |
| J5500 | 0905902V07 | CONNECTOR DC |
| J5701 | 0905901V11 | CONNECTOR RF |
| L0400 | 2485821C07 | IND RF 10UH |
| L5001 | 2462587L50 | FERRITE INDUCTOR 100UH |
| L5002 | 2462587V36 | CHIP IND 150 NH 5% 0805 |
| L5003 | 2405769X05 | COIL INDUCTOR |
| L5004 | 2405769X05 | COIL INDUCTOR |
| L5006 | 2462587V34 | CHIP IND 100 NH 5% 0805 |
| L5007 | 2462587N76 | CHIP IND 4700 NH 5% |
| L5008 | 2485209F02 | INDUCTOR 150NH 2% |
| L5010 | 2462587Q47 | IND CHIP 1,000 NH 10% |
| L5012 | 2462587V34 | CHIP IND 100 NH 5% 0805 |
| L5015 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L5053 | 2413926G19 | IND 100 NH 5% |
| L5237 | 2462587V26 | CHIP IND 22 NH 5% 0805 |
| L5250 | 2484562T02 | COIL SURFACE MOUNT AIR WOUND |
| L5251 | 2484562T03 | COIL SURFACE MOUNT AIR WOUND |
| L5252 | 2484562T04 | COIL SURFACE MOUNT AIR WOUND |
| L5253 | 2462587X52 | IND CHIP LO-PRO 82.0 NH 5% |
| L5254 | 2484562T04 | COIL SURFACE MOUNT AIR WOUND |
| L5255 | 2484562T03 | COIL SURFACE MOUNT AIR WOUND |
| L5256 | 2484562T02 | COIL SURFACE MOUNT AIR WOUND |
| L5257 | 2462587V29 | CHIP IND 39 NH 5% 0805 |
| L5258 | 2462587V26 | CHIP IND 22 NH 5% 0805 |
| L5280 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L5281 | 2462587V59 | IND CHIP 390 NH 5% |
| L5282 | 2462587V25 | CHIP IND 18 NH 5% 0805 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| L5283 | 2462587V33 | CHIP IND 82 NH 5% 0805 |
| L5284 | 2462587V25 | CHIP IND 18 NH 5% 0805 |
| L5285 | 2413926N22 | IND CER CHIP 68.0 NH 5% |
| L5286 | 2413926N20 | IND CER CHIP 47.0 NH 5% |
| L5287 | 2413926N16 | IND CER CHIP 22.0 NH 5% |
| L5288 | 2462587V33 | CHIP IND 82 NH 5% 0805 |
| L5289 | 2462587V59 | IND CHIP 390 NH 5% |
| L5290 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L5291 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L5292 | 2462587V59 | IND CHIP 390 NH 5% |
| L5293 | 2462587V59 | IND CHIP 390 NH 5% |
| L5294 | 2462587V29 | CHIP IND 39 NH 5% 0805 |
| L5295 | 2462587V59 | IND CHIP 390 NH 5% |
| L5296 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L5297 | 2462587V27 | CHIP IND 27 NH 5% 0805 |
| L5298 | 2462587V26 | CHIP IND 22 NH 5% 0805 |
| L5299 | 2484657R01 | INDUCTOR BEAD CHIP |
| L5300 | 2462587V27 | CHIP IND 27 NH 5% 0805 |
| L5301 | 2462587V27 | CHIP IND 27 NH 5% 0805 |
| L5302 | 2462587V23 | CHIP IND 12 NH 5% 0805 |
| L5303 | 2462587V32 | CHIP IND 68 NH 5% 0805 |
| L5304 | 2462587V27 | CHIP IND 27 NH 5% 0805 |
| L5305 | 2462587V24 | CHIP IND 15 NH 5% 0805 |
| L5306 | 2462587V22 | CHIP IND 8.2 NH 5% 0805 |
| L5307 | 2462587V22 | CHIP IND 8.2 NH 5% 0805 |
| L5308 | 2462587V24 | CHIP IND 15 NH 5% 0805 |
| L5380 | 2462587V21 | CHIP IND 6.8 NH 5% 0805 |
| L5381 | 2462587V22 | CHIP IND 8.2 NH 5% 0805 |
| L5384 | 2462587V21 | CHIP IND 6.8 NH 5% 0805 |
| L5385 | 2413926N12 | IND CER CHIP 10.0 MH 5% |
| L5386 | 2413926N12 | IND CER CHIP 10.0 MH 5% |
| L5387 | 2413926N12 | IND CER CHIP 10.0 MH 5% |
| L5388 | 2462587V32 | CHIP IND 68 NH 5% 0805 |
| L5389 | 2413926N12 | IND CER CHIP 10.0 MH 5% |
| L5390 | 2462587V32 | CHIP IND 68 NH 5% 0805 |
| L5392 | 2462587V23 | CHIP IND 12 NH 5% 0805 |
| L5400 | 2462587V59 | IND CHIP 390 NH 5% |
| L5401 | 2462587V59 | IND CHIP 390 NH 5% |
| L5402 | 2462587V59 | IND CHIP 390 NH 5% |
| L5403 | 2462587V59 | IND CHIP 390 NH 5% |
| L5404 | 2462587V52 | IND CHIP 270NH 5% |
| L5406 | 2462587V38 | CHIP IND 220 NH 5% 0805 |
| L5407 | 2462587V38 | CHIP IND 220 NH 5% 0805 |
| L5408 | 2462587N68 | CHIP IND 1000 NH 5% |
| L5411 | 2462587V38 | CHIP IND 220 NH 5% 0805 |
| L5500 | 2462587V38 | CHIP IND 220 NH 5% 0805 |
| L5501 | 2462587V25 | CHIP IND 18 NH 5% 0805 |
| L5502 | 2462587V26 | CHIP IND 22 NH 5% 0805 |
| L5503 | 2462587V26 | CHIP IND 22 NH 5% 0805 |
| L5510 | 2462587T17 | IND CHIP 150NH 5% LOW PRO |
| L5511 | 2462587V21 | CHIP IND 6.8 NH 5% 0805 |
| L5512 | 2462587T18 | IND CHIP 180NH 5% LOW PRO |
| L5513 | 2488428L03 | IDCTR,CHIP,3.9NH,5%,2.2A,.054OHM,SM |
| L5514 | 2488428L04 | IDCTR,CHIP,6.8NH,5%,2.4A,.054OHM,SM |
| L5520 | 2484562T05 | COIL SURFACE MOUNT AIR WOUND |
| L5521 | 2484657R01 | INDUCTOR BEAD CHIP |
| L5543 | 2460592A01 | COIL AW 2 TURN 17 NH |
| L5544 | 2484657R01 | INDUCTOR BEAD CHIP |
| L5701 | 2462587N61 | CHIP IND 470 NH 5% |
| L5702 | 2462587V36 | CHIP IND 150 NH 5% 0805 |
| L5703 | 2460592A01 | COIL AW 2 TURN 17 NH |
| L5704 | 2460592A01 | COIL AW 2 TURN 17 NH |
| L5705 | 2462587N61 | CHIP IND 470 NH 5% |
| L5706 | 2460592A01 | COIL AW 2 TURN 17 NH |
| L5707 | 2460592A01 | COIL AW 2 TURN 17 NH |
| L5708 | 2460592A01 | COIL AW 2 TURN 17 NH |
| L5712 | 2484562T02 | COIL SURFACE MOUNT AIR WOUND |
| L5713 | 2484562T02 | COIL SURFACE MOUNT AIR WOUND |
| L5714 | 2488428L08 | IND CHIP WW 15NH 5% 1.9A 1608 |
| L5715 | 2488428L07 | COIL 12 NH |
| L5716 | 2462587N61 | CHIP IND 470 NH 5% |
| L5717 | 2462587N61 | CHIP IND 470 NH 5% |
| L5750 | 2462587Q44 | IND CHIP 560 NH 10% |
| L5751 | 2462587Q44 | IND CHIP 560 NH 10% |
| L5752 | 2462587Q20 | IND CHIP 2,200 NH 20% |
| L5753 | 2462587N68 | CHIP IND 1000 NH 5% |
| L5754 | 2462587Q20 | IND CHIP 2,200 NH 20% |
| L5755 | 2462587Q20 | IND CHIP 2,200 NH 20% |
| L5756 | 2462587Q20 | IND CHIP 2,200 NH 20% |
| L5757 | 2413926H14 | IND CHIP 15.0 NH 5% |
| L5758 | 2462587T30 | IND CHIP 1000NH 5% LOW PRO |
| L5759 | 2413926H14 | IND CHIP 15.0 NH 5% |
| L5760 | 2462587P25 | CHIP IND 12000 NH 5% |
| L5825 | 2462587V24 | CHIP IND 15 NH 5% 0805 |
| L5826 | 2462587V59 | IND CHIP 390 NH 5% |
| L5827 | 2462587V59 | IND CHIP 390 NH 5% |
| L5828 | 2462587V24 | CHIP IND 15 NH 5% 0805 |
| L5829 | 2413926N29 | IND CER CHIP 270.0 NH 5% |
| L5830 | 2413926N29 | IND CER CHIP 270.0 NH 5% |
| L5831 | 2413926N27 | COIL 30X60 INDUCTOR 180.0 NH |
| L5832 | 2413926N29 | IND CER CHIP 270.0 NH 5% |
| L5833 | 2413926N28 | IND CER CHIP 220.0MH 5% |
| L5834 | 2413926N27 | COIL 30X60 INDUCTOR 180.0 NH |
| L5900 | 2413926N26 | COIL 30X60 INDUCTOR 150.0 NH |
| L5901 | 2462587V40 | IND CHIP 330 NH 10% |
| L5902 | 2462587T37 | IND CHIP 18NH 5% LOW PRO |
| L5904 | 2462587V40 | IND CHIP 330 NH 10% |
| L5905 | 2462587V40 | IND CHIP 330 NH 10% |
| L5906 | 2413926N26 | COIL 30X60 INDUCTOR 150.0 NH |
| L5907 | 2413926N26 | COIL 30X60 INDUCTOR 150.0 NH |
| L5908 | 2462587V40 | IND CHIP 330 NH 10% |
| L5909 | 2462587T37 | IND CHIP 18NH 5% LOW PRO |
| L5910 | 2462587V40 | IND CHIP 330 NH 10% |
| L5911 | 2462587T37 | IND CHIP 18NH 5% LOW PRO |
| L5912 | 2462587V40 | IND CHIP 330 NH 10% |
| L5913 | 2462587V40 | IND CHIP 330 NH 10% |
| L5914 | 2462587V40 | IND CHIP 330 NH 10% |
| L5915 | 2462587V40 | IND CHIP 330 NH 10% |
| L5916 | 2413926N26 | COIL 30X60 INDUCTOR 150.0 NH |
| L5917 | 2413926N13 | ND CER CHIP 12.0 NH 5% |
| L5918 | 2413926N15 | IND CER CHIP 18.0 NH 5% |
| L5919 | 2413926N13 | ND CER CHIP 12.0 NH 5% |
| L5922 | 2413926N28 | IND CER CHIP 220.0MH 5% |
| M5520 | 2685838C01 | HEATSINK PLD1.5 TRANSISTOR ASSY |
| M5540 | 2664488H02 | HEATSINK, CARRIER TRANS, UHF100 ASSY |
| M5541 | 2664488H02 | HEATSINK, CARRIER TRANS, UHF100 ASSY |
| PCB | 8485931F01 | PCB, HP UHF 100W |
| Q0200 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q0402 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q0403 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0405 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0500 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q0501 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0502 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q0503 | 4813970A66 | XSTR,FET GP PWR,MOSFET,P-CH,ENHN |
| Q0504 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q0505 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q0506 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q0507 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0508 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0610 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0611 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0612 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0613 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0951 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q0952 | 4885844C01 | XSTR FET |
| Q0954 | 4809579E16 | TSTR MOSFET N-CHAN TN0200T |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| Q0955 | 4809579E16 | TSTR MOSFET N-CHAN TN0200T |
| Q0960 | 4805723X03 | TRANS DUAL NPN-PNP UMD3N ROHM |
| Q0970 | 4809579E16 | TSTR MOSFET N-CHAN TN0200T |
| Q0971 | 4809579E16 | TSTR MOSFET N-CHAN TN0200T |
| Q5001 | 4813824A10 | TSTR NPN 40V .2A GEN PURP |
| Q5002 | 4805218N63 | RF TRANS SOT 323 BFQ67W |
| Q5003 | 4805218N63 | RF TRANS SOT 323 BFQ67W |
| Q5250 | 4813824A10 | TSTR NPN 40V .2A GEN PURP |
| Q5251 | 4813824A10 | TSTR NPN 40V .2A GEN PURP |
| Q5252 | 4805218N63 | RF TRANS SOT 323 BFQ67W |
| Q5253 | 4813824A17 | XSTR PNP40V .2A GENP B=100-300 |
| Q5254 | 4813824A10 | TSTR NPN 40V .2A GEN PURP |
| Q5255 | 4813824A10 | TSTR NPN 40V .2A GEN PURP |
| Q5256 | 4813824A17 | XSTR PNP40V .2A GENP B=100-300 |
| Q5257 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q5258 | 4813824A17 | XSTR PNP40V .2A GENP B=100-300 |
| Q5401 | 4805218N55 | TRANSISTOR 3 LEAD BFQ67 |
| Q5402 | 4880048M01 | TSTR NPN DIG 47K/47K |
| Q5501 | 4805218N63 | RF TRANS SOT 323 BFQ67W |
| Q5520 | 4864006H01 | TRANSISTOR, RF POWER |
| Q5540 | 6415033C02 | SUBSTRATE, ALUMINA, ASSEMBLY |
| Q5541 | 6415033C02 | SUBSTRATE, ALUMINA, ASSEMBLY |
| Q5706 | 4885316E10 | XSTR,DUAL DIGITAL,IMD6AT108 |
| Q5707 | 4885316E10 | XSTR,DUAL DIGITAL,IMD6AT108 |
| Q5708 | 4885316E10 | XSTR,DUAL DIGITAL,IMD6AT108 |
| Q5709 | 4885316E10 | XSTR,DUAL DIGITAL,IMD6AT108 |
| Q5710 | 4885316E10 | XSTR,DUAL DIGITAL,IMD6AT108 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| Q5750 | 4813824A10 | TSTR NPN 40V .2A GEN PURP |
| Q5751 | 4813824A10 | TSTR NPN 40V .2A GEN PURP |
| Q5752 | 4813824A17 | XSTR PNP40V .2A GENP B=100-300 |
| Q5755 | 4805218N63 | RF TRANS SOT 323 BFQ67W |
| Q5825 | 4805218N63 | RF TRANS SOT 323 BFQ67W |
| Q5826 | 4805218N63 | RF TRANS SOT 323 BFQ67W |
| Q5828 | 4805218N63 | RF TRANS SOT 323 BFQ67W |
| Q5829 | 4805218N63 | RF TRANS SOT 323 BFQ67W |
| Q5901 | 4805793Y01 | TRANS MINI SOT NPN LOW NOISE |
| Q5902 | 4805218N63 | RF TRANS SOT 323 BFQ67W |
| Q5903 | 4805793Y01 | TRANS MINI SOT NPN LOW NOISE |
| Q5904 | 4805218N63 | RF TRANS SOT 323 BFQ67W |
| Q5905 | 4805793Y01 | TRANS MINI SOT NPN LOW NOISE |
| Q5906 | 4805218N63 | RF TRANS SOT 323 BFQ67W |
| R0103 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0104 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0106 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0107 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0109 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0110 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0111 | 0662057M86 | RES CHIP 3300 5% 20X40 |
| R0114 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0116 | 0662057B46 | CHIP RES 10.0 MEG OHMS 5% |
| R0117 | 0662057B46 | CHIP RES 10.0 MEG OHMS 5% |
| R0119 | 0662057N39 | RES. CHIP 470K 5% 20X40 |
| R0120 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0121 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0125 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0126 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0128 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0129 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0130 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0200 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0201 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0204 | 0662057M68 | RES CHIP 560 5% 20X40 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R0205 | 0662057N09 | RES. CHIP 27K 5% 20X40 |
| R0208 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0209 | 0662057N07 | RES. CHIP 22K 5% 20X40 |
| R0210 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0211 | 0662057N11 | RES. CHIP 33K 5% 20X40 |
| R0212 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0213 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0215 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0216 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0218 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0219 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0220 | 0662057N05 | RES. CHIP 18K 5% 20X40 |
| R0221 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0222 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0224 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0225 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0227 | 0662057N19 | RES. CHIP 68K 5% 20X40 |
| R0228 | 0662057N11 | RES. CHIP 33K 5% 20X40 |
| R0229 | 0662057N19 | RES. CHIP 68K 5% 20X40 |
| R0230 | 0662057N11 | RES. CHIP 33K 5% 20X40 |
| R0231 | 0662057C13 | CHIP RES 2.7 OHMS 5% |
| R0235 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0236 | 0662057M97 | RES CHIP 9100 5% 20X40 |
| R0300 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0301 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0303 | 0662057M78 | RES. CHIP 1500 5% 20X40 |
| R0304 | 0662057M38 | RES. CHIP 33 5% 20X40 |
| R0305 | 0662057M38 | RES. CHIP 33 5% 20X40 |
| R0306 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0307 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0310 | 0662057M34 | RES. CHIP 22 5% 20X40 |
| R0403 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0404 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0405 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0406 | 0662057M68 | RES CHIP 560 5% 20X40 |
| R0409 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0415 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0416 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0417 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0418 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0420 | 0662057M98 | RES. CHIP 10K 5% 20X40 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R0421 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0422 | 0662057V15 | RES CHIP 33K 1% 1/16W |
| R0425 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0431 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0433 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0434 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0435 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0441 | 0662057M82 | RES. CHIP 2200 5% 20X40 |
| R0443 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0445 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0500 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0502 | 0662057N37 | RES CHIP 390K 5% 20X40 |
| R0503 | 0662057B47 | CHIP RES 0 OHMS +-.050 OHMS |
| R0504 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0505 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0506 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0507 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0508 | 0662057M86 | RES CHIP 3300 5% 20X40 |
| R0509 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0510 | 0662057V18 | RES CHIP 43K 1% 1/16W |
| R0511 | 0662057V15 | RES CHIP 33K 1% 1/16W |
| R0512 | 0662057V02 | RES CHIP 10K 1% 1/16W |
| R0513 | 0662057V17 | RES CHIP 39K 1% 1/16W |
| R0514 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0515 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0516 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0517 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R0518 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0519 | 0662057C27 | CHIP RES 10 OHMS 5% |
| R0520 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R0521 | 0662057V17 | RES CHIP 39K 1% 1/16W |
| R0522 | 0662057V10 | RES CHIP 20K 1% 1/16W |
| R0523 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0526 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0528 | 0662057U98 | RES CHIP 7.5K 1% 1/16W |
| R0529 | 0662057U78 | RES CHIP 1.2K 1% 1/16W |
| R0530 | 0662057N35 | RES. CHIP 330K 5% 20X40 |
| R0531 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0532 | 0662057M86 | RES CHIP 3300 5% 20X40 |
| R0551 | 0662057U98 | RES CHIP 7.5K 1% 1/16W |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R0552 | 0662057U78 | RES CHIP 1.2K 1% 1/16W |
| R0553 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0620 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0621 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0622 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0623 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0624 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0625 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0626 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0627 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0628 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0629 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0630 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0631 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0634 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0635 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0636 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0639 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0700 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0701 | 0662057M96 | RES. CHIP 8200 5% 20X40 |
| R0705 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0739 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0741 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0742 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0743 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0901 | 0662057V25 | RES CHIP 82K 1% 1/16 |
| R0903 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0904 | 0662057M96 | RES. CHIP 8200 5% 20X40 |
| R0905 | 0662057N07 | RES. CHIP 22K 5% 20X40 |
| R0906 | 0662057N07 | RES. CHIP 22K 5% 20X40 |
| R0907 | 0662057M96 | RES. CHIP 8200 5% 20X40 |
| R0908 | 0662057C13 | CHIP RES 2.7 OHMS 5% |
| R0909 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0911 | 0662057V06 | RES CHIP 14K 1% 1/16W |
| R0912 | 0662057V06 | RES CHIP 14K 1% 1/16W |
| R0913 | 0662057V43 | RES CHIP 330K 1% |
| R0914 | 0662057V06 | RES CHIP 14K 1% 1/16W |
| R0915 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0917 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0918 | 0662057U86 | RES CHIP 2.4K 1% 1/16W |
| R0919 | 0662057U99 | RES CHIP 8.2K 1% 1/16W |
| R0920 | 0662057N07 | RES. CHIP 22K 5% 20X40 |
| R0921 | 0662057U99 | RES CHIP 8.2K 1% 1/16W |
| R0922 | 0662057N57 | CHIP RES 4.7M 5% 20X40 |
| R0924 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0930 | 0662057N06 | RES. CHIP 20K 5% 20X40 |
| R0931 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0932 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0934 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0935 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0936 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0938 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0940 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0941 | 0662057N10 | RES. CHIP 30K 5% 20X40 |
| R0942 | 0662057N03 | RES. CHIP 15K 5% 20X40 |
| R0943 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R0944 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0945 | 0662057N37 | RES CHIP 390K 5% 20X40 |
| R0947 | 0662057V02 | RES CHIP 10K 1% 1/16W |
| R0948 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0950 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0953 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0954 | 0662057U98 | RES CHIP 7.5K 1% 1/16W |
| R0955 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0960 | 0662057N06 | RES. CHIP 20K 5% 20X40 |
| R0961 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0962 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0963 | 0662057N09 | RES. CHIP 27K 5% 20X40 |
| R0964 | 0662057N06 | RES. CHIP 20K 5% 20X40 |
| R0965 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0966 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0967 | 0662057V27 | RES CHIP 100K 1% 1/1 6W |
| R0968 | 0662057V02 | RES CHIP 10K 1% 1/16W |
| R0971 | 0662057V07 | RES CHIP 15K 1% 1/16W |
| R0972 | 0662057U93 | RES CHIP 4.7K 1% 1/16W |
| R0973 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0974 | 0662057V02 | RES CHIP 10K 1% 1/16W |
| R0975 | 0662057V02 | RES CHIP 10K 1% 1/16W |
| R0976 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0977 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R0978 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0979 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0981 | 0662057M84 | RES. CHIP 2700 5% 20X40 |
| R0982 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R0983 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R0984 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0985 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0987 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R0988 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0989 | 0662057N17 | RES. CHIP 56K 5% 20X40 |
| R0990 | 0662057M91 | RES CHIP 5100 5% 20X40 |
| R0991 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R0992 | 0662057M84 | RES. CHIP 2700 5% 20X40 |
| R0993 | 0662057U78 | RES CHIP 1.2K 1% 1/16W |
| R0994 | 0662057M88 | RES. CHIP 3900 5% 20X40 |
| R0995 | 0662057U78 | RES CHIP 1.2K 1% 1/16W |
| R0996 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R0997 | 0662057U78 | RES CHIP 2.4K 1% 1/16W |
| R0998 | 0662057V01 | RES CHIP 9.1K 1% 1/16W |
| R0999 | 0662057V01 | RES CHIP 9.1K 1% 1/16W |
| R1000 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R5000 | 0662057M43 | RES. CHIP 51 5% 20X40 |
| R5001 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5002 | 0662057M66 | RES. CHIP 470 5% 20X40 |
| R5003 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R5005 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R5006 | 0662057M62 | RES. CHIP 330 5% 20X40 |
| R5010 | 0662057N05 | RES. CHIP 18K 5% 20X40 |
| R5011 | 0662057N03 | RES. CHIP 15K 5% 20X40 |
| R5013 | 0662057M70 | RES. CHIP 680 5% 20X40 |
| R5014 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5015 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5016 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5017 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5018 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5019 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5020 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R5022 | 0662057M60 | RES. CHIP 270 5% 20X40 |
| R5023 | 0662057N30 | RES. CHIP 200K 5% 20X40 |
| R5025 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R5026 | 0662057M34 | RES. CHIP 22 5% 20X40 |
| R5027 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R5028 | 0662057M94 | RES. CHIP 6800 5% 20X40 |
| R5029 | 0662057N06 | RES. CHIP 20K 5% 20X40 |
| R5030 | 0662057N11 | RES. CHIP 33K 5% 20X40 |
| R5031 | 0662057M66 | RES. CHIP 470 5% 20X40 |
| R5032 | 0662057M76 | RES. CHIP 1200 5% 20X40 |
| R5034 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5050 | 0662057M36 | RES CHIP 27 5% 20X4 |
| R5051 | 0662057M49 | RES CHIP 91 5% 20X40 |
| R5250 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R5251 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R5252 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R5253 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R5254 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R5255 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R5256 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R5300 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R5301 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R5302 | 0662057C75 | CHIP RES 1000 OHMS 5% |
| R5303 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R5304 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R5305 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R5306 | 0662057N03 | RES. CHIP 15K 5% 20X40 |
| R5307 | 0662057N07 | RES. CHIP 22K 5% 20X40 |
| R5308 | 0662057M46 | RES. CHIP 68 5% 20X40 |
| R5309 | 0662057M36 | RES CHIP 27 5% 20X4 |
| R5310 | 0662057C75 | CHIP RES 1000 OHMS 5% |
| R5311 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R5312 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R5313 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R5314 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R5315 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R5316 | 0662057C75 | CHIP RES 1000 OHMS 5% |
| R5317 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R5318 | 0662057C75 | CHIP RES 1000 OHMS 5% |
| R5319 | 0662057M66 | RES. CHIP 470 5% 20X40 |
| R5322 | 0662057M83 | RES. CHIP 2400 5% 20X40 |
| R5323 | 0662057N01 | RES CHIP 12K 5% 20X40 |
| R5324 | 0662057C31 | CHIP RES 15 OHMS 5% |
| R5325 | 0662057C31 | CHIP RES 15 OHMS 5% |
| R5326 | 0662057C31 | CHIP RES 15 OHMS 5% |
| R5327 | 0662057M56 | RES. CHIP 180 5% 20X40 |
| R5330 | 0662057M42 | RES. CHIP 47 5% 20X40 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R5332 | 0662057M78 | RES. CHIP 1500 5% 20X40 |
| R5333 | 0662057M42 | RES. CHIP 47 5% 20X40 |
| R5334 | 0662057M78 | RES. CHIP 1500 5% 20X40 |
| R5383 | 0662057M56 | RES. CHIP 180 5% 20X40 |
| R5384 | 0662057M56 | RES. CHIP 180 5% 20X40 |
| R5385 | 0662057M56 | RES. CHIP 180 5% 20X40 |
| R5386 | 0662057M56 | RES. CHIP 180 5% 20X40 |
| R5387 | 0662057M42 | RES. CHIP 47 5% 20X40 |
| R5388 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5400 | 0662057M70 | RES. CHIP 680 5% 20X40 |
| R5401 | 0662057N09 | RES. CHIP 27K 5% 20X40 |
| R5402 | 0662057M94 | RES. CHIP 6800 5% 20X40 |
| R5403 | 0662057M62 | RES. CHIP 330 5% 20X40 |
| R5404 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5405 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R5406 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R5412 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5414 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5415 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5420 | 0662057M96 | RES. CHIP 8200 5% 20X40 |
| R5500 | 0662057A29 | CHIP RES 150 OHMS 5% |
| R5501 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R5503 | 0662057M54 | RES. CHIP 150 5% 20X40 |
| R5504 | 0662057M94 | RES. CHIP 6800 5% 20X40 |
| R5505 | 0662057M56 | RES. CHIP 180 5% 20X40 |
| R5506 | 0662057M54 | RES. CHIP 150 5% 20X40 |
| R5507 | 0662057M40 | RES. CHIP 39 5% 20X40 |
| R5508 | 0662057M54 | RES. CHIP 150 5% 20X40 |
| R5510 | 0611077A01 | RES CHIP JUMPER |
| R5511 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R5520 | 0662057M27 | RES. CHIP 11 5% 20X40 |
| R5521 | 0662057M27 | RES. CHIP 11 5% 20X40 |
| R5522 | 0662057M27 | RES. CHIP 11 5% 20X40 |
| R5523 | 0662057M27 | RES. CHIP 11 5% 20X40 |
| R5524 | 0662057M27 | RES. CHIP 11 5% 20X40 |
| R5525 | 0662057M27 | RES. CHIP 11 5% 20X40 |
| R5526 | 0662057C75 | CHIP RES 1000 OHMS 5% |
| R5527 | 0680195M08 | RES CHIP 20 OHMS 5% .5W |
| R5528 | 0611077A01 | RES CHIP JUMPER |
| R5542 | 0611077A17 | RES CHIP 4.3 5 1/8W |
| R5543 | 0611077A17 | RES CHIP 4.3 5 1/8W |
| R5544 | 0611077A17 | RES CHIP 4.3 5 1/8W |
| R5545 | 0611077A17 | RES CHIP 4.3 5 1/8W |
| R5546 | 0611077A74 | RES CHIP 1000 5 1/8 |
| R5547 | 0680194M54 | RES 3.30 OHMS 5% 1W |
| R5548 | 0611077A17 | RES CHIP 4.3 5 1/8W |
| R5549 | 0611077A17 | RES CHIP 4.3 5 1/8W |
| R5550 | 0611077A17 | RES CHIP 4.3 5 1/8W |
| R5551 | 0611077A17 | RES CHIP 4.3 5 1/8W |
| R5552 | 0611077A17 | RES CHIP 4.3 5 1/8W |
| R5553 | 0611077A17 | RES CHIP 4.3 5 1/8W |
| R5554 | 0611077A17 | RES CHIP 4.3 5 1/8W |
| R5555 | 0611077A17 | RES CHIP 4.3 5 1/8W |
| R5556 | 0680194M54 | RES 3.30 OHMS 5% 1W |
| R5557 | 0611077A17 | RES CHIP 4.3 5 1/8W |
| R5558 | 0611077A17 | RES CHIP 4.3 5 1/8W |
| R5559 | 0611077A17 | RES CHIP 4.3 5 1/8W |
| R5560 | 0611077A17 | RES CHIP 4.3 5 1/8W |
| R5562 | 0680194M13 | RES 33 OHMS 5% 1W |
| R5565 | 0662057C01 | CHIP RES 0 OHMS +.050 OHMS |
| R5566 | 0680194M01 | RES 10 OHMS 5% 1W |
| R5568 | 0680194M13 | RES 33 OHMS 5% 1W |
| R5571 | 0662057C01 | CHIP RES 0 OHMS +.050 OHMS |
| R5573 | 0680194M13 | RES 33 OHMS 5% 1W |
| R5574 | 0680195M01 | RES CHIP 10 OHMS 5% .5W |
| R5575 | 0685934D02 | RES,,5MOHM,1%,3W,SM,,180 PPM |
| R5576 | 0662057C13 | CHIP RES 2.7 OHMS 5% |
| R5577 | 0662057C13 | CHIP RES 2.7 OHMS 5% |
| R5578 | 0662057V27 | RES CHIP 100K 1% 1/1 6W |
| R5579 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5581 | 0611077A74 | RES CHIP 1000 5 1/8 |
| R5582 | 0680194M13 | RES 33 OHMS 5% 1W |
| R5584 | 0680194M13 | RES 33 OHMS 5% 1W |
| R5585 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5586 | 0680194M13 | RES 33 OHMS 5% 1W |
| R5587 | 0680194M13 | RES 33 OHMS 5% 1W |
| R5702 | 0662057M78 | RES. CHIP 1500 5% 20X40 |
| R5703 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5704 | 0680149M02 | THERMISTOR CHIP 100K OHM |
| R5705 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R5706 | 0662057M48 | RES. CHIP 82 5% 20X40 |
| R5707 | 0662057M48 | RES. CHIP 82 5% 20X40 |
| R5708 | 0662057M39 | RES. CHIP 36 5% 20X40 |
| R5709 | 0662057M78 | RES. CHIP 1500 5% 20X40 |
| R5710 | 0662057A94 | CHIP RES 75K OHMS 5% |
| R5711 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5712 | 0680149M02 | THERMISTOR CHIP 100K OHM |
| R5750 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R5751 | 0662057M98 | RES. CHIP 10K 5% 20X40 |
| R5752 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R5753 | 0662057M91 | RES CHIP 5100 5% 20X40 |
| R5754 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R5755 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5758 | 0662057M86 | RES CHIP 3300 5% 20X40 |
| R5759 | 0662057M81 | RES. CHIP 2000 5% 20X40 |
| R5761 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R5762 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R5763 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R5764 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R5765 | 0662057M91 | RES CHIP 5100 5% 20X40 |
| R5766 | 0662057N23 | RES. CHIP 100K 5% 20X40 |
| R5767 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R5768 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R5769 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5771 | 0662057M54 | RES. CHIP 150 5% 20X40 |
| R5772 | 0662057M71 | RES CHIP 750 5% 20X40 |
| R5773 | 0662057M54 | RES. CHIP 150 5% 20X40 |
| R5774 | 0662057M48 | RES. CHIP 82 5% 20X40 |
| R5775 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R5776 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R5777 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R5778 | 0662057M72 | RES. CHIP 820 5% 20X40 |
| R5779 | 0662057N01 | RES CHIP 12K 5% 20X40 |
| R5780 | 0662057M84 | RES. CHIP 2700 5% 20X40 |
| R5782 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R5783 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R5784 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R5785 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R5786 | 0662057N15 | RES. CHIP 47K 5% 20X40 |
| R5825 | 0662057M83 | RES. CHIP 2400 5% 20X40 |
| R5826 | 0662057M88 | RES. CHIP 3900 5% 20X40 |
| R5827 | 0662057M60 | RES. CHIP 270 5% 20X40 |
| R5828 | 0662057M66 | RES. CHIP 470 5% 20X40 |
| R5829 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R5830 | 0662057M77 | RES. CHIP 1300 5% 20X40 |
| R5831 | 0662057M38 | RES. CHIP 33 5% 20X40 |
| R5832 | 0662057M38 | RES. CHIP 33 5% 20X40 |
| R5833 | 0662057M60 | RES. CHIP 270 5% 20X40 |
| R5834 | 0662057M60 | RES. CHIP 270 5% 20X40 |
| R5837 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R5838 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R5839 | 0662057M43 | RES. CHIP 51 5% 20X40 |
| R5840 | 0662057M43 | RES. CHIP 51 5% 20X40 |
| R5841 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R5842 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R5843 | 0662057M58 | RES. CHIP 220 5% 20X40 |
| R5845 | 0662057M84 | RES. CHIP 2700 5% 20X40 |
| R5846 | 0662057N01 | RES CHIP 12K 5% 20X40 |
| R5848 | 0662057M72 | RES. CHIP 820 5% 20X40 |
| R5849 | 0662057M30 | RES. CHIP 15 5% 20X40 |
| R5850 | 0662057M58 | RES. CHIP 220 5% 20X40 |
| R5851 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R5852 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R5853 | 0662057M74 | RES. CHIP 1000 5% 20X40 |
| R5854 | 0662057M63 | RES CHIP 360 5% 20X40 |
| R5855 | 0662057M01 | RES. CHIP 0 5% 20X40 |
| R5900 | 0662057M81 | RES. CHIP 2000 5% 20X40 |
| R5902 | 0662057M58 | RES. CHIP 220 5% 20X40 |
| R5903 | 0662057M81 | RES. CHIP 2000 5% 20X40 |
| R5904 | 0662057M60 | RES. CHIP 270 5% 20X40 |
| R5905 | 0662057M50 | RES. CHIP 100 5% 20X40 |
| R5909 | 0662057M30 | RES. CHIP 15 5% 20X40 |
| R5910 | 0662057M38 | RES. CHIP 33 5% 20X40 |
| R5911 | 0662057M66 | RES. CHIP 470 5% 20X40 |
| R5912 | 0662057M81 | RES. CHIP 2000 5% 20X40 |
| R5914 | 0662057M72 | RES. CHIP 820 5% 20X40 |
| R5915 | 0662057M60 | RES. CHIP 270 5% 20X40 |
| R5916 | 0662057M79 | RES CHIP 1600 5% 20X40 |
| R5917 | 0662057N01 | RES CHIP 12K 5% 20X40 |
| R5918 | 0662057M50 | RES. CHIP 100 5% 20X40 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R5919 | 0662057M47 | RES CHIP 75 5% 20X40 |
| R5921 | 0662057M84 | RES. CHIP 2700 5% 20X40 |
| R5922 | 0662057M38 | RES. CHIP 33 5% 20X40 |
| R5923 | 0662057M66 | RES. CHIP 470 5% 20X40 |
| R5924 | 0662057M79 | RES CHIP 1600 5% 20X40 |
| R5926 | 0662057M72 | RES. CHIP 820 5% 20X40 |
| R5927 | 0662057M81 | RES. CHIP 2000 5% 20X40 |
| R5928 | 0662057M60 | RES. CHIP 270 5% 20X40 |
| R5929 | 0662057N01 | RES CHIP 12K 5% 20X40 |
| R5930 | 0662057M43 | RES. CHIP 51 5% 20X40 |
| R5931 | 0662057M47 | RES CHIP 75 5% 20X40 |
| R5932 | 0662057M47 | RES CHIP 75 5% 20X40 |
| R5933 | 0662057M84 | RES. CHIP 2700 5% 20X40 |
| R5934 | 0662057M38 | RES. CHIP 33 5% 20X40 |
| R5935 | 0662057M66 | RES. CHIP 470 5% 20X40 |
| R5937 | 0662057M62 | RES. CHIP 330 5% 20X40 |
| R5938 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R5939 | 0662057M90 | RES. CHIP 4700 5% 20X40 |
| R5940 | 0662057M63 | RES CHIP 360 5% 20X40 |
| R5948 | 0662057M47 | RES CHIP 75 5% 20X40 |
| R5949 | 0662057M30 | RES. CHIP 15 5% 20X40 |
| R5950 | 0662057M58 | RES. CHIP 220 5% 20X40 |
| SH5400 | 2685882A01 | SHLD VCO TANK |
| T5380 | 2584600T01 | BALUN RF |
| T5381 | 2584600T01 | BALUN RF |
| U0001 | 0105958T50 | XTL5000 DAUGHTER BD W/ BRAVO |
| U0102 | 5185623B01 | HIGH SPEED CMOS INVERTER |
| U0103 | 5113837A15 | IC 3.3V QUAD BUFFER |
| U0104 | 5113837A15 | IC 3.3V QUAD BUFFER |
| U0105 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0106 | 5109522E53 | IC SNGL BUF NC7S125P5X SC70 |
| U0200 | 5105109Z38 | 3 VOLT LINEAR PCM CODEC FILTER |
| U0201 | 5113819A14 | IC QD OP AMP _33204_ |
| U0202 | 5185143E67 | IC LM1971-62 DB LOG POT |
| U0203 | 5162852A79 | IC MOS TTL SPDT ANALOG SC70 |
| U0204 | 5185794L01 | AUDIO AMP TAPE AND REEL |
| U0206 | 5185143E67 | IC LM1971-62 DB LOG POT |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| U0208 | 5162852A79 | IC MOS TTL SPDT ANALOG SC70 |
| U0209 | 5162852A79 | IC MOS TTL SPDT ANALOG SC70 |
| U0210 | 5162852A79 | IC MOS TTL SPDT ANALOG SC70 |
| U0300 | 5113837A15 | IC 3.3V QUAD BUFFER |
| U0303 | 5113837A15 | IC 3.3V QUAD BUFFER |
| U0304 | 5187970L15 | IC USB TRANS FULL-SPEED |
| U0305 | 5185941F54 | IC, RS232 TRANSCEIVER |
| U0307 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0308 | 5113805B88 | IC HCMOS NON-INV BUFFER W/TTL |
| U0309 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0401 | 5189290U41 | PRPHL INTFC,PRPHL INTFC,,,MAX3370 |
| U0500 | 5183308X01 | IC, LM2941, TO DRPOUT RGTR |
| U0501 | 5185353D55 | IC VOLTAGE REGULATOR 100MZ ADJ |
| U0502 | 5185353D55 | IC VOLTAGE REGULATOR 100MZ ADJ |
| U0503 | 5113816A07 | REG 5V POS 500MA MC78M05BDTRK |
| U0504 | 5185353D46 | IF 4.3V VOLTAGE DETECTOR |
| U0505 | 5113816A07 | REG 5V POS 500MA MC78M05BDTRK |
| U0506 | 5185143E57 | CMOS TIMER-LMC555CM |
| U0507 | 5185353D55 | IC VOLTAGE REGULATOR 100MZ ADJ |
| U0550 | 5183308X01 | IC, LM2941, TO DRPOUT RGTR |
| U0601 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0602 | 5113837A15 | IC 3.3V QUAD BUFFER |
| U0603 | 5109522E53 | IC SNGL BUF NC7S125P5X SC70 |
| U0604 | 5113818A14 | IC DL OP AMP RAIL TO RAIL |
| U0605 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0606 | 5105109Z31 | IC QUAD 2:1 MUX/DEMUX |
| U0607 | 5109522E74 | IC 2-INPUT AND GATE |
| U0608 | 5109522E74 | IC 2-INPUT AND GATE |
| U0609 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0610 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0611 | 5113805B78 | IC 1 GATE 2 INPUT NAND |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| U0700 | 5185368C83 | IC 12 BIT DAC |
| U0701 | 5164015H66 | IC, 64 MACROCELL CPLD |
| U0703 | 5162852A79 | IC MOS TTL SPDT ANALOG SC70 |
| U0704 | 5162852A79 | IC MOS TTL SPDT ANALOG SC70 |
| U0705 | 5162852A79 | IC MOS TTL SPDT ANALOG SC70 |
| U0740 | 5185143E68 | IC LM7219 HIGH SPEED COMPARATOR |
| U0951 | 5183308X01 | IC, LM2941, TO DRPOUT RGTR |
| U0952 | 5185956E99 | IC, DUAL DIGITAL POTENTIOMETER, 256-TAP SPI |
| U0953 | 5185143E16 | IC ANALOG TO DIGITAL CONVERTER |
| U0954 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0955 | 5113819A14 | IC QD OP AMP _33204_ |
| U0956 | 5185956E24 | QUAD OP AMP RAIL TO RAIL 14 |
| U0957 | 5113819A14 | IC QD OP AMP _33204_ |
| U0958 | 5113805B78 | IC 1 GATE 2 INPUT NAND |
| U0959 | 5185143E05 | IC DAC OCTAL 8 BIT |
| U0960 | 5113819A14 | IC QD OP AMP _33204_ |
| U0962 | 5185353D14 | IC SOT23-5 HI PRECISION REG 3V |
| U0965 | 5185143E68 | IC LM7219 HIGH SPEED COMPARATOR |
| U0966 | 5113816A07 | REG 5V POS 500MA MC78M05BDTRK |
| U0970 | 5185143E68 | IC LM7219 HIGH SPEED COMPARATOR |
| U5001 | 5185353D14 | IC SOT23-5 HI PRECISION REG 3V |
| U5002 | 5185963A85 | IC-ABACUS III-LP |
| U5300 | 5185130C83 | IC 15DB DIGITAL ATTEUATOR SOT25 PKG |
| U5301 | 5113816A07 | REG 5V POS 500MA MC78M05BDTRK |
| U5302 | 5186258W01 | IC GAAS RF GAIN STAGE |
| U5303 | 5185130C65 | IC VHF/UHF/800 MHZ LDMOS DRIVER |
| U5400 | 5185963A87 | IC ATTENUATOR |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| U5500 | 5185130C65 | IC VHF/UHF/800 MHZ LDMOS DRIVER |
| U5560 | 5185963A15 | IC TEMPERTURE SENSOR 1M50C |
| U5561 | 5185353D92 | IC CURRENT SHUNT MONITOR |
| U5750 | 5185353D14 | IC SOT23-5 HI PRECISION REG 3V |
| U5751 | 5105492X03 | IC SNG HI SPD L-MOS NOT GATE |
| U5752 | 5185963A27 | IC TESTED AT25016 48 PIN GFP |
| U5753 | 5113805B87 | IC MUX/DEMUX DUAL 4 CHAN ANALOG |
| U5825 | 4885757E03 | RESONATOR 4MMX4MM COPPER DIELECTRIC COAXIAL |
| U5826 | 4885757E02 | RESONATOR 4MM X 4MM COPPER DIELECTRIC |
| VR0411 | 4805656W39 | QUAD ESD SUPPRESSOR ARRAY -41206ESD |
| VR0412 | 4805656W09 | DIODE QUAD 20 VOLT ZENER |
| VR0414 | 4813832C75 | DIODE ZENER QU O |
| VR0415 | 4805656W09 | DIODE QUAD 20 VOLT ZENER |
| VR0418 | 4813832C75 | DIODE ZENER QU O |
| VR0420 | 4813830A24 | DIODE 11V 5% 225MW MMBZ5241B_ |
| VR0422 | 4805656W10 | DIODE DUAL 15 VOLT ZENER |
| VR0423 | 4805656W10 | DIODE DUAL 15 VOLT ZENER |
| VR0424 | 4805656W10 | DIODE DUAL 15 VOLT ZENER |
| VR0425 | 4805656W10 | DIODE DUAL 15 VOLT ZENER |
| VR0426 | 4813832C75 | DIODE ZENER QU O |
| VR0500 | 4813830A14 | DIODE 5.1V 5% 225MW MMBZ5231B_ |
| VR0501 | 4805656W10 | DIODE DUAL 15 VOLT ZENER |
| VR0502 | 4813830A75 | DIODE DUAL COM ANODE |
| VR5500 | 4813832C77 | TRANS SUP .24V HIGH PWR |
| Y0100 | 4809995L05 | XTAL QUARTZ 32.768KHZ CC4V-T1 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| Y5400 | 4885230C01 | 109.65MHZ FILTER 3RD OVERTONE |
| Y5401 | 4885230C01 | 109.65MHZ FILTER 3RD OVERTONE |
| Y5750 | 5185143E07 | IC 16.8 MHZ REF OSC .8 PPM |
| Y5900 | 4885593E04 | RESONATOR 6MMX6MM COPPER DIELECTRIC COAXIAL R |
| Y5901 | 4885593E05 | RESONATOR 6MMX6MM COPPER DIELECTRIC COAXIAL |
| Y5902 | 4885593E06 | RESONATOR 6MMX6MM COPPER DIELECTRIC COAXIAL |

Note: For optimum performance, diodes, transistors and integrated circuits must be ordered by MOTOROLA part numbers.

# Notes

# Chapter 8 Interconnect Boards Schematics, Component Location Diagrams, and Parts Lists

## 8.1 List of Interconnect Board Schematics and Component Location Diagrams

The following table lists the remote interconnect boards schematics and component location diagrams contained in this chapter.

*Table 8-1. List of Interconnect Board Schematics and Component Location Diagrams*


| Figure Title | Page |
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| HLN1472A Tansceiver  Interface Board Parts List | 8-27 |

## 8.2 PMLN 4866A Control Head Interface Boards

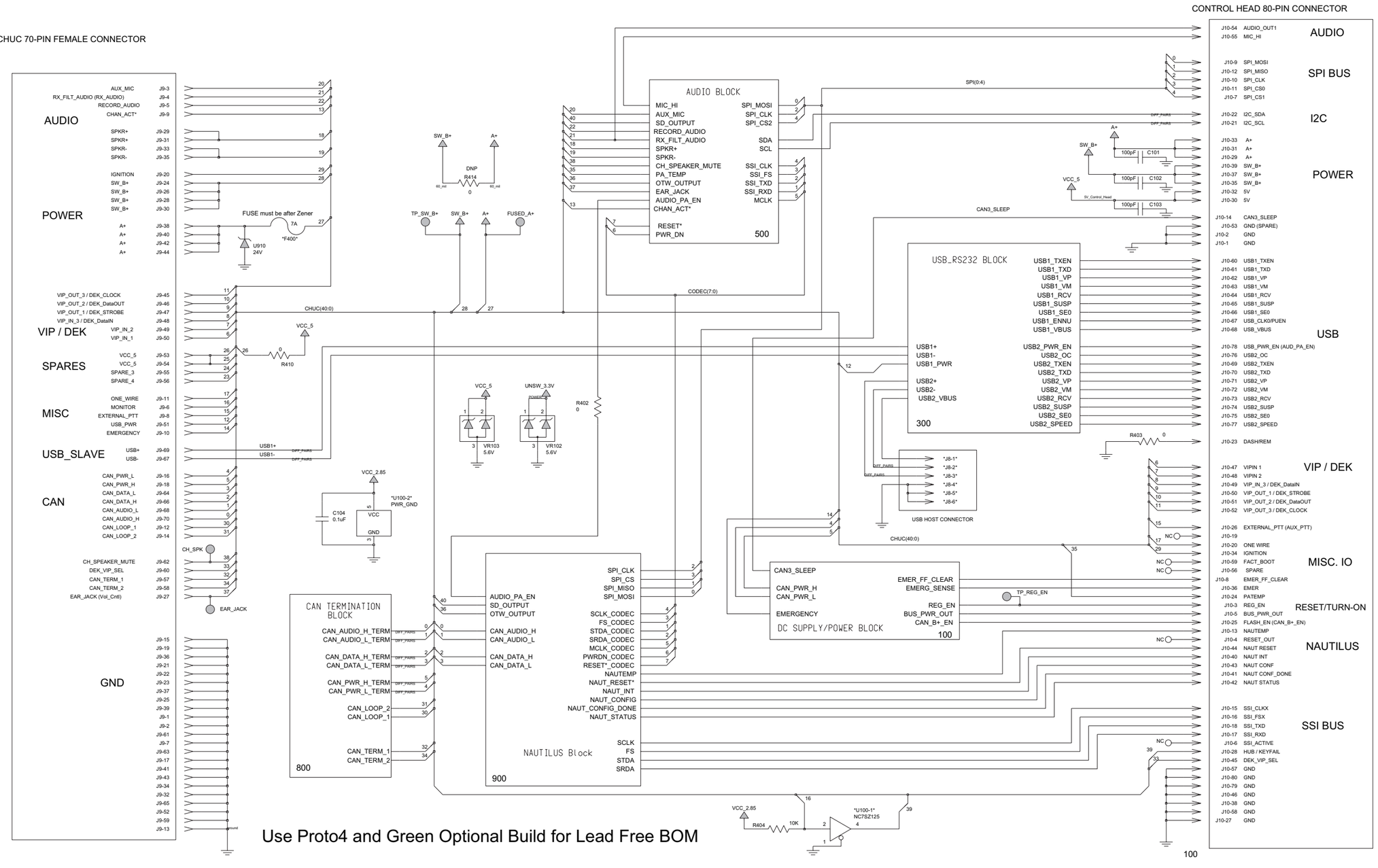



*Figure 8-1. Control Head Interface Board*

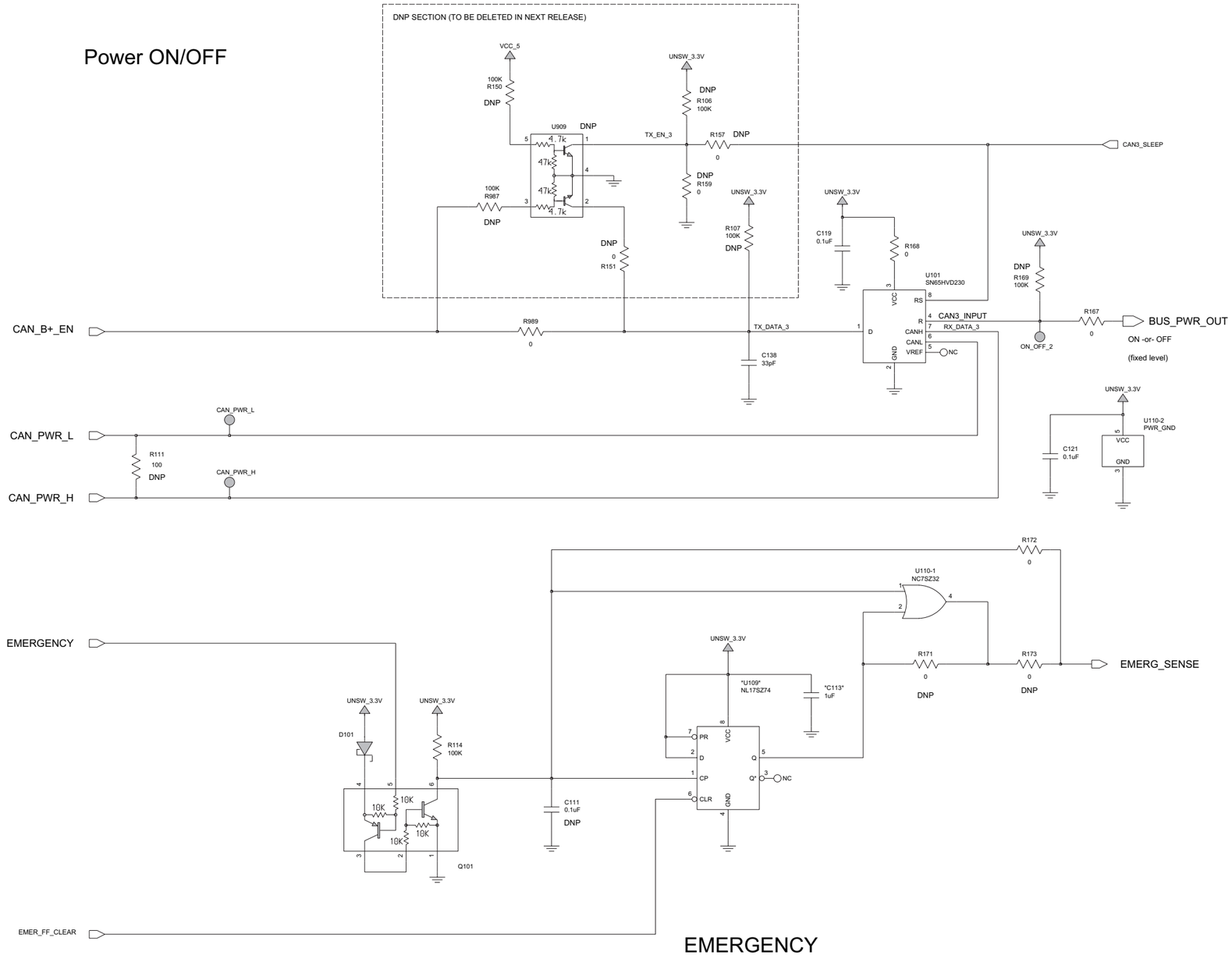



*Figure 8-2. Voltage Control*

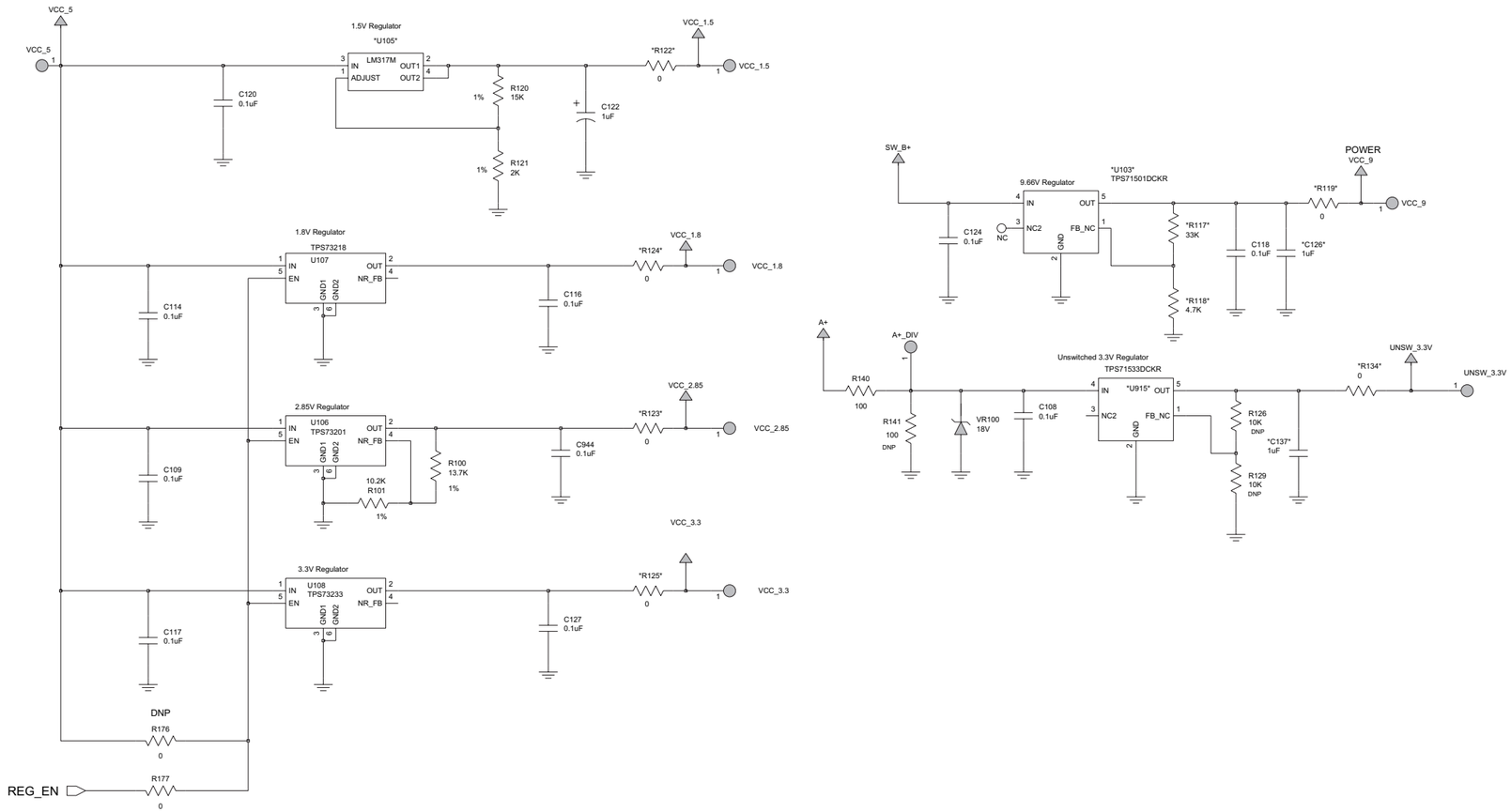
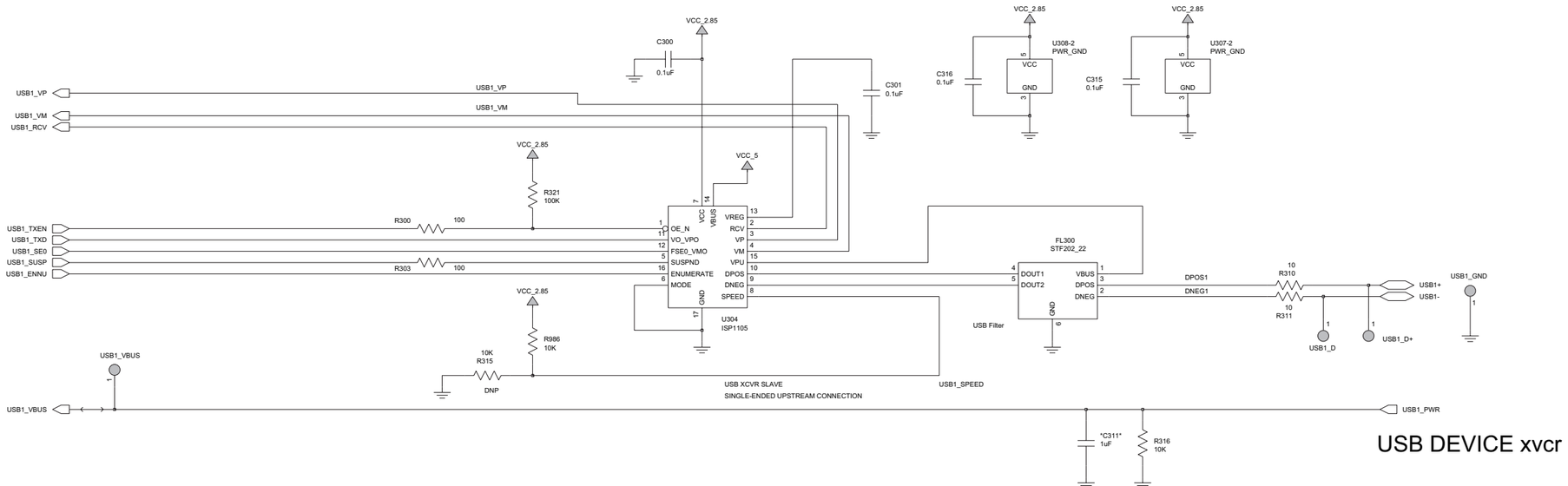
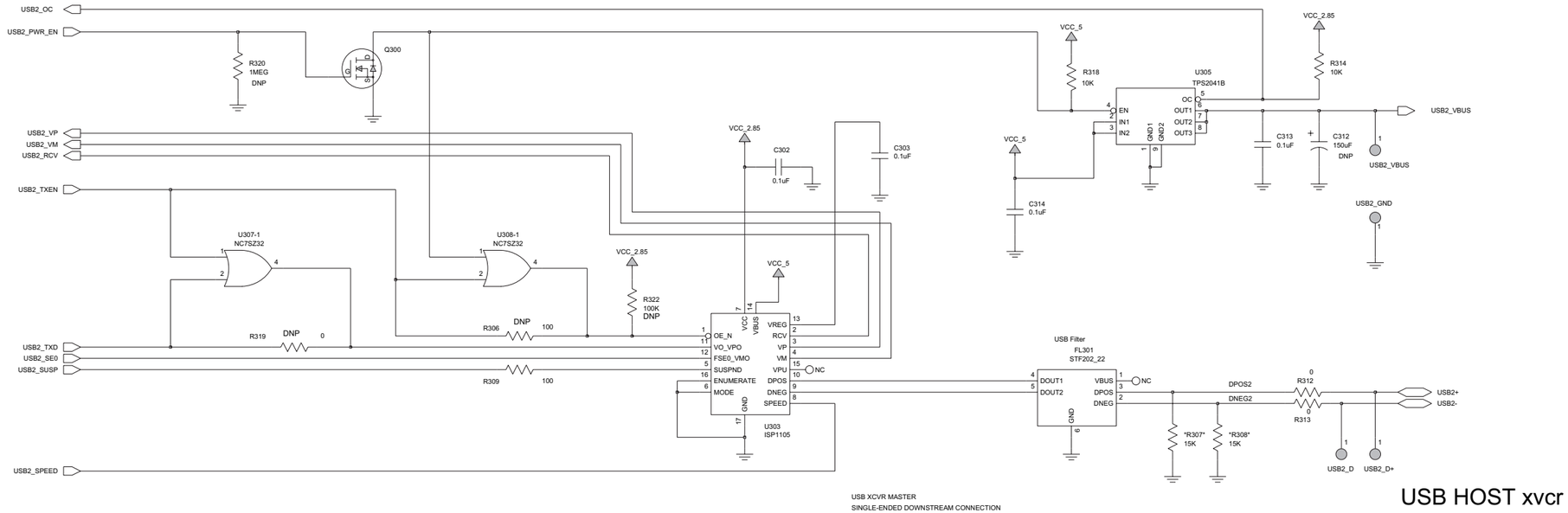



*Figure 8-3. Audio PA Evaluation Board DC Supply*




USB DEVICE xvcr




USB HOST xvcr

*Figure 8-4. USB Power*

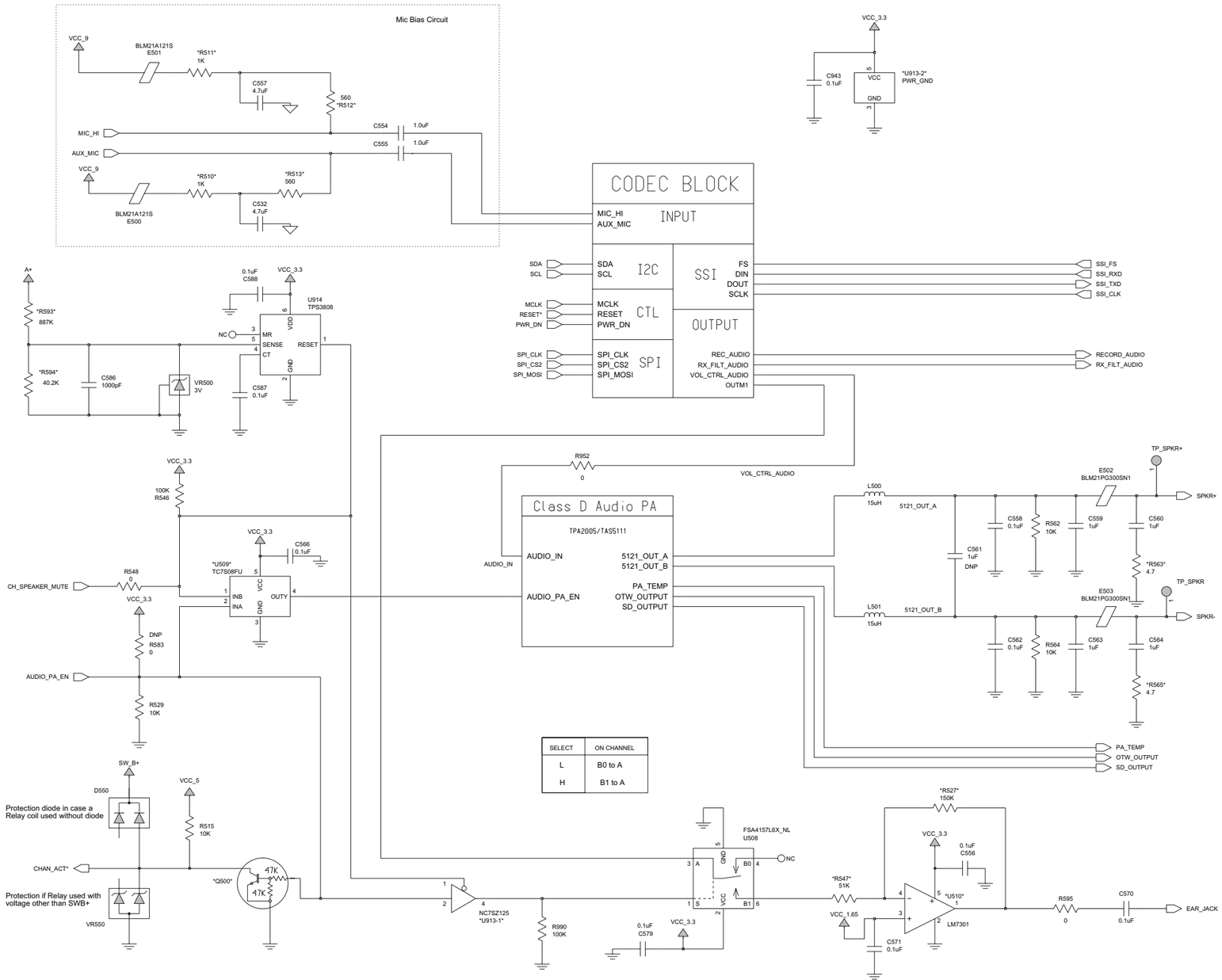



*Figure 8-5. Audio PA Evaluation Board (Sheet 1 of 2)*

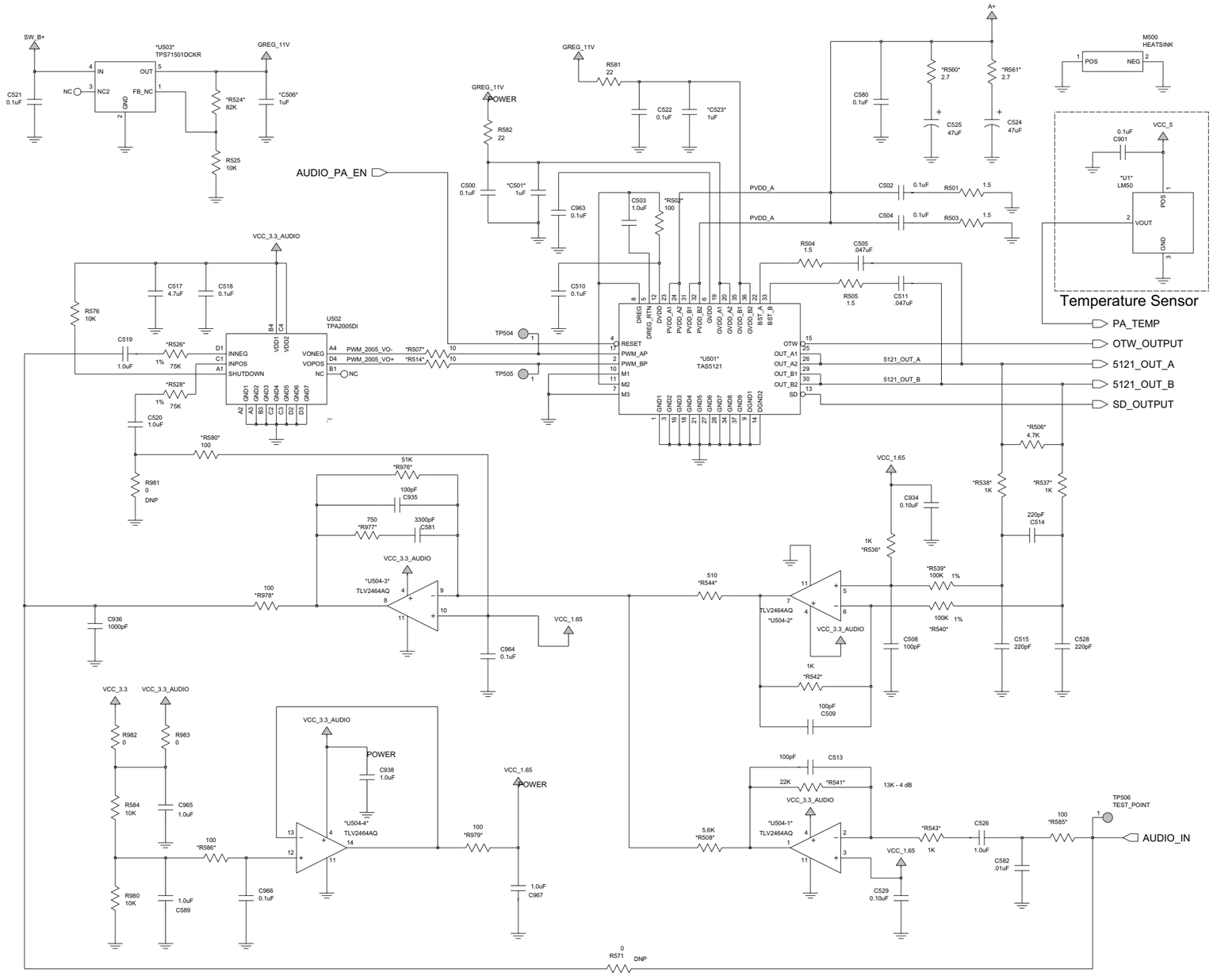



*Figure 8-6. Audio PA Evaluation Board (sheet 2 of 2)*

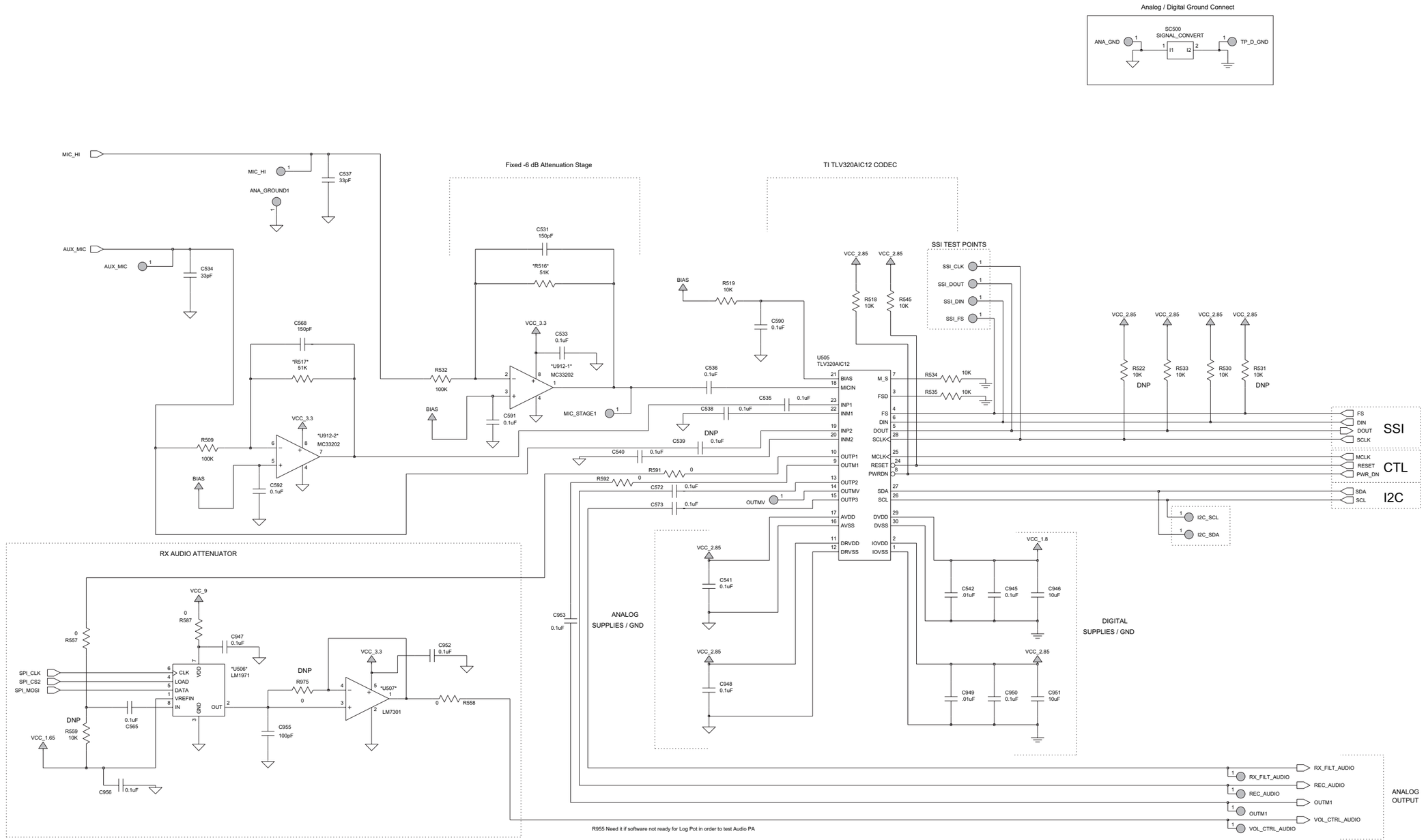



*Figure 8-7. CODEC Block*

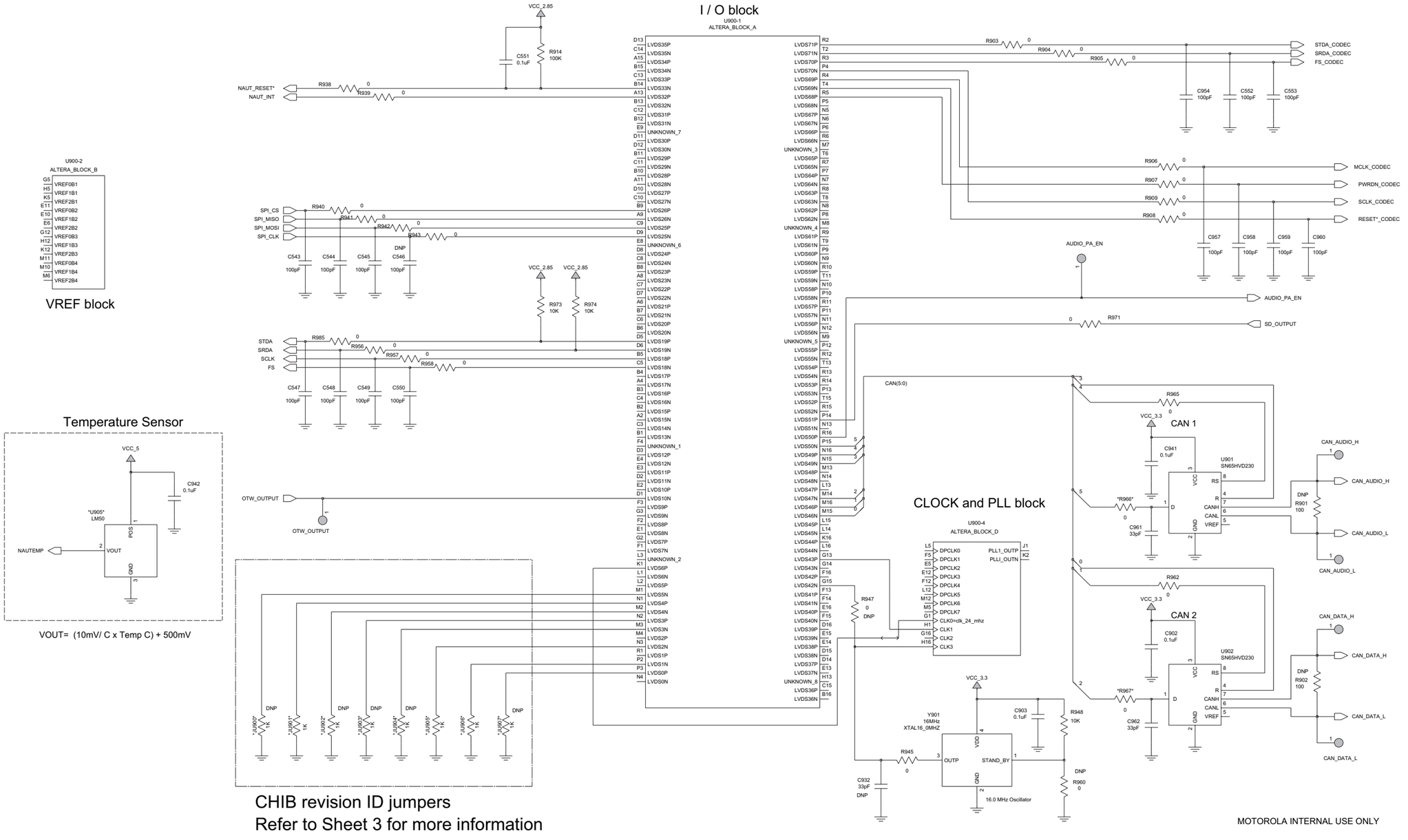
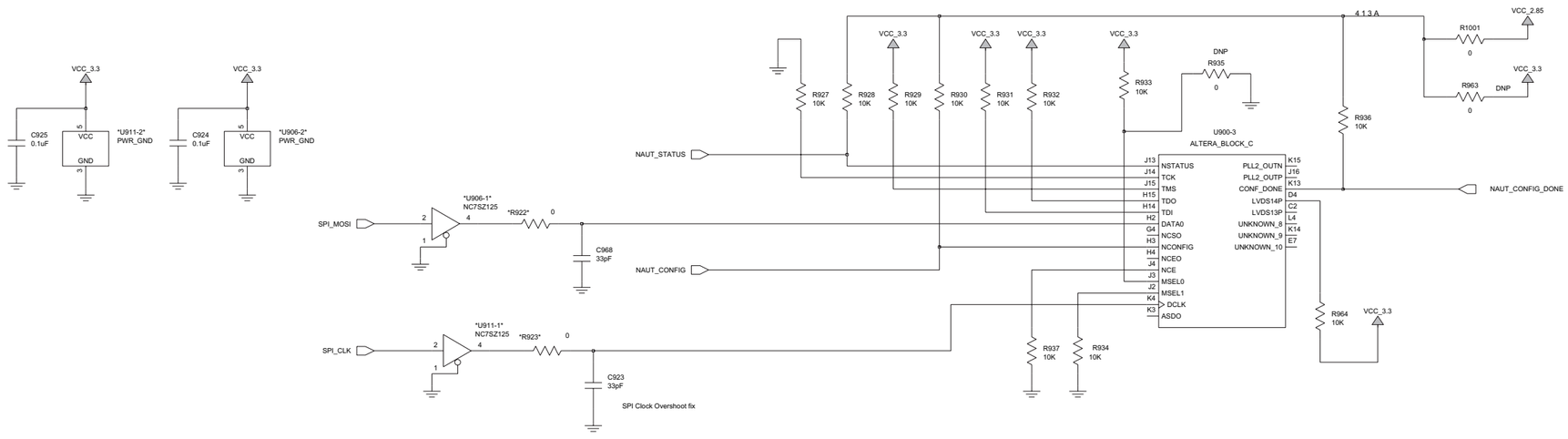



*Figure 8-8. Control Head Interface Board (Shared Schematic for CHIB and TIB) - (Sheet 1 of 2)*



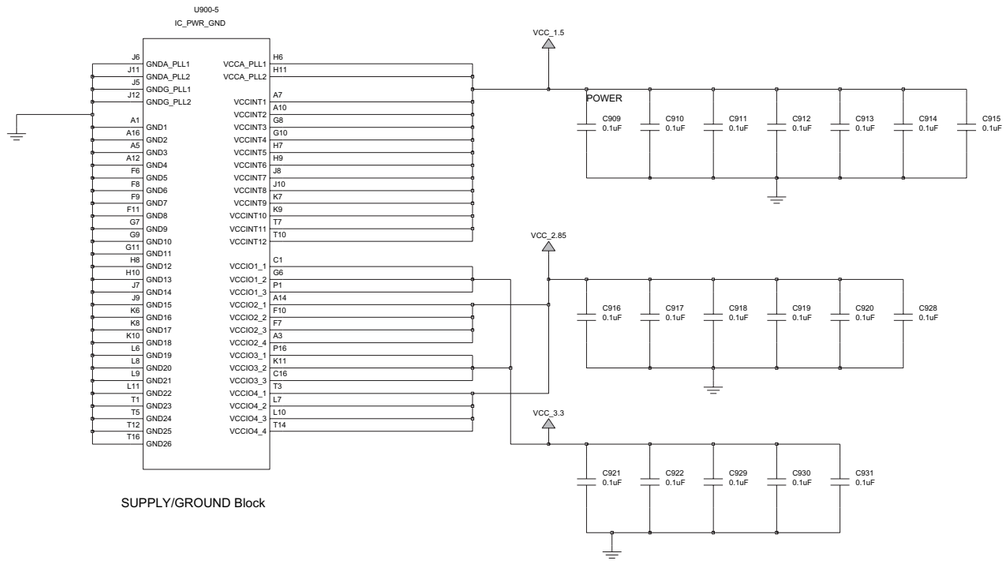




*Figure 8-9. Control Head Interface Board (Shared Schematic for CHIB and TIB) - (Sheet 2 of 2)*

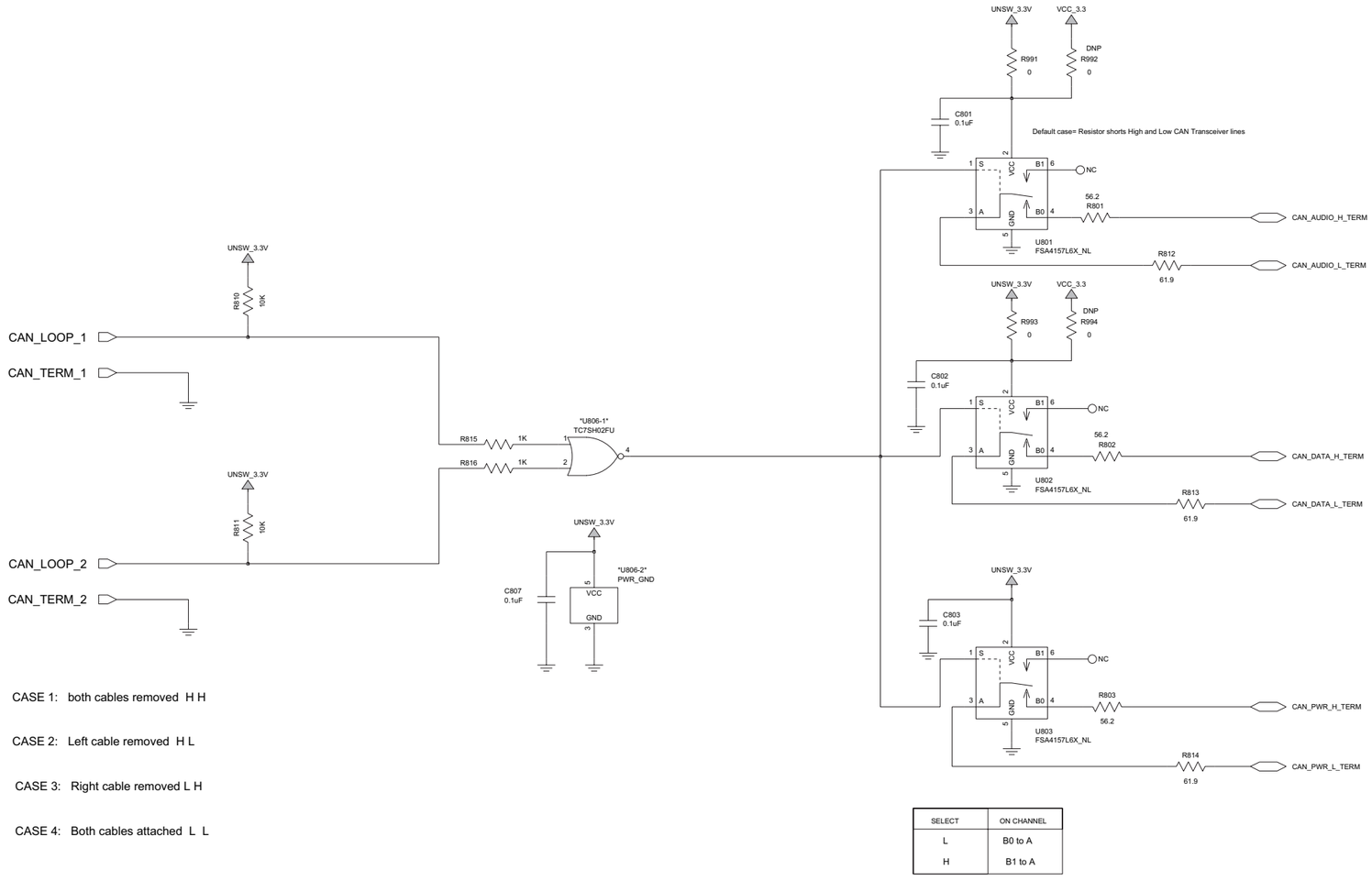



*Figure 8-10. CAN Termination*

## Notes

PMLN 4866A Control Head Interface Board Parts List

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C101 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C102 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C103 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C104 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C108 | 2113945H89 | CAP,FXD,.1UF,+10%,-10%,50V-DC,1206,X7R,-55DEG “ |
| C109 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C111 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C113 | 2113955C31 | CAP,FXD,1UF,+10%,-10%,16V-DC,X7R,-55DEG CMIN, “ |
| C114 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C116 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C117 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C118 | 2113945D04 | CAP CER CHP 100,000PF 25V 10% |
| C119 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C120 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C121 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C122 | 2313960B01 | CAP,FXD,1UF,+10%,-10%,16V-DC,SM,,-55DEG CMIN, “ |
| C124 | 2113945H89 | CAP,FXD,.1UF,+10%,-10%,50V-DC,1206,X7R,-55DEG “ |
| C126 | 2113955C31 | CAP,FXD,1UF,+10%,-10%,16V-DC,X7R,-55DEG CMIN, “ |
| C127 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C137 | 2113955C31 | CAP,FXD,1UF,+10%,-10%,16V-DC,X7R,-55DEG CMIN, “ |
| C138 | 2113944A31 | CAP CER CHP 33.0PF 50V 5% |
| C300 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C301 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C302 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C303 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C311 | 2113955C31 | CAP,FXD,1UF,+10%,-10%,16V-DC,X7R,-55DEG CMIN, “ |
| C312 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C313 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C314 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C315 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C316 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C500 | 2113945D04 | CAP CER CHP 100,000PF 25V 10% |
| C501 | 2113955C31 | CAP,FXD,1UF,+10%,-10%,16V-DC,X7R,-55DEG CMIN, “ |
| C502 | 2113945H89 | CAP,FXD,.1UF,+10%,-10%,50V-DC,1206,X7R,-55DEG “ |
| C503 | 2113946S35 | CAP CER CHP 1.0UF 16V 10% |
| C504 | 2113945H89 | CAP,FXD,.1UF,+10%,-10%,50V-DC,1206,X7R,-55DEG “ |
| C505 | 2113945D02 | CAP CER CHP 47,000PF 25V 10% |
| C506 | 2113955C31 | CAP,FXD,1UF,+10%,-10%,16V-DC,X7R,-55DEG CMIN, “ |
| C508 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C509 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C510 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C511 | 2113945D02 | CAP CER CHP 47,000PF 25V 10% |
| C513 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C514 | 2113944C02 | CAP CER CHP 220.0PF 50V 5% |
| C515 | 2113944C02 | CAP CER CHP 220.0PF 50V 5% |
| C517 | 2185802B01 | CAP 10V 4.7UF |
| C518 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C519 | 2113946S35 | CAP CER CHP 1.0UF 16V 10% |
| C520 | 2113946S35 | CAP CER CHP 1.0UF 16V 10% |
| C521 | 2113945H89 | CAP,FXD,.1UF,+10%,-10%,50V-DC,1206,X7R,-55DEG “ |
| C522 | 2113945D04 | CAP CER CHP 100,000PF 25V 10% |
| C523 | 2113955C31 | CAP,FXD,1UF,+10%,-10%,16V-DC,X7R,-55DEG CMIN, “ |
| C524 | 2314030J55 | CAP,FXD,47UF,+10%,-10%,25V-DC,SM,-55DEG CMIN, “ |
| C525 | 2314030J55 | CAP,FXD,47UF,+10%,-10%,25V-DC,SM,-55DEG CMIN, “ |
| C526 | 2113946S35 | CAP CER CHP 1.0UF 16V 10% |
| C528 | 2113944C02 | CAP CER CHP 220.0PF 50V 5% |
| C529 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C531 | 2113944A42 | CAP CER CHP 150.0PF 50V 5% |
| C532 | 2185802B01 | CAP 10V 4.7UF |
| C533 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C534 | 2113944A31 | CAP CER CHP 33.0PF 50V 5% |
| C535 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C536 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C537 | 2113944A31 | CAP CER CHP 33.0PF 50V 5% |
| C538 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C539 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C540 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C541 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C542 | 2113945B02 | CAP CER CHP 10,000PF 25V 10% |
| C543 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C544 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C545 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C546 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C547 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C548 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C549 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C550 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C551 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C552 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C553 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C554 | 2113946S35 | CAP CER CHP 1.0UF 16V 10% |
| C555 | 2113946S35 | CAP CER CHP 1.0UF 16V 10% |
| C556 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C557 | 2185802B01 | CAP 10V 4.7UF |
| C558 | 2113945H89 | CAP,FXD,.1UF,+10%,-10%,50V-DC,1206,X7R,-55DEG “ |
| C559 | 2113955E11 | CAP,FXD,1UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN, “ |
| C560 | 2113955E11 | CAP,FXD,1UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN, “ |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C561 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C562 | 2113945H89 | CAP,FXD,.1UF,+10%,-10%,50V-DC,1206,X7R,-55DEG “ |
| C563 | 2113955E11 | CAP,FXD,1UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN, “ |
| C564 | 2113955E11 | CAP,FXD,1UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN, “ |
| C565 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C566 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C568 | 2113944A42 | CAP CER CHP 150.0PF 50V 5% |
| C570 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C571 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C572 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C573 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C579 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C580 | 2113945H89 | CAP,FXD,.1UF,+10%,-10%,50V-DC,1206,X7R,-55DEG “ |
| C581 | 2113945A12 | CAP CER CHP 3300PF 50V 10% |
| C582 | 2113945B02 | CAP CER CHP 10,000PF 25V 10% |
| C586 | 2113945A09 | CAP CER CHP 1000PF 50V 10% |
| C587 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C588 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C589 | 2113946S35 | CAP CER CHP 1.0UF 16V 10% |
| C590 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C591 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C592 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C801 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C802 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C803 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C807 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C901 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C902 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C903 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C909 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C910 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C911 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C912 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C913 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C914 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C915 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C916 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C917 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C918 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C919 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C920 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C921 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C922 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C923 | 2113944A31 | CAP CER CHP 33.0PF 50V 5% |
| C924 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C925 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C928 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C929 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C930 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C931 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C932 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C934 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C935 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C936 | 2113945A09 | CAP CER CHP 1000PF 50V 10% |
| C938 | 2113946S35 | CAP CER CHP 1.0UF 16V 10% |
| C941 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C942 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C943 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C944 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C945 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C946 | 2113946F05 | CAP,CHIP,10UF,+10%,-10%,6.3V-DC,0805,X5R,-55D “ |
| C947 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C948 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C949 | 2113945B02 | CAP CER CHP 10,000PF 25V 10% |
| C950 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C951 | 2113946F05 | CAP,CHIP,10UF,+10%,-10%,6.3V-DC,0805,X5R,-55D “ |
| C952 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C953 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C954 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C955 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C956 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C957 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C958 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C959 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C960 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C961 | 2113944A31 | CAP CER CHP 33.0PF 50V 5% |
| C962 | 2113944A31 | CAP CER CHP 33.0PF 50V 5% |
| C963 | 2113945D04 | CAP CER CHP 100,000PF 25V 10% |
| C964 | 2113945D04 | CAP CER CHP 100,000PF 25V 10% |
| C965 | 2113946S35 | CAP CER CHP 1.0UF 16V 10% |
| C966 | 2113945D04 | CAP CER CHP 100,000PF 25V 10% |
| C967 | 2113946S35 | CAP CER CHP 1.0UF 16V 10% |
| C968 | 2113944A31 | CAP CER CHP 33.0PF 50V 5% |
| D101 | 4813833A28 | DIODE SCHOTTKY RECTIFIER 1.0A 20V |
| D550 | 4888722V03 | DIODE,SWG,,SM,SOT-323/SC-70,30MA,40 |
| E500 | 2480067M02 | CHK RF CHIP BEAD INDUCTOR |
| E501 | 2480067M02 | CHK RF CHIP BEAD INDUCTOR |
| E502 | 2480675U01 | 0805 CHIP-3AMP |
| E503 | 2480675U01 | 0805 CHIP-3AMP |
| F400 | 6585227Y01 | FUSE,7AMP, FAST ACTING |
| FL300 | 4813979A43 | FLTR,EMI/RFI,5.25V-DC,TSOP,USB FLTR W/ ESD PR “ |
| FL301 | 4813979A43 | FLTR,EMI/RFI,5.25V-DC,TSOP,USB FLTR W/ ESD PR “ |
| J10 | 2864447H01 | CONN,TERMNL,PLG,80 PIN,KYD |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| J8 | 2864424H01 | CONN, PLUG, USB (SMT) |
| J9 | 0964206H01 | CONNECTOR RECTANGULAR,BOARD TO BOARD,F,70CONT “ |
| JU900 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU901 | 0613952Q73 | CER CHIP RES 1000 OHM 5 0402 |
| JU902 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU903 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU904 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU905 | 0613952Q73 | CER CHIP RES 1000 OHM 5 0402 |
| JU906 | 0613952Q73 | CER CHIP RES 1000 OHM 5 0402 |
| JU907 | NOTPLACED | GCAM DUMMY PART NUMBER |
| L500 | 2413980A05 | INDUCTOR, SURFACE MOUNT POWER |
| L501 | 2413980A05 | INDUCTOR, SURFACE MOUNT POWER |
| M500 | 2664092H01 | HEATSINK, AUDIO PA |
| PWB | 8485934F07 | PCB, CHIB |
| Q101 | 4813973A81 | XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.2 “ |
| Q300 | 4813972A17 | PB-FREE,NOT COMPLETELY ENRICHED |
| Q500 | 4813973A42 | XSTR,BIP GP SS,,NPN,,SM,SC-59,,SMT,50V,.23W,, “ |
| R100 | 0613952E14 | CER CHIP RES 13.7K OHM 1 0603 |
| R1001 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R101 | 0613952E02 | CER CHIP RES 10.2K OHM 1 0603 |
| R106 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R107 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R111 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R114 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R117 | 0613952R13 | CER CHIP RES 33K OHM 5% 0402 |
| R118 | 0613952Q89 | CER CHIP RES 4700 OHM 5 0402 |
| R119 | 0613958J74 | CER CHIP RES 0.0 OHM JMP 0805 |
| R120 | 0613952E18 | CER CHIP RES 15.0K OHM 1 0603 |
| R121 | 0613952D30 | CER CHIP RES 2000 OHM 1% 0603 |
| R122 | 0613958J74 | CER CHIP RES 0.0 OHM JMP 0805 |
| R123 | 0613958J74 | CER CHIP RES 0.0 OHM JMP 0805 |
| R124 | 0613958J74 | CER CHIP RES 0.0 OHM JMP 0805 |
| R125 | 0613958J74 | CER CHIP RES 0.0 OHM JMP 0805 |
| R126 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R129 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R134 | 0613958J74 | CER CHIP RES 0.0 OHM JMP 0805 |
| R140 | 0613958S49 | CER CHIP RES 100 OHM 5 |
| R141 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R150 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R151 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R157 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R159 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R167 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R168 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R169 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R171 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R172 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R173 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R176 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R177 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R300 | 0613952Q49 | CER CHIP RES 100 OHM 5 0402 |
| R303 | 0613952Q49 | CER CHIP RES 100 OHM 5 0402 |
| R306 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R307 | 0613952R05 | CER CHIP RES 15K OHM 5% 0402 |
| R308 | 0613952R05 | CER CHIP RES 15K OHM 5% 0402 |
| R309 | 0613952Q49 | CER CHIP RES 100 OHM 5 0402 |
| R310 | 0613952Q25 | CER CHIP RES 10.0 OHM 5 0402 |
| R311 | 0613952Q25 | CER CHIP RES 10.0 OHM 5 0402 |
| R312 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R313 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R314 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R315 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R316 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R318 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R319 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R320 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R321 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R322 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R402 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R403 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R404 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R410 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R414 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R501 | 0613958H05 | CER CHIP RES 1.5 OHM 5% 0805 |
| R502 | 0613952Q49 | CER CHIP RES 100 OHM 5 0402 |
| R503 | 0613958H05 | CER CHIP RES 1.5 OHM 5% 0805 |
| R504 | 0613958H05 | CER CHIP RES 1.5 OHM 5% 0805 |
| R505 | 0613958H05 | CER CHIP RES 1.5 OHM 5% 0805 |
| R506 | 0613952Q89 | CER CHIP RES 4700 OHM 5 0402 |
| R507 | 0613952Q25 | CER CHIP RES 10.0 OHM 5 0402 |
| R508 | 0613952Q91 | CER CHIP RES 5600 OHM 5 0402 |
| R509 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R510 | 0613952Q73 | CER CHIP RES 1000 OHM 5 0402 |
| R511 | 0613952Q73 | CER CHIP RES 1000 OHM 5 0402 |
| R512 | 0613952Q67 | CER CHIP RES 560 OHM 5 0402 |
| R513 | 0613952Q67 | CER CHIP RES 560 OHM 5 0402 |
| R514 | 0613952Q25 | CER CHIP RES 10.0 OHM 5 0402 |
| R515 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R516 | 0613952R18 | CER CHIP RES 51K OHM 5 0402 |
| R517 | 0613952R18 | CER CHIP RES 51K OHM 5 0402 |
| R518 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R519 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R522 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R524 | 0613952R23 | CER CHIP RES 82K OHM 5% 0402 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R525 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R526 | 0613952R23 | CER CHIP RES 82K OHM 5% 0402 |
| R527 | 0613952R29 | CER CHIP RES 150K OHM 5% 0402 |
| R528 | 0613952R23 | CER CHIP RES 82K OHM 5% 0402 |
| R529 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R530 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R531 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R532 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R533 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R534 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R535 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R536 | 0613952M01 | CER CHIP RES 1000 OHM 1% 0402 |
| R537 | 0613952Q73 | CER CHIP RES 1000 OHM 5 0402 |
| R538 | 0613952Q73 | CER CHIP RES 1000 OHM 5 0402 |
| R539 | 0613952P01 | CER CHIP RES 100K OHM 1 0402 |
| R540 | 0613952P01 | CER CHIP RES 100K OHM 1 0402 |
| R541 | 0613952R04 | CER CHIP RES 13K OHM 5 0402 |
| R542 | 0613952M01 | CER CHIP RES 1000 OHM 1% 0402 |
| R543 | 0613952M01 | CER CHIP RES 1000 OHM 1% 0402 |
| R544 | 0613952Q66 | CER CHIP RES 510 OHM 5 0402 |
| R545 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R546 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R547 | 0613952R18 | CER CHIP RES 51K OHM 5 0402 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R548 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R557 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R558 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R559 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R560 | 0613958H11 | CER CHIP RES 2.7 OHM 5% 0805 |
| R561 | 0613958H11 | CER CHIP RES 2.7 OHM 5% 0805 |
| R562 | 0613958J01 | CER CHIP RES 10.0K OHM 5% 0805 |
| R563 | 0613958H17 | CER CHIP RES 4.7 OHM 5% 0805 |
| R564 | 0613958J01 | CER CHIP RES 10.0K OHM 5% 0805 |
| R565 | 0613958H17 | CER CHIP RES 4.7 OHM 5% 0805 |
| R571 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R576 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R580 | 0613952Q49 | CER CHIP RES 100 OHM 5 0402 |
| R581 | 0613952H33 | CER CHIP RES 22.0 OHM 5% 0603 |
| R582 | 0613952H33 | CER CHIP RES 22.0 OHM 5% 0603 |
| R583 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R584 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R585 | 0613952Q49 | CER CHIP RES 100 OHM 5 0402 |
| R586 | 0613952Q49 | CER CHIP RES 100 OHM 5 0402 |
| R587 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R591 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R592 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R593 | 0613952P94 | CER CHIP RES 931K OHM 1 0402 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R594 | 0613952N60 | CER CHIP RES 41.2K OHM 1 0402 |
| R595 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R801 | 0613952K73 | CER CHIP RES 56.2 OHM 1% 0402 |
| R802 | 0613952K73 | CER CHIP RES 56.2 OHM 1% 0402 |
| R803 | 0613952K73 | CER CHIP RES 56.2 OHM 1% 0402 |

## 8.3 HLN 1472A Transceiver Interface Board

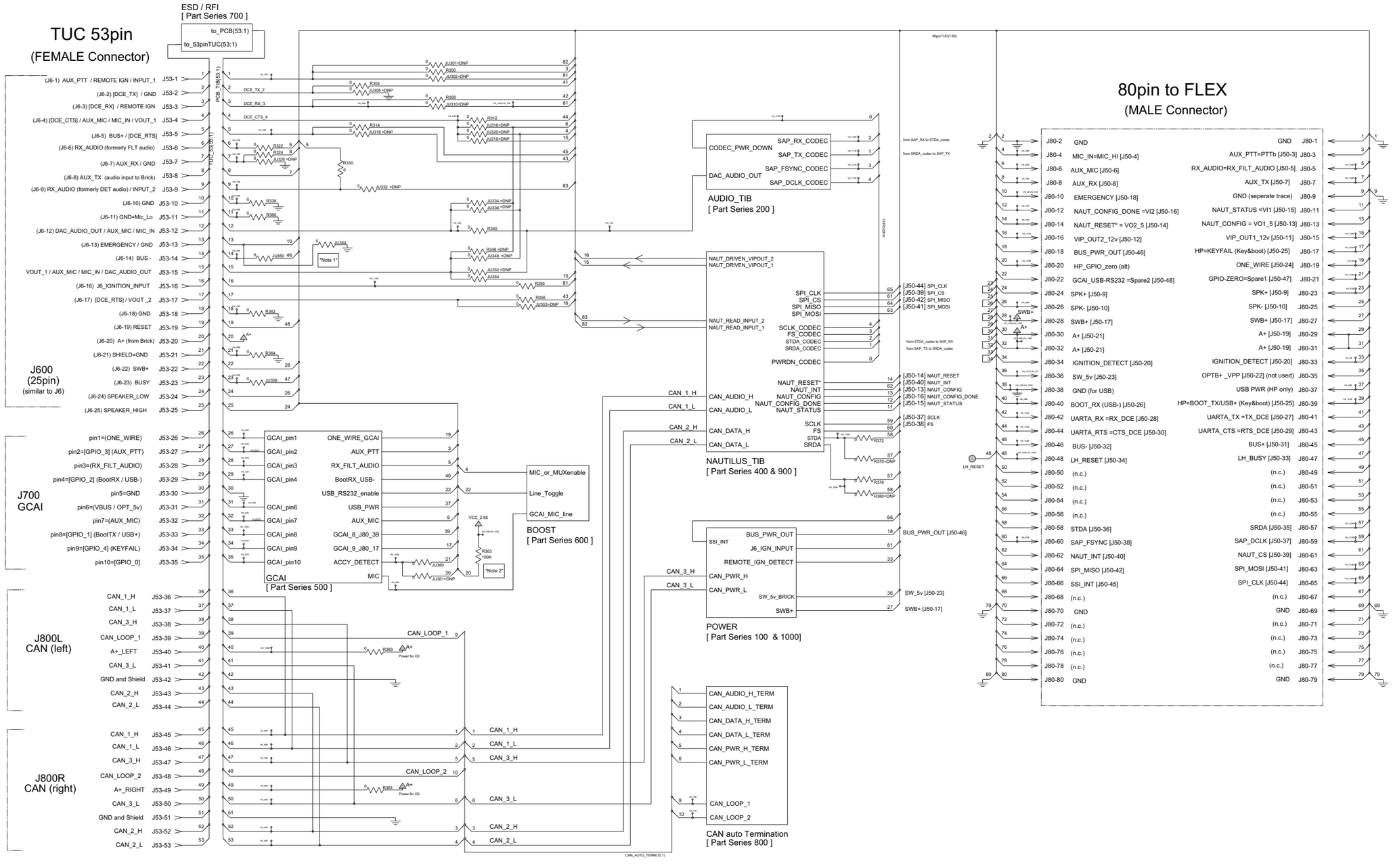



*Figure 8-11. Top Sheet*

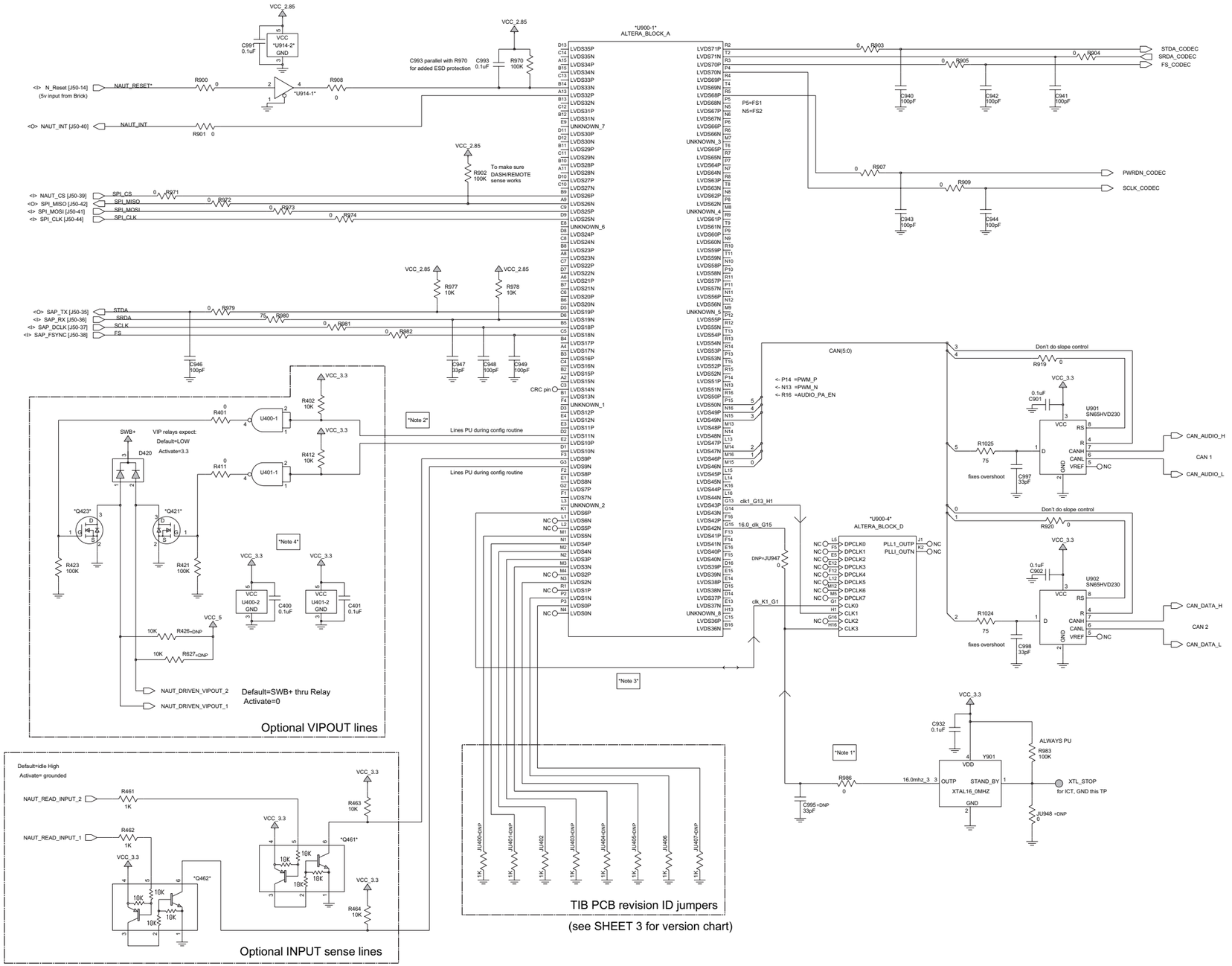



*Figure 8-12. Nautilus Block - (Sheet 1 of 2)*

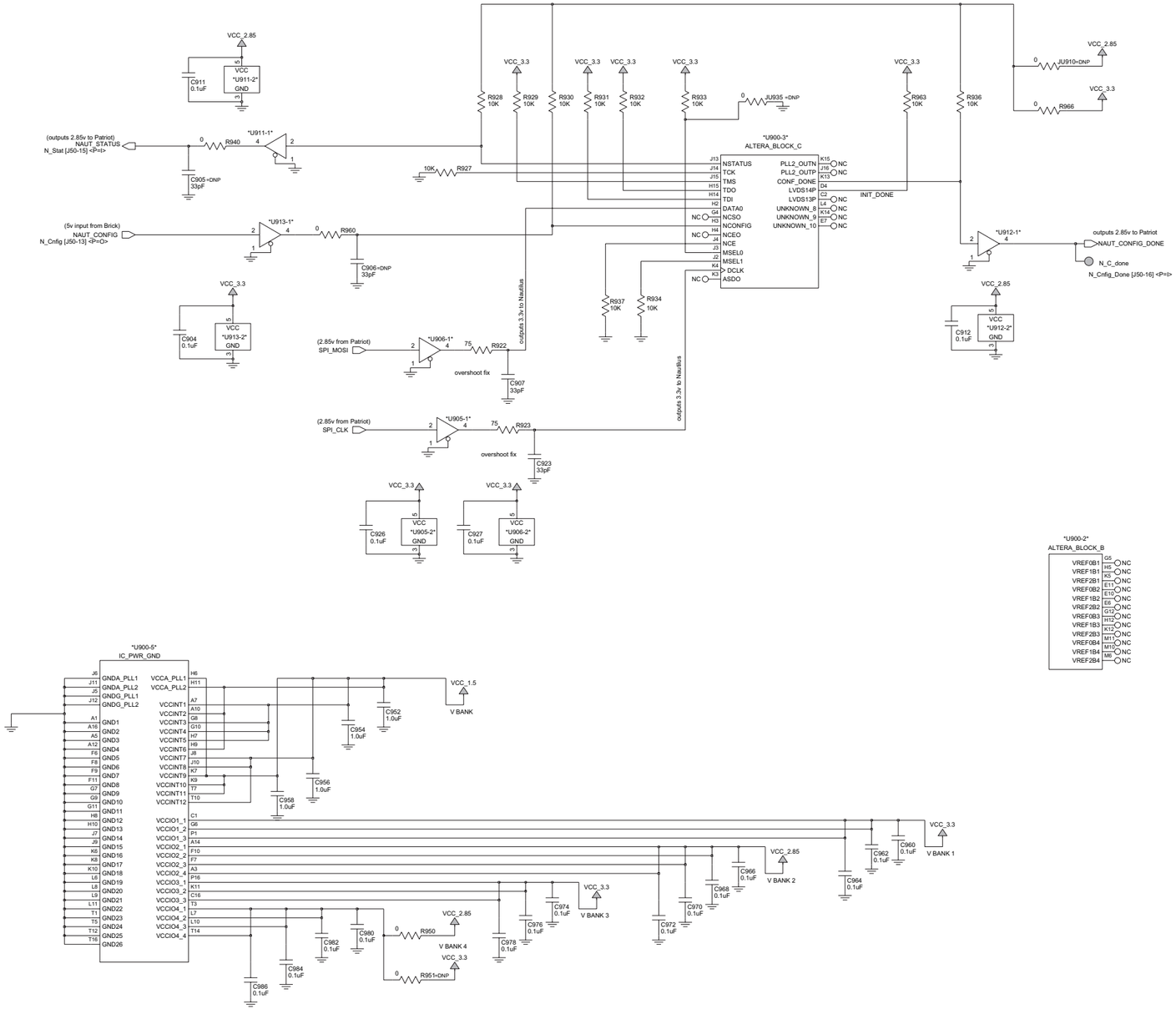



*Figure 8-13. Nautilus Block - (Sheet 2 of 2)*

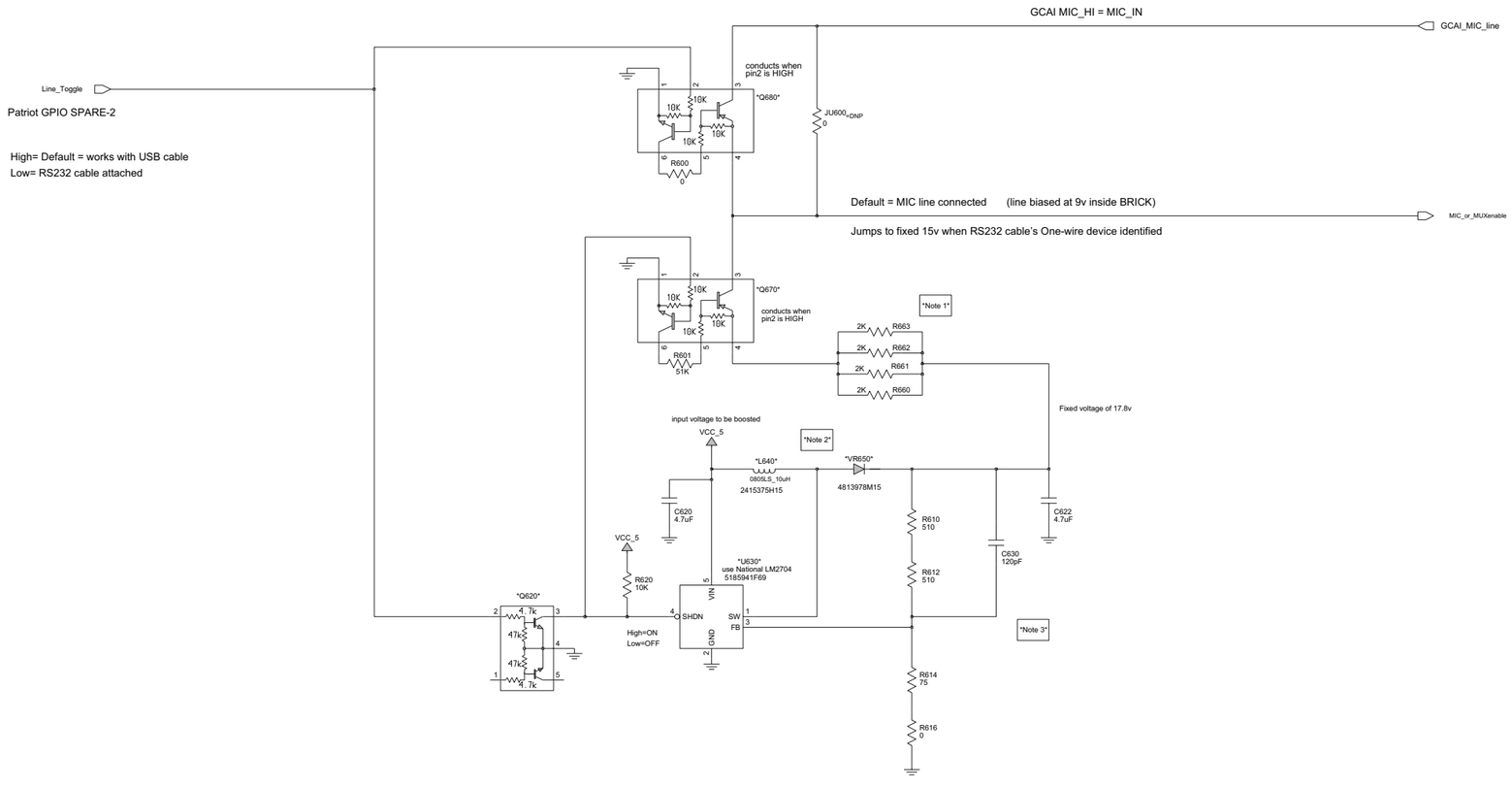



*Figure 8-14. Charge Pump*

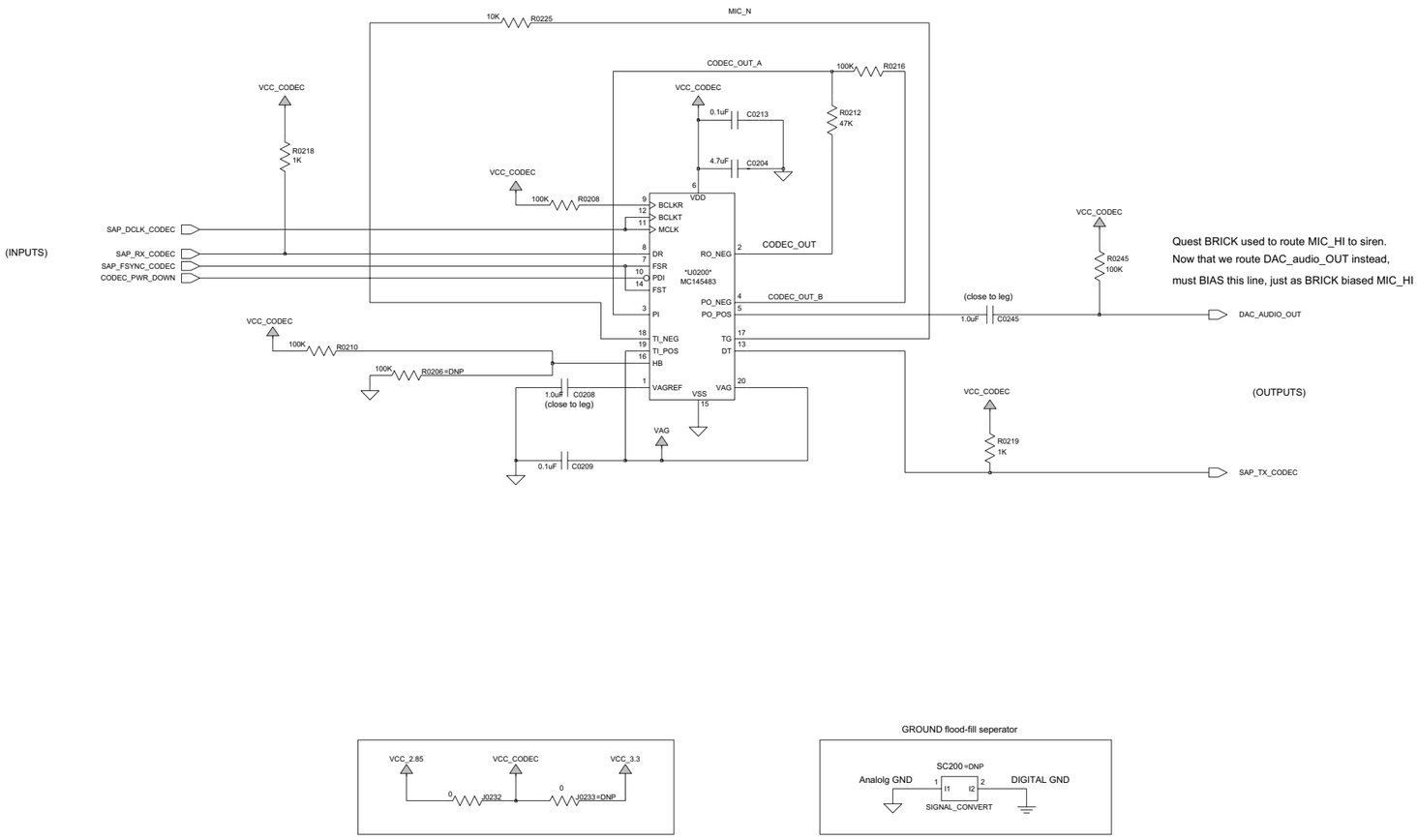



*Figure 8-15. Audio CODEC*

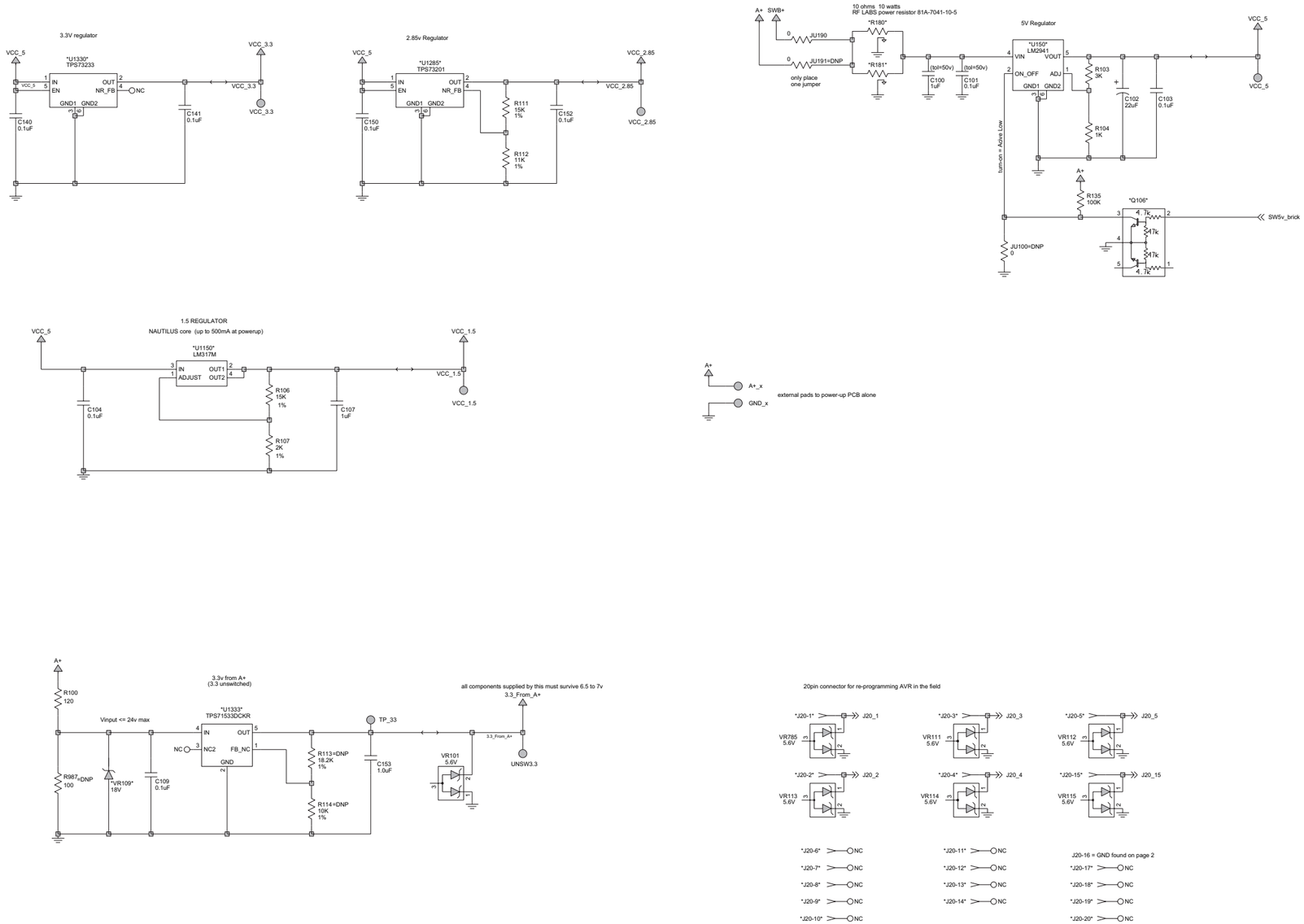



*Figure 8-16. Power Supplies*

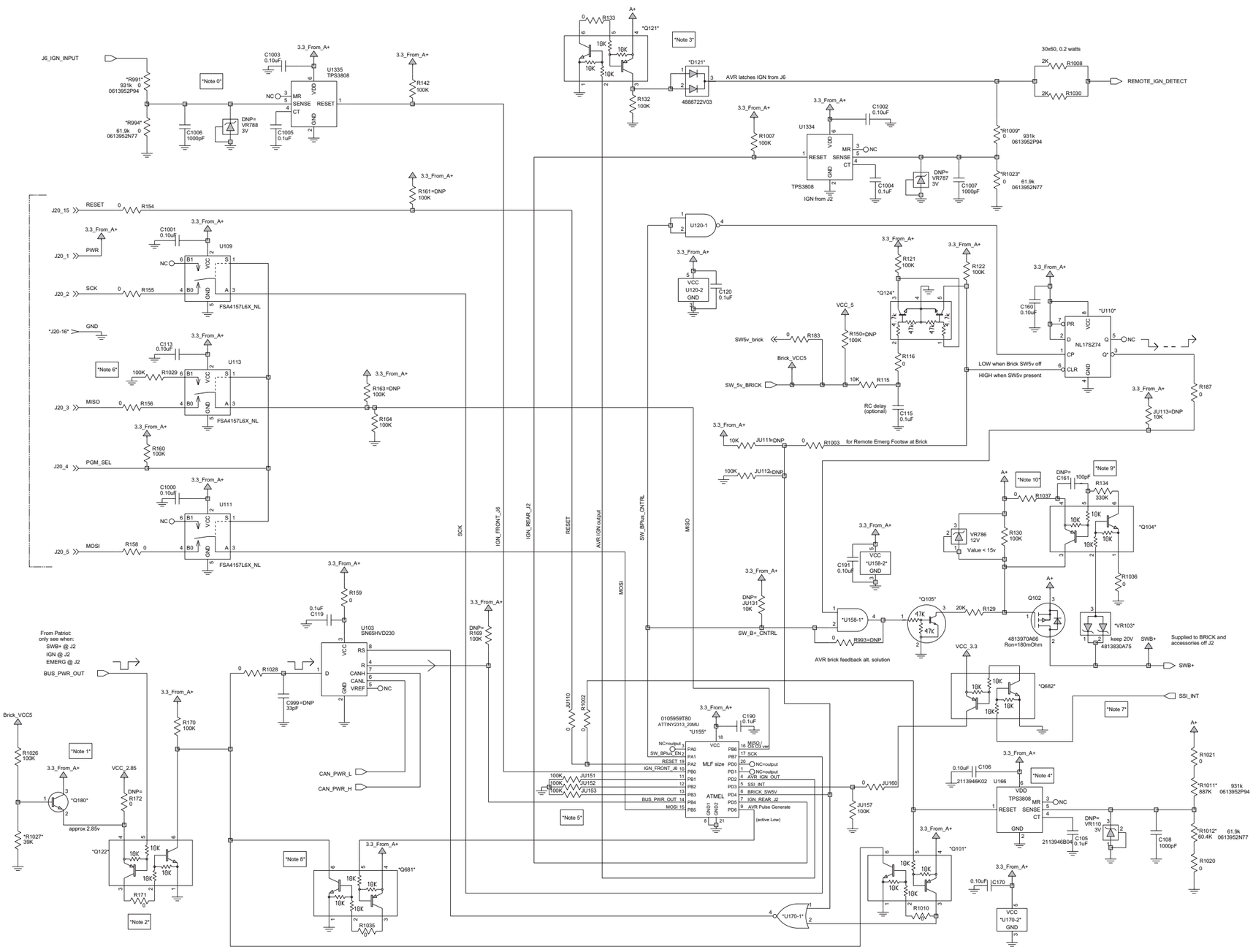
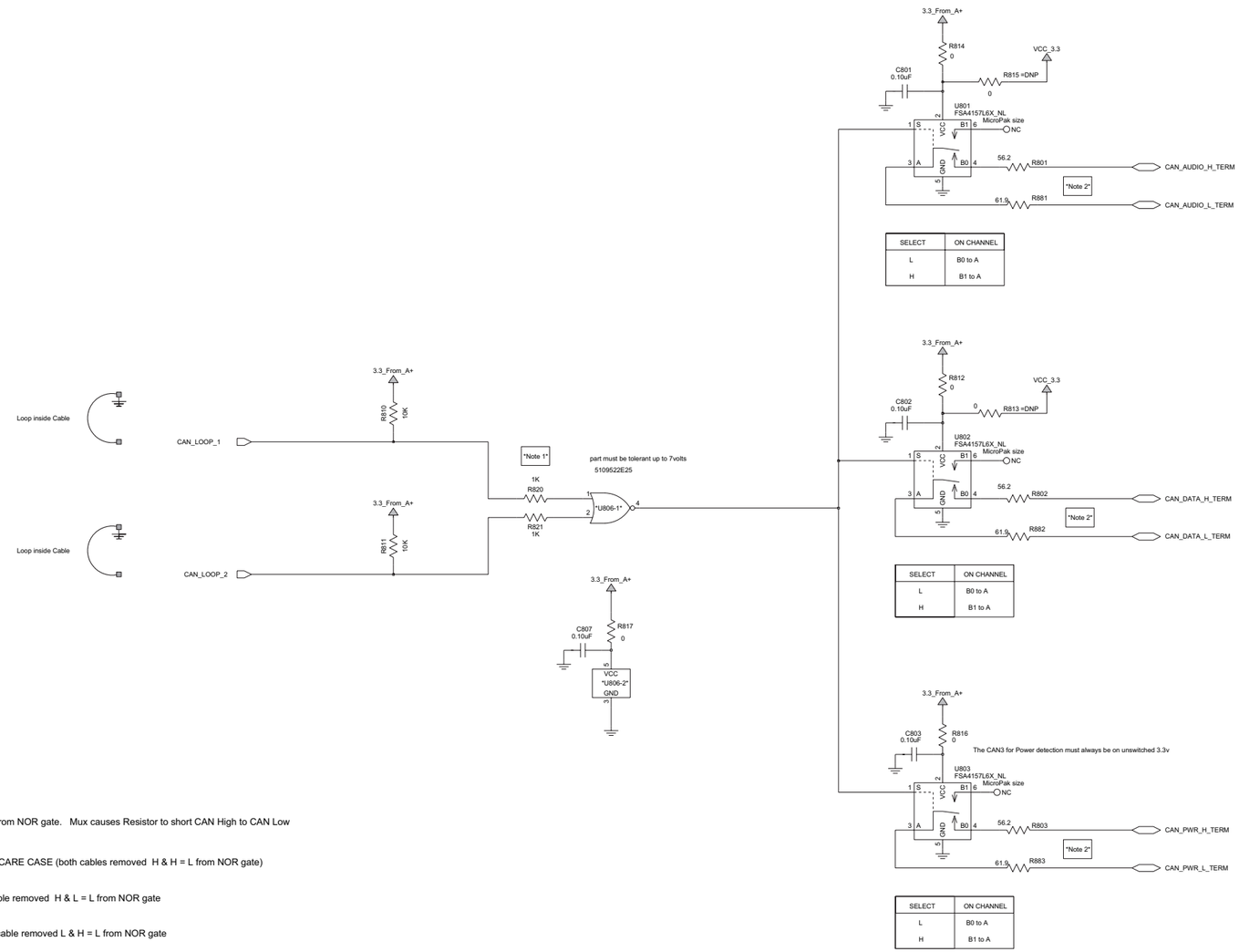



*Figure 8-17. Power ON-OFF-RESET*




Default case= L from NOR gate. Mux causes Resistor to short CAN High to CAN Low

CASE 1: DONT CARE CASE (both cables removed H & H = L from NOR gate)

CASE 2: Left cable removed H & L = L from NOR gate

CASE 3: Right cable removed L & H = L from NOR gate

CASE 4: Both cables attached L & L = H from NOR gate

*Figure 8-18. CAN bus Auto-Termination*

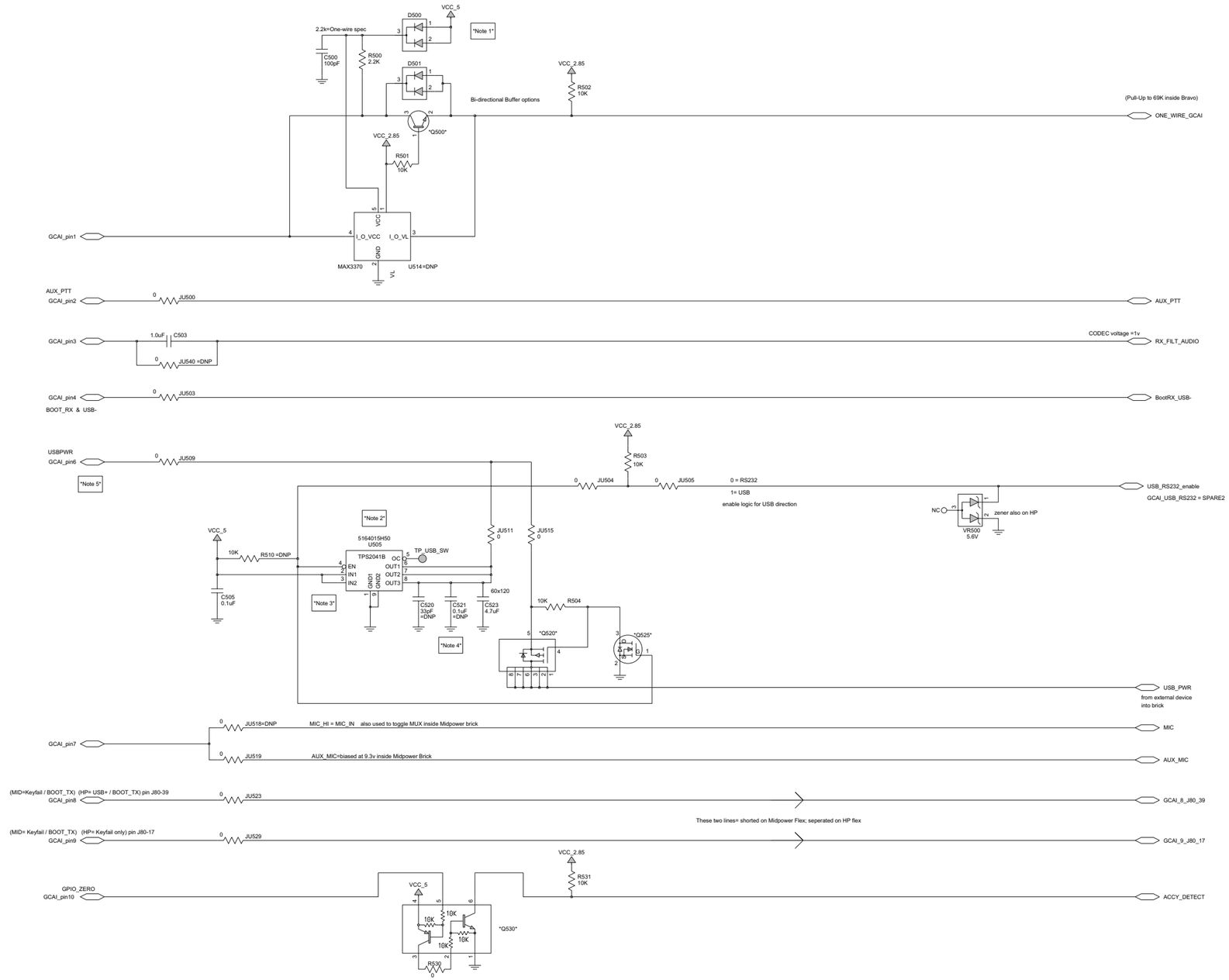



*Figure 8-19. GCAI Interface*

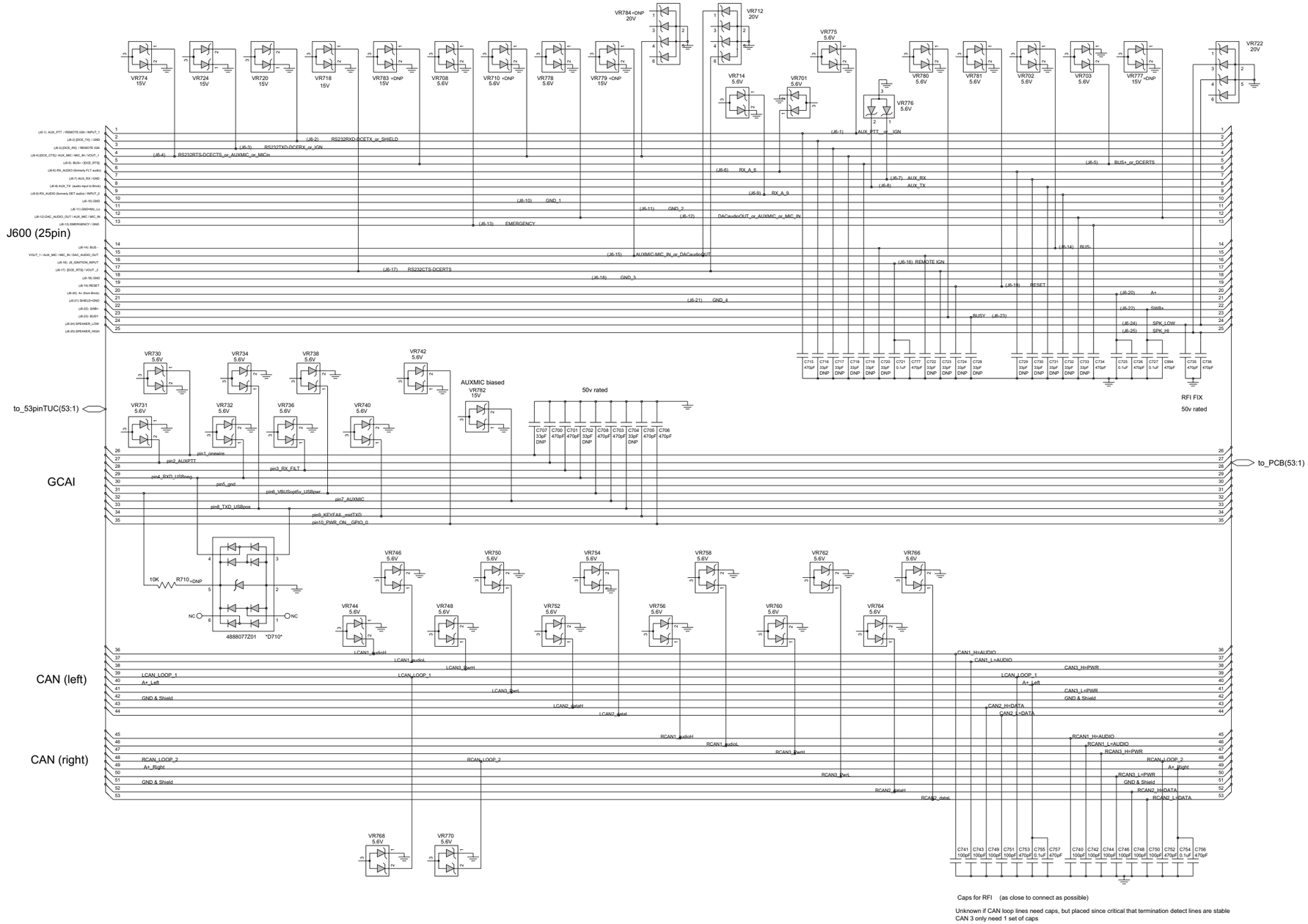



*Figure 8-20. ESD and RFI*

HLN1472A Tansceiver Interface Board Parts List

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| C0204 | 2185802B01 | CAP 10V 4.7UF |
| C0208 | 2113946S35 | CAP CER CHP 1.0UF 16V 10% |
| C0209 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C0213 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C0245 | 2113946S35 | CAP CER CHP 1.0UF 16V 10% |
| C100 | 2113955E11 | CAP,FXD,1UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN, “ |
| C1000 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1001 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1002 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1003 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C1004 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C1005 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C1006 | 2113945A09 | CAP CER CHP 1000PF 50V 10% |
| C1007 | 2113945A09 | CAP CER CHP 1000PF 50V 10% |
| C101 | 2113945H89 | CAP,FXD,.1UF,+10%,-10%,50V-DC,1206,X7R,-55DEG “ |
| C102 | 2314030F03 | CAP,FXD,22UF,+10%,-10%,16V-DC,SM,-55DEG CMIN, “ |
| C103 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C104 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C105 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C106 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C107 | 2113955C31 | CAP,FXD,1UF,+10%,-10%,16V-DC,X7R,-55DEG CMIN, “ |
| C108 | 2113945A09 | CAP CER CHP 1000PF 50V 10% |
| C109 | 2113945H89 | CAP,FXD,.1UF,+10%,-10%,50V-DC,1206,X7R,-55DEG “ |
| C113 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C115 | 2113945G91 | CAP,FXD,.1UF,+10%,-10%,50V-DC,0805,X7R,-55DEG “ |
| C119 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C120 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C140 | 2113945G91 | CAP,FXD,.1UF,+10%,-10%,50V-DC,0805,X7R,-55DEG “ |
| C141 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C150 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C152 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C153 | 2113946S35 | CAP CER CHP 1.0UF 16V 10% |
| C160 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C161 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C170 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C190 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C191 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C400 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C401 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C500 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C503 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C505 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C520 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C521 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C523 | 2113946Q01 | CAP CER CHP 4.7UF 16V |
| C620 | 2113946Q01 | CAP CER CHP 4.7UF 16V |
| C622 | 2113946Q01 | CAP CER CHP 4.7UF 16V |
| C630 | 2113944A41 | CAP CER CHP 120.0PF 50V 5% |
| C700 | 2113945A05 | CAP CER CHP 470PF 50V 10% |
| C701 | 2113945A05 | CAP CER CHP 470PF 50V 10% |
| C702 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C703 | 2113945A05 | CAP CER CHP 470PF 50V 10% |
| C704 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C705 | 2113945A05 | CAP CER CHP 470PF 50V 10% |
| C706 | 2113945A05 | CAP CER CHP 470PF 50V 10% |
| C707 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C708 | 2113945A05 | CAP CER CHP 470PF 50V 10% |
| C715 | 2113945A05 | CAP CER CHP 470PF 50V 10% |
| C716 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C717 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C718 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C719 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C720 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C721 | 2113945H89 | CAP,FXD,.1UF,+10%,-10%,50V-DC,1206,X7R,-55DEG “ |
| C722 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C723 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C724 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C725 | 2113945H89 | CAP,FXD,.1UF,+10%,-10%,50V-DC,1206,X7R,-55DEG “ |
| C726 | 2113945A05 | CAP CER CHP 470PF 50V 10% |
| C727 | 2113945H89 | CAP,FXD,.1UF,+10%,-10%,50V-DC,1206,X7R,-55DEG “ |
| C728 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C729 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C730 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C731 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C732 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C733 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C734 | 2113945A05 | CAP CER CHP 470PF 50V 10% |
| C735 | 2113945A05 | CAP CER CHP 470PF 50V 10% |
| C736 | 2113945A05 | CAP CER CHP 470PF 50V 10% |
| C740 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C741 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C742 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C743 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C744 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C746 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C748 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C749 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C750 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C751 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C752 | 2113945A05 | CAP CER CHP 470PF 50V 10% |
| C753 | 2113945A05 | CAP CER CHP 470PF 50V 10% |
| C754 | 2113945H89 | CAP,FXD,.1UF,+10%,-10%,50V-DC,1206,X7R,-55DEG “ |
| C755 | 2113945H89 | CAP,FXD,.1UF,+10%,-10%,50V-DC,1206,X7R,-55DEG “ |
| C756 | 2113945A05 | CAP CER CHP 470PF 50V 10% |
| C757 | 2113945A05 | CAP CER CHP 470PF 50V 10% |
| C777 | 2113945A05 | CAP CER CHP 470PF 50V 10% |
| C801 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C802 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C803 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C807 | 2113946K02 | CAP CER CHP 0.10UF 16V |
| C901 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C902 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C904 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C905 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C906 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C907 | 2113944A31 | CAP CER CHP 33.0PF 50V 5% |
| C911 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C912 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C923 | 2113944A31 | CAP CER CHP 33.0PF 50V 5% |
| C926 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C927 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C932 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C940 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C941 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C942 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C943 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C944 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C946 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C947 | 2113944A31 | CAP CER CHP 33.0PF 50V 5% |
| C948 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C949 | 2113944A40 | CAP CER CHP 100.0PF 50V 5% |
| C952 | 2113946S35 | CAP CER CHP 1.0UF 16V 10% |
| C954 | 2113946S35 | CAP CER CHP 1.0UF 16V 10% |
| C956 | 2113946S35 | CAP CER CHP 1.0UF 16V 10% |
| C958 | 2113946S35 | CAP CER CHP 1.0UF 16V 10% |
| C960 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C962 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C964 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C966 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C968 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C970 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C972 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C974 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C976 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C978 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C980 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C982 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C984 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C986 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C991 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C993 | 2113946B04 | CAP CER CHP 0.10UF 10V 10% |
| C994 | 2113945A05 | CAP CER CHP 470PF 50V 10% |
| C995 | NOTPLACED | GCAM DUMMY PART NUMBER |
| C997 | 2113944A31 | CAP CER CHP 33.0PF 50V 5% |
| C998 | 2113944A31 | CAP CER CHP 33.0PF 50V 5% |
| C999 | NOTPLACED | GCAM DUMMY PART NUMBER |
| D121 | 4888722V03 | DIODE,SWG,,SM,SOT-323/SC-70,30MA,40 |
| D420 | 4888722V03 | DIODE,SWG,,SM,SOT-323/SC-70,30MA,40 |
| D500 | 4888722V03 | DIODE,SWG,,SM,SOT-323/SC-70,30MA,40 |
| D501 | 4888722V03 | DIODE,SWG,,SM,SOT-323/SC-70,30MA,40 |
| D710 | 4813979A45 | DIODE ARRAY,SUPR,TSOP,5V,500W,9,PB-FREE |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| J0232 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| J0233 | NOTPLACED | GCAM DUMMY PART NUMBER |
| J20 | 0980423L10 | CONNECTOR, 20 PIN, RECEPTACLE |
| J53 | 0964120H01 | CONNECTOR, CUSTOM, ACCESSORY |
| J80 | 2864447H01 | CONN,TERMNL,PLG,80 PIN,KYD |
| JU100 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU110 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| JU111 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU112 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU113 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU131 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU151 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| JU152 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| JU153 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| JU157 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| JU160 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| JU190 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| JU191 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU301 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU302 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU306 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU310 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU316 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU318 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU319 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU320 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU326 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU332 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU334 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU336 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU344 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| JU348 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU350 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| JU352 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU353 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU354 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| JU358 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| JU360 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| JU361 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU400 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU401 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU402 | 0613952Q73 | CER CHIP RES 1000 OHM 5 0402 |
| JU403 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU404 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU405 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU406 | 0613952Q73 | CER CHIP RES 1000 OHM 5 0402 |
| JU407 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU500 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| JU503 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| JU504 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| JU505 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| JU509 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| JU511 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| JU515 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| JU518 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU519 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| JU523 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| JU529 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| JU540 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU600 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU910 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU935 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU947 | NOTPLACED | GCAM DUMMY PART NUMBER |
| JU948 | NOTPLACED | GCAM DUMMY PART NUMBER |
| L640 | 2415375H15 | CHIP INDUCTOR |
| PWB | 8485935F03 | PCB, MANTARAY TIB |
| Q101 | 4813973A81 | XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.2 “ |
| Q102 | 4813970A66 | XSTR,FET GP PWR,MOSFET,P-CH,ENHN,DPAK,60V,55W “ |
| Q104 | 4813973A81 | XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.2 “ |
| Q105 | 4813973A42 | XSTR,BIP GP SS,,NPN,,SM,SC-59,,SMT,50V,.23W,, “ |
| Q106 | 4805921T28 | XSTR, DUAL NOPB |
| Q121 | 4813973A81 | XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.2 “ |
| Q122 | 4813973A81 | XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.2 “ |
| Q124 | 4805921T28 | XSTR, DUAL NOPB |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| Q180 | 4813973M07 | XSTR,BIP GP SS,,NPN,,TO-236,,,SMT,40V,.225W,2 “ |
| Q421 | 4885316E17 | XSTR,POWER MOSFET 30V,2.5A,SINGLE |
| Q423 | 4885316E17 | XSTR,POWER MOSFET 30V,2.5A,SINGLE |
| Q461 | 4813973A81 | XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.2 “ |
| Q462 | 4813973A81 | XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.2 “ |
| Q500 | 4813973M07 | XSTR,BIP GP SS,,NPN,,TO-236,,,SMT,40V,.225W,2 “ |
| Q520 | 4813970A62 | XSTR,FET GP PWR,MOSFET,P-CH,ENHN,CF,-20V,1.3W “ |
| Q525 | 4885316E17 | XSTR,POWER MOSFET 30V,2.5A,SINGLE |
| Q530 | 4813973A81 | XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.2 “ |
| Q620 | 4805921T28 | XSTR, DUAL NOPB |
| Q670 | 4813973A81 | XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.2 “ |
| Q680 | 4813973A81 | XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.2 “ |
| Q681 | 4813973A81 | XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.2 “ |
| Q682 | 4813973A81 | XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.2 “ |
| R0206 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R0208 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R0210 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R0212 | 0613952R17 | CER CHIP RES 47K OHM 5% 0402 |
| R0216 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R0218 | 0613952Q73 | CER CHIP RES 1000 OHM 5 0402 |
| R0219 | 0613952Q73 | CER CHIP RES 1000 OHM 5 0402 |
| R0225 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R0245 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R100 | 0613958S49 | CER CHIP RES 100 OHM 5 |
| R1002 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1003 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R1007 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R1008 | 0613952D30 | CER CHIP RES 2000 OHM 1% 0603 |
| R1009 | 0613952F94 | CER CHIP RES 931K OHM 1 0603 |
| R1010 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1011 | 0613952P94 | CER CHIP RES 931K OHM 1 0402 |
| R1012 | 0613952N72 | CER CHIP RES 54.9K OHM 1 0402 |
| R1020 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1021 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1023 | 0613952N60 | CER CHIP RES 41.2K OHM 1 0402 |
| R1024 | 0613952Q46 | CER CHIP RES 75.0 OHM 5 0402 |
| R1025 | 0613952Q46 | CER CHIP RES 75.0 OHM 5 0402 |
| R1026 | 0613952R18 | CER CHIP RES 51K OHM 5 0402 |
| R1027 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R1028 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1029 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R103 | 0613952Q84 | CER CHIP RES 3000 OHM 5 0402 |
| R1030 | 0613952D30 | CER CHIP RES 2000 OHM 1% 0603 |
| R1035 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1036 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R1037 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R104 | 0613952Q73 | CER CHIP RES 1000 OHM 5 0402 |
| R106 | 0613952E18 | CER CHIP RES 15.0K OHM 1 0603 |
| R107 | 0613952D30 | CER CHIP RES 2000 OHM 1% 0603 |
| R111 | 0613952E18 | CER CHIP RES 15.0K OHM 1 0603 |
| R112 | 0613952E05 | CER CHIP RES 11.0K OHM 1 0603 |
| R113 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R114 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R115 | 0613952R01 | CER CHIP RES 10K OHM 5% 0402 |
| R116 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R121 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R122 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R129 | 0613952R08 | CER CHIP RES 20K OHM 5 0402 |
| R130 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R132 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R133 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R134 | 0613952R37 | CER CHIP RES 330K OHM 5% 0402 |
| R135 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R142 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R150 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R154 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R155 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R156 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R158 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R159 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R160 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R161 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R163 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R164 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R169 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R170 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R171 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R172 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R180 | 0664897H01 | RES, CHIP 10 OHM, 10W, DC-4GHZ |
| R181 | 0664897H01 | RES, CHIP 10 OHM, 10W, DC-4GHZ |
| R183 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R187 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R300 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R304 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R308 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R312 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| R314 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R322 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R324 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |

| Reference Designator | Motorola Part Number | Description |
|---|---|---|
| R330 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R338 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R340 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R346 | NOTPLACED | GCAM DUMMY PART NUMBER |
| R350 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| R356 | 0613952G67 | CER CHIP RES 0.0 +/-0.050 OHM |
| R360 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R362 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R363 | 0613952R25 | CER CHIP RES 100K OHM 5% 0402 |
| R364 | 0613952R66 | CER CHIP RES 0.0 +/-0.050 OHM |
| R370 | NOTPLACED | GCAM DUMMY PART NUMBER |

# Notes

# Chapter 9 Flex Cable Pin-Out Lists

## 9.1 List of Flex Cables

This chapter lists the pin-out assignments for the following flex cables:

- High Power Remote (Table 9-2 on page 9-2)

## 9.2 Flex Cables

*Table 9-1. PM1500 Control Head 80-pin Assignments*

| PIN | CH |
|---|---|
| 1 | GND |
| 2 | GND |
| 3 | FACT BOOT |
| 4 | GND |
| 5 | USB_CHIB_PUEN |
| 6 | CHIB_VBUS |
| 7 | MPU_BOOT_USB1_SUSP |
| 8 | WAKEUP_USB1_SE0 |
| 9 | USB1_VM |
| 10 | Top Sheet TIB |
| 11 | USB1_TXD |
| 12 | USB1_VP |
| 13 | GND |
| 14 | USB1_TXEN |
| 15 | GND |
| 16 | GND |
| 17 | SPKR- |
| 18 | SPKR+ |
| 19 | SPKR- |
| 20 | SPKR+ |
| 21 | MIC_HI_IN |
| 22 | GND |
| 23 | GND |
| 24 | RX AUDIO |
| 25 | VIPOUT_2_RE |
| 26 | VIPOUT_3_RE |
| 27 | VIPIN_3 |
| 28 | VIPOUT_1_RE |
| 29 | VIPIN_1 |
| 30 | VIPIN_2 |
| 31 | DEK_VIP_SEL |
| 32 | GND |
| 33 | NAUT CONF |
| 34 | NAUT RESET |
| 35 | NAUT CD |
| 36 | NAUT STATUS |
| 37 | SW_B+ |
| 38 | NAUT INT |
| 39 | SW_ B+ |
| 40 | GND |
| 41 | SW_B+ |
| 42 | EMERGENCY |
| 43 | A+ |
| 44 | IGNITION |
| 45 | A+ |
| 46 | GND |
| 47 | A+ |
| 48 | REAR_5V |
| 49 | A+ |
| 50 | REAR_5V |
| 51 | GND |
| 52 | REAR_5V |
| 53 | BRICK 5V |
| 54 | REAR HUB |
| 55 | CAN3_DRV |
| 56 | EXT_PTT |
| 57 | DAMOTE |
| 58 | GND |
| 59 | SCL |
| 60 | SDA |
| 61 | GND |
| 62 | ONE_WIRE_REAR |
| 63 | SSI_DR |
| 64 | SSI_DX |
| 65 | SSI_CLKX |
| 66 | SSI_FSX |
| 67 | GND |
| 68 | CAN3_SLEEP |
| 69 | SPI_CS0 |
| 70 | SPI_MISO |
| 71 | SPI_MOSI |
| 72 | SPI_CLK |
| 73 | SPI_CS1 |
| 74 | EMER_FF_CLR |
| 75 | BUS_PWR_OUT |
| 76 | SSI_ACTIVE |
| 77 | POR |
| 78 | GND |
| 79 | GND |
| 80 | GND |

*Table 9-2. High Power Remote Flex Cable P0401 to J512 Pin-Out List*

| Signal | P0401 60-Pin (Male) | | J512 80-Pin (Female) |
|---|---|---|---|
| GND | 1,2,23,52,59,60 | <--> | 1,2,9,38,69,70,79,80 |
| PTT | 58 | <--> | 3 |
| MIC_HI | 57 | <--> | 4 |
| RX_FILT_AUDIO | 56 | <--> | 5 |
| AUX_MIC | 55 | <--> | 6 |
| AUX_TX | 54 | <--> | 7 |
| AUX_RX | 53 | <--> | 8 |
| EMERGENCY | 51 | <--> | 10 |
| VIP IN 1 (5V) / NAUT STATUS | 50 | <--> | 11 |
| VIP IN 2 (5V) / NAUT CONF DONE | 49 | <--> | 12 |
| VIP OUT 1 (5V) / NAUT CONFIG | 48 | <--> | 13 |
| VIP OUT 2 (5V) / NAUT RESET | 47 | <--> | 14 |
| VIP OUT 1 (12V) | 46 | <--> | 15 |
| VIP OUT 2 (12V) | 45 | <--> | 16 |
| KEYFAIL | 44 | <--> | 17 |
| BUS_PWR_OUT | 43 | <--> | 18 |
| ONE-WIRE | 42 | <--> | 19 |
| GPIO0 | 41 | <--> | 20 |
| SPARE GPIO | 40 | <--> | 21 |
| GCAI_USB-RS232 | 39 | <--> | 22 |
| SPK+ | 37, 38 | <--> | 23, 24 |
| SPK- | 35, 36 | <--> | 25, 26 |
| SW_B+ | 33, 34 | <--> | 27, 28 |
| A+ | 29, 30, 31, 32 | <--> | 29, 30, 31, 32 |
| IGNITION | 27, 28 | <--> | 33, 34 |
| OPTB+ | 26 | <--> | 35 |
| SW_5V | 25 | <--> | 36 |
| VBUS_PWR_IN | 24 | <--> | 37 |
| BOOT TX-USB+ | 22 | <--> | 39 |
| BOOT RX-USB- | 21 | <--> | 40 |
| TX_DCE | 20 | <--> | 41 |
| RX_DCE | 19 | <--> | 42 |
| RTS_DCE | 18 | <--> | 43 |
| CTS_DCE | 17 | <--> | 44 |
| BUS+ | 16 | <--> | 45 |
| BUS- | 15 | <--> | 46 |
| LH_BUSY | 14 | <--> | 47 |
| LH_RESET | 13 | <--> | 48 |
| SAP-TX (SRDA) PATRIOT | 12 | <--> | 57 |
| SAP-RX (STDA) PATRIOT | 11 | <--> | 58 |
| SAP-DCLK | 10 | <--> | 59 |
| SAP-FSYNC | 9 | <--> | 60 |
| NAUTILUS-CS | 8 | <--> | 61 |
| NAUTILUS-INT | 7 | <--> | 62 |
| SPI-MOSI | 6 | <--> | 63 |
| SPI-MISO | 5 | <--> | 64 |
| SPI-CLK | 4 | <--> | 65 |
| SSI_INT | 3 | <--> | 66 |
| NC | Remaining Pins | <--> | Remaining Pins |

# Appendix A Replacement Parts Ordering

## A.1 Basic Ordering Information

When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

Crystal orders should specify the crystal type number, crystal and carrier frequency, and the model number in which the part is used.

## A.2 Motorola Online

Motorola Online users can access our online catalog at

https://www.motorola.com/businessonline

To register for online access, please call 800-814-0601 (for U.S. and Canada Service Centers only). International customers can obtain assistance at https://businessonline.motorola.com.

## A.3 Mail Orders

Send written orders to the following addresses:

**Replacement Parts/ Test Equipment/Manuals/ Crystal Service Items:**

Motorola Inc.
Radio Products and Services Division*
Attention: Order Processing
2200 Galvin Drive
Elgin, IL 60123
U.S.A.

**Federal Government Orders:**

Motorola Inc.
U.S. Federal Government Markets Division
Attention: Order Processing
7230 Parkway Drive
Landover, MD 21076
U.S.A.

**International Orders:**

Motorola Inc.
Radio Products and Services Division*
Attention: Order Processing
2200 Galvin Drive
Elgin, IL 60123
U.S.A.

* The Radio Products and Services Division (RPSD) was formerly known as the Customer Care and Services Division (CCSD) and/or the Accessories and Aftermarket Division (AAD).

## A.4 Telephone Orders

Radio Products and Services Division*
(United States and Canada)
7:00 AM to 7:00 PM (Central Standard Time)
Monday through Friday (Chicago, U.S.A.)
1-800-422-4210
1-847-538-8023 (International Orders)

U.S. Federal Government Markets Division (USFGMD)
1-800-826-1913 Federal Government Parts - Credit Cards Only
8:30 AM to 5:00 PM (Eastern Standard Time)

## A.5 Fax Orders

Radio Products and Services Division*
(United States and Canada)
1-800-622-6210
847-576-3023 (International)

USFGMD
(Federal Government Orders)
1-800-526-8641 (For Parts and Equipment Purchase Orders)

## A.6 Parts Identification

Radio Products and Services Division*
(United States and Canada)
1-800-422-4210, menu 3

## A.7 Product Customer Service

Customer Response Center
(Non-technical Issues)
1-800-247-2346
FAX:1-800-247-2347

* The Radio Products and Services Division (RPSD) was formerly known as the Customer Care and Services Division (CCSD) and/or the Accessories and Aftermarket Division (AAD).

# Glossary

This glossary contains an alphabetical listing of terms and their definitions that are applicable to ASTRO portable and mobile subscriber radio products.

| Term | Definition |
|---|---|
| **A/D** | *See analog-to-digital conversion.* |
| **ABACUS IC** | A custom integrated circuit providing a digital receiver intermediate frequency (IF) backend. |
| **ADC** | *See analog-to-digital converter.* |
| **ADDAG** | *See Analog-to-Digital, Digital-to-Analog and Glue.* |
| **ALC** | *See automatic level control.* |
| **analog** | Refers to a continuously variable signal or a circuit or device designed to handle such signals. *See also digital.* |
| **Analog-to-Digital, Digital-to-Analog and Glue** | An integrated circuit designed to be an interface between the radio's DSP, which is digital, and the analog transmitter and receiver ICs. |
| **analog-to-digital conversion** | Conversion of an instantaneous dc voltage level to a corresponding digital value. *See also D/A.* |
| **analog-to-digital converter** | A device that converts analog signals into digital data. *See also DAC.* |
| **automatic level control** | A circuit in the transmit RF path that controls RF power amplifier output, provides leveling over frequency and voltage, and protects against high VSWR. |
| **band** | Frequencies allowed for a specific purpose. |
| **BBP** | *See baseband interface port.* |
| **baseband interface port** | Synchronous serial interface to the transceiver board used to transfer transmit and receive audio data. |
| **BGA** | *See ball grid array.* |
| **ball grid array** | A type of IC package characterized by solder balls arranged in a grid that are located on the underside of the package. |

| Term | Definition |
|---|---|
| **CODEC** | *See coder/decoder.* |
| **codeplug** | A memory chip inside a device that contains various programmable parameters, including frequencies, time-out timer, and so on. |
| **coder/decoder** | A device that encodes or decodes a signal. |
| **CPS** | *See Customer Programming Software.* |
| **Customer Programming Software** | Software with a graphical user interface containing the feature set of an ASTRO radio. *See also RSS.* |
| **D/A** | *See digital-to-analog conversion.* |
| **DAC** | *See digital-to-analog converter.* |
| **default** | A pre-defined set of parameters. |
| **digital** | Refers to data that is stored or transmitted as a sequence of discrete symbols from a finite set; most commonly this means binary data represented using electronic or electromagnetic signals. *See also analog.* |
| **digital-to-analog conversion** | Conversion of a digital signal to a voltage that is proportional to the input value. *See also A/D.* |
| **digital-to-analog converter** | A device that converts digital data into analog signals. *See also ADC.* |
| **Digital Private Line** | A type of digital communications that utilizes privacy call, as well as memory channel and busy channel lock out to enhance communication efficiency. |
| **digital signal processor** | A microcontroller specifically designed for performing the mathematics involved in manipulating analog information, such as sound, that has been converted into a digital form. DSP also implies the use of a data compression technique. |
| **digital signal processor code** | Object code executed by the Digital Signal Processor in an ASTRO subscriber radio. The DSP is responsible for computation-intensive tasks, such as decoding ASTRO signaling. |
| **DPL** | *See Digital Private Line. See also PL.* |

| Term | Definition |
|---|---|
| **DSP** | *See digital signal processor.* |
| **DSP code** | *See digital signal processor code.* |
| **DTMF** | *See dual tone multi-frequency.* |
| **dual tone multi-frequency** | The system used by touch-tone telephones. DTMF assigns a specific frequency, or tone, to each key so that it can easily be identified by a microprocessor. |
| **EPOT** | Electrically Programmable Digital Potentiometer. |
| **EEPROM** | *See Electrically Erasable Programmable Read-Only Memory.* |
| **Electrically Erasable Programmable Read-Only Memory** | A special type of PROM that can be erased by exposing it to an electrical charge. An EEPROM retains its contents even when the power is turned off. |
| **EME** | Electromagnetic Emissions. |
| **ESD** | Electrostatic Discharge. |
| **FCC** | Federal Communications Commission. |
| **FET** | Field-Effect Transistor. |
| **firmware** | Code executed by an embedded processor such as the Host or DSP in a subscriber radio. This type of code is typically resident in non-volatile memory and as such is more difficult to change than code executed from RAM. |
| **FGU** | *See frequency generation unit.* |
| **flash** | A non-volatile memory device similar to an EEPROM. Flash memory can be erased and reprogrammed in blocks instead of one byte at a time. |
| **FLASHcode** | A 13-digit code which uniquely identifies the System Software Package and Software Revenue Options that are enabled in a particular subscriber radio. FLASHcodes are only applicable for radios which are upgradeable through the FLASHport process. |

| Term | Definition |
|---|---|
| **FLASHport®** | A Motorola term that describes the ability of a radio to change memory. Every FLASHport radio contains a FLASHport EEPROM memory chip that can be software written and rewritten to, again and again. |
| **FMR** | *See Florida Manual Revision.* |
| **Florida Manual Revision** | A publication that provides supplemental information for its parent publication before it is revised and reissued. |
| **frequency** | Number of times a complete electromagnetic-wave cycle occurs in a fixed unit of time (usually one second). |
| **frequency generation unit** | This unit generates ultra-stable, low-phase noise master clock and other derived synchronization clocks that are distributed throughout the communication network. |
| **General-Purpose Input/Output** | Pins whose function is programmable. |
| **GPIO** | *See General-Purpose Input/Output.* |
| **host code** | Object code executed by the host processor in an ASTRO subscriber radio. The host is responsible for control-oriented tasks such as decoding and responding to user inputs. |
| **IC** | *See integrated circuit.* |
| **IF** | Intermediate Frequency. |
| **IMBE** | A sub-band, voice-encoding algorithm used in ASTRO digital voice. |
| **inbound signaling word** | Data transmitted on the control channel from a subscriber unit to the central control unit. |
| **integrated circuit** | An assembly of interconnected components on a small semiconductor chip, usually made of silicon. One chip can contain millions of microscopic components and perform many functions. |
| **ISW** | *See inbound signaling word.* |
| **key-variable loader** | A device used to load encryption keys into a radio. |
| **kHz** | *See kilohertz.* |

| Term | Definition |
|---|---|
| **kilohertz** | One thousand cycles per second. Used especially as a radio-frequency unit. |
| **KVL** | *See key-variable loader.* |
| **LCD** | *See liquid-crystal display.* |
| **LED** | *See light emitting diode.* |
| **light emitting diode** | An electronic device that lights up when electricity is passed through it. |
| **liquid-crystal display** | An LCD uses two sheets of polarizing material with a liquid-crystal solution between them. An electric current passed through the liquid causes the crystals to align so that light cannot pass through them. |
| **LO** | Local oscillator. |
| **low-speed handshake** | 150-baud digital data sent to the radio during trunked operation while receiving audio. |
| **LSH** | *See low-speed handshake.* |
| **Master In Slave Out** | SPI data line from a peripheral to the MCU. |
| **Master Out Slave In** | SPI data line from the MCU to a peripheral. |
| **MCU** | *See microcontroller unit.* |
| **MDC** | Motorola Digital Communications. |
| **MDI** | MCU/DSP Interface internal to the Patriot IC. |
| **MHz** | *See Megahertz.* |
| **Megahertz** | One million cycles per second. Used especially as a radio-frequency unit. |
| **microcontroller unit** | Also written as µC. A microprocessor that contains RAM and ROM components, as well as communications and programming components and peripherals. |
| **microprocessor core** | The central processing unit of the microprocessor and DSP IC and powered by a lower voltage supply than the logic I/O section. |

| Term | Definition |
|---|---|
| **MISO** | *See Master In Slave Out.* |
| **MOSI** | *See Master Out Slave In.* |
| **multiplexer** | An electronic device that combines several signals for transmission on some shared medium (e.g., a telephone wire). |
| **MUX** | *See multiplexer.* |
| **NiCd** | Nickel-cadmium. |
| **NiMH** | Nickel-metal-hydride. |
| **OMPAC** | *See over-molded pad-array carrier.* |
| **open architecture** | A controller configuration that utilizes a microprocessor with extended ROM, RAM, and EEPROM. |
| **oscillator** | An electronic device that produces alternating electric current and commonly employs tuned circuits and amplifying components. |
| **OSW** | *See outbound signaling word.* |
| **OTAR** | *See over-the-air rekeying.* |
| **outbound signaling word** | Data transmitted on the control channel from the central controller to the subscriber unit. |
| **over-molded pad-array carrier** | A Motorola custom IC package, distinguished by the presence of solder balls on the bottom pads. |
| **over-the-air rekeying** | Allows the dispatcher to remotely reprogram the encryption keys in the radio. |
| **PA** | Power amplifier. |
| **paging** | One-way communication that alerts the receiver to retrieve a message. |
| **Patriot IC** | A dual-core processor that contains an MCU and a DSP in one IC package. |
| **PC Board** | Printed Circuit Board. Also referred to as a PCB. |
| **phase-locked loop** | A circuit in which an oscillator is kept in phase with a reference, usually after passing through a frequency divider. |

| Term | Definition |
|---|---|
| **PL** | *See private-line tone squelch.* |
| **PLL** | *See phase-locked loop.* |
| **private-line tone squelch** | A continuous sub-audible tone that is transmitted along with the carrier. *See also DPL.* |
| **Programmable Read-Only Memory** | A memory chip on which data can be written only once. Once data has been written onto a PROM, it remains there forever. |
| **PROM** | *See Programmable Read-Only Memory.* |
| **PTT** | *See Push-to-Talk.* |
| **Push-to-Talk** | The switch or button usually located on the left side of the radio which, when pressed, causes the radio to transmit. When the PTT is released, the unit returns to receive operation. |
| **radio frequency** | The portion of the electromagnetic spectrum between audio sound and infrared light (approximately 10 kHz to 10 GHz). |
| **radio frequency power amplifier** | Amplifier having one or more active devices to amplify radio signals. |
| **Radio Interface Box** | A service aid used to enable communications between a radio and the programming software. |
| **Radio Service Software** | DOS-based software containing the feature set of an ASTRO radio. *See also CPS.* |
| **random access memory** | A type of computer memory that can be accessed randomly; that is, any byte of memory can be accessed without touching the preceding bytes. |
| **RAM** | *See random access memory.* |
| **read-only memory** | A type of computer memory on which data has been prerecorded. Once data has been written onto a ROM chip, it cannot be removed and can only be read. |
| **real-time clock** | A module that keeps track of elapsed time even when a computer is turned off. |

| Term | Definition |
|---|---|
| **receiver** | Electronic device that amplifies RF signals. A receiver separates the audio signal from the RF carrier, amplifies it, and converts it back to the original sound waves. |
| **registers** | Short-term data-storage circuits within the microcontroller unit or programmable logic IC. |
| **repeater** | Remote transmit/receive facility that re-transmits received signals in order to improve communications range and coverage (conventional operation). |
| **repeater/ talkaround** | A conventional radio feature that permits communication through a receive/transmit facility, which re-transmits received signals in order to improve communication range and coverage. |
| **RESET** | Reset line: an input to the microcontroller that restarts execution. |
| **RF** | *See radio frequency.* |
| **RF PA** | *See radio frequency power amplifier.* |
| **RIB** | *See Radio Interface Box.* |
| **ROM** | *See read-only memory.* |
| **RPCIC** | Regulator/power control IC. |
| **RPT/TA** | *See repeater/talkaround.* |
| **RSS** | *See Radio Service Software.* |
| **RTC** | *See real-time clock.* |
| **RX** | Receive. |
| **RX DATA** | Recovered digital data line. |
| **SAP** | *See Serial Audio CODEC Port.* |
| **Serial Audio CODEC Port** | SSI to and from the GCAP II IC CODEC used to transfer transmit and receive audio data. |
| **Serial Communication Interface Input Line** | A full-duplex (receiver/transmitter) asynchronous serial interface. |

| Term | Definition |
|---|---|
| **SCI IN** | *See Serial Communication Interface Input Line.* |
| **Serial Peripheral Interface** | How the microcontroller communicates to modules and ICs through the CLOCK and DATA lines. |
| **signal** | An electrically transmitted electromagnetic wave. |
| **Signal Qualifier mode** | An operating mode in which the radio is muted, but still continues to analyze receive data to determine RX signal type. |
| **softpot** | *See software potentiometer.* |
| **software** | Computer programs, procedures, rules, documentation, and data pertaining to the operation of a system. |
| **software potentiometer** | A computer-adjustable electronic attenuator. |
| **spectrum** | Frequency range within which radiation has specific characteristics. |
| **SPI** | *See Serial Peripheral Interface.* |
| **squelch** | Muting of audio circuits when received signal levels fall below a pre-determined value. With carrier squelch, all channel activity that exceeds the radio's preset squelch level can be heard. |
| **SRAM** | *See static RAM.* |
| **SRIB** | Smart Radio Interface Box. *See RIB.* |
| **SSI** | *See Synchronous Serial Interface.* |
| **Standby mode** | An operating mode in which the radio is muted but still continues to monitor data. |
| **static RAM** | A type of memory used for volatile, program/data memory that does not need to be refreshed. |
| **Synchronous Serial Interface** | DSP interface to peripherals that consists of a clock signal line, a frame synchronization signal line, and a data line. |
| **system central controllers** | Main control unit of the trunked dispatch system; handles ISW and OSW messages to and from subscriber units *(See ISW and OSW)*. |

| Term | Definition |
|---|---|
| **system select** | The act of selecting the desired operating system with the system-select switch (also, the name given to this switch). |
| **thin small-outline package** | A type of dynamic random-access memory (DRAM) package that is commonly used in memory applications. |
| **time-out timer** | A timer that limits the length of a transmission. |
| **TOT** | *See time-out timer.* |
| **transceiver** | Transmitter-receiver. A device that both transmits and receives analog or digital signals. Also abbreviated as XCVR. |
| **transmitter** | Electronic equipment that generates and amplifies an RF carrier signal, modulates the signal, and then radiates it into space. |
| **TSOP** | *See thin small-outline package.* |
| **TX** | Transmit. |
| **UART** | *See also Universal Asynchronous Receiver Transmitter.* |
| **UCM** | Universal Crypto Module. |
| **UHF** | Ultra-High Frequency. |
| **Universal Asynchronous Receiver Transmitter** | A microchip with programming that controls a computer's interface to its attached serial devices. |
| **Universal Serial Bus** | An external bus standard that supports data transfer rates of 12 Mbps. |
| **Urchin IC** | A programmable logic device configured to supply a 2.8 V, 48 kHz square wave at 2% duty cycle and a 2.8 V, 2.4 MHz square wave at 50% duty cycle to the TX modulation DAC using a 16.8 MHz reference input.These clock signals are used by the DAC to convert the digital SSI audio into an analog modulation waveform. |
| **USB** | *See Universal Serial Bus.* |
| **VCO** | *See voltage-controlled oscillator.* |

| Term | Definition |
|---|---|
| **vector sum excited linear predictive coding** | A voice-encoding technique used in ASTRO digital voice. |
| **VHF** | Very-High Frequency. |
| **VIP** | Vehicle Interface Port. |
| **VOCON** | *See vocoder/controller.* |
| **vocoder** | An electronic device for synthesizing speech by implementing a compression algorithm particular to voice. *See also voice encoder.* |
| **vocoder/ controller** | A PC board that contains an ASTRO radio's microcontroller, DSP, memory, audio and power functions, and interface support circuitry. |
| **voice encoder** | The DSP-based system for digitally processing analog signals, and includes the capabilities of performing voice compression algorithms or voice encoding. *See also vocoder.* |
| **voltage-controlled oscillator** | An oscillator in which the frequency of oscillation can be varied by changing a control voltage. |
| **A/D** | *See analog-to-digital conversion.* |

# Notes

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