CSM92 Reference Modem

User's Guide

Conexant Proprietary Information

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CONEXANT®

Revision Record

Revision	Date	Comments
A	6/3/2008	Initial release

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1 Introduction

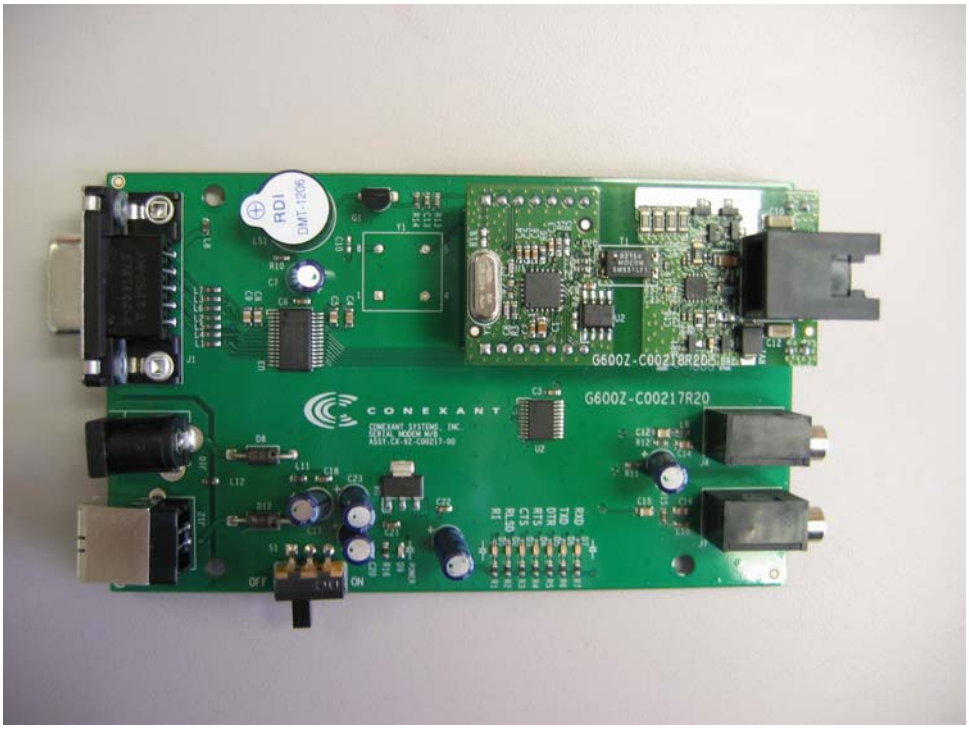
The Conexant CSM92 Reference Modem is a V.92 Data/14.4 kbps Fax modem on a small printed circuit board (PCB) daughtercard. This modem card is a production-ready design which can be used in one of three possible ways by a customer:

1. The exact layout can dropped into onto an embedded application to preserve functionality, modem performance and regulatory performance.
2. The layout can be altered slightly onto an embedded application with unique form factor requirements to maintain functionality and modem performance.
3. The Reference Modem can be produced as is and plugged into a host motherboard.

A Serial Motherboard (referred to as the Motherboard) is also provided for the purpose of evaluation and testing. When the CSM92 Reference Modem is connected to the Motherboard, the integrated unit forms a complete V.92 Data/14.4 kbps Fax serial modem. The Motherboard with a CSM92 Reference Modem daughtercard installed is shown in Figure 1-1.

This same Serial Motherboard can be connected to other Conexant Reference Modems as outlined in Section 1.5.

a. Side View



b, Top View

Figure 1-1. Serial Motherboard with CSM92 Reference Modem Daughtercard

1.1 Features

1.1.1 CSM92 Reference Modem Features

- CSM92 Serial Data/Fax modem device features
  - V.92 data modem
  - 14.4 kbps fax modem
  - Remote TAM
  - V.44/V.42 bis/MNPS data compression
  - V.42 LAPM/MNP2-4 error correction
  - SmartDAA 4 –single SKU for worldwide compliance
- Production-ready design (exact design can be placed onto an embedded application to preserve functionality, modem performance and regulatory performance)
- Designed for size, manufacturability, cost and performance
  - Single-sided 4-layer PCB
  - Small area: 1.1 in. x 2.2 in.
  - Low-cost BOM
- Design tested for regulatory requirements
  - EMC/EMI
  - Safety (CB)
  - SKU surge protection
  - Pre-tested for WW telecom type approval
  - Actual PTT certification is responsibility of customer
- Fast time to market if using provided reference design

1.1.2 Serial Motherboard Features

- Allows easy hookup, debug and evaluation of reference modem featuring
  - External 5V power source or USB powered
  - RS232 connector
  - Pin header connectors for reference modem attachment
  - On/off switch
  - Buzzer for call progress
  - Audio and microphone jacks for optional speakerphone function

1.2 Purpose

The purpose of this document is to describe the reference modem daughtercard and the motherboard, provide instructions for setup and operation, provide layout guidelines for laying out circuit traces on a customer PCB, and provide mechanical information for use in manufacturing a PCB with modem circuit components.

1.3 Document Contents

Chapter 1, Introduction, introduces the CSM92 Reference Modem and Serial Motherboard, describes the scope of this document, and lists reference documents.

Chapter 2, Installation, describes how to set up the CSM92 Reference Modem and Motherboard for test, evaluation, or general operation.

Chapter 3, Operation, describes how to operate the modem manually from a host terminal or computer and how to initiate common commands using the manual interface.

Chapter 4, CSM92 Reference Modem Circuit Description, describes the CSM92 Reference Modem circuits and identifies interface signals.

Chapter 5, Motherboard Hardware Description, describes the Motherboard circuits and identifies interface signals.

Chapter 6, Layout Guidelines, describes guidelines for PCB layout of traces for the modem circuits.

Chapter 7, CSM92 Reference Modem Fabrication Information, identifies components required to populate circuits on the CSM92 Reference Modem.

Chapter 8, Motherboard Fabrication Information, identifies components required to populate circuits on the Serial Motherboard.

1.4 Reference Documents

Document Title	Document No.
CX93011 CSMxx V.92/V.34/V.32bis Controllered Serial Modem with CX20548 SmartDAA Data Sheet	DSH-201719 (Doc. No. 102635)
AT Command Reference Manual	REM-200837 (Doc. No. 102752)
CX93011/20548 Serial Modem Daughter Bd Manufacturing Drawings	G600Z-C00218R20
CX93011/20548 Serial Modem Motherboard Manufacturing Drawings	G600Z-C00217R20
CSM92 Reference Modem User's Guide	USG-201664

1.5 Ordering Information

Reference Modem/ Motherboard	Order Number	Modem Device	SmartDAA	Voice Codec
SCXV.92	CX-9Z-C00226	CX86500-25	CX20493-31	N/A
CSM92	CX-9Z-C00218	CX93011-11Z	CX20548-11Z	N/A
CSM22	CX-9Z-C00258	CX90240-11Z	CX20548-11Z	N/A
CSM92-SP	CX-9Z-C00234	CX93021-11Z	CX20548-11Z	CX20452-11Z

Motherboard	CX-9Z-C00217	N/A	N/A	N/A

2 Installation

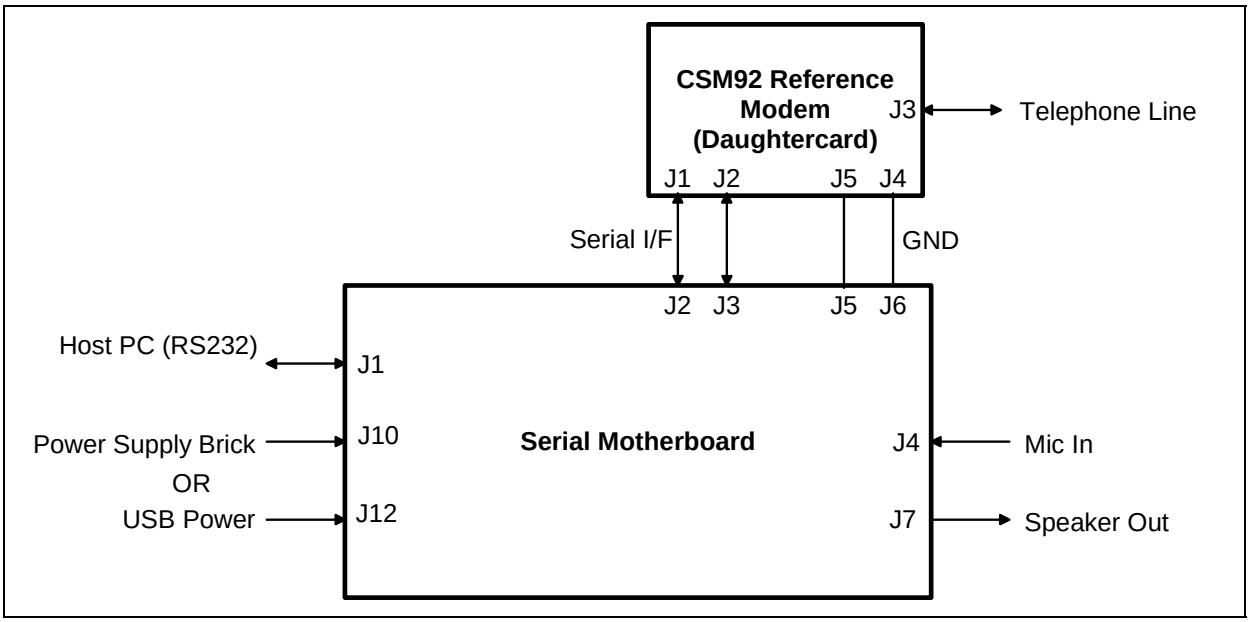
1. Remove the serial motherboard from the shipping package and inspect it to ensure no damage occurred in shipping.
2. Remove the reference modem daughtercard from the shipping package and inspect it to ensure no damage occurred in shipping.
3. If any header pins are bent on the reference modem, straighten them by applying light pressure to the side of the any bent posts (pins).
4. Connect the reference modem to the motherboard by aligning the reference modem over the motherboard header pin receptacles with the reference modem connector J3 (telephone line RJ11 connector) positioned to the outside of the motherboard.

   Caution: Installing the reference modem with the reference modem connector J3 (telephone line RJ11 connector) positioned to the inside of the motherboard may damage one or both of the cards when power is applied.
5. Connect an RS232 cable from the host computer to Motherboard connector J1.
6. Connect the telephone line to reference modem connector J3.
7. Ensure the motherboard ON/OFF switch (S1) is in the OFF position.
8. Connect +5V power from a power supply (power brick) to motherboard connector J10 (Power Jack) or connect a USB cable from the host computer to motherboard connector J12 (USB).

   Caution: Do not connect both the USB power connection and the power brick connection at the same time.

   Note: The USB connection provides only +5V power from the host computer to the motherboard and is not a data connection.
9. Once all the hardware and cabling has been correctly set up, apply power to the modem by turning the motherboard ON/OFF switch (S1) to the ON position.
10. Upon power turn-on, the red Power On LED (D9) on the Motherboard will turn on indicating the Motherboard and Reference Modem are powered up and then the green CTS LED (D3) will turn on indicating the modem is ready to receive "AT" commands.

Figure 2-1. Installation



3 Operation

This chapter describes how to operate the modem manually from a host and how to initiate common commands using the manual interface.

3.1 Manual Operation

The modem operates in response to commands issued by the host computer.

Use a terminal emulator software package such as HyperTerminal for Windows or Minicom for Linux to issue commands to the modem. The modem automatically senses the DTE speed and data but hardware flow control must be enabled on the terminal software.

Start all commands by keying "AT" followed by command characters, then press ENTER to terminate the command, which causes the AT characters, command characters, and a carriage return control character (*<cr>*) to be sent to the modem.

The modem will acknowledge the commands by responding with carriage return control (*<cr>*), linefeed control (*<lf>),* "OK", and other characters, depending on the command, to inform the host the command has been accepted.

3.1.1 To Verify Modem Operation

Host	Modem	Comments
AT*<cr>*		
	*<cr><lf>*OK*<cr><lf>*	

3.1.2 To Identify the Firmware Version and Device Set Model

Host	Modem	Comments
ATI3*<cr>*		
	*<cr><lf>*CX93001-EIS_V0.2002-V92*<cr><lf>*	Response may differ depending on firmware version and chipset model

3.1.3 To Identify the Firmware Patch Version

Host	Modem	Comments
AT-PV*<cr>*		
	*<cr><lf>*000000*<cr><lf>*OK*<cr><lf>*	00000 indicates there is no patch loaded. Response will differ if a patch is loaded

3.1.4 To Load a RAM Patch

Host	Modem	Comments
AT**<*cr*>		
	<*cr*><*lf*>Download initiated ..<*cr*><*lf*>	
Send RAM patch file in ASCII or text mode		
	<*cr*><*lf*>OK<*cr*><*lf*>	

3.1.5 To load an NVRAM Patch

Host	Modem	Comments
AT**<*cr*>		
	<*cr*><*lf*>Download initiated ..<*cr*><*lf*>	
Send NVRAM patch loader in ASCII or text mode		
	<*cr*><*lf*>CX93001 NV_Ram Uploader – REV 0B<*cr*><*lf*>Upload NV_Ram Data ..<*cr*><*lf*>	
Send NVRAM patch in ASCII or text mode		
	<*cr*><*lf*>Upload successfully completed<*cr*><*lf*>	

3.1.6 To Make a Data Call

Host	Modem	Comments
AT+FCLASS=0<*cr*>		Enable data mode, FCLASS=0 is set by default
	<*cr*><*lf*>OK<*cr*><*lf*>	
AT\V1<*cr*>		Enable single line connect message
	<*cr*><*lf*>OK<*cr*><*lf*>	
ATDT<phone number><*cr*>		Dial using DTMF dialing
	<*cr*><*lf*>CONNECT 115200/V92/LAPM/V44/28800:TX/45333:RX<*cr*><*lf*>	Modem connected in V92 with LAPM error correction and V44 data compression upstream speed of 28800 bps and downstream speed of 45333 bps. Response may differ depending on server and modem configuration

3.1.7 To Make a Voice Call in Speakerphone Mode

Host	Modem	Comments
AT+FCLASS=8<*cr*>		Enable voice mode
	<*cr*><*lf*>OK<*cr*><*lf*>	
AT+VSP=1<*cr*>		Enable speakerphone mode
	<*cr*><*lf*>OK<*cr*><*lf*>	
ATDT<phone number><*cr*>		Dial using DTMF dialing
	<*cr*><*lf*>OK<*cr*><*lf*>	

3.2 Automatic Operation

Load a communications software product into the host computer and follow accompanying instructions.

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4 CSM92 Reference Modem Circuit Description

The CSM92 Reference Modem supports V.92 analog data modem operation, 14.4 kbps fax modem, and remote telephone answering machine (TAM). The modem also supports V.44/V.42bis/MNP 5 data compression for greater data throughput and V.42 LAPM/MNP2-4 error correction protocol for increased data integrity and reliability.

4.1 CSM92 Modem Device (CX93011/CX20548)

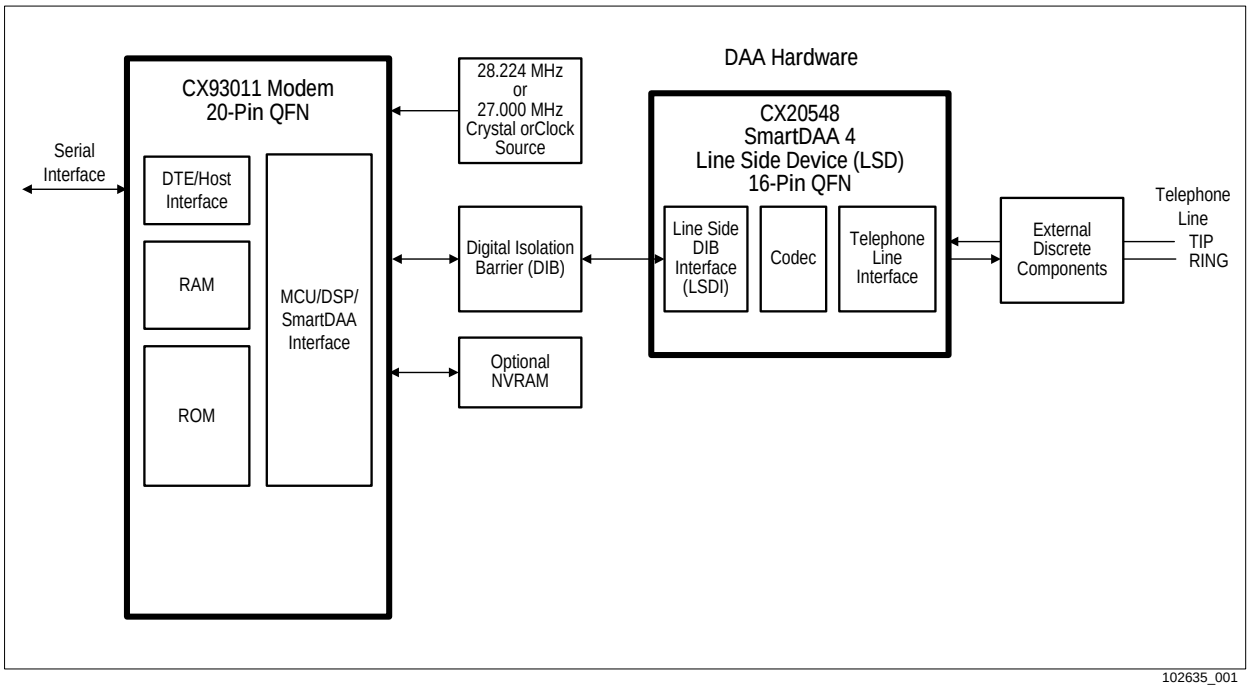
The heart of the CSM92 Reference Modem is the Conexant® CSM92 Modem Device Set. This device set consists of a CX93011 V.92/V.34/V.32bis Modem device in a 20-pin QFN and a CX20548 SmartDAA® 4 Line Side Device (LSD) in a 16-pin QPN. Figure 4-1 illustrates the top-level modem interface connection.

The CX93011 modem device integrates a microcontroller (MCU), a digital signal processor (DSP), internal RAM, internal ROM, and a SmartDAA system side device (SSD) onto a 20-pin QFN. The CX93011 connects to the host over a serial interface.

The CX20548 SmartDAA 4 LSD includes a Line Side DIB Interface, a coder/decoder (codec), and a Telephone Line Interface (TLI). The Line Side DIB Interface communicates with, and receives power and clock from, the SmartDAA 4 interface in the host side device (HSD) through the DIB transformer. The TLI integrates DAA and direct telephone line interface functions and connects directly to the line TIP and RING pins, as well as to external line protection components.

Refer to the CX93011 CSM92 Modem Device Data Sheet for additional information.

Figure 4-1. CSM92 Modem Device Set Simplified Interface Diagram



4.2 CSM92 Reference Modem

The CSM92 Reference Modem incorporates CSM92 Modem device, supporting support circuits, interface connector to the motherboard, and telephone line connector on a small daughtercard. The CSM92 Reference Modem is shown in Figure 4-2. A block diagram of the CSM92 Reference Modem is illustrated in Figure 4-3.

Figure 4-2. Top view of the CSM92 Reference Modem

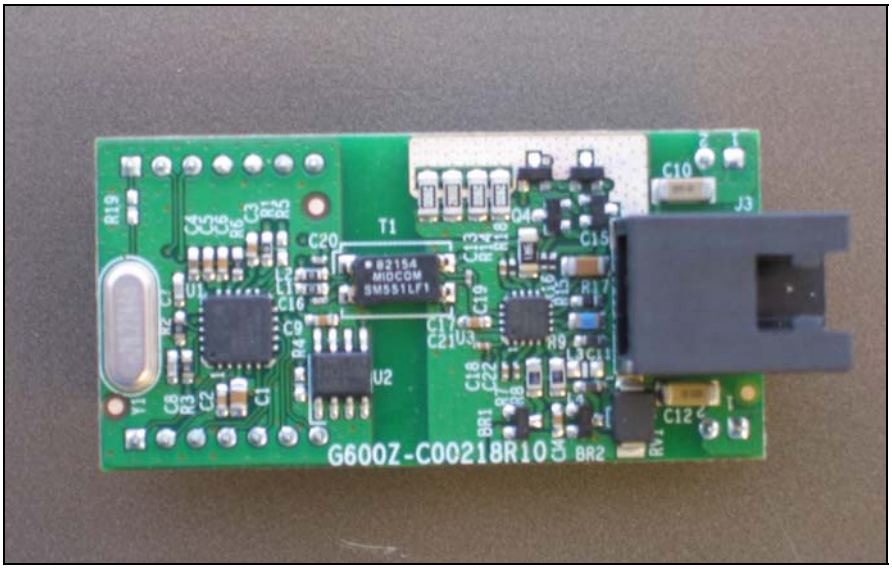
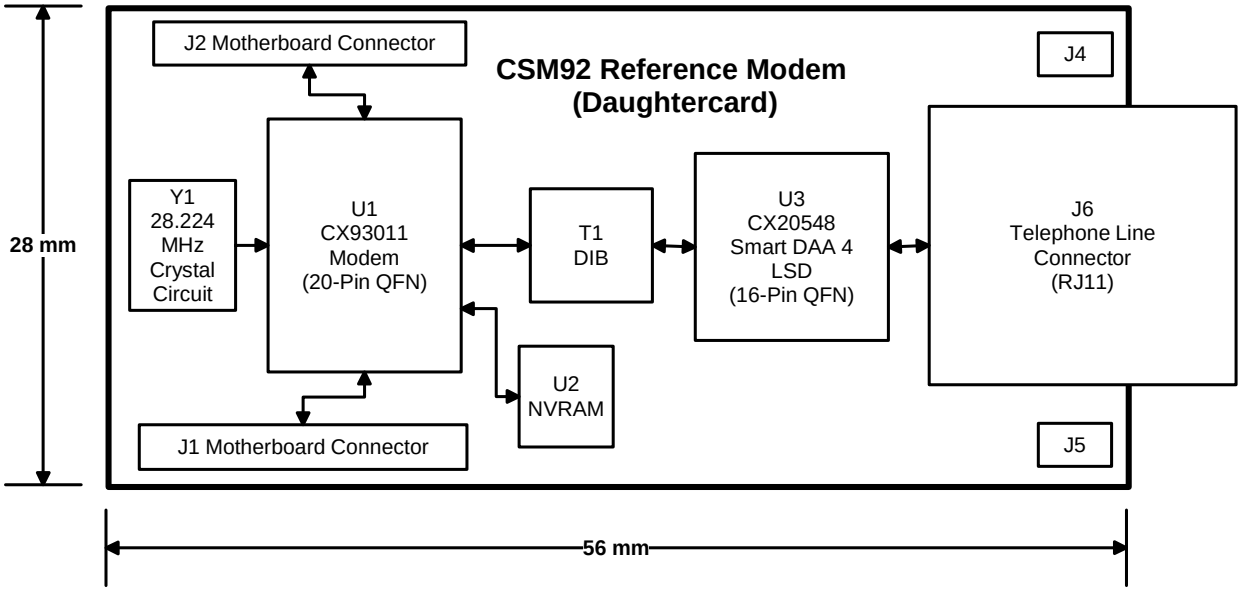


Figure 4-3. Block Diagram of the CSM92 Reference Modem



4.3 CSM92 Reference Modem Connectors

CSM92 Reference Modem connectors and pin signals are identified in Table 4-1.

Table 4-1. CSM92 Reference Modem Connector Pin Signals

Connector	Pin No.	Signal Name	
J1 (Motherboard)	1	RXD#	Received Data (EIA BB/ITU-T CT104), active low
	2	TXD#	Transmitted Data (EIA BA/ITU-T CT103), active low
	3	RTS#	Request To Send (EIA CA/ITU-T CT105), active low
	4	CTS#	Clear To Send (EIA CB/ITU-T CT106). active low
	5	DTR#	Data Terminal Ready (EIA CD/ITU-T CT108), active low
	6	RLSD#	Received Line Signal Detector (EIA CF/ITU-T CT109), active low
	7	RI#	Ring Indicator (EIA CE/ITU-T CT125), active low
J2 (Motherboard)	1	OSCI	Oscillator Input
	2	DSPKOUT	Digital Speaker Out.
	3	RESET#	Reset, active low
	4	GND	Ground
	5	GND	Ground
	6	+3.3V	+3.3V Power
	7	+3.3V	+3.3V Power
J4 (GND)	1	GND	Ground
	2	GND	Ground
J5 (GND)	1	GND	Ground
	2	GND	Ground
J6 (Telephone Line)	1	RING	RING
	2	TIP	TIP
	3	NC	No internal connection
	4	NC	No internal connection

4.4 Description of CSM92 Reference Modem Circuits

4.4.1 CSM92 Reference Modem to Motherboard Connector Interface

A schematic of the CSM92 Reference Modem to Motherboard connector interface is shown in Figure 4-4.

The CSM92 Reference Modem connects to the motherboard via two 7-pin headers, connectors J1 and J3 (Table 4-1). These two single-row strips are inserted into pin receptacles on the motherboard.

4.4.2 CSM92 Reference Modem CX93011 Interface

A schematic of the CSM92 Reference Modem CX93011 interface circuit is shown in Figure 4-5.

4.4.3 CSM92 Reference Modem CX20548 SmartDAA Interface

A schematic of the CSM92 Reference Modem CX20548 SmartDAA interface circuit is shown in Figure 4-6.

The CSM92 Reference Modem connects to the telephone line via Connector J6 (Table 4-1).

Figure 4-4. Schematic of CSM92 Reference Modem to Motherboard Connector Interface

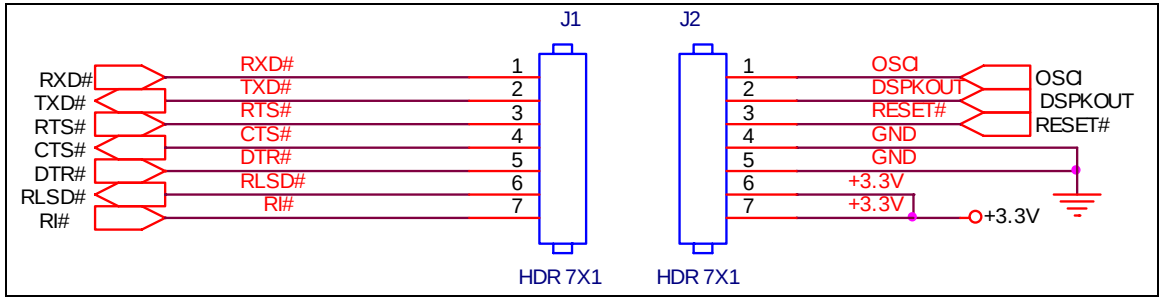


Figure 4-5. Schematic of CSM92 Reference Modem CX93011 Interface Circuit

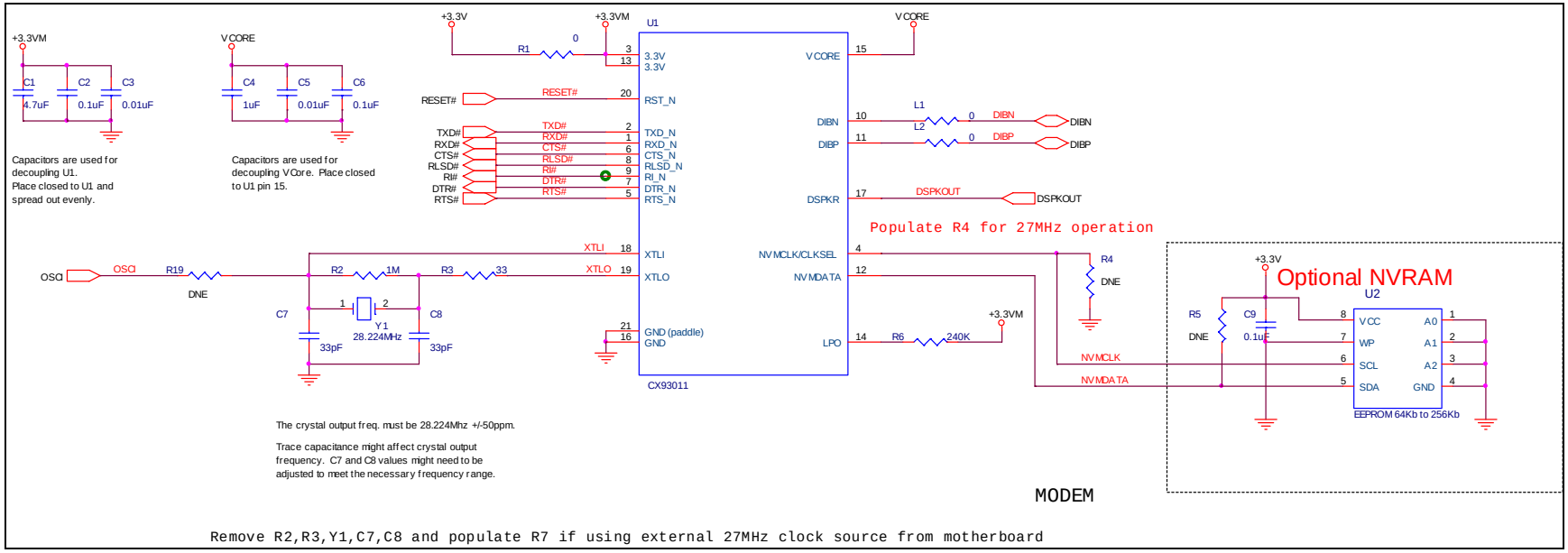
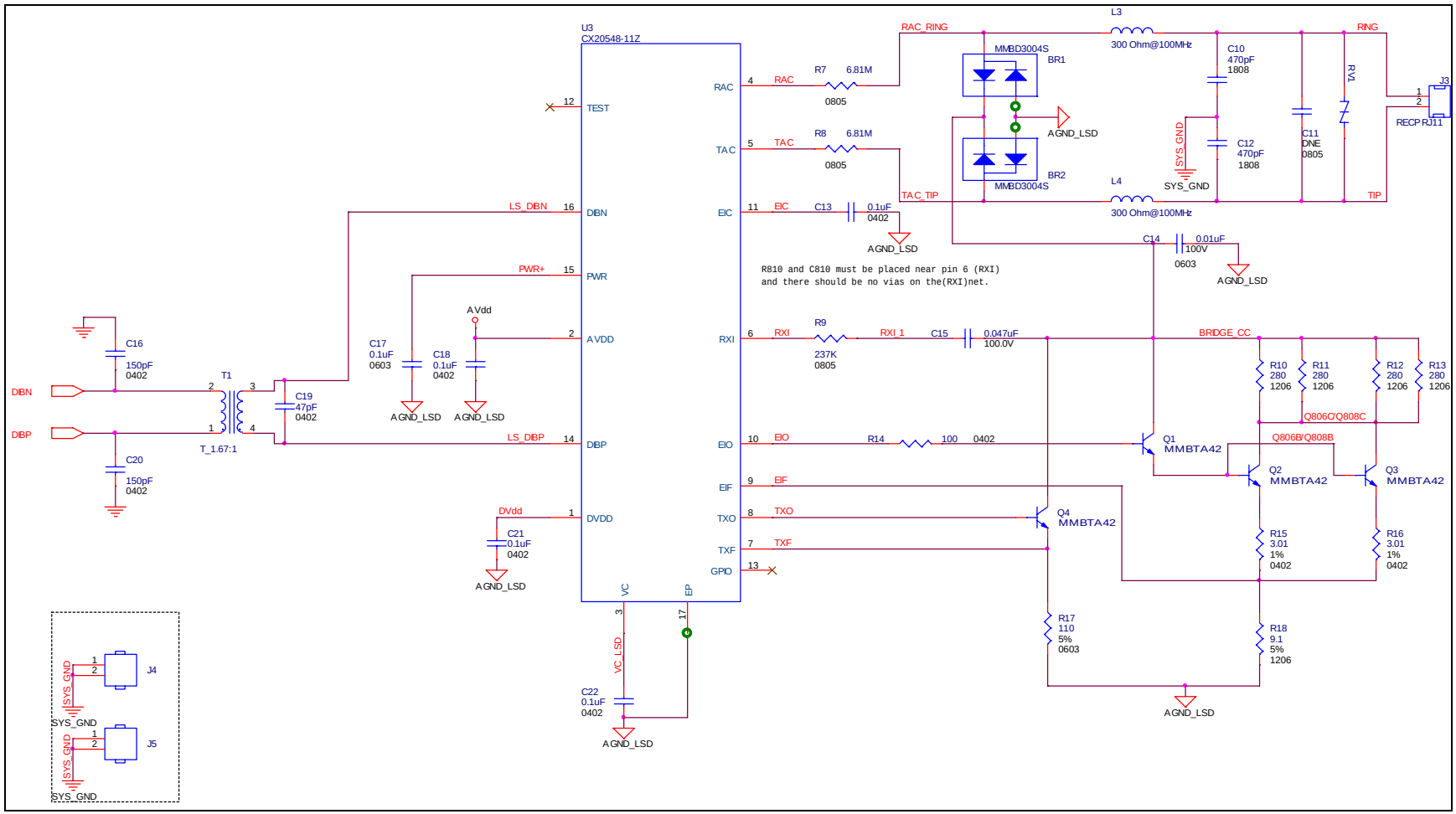


Figure 4-6. Schematic of CSM92 Reference Modem CX20548 SmartDAA Interface Circuit



5 Motherboard Hardware Description

The Motherboard is shown in Figure 5-1. A block diagram of the Motherboard is illustrated in Figure 5-2.

Figure 5-1. Top View of the Motherboard

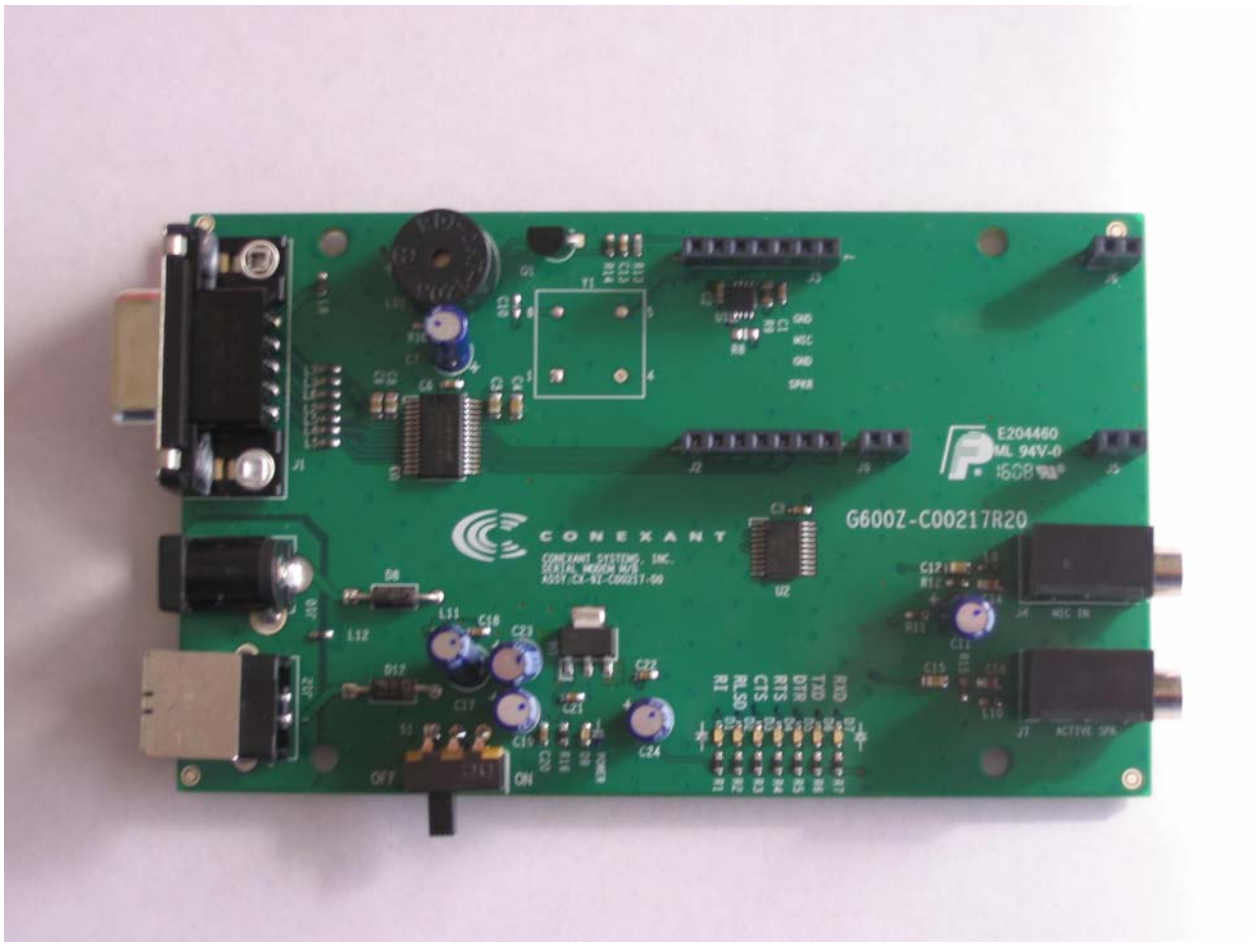
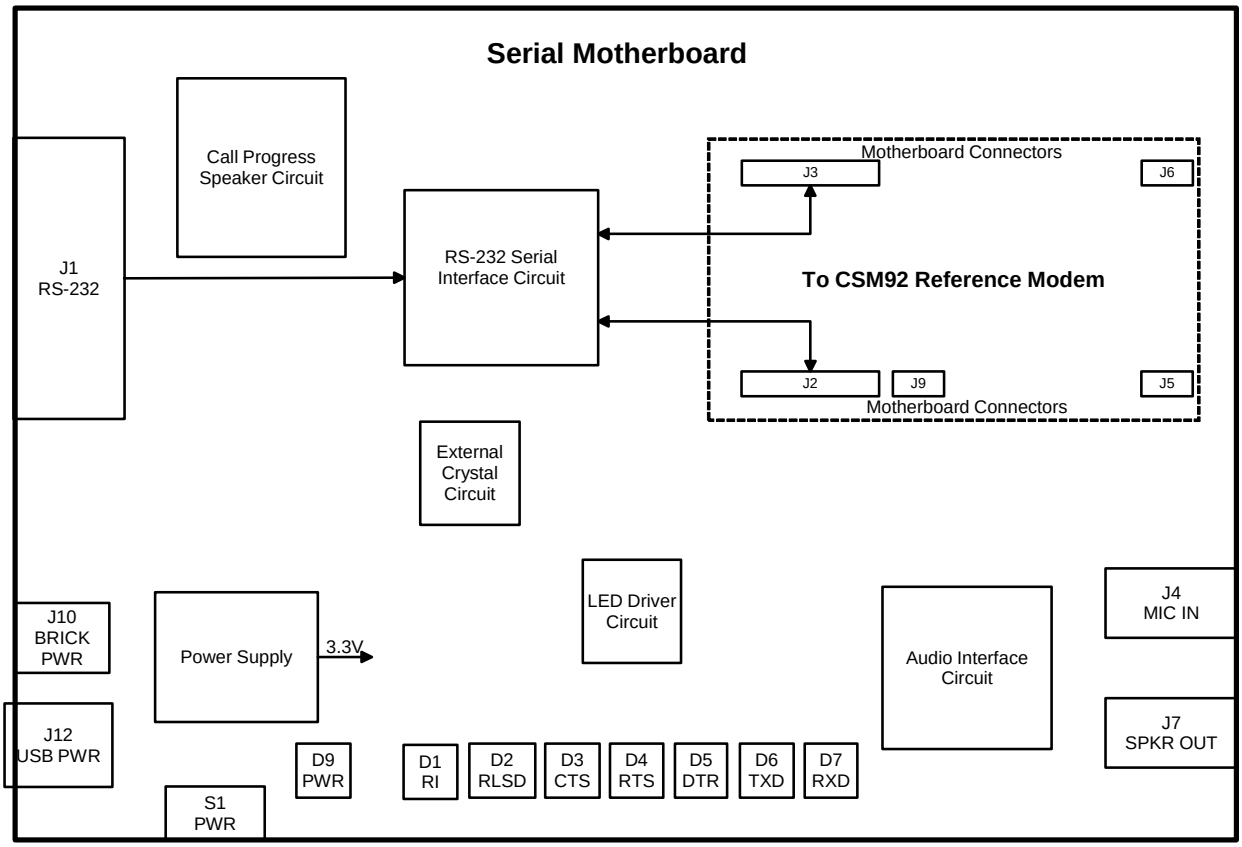


Figure 5-2. Block Diagram of the Motherboard



5.1 Motherboard Connectors and Indicators

Motherboard connectors and pin signals are identified in Table 5-1. Motherboard indicators are identified Table 5-2.

Table 5-1. Motherboard Connector Pin Signals

Connector	Pin No.	Signal Label	
J1 (RS-232)	1	RLSD~	Received Line Signal Detector (EIA CF/ITU-T CT109), active low
	2	RXD~	Received Data (EIA BB/ITU-T CT104), active low
	3	TXD~	Transmitted Data (EIA BA/ITU-T CT103), active low
	4	DTR~	Data Terminal Ready (EIA CD/ITU-T CT108), active low
	5	GND~	Ground
	6	NC	No internal connection
	7	RTS~	Request To Send (EIA CA/ITU-T CT105), active low
	8	CTS~	Clear To Send (EIA CB/ITU-T CT106)., active low
	9	RI~	Ring Indicator (EIA CE/ITU-T CT125), active low
J2 (Daughtercard)	1	RXD#	Received Data (EIA BB/ITU-T CT104), active low
	2	TXD#	Transmitted Data (EIA BA/ITU-T CT103), active low
	3	RTS#	Request To Send (EIA CA/ITU-T CT105), active low
	4	CTS#	Clear To Send (EIA CB/ITU-T CT106). active low
	5	DTR#	Data Terminal Ready (EIA CD/ITU-T CT108), active low
	6	RLSD#	Received Line Signal Detector (EIA CF/ITU-T CT109), active low
	7	RI#	Ring Indicator (EIA CE/ITU-T CT125), active low
J3 (Daughtercard)	1	OSCI	Oscillator Input
	2	DSPKOUT	Digital Speaker Out.
	3	RESET#	Reset, active low
	4	GND	Ground
	5	GND	Ground
	6	+3.3V	+3.3V Power
	7	+3.3V	+3.3V Power
J4 (Mic 3.5 mm Audio Jack)	Tip	MIC IN	Input from Microphone
	Sleeve	GND	Ground
J5 (GND)	1	GND	Ground
	2	GND	Ground
J6 (GND)	1	GND	Ground
	2	GND	Ground
J7 (Speaker 3.5 mm Audio Jack)	Tip	SPKR OUT	Output to Speaker
	Sleeve	GND	Ground
J9 (Daughtercard)	1	MIC IN	Input from Microphone
	2	GND	Ground
J10 (Power Jack)	Tip	+5V	+5V power.
	Sleeve	GND	Ground. Connected to Motherboard Ground through 100 Ω at 100MHz filter.
J12 (USB Power)	1	VCC	+5V power.
	2	NC	No internal connection.
	3	NC	No internal connection.
	4	GND	Ground. Connected to Motherboard Ground through 100 Ω at 100MHz filter.
	5	shell2	Connected to Motherboard Ground through filter.
	6	shell2	Connected to Motherboard Ground through filter.

Table 5-2. Motherboard Indicators

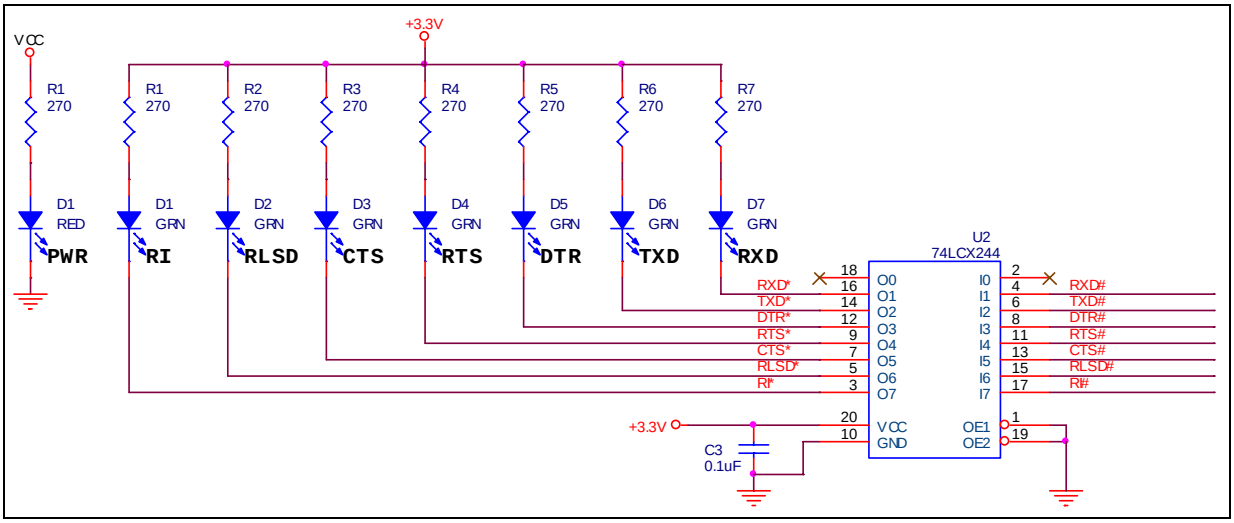
LED No.	Color	Signal Label	Signal Name
D1	Green	RI	Ring Indicator (EIA CE/ITU-T CT125)
D2	Green	RLSD	Received Line Signal Detector (EIA CF/ITU-T CT109)
D3	Green	CTS	Clear To Send (EIA CB/ITU-T CT106).
D4	Green	RTS	Request To Send (EIA CA/ITU-T CT105)
D5	Green	DTR	Data Terminal Ready (EIA CD/ITU-T CT108)
D6	Green	TXD	Transmitted Data (EIA BA/ITU-T CT103)
D7	Green	RXD	Received Data (EIA BB/ITU-T CT104)
D9	Red	Power On	Power On

5.2 Description of Motherboard Circuits

5.2.1 Motherboard LED Indicator Circuit

A schematic of the LED indicator circuit is shown in Figure 5-3.

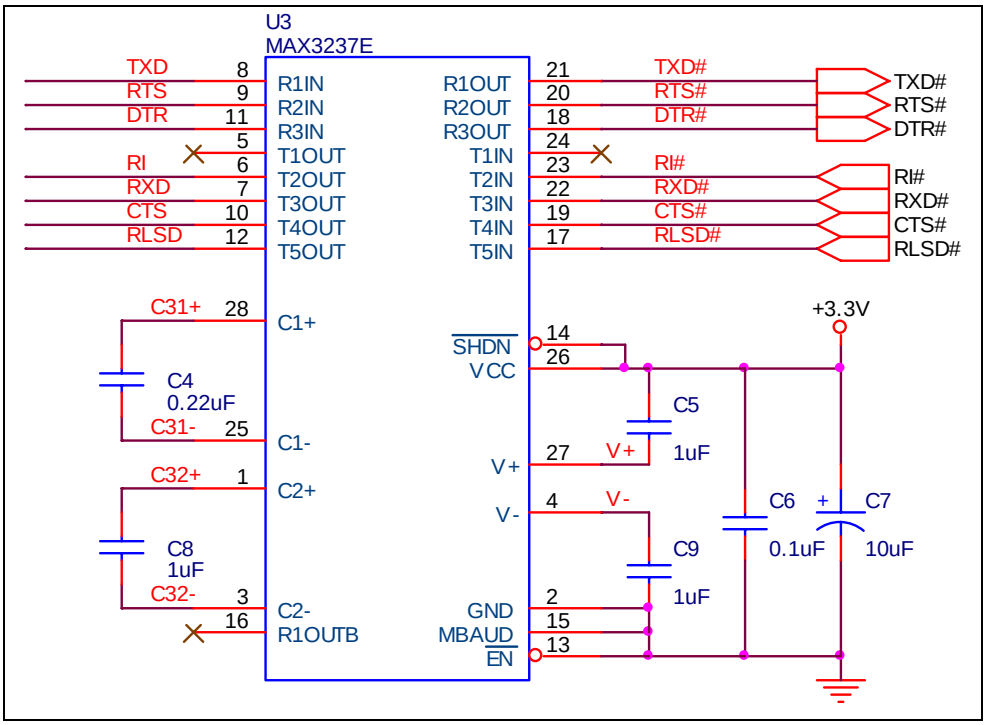
Figure 5-3. Schematic of Motherboard LED Indicators



5.2.2 Motherboard RS-232 Interface

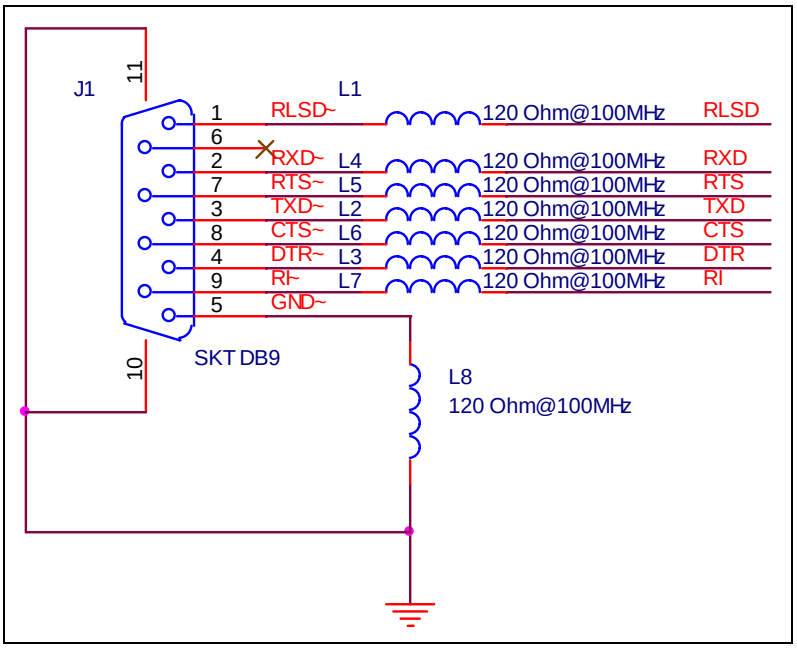
A schematic of the Motherboard RS-232 interface circuit is shown in Figure 5-4.

Figure 5-4. Schematic of Motherboard RS-232 Interface Circuit



A schematic of the RS-232 connector interface is shown in Figure 5-5.

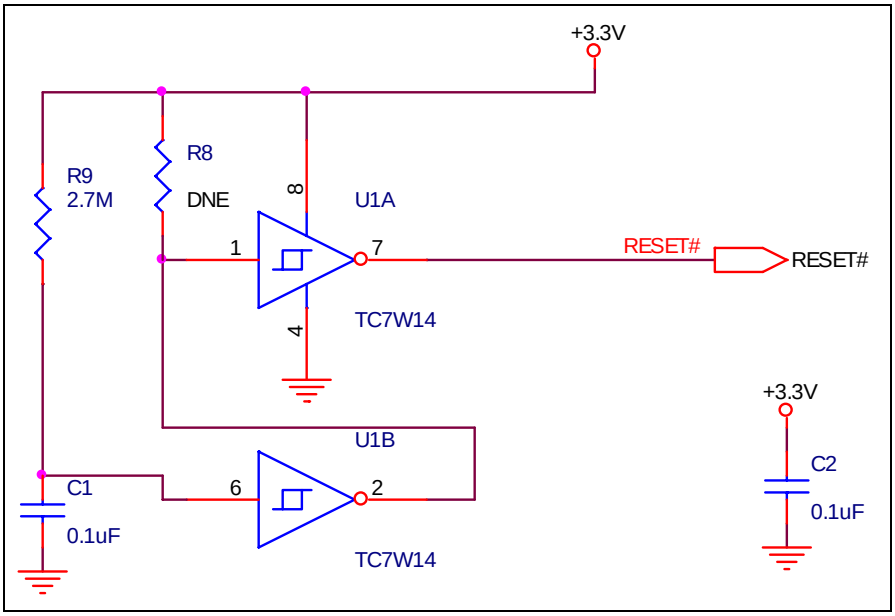
Figure 5-5. Schematic of Motherboard RS-232 Connector Interface



5.2.3 Motherboard Reset Circuit

A schematic of the Motherboard Reset circuit is shown in Figure 5-6.

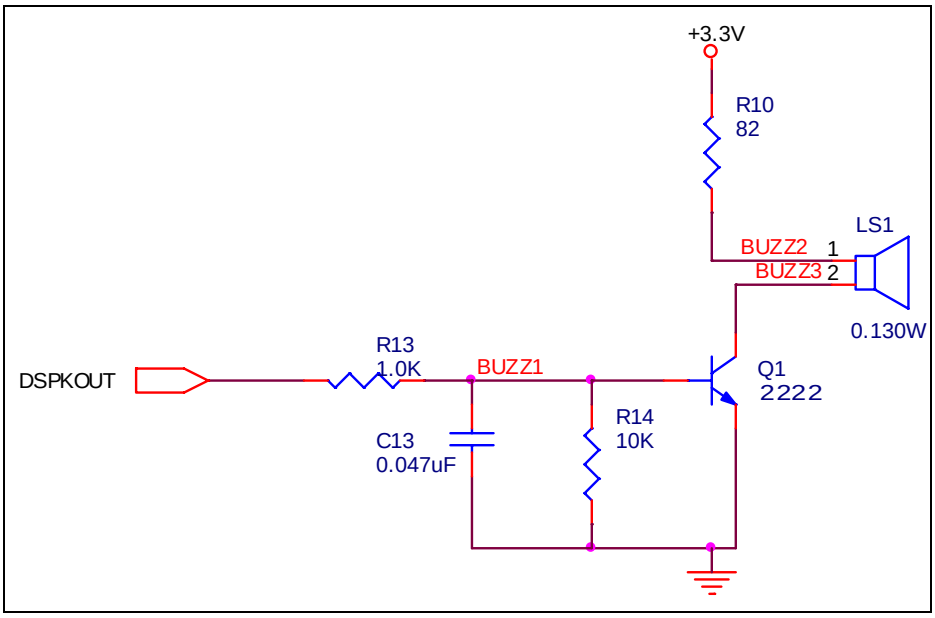
Figure 5-6. Schematic of Motherboard Reset Circuit



5.2.4 Motherboard Call Progress Speaker Circuit

A schematic of the Motherboard Call Progress Speaker circuit is shown in Figure 5-7.

Figure 5-7. Schematic of Motherboard Call Progress Speaker Circuit

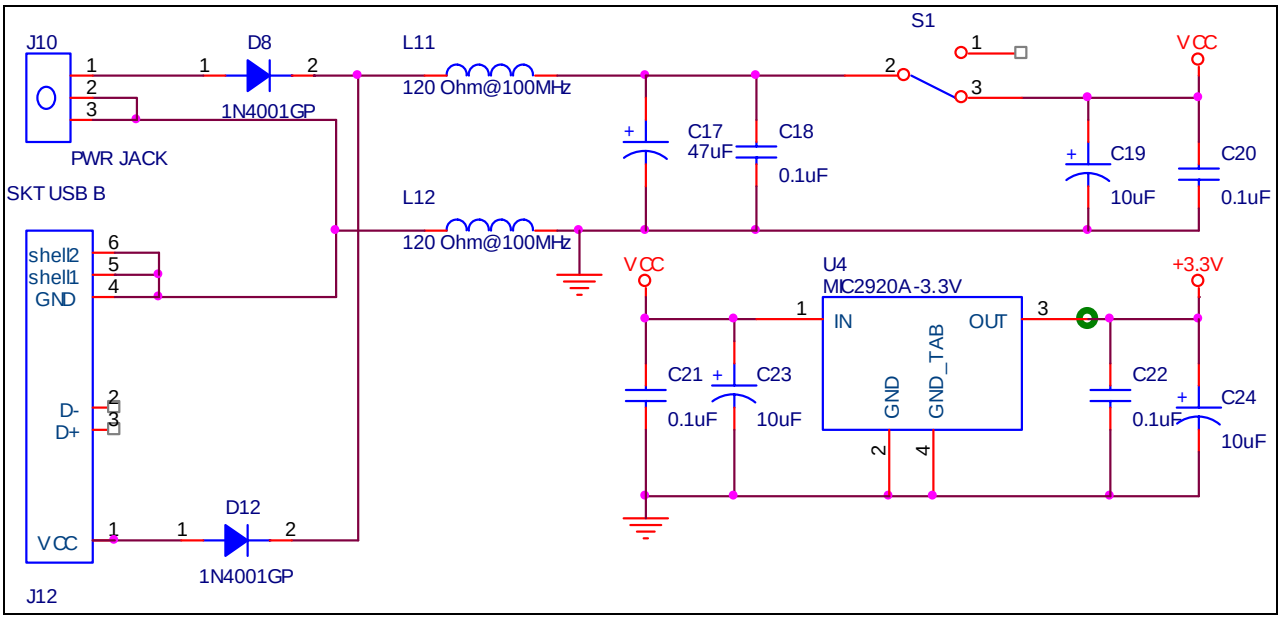


5.2.5 Motherboard Power Supply Circuit

The Motherboard is powered by a +3.3V power source supplied either from +3.3V source connected to connector J10 Power Jack or from a USB cable connected to Connector J12 USB (Table 5-1).

A schematic of the Motherboard Power Supply circuit is shown in Figure 5-7.

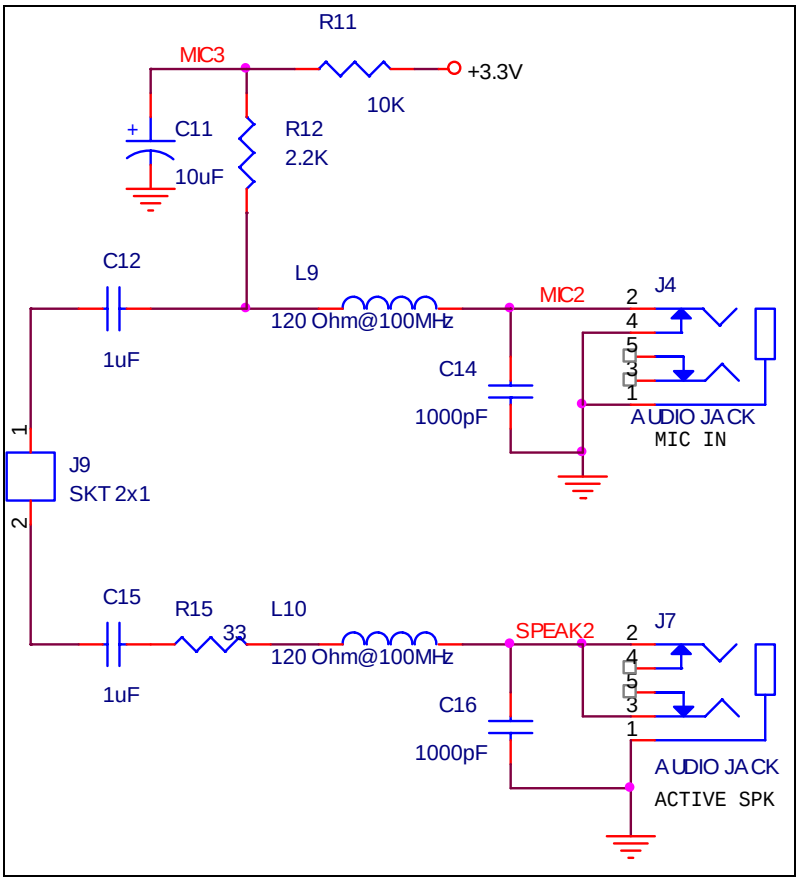
Figure 5-8. Schematic of Motherboard Power Supply Circuit



5.2.6 Motherboard Audio Interface Circuit

A schematic of the Audio Interface circuit is shown in Figure 5-9. Connector J4 and J7 pin signals are listed in Table 5-1.

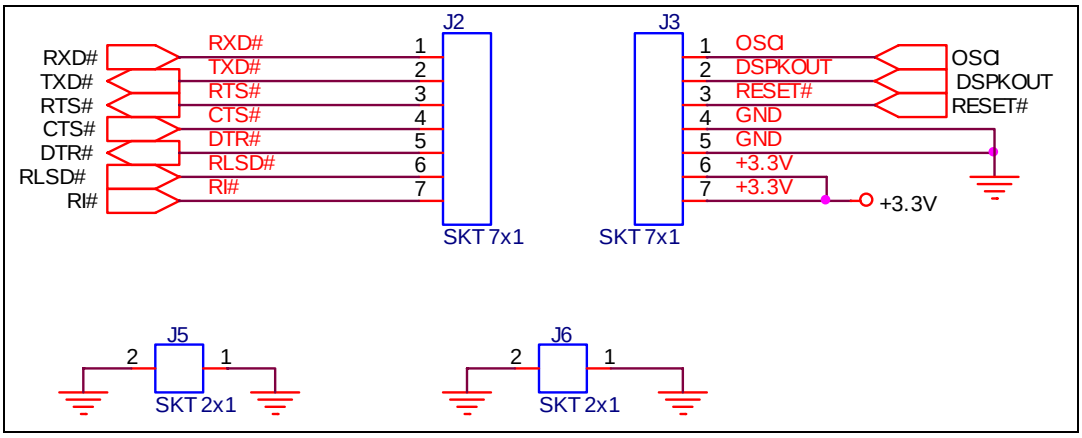
Figure 5-9. Schematic of Motherboard Audio Interface Circuit



5.2.7 Motherboard Reference Modem Interface

A schematic of the Reference Modem to Reference Modem interface is shown in Figure 5-10. Connector J2 and J3 pin signals are listed in Table 5-1. Connect J5 and J6 are GND posts.

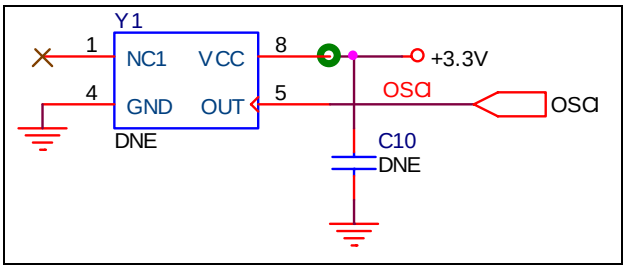
Figure 5-10. Schematic of Motherboard to Reference Modem Interface



5.2.8 Motherboard External Crystal/Clock Circuit

A schematic of the External Crystal/Clock circuit is shown in Figure 5-11.

Figure 5-11. Schematic of Motherboard External Crystal/Clock Circuit



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6 Layout Guidelines

This chapter describes printed circuit board (PCB) layout guidelines for the CSM-92 modem device set in the event the hardware design layout needs to be modified to accommodate specific applications. The layout guidelines deal with issues, which affect modem performance, conducted emissions, radiated emissions and safety. The purpose of this chapter is to assist design engineers in producing a PCB design, which meets worldwide EMC, EMI, and Safety regulations. This chapter also addresses thermal issues and modem performance issues.

The PCB design rules provided in this document are intended for a 2-layer PCB design, however, these rules can be easily adapted to a multi-layer PCB design.

6.1 Layout Guidelines Summary for CX93011

This section addresses the layout guidelines associated with the CX93011 V.92 Modem device. This device is referred to the system side device because it is on the system side of the DIB whereas the CX20548 SmartDAA 4 is on the line side of the DIB and is often referred to as the line side device.

Because the CX93011 is a digital device, industry standard layout guidelines for microcomputers should be followed. Any exceptions relating to interfacing to the CX20548 are described in Section 6.2.

6.2 Layout Guidelines for CX20548 (SmartDAA 4)

This section describes printed circuit board (PCB) layout guidelines for the line-side circuitry of a modem DAA based on Conexant's CX20548 SmartDAA 4 device. Thermal issues and modem performance issues are also addressed. .

Telephone networks can have high ring voltages and even lightning surges of many kilovolts. One purpose of a DAA is to isolate the low voltage or earth referenced system from the telephone network. This isolation is achieved by physically separating the line side components and the system side components using an isolation barrier or a moat. Components that bridge the isolation barrier must maintain this isolation. The line side of the DAA circuitry is commonly referred to as telephone network voltage (TNV) and the system side components is commonly referred to as safety extra-low voltage (SELV). These terms will be used throughout this section. All circuits shown on the schematic which are located to the right of the transformer T802 are considered TNV (Telephone Network Voltage) circuits.

6.2.1 General Trace Layout Requirements

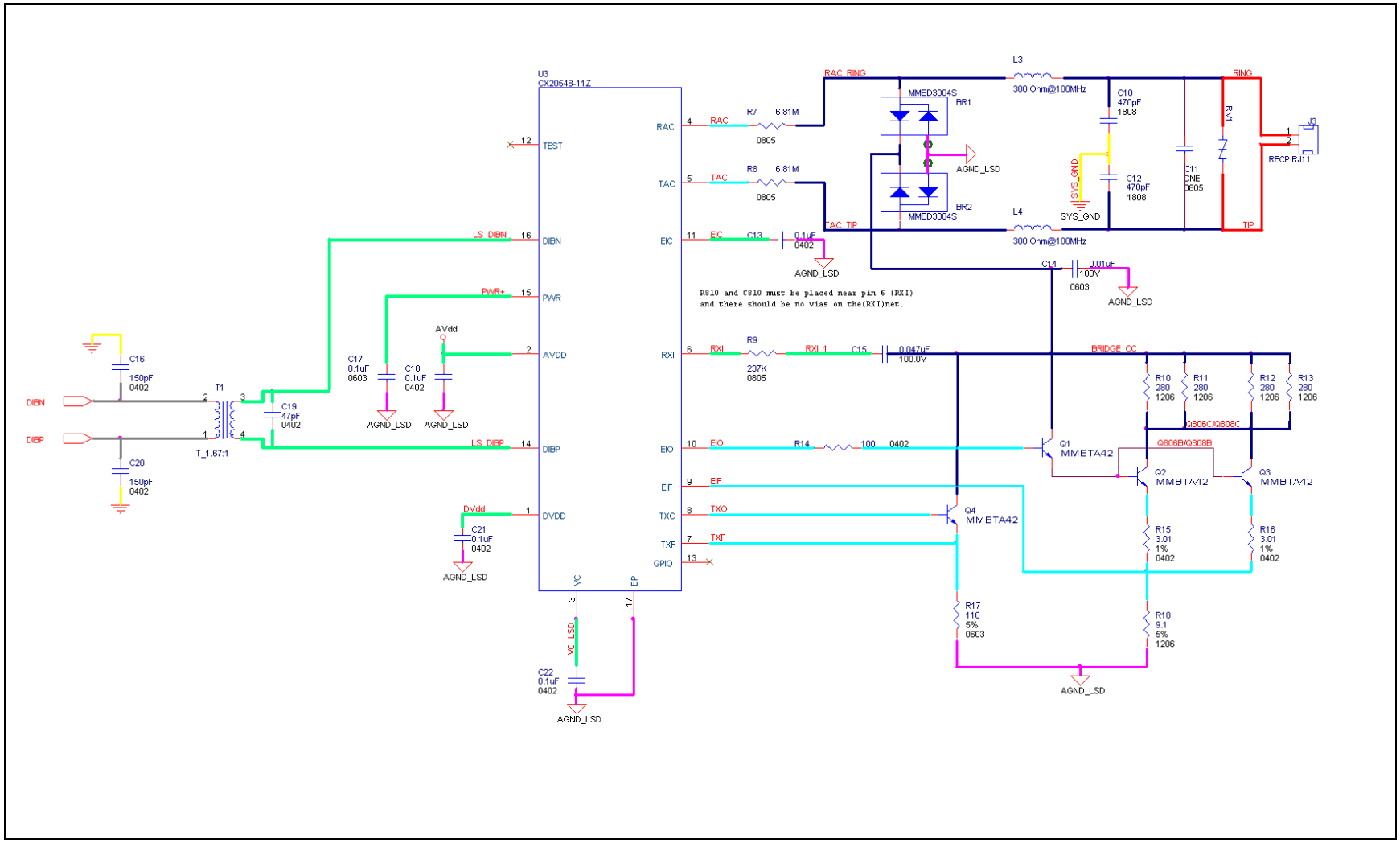
Figure 6-1 shows the CX20548 interface signals in colors coded for the following general layout requirements:

Note: Figure 6-1 refers to a generic schematic in which the component designators do no correspond to the component designators in the reference modem schematic. See Figure 4-6 for the component designators in the reference modem schematic.

1. Red traces: 25-mil trace minimum with 20-mil clearance. RV1 must be very close to Tip/Ring jack J3.
2. Blue traces: 20-mil trace minimum with 20-mil clearance.
3. Other traces on TNV (DAA): 7-mil trace minimum with 7-mil clearance.
4. Green traces: Very short traces, preferably less than 40-mil pad-to-pad.
5. Pink traces: AGND_LSD ground plane that is as continuous as possible. Under U3 device, only have AGND_LSD ground plane on all layers. No traces should be routed under U3 device.
6. Turquoise traces: Traces should be as short as possible.
7. Grey traces: DIBN and DIBP are differential signals and should be routed as close to each other as possible.
8. Yellow traces: Continuous system side ground.

These requirements are expanded in the following subsections.

Figure 6-1. CX93011 Interface Signals Color Coded for Layout Guidelines



6.2.2 Rules Pertaining to EMI and EMC

The following rules pertain to producing a PCB design, which shall meet international Electromagnetic Interference (EMI), and Electromagnetic Compatibility (EMC) requirements. Specifically, these rules are geared towards achieving compliance with European standards EN55022: 1998 (EMI) and EN55024: 1998 (EMC) as well as US FCC Part 15.

1. Place TIP and RING EMI/EMC filter capacitors C10 and C12 as close as possible to the phone jack J3.
2. Provide system side (SELV-side) SYS_GND near the phone jack J3. The system ground in this area is essential to low radiated and conducted emissions. Capacitors C10 and C12, which must be placed close to J3, must be tied to system side (SELV-side) SYS_GND via a low-impedance connection which can be provided by a copper area.
3. Place capacitors C16 and C20 as close as possible to U1 (CX93011) and provide low impedance connections to the SYS_ GND plane.
4. Place capacitor C19 as close as possible to T1.
5. Place capacitor C14 close to BR1 and BR2 (diode bridge) and provide a low impedance connection to AGND_LSD.

6.2.3 Rules Pertaining to Safety

The following rules pertain to safety considerations that ensure the compliance of the product with international safety requirements. Also, the design rules described herein address enhanced lightning requirements up to 5kV and beyond.

6.2.4 Definition of TNV and SELV Circuits

All circuits shown on the CX20548 interface schematic that are located to the right of transformer T1 are considered TNV (Telephone Network Voltage) circuits. All TNV circuitry must be properly isolated from the SELV circuits, which essentially corresponds to the remainder of the system schematic, including system-side GND (SYS_GND).

In this document, the term TNV is sometimes used interchangeably with the term "line-side" to refer to the fact the circuit is located on the telephone line side of T1. Also, the term SELV is sometimes interchangeably used with the term "system-side" to refer to the fact that a given circuit is located on the host system side of T1.

The DIB (Digital Isolation Barrier) transformer, T1, provides isolation between the SELV circuits and the TNV circuits. The clearance requirements listed below are also part of the barrier between TNV and SELV.

6.2.5 Common Guidelines

The dielectric breakdown of air is approximately 3000 volts/mm. This breakdown constant can be effectively reduced by dust particles and other contaminants, which may accumulate over the course of time, between two metal traces separated by an air gap. The clearances provided below are geared towards providing adequate margin with respect to longitudinal lightning surges up to 5kV.

1. All TNV circuits must have a minimum of 2.7mm (0.106") separation from all SELV circuits.
2. All PCB traces and pads connected to TIP shall have a minimum separation from all traces and pads connected to RING by a minimum distance of 0.51mm (0.020"). This rule represents an absolute minimum requirement applicable to mobile designs such as MDC or MiniPCI (very constrained PCB area). Of course, a larger clearance is acceptable and desirable, if the PCB area permits it.
3. All PCB traces and pads connected to the high side of the BR1 and BR2 connection (side not connected to AGND_LSD) shall have a minimum separation of 0.51mm (0.020") from all other TNV-connected traces and pads. This rule represents an absolute minimum requirement applicable to mobile designs such as MDC or MiniPCI (very constrained PCB area). Again, larger clearances are desirable, if the PCB area permits it.
4. Place DIB transformer T1 to straddle the 2.7mm gap between TNV and SELV.
5. The traces connecting the system-side device DIBN and DIBP signals to the transformer shall be free of vias and shall be made as close together as possible in a straightforward fashion.
6. The traces connecting the transformer to U1-10 (DIBN) and U1-11 (DIBP) shall be free of vias and shall be made as close together as possible in straightforward fashion.
7. Place Sidactor RVI close to the telephone jack J3. The circuit traces connecting RVI to J3 shall be no less than 0.025" wide. This minimum trace width ensures that the traces will survive lightning surge currents during metallic surge events.
8. Place the full-wave rectifier diode bridge (BR1 and BR2) reasonably close to the phone jack and tie their negative terminals to AGND_LSD via a low impedance connection.

6.2.6 Rules Pertaining to Modem Performance

The line side circuitry requires a distinct ground network, which is termed AGND_LSD in the CX20548 schematic. A low-impedance, contiguous, uniform AGND_LSD ground plane is necessary to achieve a low-noise DAA design.

1. The AGND_LSD ground plane shall consist of a contiguous copper area extending to all regions of the TNV (line-side) circuitry where connections to this net are required. The AGND_LSD net is part of the TNV circuitry and must observe the TNV-SELV clearance requirements stated in Section 6.2.2. To facilitate connections to the

AGND_LSD net, the AGND_LSD copper plane shall be placed on both layers of the PCB. The top and bottom layers of AGND_LSD plane shall be connected to each other with multiple vias to minimize the impedance between the two sides.

2. Place capacitor C18 as close as possible to U3-2 (AVDD).
3. Place capacitor C17 as close as possible to U3-15 (PWR).
4. Place capacitor C22 as close as possible to U3-3 (VC) and connect to the AGND_LSD ground plane through a low-impedance connection.
5. Place resistor R9 and capacitor C15 as close as possible to U3-6 (RXI). Keep the trace connecting R9 to C15 as short as possible. This rule is critical to minimizing stray coupling from a noisy system chassis.
6. Place capacitor C13 as close as possible to U3-11 (EIC) and provide a low-impedance connection to the AGND_LSD plane.
7. Place resistor R7 close to U3-4 (RAC).
8. Place resistor R8 close to U3-5 (TAC).

6.2.7 Thermal Considerations

1. Transistors Q1, Q2, and Q3, which are SOT23 packages, must each have a heat slug (PCB copper area) which is no less than 10mm^2 in area thermally and be electrically bonded to their collector tabs. If PCB area permits it, a larger heat slug area is recommended. The heat slug shall be replicated on both copper layers of the PCB. The two heat slug layers shall be connected with multiple vias to facilitate heat flow from one side to the other. In a multi-layer PCB design, the heat slug may be replicated on all layers and connected with multiple vias. Q4 does not need a heat slug. Maximum power dissipation for Q4 is less than 0.07W.
2. Place transistors Q1, Q2, and Q3 near U3-10 (EIO) and U3-9 (EIF).
3. Place transistor Q4 near U3-8 (TXO) and U3-7 (TXF).
4. Place resistors R15 and R16 near Q1, Q2, Q3 and R18 shall have low-impedance connection to AGND_LSD.
5. Place resistor R17 near Q4 and shall have a low-impedance connection to AGND_LSD.

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7 CSM92 Reference Modem Fabrication Information

7.1 CSM92 Reference Modem Fabrication Drawing Excerpts

Figure 7-1 through Figure 7-12 show excerpts from Conexant drawing G600Z-C00218R20. Consult the actual drawings for complete information.

Figure 7-1. ASY1: Top Assembly

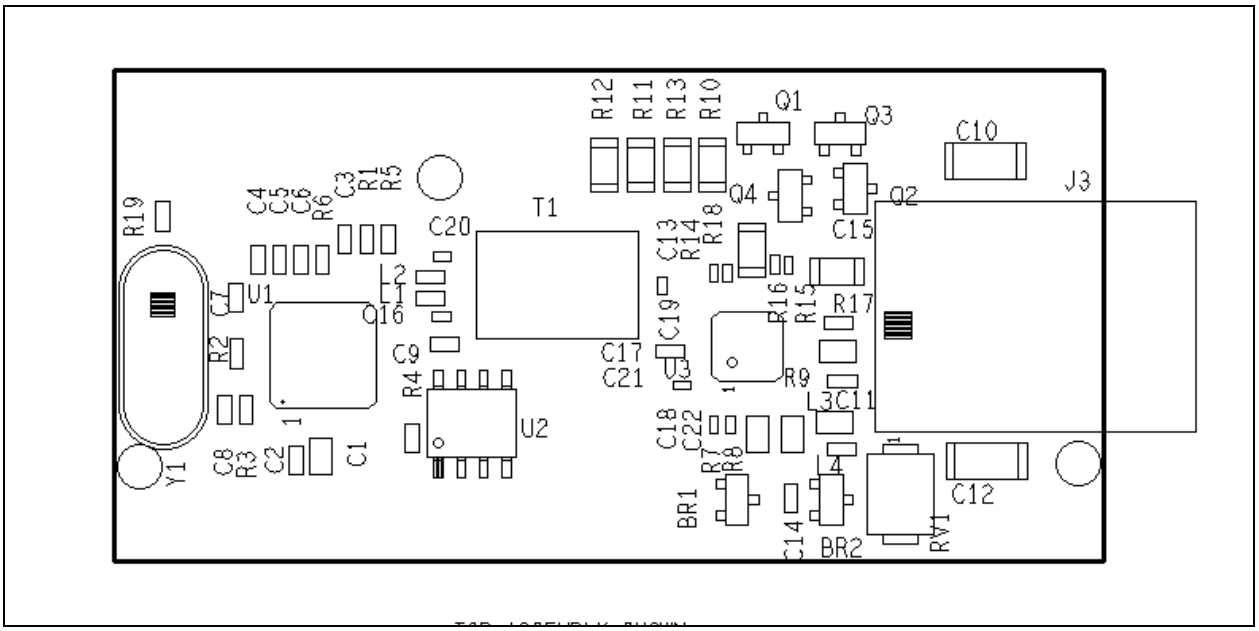


Figure 7-2. ASY2: Bottom Assembly

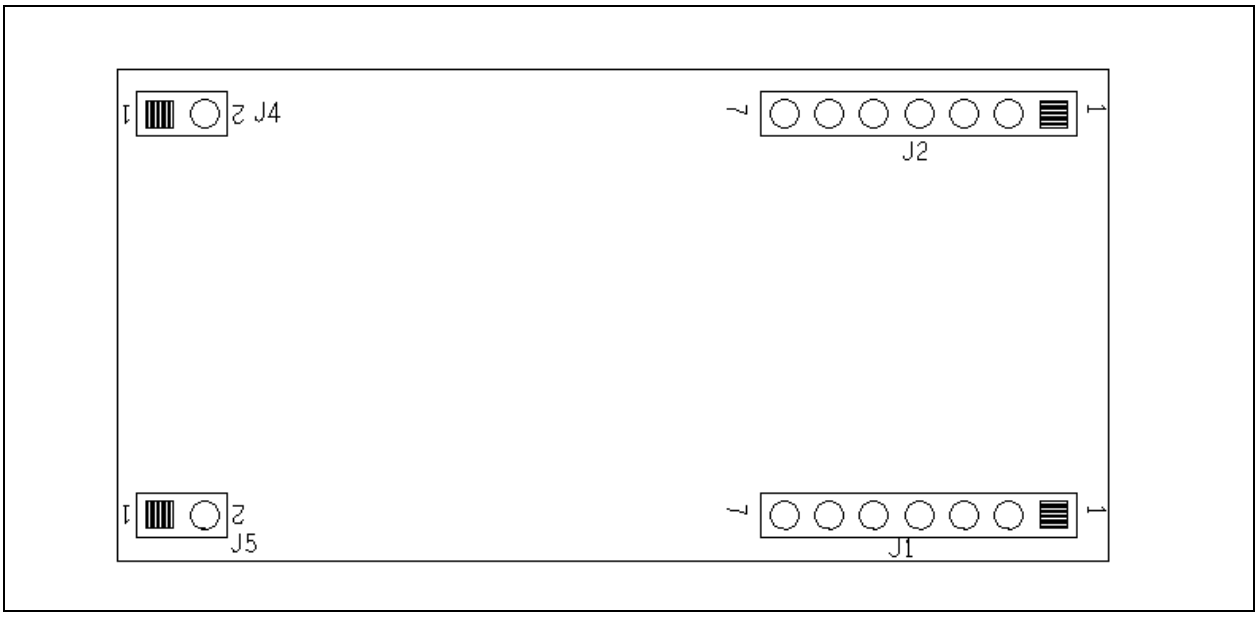


Figure 7-3. FAB1: Drill

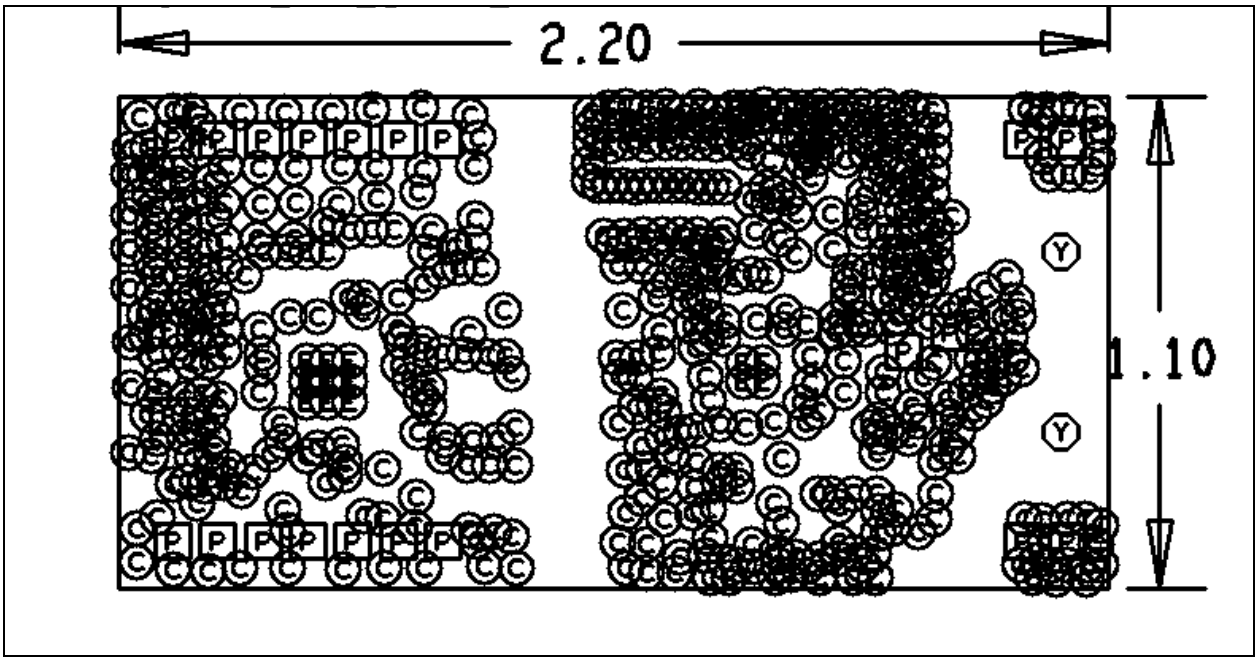


Figure 7-4. BOTTOM: Copper Bottom

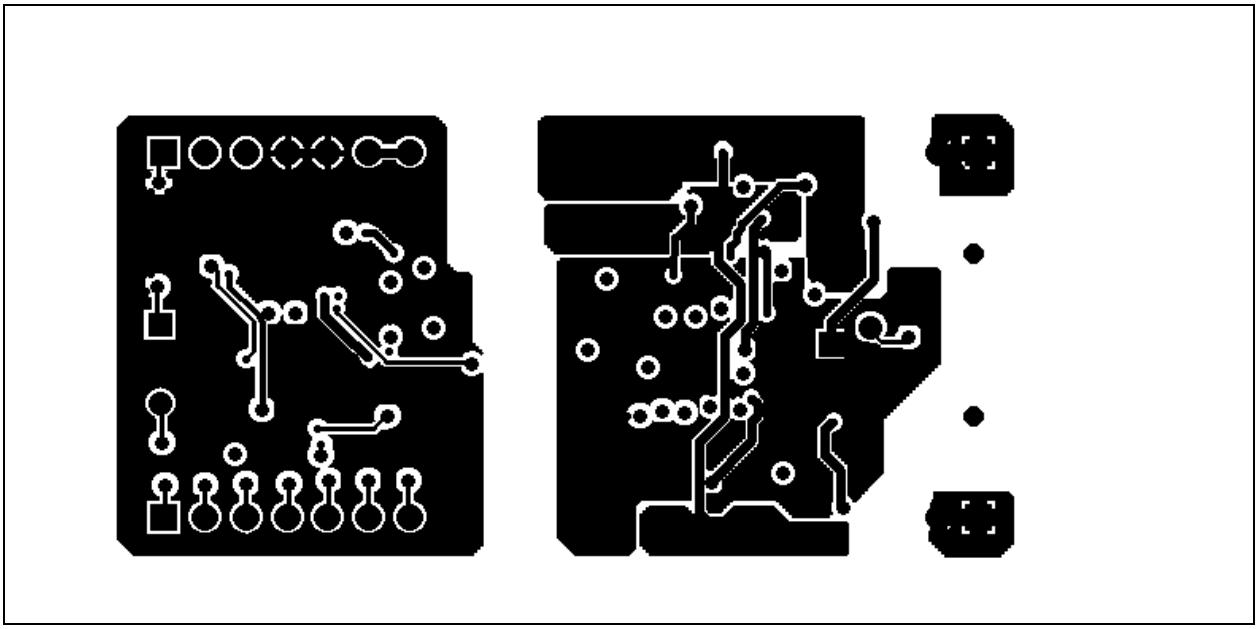


Figure 7-5. TOP: Copper Top

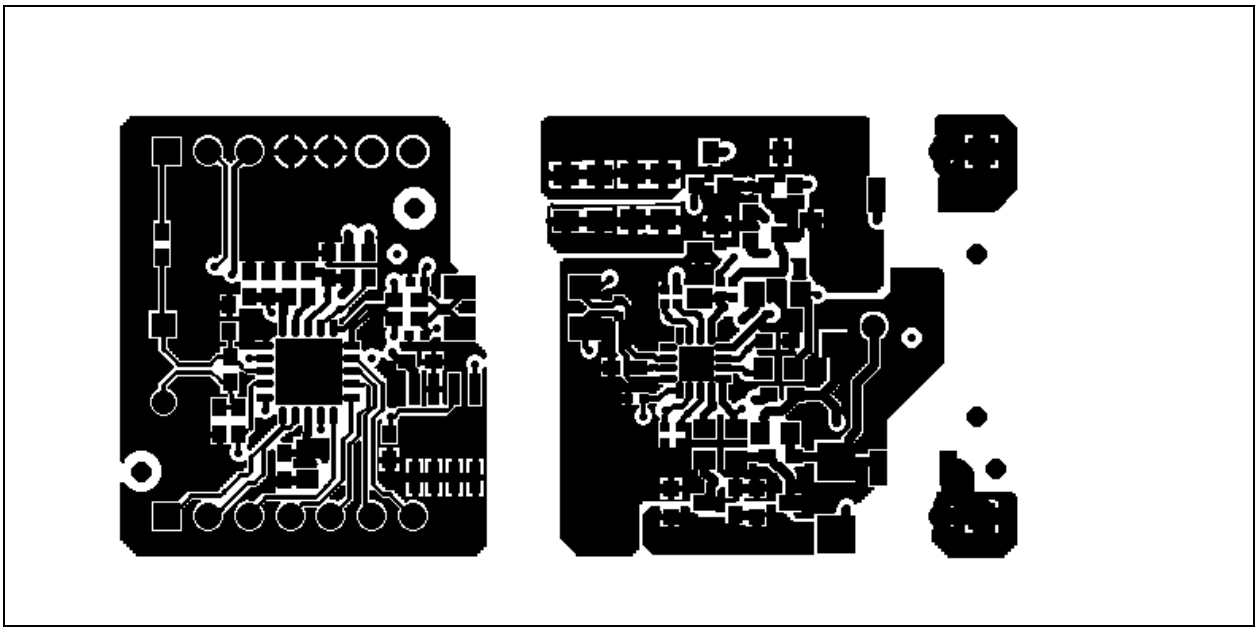


Figure 7-6. LYR2_GND: Layer 2 Ground and Heatsink Planes

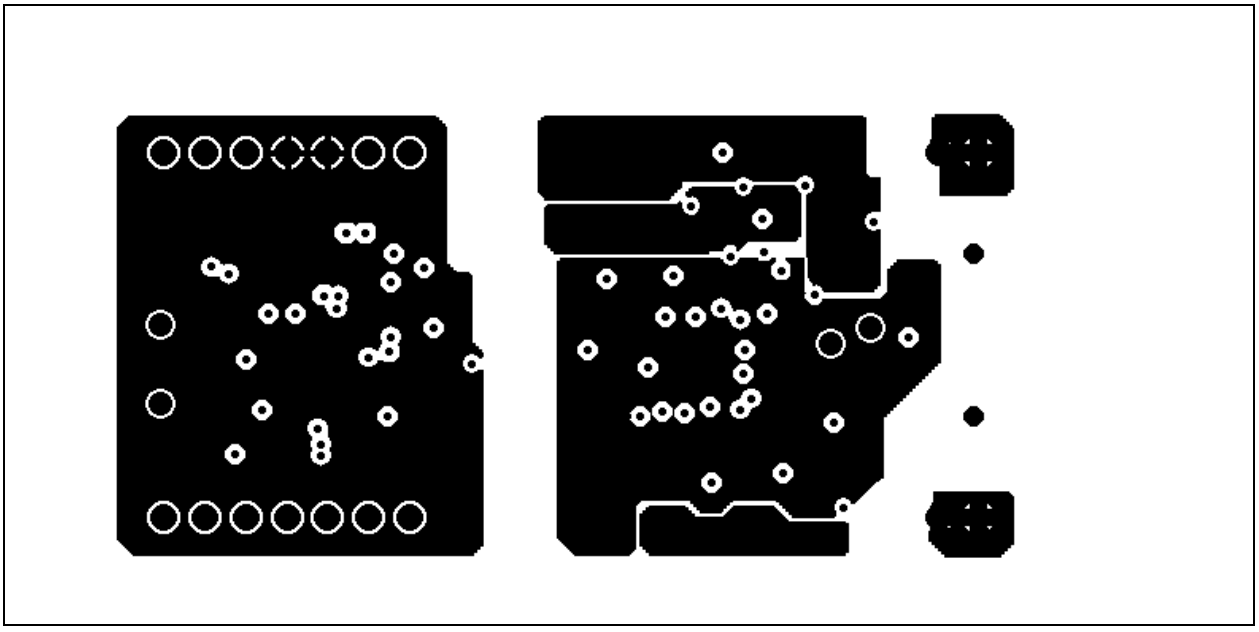


Figure 7-7. LYR3_PWR: Layer 3 Power, Ground, and Heatsink Planes

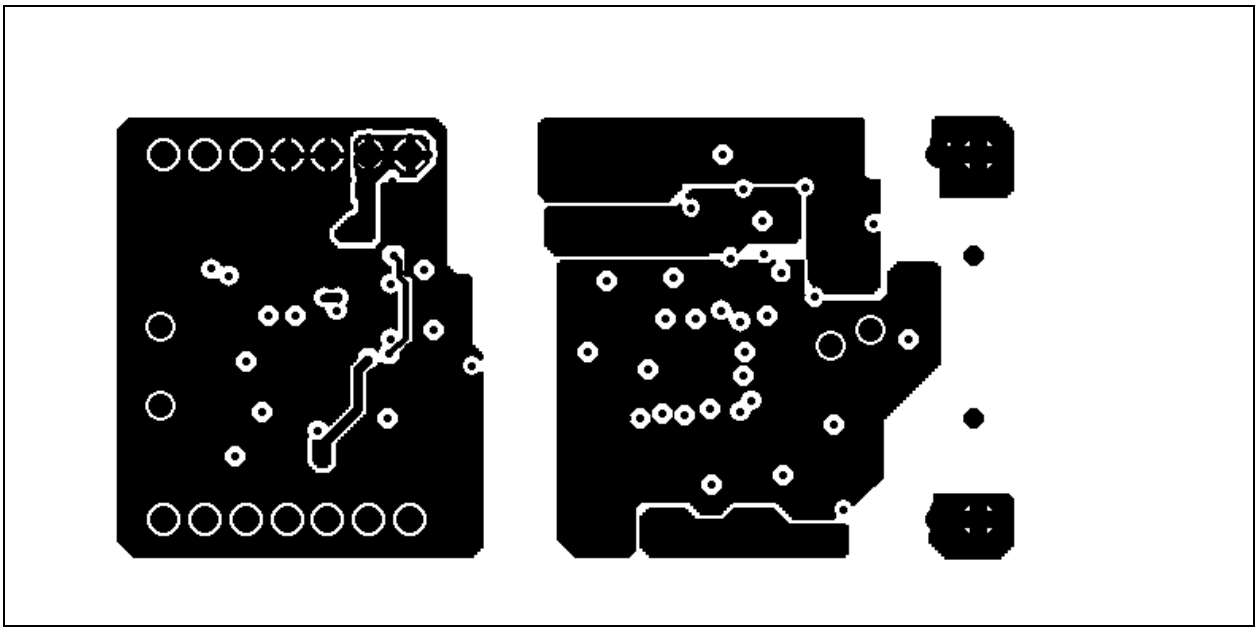


Figure 7-8. MASKBOT: Solder Mask Bottom

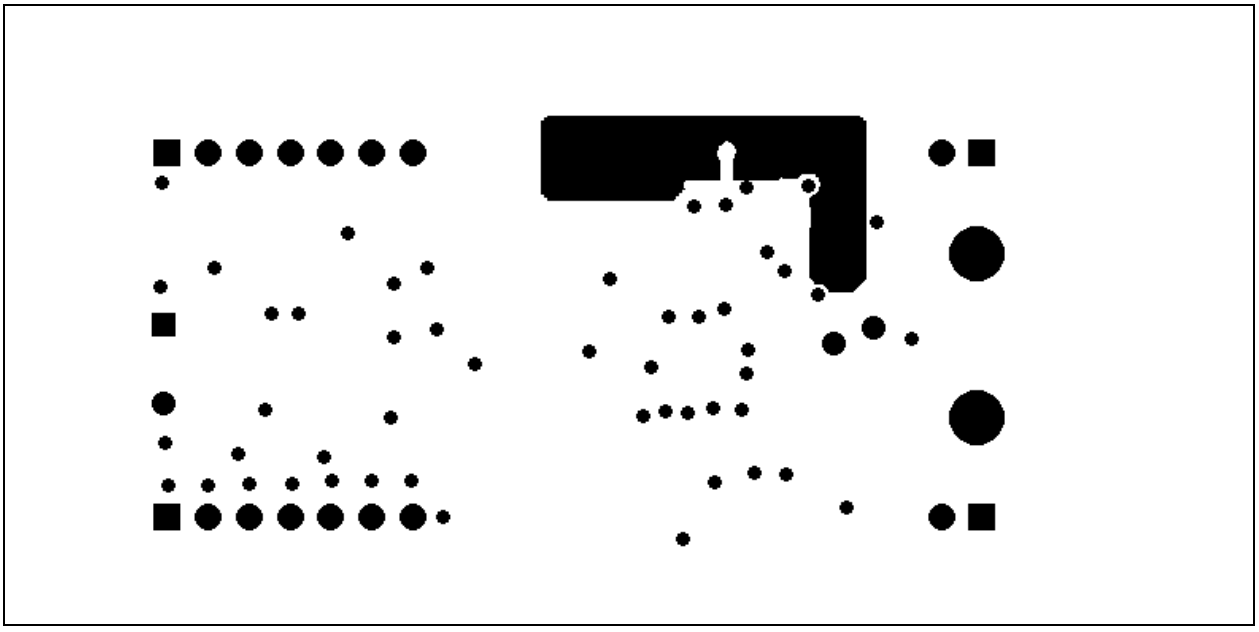


Figure 7-9. MASKTOP: Solder Mask Top

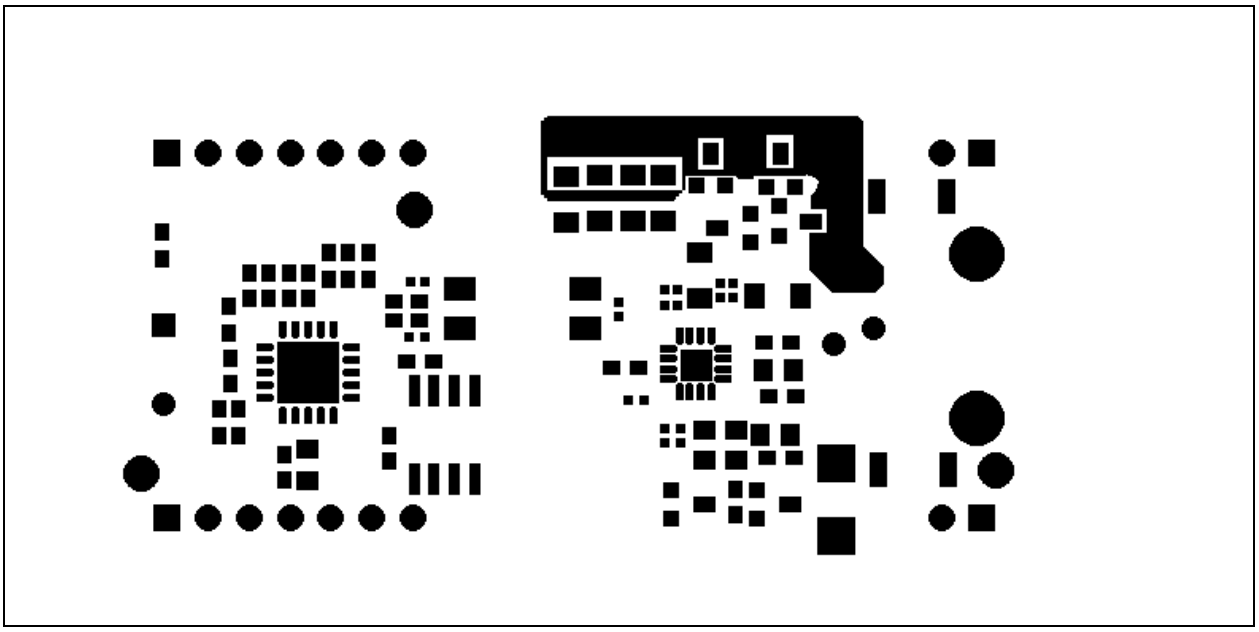


Figure 7-10. PASTETOP: Solder Paste Top

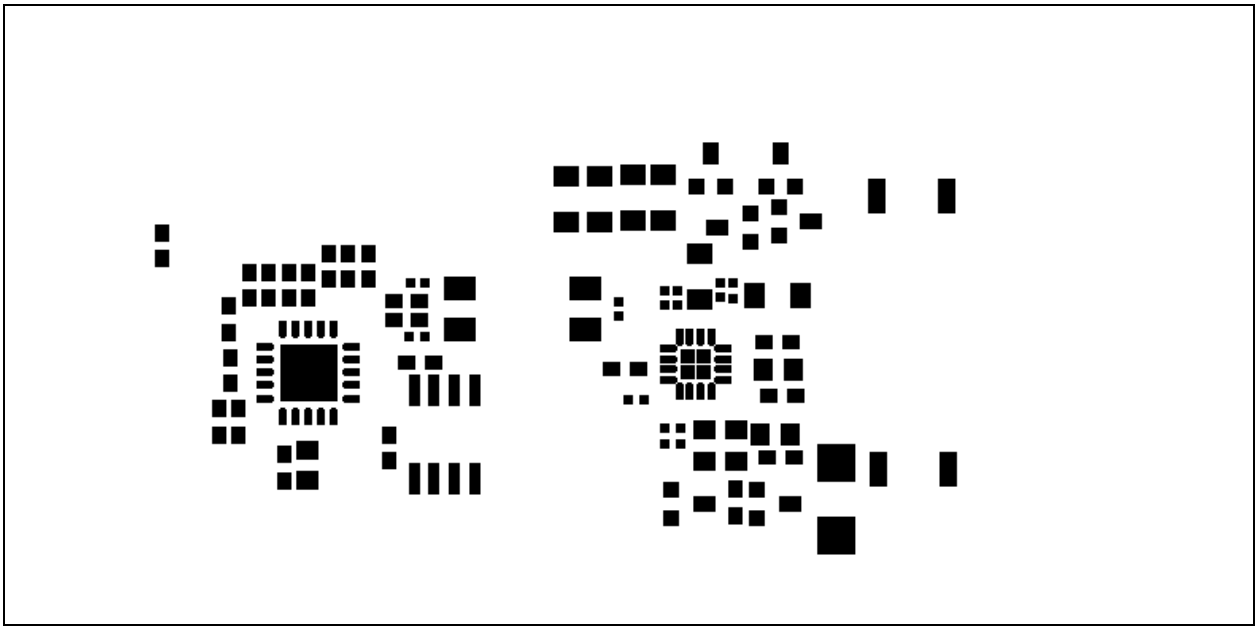


Figure 7-11. SILKBOT: Silkscreen Bottom

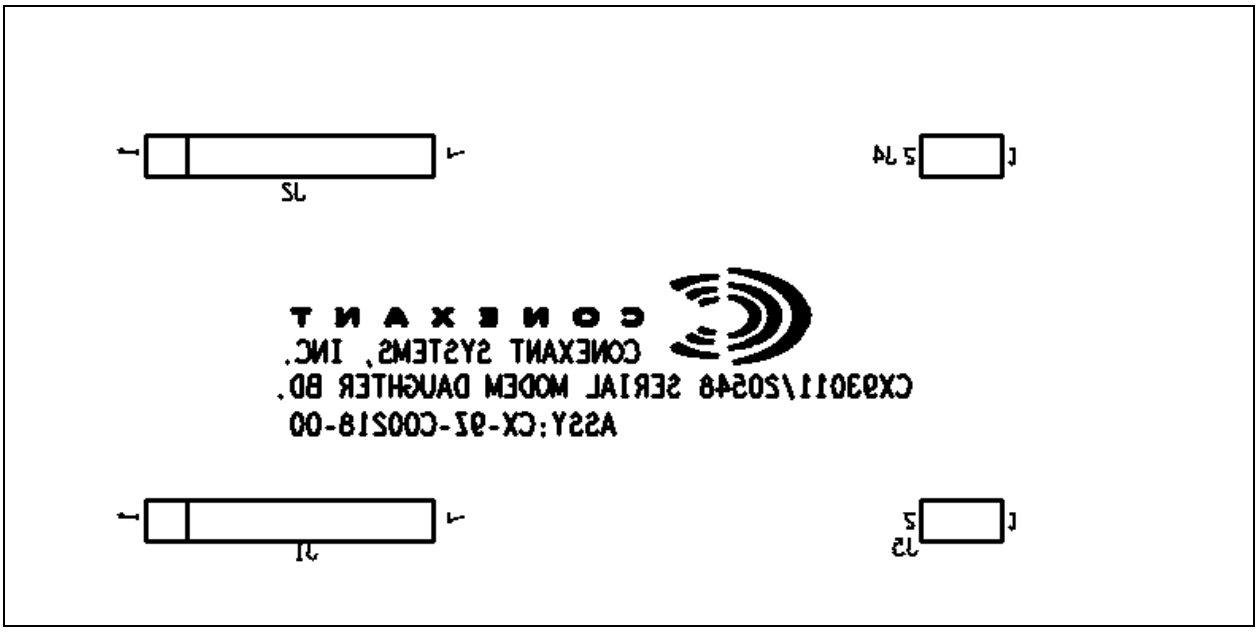
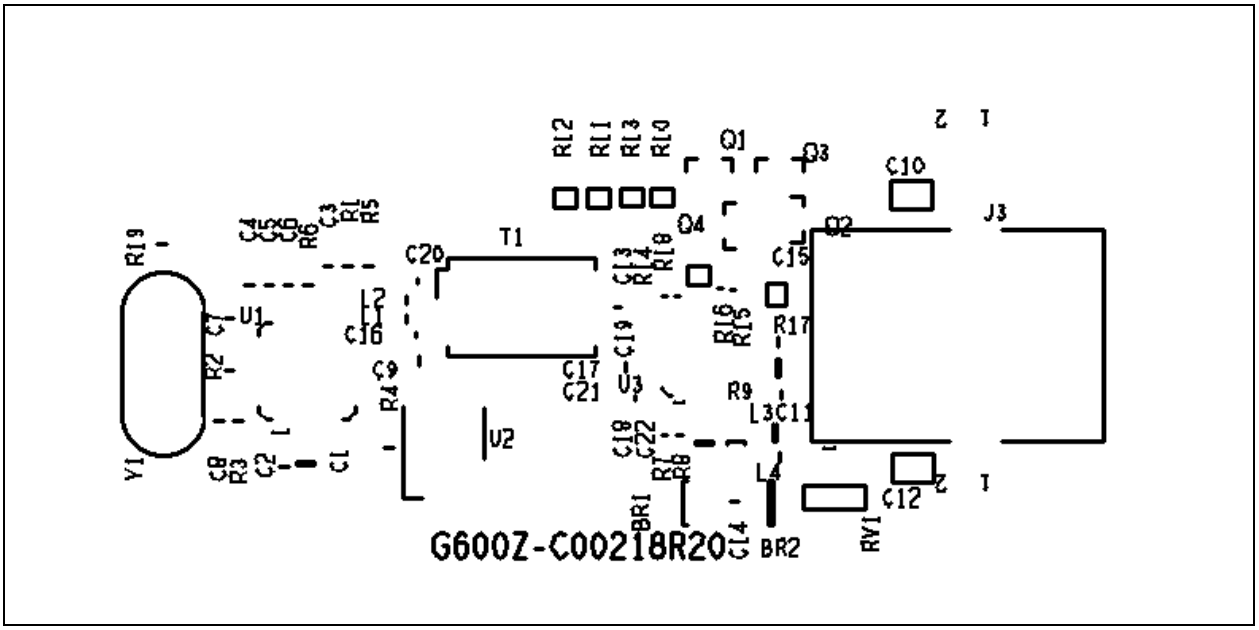


Figure 7-12. SILKTOP: Silkscreen Top



7.2 CSM92 Reference Modem BOM

The bill of materials (BOM) for the CSM92 Reference Modem is listed in Table 7-1.

Table 7-1. BOM for CSM92 Reference Modem

Item	Qty	Reference Designator	Description	Value	Package	Manufacturing Number (Vendor)	Notes
1	1	BD1	PCB; G600Z-C00218; CSM92 Reference Modem Board	PCB	PCB		C
2	2	BR1, BR2	diode; SOT-23; MMBD3004S; dual-in ser; 350V; 225mA	MMBD3004S	SOT-23	CMPD2005S LEAD FREE (CENTRAL SEMICONDUCTOR) MMBD3004S (DIODES INC)	C
3	1	C1	ceramic capacitor/X5R; 0805; 16V; 10%; 4.7uF	4.7uF	SMD-0805	0805YD475KAT2A (AVX) C0805C475K4PAC (KEMET) CMC-016/475KX50805TF (TECATE) C0805X5R160-475KNE (VENKEL LTD.) 0805X475K160CT (WALSIN)	
4	4	C2, C6, C9, C17	ceramic capacitor/X7R; 0603; 16V; 20%; 0.1uF	0.1uF	SMD-0603	0603YC104MAT2A (AVX) C0603C104M4RAC (KEMET) 0603B104M160N (NOVACAP)	
5	2	C3, C5	ceramic capacitor/X7R; 0603; 50V; 20%; 0.01uF	0.01uF	SMD-0603	GMC10X7R103M50NT-LF (CAL-CHIP) CC0603X103M3OST (COMPOSTAR) 500R14W103MV4E (JOHANSON DIELECTRICS INC.) C0603C103M5RAC (KEMET) CL10B103MB8NNNC (SAMSUNG ELECTRO MECHANICS)	
6	1	C4	ceramic capacitor/X5R; 0603; 16V; 10%; 1uF	1uF	SMD-0603	GMC10X5R105K16NT-LF (CAL-CHIP) ECJ1VB1C105K (PANASONIC) C0603X5R160-105KNE (VENKEL LTD.)	
7	2	C7, C8	ceramic capacitor/NPO; 0603; 50V; 5%; 33pF	33pF	SMD-0603	GMC10CG330J50NT-LF (CAL-CHIP) CC0603N330J3SST (COMPOSTAR) GRM1885C1H330JA01 (MURATA) CL10C330JB8NNNC (SAMSUNG) C1608C0G1H330J (TDK)	
8	2	C10, C12	ceramic capacitor/X7R-Y3; 1808; 3KV; 10%; 470pF	470pF	SMD-1808	SCC1808X471K302TS (HOLY STONE ENTERPRISE CO.) 302R29W471KV3E-****-SC (JOHANSON DIELECTRICS INC.) GA342QR7GD471KW01 (MURATA) LS1808B471K302NT (NOVACAP) 1808JA250471KXTSP (SYFER TECH.)	C
9	4	C13, C18, C21, C22	ceramic capacitor/X7R; 0402; 6.3V; 10%; 0.1uF	0.1uF	SMD-0402	GMC04X7R104K6R3NT-LF (CAL-CHIP) C0402C104K9RAC (KEMET) C1005X7R0J104KT (TDK) C0402X7R6R3-104KNP (VENKEL LTD.)	
10	1	C14	ceramic capacitor/X7R; 0603; 100V; 20%; 0.01uF	0.01uF	SMD-0603	CC0603X103M4OST (COMPOSTAR) C0603X103M101T (HOLY STONE ENTERPRISE CO.) 101R14W103MV4E (JOHANSON DIELECTRICS INC.) C1608X7R2A103M (TDK) CPH03T103M101X (TRIGON)	

Item	Qty	Reference Designator	Description	Value	Package	Manufacturing Number (Vendor)	Notes
11	1	C15	ceramic capacitor/X7R; 1206; 100V; 10%; 0.047uF	0.047uF	SMD-1206	CC1206X473K4OBT (COMPOSTAR) C1206X473K101T (HOLY STONE ENTERPRISE CO.) 1206B473K101NXT (NOVACAP) C3216X7R2A473K (TDK) CPH06T473K101X (TRIGON)	C
12	2	C16, C20	ceramic capacitor/NPO; 0402; 50V; 5%; 150pF	150pF	SMD-0402	GMC04CG151J50NT-LF (CAL-CHIP) CC0402N151J3SST (COMPOSTAR) GRM1555C1H151JA01 (MURATA) C1005C0G1H151JT (TDK) CMC-050/151JN0402TF (TECATE)	
13	1	C19	ceramic capacitor/NPO; 0402; 50V; 5%; 47pF	47pF	SMD-0402	CC0402N470J3SST (COMPOSTAR) GRM1555C1H470JZ01 (MURATA) ECJ0EC1H470J (PANASONIC) C1005C0G1H470JT (TDK) CPH02T470J500N (TRIGON)	
14	2	J1, J2	header connector; THD; plug; STRIP; 7P (7x1) 0.10in.; no shield; vertical	HDR 7X1	THD-SPECIAL		
15	1	J3	modular connector; THD; receptacle; RJ11 low profile; 6P2C; no shield; RA	RECP RJ11	THD-SPECIAL		
16	2	J4, J5	header connector; THD; plug; strip; 2P (2x1) 0.10in.; no shield; vertical	HDR 2x1	THD	CA-S02-24B-44 (CIRCUIT ASSEMBLY) TSW-102-07-G-S (SAMTEC)	
17	3	L1, L2, R1	resistor; 0603; 1A-50 MΩ; 1/10W; 0Ω	0	SMD-0603	RM06J000CT-LF (CAL-CHIP) CR030000J001 (COMPOSTAR) RK73Z1JTTD (KOA-SPEER ELECTRONICS) ERJ3GEY0R00V (PANASONIC) CR0603-10W-000SNT (VENKEL LTD.)	
18	2	L3, L4	ferrite bead; 0603; MMZ1608; 300Ω @ 100MHz; 0.7Ω DCR; 300mA	300Ω @100MHz	SMD-0603	MMZ1608D301B (TDK)	C
19	4	Q1-Q4	transistor; SOT-23; MMBTA42; NPN; 300V; 500mA	MMBTA42	SOT-23	MMBTA42-7-F (DIODES INC) MMBTA42_NL (FAIRCHILD SEMICONDUCTOR) MMBTA42LT1G (ON SEMICONDUCTOR)	C
20	1	R2	resistor; 0603; 5%; 1/10W; 1.0MΩ	1M	SMD-0603	RMC1/16-105JTP (KAMAYA INC.) RK73B1JTTD105J (KOA-SPEER ELECTRONICS) ERJ3GEYJ105V (PANASONIC) MCR03EZPJ105 (ROHM) RCH0603J105T (TRIGON)	
21	1	R3	resistor; 0603; 5%; 1/10W; 33Ω	33	SMD-0603	RM06J330CT-LF (CAL-CHIP) CR030330J001 (COMPOSTAR) RK73B1JTTD330J (KOA-SPEER ELECTRONICS) ERJ3GEYJ330V (PANASONIC) CR0603-10W-330JT (VENKEL LTD.)	

Item	Qty	Reference Designator	Description	Value	Package	Manufacturing Number (Vendor)	Notes
22	1	R6	resistor; 0603; 5%; 1/10W; 240KΩ	240KΩ	SMD-0603	RMC1/16-244JTP (KAMAYA INC.) RK73B1JTTD244J (KOA-SPEER ELECTRONICS) ERJ3GEYJ244V (PANASONIC) MCR03EZPJ244 (ROHM) RCH0603J244T (TRIGON)	
23	2	R7, R8	resistor; 0805; 1%; 1/8W; 6.81MΩ	6.81MΩ	SMD-0805	CR21-6814FL (ASJ COMPONENTS) RMC1/10-6814FTP (KAMAYA INC.) CR0805-8W-6814FT (VENKEL LTD.) 9C08052A6814FKPFT (YAGEO)	
24	1	R9	resistor; 0805; 1%; 1/8W; 237KΩ	237KΩ	SMD-0805	RK73H2ATTE2373F (KOA-SPEER ELECTRONICS) MCR10EZPF2373 (ROHM) RCH0805F2373T (TRIGON) CR0805-8W-2373FT (VENKEL LTD.) 9C08052A2373FKPFT (YAGEO)	
25	4	R10-R13	resistor; 1206; 1%; 1/4W; 280Ω	280Ω	SMD-1206	RM12F2800CT-LF (CAL-CHIP) CR06280RF001 (COMPOSTAR) RK73H2BTTD2800F (KOA-SPEER ELECTRONICS) ERJ8ENF2800V (PANASONIC) CR1206-4W-2800-FSNT (VENKEL LTD.)	
26	1	R14	resistor; 0402; 5%; 1/16W; 100Ω	100Ω	SMD-0402	RMC1/16S-101JTH (KAMAYA INC.) RK73B1ETTD101J (KOA-SPEER ELECTRONICS) ERJ2GEJ101X (PANASONIC) CR0402-16W-101JT (VENKEL LTD.) CRCW0402101JNED (VISHAY DALE)	
27	2	R15, R16	resistor; 0402; 1%; 1/16W; 3.01Ω	3.01Ω	SMD-0402	CR10-3R01FK (ASJ COMPONENTS) RM04F3R01CT-LF (CAL-CHIP) CR023R01F002 (COMPOSTAR) RK73H1ETTP3R01F (KOA-SPEER ELECTRONICS) CR0402-16W-3R01FT (VENKEL LTD.)	
28	1	R17	resistor; 0603; 5%; 1/10W; 110Ω	110Ω	SMD-0603	RMC1/16-111JTP (KAMAYA INC.) RK73B1JTTD111J (KOA-SPEER ELECTRONICS) ERJ3GEYJ111V (PANASONIC) MCR03EZPJ111 (ROHM) RCH0603J111T (TRIGON)	
29	1	R18	resistor; 1206; 5%; 1/4W; 9.1Ω	9.1Ω	SMD-1206	RMC1/8-9R1JTP (KAMAYA INC.) RK73B2BTTD9R1J (KOA-SPEER ELECTRONICS) RCH1206J9R1T (TRIGON) CR1206-4W-9R1JT (VENKEL LTD.)	
30	1	RV1	thyristor; DO-214AA; bidirectional; 275V; 120A	275V_120A	DO-214AA	TISP4350T3BJR-S (BOURNS) TB3100M-13-F (DIODES INC)	C
31	1	T1	transformer/SUP; SMD; 1.67:1; SmartDAA; 2800V; 30uH	T_1.67:1	SMD-SPECIAL	835-00252F (E & E MAGNETIC PRODUCTS LTD) LAN0019-01G (LINKCOM) LAN0066-50 (LINKCOM) 82154R-LF1 (MIDCOM) ESMIT-4164 (SUMIDA)	C

Item	Qty	Reference Designator	Description	Value	Package	Manufacturing Number (Vendor)	Notes
32	1	U1	IC, CX93011 V.92/V.34/V.32bis Modem; QFN-20EP	CX93011	QFN-20EP	(CONEXANT) RoHS	C
33	1	U2	IC, EEPROM; SO-8; serial 2-wire; 256Kb (32Kx8); INDT; 1.8-3.6V	EEPROM 256Kb	SO-8	AT24C256BN-10SU-1.8 (ATMEL) 24AA256T-ISNG (MICROCHIP TECH.)	
34	1	U3	IC, CX20548 SmartDAA; QFN-16; COMT; 3.3V	CX20548-11Z	QFN-16	(CONEXANT) RoHS	C
35	1	Y1	quartz crystal; THD-HC49US; fundamental; 30 FT/30 FS; -10C to 60C; 18pF; 40Ω; 28.224MHz	28.224MHz	THD-HC49US	XAT028224FI1H-O (HARMONY ELECTRONICS CORP) NXS28.224AC18F (NSK JENJAAN QUARTEK CORPORATION)	C
36	1	C11	ceramic capacitor/X7R; 0805; 200V; 10%; 4700pF	4700pF	SMD-0805	08052C472KAT2A (AVX) GMC21X7R472K200NT-LF (CAL-CHIP) CMC-200/472KX0805TF (TECATE)	DNE
37	2	R4, R5	resistor; 0603; 5%; 1/10W; 10KΩ	10KΩ	SMD-0603	RMC1/16-103JTP (KAMAYA INC.) RK73B1JTTD103J (KOA-SPEER ELECTRONICS) ERJ3GEYJ103V (PANASONIC) MCR03EZPJ103 (ROHM) RCH0603J103T (TRIGON)	DNE
38	1	R19	resistor; 0603; 1A-50MΩ; 1/10W; 0Ω	0Ω	SMD-0603	RM06J000CT-LF (CAL-CHIP) CR030000J001 (COMPOSTAR) RK73Z1JTTD (KOA-SPEER ELECTRONICS) ERJ3GEY0R00V (PANASONIC) CR0603-10W-000SNT (VENKEL LTD.)	DNE

Notes Legend:

C = Critical; must use the specified source(s).

DNE = Do not equip (non-installed components)

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8 Motherboard Fabrication Information

8.1 Motherboard Fabrication Drawing Excerpts

Figure 8-1 through Figure 8-10 show excerpts from Conexant drawing G600Z-C00217R20. Consult the actual drawings for complete information.

Figure 8-1. ASY1: Top Assembly

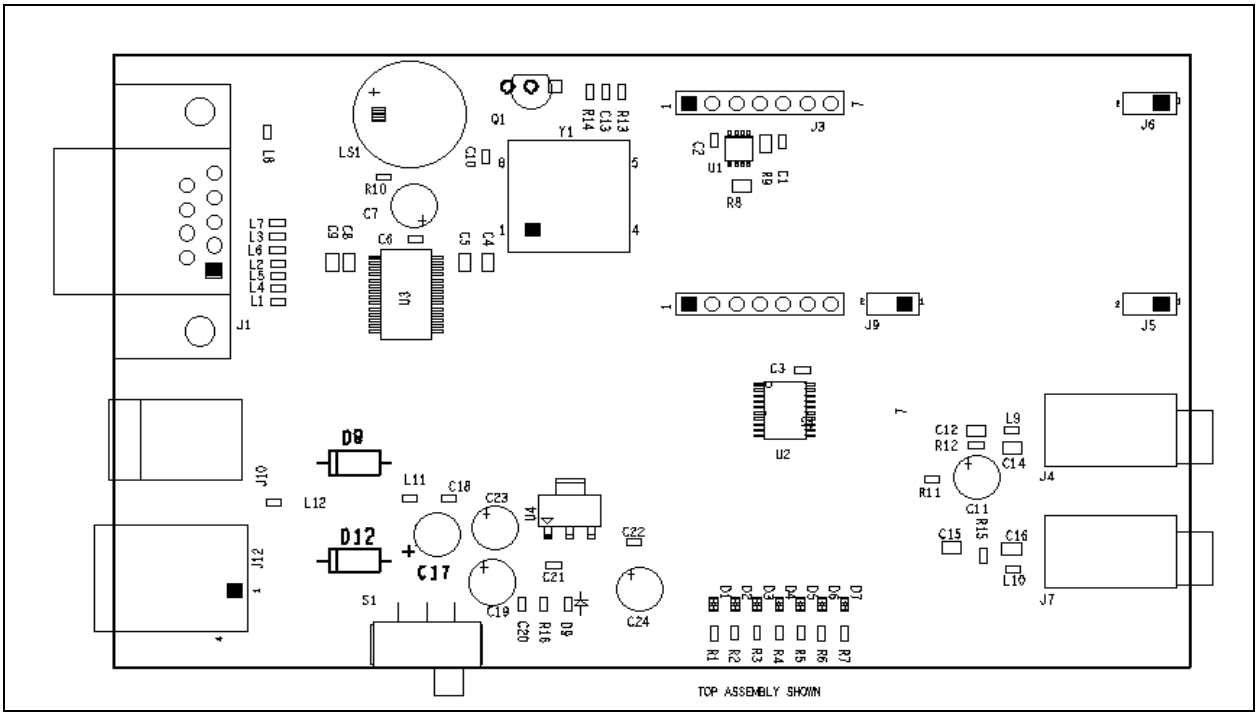


Figure 8-2. FAB1: Drill

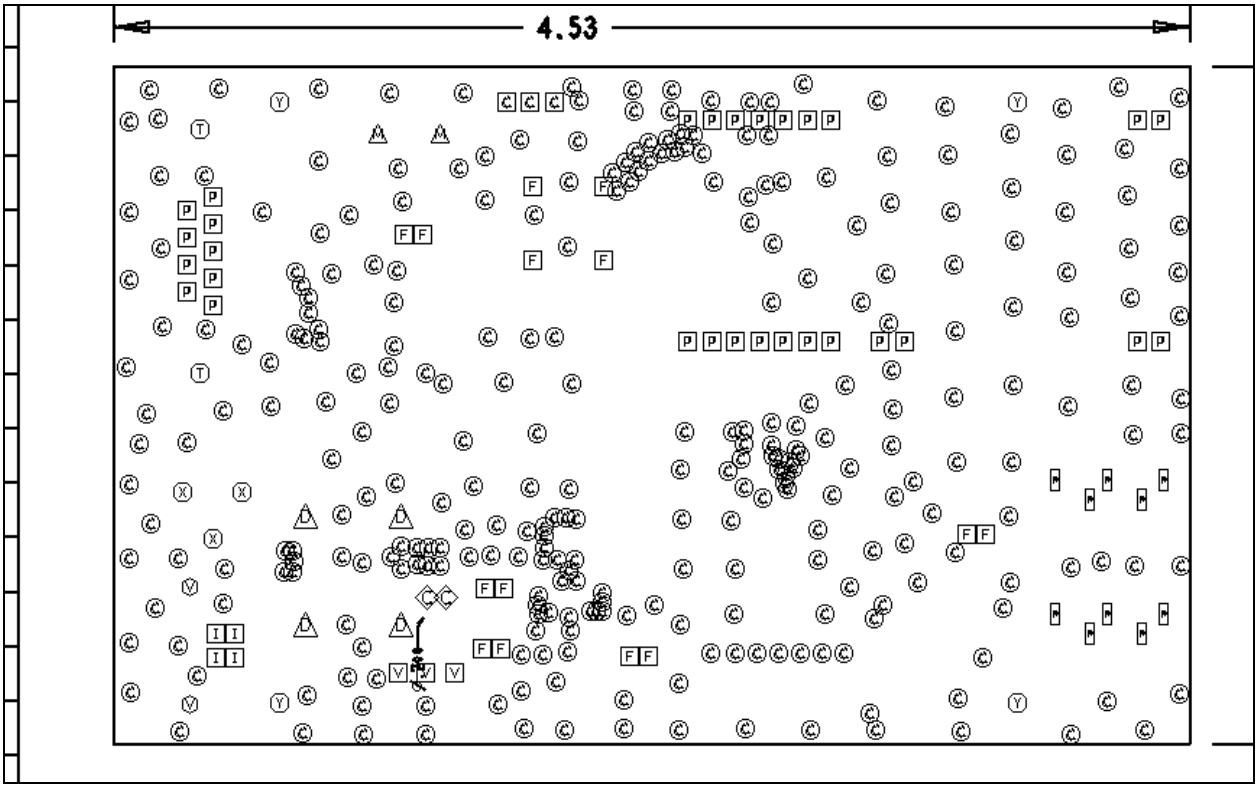


Figure 8-3. BOTTOM: Copper Bottom

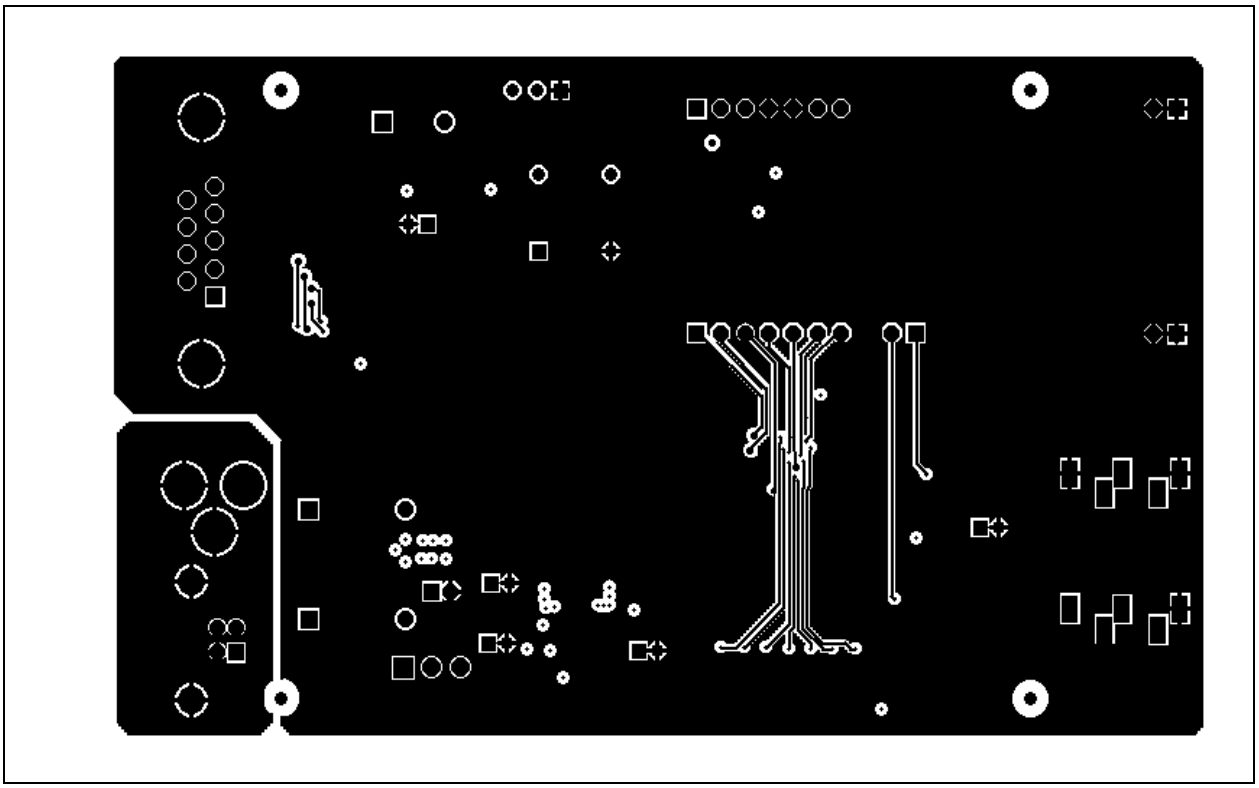


Figure 8-4. TOP: Copper Top

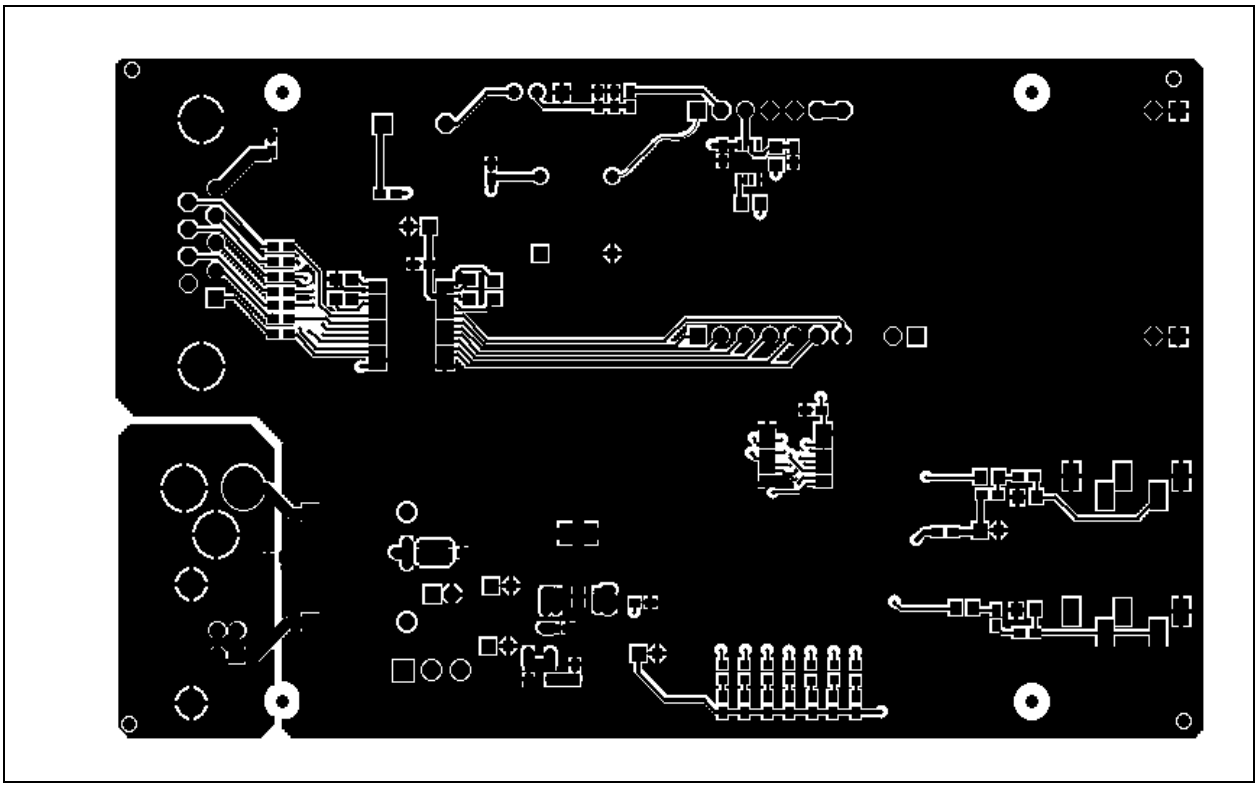


Figure 8-5. LYR2_GND: Layer 2 Ground Planes

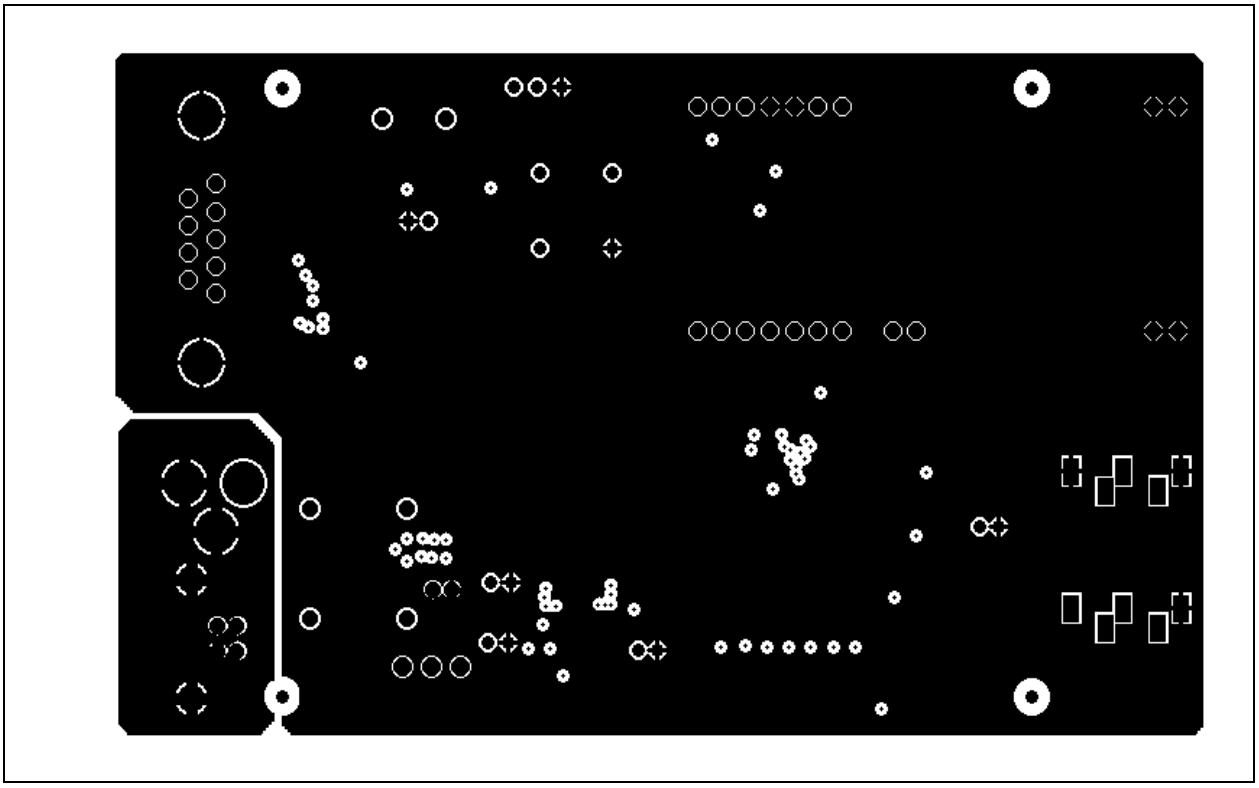


Figure 8-6. LYR3_PWR: Layer 3 Power and Ground Planes

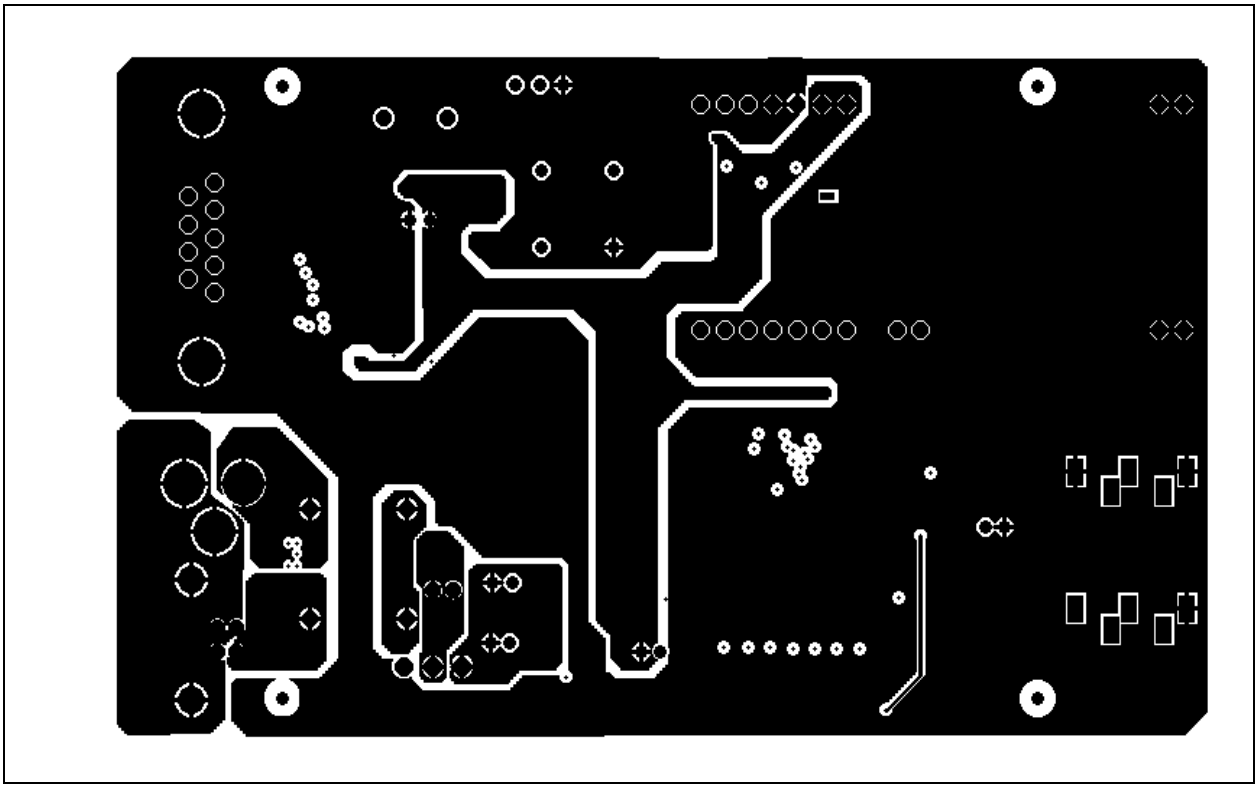


Figure 8-7. MASKBOT: Solder Mask Bottom

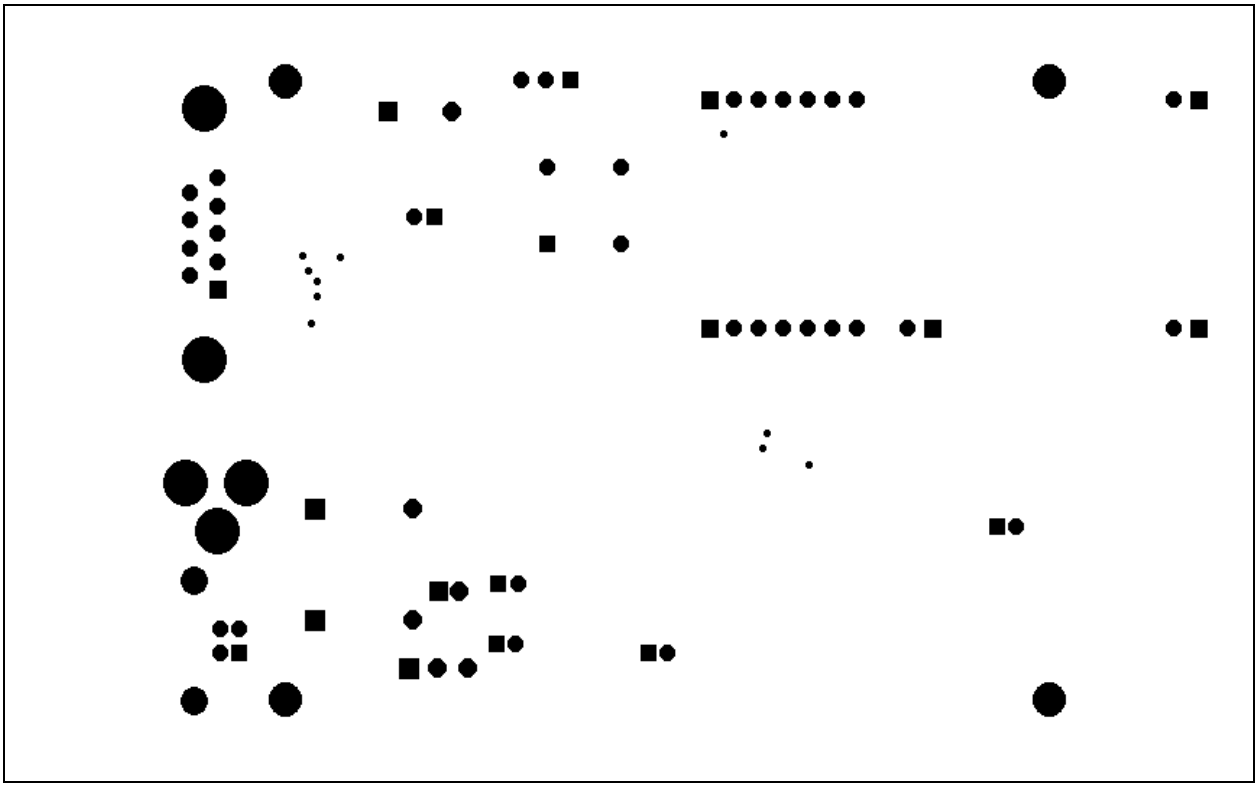


Figure 8-8. MASKTOP: Solder Mask Top

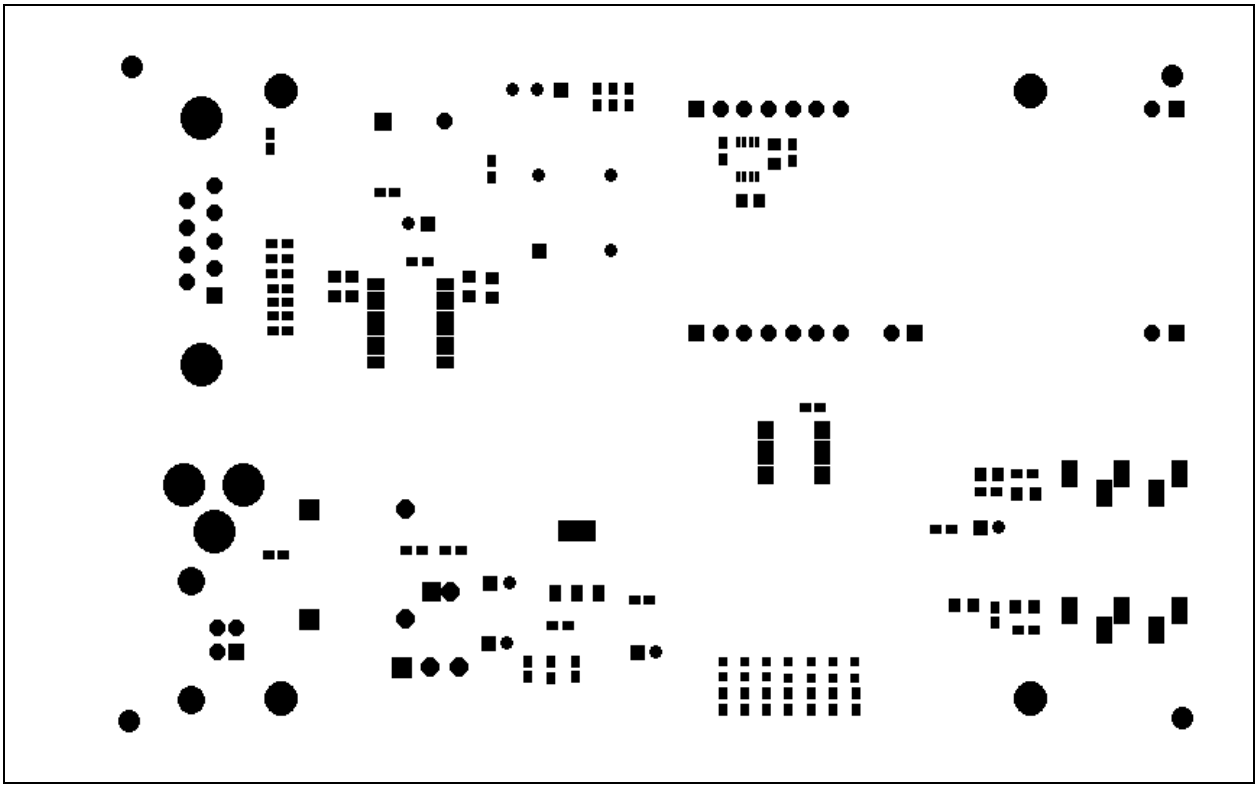


Figure 8-9. PASTETOP: Solder Paste Top

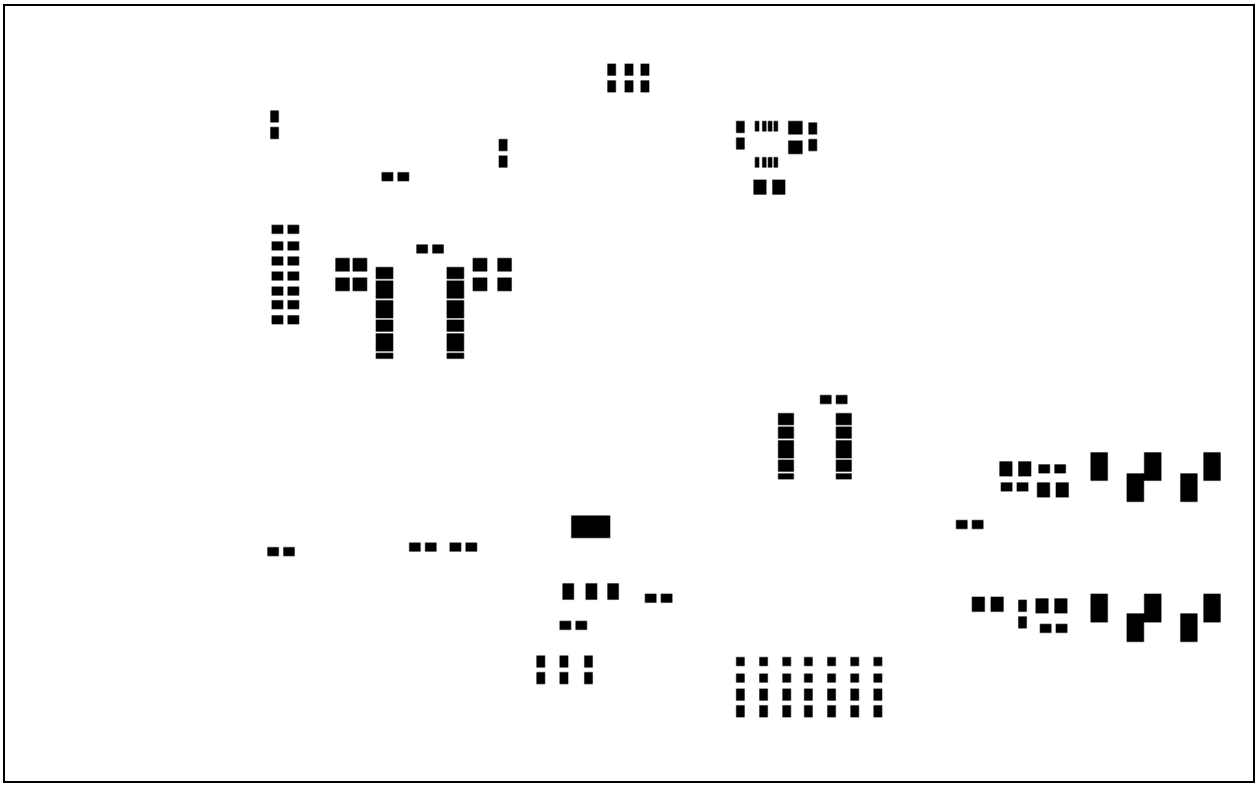
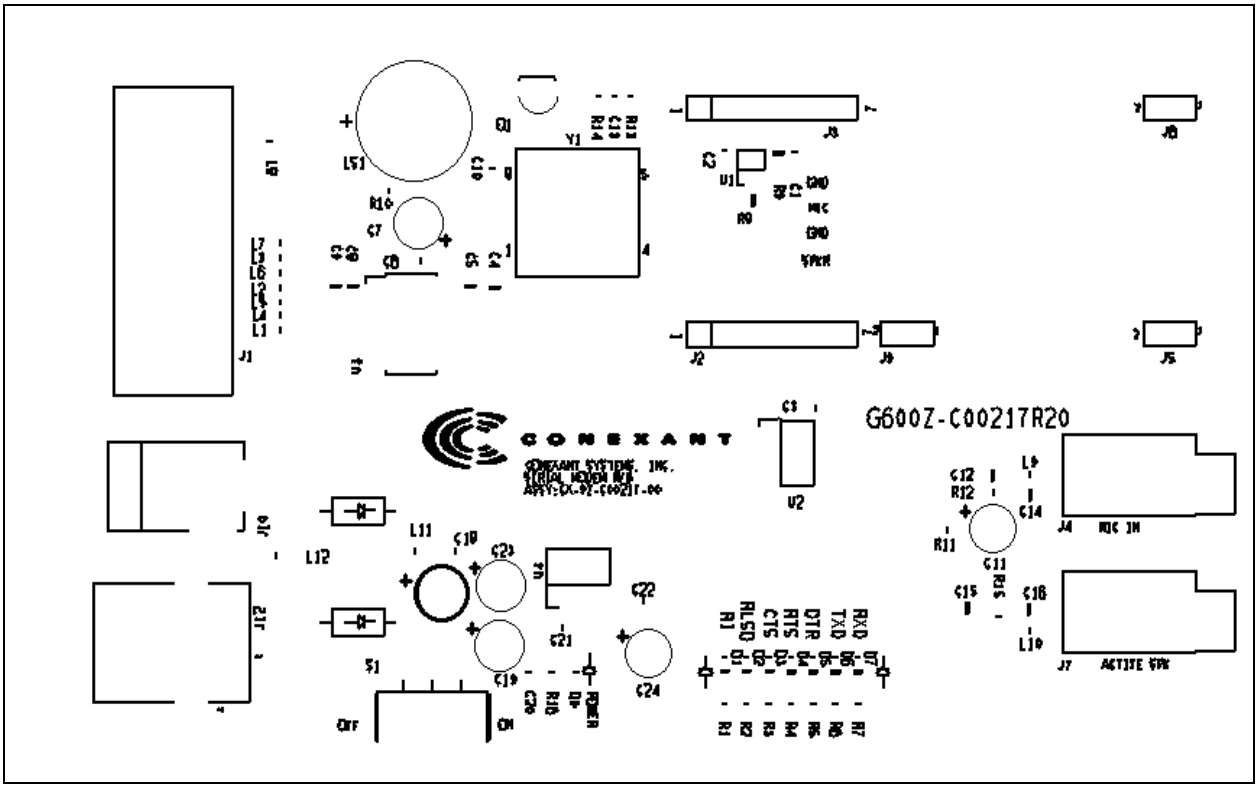


Figure 8-10. SILKTOP: Silkscreen Top



8.2 Motherboard BOM

The BOM for the Motherboard is listed in Table 8-1.

Table 8-1. BOM for Motherboard

Item	Qty	Reference Designator	Description	Value	Package	Manufacturing Number (Vendor)	Notes
1	1	BD1	PCB; G600Z-C00217; Serial Motherboard	PCB	PCB		C
2	8	C1-C3, C6, C18, C20-C22	ceramic capacitor/X7R; 0603; 50V; 10%; 0.1uF	0.1uF	SMD-0603	GMC10X7R104K50NT-LF (CAL-CHIP) 0603B104K500N (NOVACAP) ECJ1VB1H104K (PANASONIC) C1608X7R1H104K (TDK) C0603X7R500-104KN (VENKEL LTD.)	
3	1	C4	ceramic capacitor/X7R; 0805; 16V; 10%; 0.22uF	0.22uF	SMD-0805	0805YC224KAT2A (AVX) 160R15W224KV4TX (JOHANSON DIELECTRICS INC.) C0805C224K4RAC (KEMET) GRM21BR71C224KA01 (MURATA) ECJ2VB1C224K (PANASONIC)	
4	3	C5, C8, C9	ceramic capacitor/Y5V; 0805; 16V; +80/-20%; 1uF	1uF	SMD-0805	0805YG105ZAT2A (AVX) 160R15Y105ZV4E (JOHANSON DIELECTRICS INC.) EMK212F105ZG-T (TAIYO YUDEN)	
5	5	C7, C11, C19, C23, C24	capacitor; RAD-STRT; 16V; 20%; 0.75Ω ESR; 10uF	10uF	RADIAL	ECRE100M0160511ECC (EVERCON)	
6	2	C12, C15	ceramic capacitor/X7R; 0805; 10V; 10%; 1uF	1uF	SMD-0805	0805ZC105KAT2A (AVX) GMC21X7R105K10NT-LF (CAL-CHIP) C0805C105K8RAC (KEMET) LMK212BJ105KG (TAIYO YUDEN) C2012X7R1A105K (TDK)	
7	1	C13	ceramic capacitor/X7R; 0603; 16V; 20%; 0.047uF	0.047uF	SMD-0603	GMC10X7R473M16NT-LF (CAL-CHIP) CC0603X473M1OST (COMPOSTAR) C0603C473M4RAC (KEMET) CMC-016/473MX0603TF (TECATE) C0603X7R160-473MNP (VENKEL LTD.)	
8	2	C14, C16	ceramic capacitor/X7R; 0805; 50V; 10%; 1000pF	1000pF	SMD-0805	GMC21X7R102K50NT-LF (CAL-CHIP) CC0805X102K3OBB (COMPOSTAR) 500R15W102KV6T (JOHANSON DIELECTRICS INC.) CL21B102KBANNNC (SAMSUNG ELECTRO MECHANICS) C2012X7R1H102K (TDK)	
9	1	C17	aluminum electrolytic capacitor/; RAD-STRT; 16V; 20%; 47uF	47uF	RADIAL	ECA1CM470 (PANASONIC)	
10	7	D1-D7	light emitting diode (LED);; 0603; XZMG53W; green; 14mcd; 25mA	GRN	SMD-0603	XZMG53W (SUNLED)	
11	2	D8, D12	diode rectifier; AXIAL; 1N4001; general purpose; 50V; 1A	1N4001GP	AXIAL	1N4001GP (FAIRCHILD SEMICONDUCTOR)	
12	1	D9	light emitting diode (LED); 0603; LTST-C190CKT; red; 10mcd; 40mA	RED	SMD-0603	LTST-C190CKT (LITE-ON)	

Item	Qty	Reference Designator	Description	Value	Package	Manufacturing Number (Vendor)	Notes
13	1	J1	DSUB connector; THD; receptacle; threaded insert w/ BRD LK; 9P; shield; RA	SKT DB9	THD-SPECIAL	DE09-SL-24 (ADAM TECH.) MR-7500-09F-1-N-2-A (MICRO-RAY) 5747844-4 (TYCO-AMP)	
14	2	J2, J3	SKT connector; THD; receptacle; strip; 7P (7x1) 0.10in.; no shield; vertical	SKT 7x1	THD-SPECIAL	SSW-107-01-G-S (SAMTEC)	
15	2	J4, J7	audio connector; THD; RECP; 3.5mm stereo BLK; 5P; shield; RA	AUDIO JACK	THD-SPECIAL	SJ1-3535N (CUI INC.)	
16	3	J5, J6, J9	SKT connector; THD; receptacle; strip; 2P (2x1) 0.10in.; no shield; vertical	SKT 2x1	THD-SPECIAL	SSQ-102-01-T-S (SAMTEC)	
17	1	J10	power connector; THD; receptacle; 2.5mm/ 12VDC@1A; 3P; no shield; RA	PWR JACK	THD-SPECIAL	RDJ-005B-NL (RDI ELECTRONICS)	
18	1	J12	modular connector; THD; receptacle; USB type B BLK; 4P; shield; RA	SKT USB B	THD-SPECIAL	MR-USB-03-RH-HT (MICRO-RAY) 292304-1 (TYCO-AMP) G3700-4ABT1S5W (WIESON)	
19	12	L1-L12	ferrite bead; 0603; EXC3BP; 120Ω @ 100MHz; 0.1Ω DCR; 500mA	120Ω @100MHz	SMD-0603	EXC3BP121H (PANASONIC)	
20	1	LS1	speaker; THD-CYL; 12mm Dia; 50Ω; 3.3V	0.130W	THD-CYLINDRICAL	DMT-1206-3.3-NL (RDI ELECTRONICS)	
21	1	Q1	transistor; TO-92; 2222; NPN; 30V; 600mA	2222	TO-92	PN2222TFR (FAIRCHILD SEMICONDUCTOR) MPS2222RLRAG (ON SEMICONDUCTOR)	
22	8	R1-R7, R16	resistor; 0603; 5%; 1/10W; 270Ω	270Ω	SMD-0603	RMC1/16-271JTP (KAMAYA INC.) RK73B1JTTD271J (KOA-SPEER ELECTRONICS) MCR03EZPJ271 (ROHM) RCH0603J271T (TRIGON) 9C06031A2700JPFT (YAGEO)	
23	1	R9	resistor; 0805; 5%; 1/8W; 2.7MΩ	2.7MΩ	SMD-0805	RMC1/10-275JTP (KAMAYA INC.) RK73B2ATTD275J (KOA-SPEER ELECTRONICS) MCR10EZHJ275 (ROHM) RCH0805J275T (TRIGON) CRCW0805275JNEA (VISHAY DALE)	
24	1	R10	resistor; 0603; 5%; 1/10W; 82Ω	82Ω	SMD-0603	RM06J820CT-LF (CAL-CHIP) CR030820J001 (COMPOSTAR) RMC1/16-820JTP (KAMAYA INC.) RK73B1JTTD820J (KOA-SPEER ELECTRONICS) ERJ3GEYJ820V (PANASONIC)	
25	2	R11, R14	resistor; 0603; 5%; 1/10W; 10KΩ	10KΩ	SMD-0603	RMC1/16-103JTP (KAMAYA INC.) RK73B1JTTD103J (KOA-SPEER ELECTRONICS) ERJ3GEYJ103V (PANASONIC) MCR03EZPJ103 (ROHM) RCH0603J103T (TRIGON)	

Item	Qty	Reference Designator	Description	Value	Package	Manufacturing Number (Vendor)	Notes
26	1	R12	resistor; 0603; 5%; 1/10W; 2.2KΩ	2.2KΩ	SMD-0603	RMC1/16-222JTP (KAMAYA INC.) RK73B1JTTD222J (KOA-SPEER ELECTRONICS) ERJ3GEYJ222V (PANASONIC) MCR03EZPJ222 (ROHM) RCH0603J222T (TRIGON)	
27	1	R13	resistor; 0603; 5%; 1/10W; 1.0KΩ	1.0KΩ	SMD-0603	RM06J102CT-LF (CAL-CHIP) CR030102J001 (COMPOSTAR) RK73B1JTTD102J (KOA-SPEER ELECTRONICS) ERJ3GEYJ102V (PANASONIC) CR0603-10W-102JT (VENKEL LTD.)	
28	1	R15	resistor; 0603; 5%; 1/10W; 33Ω	33Ω	SMD-0603	RM06J330CT-LF (CAL-CHIP) CR030330J001 (COMPOSTAR) RK73B1JTTD330J (KOA-SPEER ELECTRONICS) ERJ3GEYJ330V (PANASONIC) CR0603-10W-330JT (VENKEL LTD.)	
29	1	S1	SLD switch; THD; SPDT; low current; 6mm ACTR; RA	SPDT	THD-SPECIAL	SS-12F21-G6-NL (RDI ELECTRONICS)	
30	1	U1	IC, inverter; SSOP-8; TC7W14; SCHMITT; INDT; 2-6V	TC7W14	SSOP-8	TC7W14FU(TE12L,F) (TOSHIBA)	
31	1	U2	IC, buffer/driver; TSSOP-20; 74LCX244; NON-INV OCTAL W/ 5V TOL I/O; INDT; 2.3-3.6V	74LCX244	TSSOP-20	74LCX244MTC (FAIRCHILD SEMICONDUCTOR) MC74LCX244DT (ON SEMICONDUCTOR) 74LCX244TTR (ST MICROELECTRONICS)	
32	1	U3	IC, transceiver; SSOP-28; MX3237E; RS-232 1MBPS; COMT; 3V-5.5V	MAX3237E	SSOP-28	MAX3237ECAI+ (MAXIM)	
33	1	U4	regulator; SOT-223; MIC2920A; LDO 400mA; XINDT; 3.3V OUT	MIC2920A-3.3V	SOT-223	MIC2920A-3.3WS TR (MICREL)	
34	1	C10	ceramic capacitor/X7R; 0603; 50V; 10%; 0.1uF	0.1uF	SMD-0603	GMC10X7R104K50NT-LF (CAL-CHIP) 0603B104K500N (NOVACAP) ECJ1VB1H104K (PANASONIC) C1608X7R1H104K (TDK) C0603X7R500-104KN (VENKEL LTD.)	DNE
35	1	R8	resistor; 0805; 5%; 1/8W; 1.5KΩ	1.5KΩ	SMD-0805	RMC1/10-152JTP (KAMAYA INC.) RK73B2ATTD152J (KOA-SPEER ELECTRONICS) ERJ6GEYJ152V (PANASONIC) MC0805-152-JTW (RCD COMPONENTS INC.) MCR10EZPJ152 (ROHM)	DNE
36	1	Y1	clock oscillator; DIP-8; HCMOS/TTL; 50ppm; 0C to 70C; 10 TTL/15pF; 3.3V; 27.000MHz	27.000MHz	DIP-8	HEH112DV-27.000MHz (HEC, INC.)	DNE

Notes Legend:
C = Critical; must use the specified source(s).
DNE = Do not equip (non-installed components)

NOTES

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