EB-GS3471-00

Evaluation Board User Guide

Revision History

Version	ECO	PCN	Date	Changes and/or Modifications
3	041088	—	March 2018	Updated Section 1.1.
2	038786	—	September 2017	Digital and analog ground pin names updated to CORE_GND and A_GND respectively. Updates to Pin A1, A2, F1, G1 in Figure 2-3.
1	034214	—	November 2016	Pin A7 changed to RSVD in Figure 2-3.
0	030575	—	May 2016	New document.

Contents

Overview

Together with the EB-GS3471-00 Evaluation Board, this document serves as a guide for evaluating the GS3471. The GS3471 is a Semtech 3Gb/s, HD, SD SDI Receiver. For more information on the GS3471, please refer to the Product Data Sheet (PDS-060500). This document is partitioned into the following sections:

- EB-GS3471-00 User Guide
- EB-GS3471-00 Schematics
- EB-GS3471-00 Board Layout
- EB-GS3471-00 Bill of Materials (BOM)

Figure A below shows a block diagram of the features and the functions of the EB-GS3471-00.

The board includes power supplies, USB control interface, two 3G-SDI inputs, one GS3140 equalizer, a 3G-SDI loop-through output, a GS2988 multi-rate cable driver, a GS3471 Receiver, a parallel video output connector, an audio output with four RCA for AES audio, a 27MHz crystal, DIP switches, and a few status indication LEDs.

The GS3471 will automatically detect the input signal (J6 and J7) as SD-SDI, HD-SDI, or 3G-SDI. The deserialized video is available on the parallel output connector (J1). The extracted audio is available as serial audio or AES on audio headers (J4 and J12). A serial digital loop-through output (J10) is also available.

The EB-GS3471-00 also provides a JTAG interface used for boundary scan and a USB interface to control the GS3471 and the GS3140 through the GSPI ports on the devices.

Kit Contents

- Semtech EB-GS3471-00 Evaluation Board
- Semtech AB-GS3470 Adaptor Board
- Micro USB Cable (for GUI communication)
- DC Power Terminal

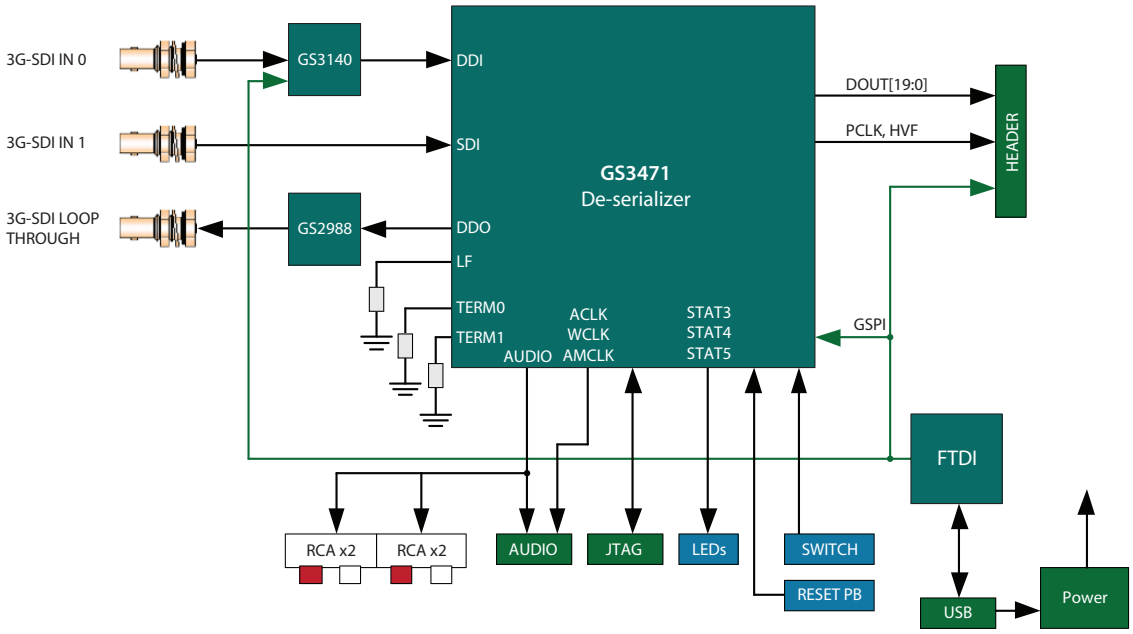

Figure A: Block Diagram

1. EB-GS3471-00 User Guide

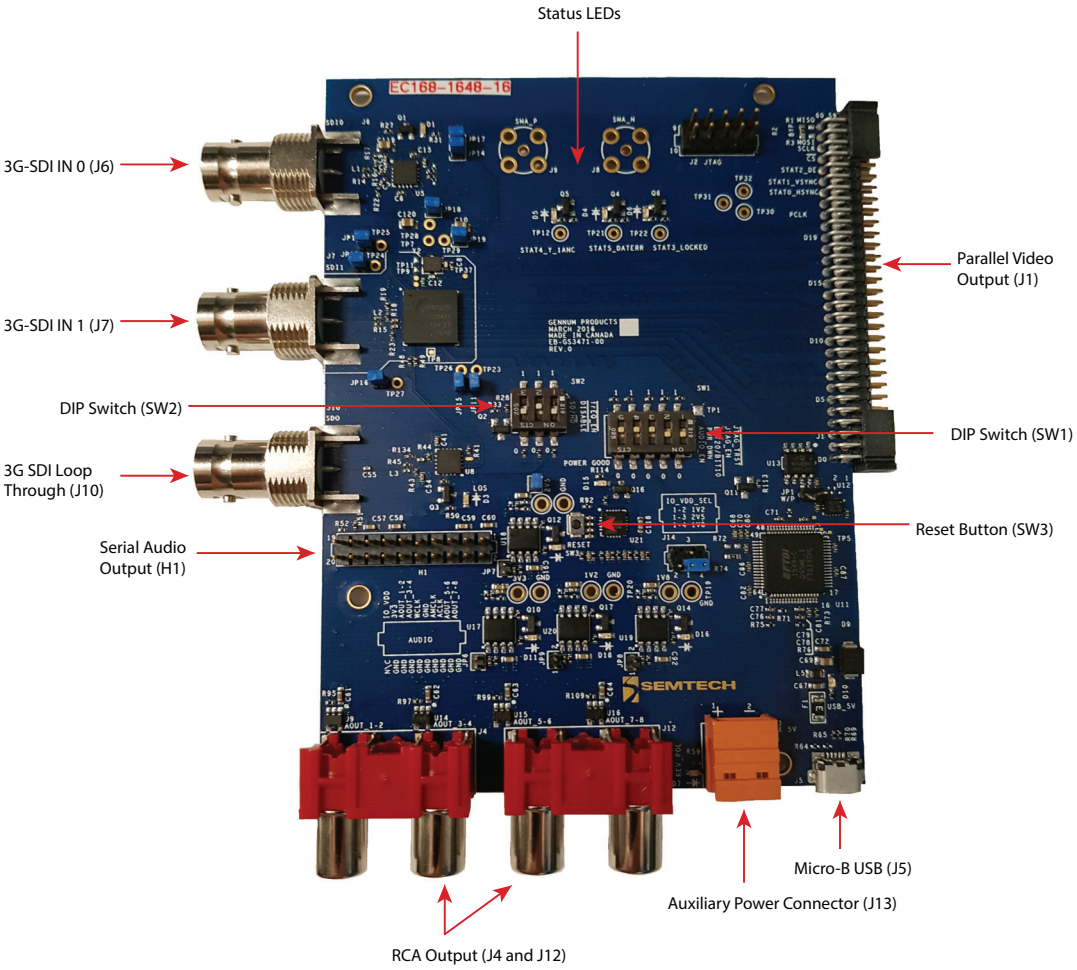

Figure 1-1: GS3471 Evaluation Board (EB-GS3471-00)

1.1 Power (J5 or J13)

The EB-GS3471-00 board is powered by a +5V supply through a Micro-B USB connector (J5) or through the auxiliary power connector (J13). Not all USB ports are capable of supplying enough current to power the board. In this case, use the external +5V auxiliary power connector (J13) with the included DC power terminal. Connect the auxiliary power supply before connecting the USB.

LED D10 is used to indicate if there is voltage present on the +5V input.

LED D7 is used to indicate if the voltage connected to J13 has been reversed.

1.2 SDI Input (J6 and J7)

The EB-GS3471-00 includes two 3G-SDI inputs DC-coupled to the GS3471. The applied video stream will first pass through Semtech's GS3140 Cable Equalizer (PDS-060939) before entering the DDI input pin of the GS3471. The pin J6 provides a DC path to the GS3471 through the GS3140, while the pin J7 provides a direct AC path to the GS3471.

1.3 Switch Settings (SW1 and SW2)

1.3.1 GS3471 Switch Settings (SW1)

Figure 1-2 shows the switch settings for SW1 which control the static configuration input of the GS3471.

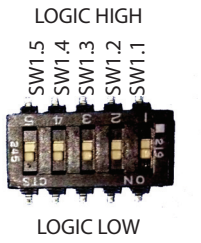

Figure 1-2: GS3471 Switch Configuration

Table 1-1: SW1 Switch Settings

Switch	Pin	Description
SW1.1	JTAG TRST	When HIGH, the GS3471 JTAG interface is in operational mode. When LOW, the GS3471 JTAG interface is held in reset.
SW1.2	JTAG interface enable	When HIGH, the GS3471 JTAG interface is in operational mode. When LOW, the GS3471 JTAG interface is disabled.
SW1.3	BIT20/$\overline{\text{BIT10}}$	Used to select the video output bus width. When HIGH, 20-bit bus width. When LOW, 10-bit bus width.

Table 1-1: SW1 Switch Settings (Continued)

Switch	Pin	Description
SW1.4	PWR_DWN	When HIGH, places the GS3471 in low-power mode. When LOW, normal operation mode occurs. **Note:** This switch should be in the HIGH position to allow the GUI to control lower power modes.
SW1.5	Audio_EN/$\overline{DIS}$	When HIGH, audio extraction is enabled. When LOW, audio extraction is disabled.

1.3.2 GS2988 Switch Settings (SW2)

Figure 1-3 shows the switch settings for SW2 which controls the static configuration input pins of the GS2988.

Figure 1-3: GS2988 Switch Configuration

Table 1-2: SW2 Switch Settings

Switch	Pin	Description
SW1.1	EQ_EN	When HIGH, trace-equalization is turned off. When LOW, trace-equalization is turned on.
SW1.2	DISN	Sets the GS2988 into low power mode. When HIGH, the GS2988 will be in normal operation mode. When LOW, the entire device is powered down.
SW1.3	SD_HDN	When HIGH, the serial data output will meet the SMPTE 259M rise/fall time specification. When LOW, the serial output will meet the SMPTE 292M and SMPTE 424M rise/fall time specification.

1.4 3G-SDI Loop Through (J10)

The output connector J10 is used for the 3G-SDI loop though output. The output for the EB-GS3471-00 evaluation board is capable of the following standards:

- SMPTE 424M
- SMPTE 292M
- SMPTE 259M

The EB-GS3471-00 evaluation board supports DVB-ASI at 270Mb/s and data rates from 270Mb/s to 2.97Gb/s. The output is configured for a single ended coaxial cable terminated with a BNC connection.

1.5 Video Header (J1)

Parallel video data with the PCLK and timing signals H, V, and F are available on a 60-pin connector (J1). Using AB-GS3471-00 will allow the EB-GS3471-00 to interface to legacy evaluation boards.

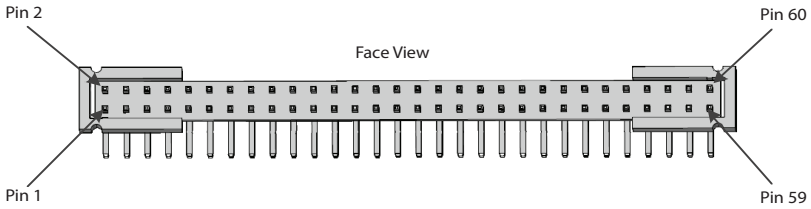

Figure 1-4: Video Header

Table 1-3: Pin Out Video Header

Pin Number	Net Name
J1.1, J1.3, J1.5, J1.7, J1.9, J1.11, J1.13, J1.15, J1.17, J1.19, J1.21, J1.23, J1.25, J1.27, J1.29, J1.31, J1.33, J1.35, J1.37, J1.39, J1.41, J1.43, J1.45, J1.47, J1.49, J1.51, J1.53, J1.55	CORE_GND
J1.2	DATA[0]
J1.4	DATA[1]
J1.6	DATA[2]
J1.8	DATA[3]
J1.10	DATA[4]
J1.12	DATA[5]
J1.14	DATA[6]

Table 1-3: Pin Out Video Header (Continued)

Pin Number	Net Name
J1.16	DATA[7]
J1.18	DATA[8]
J1.20	DATA[9]
J1.22	DATA[10]
J1.24	DATA[11]
J1.26	DATA[12]
J1.28	DATA[13]
J1.30	DATA[14]
J1.32	DATA[15]
J1.34	DATA[16]
J1.36	DATA[17]
J1.38	DATA[18]
J1.40	DATA[19]
J1.42, J1.46	N/C
J1.48	STAT0_HSYNC
J1.50	STAT1_HSYNC
J1.52	STAT2_DE
J1.54	GSPI_CS_N
J1.56	GSPI_SCLK
J1.57	USB_5V_D
J1.58	GSPI_SDIN_EXT
J1.59	USB_GPIO0
J1.60	GSPI_SDOUT_EXT

1.6 Audio Header (H1, J4 and J12)

Audio Outputs (H1 and RCA connectors J4 and J12), are provided to monitor audio in raw form (H1) and AES mode (J4 and J12).

1.6.1 Audio Header (H1)

This connector provides extracted 8-channel audio in conjunction with AMCLK, ACLK, and WCLK.

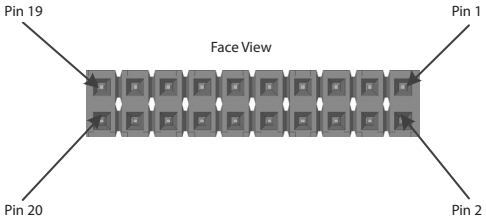

Figure 1-5: Audio Header (H1)

Table 1-4: Pin-Out Audio Header

Pin Number	Net Name
H1.1, H1.3, H1.13, H1.15	AOUT_7_8, AOUT_5_6, AOUT_3_4, AOUT_1_2
H1.2, H1.4, H1.6, H1.8, H1.9, H1.10, H1.12, H1.14, H1.16, H1.18	CORE_GND
H1.5	ACLK
H1.7	AMCLK
H1.11	WCLK
H1.17	+3.3V
H1.19	IO_VDD
H1.20	N/C

This pin-out takes precedence over the silk-screening on the EB-GS3471-00.

1.6.2 AES Model — RCA Connectors (J4 and J12)

For AES mode, AES-encoded CMOS-level signals are distributed through line drivers, and supplied to two RCA connectors (J4 and J12).

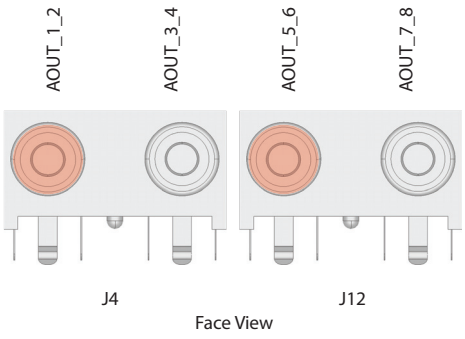

Figure 1-6: RCA Connectors (J4 and J12)

1.7 JTAG Header

The JTAG interface is used for boundary scan testing for the GS3471

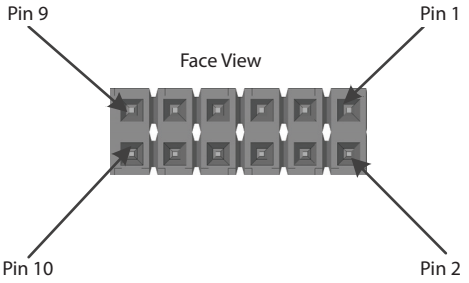

Figure 1-7: JTAG Header (J2)

Table 1-5: Pin-Out JTAG Header

Pin Number	Net Name
J2.1	JTAG_TCK
J2.2, J2.10	CORE_GND
J2.3	JTAG_TDO
J2.4	IO_VDD
J2.5	JTAG_TMS
J2.6, J2.7, J2.8	N/C
J2.9	JTAG_TDI

1.8 Status LED's

The functions for the LEDs found on the EB-GS3471-00 are described in Table 1-6.

Table 1-6: Status LEDs Description

Ref	Colour	Programmable	Device	Description
D1	Red	No	GS3140	When active, input Serial Data CH0 signal loss detected.
D2	Red	No	GS3471	When active, input Serial Data CH1 signal loss detected.
D3	Red	No	GS2988	When active, output Serial Data signal loss detected.
D4	Green	Yes	GS3471	When Reclocker lock, PLL locked, LED is active.

Table 1-6: Status LEDs Description (Continued)

Ref	Colour	Programmable	Device	Description
D5	Green	Yes	GS3471	Y/1ANC, when Data Stream 1 ancillary data is detected, LED is active.
D6	Green	Yes	GS3471	When DATA ERROR is detected, LED is active.
D7	Red	No	—	Reverse polarity. When polarity is reversed on J13, LED is active.
D10	Green	No	—	When power is present on the 5V input J5 and J13, LED is active.
D11	Green	No	—	When internal +3.3V is good, LED is active.
D13	Green	No	—	When internal +2.5V is good, LED is active.
D15	Green	No	—	Reset indicator, When LED active EB-GS3471-00 is not in reset.
D16	Green	No	—	When internal +1.8V is good, LED is active.
D18	Green	No	—	When internal +1.2V is good, LED is active.

1.9 Modes of Operation

The GS3471 supports four distinct modes of operation that can be accessed through the GUI or through the GSPI interface to internal registers. These modes are: SMPTE mode, Data-Through mode, DVB-ASI mode, and Standby mode.

The GS3471 can automatically detect the format of the incoming signal. If the format of the incoming signal is not recognized, the GS3471 defaults into SMPTE Bypass mode. Alternatively, the device may be forced into any of the four modes through the GUI.

In SMPTE mode, the GS3471 performs full SMPTE processing, and features a number of signal integrity checks and measurement capabilities.

In DVB-ASI mode, 8b/10b decoding is applied to the received data stream.

In SMPTE Bypass mode, all forms of SMPTE and DVB-ASI decoding are disabled, and the device can be used as a simple serial-to-parallel converter without incurring the latency penalties associated with SMPTE or DVB-ASI mode.

The device can also operate in a several lower power modes:

- Sleep
- Standby
- Standby with PCLK
- Sleep with SDO
- Standby with SDO Retimed
- Standby with SDO with PCLK
- Standby with SDO Retimed with PCLK

2. EB-GS3471-00 Schematics

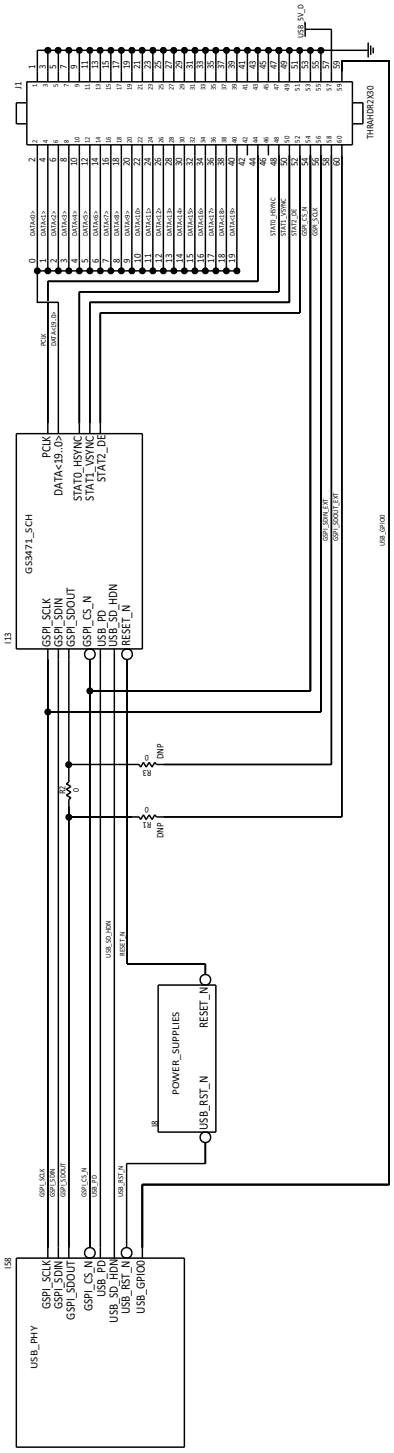

Figure 2-1: EB-GS3471-00 Schematic

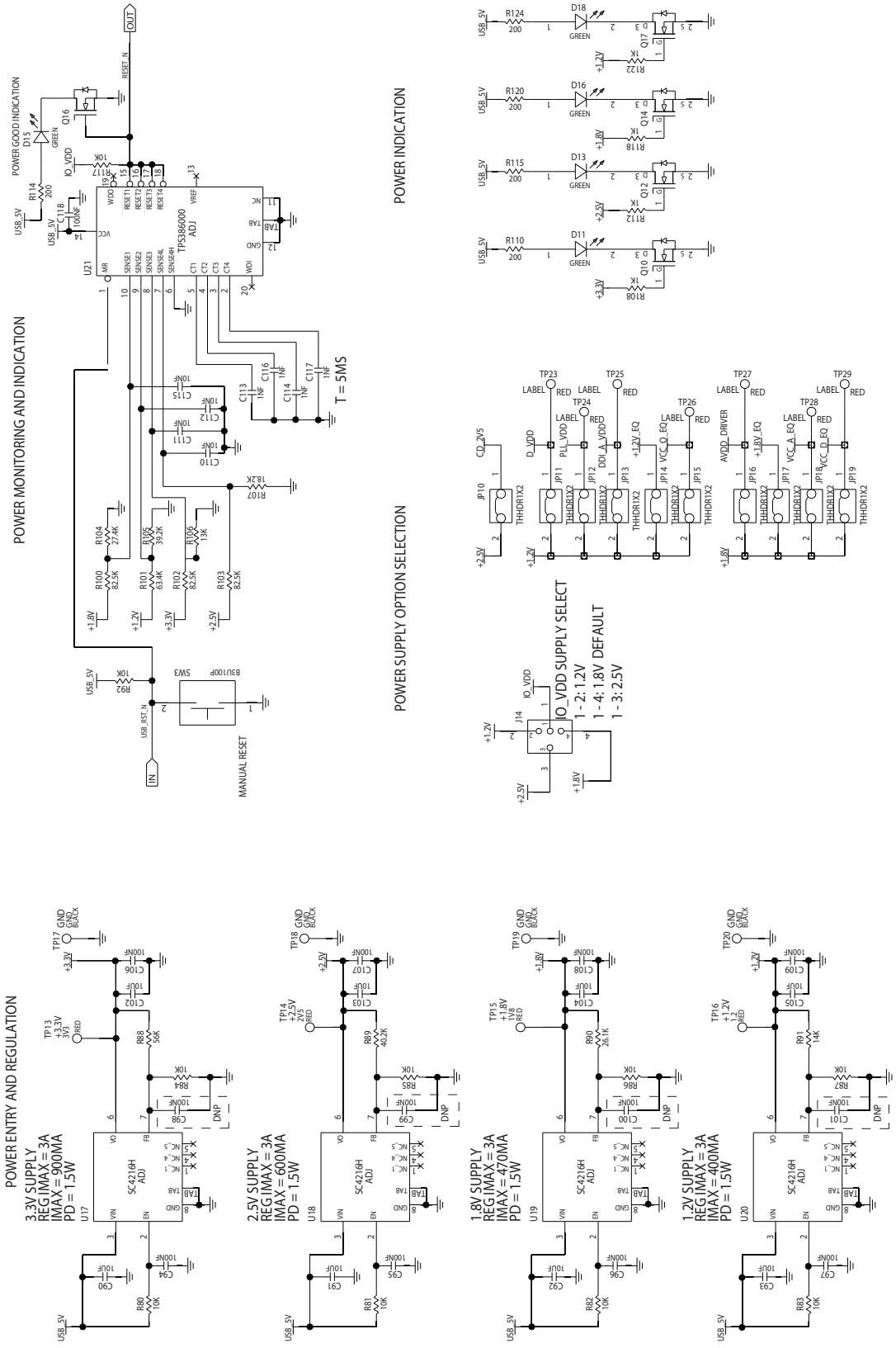

Figure 2-2: EB-GS3471-00 Schematic 2

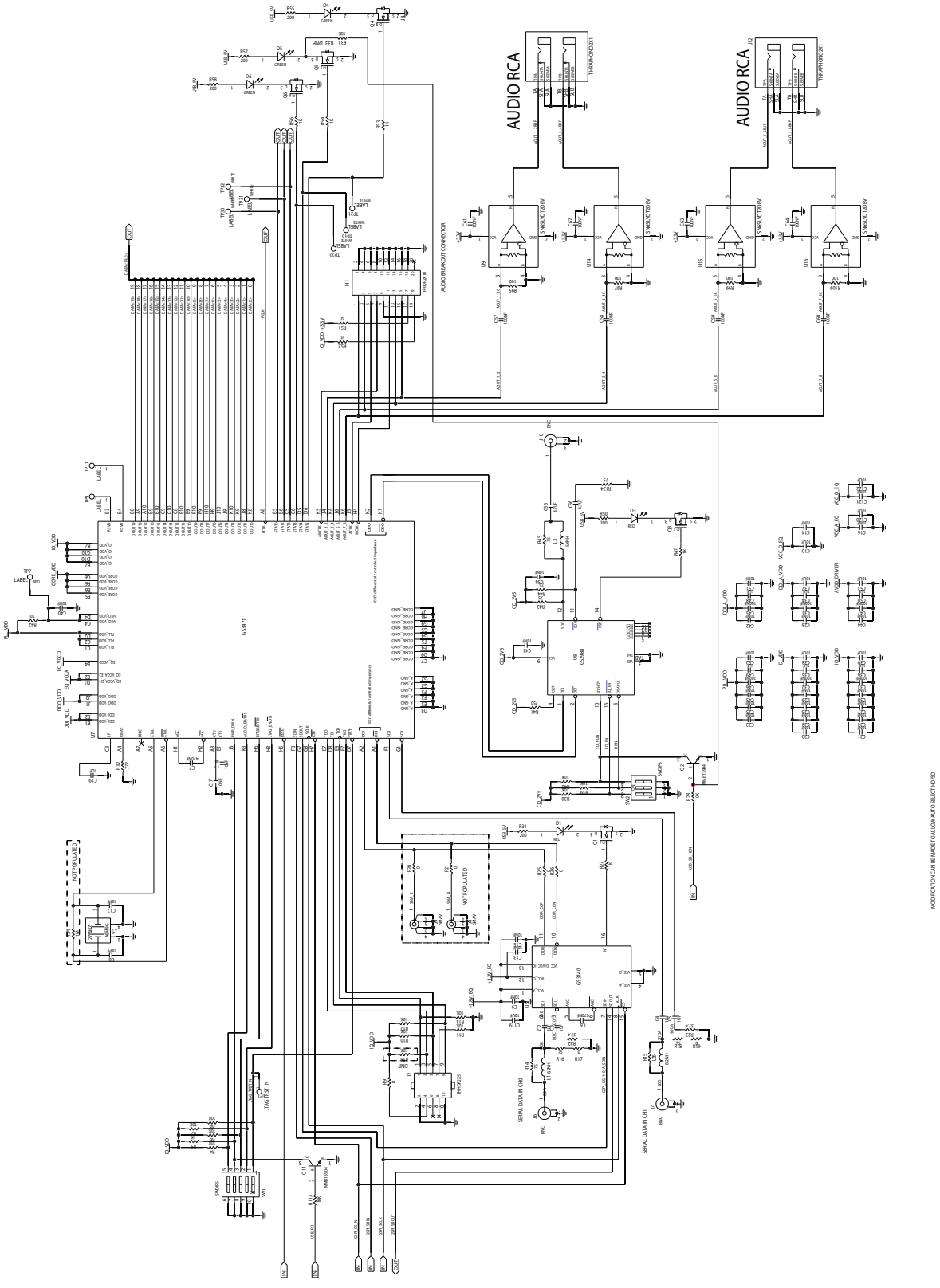

Figure 2-3: EB-GS3471-00 Schematic 3

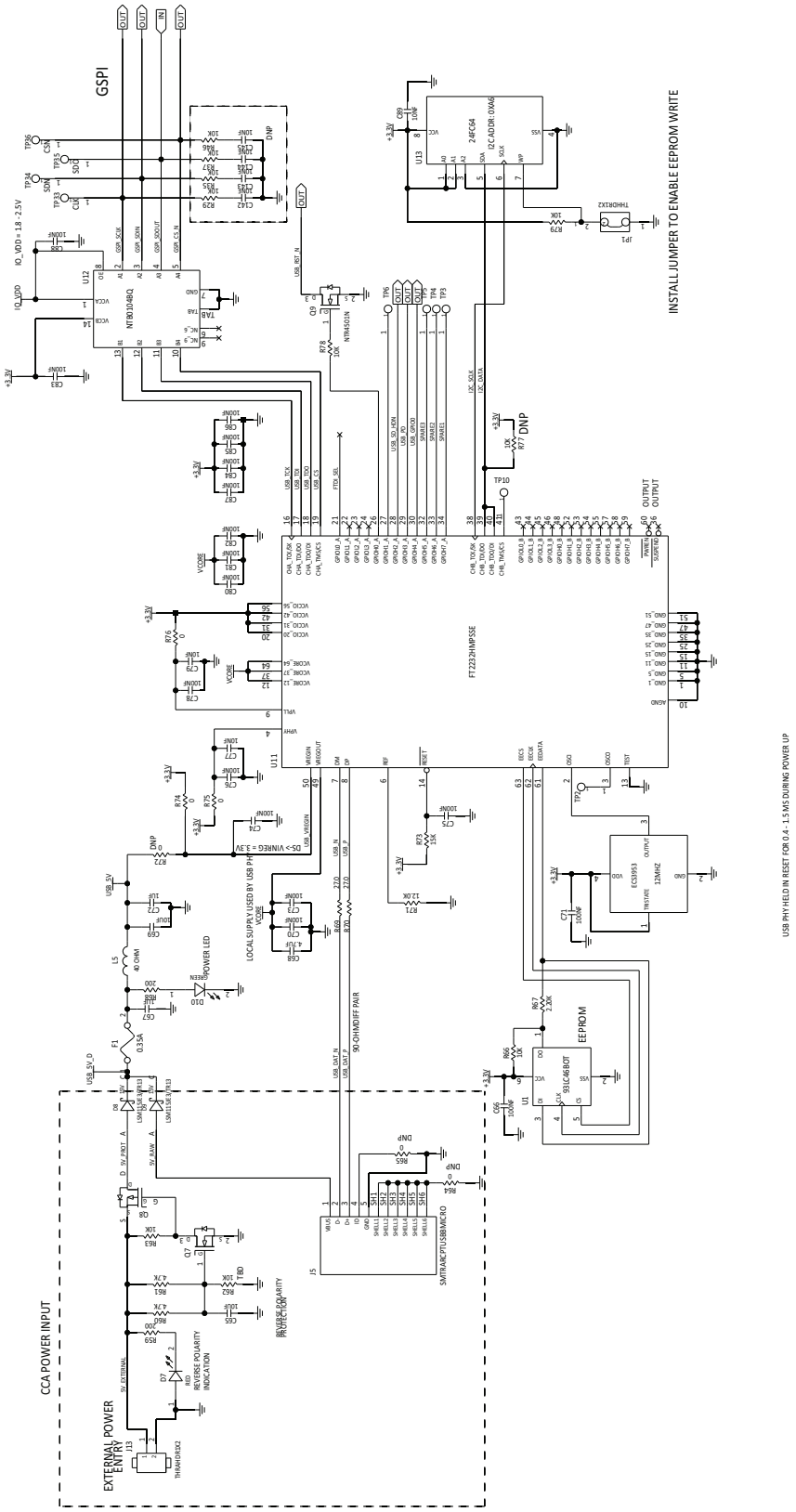

Figure 2-4: EB-GS3471-00 Schematic 4

3. EB-GS3471-00 Board Layout

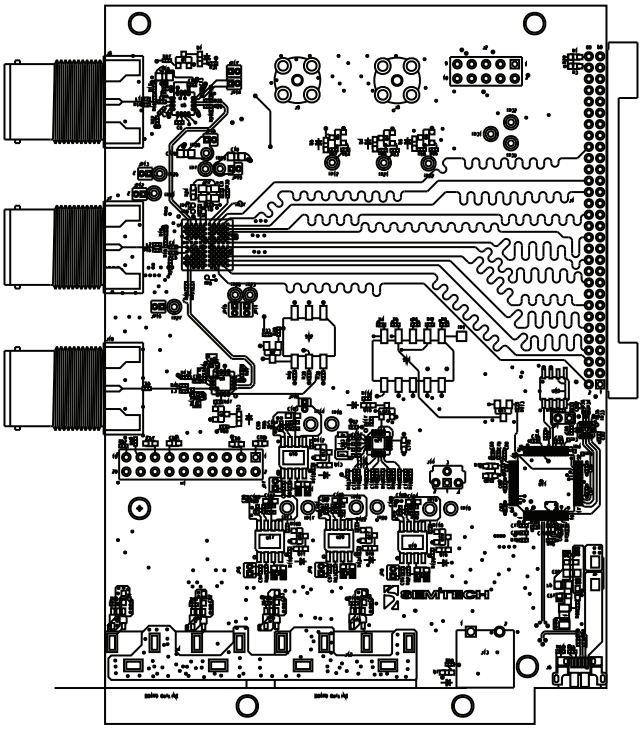

Figure 3-1: Layer 1 (TOP)

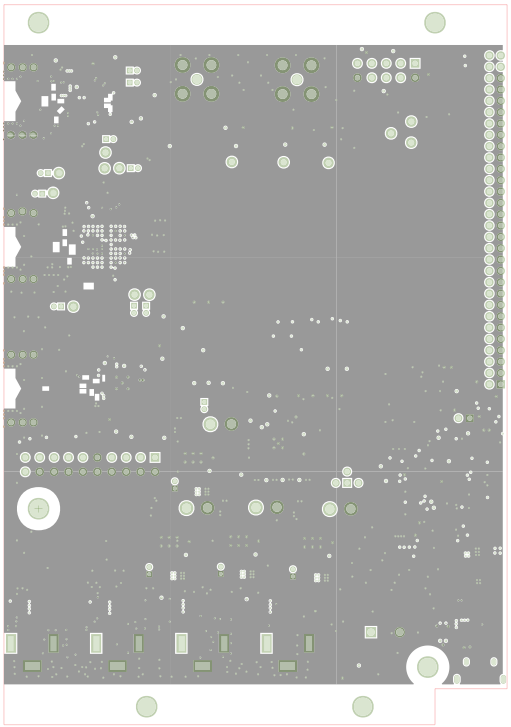

Figure 3-2: Layer 2 (GND1)

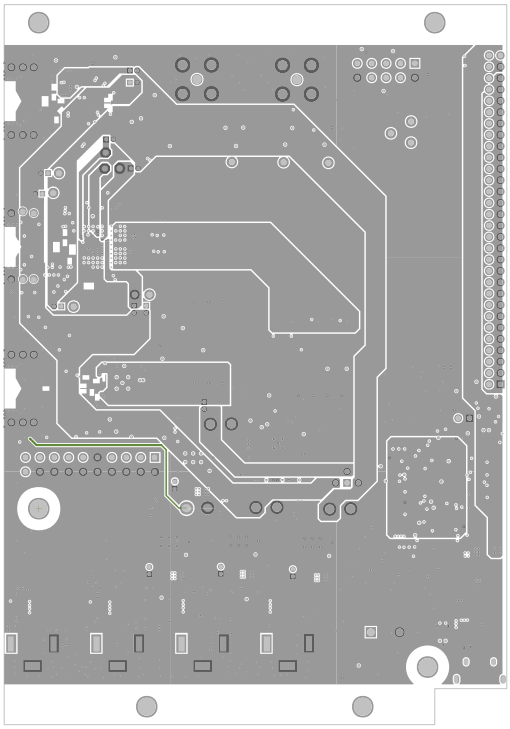

Figure 3-3: Layer 3 (PWR1)

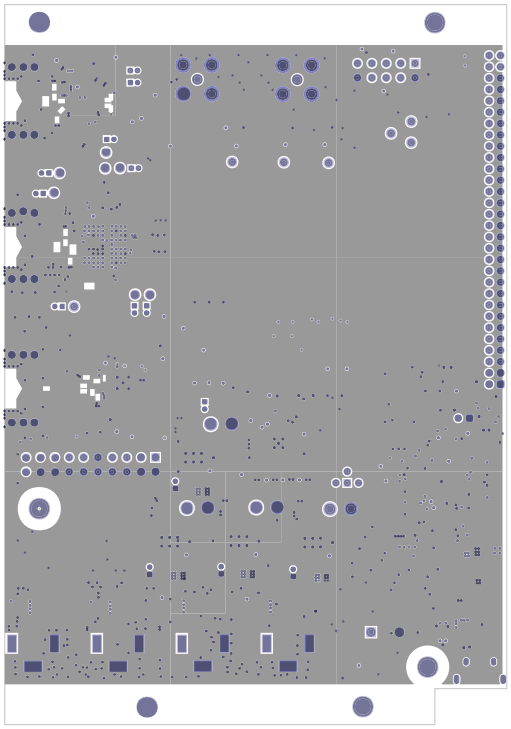

Figure 3-4: Layer 4 (GND2)

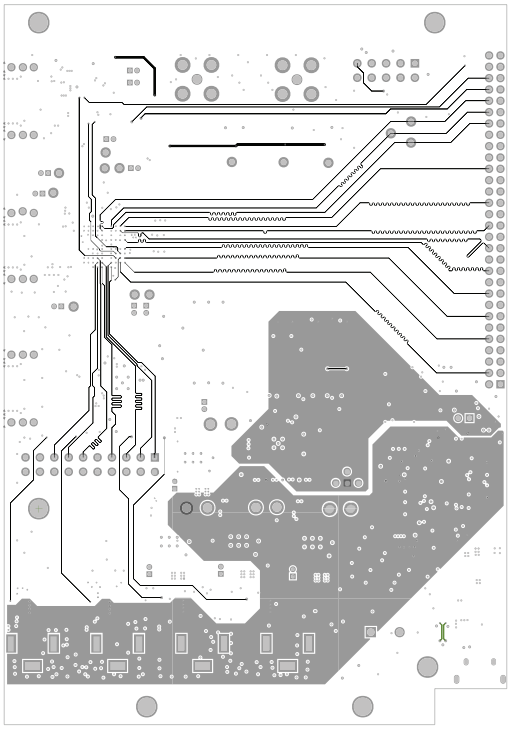

Figure 3-5: Layer 5 (SIG1)

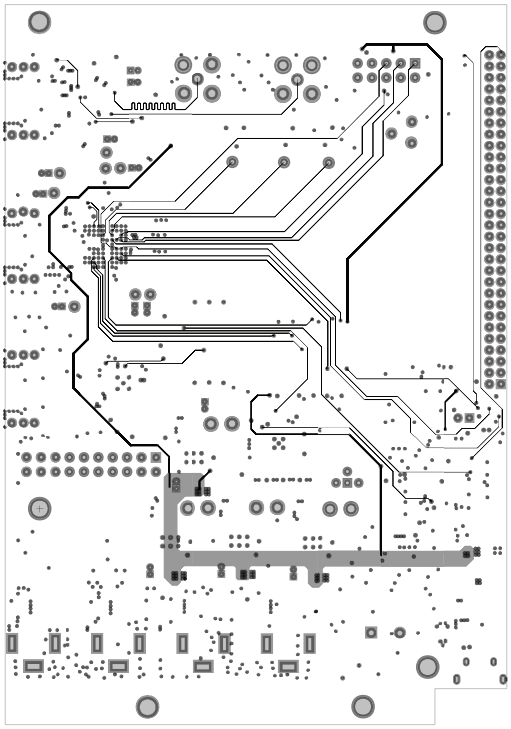

Figure 3-6: Layer 6 (SIG2)

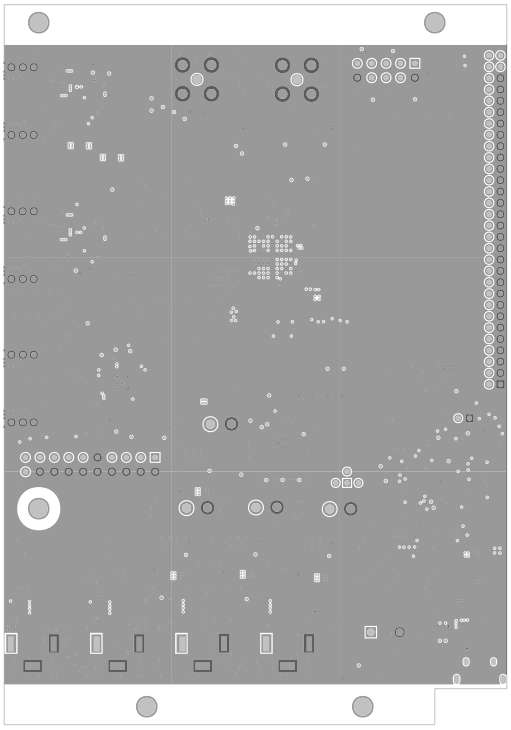

Figure 3-7: Layer 7 (GND3)

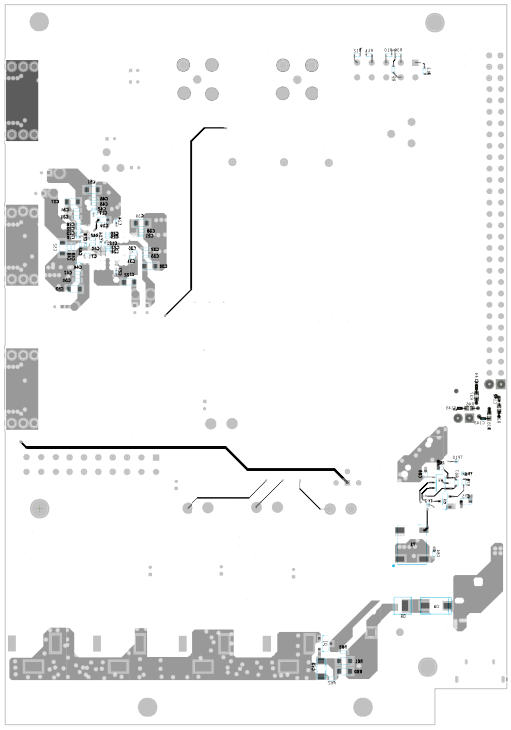

Figure 3-8: Layer 8 (BOT)

4. EB-GS3471-00 Bill of Materials (BOM)

Table 4-1: Bill of Materials

Quantity	Ref Description	Description
4	C2, C3, C4, C5	Capacitor; Ceramic 1.0µF 10V 10% X5R 0402
2	C6, C7	Capacitor; Ceramic 0.47µF 10V 10% X5R 0402
2	C8, C12	Capacitor; Ceramic RF 18pF 50V 5% C0G 0402
15	C9, C10, C13, C14, C15, C16, C41, C54, C77, C79, C89, C110, C111, C112, C115	Capacitor; Ceramic 10000pF 25V 10% X7R 0402
16	C17, C18, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C42, C43, C44	Capacitor; Ceramic 10000pF 16V 10% X7R 0201
3	C19, C67, C72	Capacitor; Ceramic 1.0µF 25V 10% X5R 0603
30	C31, C32, C33, C45, C46, C47, C66, C70, C71, C73, C74, C76, C78, C80, C81, C82, C83, C84, C85, C86, C87, C88, C94, C95, C96, C97, C106, C107, C108, C109	Capacitor; Ceramic 0.1µF 16V 10% X7R 0402
6	C34, C35, C36, C48, C49, C50	Capacitor; Ceramic 1.0µF 6.3V 10% X7R 0402
9	C37, C38, C39, C51, C52, C53, C69, C119, C120	Capacitor; Ceramic 10µF 16V C5R 20% X5R 0805
9	C40, C90, C91, C92, C93, C102, C103, C104, C105	Capacitor; Ceramic 10µF 6.3V 20% X5R 0603
3	C55, C56, C68	Capacitor; Ceramic 4.7µF 6.3V 20% X5R 0402
10	C57, C58, C59, C60, C61, C62, C63, C64, C75, C118	Capacitor; Ceramic 0.1µF 25V 10% X7R 0603
1	C65	Capacitor; Ceramic 10µF 25V X5R 1206
4	C113, C114, C116, C117	Capacitor; Ceramic 1000pF 50V 10% X7R 0402
3	D1, D2, D3	LED; Red TSS Type SMD
9	D4, D5, D6, D10, D11, D13, D15, D16, D18	LED; 1.6x0.8mm 568nm Green CLR SMD
1	D7	LED; 1.6x0.8mm 625nm Red CLR SMD
2	D8, D9	Diode; Schottky 20V 3A SMD
1	F1	Fuse; PTC Reset 6V 0.35A 1206
1	H1	Connector; HDR Drkaway 0.100 78-position VERT (20 POS USED)
1	J1	Connector; Header 3x30-position 2mm RA ES
1	J2	Connector; Header 10-position 0.100DL Gold
2	J4, J12	Connector; RCA Phono 2P R/A Phono Jack
1	J5	Connector; receptacle REV Micro USB Type B

Table 4-1: Bill of Materials (Continued)

Quantity	Ref Description	Description
3	J6, J7, J10	Connector; Bulkhead/PCB edge mount BNC 75Ω
1	J14	Connector; Header 2mm dual STR 72-position (6 positions used, 2 pins removed)
1	JP1	Connector; Header 2mm single STR 36-position (2 positions used)
2	L1, L2	Inductor; 8.2nH 1500mA ±2% 0402
1	L3	Inductor; 5.6nH 300mA 0402
1	L5	Ferrite; 1.5A 40Ω 0805 SMD
13	Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q9, Q10, Q12, Q14, Q16, Q17	Transistor; MOSFET N-CH 20V 3.2A SOT23-3
1	Q8	Transistor; MOSFET P-CH 30V 11A 8-PQFN
1	Q11	Transistor; GP NPN AMP SOT23-3
2	R2, R74	Resistor; 0.0Ω 1/10W 5% 0603 SMD
27	R4, R6, R7, R8, R10, R11, R12, R13, R38, R39, R40, R62, R63, R66, R78, R79, R80, R81, R82, R83, R84, R85, R86, R87, R92, R113, R117	Resistor; 10.0kΩ 1/16W 1% 0402 SMD
1	R5	Resistor; 1.0kΩ 1/16W 1% 0402 SMD
21	R9, R17, R19, R25, R26, R28, R29, R30, R46, R48, R49, R51, R52, R75, R76, R93, R94, R96, R98, R111, R116	Resistor; 0.0Ω 1/16W 5% 0402 SMD
8	R14, R15, R16, R18, R43, R44, R45, R134	Resistor; 75.0Ω 1/16W 1% 0402 SMD
2	R22, R23	Resistor; 37.4Ω 1/16W 1% 0402 SMD
10	R27, R35, R47, R53, R54, R56, R108, R112, R118, R122	Resistor; 1.00kΩ 1/16W 1% 0402 SMD
13	R31, R37, R50, R55, R57, R58, R59, R68, R110, R114, R115, R120, R124	Resistor; 200Ω 1/16W 1% 0402 SMD
1	R32	Resistor; 777Ω 1/16W 0.1% 0402 SMD
1	R41	Resistor; 750Ω 1/16W 1% 0402 SMD
1	R42	Resistor; 24.9Ω 1/10W 1% 0402 SMD
2	R60, R61	Resistor; 4.70kΩ 1/4W 1% 0805 SMD
1	R67	Resistor; 2.20kΩ 1/10W 1% 0402 SMD
2	R69, R70	Resistor; 27.0Ω 1/10W 1% 0402 SMD
1	R71	Resistor; 12.0kΩ 1/10W 1% 0402 SMD
1	R73	Resistor; 15.0kΩ 1/16W 1% 0402 SMD
1	R88	Resistor; 56.0kΩ 1/10W 1% 0402 SMD

Table 4-1: Bill of Materials (Continued)

Quantity	Ref Description	Description
1	R89	Resistor; 40.2kΩ 1/10W 1% 0402 SMD
1	R90	Resistor; 26.1kΩ 1/10W 1% 0402 SMD
1	R91	Resistor; 14.0kΩ 1/16W 1% 0402 SMD
4	R95, R97, R99, R109	Resistor; 100Ω 1/16W 1% 0402 SMD
3	R100, R102, R103	Resistor; 82.5kΩ 1/16W 1% 0402 SMD
1	R101	Resistor; 63.4kΩ 1/16W 1% 0402 SMD
1	R104	Resistor; 27.4kΩ 1/16W 1% 0402 SMD
1	R105	Resistor; 39.2kΩ 1/16W 1% 0402 SMD
1	R106	Resistor; 13.0kΩ 1/16W 1% 0402 SMD
1	R107	Resistor; 18.2kΩ 1/16W 1% 0402 SMD
1	SW1	Switch; Tape Seal 5 POS SMD
1	SW2	Switch; Tape Seal 3 POS SMD
1	SW3	Switch; Tact SPST Without Ground SMD MOM 153GF
4	TP13, TP14, TP15, TP16	Test Point; PC Multi-purpose Red
4	TP17, TP18, TP19, TP20	Test Point; PC Multi-purpose Black
1	U1	IC; EEPROM 1kBIT 2MHz SOT23-6
1	U5	IC; Multi-Rate Adaptive 3G SDI Equalizer (Semtech GS3140)
1	U7	IC; 3G, HD, SD SDI Receiver, with Integrated Adaptive Cable Equalizer (Semtech GS3471)
1	U8	IC; Dual Slew-Rate, Cable Driver with 3Gb/s Capability (Semtech GS2988)
4	U9, U14, U15, U16	IC; Diff Line Receiver SOT23-5
1	U11	IC; USB HS dual UART/FIFO 64-LQFP
1	U12	IC; TXRX Translating 3STATE 14DHVQFN
1	U13	IC; EEPROM 64kBIT 1MHz 8SOIC
4	U17, U18, U19, U20	IC; Regulator very low input/very low dropout 3A Regulator with enable
1	U21	IC; Supply monitor ADJ open drain/COLL QUAD 20QFN
1	Y1	IC; OSC 12.000MHz 50ppm 3.3V SMD
1	Y2	Crystal; 27.000MHz 18pF 3.2x2.5x1mm SMD