Author: Manjing Xie

ISL9440AMGTHEVAL3Z User Guide

Introduction

The ISL9440AMGTHEVAL3Z is Intersil's high performance, cost-effective power module for Xilinx's high speed serial transceivers on Virtex-7 Characterization Boards. Utilizing the popular ISL9440A for the DC/DC control, the module also features the quad-DCP ISL22346 for set point adjustment. Sequencing is achieved using Intersil's dual voltage monitor ISL88012.

This user guide is intended to serve as a manual for using the ISL9440AMGTHEVAL3Z power module and also list its various performance characteristics.

Key Features

The ISL9440AMGTHEVAL3Z power module uses the three channel buck controller ISL9440A for generating voltage rails AVCC, AVTT and VCCAUX. The ISL9440A reduces output inductor and capacitor requirements. Table 1 lists the specifications of each rail. Voltage margining on all the output rails is achieved by changing the equivalent feedback resistor divider setting using the I^2C bus controlled quad-Digitally Controlled Potentiometer (DCP) ISL22346.

The power module achieves excellent regulation by remotely sensing the output voltage close to its load. Figure 1 shows the block diagram implementation of the power module.

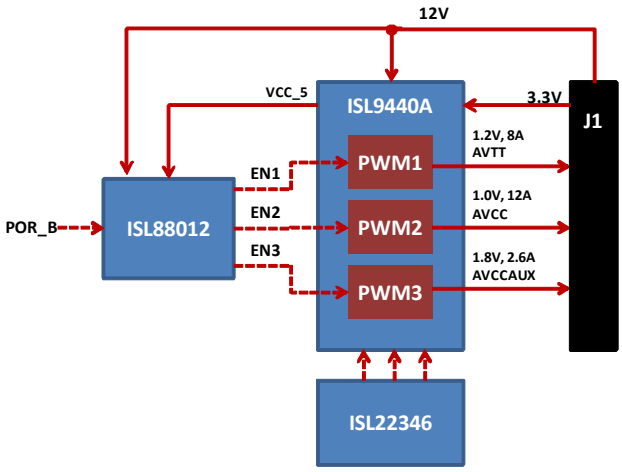

FIGURE 1. ISL9440AMGTHEVAL3Z BLOCK DIAGRAM

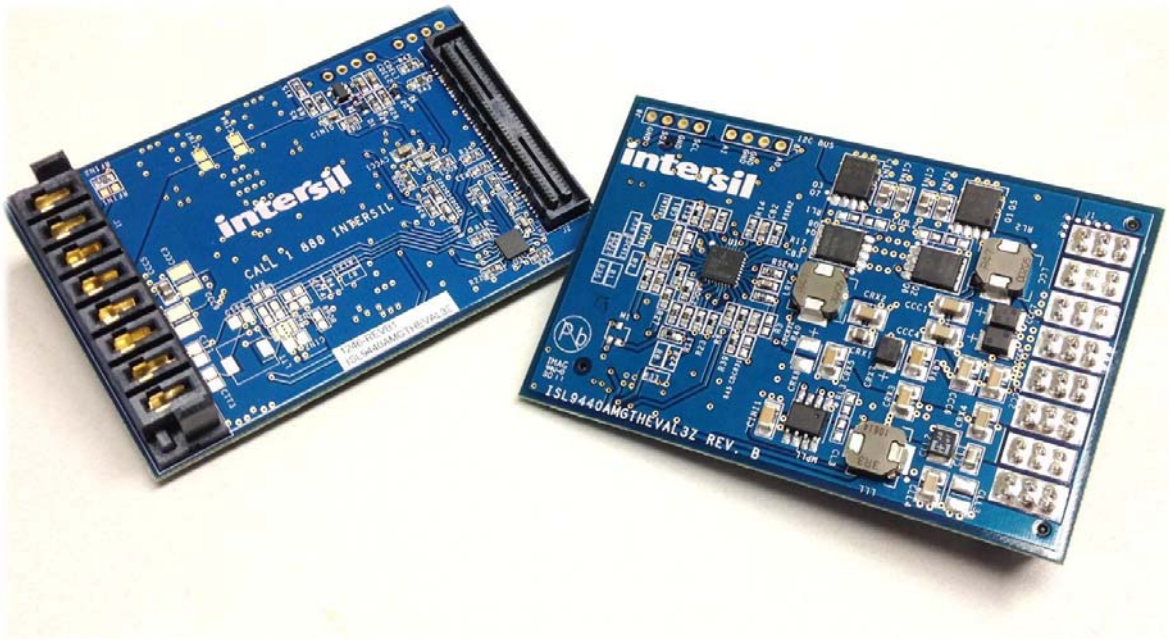

FIGURE 2. ISL9440AMGTHEVAL3Z TOP VIEW AND BOTTOM VIEW

TABLE 1. POWER MODULE PARAMETERS

PARAMETER	AVCC	AVTT	AVCCAUX
Output Voltage	1.05V ±2%	1.2V ±2%	1.8V ±2%
Rated Current	12A	8A	2.6A
Peak-to-Peak Ripple	<10mV	<10mV	<10mV

NOTE: Please contact Intersil Marketing to order this power module.

TABLE 2. ADDRESS BYTE AND VALUE OF WIPER REGISTER FOR MARGINING

OUTPUT RAIL	ADDRESS (HEX)	DEFAULT VALUE (HEX)	WR FOR -15% MARGINING (HEX)	WR FOR -10% MARGINING (HEX)	WR FOR -5% MARGINING (HEX)	WR FOR +5% MARGINING (HEX)	WR FOR +10% MARGINING (HEX)	WR FOR +15% MARGINING (HEX)
AVCC(GEN 7)	01	5A	7D	73	67	4E	42	39
AVTT(GEN7)	00	54	6E	65	5D	4C	45	3F
VCCAUX(GEN7)	10	37	6F	5B	49	29	1B	10

Voltage Margining Using DCP

The ISL22346 is a quad-DCP that allows changing the center tap position by writing an 8-bit word into its Wiper Position (WP) register through the I^2C bus. Changing the center tap position of the DCP changes the equivalent feedback resistor divider and results in a change in output voltage.

The DCP can be identified via the I^2C byte 'A0'. Please refer to the ISL22346 datasheet for a description of the I^2C bus. Table 2 lists the specific address for each output rail. It also lists the typical value of the wiper register for each rail to achieve margining. Margining is fairly linear between the values shown.

Sequencing Using ISL88012

The power module uses the 12V input rail to bias the ISL9440A and deliver power to the 1.8V rail. The 3.3V input rail is used as input voltage for power conversion for the 1.0V and 1.2V rails. The ISL88012 is a dual voltage monitor that signals a logic high when both the ISL9440A VCC and the 3.3V rails have started-up. An open drain POR_B signal can be used to control the power-up of the complete power module. Sequencing might not be necessary for the V7 series tranceivers. The ISL88012 provides the flexibility to customer sequencing.

Protection Features

All the output rails feature overcurrent and overvoltage protections. Please refer to ISL9440A datasheet for specific protection mechanisms.

In the event that remote sense feedback from control connector J2 is lost, the module will not get damaged. In fact, all the output rails of the power module continue good voltage regulation under such an event. This is achieved via a redundant internal feedback path.

Remote Sensing and Open-Circuit Protection

All three rails has positive rail remote sensing implemented. This method has proved to provide effective PCB trace droop compensation.

There is concern for overvoltage damage in the events the remote sensing traces are open. The power module adds redundant internal feedback path which prevents such a catastrophe. The AVCC rail is used as an example for illustration purposes. In the event that the remote sensing trace is open, the 200Ω resistor, R_{37} connects the feedback resistor divider R_8 and R_{11} to the local AVCC output.

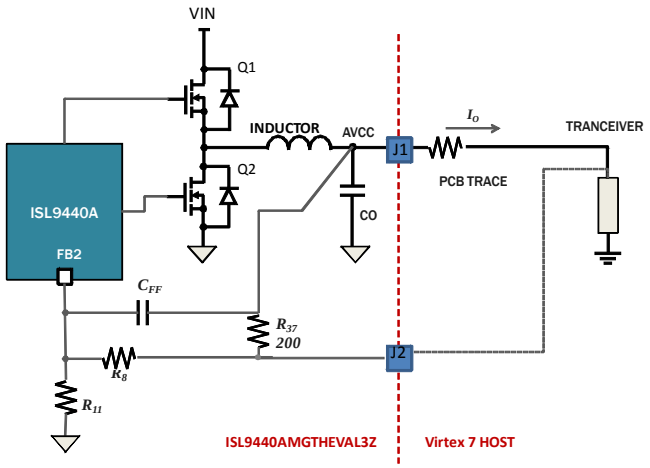

FIGURE 3. FEEDBACK DIVIDER WITH REMOTE SENSING

At the same time, the redundance feedback resistor, R_{37} and the output capacitors form a low-path filter to filter out any noise coupled by the long remote sensing trace.

Typical Performance Curves

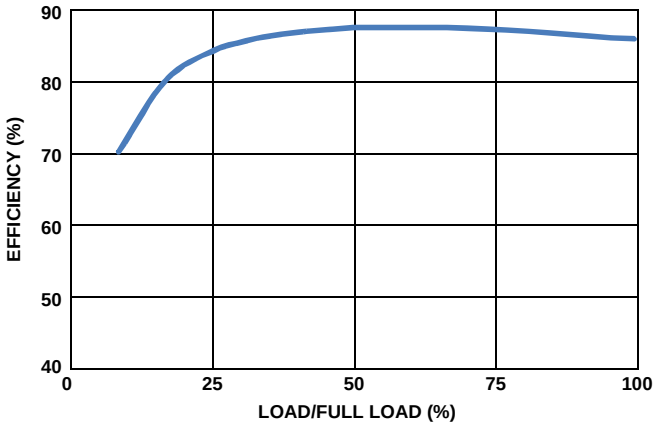

FIGURE 4. OVERALL EFFICIENCY vs LOAD

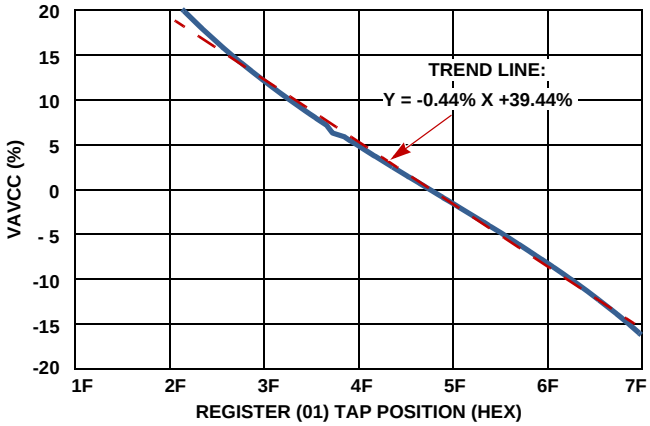

FIGURE 5. AVCC vs. TAP POSITION

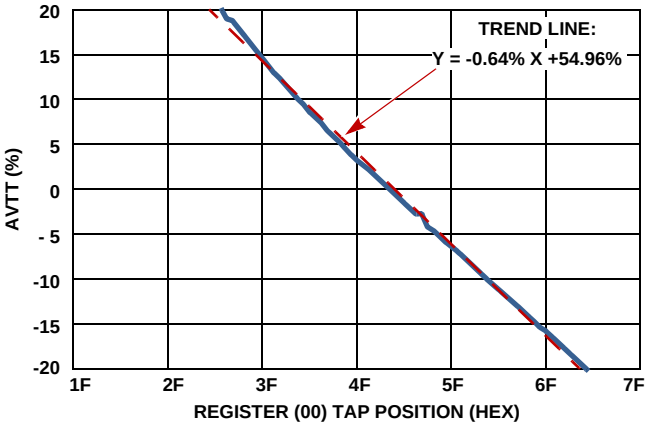

FIGURE 6. AVCC vs. TAP POSITION

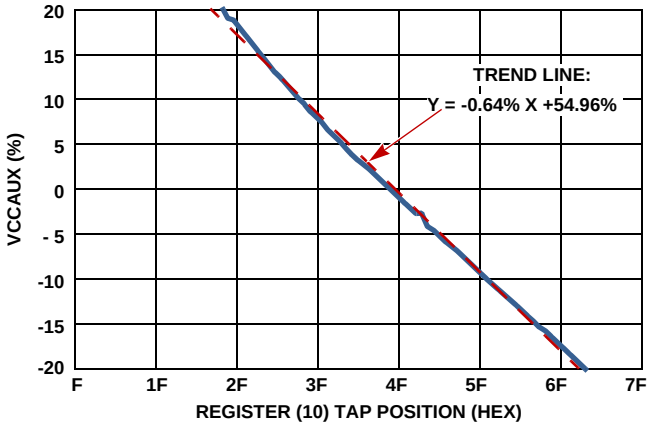

FIGURE 7. AVTT OUTPUT RIPPLE (MODULE AT FULL LOAD)

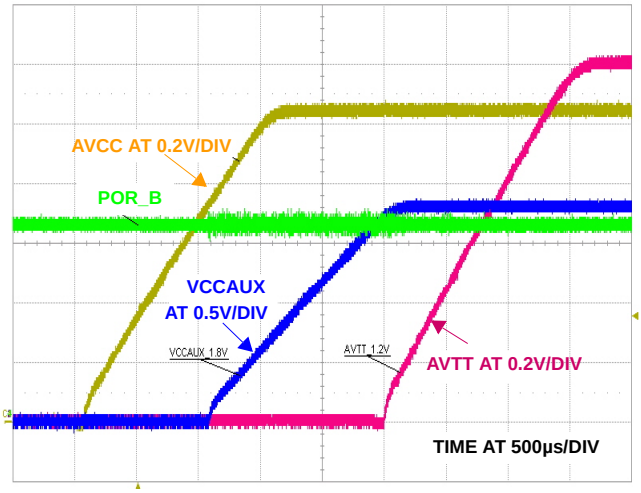

FIGURE 8. START-UP WAVEFORMS

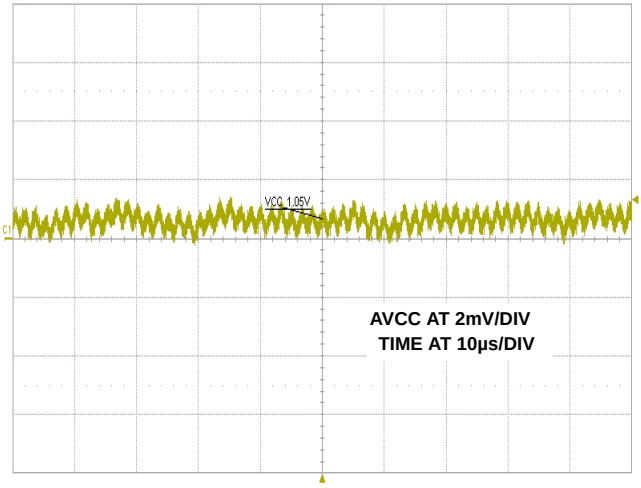

FIGURE 9. AVCC OUTPUT RIPPLE (MODULE AT FULL LOAD)

Typical Performance Curves (Continued)

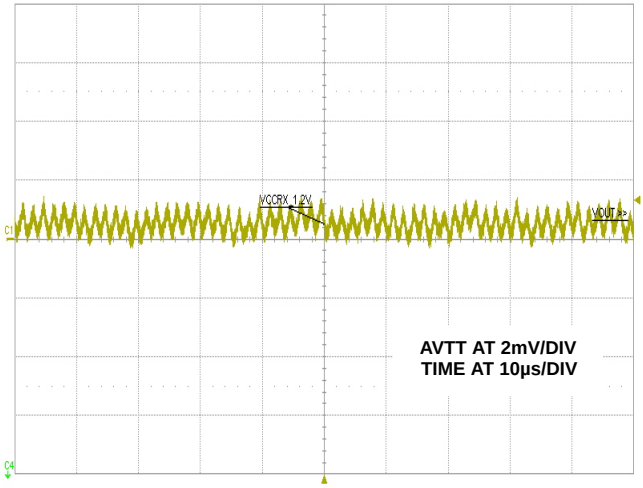

FIGURE 10. AVTT OUTPUT RIPPLE (MODULE AT FULL LOAD)

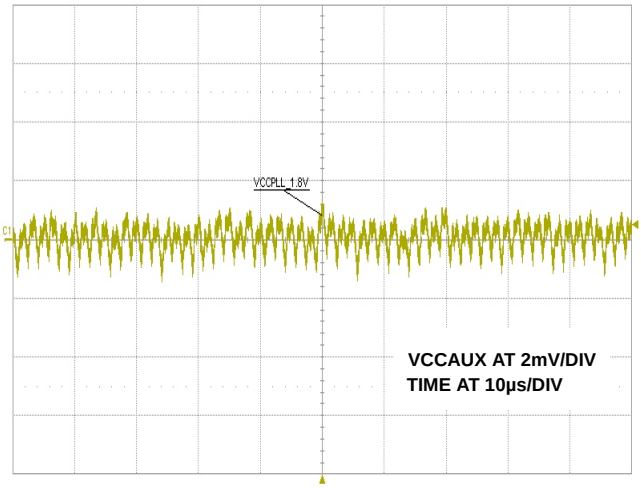

FIGURE 11. VCCAUX OUTPUT RIPPLE (MODULE AT FULL LOAD)

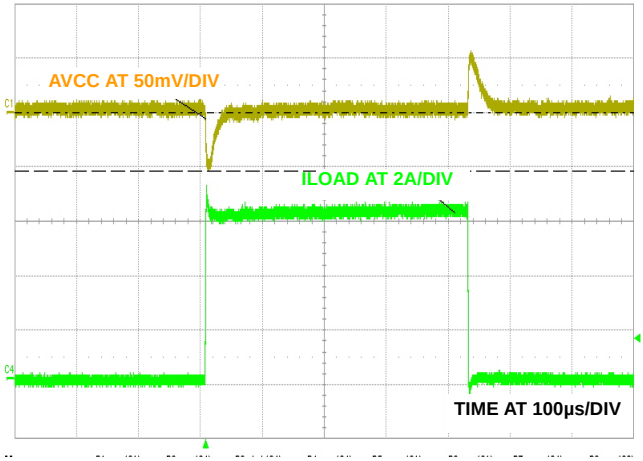

FIGURE 12. AVCC LOAD TRANSIENT (di/dt = 6A/µs)

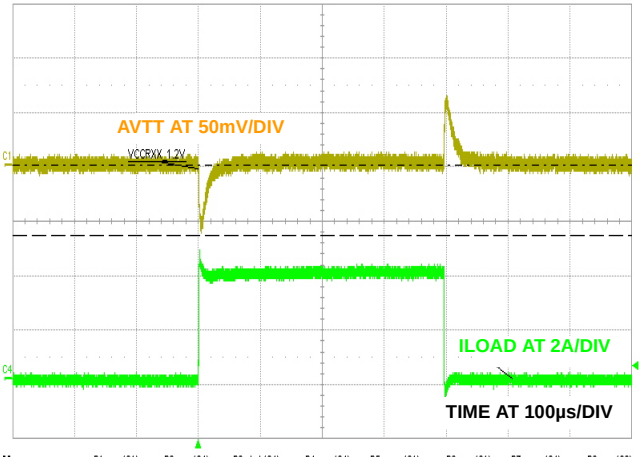

FIGURE 13. AVTT LOAD TRANSIENT (di/dt = 4A µs)

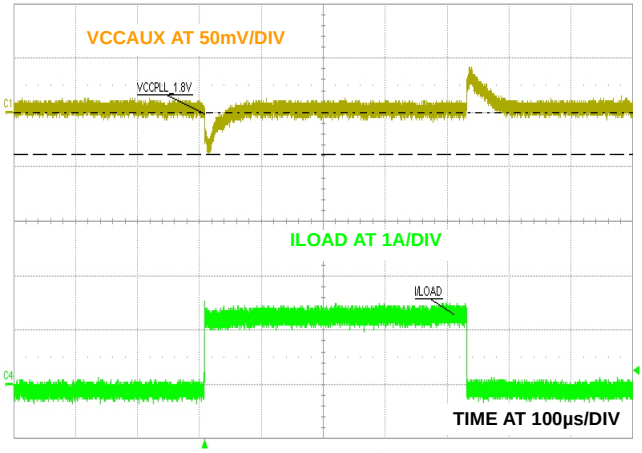

FIGURE 14. VCCAUX LOAD TRANSIENT(di/dt = 1.4A/µs)

ISL9440AMGTHEVAL3Z Schematics

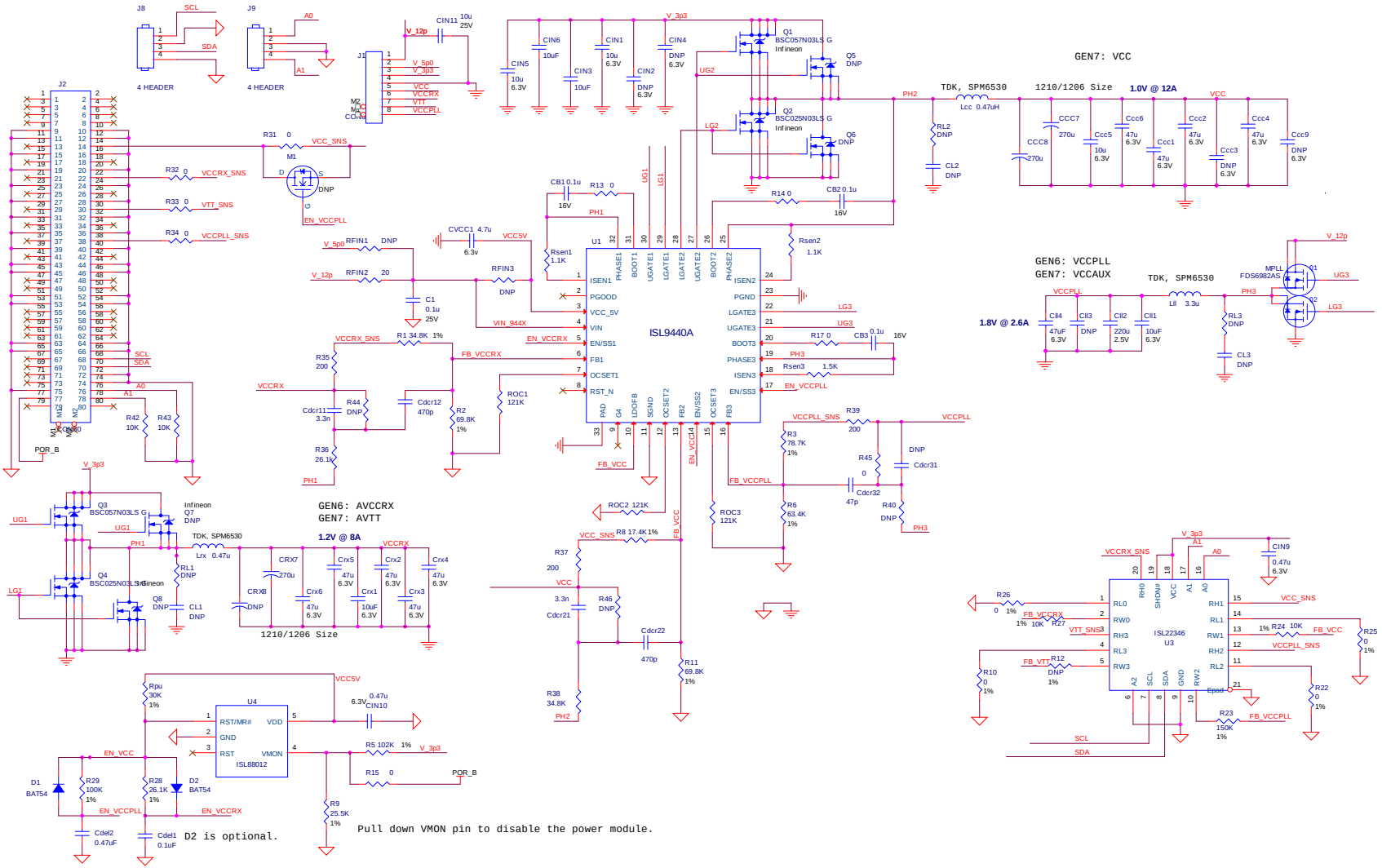

FIGURE 15. ISL9440AMGTHEVAL3Z SCHEMATIC

ISL9440AMGTHEVAL3Z Schematics (Continued)

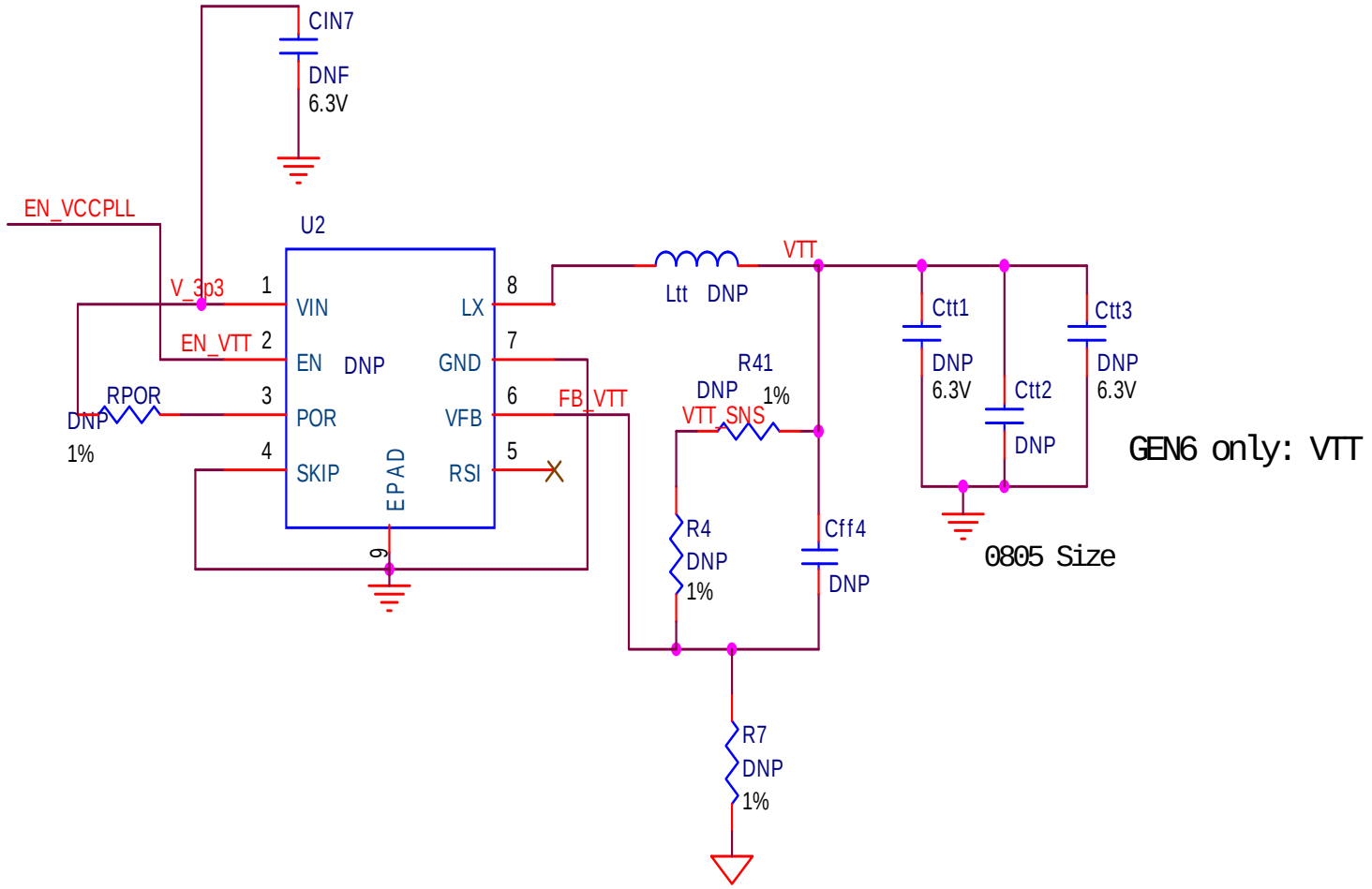

FIGURE 16. ISL9440AMGTHEVAL3Z SCHEMATIC (V6 COMPATIBLE)

ISL9440AMGTHEVAL3Z PCB Layout

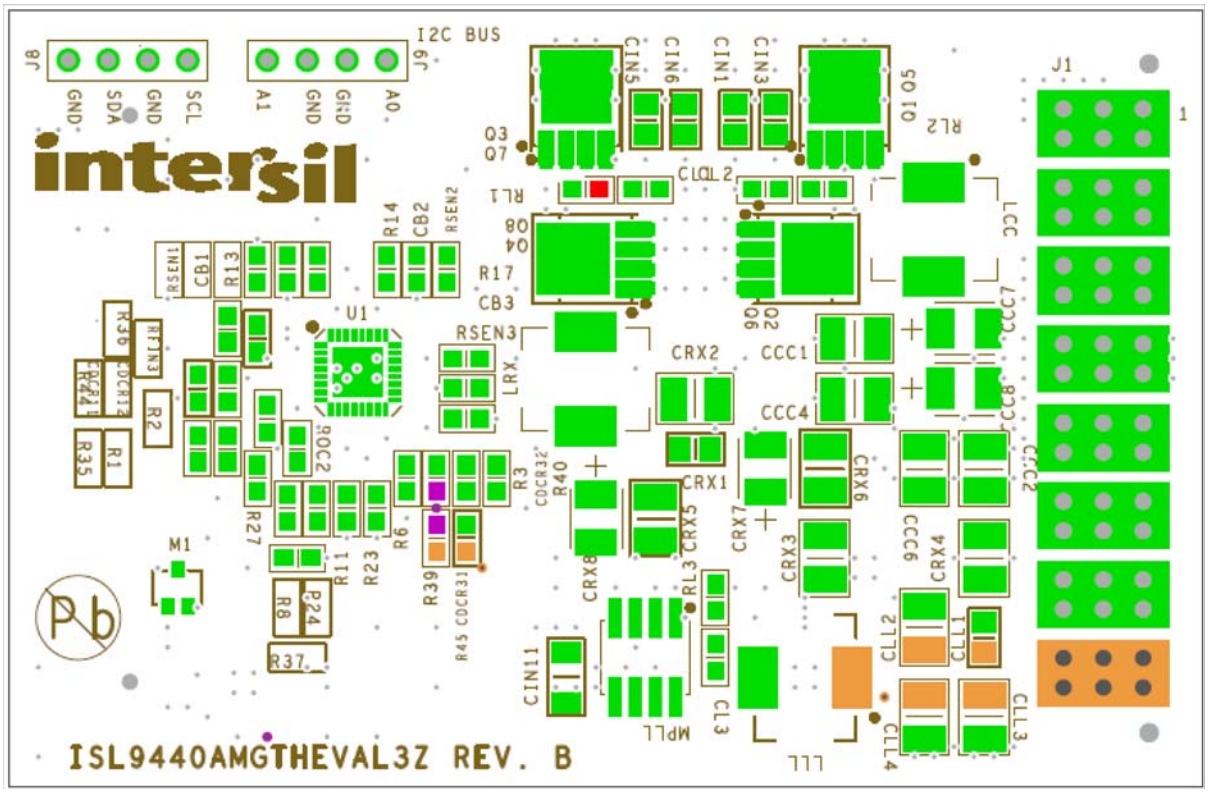

FIGURE 17. TOP SILKSCREEN

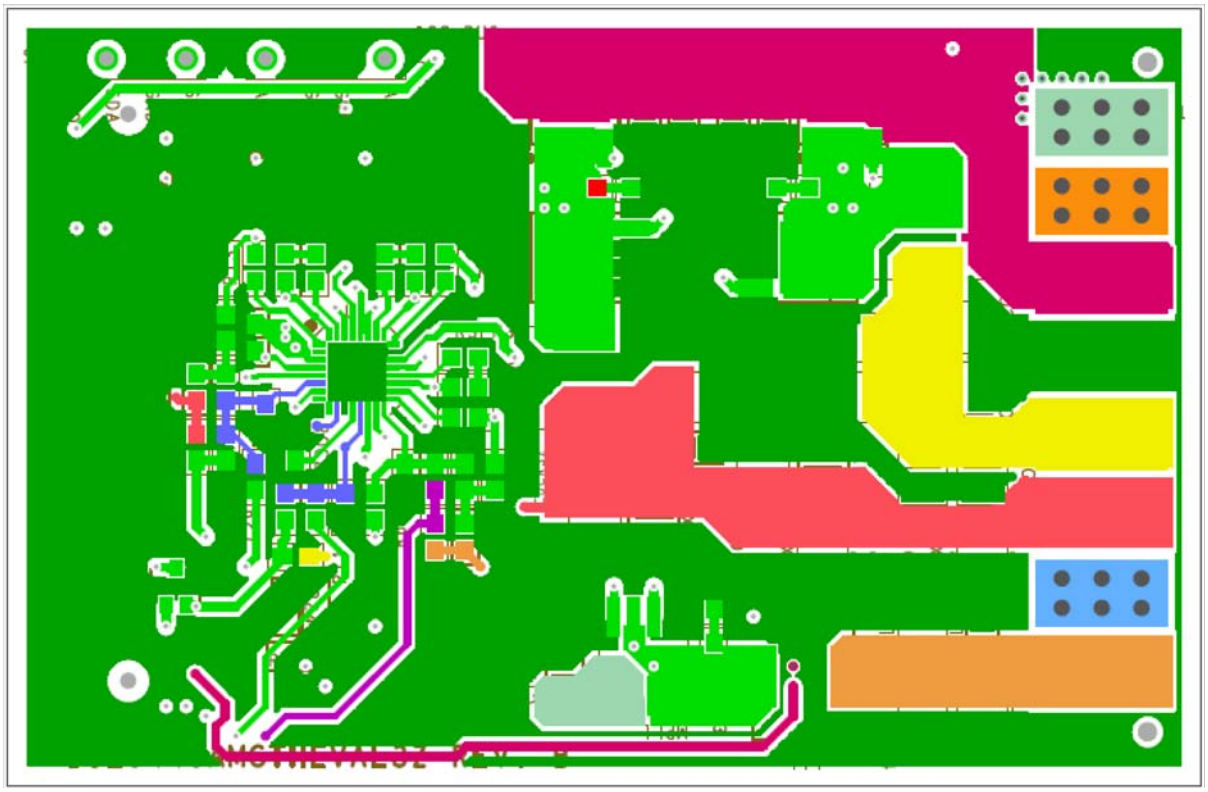

FIGURE 18. TOP LAYER

ISL9440AMGTHEVAL3Z PCB Layout (Continued)

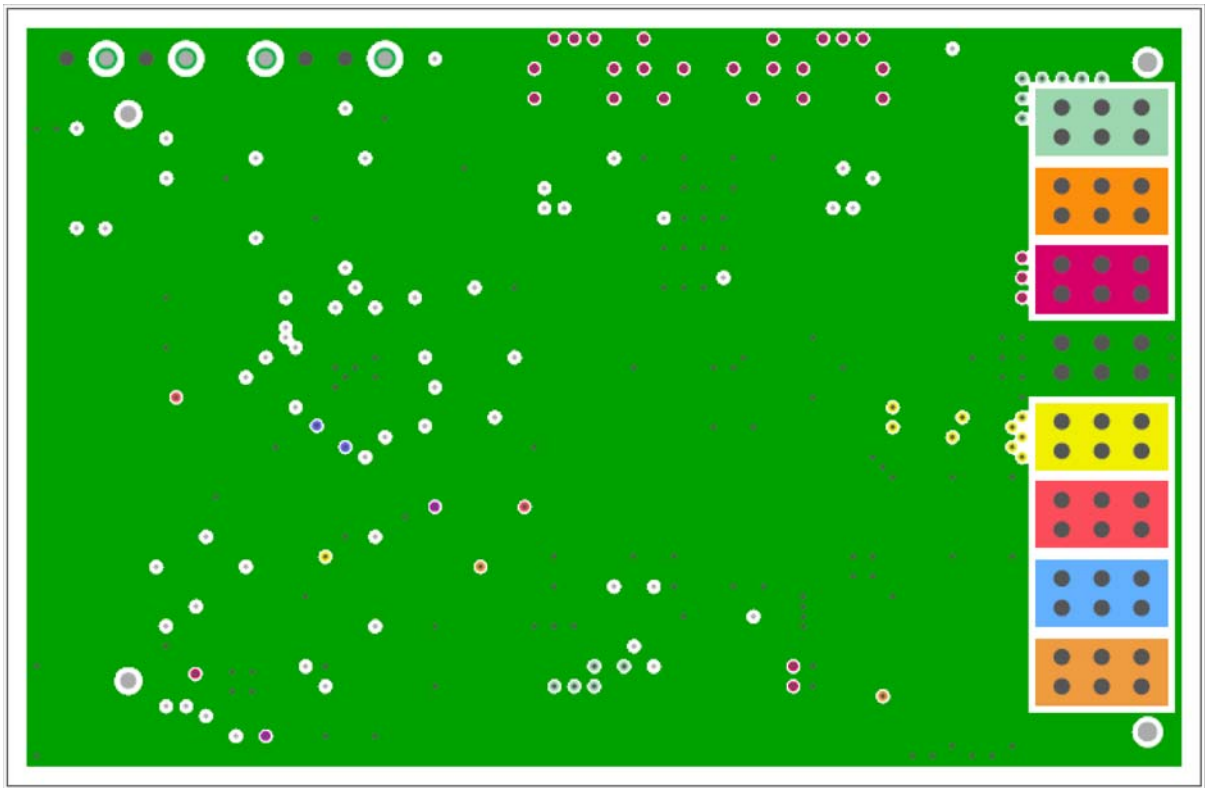

FIGURE 19. SECOND LAYER (SOLID GROUND)

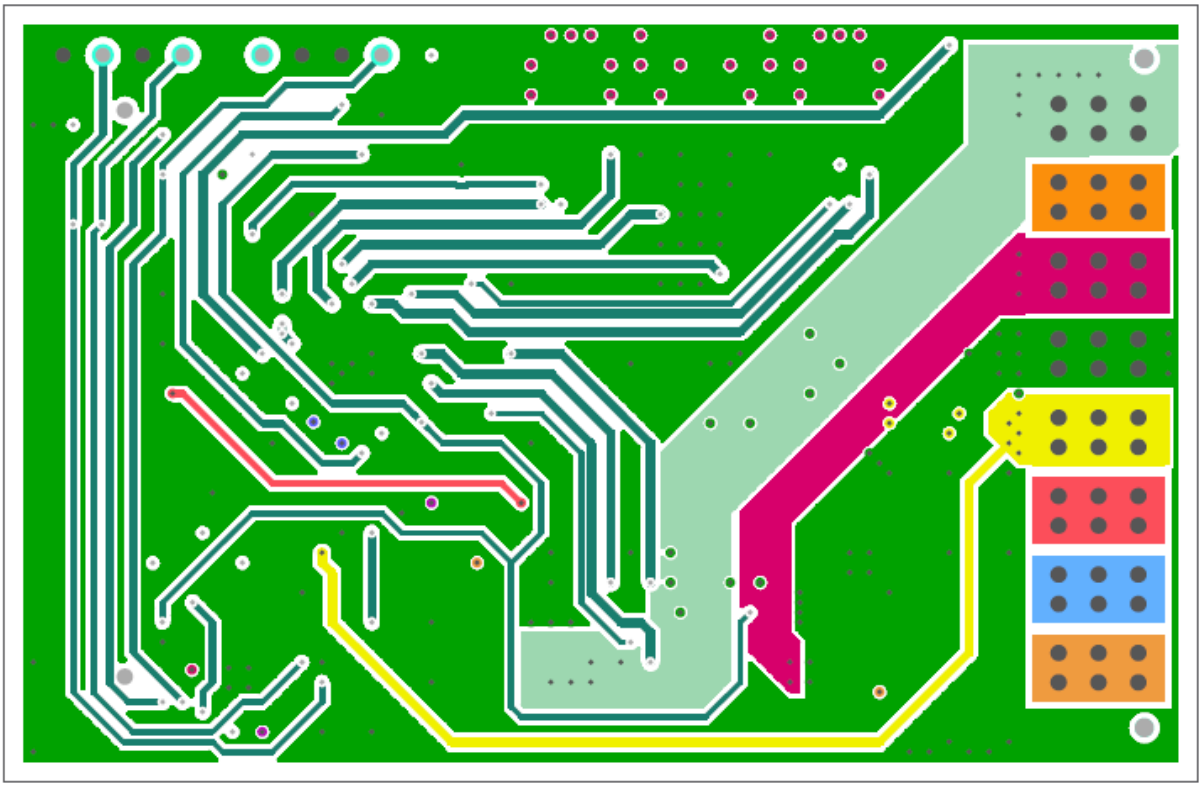

FIGURE 20. THIRD LAYER

ISL9440AMGTHEVAL3Z PCB Layout (Continued)

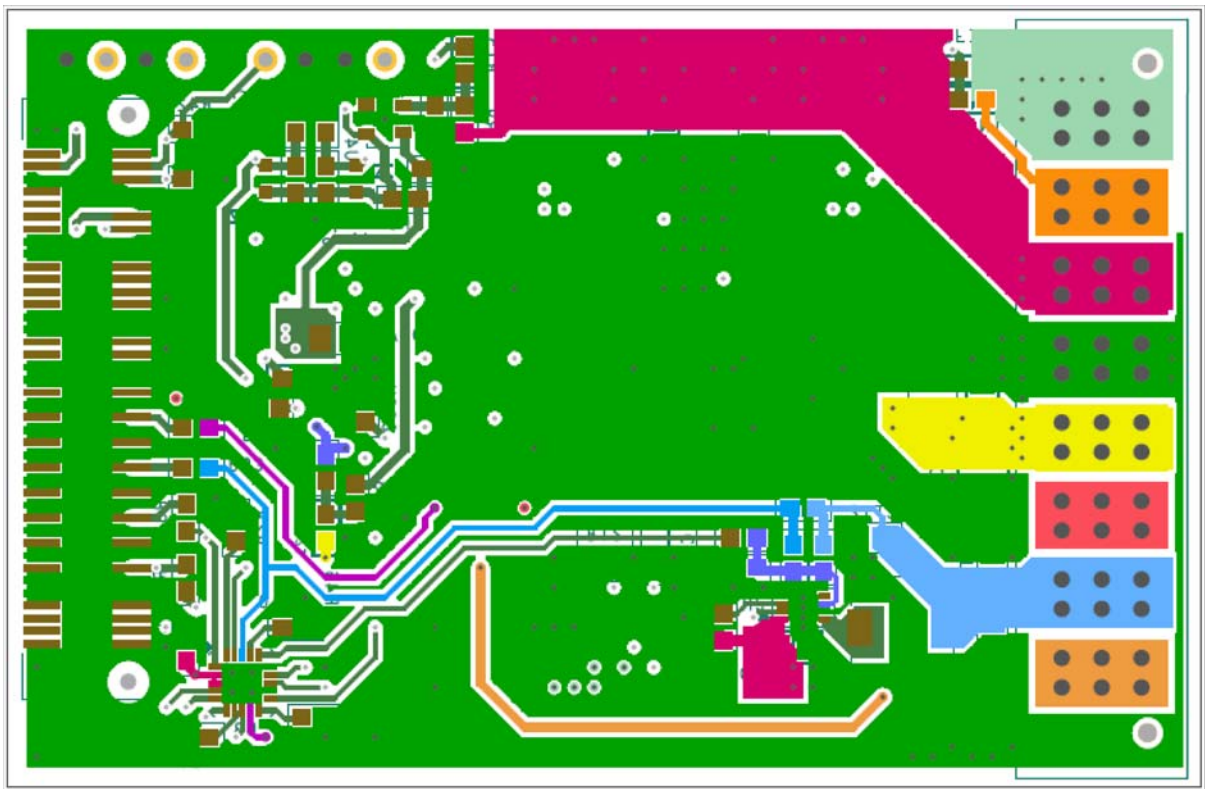

FIGURE 21. BOTTOM LAYER

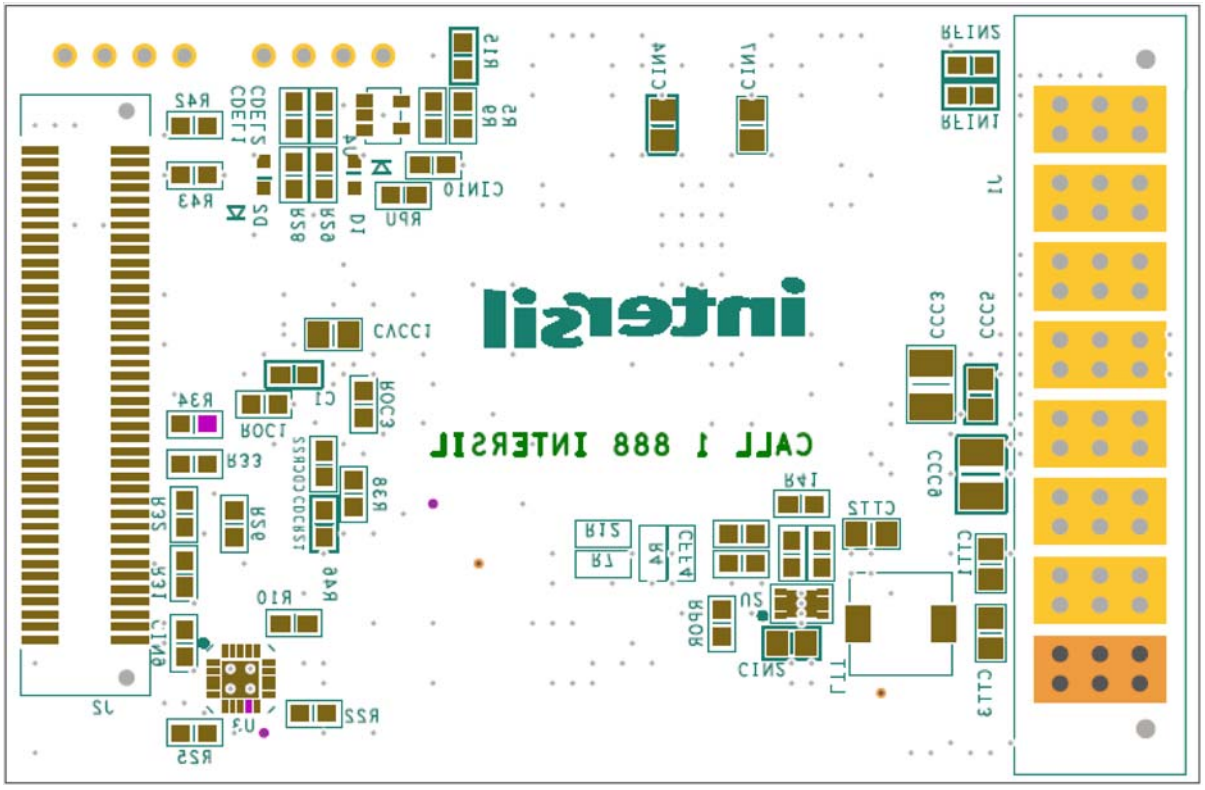

FIGURE 22. BOTTOM SILKSCREEN

Essential BOM Components

ITEM	QTY	REFERENCE	VALUE	DESCRIPTION	PART NUMBER	VENDOR
1	4	CB1, C1, CB2, CB3	0.1µF	Ceramic Capacitor, X5R, 25V, sm0603	Generic	Generic
2	3	CRX7, CCC7, CCC8	270µF	POSCAP, 2V, ESR = 9mΩ	2TPSF270M9	SANYO
3	1	CIN11	10µF	Ceramic Capacitor, X5R, 25V, sm1206	Generic	Generic
4	7	CIN1, CIN5, CIN3, CIN6, Ccc5, Crx1, Cll1,	10µF	Ceramic Capacitor, X5R, 6.3V, sm0805	Generic	Generic
5	3	CIN9, CIN10, Cdel2	0.47µF	Ceramic Capacitor, X5R, 25V, sm0603	Generic	Generic
6	1	CVCC1	4.7µ	Ceramic Capacitor, X5R, 16V, sm0805	Generic	Generic
7	11	Ccc1, Ccc2, Ccc3, Ccc4, Ccc6, Crx2, Crx3, Crx4, Crx5, Crx6, Cll4,	47µ	Ceramic Capacitor, X5R, sm1206	Generic	Generic
8	1	Cll2	220µF	POSCAP, 2, 5V, ESR = 15mΩ	2R5TPE220MAFB	SANYO
9	2	Cdcr11, Cdcr21	3.3n	Ceramic Capacitor, NP0 or C0G, sm0603	Generic	Generic
10	2	Cdcr12, Cdcr22	470p	Ceramic Capacitor, NP0 or C0G, sm0603	Generic	Generic
11	1	Cdcr32	47p	Ceramic Capacitor, NP0 or C0G, sm0603	Generic	Generic
12	1	Cdel1	0.1µF	Ceramic Capacitor, NP0 or C0G, sm0603	Generic	Generic
13	2	D1, D2		Diode, 30V, SOD523(sc79)	BAT54-02V-V-G	Vishay
14	2	Lcc, Lrx	0.47µH	Inductor	SPM6530T-R47M170	TDK
15	1	Lll	3.3µH	Inductor	SPM6530T-3R3M	TDK
16	1	MPLL	FDS6982AS	Dual Channel NFET, 30V, SOIC8	FDS6982AS	Fairchild
17	2	Q1, Q3	BSC057N03LS G	Single Channel NFET, 30V	BSC057N03LS G	Infineon
18	2	Q2, Q4	BSC025N03LS G	Single Channel NFET, 30V	BSC025N03LS G	Infineon
19	3	ROC1, ROC2, ROC3	121kΩ	Resistor, sm0603, 1%	Generic	Generic
20	1	Rpu	30.1kΩ	Resistor, sm0603, 1%	Generic	Generic
21	2	Rsen1, Rsen2,	1.1kΩ	Resistor, sm0603, 1%	Generic	Generic
22	1	Rsen3	1.5kΩ	Resistor, sm0603, 1%	Generic	Generic
23	2	R1, R38	34.8kΩ	Resistor, sm0603, 1%	Generic	Generic
24	2	R2, R11	69.8kΩ	Resistor, sm0603, 1%	Generic	Generic
25	1	R3	78.7kΩ	Resistor, sm0603, 1%	Generic	Generic
26	1	R5	102kΩ	Resistor, sm0603, 1%	Generic	Generic
27	2	R6, R40	63.4kΩ	Resistor, sm0603, 1%	Generic	Generic
28	1	R8	17.4kΩ	Resistor, sm0603, 1%	Generic	Generic
29	1	R9	25.5kΩ	Resistor, sm0603, 1%	Generic	Generic
30	1	R23	150kΩ	Resistor, sm0603, 1%	Generic	Generic
31	4	R24, R27, R42, R43	10kΩ	Resistor, sm0603, 1%	Generic	Generic
32	2	R28, R36	26.1kΩ	Resistor, sm0603, 1%	Generic	Generic

Essential BOM Components (Continued)

ITEM	QTY	REFERENCE	VALUE	DESCRIPTION	PART NUMBER	VENDOR
33	1	R29	100kΩ	Resistor, sm0603, 1%	Generic	Generic
34	3	R35, R37, R39	200Ω	Resistor, sm0603, 10%	Generic	Generic
35	1	RFIN2	20Ω	Resistor, sm0603, 1%	Generic	Generic
36	13	R10, R13, R14, R15, R17, R22, R25, R26, R31, R32, R33, R34, R45	0Ω	Resistor, sm0603, 10%	Generic	Generic
37	1	U1	ISL9440A	Triple PWM CONTROLLER	ISL9440AIRZ	Intersil
38	1	U3	ISL22346	DCP, 20LTQFN, Option U	ISL22346UFRT20Z	Intersil
39	1	U4	ISL88012	Voltage Monitor, 4.6V VDD, 0.6V ref.	ISL88012IH546Z	Intersil
Connectors or Resistor Jumpers, not for Embeded Power Supplies						
36	1	J1	CON8	8 Lead Connector	MPS-08-7.70-01-L-V	Samtec
37	1	J2	CON80		BSE-040-01-L-D-A	Samtec
Optional Components not Populated for Debugging Purpose						
39	0	CIN7, CIN4, Cdcr31	DNP	Capacitor Holder	Generic	Generic
40	0	RL1, RFIN1, Ctt1, CL1, U2, RL2, Ctt2, CL2, RL3, RFIN3, Ctt3, CL3, R4, Cff4, Q5, Q6, R7, Q7, Q8, CRX8, Ccc9, R12, R40, R41, R44, R46, RPOR, Ltt, CIN2,	DNP	Resistor Holder	Generic	Generic
41	0	J8, J9	DO NOT POPULATE	4 Head Jumper	Generic	Generic
42	0	M1	DNP	MOSFET, N-channel, Single	Generic	Generic