ISL73849SLHEV1Z

2-Phase ISL73849SLH Board

Description

The ISL73849SLHEV1Z evaluation board benchmarks the performance of the ISL73849SLH dual-phase buck controller. The evaluation board is optimized for a 4.5V to 15V input operation to generate a 50A max, 1V output. Input and output connections, test points, and jumper settings on the board provide customers an easy-to-use evaluation platform for point-of-load power applications.

Specifications

- Buck Power Supply input (PVIN): 4.5V to 15V
- Analog Supply input (VDD): 4.75V to 13.2V
- Preset output voltage: 1V
- Preset Switching Frequency: 500kHz
- Maximum dual-phase output current: 50A
- Maximum single-phase output current: 25A
- Preset droop regulation

Features

- Power-Good LED indicator
- On-board 50A transient load current generator
- Integrated LDO (VCC)
- External Clock Synchronization (SYNC-I and SYNC-O)
- Load-line DROOP regulation
- Differential remote VOUT sensing

Contents

- ISLUSBISLUSBPMADAPT3Z
- USB 2.0, Type A Male to Type Mini-B Male

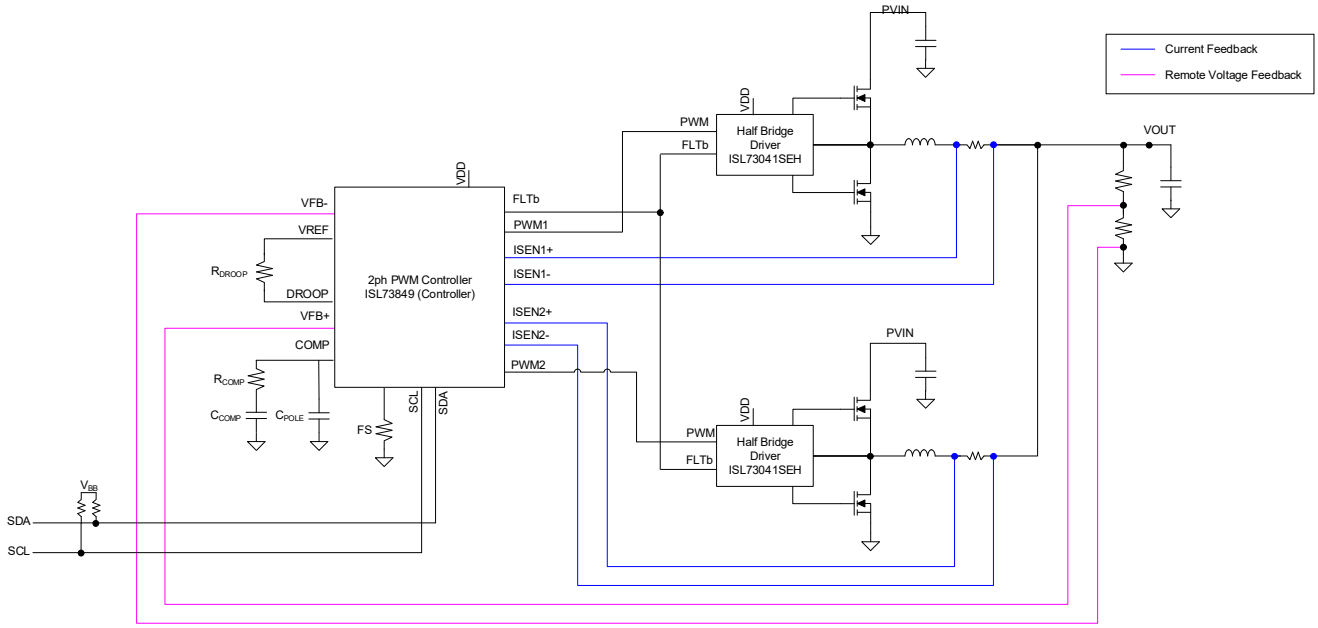

Figure 1. Block Diagram

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1. Functional Description

The ISL73849SLH is a dual-phase PWM Controller that interfaces with the ISL73041SEH GaN half-bridge drivers to control the ISL70020SEH GaN FETs for point-of-load buck regulation in low-voltage, high-current applications such as FPGA core rails. The ISL73849SLH controller operates its two phases at 180° phase shift. Each phase delivers 25A RMS for a total 50A solution.

1.1 Operating Range

The ISL73849SLHEV1Z evaluation board requires two supply rails to operate properly. One for the ISL73849SLH controller's analog supply input, the two ISL73041SEH GaN half-bridge drivers, and the load transient generator circuits (VDD). The other rail is for the on-board buck power supply input (PVIN).

The PVIN can go from 4.5V to 15V. The VDD rail accepts an input range of 4.75V to 13.2V. The VDD voltage is limited to a maximum of 13.2V because of the ISL73041SEH GaN drivers. The buck regulator circuit is preset for a 0.976V output voltage and a switching frequency of 500kHz. The output voltage can be brought up to 0.99V by programming the controllers reference voltage to 0.6V using PMBus. This converter is capable of providing 50A of output current.

1.2 PMBus GUI Installation

1. Run the ISL73849_Cust_Installer_v.0.0.13.
2. Accept the Agreement.
3. Click **Next** to default to the recommended destination location for the install.
4. Click **Next** to default to the recommended application shortcut install name and location.
5. Click **Install**.
6. Click **Finish** to launch the application. The GUI opens (Figure 2).

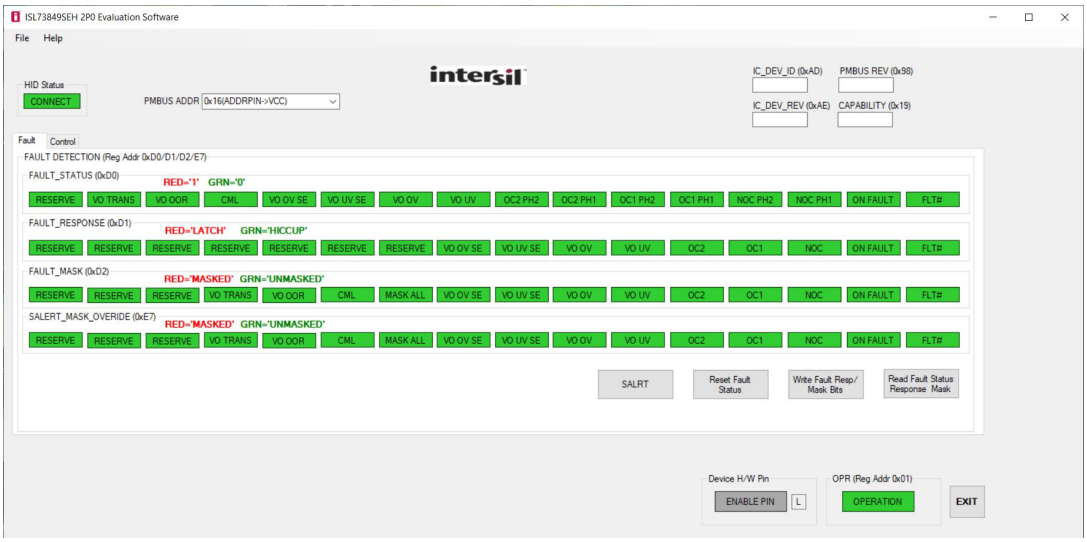

Figure 2. ISL73849 Evaluation Software Main Page

7. Close the GUI.

1.3 Quick-Start Guide

1. Ensure JP1, JP4, and JP5 are connected to position 2-3.
2. Ensure JP2 is removed.
3. Ensure JP7, JP9, and JP6 are connected.
4. Flip all the switches up on SW1.

5. Connect the ISLUSBPMBADAPT3ZA to the J2 connector as shown in Figure 3.

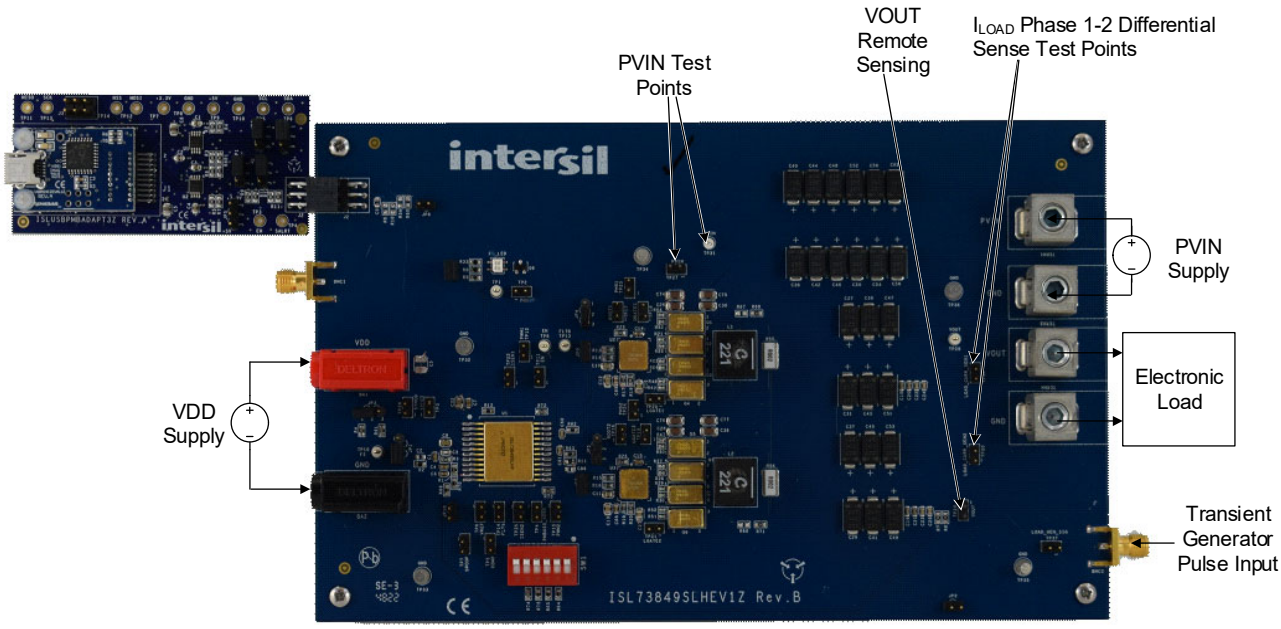

Figure 3. ISL73849SLHEV1Z Board Setup

6. Connect the provided USB to the computer and the ISLUSBPMBADAPT3ZA.
7. Apply a 4.5V to 15V voltage to PVIN metal banana plug connectors as shown in Figure 3.
8. Apply a 4.75V to 13.2V voltage to the VDD banana connectors as shown in Figure 3.
9. If required, a resistor or electronic load can be connected to the VOUT metal banana plug connectors as shown in Figure 3. For output voltage measurements, use the TP29 test point.
10. Enable the ISL73849SLH with the Device H/W Pin (**ENABLE PIN** button) on the GUI as shown in Figure 4. The board is enabled and is immediately disabled with the PMBus OPERATION bit.

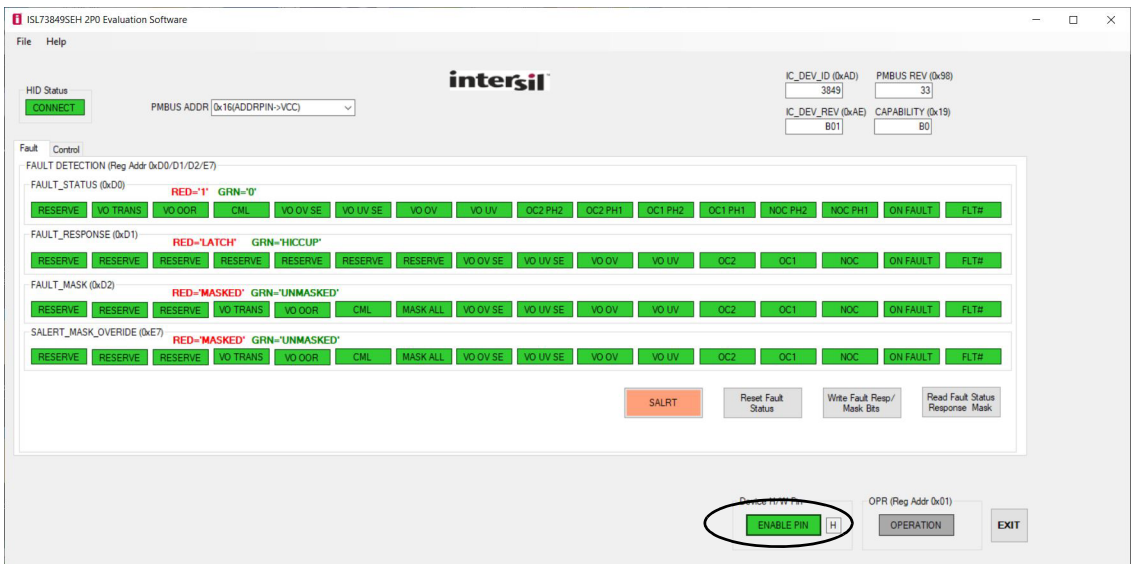

Figure 4. Click the ENBLE PIN Button

11. Program the PWM Controller VREF to 0.6V by clicking **Write VREF** as shown in Figure 5.

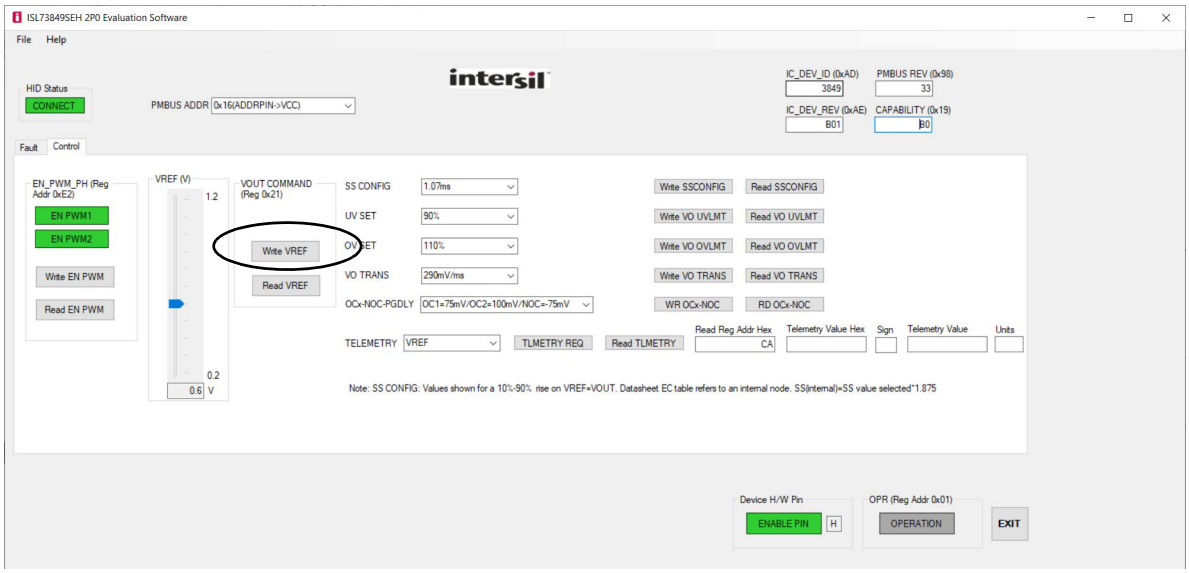

Figure 5. Change the VREF

12. Enable power-up with the **OPERATION** button as shown in Figure 6.

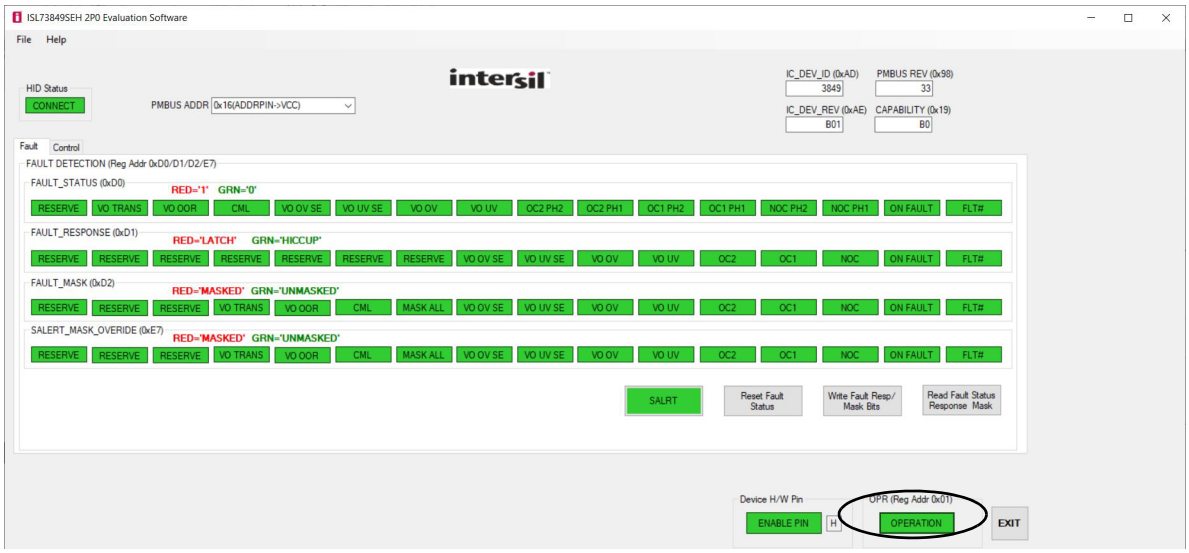

Figure 6. Click the OPERATION button

1.4 On-Board Load Transient Generator

The ISL73849SLHEV1Z includes an on-board transient load generator that uses a single ISL70040SEH GaN FET driver to drive two ISL70020SEH N-Channel GaN FET load switches. The load is composed of 6x 200mΩ resistors on each phase.The transient load generator simulates a 50A load step on the 1V rail when the FETs are turned on. For smaller load steps, remove some of the load resistors.

To use the on-board transient generator, short JP2 to power up the ISL70040SEH with the VDD supply. Connect the pulse generator or function generator to the TRAN_IN BNC1 connector. Renesas recommends using the transient load generator in low duty cycle to prevent thermal failure of the resistors. Based on the bandwidth of the converter, a load transient of 500µs is sufficiently long enough to see the converter transient response. Keep the period of the transient load low (for example, for 1% duty cycle use 50ms). A 0V to 5V logic signal is sufficient to drive the ISL70040SEH. To monitor or trigger off of the pulse generator signal, use the TP37 test jumper.

1.5 Droop Regulation

The ISL73849SLHEV1Z is configured to minimize peak-to-peak transient response excursions by using a 604Ω resistor connected between the VREF and DROOP pins (R_1). If droop regulation is not required, short out the DROOP resistors with JP10. For more information about the droop regulation, refer to the *ISL73849SLH Datasheet*.

1.6 Enabling/Disabling

The ISL73849SLHEV1Z is configured by default to enable the ISL73849SLH with the ISLUSBPMBADAPT3ZA, which has an MCU. The MCU controls the EN pin and PMBus OPERATION bit in conjunction with the ISL73849 GUI Software when first initializing the GUI. This allows changing the PMBus registers to non-default values before powering up the converter.

2. Board Design

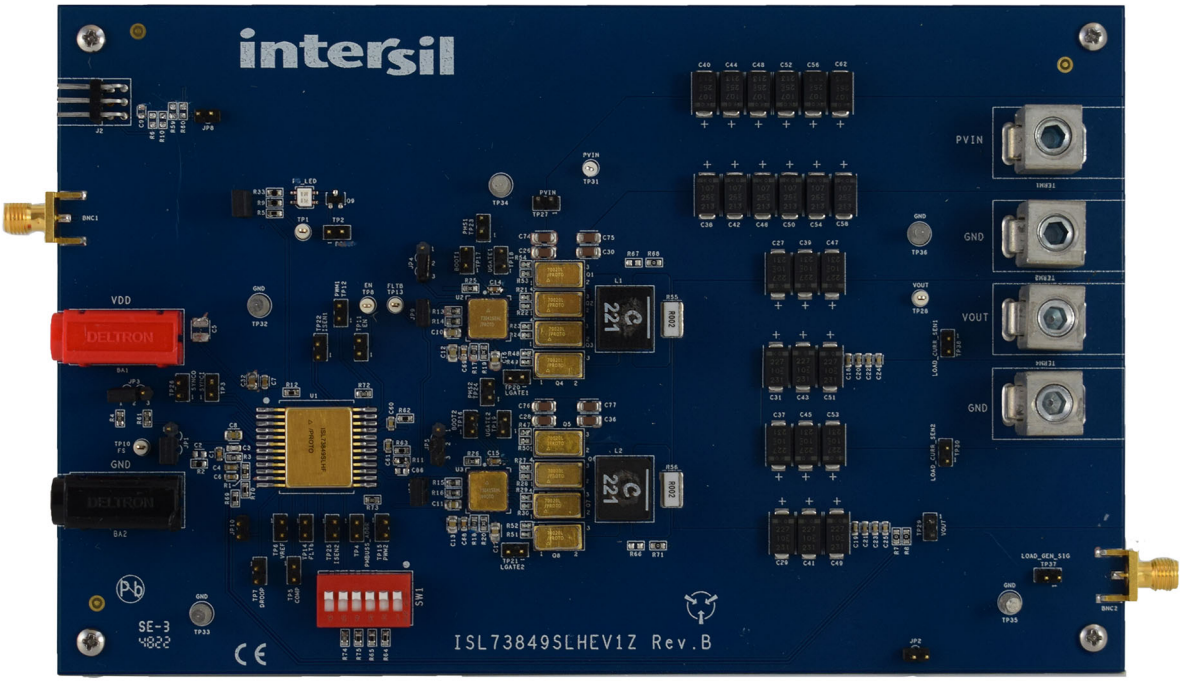

Figure 7. ISL73849SLHEV1Z Evaluation Board (Top)

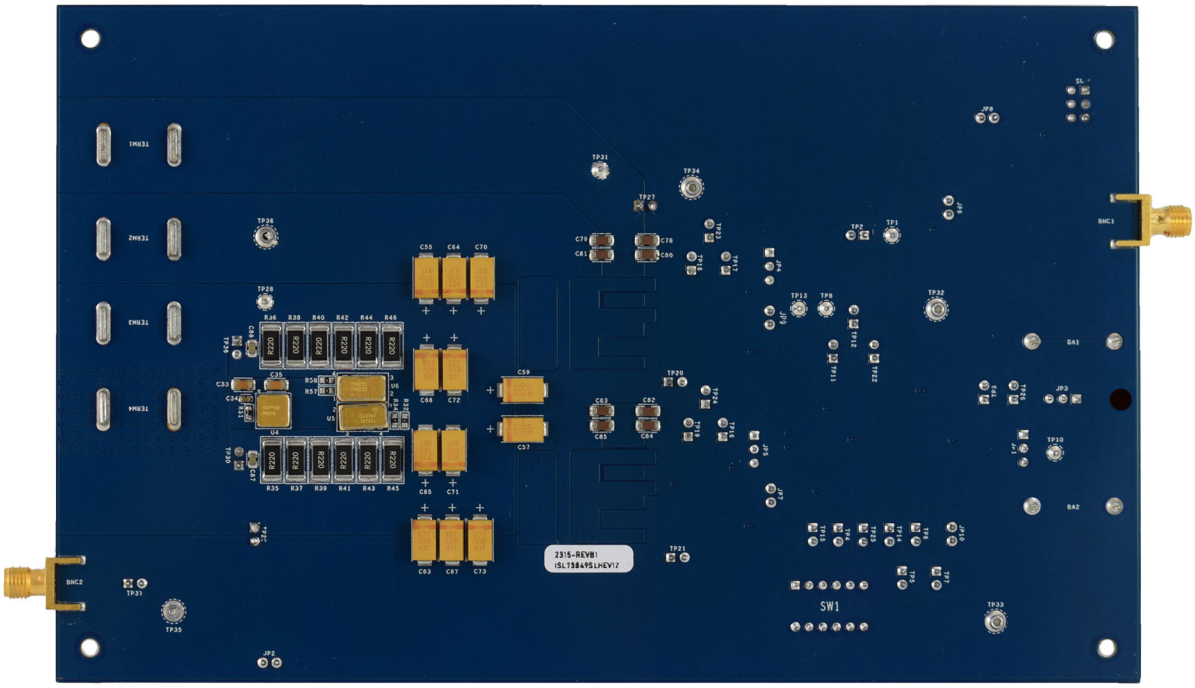

Figure 8. ISL73849SLHEV1Z Evaluation Board (Bottom)

2.1 Schematic Diagrams

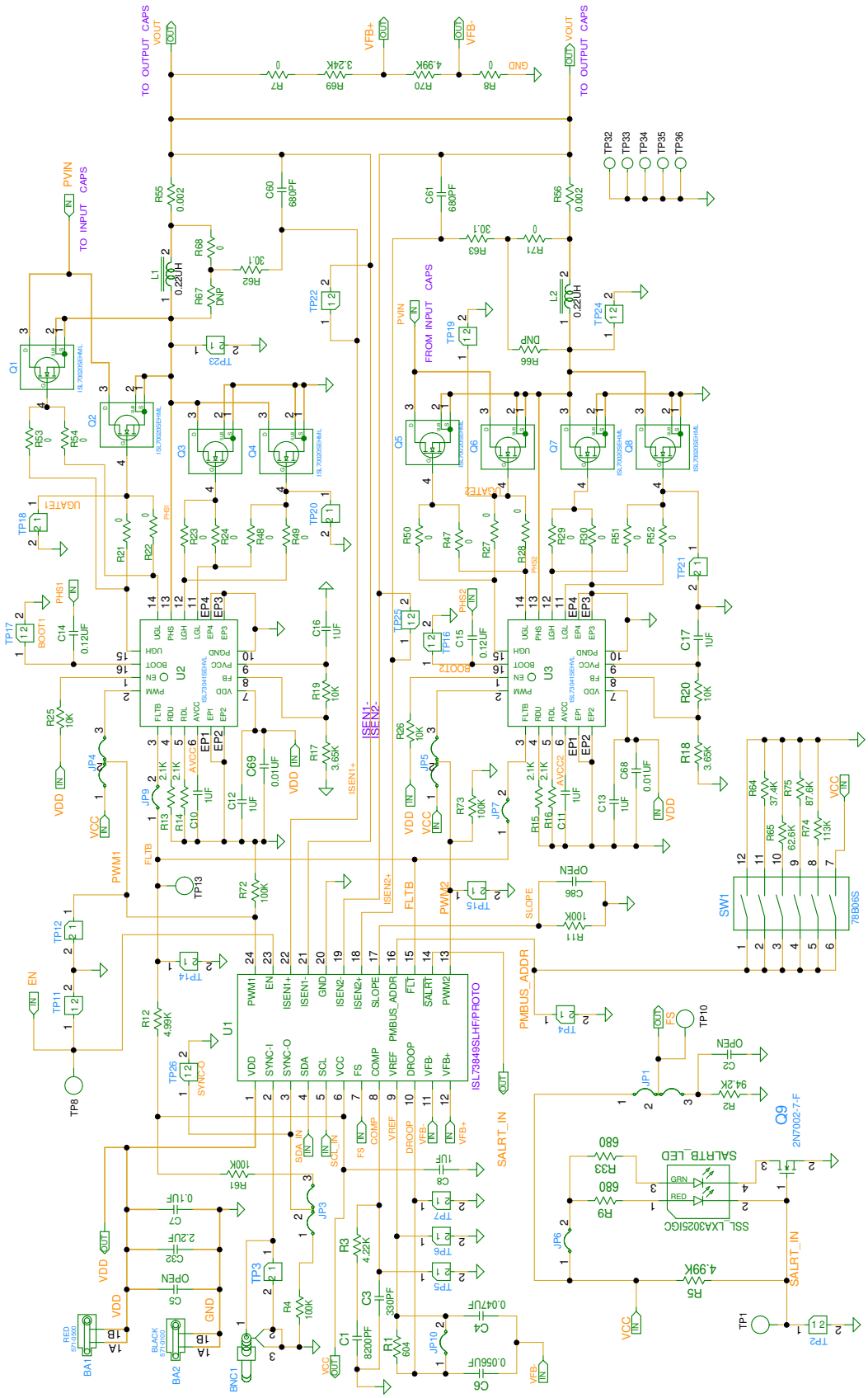

Figure 9. ISL73849SLHEV1Z Schematic

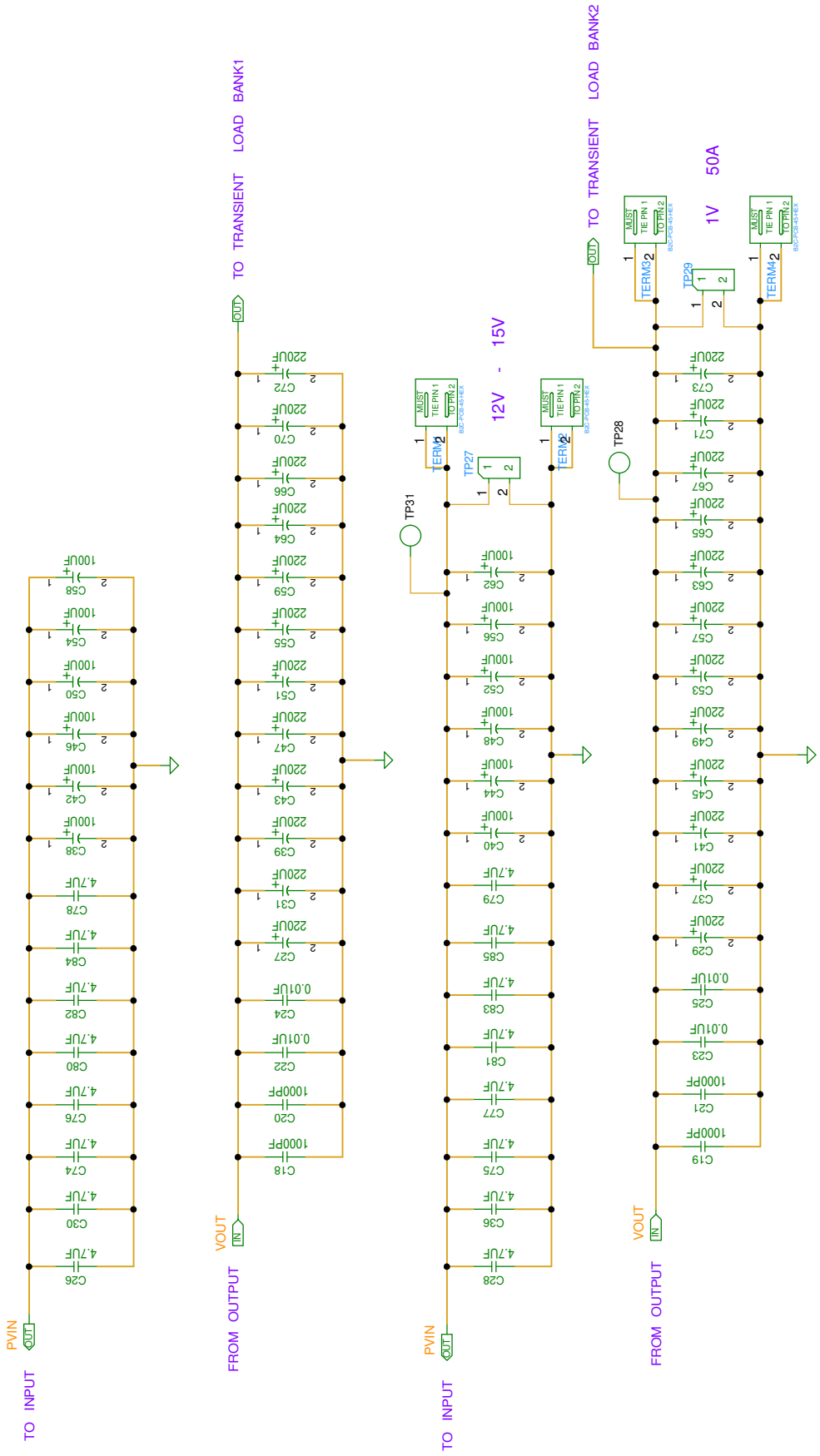

Figure 10. ISL73849SLHEV1Z Schematic (C_{IN} and C_{OUT})

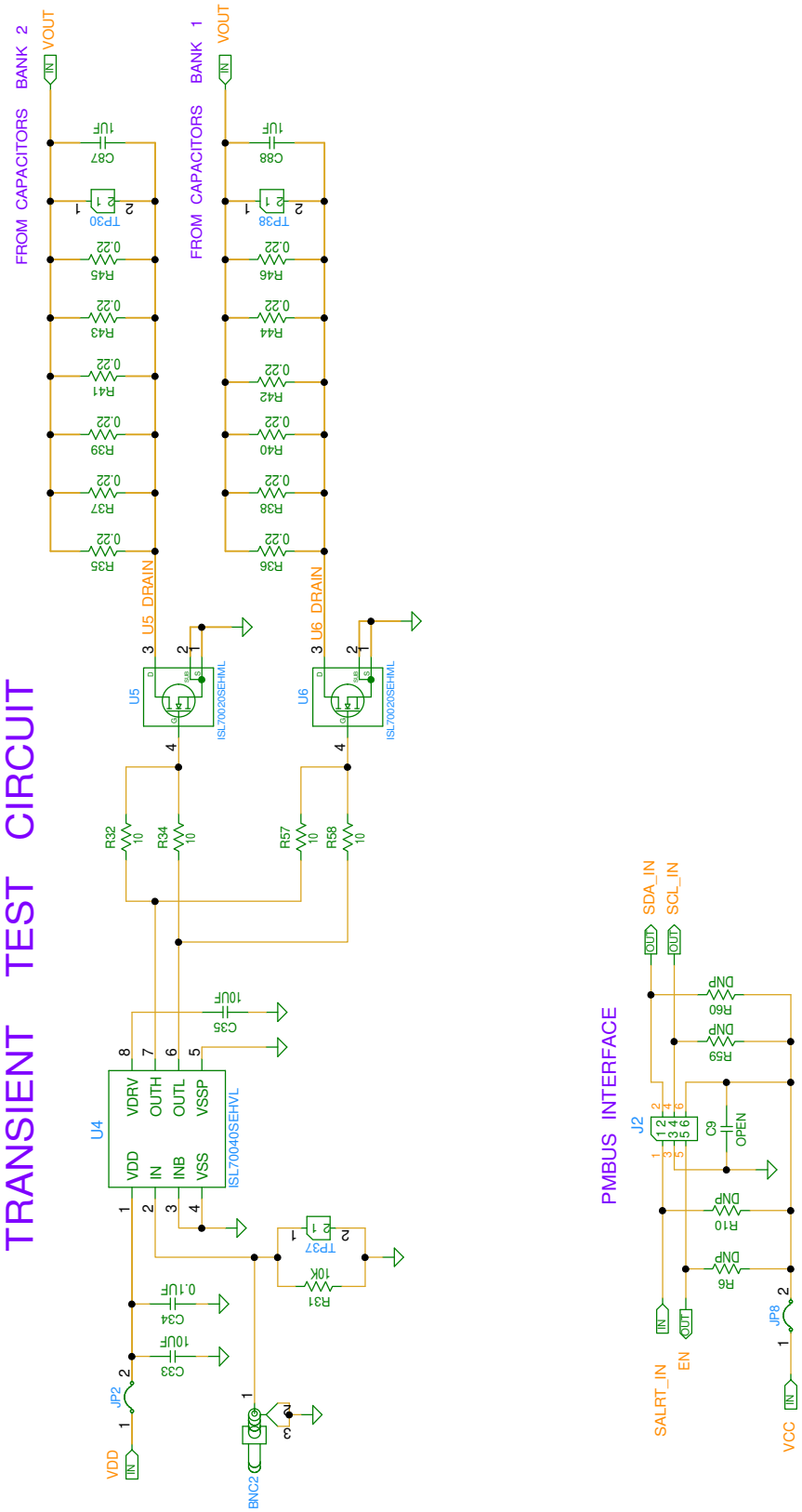

Figure 11. ISL73849SLHEV1Z Schematic (Transient Test Circuits)

2.2 Bill of Materials

Qty	Reference Designator	Description	Manufacturer	Part Number
1	PCB	-	-	ISL73849SLHEV1ZREVBPCB
6	C22-C25, C68, C69	CAP, SMD, 0603, 0.01µF, 25V, 10%, X7R, ROHS	Kemet	C0603C103K3RAC7411-T
1	C4	CAP, SMD, 0603, 0.047µF, 25V, 10%, X7R, ROHS	AVX	06033C473KAT2A-T
1	C6	CAP, SMD, 0603, 0.056µF, 50V, 10%, X7R, ROHS	KEMET	C0603X563K5RAC7867-T
2	C14, C15	CAP, SMD, 0603, 0.12µF, 50V, 10%, X7R, ROHS	Kemet	C0603C124K5RAC7867-T
2	C7, C34	CAP, SMD, 0603, 0.1µF, 50V, 10%, X7R, ROHS	TDK	C1608X7R1H104K080AA-T
4	C18-C21	CAP, SMD, 0603, 1000pF, 25V, 10%, C0G/NP0, ROHS	AVX	KGM15ACG1E102KT-T
1	C3	CAP, SMD, 0603, 330pF, 50V, 10%, X7R, ROHS	AVX	06035C331K4T2A-T
2	C60, C61	CAP, SMD, 0603, 680pF, 25V10%, X7R, ROHS	AVX	KGM15AR71E681KT-T
1	C1	CAP, SMD, 0603, 8200pF, 50V, 5%, X7R, ROHS	Vishay	VJ0603Y822JXACW1BC-T
9	C8, C10-C13, C16, C17, C87, C88	CAP, SMD, 0805, 1µF, 25V, 10%, X7R, ROHS	AVX	08053C105KAT2A-T
1	C32	CAP, SMD, 0805, 2.2µF, 25V, 10%, X7R, ROHS	MURATA	GRM21BR71E225KA73L-T
2	C33, C35	CAP, SMD, 1206, 10µF, 25V, 10%, X7R, ROHS	TDK	C3216X7R1E106K160AB-T
16	C26, C28, C30, C36, C74-C85	CAP, SMD, 1206, 4.7µF, 25V, 10%, X7R, ROHS	TDK	C3216X7R1E475K160AE-T
12	C38, C40, C42, C44, C46, C48, C50, C52	CAP-TANT, SMD, 7.3×4.3mm, 100µF, 25V, 20%, ROHS	KEMET	T521X107M025ATE030-T
0	C54, C56, C58, C62	CAP-TANT, SMD, 7.3×4.3mm, 100µF, 25V, 20%, ROHS		T521X107M025ATE030-T
24	a)C27, C29, C31, C37, C39, C41, C43, C45, C47	CAP-TANT, SMD, 7.3×4.3×2.8, 220µF, 10V, 20%, ROHS	KEMET	T530D227M010ATE006-T
0	b)C49, C51, C53, C55, C57, C59	CAP-TANT, SMD, 7.3×4.3×2.8, 220µF, 10V, 20%, ROHS		T530D227M010ATE006-T
0	c)C63-C67, C70-C73	CAP-TANT, SMD, 7.3×4.3×2.8, 220µF, 10V, 20%, ROHS		T530D227M010ATE006-T
2	L1, L2	COIL-AEC-Q200, PWR INDUCT, SMD, 11.3×10mm, 0.22µH, 20%, ROHS	CoilCraft	XAL1010-221MEB-T
6	JP2, JP6-JP10	CONN-HEADER, 1×2, BREAKAWY 1X36, 2.54mm, ROHS	GENERIC	68000-236HLF-1X2
24	a)TP2-TP7, TP11, TP12, TP14-TP26	CONN-HEADER, 1×2, RETENTIVE, 2.54mm, ROHS	FCI	69190-202HLF
0	b)TP30, TP37, TP38	CONN-HEADER, 1×2, RETENTIVE, 2.54mm, ROHS		69190-202HLF
2	TP27, TP29	CONN-HEADER, 1×2, RETENTIVE, 2.54mm, ROHS	FCI	69190-202HLF
4	JP1, JP3-JP5	CONN-HEADER, 1×3, BREAKAWY 1X36, 2.54mm, ROHS	GENERIC	68000-236HLF-1X3
1	J2	CONN-HEADER, 2×3, BRKAWY, 2.54mm, TIN, R/A, ROHS	SAMTEC	TSW-103-08-T-D-RA
6	a)JP1(PIN2-3), JP4(PIN2-3), JP5(PIN2-3)	CONN-JUMPER, SHUNT, 2P, 2.54mmPITCH, BLK, 6mm, ROHS		SPC02SYAN
0	b)JP6, (PIN1-2), JP7(PIN1-2), JP9(PIN1-2)	CONN-JUMPER, SHUNT, 2P, 2.54mmPITCH, BLK, 6mm, ROHS		SPC02SYAN
6	TP1, TP8, TP10, TP13, TP28, TP31	CONN-MINI TEST POINT, VERTICAL, WHITE, ROHS	KEYSTONE	5002

Qty	Reference Designator	Description	Manufacturer	Part Number
1	BA2	CONN-PLUG, TH, 4mm INSUL.SOCKET, BLK, R/A, ROHS	Deltron	571-0100
1	BA1	CONN-PLUG, TH, 4mm INSUL.SOCKET, RED, R/A, ROHS	Deltron	571-0500
2	BNC1, BNC2	CONN-RF, SMA JACK, 50Ω, 18GHz, TAB-END LAUNCH, ROHS	Amphenol	132357-11
5	TP32-TP36	CONN-TURRET, TERMINAL POST, TH, ROHS	Keystone	1514-2
3	C2, C9, C86	DO NOT POPULATE OR PURCHASE	-	-
1	C5	DO NOT POPULATE OR PURCHASE	-	-
6	R6, R10, R59, R60, R66, R67	DO NOT POPULATE OR PURCHASE	-	-
4	TERM1-TERM4	HDWARE-SINGLE WIRE LUG, TH, 11.8×10.3mm, HEX SCREW, ROHS	IHI Connectors	B2C-PCB-HEX
1	U4	IC-100V, RH, GAN FET DRIVER, SMD, 8P, CLCC, ROHS	Renesas	ISL70040SEHL/PROTO
10	Q1-Q8, U5, U6	IC-PROTO, RAD HARD, 40V GAN FET, 4P, CLCC, ROHS	Renesas	ISL70020SEHL/PROTO
2	U2, U3	IC-RAD LIGHT GaNFET, 1/2 BRIDGE DRIVER, 14P, CLCC, ROHS	Renesas	ISL73041SEHL/PROTO
1	U1	IC-RH, CFP, DUAL PHASE PWM CONTROLLER W/PMBUS, ROHS	Renesas	ISL73849SLHF/PROTO
1	SALRTB_LED	LED, SMD, 3×2.5mm, 4P, RED/GREEN, 2V, ROHS	LUMEX	SSL-LXA3025IGC-TR
16	R21-R24, R27-R30, R47-R54	RES, SMD, 0402, 0Ω, 1/16W, 1%, TNF, ROHS	VISHAY	MCS04020Z0000ZE000-T
4	R7, R8, R68, R71	RES, SMD, 0603, 0Ω, 1/4W, TF, ROHS	Vishay	RCS06030000Z0EA-T
1	R74	RES, SMD, 0603, 113K, 1/10W, 1%, TKF, ROHS	Yageo	RC0603FR-07113KL-T
3	R5, R12, R70	RES, SMD, 0603, 4.99K, 1/10W, 1%, TKF, ROHS	Yageo	RC0603FR-074K99L-T
1	R2	RES, SMD, 0603, 94.2K, 1/10W, 0.1%, TNF, ROHS	Yageo	RT0603BRD0794K2L-T
5	R4, R11, R61, R72, R73	RES-AEC-Q200, SMD, 0603, 100K, 1/10W, 1%, TKF, ROHS	Stackpole	RMCF0603FT100K-T
5	R19, R20, R25, R26, R31	RES-AEC-Q200, SMD, 0603, 10K, 1/10W, 1%, TKF, ROHS	Vishay	CRCW060310K0FKEB-T
4	R32, R34, R57, R58	RES-AEC-Q200, SMD, 0603, 10Ω, 1/10W, 1%, TKF, ROHS	ROHM	KTR03EZPF10R0-T
4	R13-R16	RES-AEC-Q200, SMD, 0603, 2.1K, 1/10W, 1%, TKF, ROHS	KOA	RK73H1JTTD2101F-T
1	R69	RES-AEC-Q200, SMD, 0603, 3.24K, 1/10W, 1%, TF, ROHS	Yageo	AC0603FR-073K24L-T
2	R17, R18	RES-AEC-Q200, SMD, 0603, 3.65K, 1/10W, 1%, ROHS	KOA	RK73H1JTTD3651F-T
2	R62, R63	RES-AEC-Q200, SMD, 0603, 30.1Ω, 1/8W, 1%, TKF, ROHS	KOA	RK73H1JTTD30R1F-T
1	R64	RES-AEC-Q200, SMD, 0603, 37.4K, 1/10W, 1%, ROHS	Yageo	RMCF0603FT37K4-T
1	R3	RES-AEC-Q200, SMD, 0603, 4.22K, 1/10W, 1%, TKF, ROHS	Yageo	AC0603FR-074K22L-T
1	R1	RES-AEC-Q200, SMD, 0603, 604Ω, 1/8W, 1%, TKF, ROHS	KOA	RK73H1JTTD6040F-T
1	R65	RES-AEC-Q200, SMD, 0603, 62.6K, 1/10W, 1%, TNF, ROHS	KOA	RN73R1JTTD6262F100-T

Qty	Reference Designator	Description	Manufacturer	Part Number
2	R9, R33	RES-AEC-Q200, SMD, 0603, 680Ω, 1/10W, 1%, TKF, ROHS	Vishay	CRCW0603680RFKEA-T
1	R75	RES-AEC-Q200, SMD, 0603, 87.6K, 1/10W, 1%, THINFILM, ROHS	KOA	RN73R1JTTD8762F100-T
2	R55, R56	RES-AEC-Q200, SMD, 2512W, 0.002Ω, 3W, 2%, MF, ROHS	SSM	KRL6432E-M-R002-G-T1-T
12	R35-R46	RES-CURR.SENSE, SMD, 2512, 0.22Ω, 2W, 1%, TF, ROHS	Bourns	CRM2512-FX-R220ELF-T
1	SW1	SWITCH-DIP, TH, 6POS, SLIDE, SPST, SEALED, ROHS	Grayhill	78B06ST
1	Q9	TRANSISTOR, N-CHANNEL, SOT-23, 60V, 115mA, ROHS	Fairchild	2N7002-7-F-T
4	FOUR CORNERS PCB	SCREW, 4-40×1/4in, PHILLIPS, PANHEAD, SS, ROHS	-	4-40X1/4-SCREW-SS
4	FOUR CORNERS PCB	STANDOFF, 4-40×3/4in, F/F, HEX, ALUMINUM, ROHS	-	4-40X3/4-STANDOFF-METAL
1	PWB-FG, ISLUSBPMADAPT3Z, ROHS	BAG AND SHIP	-	ISLUSBPMADAPT3ZFG
1	CABLE-USB 2.0, TYPE A MALE/TYPE MINI-B MALE, ROHS	BAG AND SHIP	-	88732-8800
1	PLACE ASSY IN BAG	BAG, STATIC, 10×10, ZIP LOC, ROHS	-	10X10-STATIC-BAG
1	AFFIX TO BOTTOM OF PCB	LABEL-DATE CODE=LINE 1:YRWK-REV#, LINE 2;BOM NAME	-	LABEL-DATE CODE

2.3 Board Layout

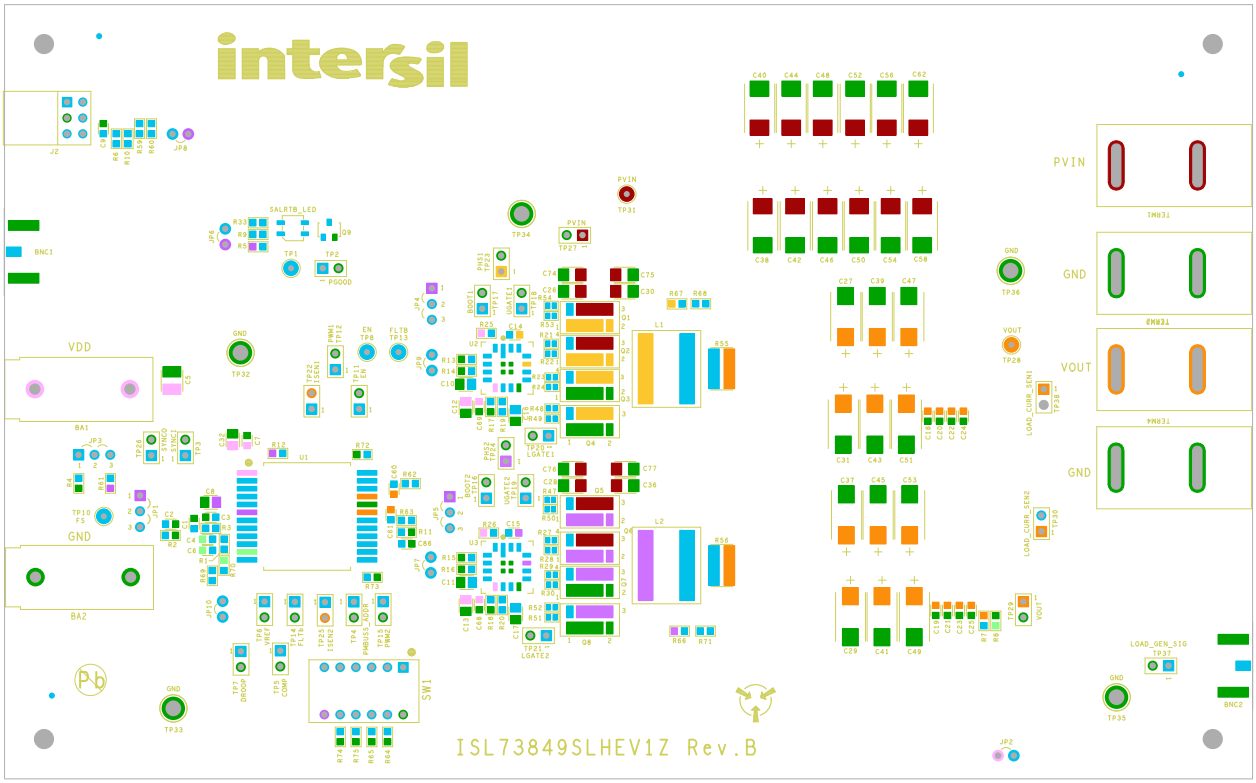

Figure 12. Silkscreen Top Layer

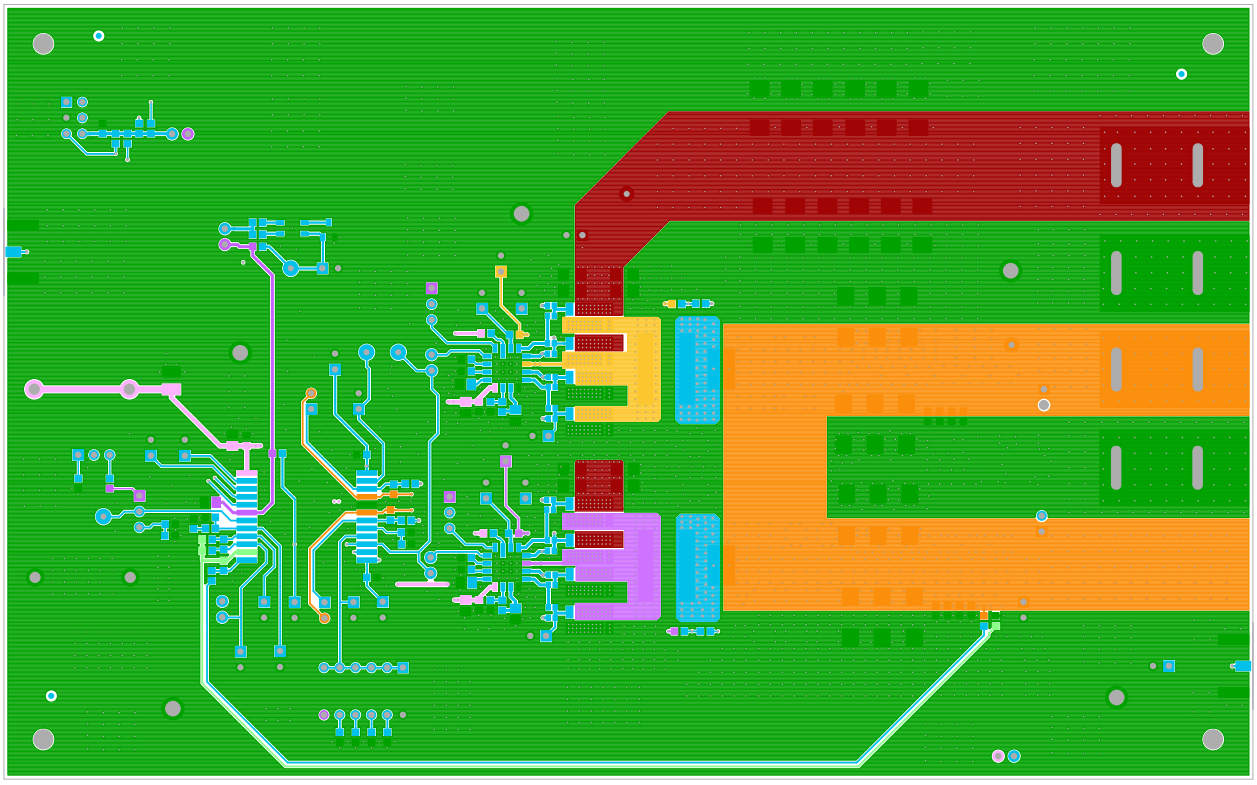

Figure 13. Top Layer

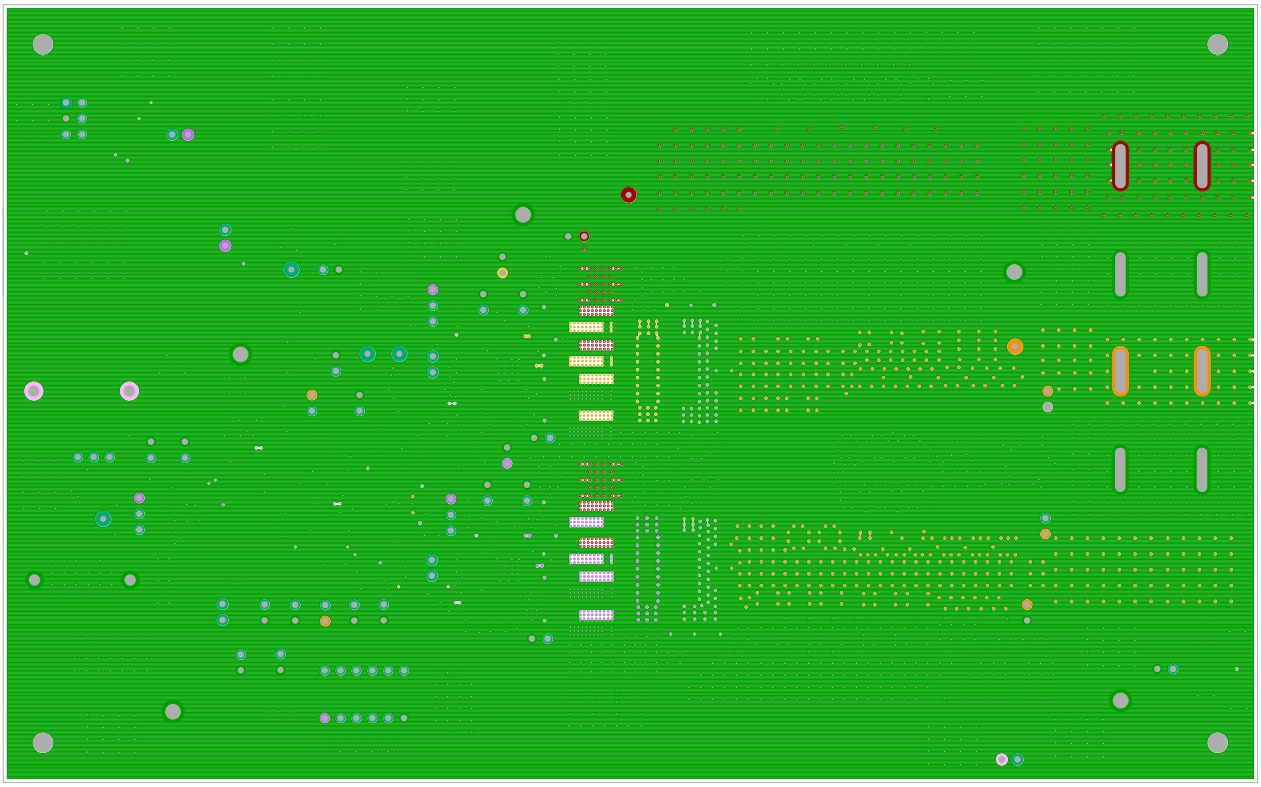

Figure 14. Layer 2

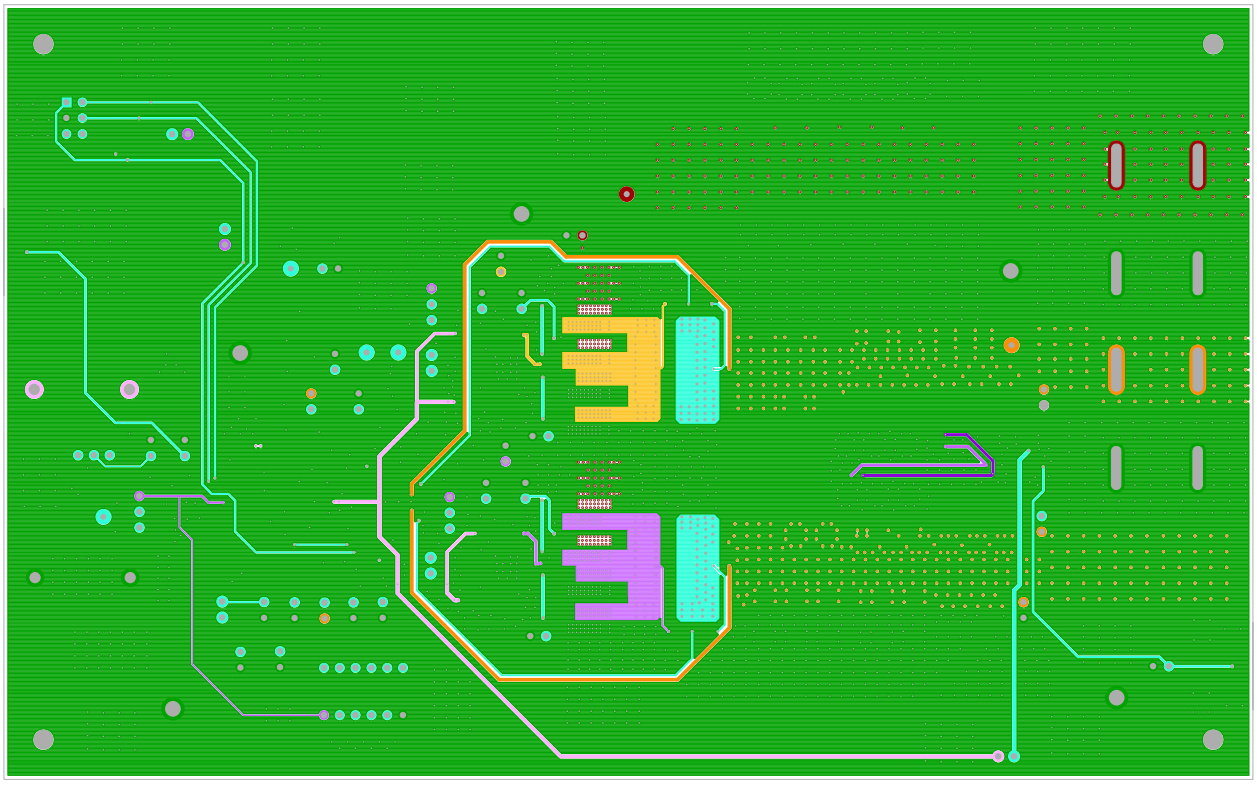

Figure 15. Layer 3

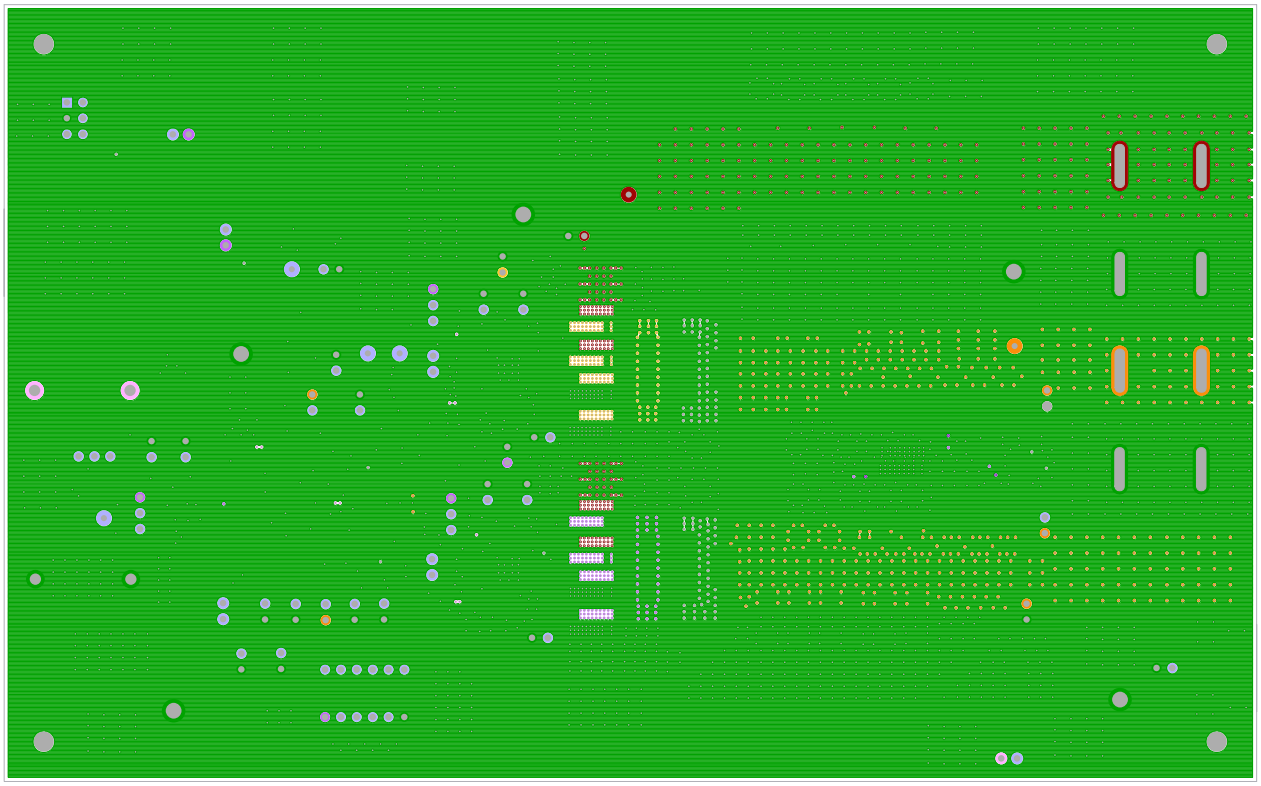

Figure 16. Layer 4

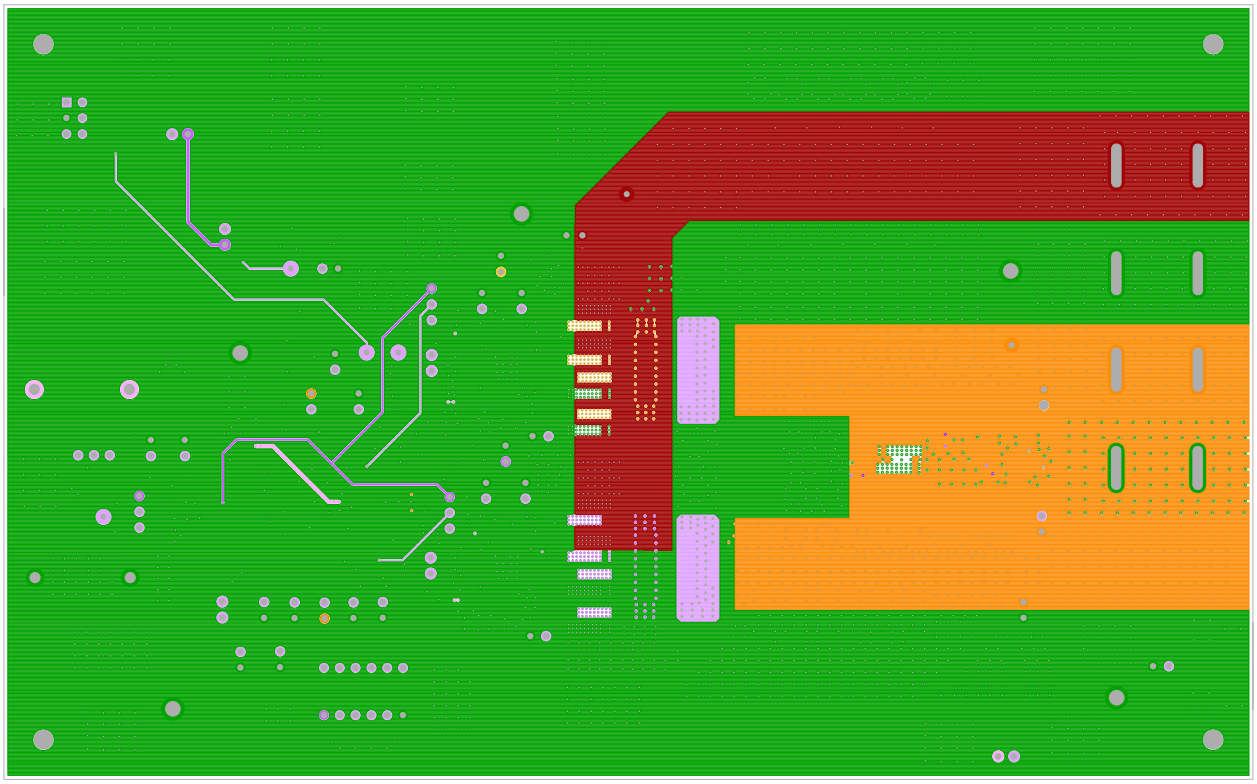

Figure 17. Layer 5

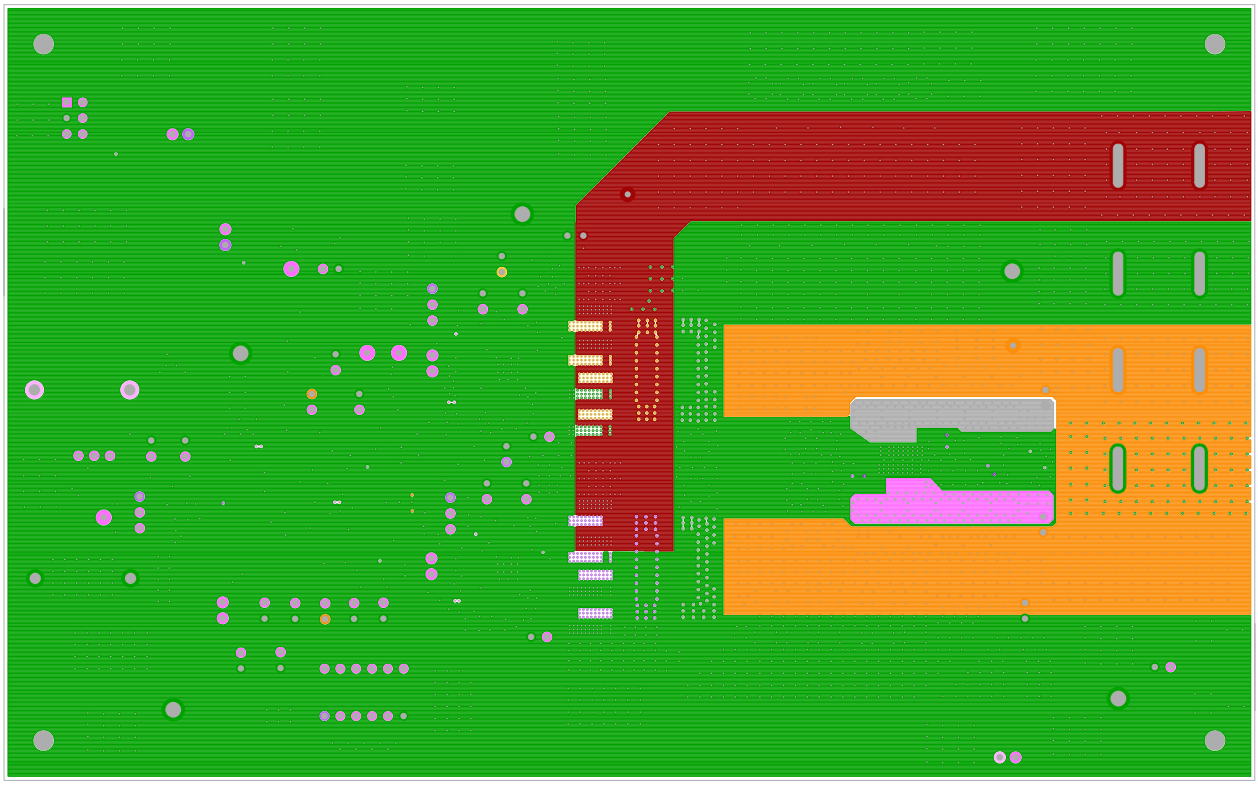

Figure 18. Layer 6

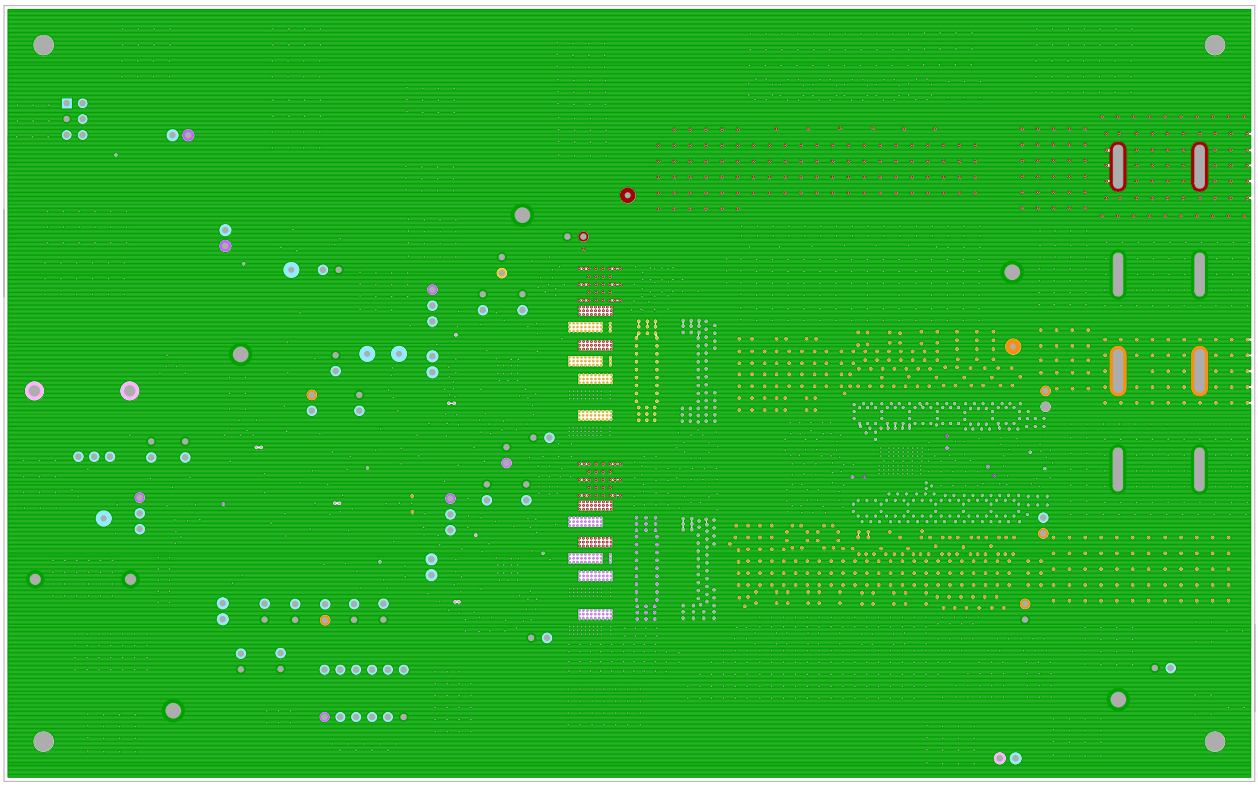

Figure 19. Layer 7

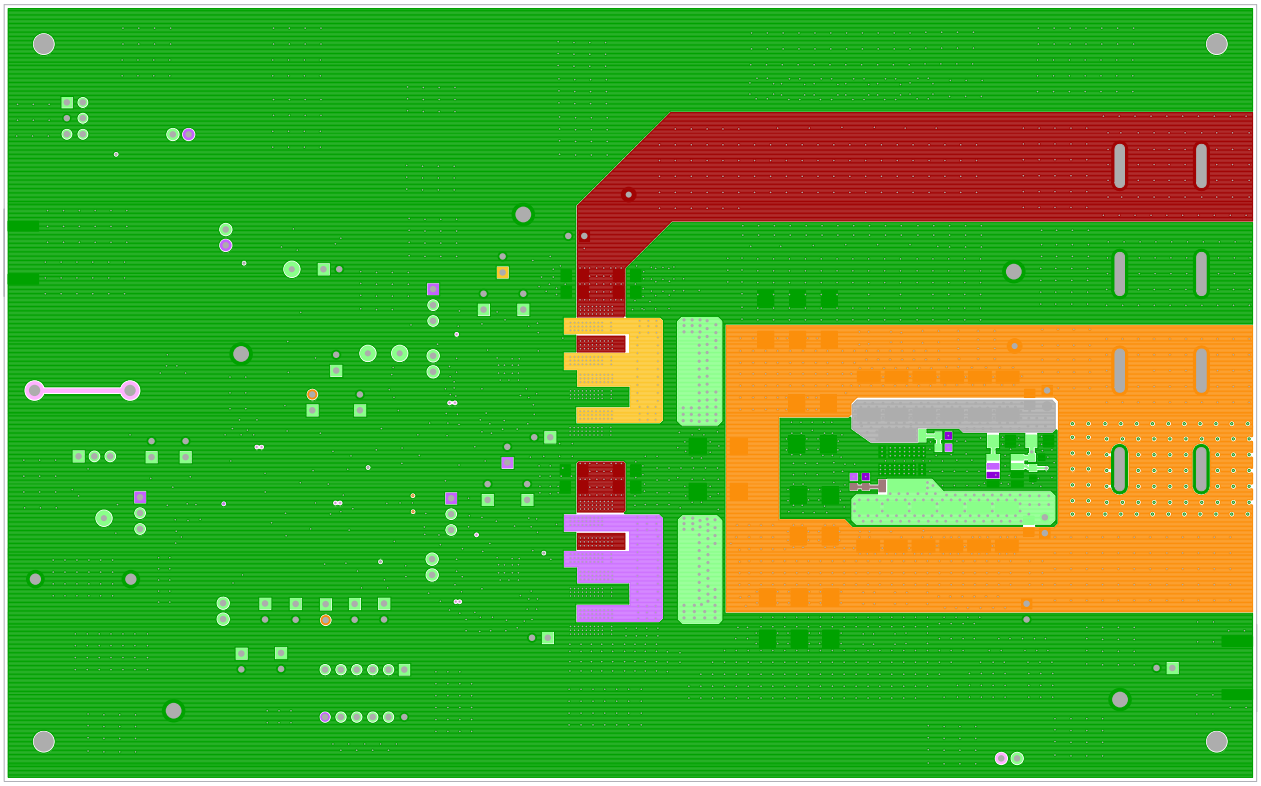

Figure 20. Bottom Layer

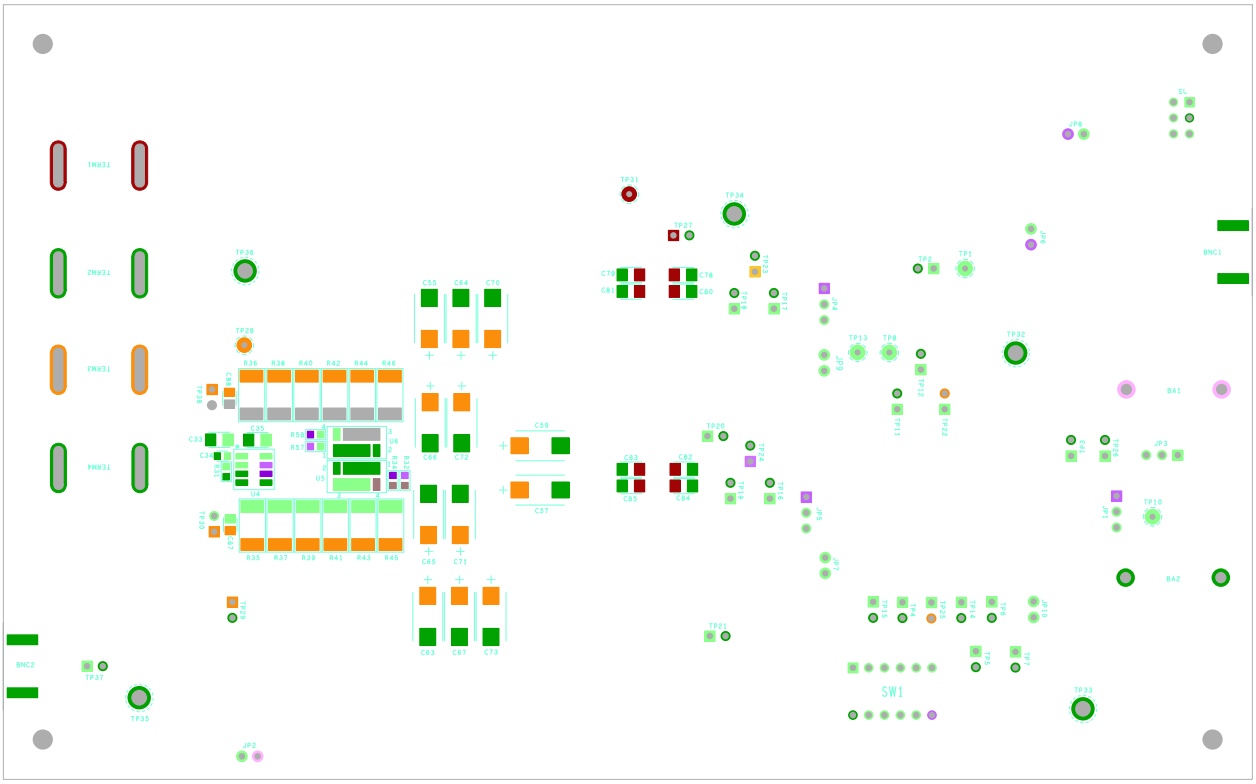

Figure 21. Silkscreen Bottom Layer

3. Typical Performance Graphs

Unless otherwise noted: VREF=0.592V, f_{SW}=500kHz; L_{OUT} = 220nH per phase, C_{OUT} = 2.64mF per phase, C_{DROOP} = 56nF, C_{VREF} = 47nF, R_{DROOP} =604Ω, FS tied to VCC, C_{SS} = 22nF, C_{COMP} = 4.7nF, R_{COMP} = 4.22kΩ, C_{POLE} = 330pF, C_{VCC} = 1µF, R_{SLOPE} = 30.1kΩ, C_{SLOPE} = 100pF, T_A = +25°C

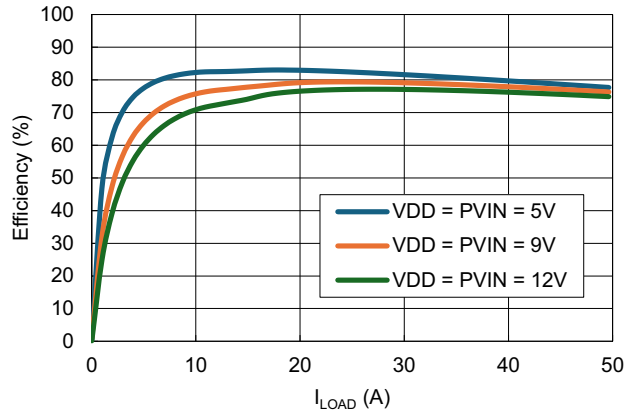

Figure 22. Conversion Efficiency

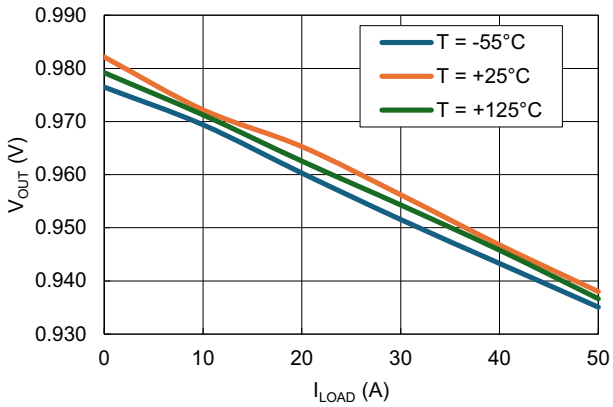

Figure 23. Droop Regulation for Various Temperatures (VDD = PVIN = 12V)

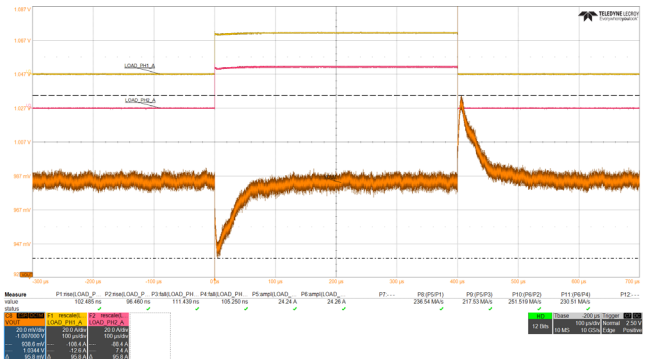

Figure 24. Load Transient Response (VDD = PVIN = 5V, V_{REF} = 0.6V, R_{DROOP} = 0Ω)

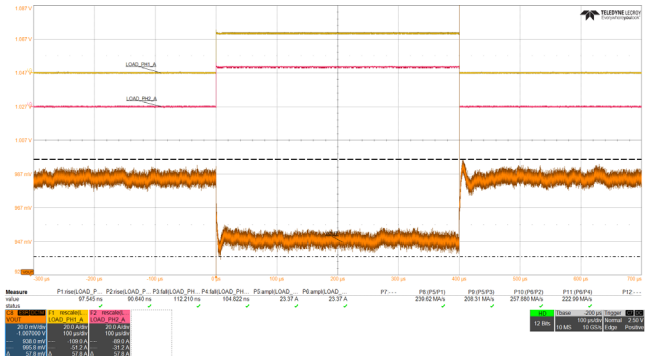

Figure 25. Load Transient Response (VDD = PVIN = 5V, V_{REF} = 0.6V, R_{DROOP} = 604Ω)

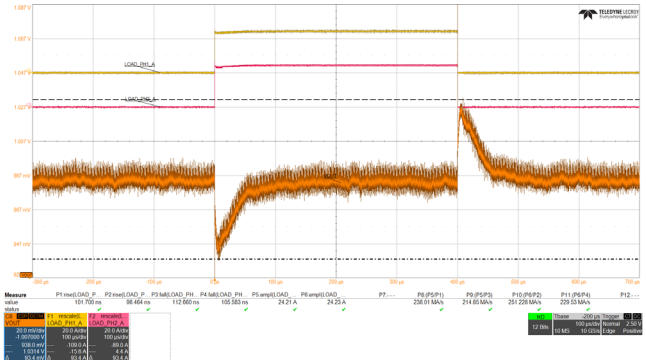

Figure 26. Load Transient Response (VDD = PVIN = 12V, V_{REF} = 0.6V, R_{DROOP} = 0Ω)

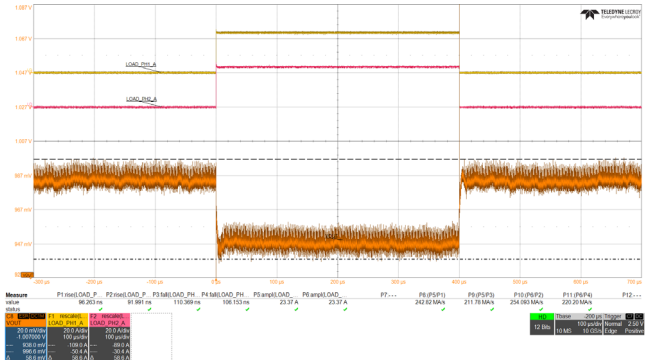

Figure 27. Load Transient Response (VDD = PVIN = 12V, V_{REF} = 0.6V, R_{DROOP} = 604Ω)

Unless otherwise noted: VREF=0.592V, f_{SW}=500kHz; L_{OUT} = 220nH per phase, C_{OUT} = 2.64mF per phase, C_{DROOP} = 56nF, C_{VREF} = 47nF, R_{DROOP} =604Ω, FS tied to VCC, C_{SS} = 22nF, C_{COMP} = 4.7nF, R_{COMP} = 4.22kΩ, C_{POLE} = 330pF, C_{VCC} = 1µF, R_{SLOPE} = 30.1kΩ, C_{SLOPE} = 100pF, T_A = +25°C (Cont.)

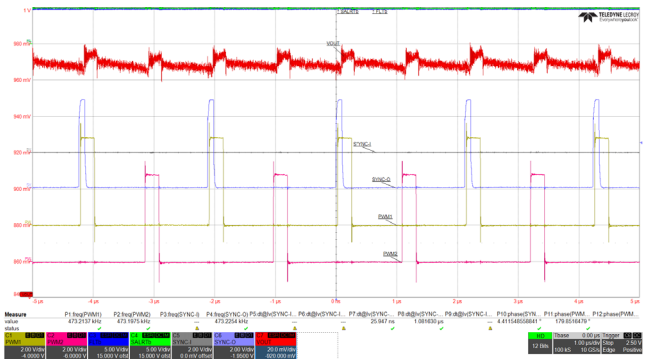

Figure 28. SYNC-O Frequency = SYNC-I Frequency (VDD = 12V = PVIN = 12V, R_{SYNC-O} = Floating)

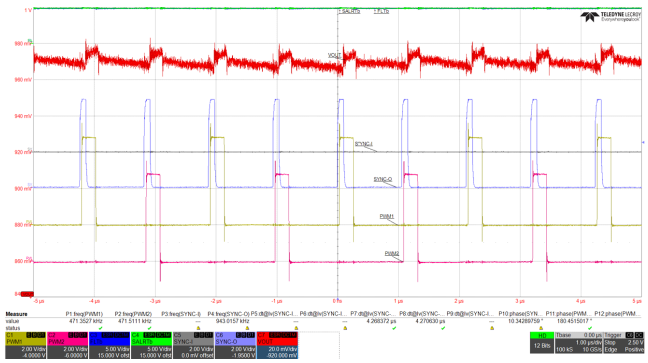

Figure 29. SYNC-O Frequency = SYNC-I Frequency (VDD = 12V = PVIN = 12V, R_{SYNC-O} = 100kΩ to GND)

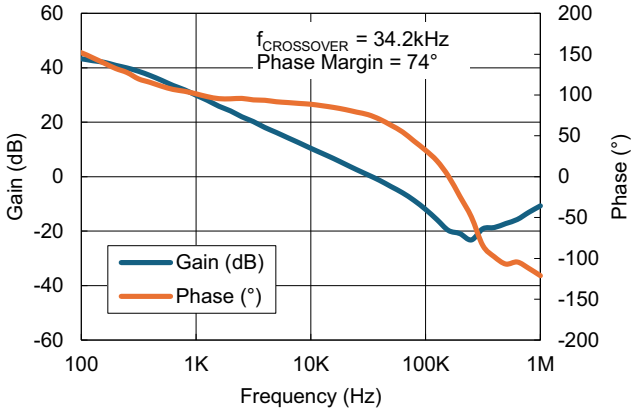

Figure 30. Gain and Phase vs Frequency (VDD = PVIN = 5V, I_{LOAD} = 0A)

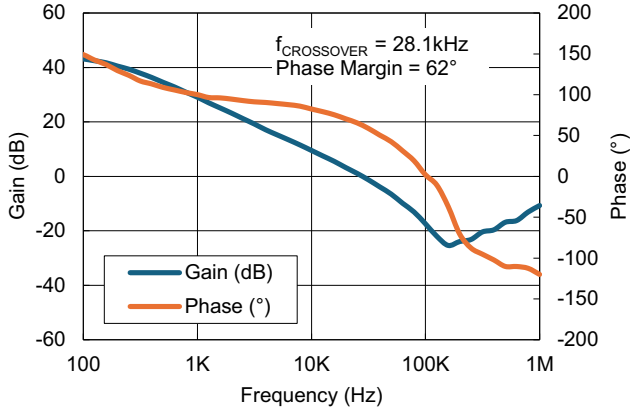

Figure 31. Gain and Phase vs Frequency (VDD = PVIN = 12V, I_{LOAD} = 0A)

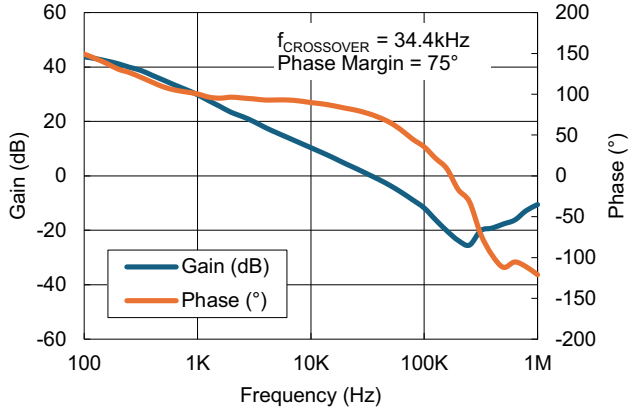

Figure 32. Gain and Phase vs Frequency (VDD = PVIN = 5V, I_{LOAD} = 25A)

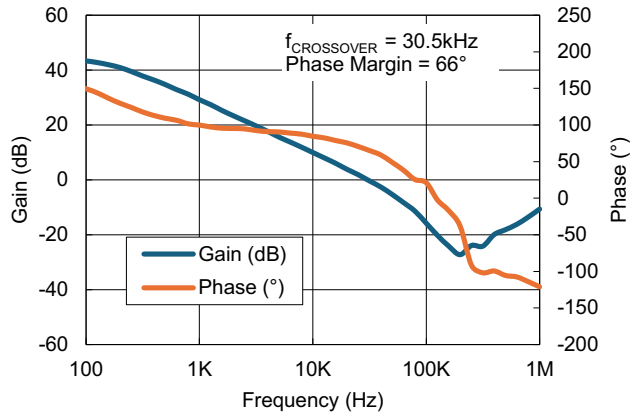

Figure 33. Gain and Phase vs Frequency (VDD = PVIN = 12V, I_{LOAD} = 25A)

Unless otherwise noted: VREF=0.592V, f_{SW}=500kHz; L_{OUT} = 220nH per phase, C_{OUT} = 2.64mF per phase, C_{DROOP} = 56nF, C_{VREF} = 47nF, R_{DROOP} =604Ω, FS tied to VCC, C_{SS} = 22nF, C_{COMP} = 4.7nF, R_{COMP} = 4.22kΩ, C_{POLE} = 330pF, C_{VCC} = 1µF, R_{SLOPE} = 30.1kΩ, C_{SLOPE} = 100pF, T_A = +25°C (Cont.)

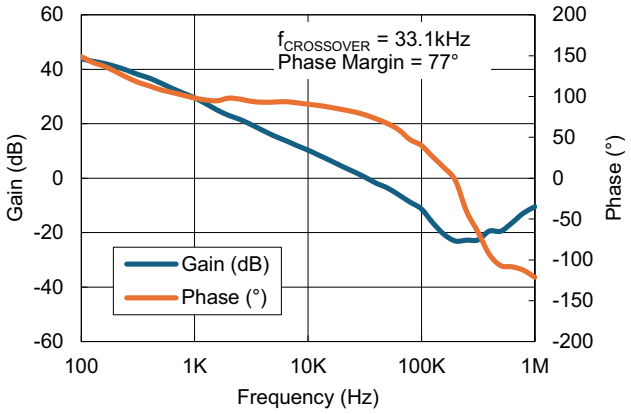

Figure 34. Gain and Phase vs Frequency (VDD = PVIN = 5V, I_{LOAD} = 50A)

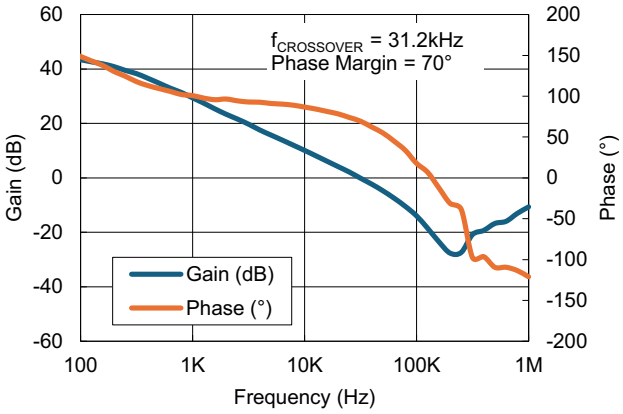

Figure 35. Gain and Phase vs Frequency (VDD = PVIN = 12V, I_{LOAD} 50A)

4. Ordering Information

Part Number	Description
ISL73849SLHEV1Z	2-Phase ISL73849SLH Board

5. Revision History

Revision	Date	Description
1.01	Dec 5, 2025	Updated page 1 content. Made minor text updates throughout. Updated board photos.
1.00	Feb 4, 2025	Initial release

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