ISL73847SEHEV3Z

The ISL73847SEHEV3Z evaluation board benchmarks the performance of two ISL73847SEH dual-phase buck controller, four ISL73041SEH GaN half-bridge drivers, and twelve ISL70020SEH 40V GaN FETs in a 4-phase, 100A configuration. It is designed for the VERSAL VC1902 VCCINT core rail. The evaluation board is designed for a 5V PVIN power rail and an auxiliary VDD supply for the controller/driver VDD and external clock generator circuits.

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.

Features

- On-board 2MHz clock generator for synchronization
- On-board 100A transient load current generator
- Power-Good (PG) LED indicator
- Integrated LDO (VCC)
- Load-line DROOP regulation
- Differential remote sensing

Specifications

- Buck power supply input (PVIN): 5V, ±5%
- Analog Supply input (VDD)
  - 5V to 13.2V when clocks come from an off-board external clock
  - 9V to 13.2V when using the on-board clock generator circuit
- Preset output voltage (no-load): 0.809V
- Preset Switching Frequency: 1MHz
- Maximum output current: 100A (25A/phase)
- Preset 2.6% DROOP regulation
- Number of Board Layers: 8
- PCB Thickness: 2oz outer, 1oz inner

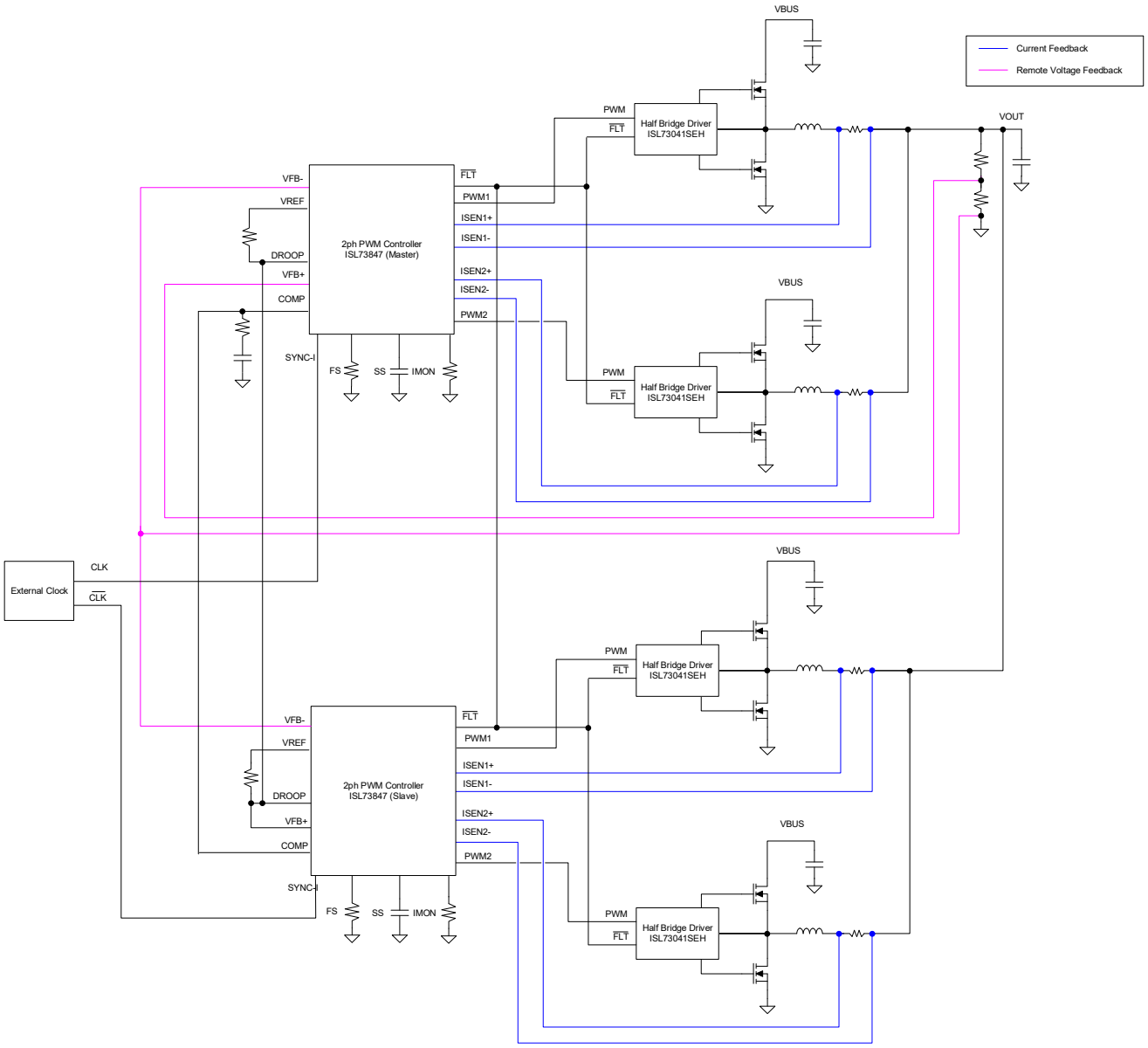

Figure 1. Block Diagram

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1. Functional Description

The ISL73847SEH 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. Each PWM Controller is a dual-phase IC; therefore, the design is a 4-phase solution. Each ISL73847SEH controller operates its two phases at 180 degrees phase shift. Using an external clock with a 50% duty cycle and an inverted and non-inverted input to the SYNC-I pins of the ISL73847SEH provides the 90 degrees phase shift needed for 4-phase operation. Each phase delivers 25A RMS for a total 100A solution.

1.1 Operating Range

The ISL73847SEHEV3Z evaluation board requires two supply rails to operate properly. One for the two ISL73847SEH controller's analog supply input, the four ISL73041SEH GaN half-bridge drivers, and the load transient and clock generator circuits (VDD). The other rail is for the on-board buck power supply input (PVIN).

The VDD rail accepts an input range of 9V to 13.2V when using the on-board clock circuit because of the minimum VDD of the ISL78841A in that circuit. If using an off-board external clock circuit to supply the clocks to the SYNC-I pins of both controllers, the VDD rail can be 5V to 13.2V or simply tied to the PVIN rail to be powered by a single 5V supply. The PVIN should be set to 5V. The buck regulator circuit is preset for a 0.809V output voltage and a switching frequency of 1MHz. This board is capable of providing 100A of output current.

1.2 Two Controller 4-Phase Configuration

The ISL73847SEH is a stand-alone PWM Controller, but with proper configuration it can be connected together to provide multi-phase operation to deliver higher load current and reduce output ripple voltage. The configuration diagram of connecting two controllers together is shown in Figure 2.

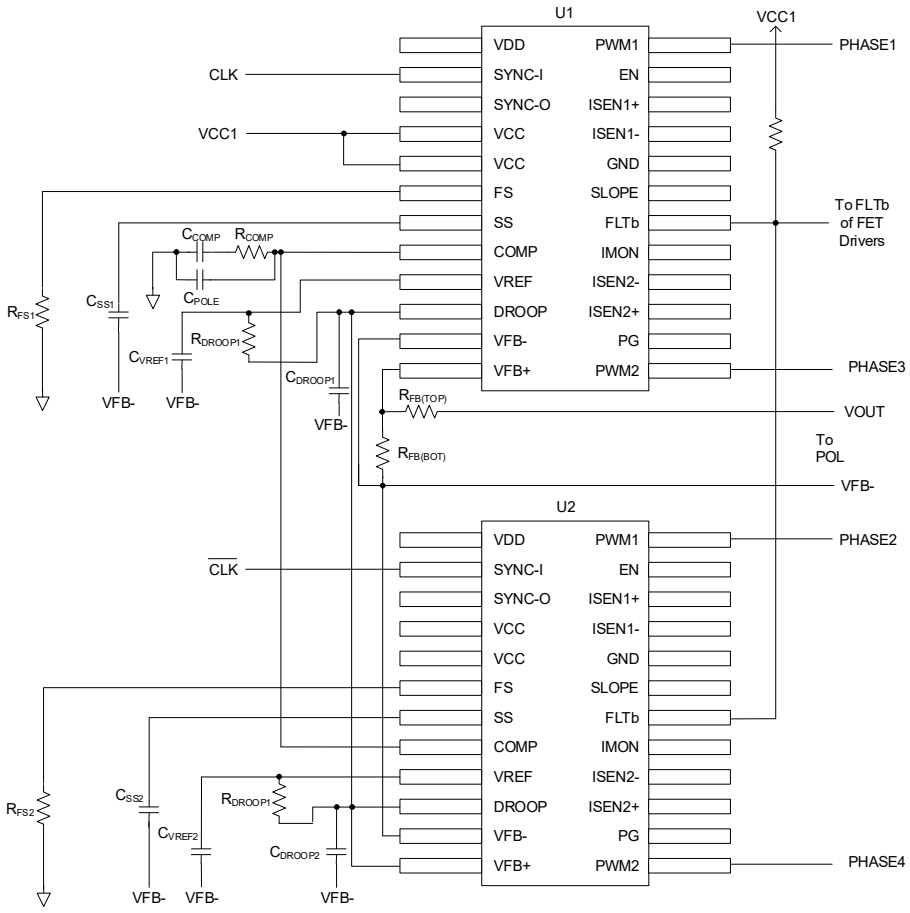

Figure 2. 4-Phase Configuration

To connect two ISL73847SEH controllers for a 4-phase configuration, use the following connections.

- For 90° phase shifted operation in a 4-phase Buck, an external Clock at twice the switching frequency with 50% duty cycle and its complimentary is necessary. See On-Board Clock Generator for Synchronization on generating the clock and complimentary signal for this demonstration board.
- The error amplifier of the second controller (U2) is disabled by tying its DROOP (EA+) and VFB+ (EA-) pins together so it outputs zero current. This allows the first controller's (U1) COMP signal to drive its own PWM comparator in addition to the U2 controller when the COMP pins of the two controllers are connected together.
- RCOMP, CCOMP, and CPOLE are connected to the first controller's (U1) COMP pin. Depopulate the RCOMP, CCOMP, and CPOLE of the second controller (U2) and tie its COMP pin to the first controller's COMP pin.
- When using droop regulation, determine the amount of droop resistance needed on each controller by using the *ISL73847SEH Datasheet* or by using the *ISL73847 Design Calculator*.
- Connect the DROOP pins of the two controllers together. The VREF of each controller supplies the droop current needed into the DROOP pins and the voltage on DROOP includes the average of the VREF voltage on the two controllers.
- Connect the VFB- pins of the two controllers together so they have a common differential reference voltage.
- Connect the FLTb pins of the two controllers and four ISL73041SEH drivers together to a single pull-up resistor. The resistor can connect to VCC of either controller.
- Because the ISL73847SEH controller has 180° phase shift between its own two phases and a 4-phase system has 90° phase shift, the phases are interleaved between the two controllers. For example, U1 controller is Phase 1/Phase 3 and U2 controller is Phase 2/Phase 4.

1.3 Quick-Start Guide

1. Ensure JP1 and JP3 is connected to position 1-2.
2. Ensure JP4, JP5, JP14, and JP15 is connected to position 2-3.
3. Ensure JP2, JP9, J10, JP11, JP16, and JP17 is removed.
4. Ensure JP6, JP7, JP8, JP9, JP12, JP13, and JP18 is connected. JP8 and JP18 connect the on-board clock generator.
5. Apply a 5V voltage to the PVIN metal banana plug connectors as shown in Figure 3. To monitor PVIN on the board, use TP27 or TP65. TP27 is closer to Phase 1 and 3, TP65 is closer to Phase 2 and 4.
6. Apply a 9V to 13.2V voltage to the VDD banana connectors as shown in Figure 3 to use the on-board clock generator. If using an off-board external clock generator, VDD can be 5V to 13.2V.
7. If required, a resistor or electronic load can be connected to the VOUT metal banana plug connectors as shown in Figure 3. If using an electronic load, you can add 4W sense lines on the TP29 test jumper.

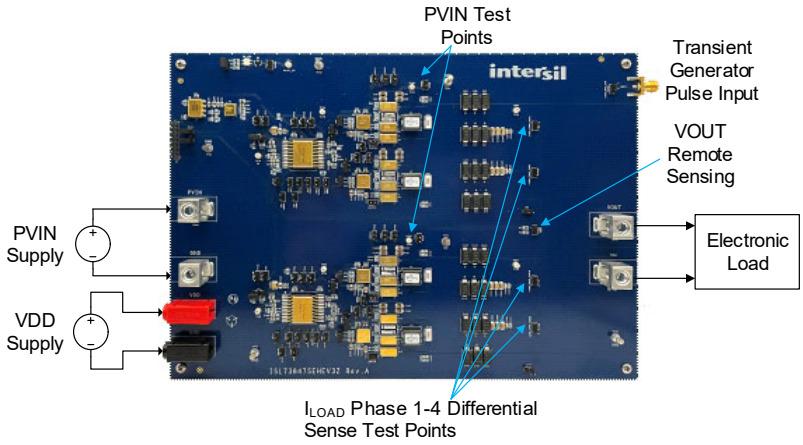

Figure 3. ISL73847SEHEV3Z Board Setup

1.4 On-Board Load Transient Generator

The ISL73847SEHEV3Z includes an on-board transient load generator that uses two ISL70040SEH GaN FET drivers to control four ISL70020SEH N-Channel GaN FET load switches. The load is composed of 7x 200mΩ resistors on each phase.The transient load generator simulates a 100A load step on the 0.807V rail when the FETs are turned on. For smaller load steps, un-populate some of the load resistors.

To use the on-board transient generator, short JP2 and JP17 to power up the two ISL70040SEH with the VDD supply. Connect your 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 0-5V 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 On-Board Clock Generator for Synchronization

For proper 4-phase 90° phase shifted operation, the ISL73847SEHEV3Z uses an external clock synchronization circuit to output complimentary clocks on the SYNC-I pins of the ISL73847SEH controller.

The ISL73847SEHEV3Z is designed with 1MHz switching frequency, therefore a 2MHz clock is needed. The external clock solution is implemented with a ISL78841ASRH current mode PWM controller. Timing is made through the RTCT pin, which provides a square wave clock signal at the OUT pin. The inverted clock output is generated by putting the clock signal into the ISL70040 GaN FET driver, which offers an INB input that provides the inverted clock signal at OUTH/OUTL. While the 2MHz clock generated by the ISL78841ASRH works under a nominal case, it cannot be guaranteed over full operational range. Renesas recommends using a dedicated clock generator instead. The ISL70040 GaN FET driver can be used to generate the inverted clock signal.

To use the On-board clock synchronization circuit, ensure the JP8 and JP18 jumpers are shorted.

1.6 Soft-Start Adjustment

The ISL73847SEHEV3Z is configured for a 2ms soft-start time by two 22nF bypass capacitors (C_9 and C_{210}) connected to each controller's SS pin. Renesas recommends keeping the SS pins separate to prevent start-up issues that prevent the FLTb pins of the controller's from going logic HIGH and initiating a soft-start. The SS time can be adjusted from 2ms to 200ms by changing these capacitors. If you need to select a different soft-start time, use Equation 1 to calculate the capacitance given the required soft-start time. For more information about SS, refer to the *ISL73847SEH Datasheet*.

(EQ. 1) $$C_{SS} = \frac{t_{SS} \times 1 \times 10^{-5}}{V_{REF}}$$

where:

- C_{SS} is the soft-start capacitance in Farads
- t_{SS} is the required soft-start time in seconds
- V_{REF} is the reference voltage, which is nominally 0.6V

1.7 Droop Regulation

The ISL73847SEHEV3Z is configured to minimize peak-to-peak transient response excursions by using a 392Ω resistor connected between VREF and DROOP pin of each controller (R_1 and R_{86}). If droop regulation is not needed, short out the DROOP resistors with JP10 and JP11. For more information about the droop regulation, refer to the *ISL73847SEH Datasheet*.

1.8 IMON

The ISL73847SEHEV3Z is configured to monitor the total average inductor current as a voltage on the IMON pin. The IMON pin can monitor the total average inductor current for the phases sensed by the controller. TP4 and TP43 monitor the IMON pin voltage on the master and slave, respectively. TP4 gives Phase 1 and 3 total average current, and TP43 gives Phase 2 and 4 total average current. There are 10kΩ resistors (R_4 and R_{60}) connected to this pin with a DNP spot for a bypass capacitor in parallel. If required, bypass capacitors (C_9 and C_{211}) can be added in parallel to improve the averaging. For more information on the IMON pin, refer to the *ISL73847SEH Datasheet*.

1.9 Enabling/Disabling

The ISL73847SEHEV3Z is configured to automatically enable when VDD reaches the VEN Rising Threshold level (1.8V typical) on power-up through a 4.99kΩ resistor on each controller connected to VDD (R_{61} and R_{64}). To disable the part in this default configuration, the easiest method is to short the EN test point (TP44) with a jumper. To disable automatic enabling on power-up and control EN by an external supply, remove R_{61} and connect another external supply to TP44. For more information about enabling and disabling the controller, refer to the *ISL73847SEH Datasheet.*

2. Changing VIN, VOUT, IOUT, and transient parameters

The ISL73847SEHEV3Z showcases a multi-phase converter design for the VERSAL VC1902 VCCINT core rail for V_{IN} = 5V, V_{OUT} = 0.8V, and I_{LOAD} = 140A. However, the design can be adjusted for different PVIN, VOUT, and I_{LOAD} parameters by changing various components throughout the board. Renesas highly recommends using the ISL73847 design tool to quickly determine component values for the design.

2.1 Increasing the Maximum Output Current

For higher output currents, the ISL73847SEHEV3Z can be modified by changing various components. For example, to increase the per-phase current from 25 to 35A for a total 140A solution, make the following changes to the ISLVERSALDEMO2Z board:

Note: The dissipative elements in the power stage (GaN FETs and inductor) see a higher temperature rise due to the increased load current.

1. To evaluate 140A continuous operation, there is an extra footprint to add an additional high-side GaN FET per phase if needed. For larger currents, a separate PCB design to accommodate more GaN FETs in parallel and increase the number of PCB layers to handle the extra current needs to be designed.
2. Decrease the Rsense (R55, R56, R132, R133) resistor from 2mΩ down to 1.43mΩ so that a 50mV full-scale input to the ISENSE+/ISENSE- pins of the ISL73847SEH is developed with 35A RMS of load current. The Susumu resistors have a 3mΩ available, therefore, two in parallel can be used for 1.5mΩ.
3. Reduce the inductor value. The inductor Coilcraft SLR1070 120nH was used. There is no smaller inductance in this family. However, the Coilcraft SLC1049 offers a 75nH inductor with adequate saturation and RMS current ratings that can be substituted. The SLC1049 recommended PCB land pattern is slightly different but can be reasonably mounted onto the PCB board.
4. Use the additional DNP placeholders for tantalum capacitors on the 0.8V rail if needed. A minimum of 6x220µF per phase is needed for 140A operation.
5. Change the slope compensation, error amp compensation, and droop compensation per the loop design calculator. At minimum, change C_comp from 4.7nF to 3.9nF.
6. Adjust the timing circuit on ISL71041M U107 from ~1MHz to 875kHz to comply with the maximum inductor value recommended in the loop design calculator. Change C89 from 10pF to 22pF and R78 from 11kΩ to 30.9kΩ.

7. It is not necessary to change the single ISL70020SEH GaN FET on the high-side and two ISL70020SEH GaN FET on the low-side per phase. The high-side operates at ~16% duty cycle, and the increase in per-phase current does not necessitate changing the FETs for evaluating 140A transient load steps.

3. Board Design

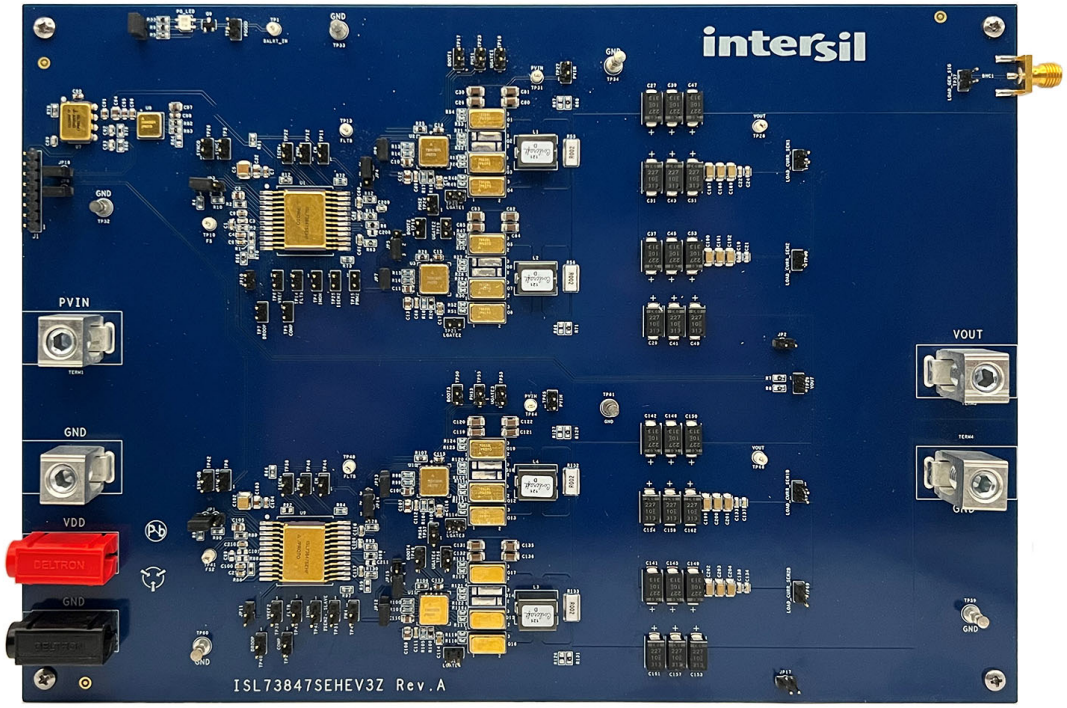

Figure 4. ISL73847SEHEV3Z Evaluation Board (Top)

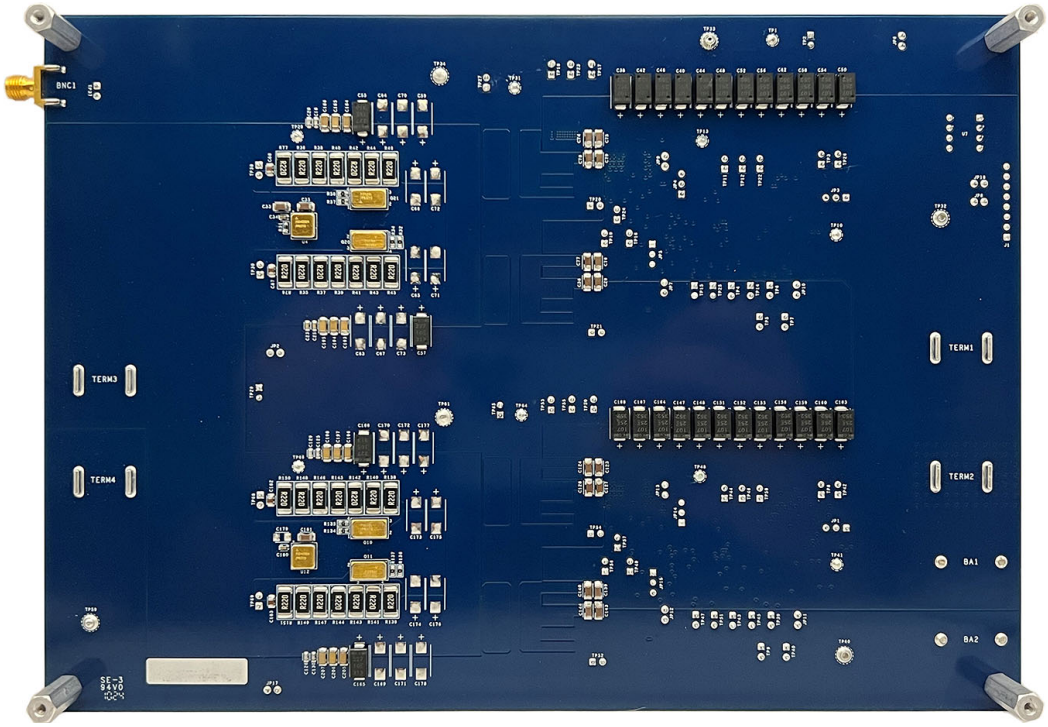

Figure 5. ISL73847SEHEV3Z Evaluation Board (Bottom)

3.1 Schematic Diagrams

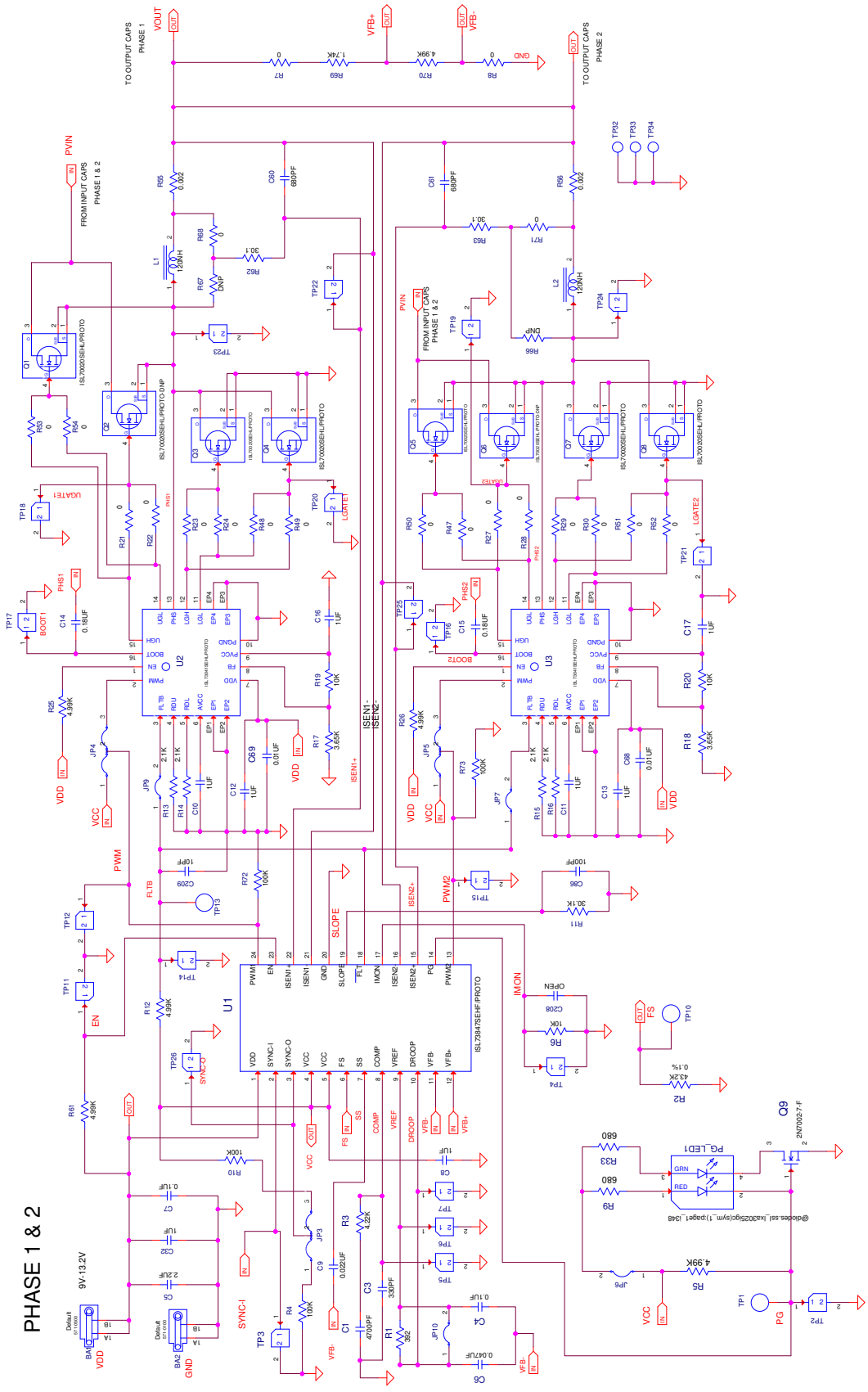

Figure 6. ISL73847SEHEV3Z Schematic (Phases 1 & 2)

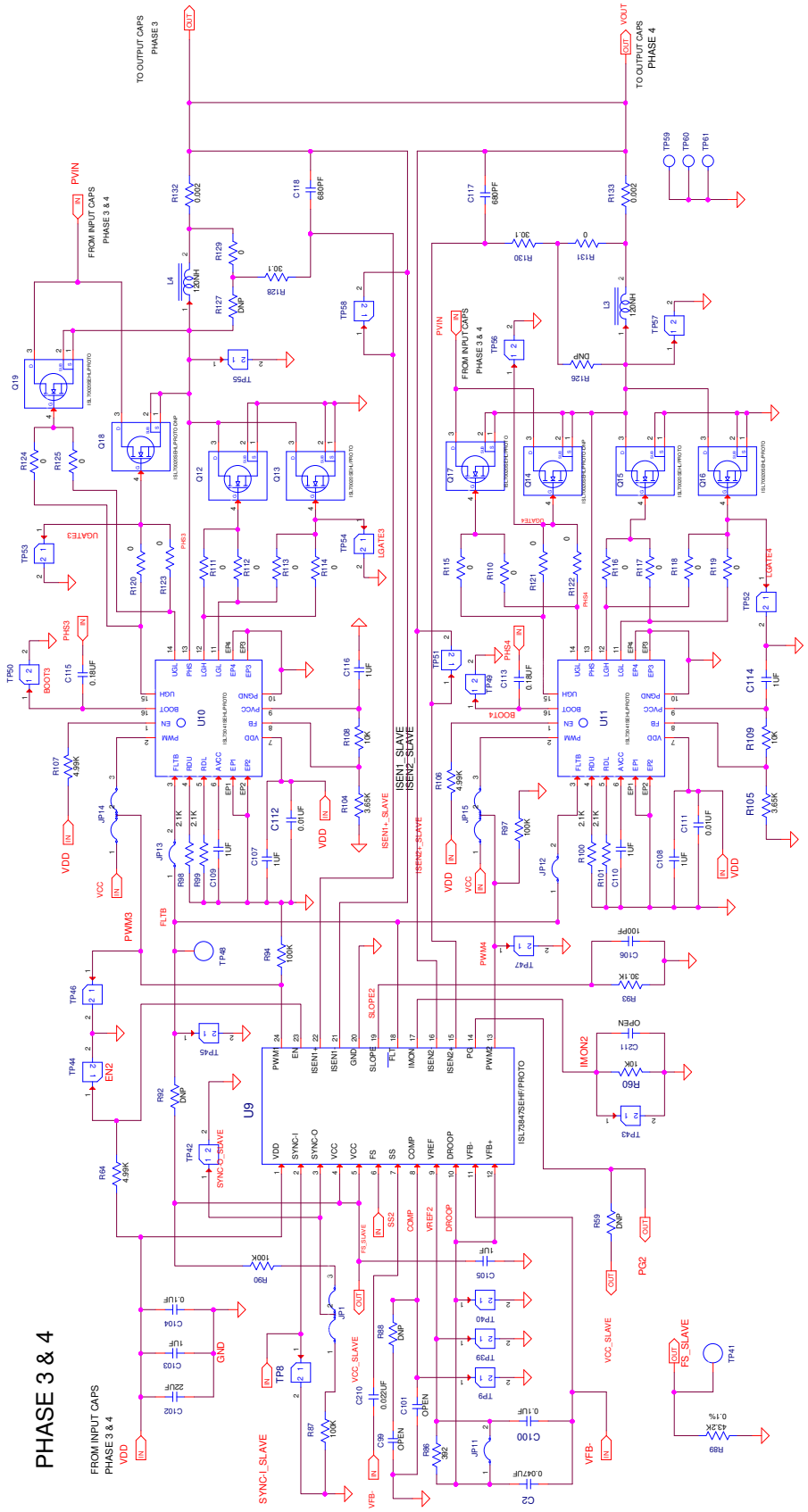

Figure 7. ISL73847SEHEV3Z Schematic (Phases 3 & 4)

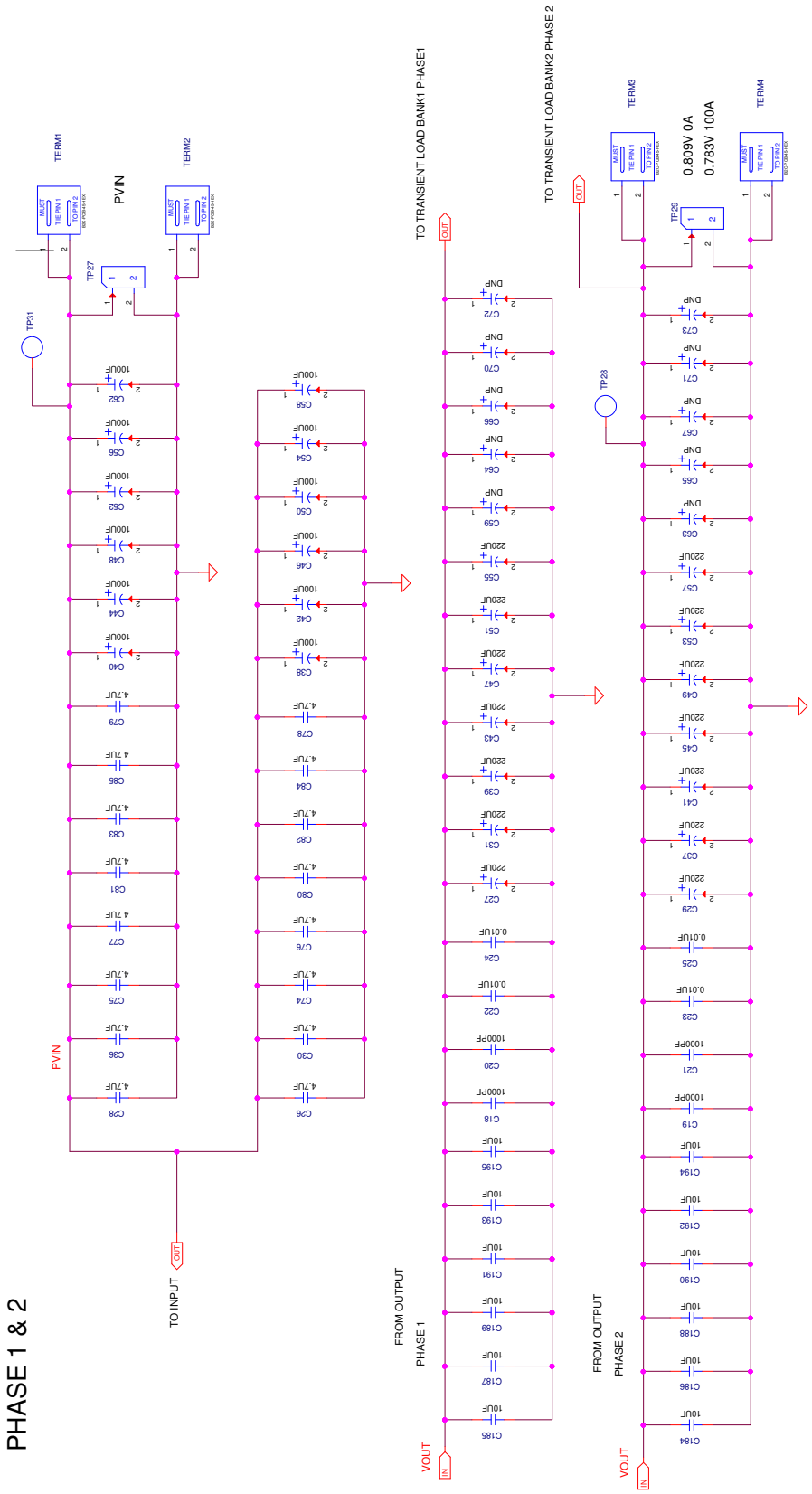

Figure 8. ISL73847SEHEV3Z Schematic (Phases 1 & 2 C_{IN} and C_{OUT})

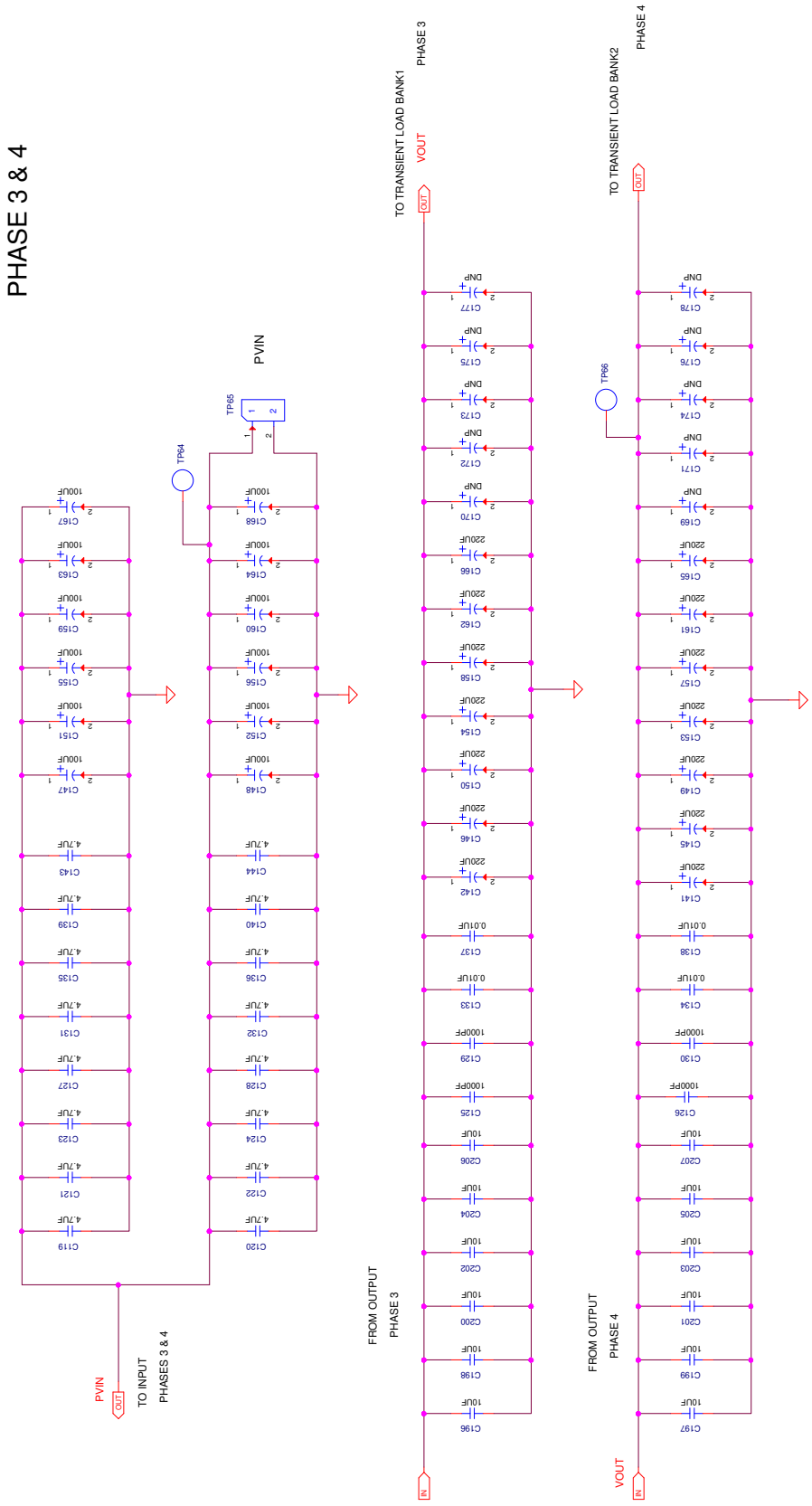

Figure 9. ISL73847SEHEV3Z Schematic (Phases 3 & 4 - C_{IN} and C_{OUT})

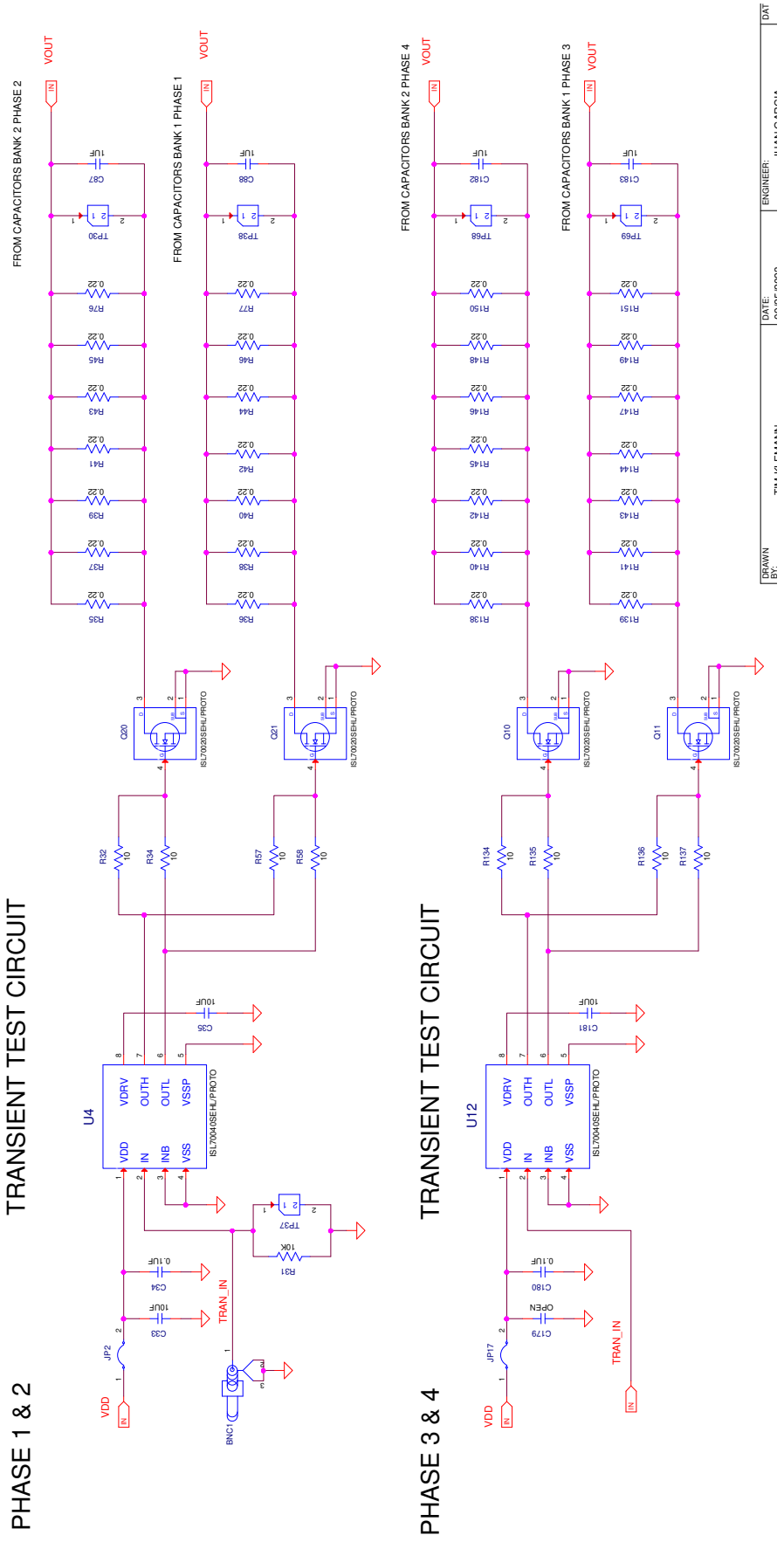

Figure 10. ISL73847SEHEV3Z Schematic (Transient Test Circuits)

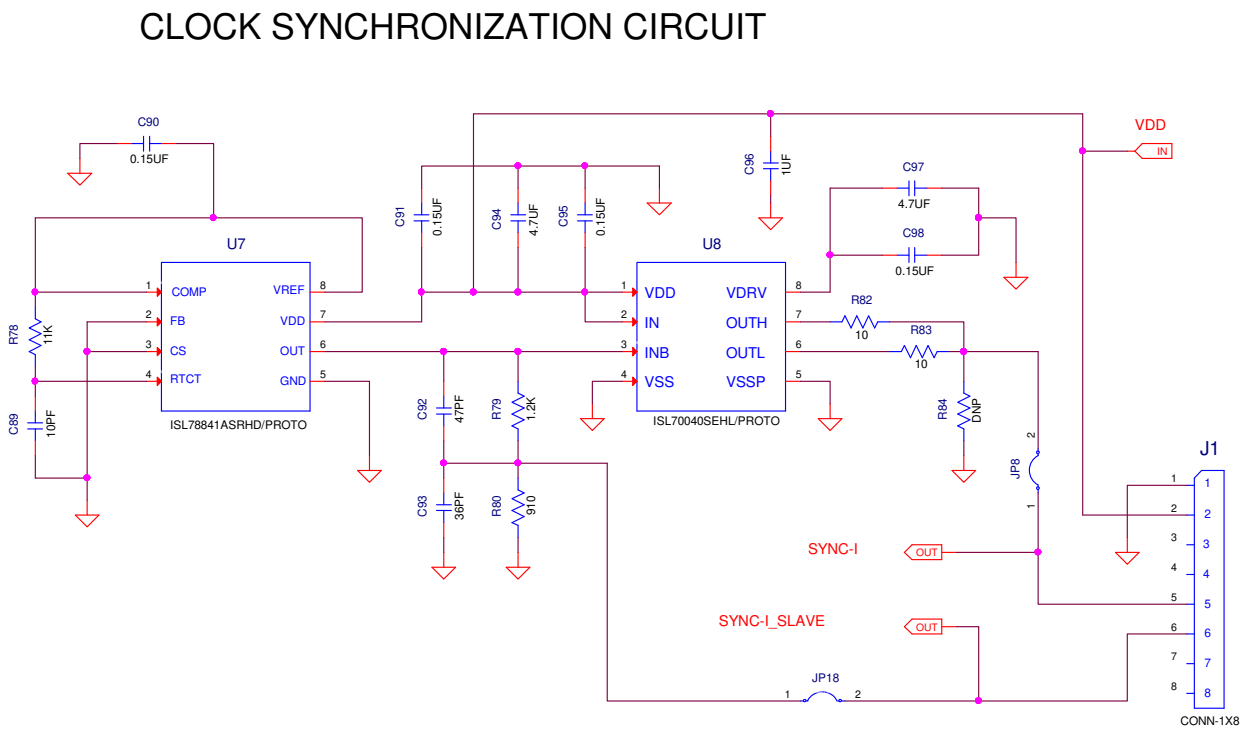

Figure 11. ISL73847SEHEV3Z Schematic (Clock Synchronization Circuit)

3.2 Bill of Materials

Qty	Ref Des	Description	Manufacturer	Part Number
2	C2, C6	Multilayer Cap	Walsin	0603B473K500CT
1	BNC1	SMA End Launch JACK Connector	Amphenol	132357-11
6	TP32-TP34, TP59-TP61	Test Point Turret 0.150 Pad 0.100 Thole	Keystone	1514-2
1	Q9	N-Channel EMF Effect Transistor (Pb-Free)	Fairchild	2N7002-7-F
9	TP1, TP10, TP13, TP28, TP31, TP41, TP48, TP64, TP66	Miniature White Test Point 0.100 Pad 0.040 Thole	Keystone	5002
1	BA2	10A BLACK Banana Jack Socket Terminal - Female - Horizontal - 4mm Plug	Deltron	571-0100
1	BA1	10A RED Banana Jack Socket Terminal - Female - Horizontal - 4mm Plug	Deltron	571-0500
3	TP27, TP29, TP65	(Do Not Populate) Test Point 2 Pin Header 2.54mm (0.100) Pitch	FCI	68000-236 DNP TESTPOINT
46	TP2-TP9, TP11, TP12, TP14-TP26, TP30, TP37-TP40, TP42-TP47, TP49-TP58, TP68, TP69	Test Point 2 Pin Header 2.54mm (0.100) Pitch	FCI	68000-236 TESTPOINT
2	R11, R93	Thick Film Chip Resistor (Automotive AEC-Q200)	Yageo	AC0603FR-0730K1L
1	R3	Thick Film Chip Resistor (Automotive AEC-Q200)	Yageo	AC0603FR-074K22L

Qty	Ref Des	Description	Manufacturer	Part Number
1	R80	Thick Film Chip Resistor (Automotive AEC-Q200)	Yageo	AC0603FR-07910RL
4	TERM1-TERM4	Single - Hex Screw - 0.090in PCB depth Screw Down Large Wire Type Power Terminal	IHI Connectors	B2C-PCB-45-HEX
1	C209	Multilayer Cap	Kemet	C0603C100K3GAC7867
12	C22-C25, C68, C69, C111, C112, C133, C134, C137, C138	Multilayer Cap	Kemet	C0603C103K3RAC7411
2	C9, C210	Multilayer Capacitor	Kemet	C0603C223K5RACAUTO
1	C3	Multilayer Cap	Kemet	C0603C331J3GAC7867
1	C93	Multilayer Cap (Automotive)	Kemet	C0603C360K5HACAUTO
1	C92	CERAMIC CHIP CAP	Kemet	C0603C470K1GACAUTO
1	C1	Multilayer Cap	Kemet	C0603C472K3RAC7867
4	C4, C34, C100, C180	Ceramic Chip Capacitor	Kemet	C0603X104K3RACTU
4	C16, C17, C114, C116	Multilayer Cap (Automotive AEC-Q200)	Kemet	C0805C105K3RACAUTO
2	C94, C97	CERAMIC CHIP CAP (Automotive AEC-Q200)	Kemet	C0805C475K3RACAUTO
1	C5	Ceramic Chip Cap	Kemet	C1210C225K3RACTU
2	C7, C104	Multilayer Capacitor	TDK	C1608X7R1H104K
16	C8, C10-C13, C32, C87, C88, C103, C105, C107-C110, C182, C183	Multilayer Ceramic Chip Capacitor	TDK	C2012X7R1E105K
3	C33, C35, C181	Multilayer Capacitor	TDK	C3216X7R1E106K160AB
32	C26, C28, C30, C36, C74-C85, C119-C124, C127, C128, C131, C132, C135, C136, C139, C140, C143, C144	Multilayer Capacitor	TDK	C3216X7R1E475K
2	C86, C106	Multilayer Capacitor	Yageo	CC0603KPX7R9BB101
4	C90, C91, C95, C98	Multilayer Capacitor	TDK	CGA3E3X7R1H154K080AB
1	J1	Male In-line 8 pins×0.1 inch Connector Strip	Various	CONN-1X8
7	R6, R19, R20, R31, R60, R108, R109	Thick Film Chip Resistor	Vishay	CRCW060310K0FKEB
2	R9, R33	Thick Film Chip Resistor	Vishay	CRCW0603680RFKEA
28	R35-R46, R76, R77, R138-R151	Thich Film Chip Resistor	Bourns	CRM2512-FX-R220ELF
1	R69	Thin Film Chip Resistor (Automotive QEC-Q200)	Panasonic	ERA-3AEB1741V
2	R2, R89	Thin Film Chip Resistor	Panasonic	ERA-3AEB4322V
1	R79	Thick Film Chip Resistor	Panasonic	ERJ-3EKF1201V
2	R1, R86	Thick Film Chip Resistor	Panasonic	ERJ3EKF3920V

Qty	Ref Des	Description	Manufacturer	Part Number
4	C14, C15, C113, C115	Ceramic Chip Cap (Automotive)	Murata	GCJ188R91H184KA01D
1	C96	Ceramic Chip Cap	Murata	GRM188R71E105KA12
24	C184-C207	Multilayer Cap	Murata	GRM31CR71C106KAC7L
1	C102	Ceramic Chip Cap	Murata	GRM32ER71E226KE15L
4	C99, C101, C208, C211	Multilayer Cap	Various	Generic
1	C179	Multilayer Cap	Various	Generic
8	R59, R66, R67, R84, R88, R92, R126, R127	Metal Film Chip Resistor (Do Not Populate)	Various	Generic
16	Q1, Q3-Q5, Q7, Q8, Q10-Q13, Q15-Q17, Q19-Q21	40V 60A Enhancement Mode GaN Power Transistor	Renesas	ISL70020SEHL/PROTO
4	Q2, Q6, Q14, Q18	(Do Not Populate) 40V 60A Enhancement Mode GaN Power Transistor	Renesas	ISL70020SEHL/PROTO-DNP
3	U4, U8, U12	Radation Tolerant Single Low Side GaN FET Driver	Renesas	ISL70040SEHL/PROTO
4	U2, U3, U10, U11	Radiation Harden 12V Half Bridge GaN FET Driver	Renesas	ISL73041SEHL/PROTO
2	U1, U9	Rad Hard Single/Dual Phase Current Mode PWM Controller	Renesas	ISL73847SEHF/PROTO
1	U7	Current Mode PWM Controller UVLO 7.0v 50% DC	Renesas	ISL78841ASRHD/PROTO
6	JP1, JP3-JP5, JP14, JP15	Three Pin Jumper	Various	JUMPER-3-100
11	JP2, JP6-JP13, JP17, JP18	100 mil Spacing Two Pin Jumper	Various	JUMPER2_100
8	C18-C21, C125, C126, C129, C130	Multilayer Cap	AVX	KGM15ACG1E102KT
4	C60, C61, C117, C118	Multilayer Cap	AVX	KGM15AR71E681KT
4	R55, R56, R132, R133	Wide Metal Foil Current Sense Chip Resistor	SSM	KRL6432E-M-R002-G-F-T1
10	R32, R34, R57, R58, R82, R83, R134-R137	Thick Film Chip Resistor	Rohm	KTR03EZPF10R0
32	R21-R24, R27-R30, R47-R54, R110-R125	Jumper Thin Film Chip Resistor	Vishay	MCS04020Z0000ZE000
9	R5, R12, R25, R26, R61, R64, R70, R106, R107	Thick Film Chip Resistor	Yageo	RC0603FR-074K99L
8	R4, R10, R72, R73, R87, R90, R94, R97	Thick Film Chip Resistor (AEC-Q200)	KOA	RK73H1JTTD1003F
8	R13-R16, R98-R101	Thick Film Chip Resistor (Automotive AEC-Q200)	KOA	RK73H1JTTD2101F
4	R62, R63, R128, R130	Thick Film Chip Resistor (Automotive AEC-Q200)	KOA	RK73H1JTTD30R1V
4	R17, R18, R104, R105	Thick Film Chip Resistor (Automotive AEC-Q200)	KOA	RK73H1JTTD3651F

Qty	Ref Des	Description	Manufacturer	Part Number
1	R78	Thick Film Chip Resistor (AEC-Q200 Automotive)	Stackpole	RMCF0603FT11K0
6	R7, R8, R68, R71, R129, R131	Film Chip Resistor	Yageo	RMCF0603ZT0R00
4	L1-L4	Shielded Power Inductor (RoHS Compliant)	CoilCraft	SLR1070-121KE
1	PG_LED	3x2.5mm Surface Mount Red/Green LED	Lumex	SSL-LXA3025IGC
24	C38, C40, C42, C44, C46, C48, C50, C52, C54, C56, C58, C62, C147, C148, C151, C152, C155, C156, C159, C160, C163, C164, C167, C168	ESR 30mΩ Conductive Polymer Capacitor	Kemet	T521X107M025ATE030
28	C27, C29, C31, C37, C39, C41, C43, C45, C47, C49, C51, C53, C55, C57, C141, C142, C145, C146, C149, C150, C153, C154, C157, C158, C161, C162, C165, C166	Ripple 6500mA ESR 6mΩ High Capacitance Low ESR Tantalum SMD Cap	Kemet	T530D227M010ATE006
20	C59, C63-C67, C70-C73, C169-C178	Ripple 6500mA ESR 6mΩ High Capacitance Low ESR Tantalum SMD Cap	Kemet	T530D227M010ATE006-DNP
1	C89	Multilayer Capacitor (AEC-Q200)	Vishay	VJ0603A100KXBAC31

3.3 Board Layout

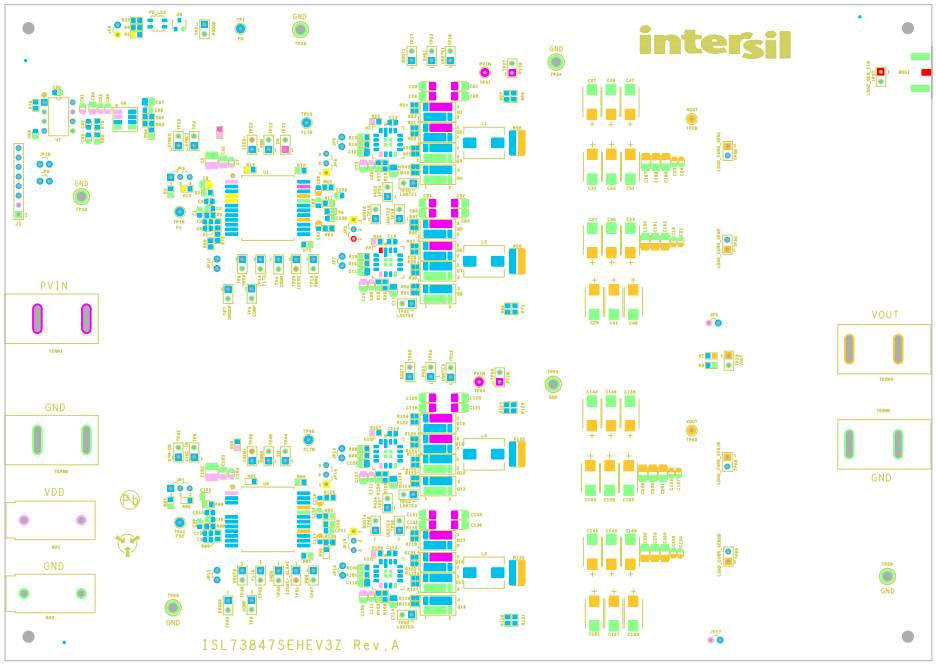

Figure 12. Silkscreen Top Layer

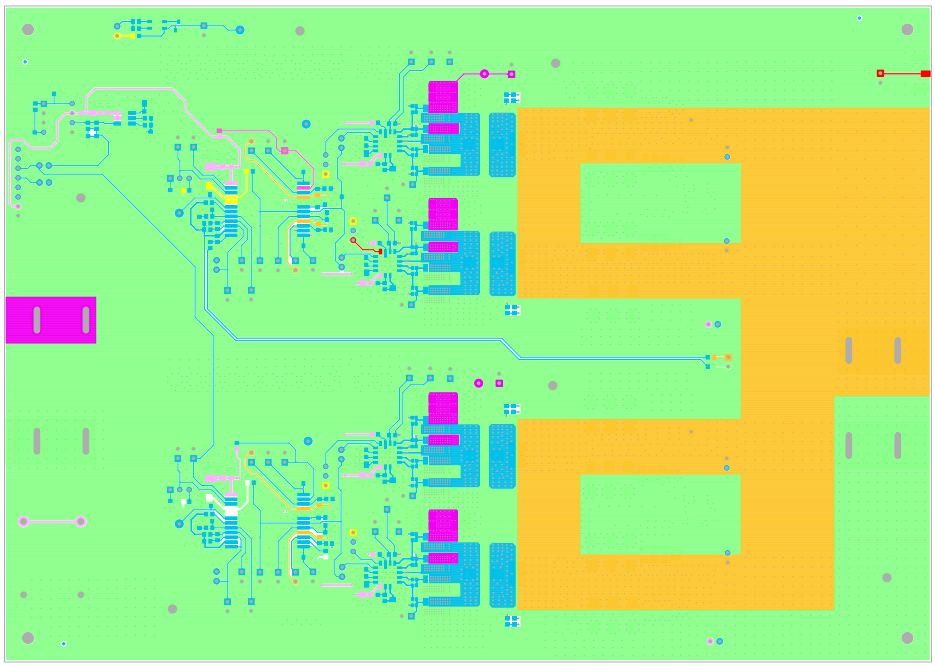

Figure 13. Top Layer

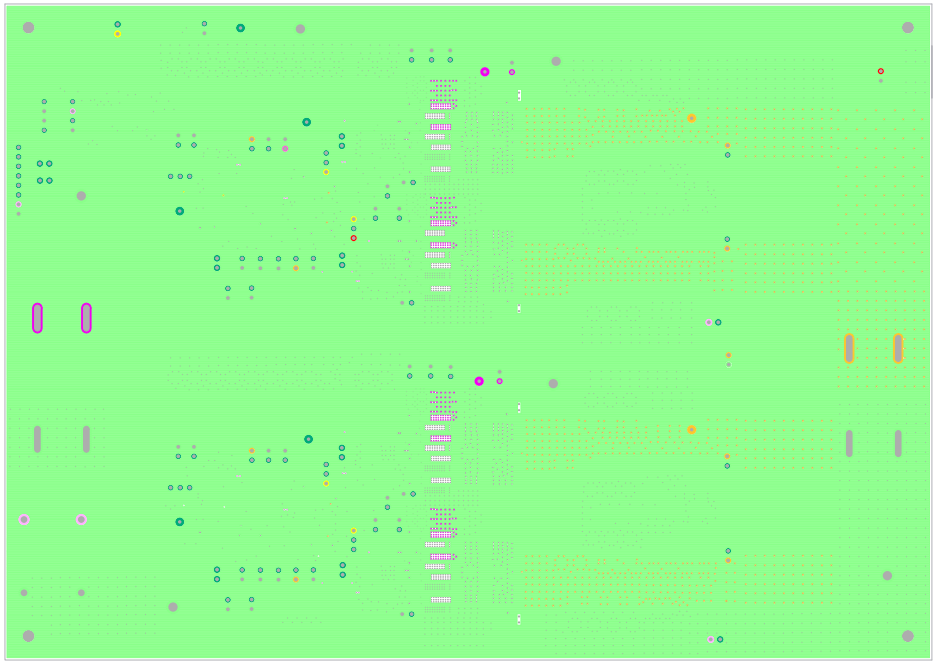

Figure 14. Layer 2

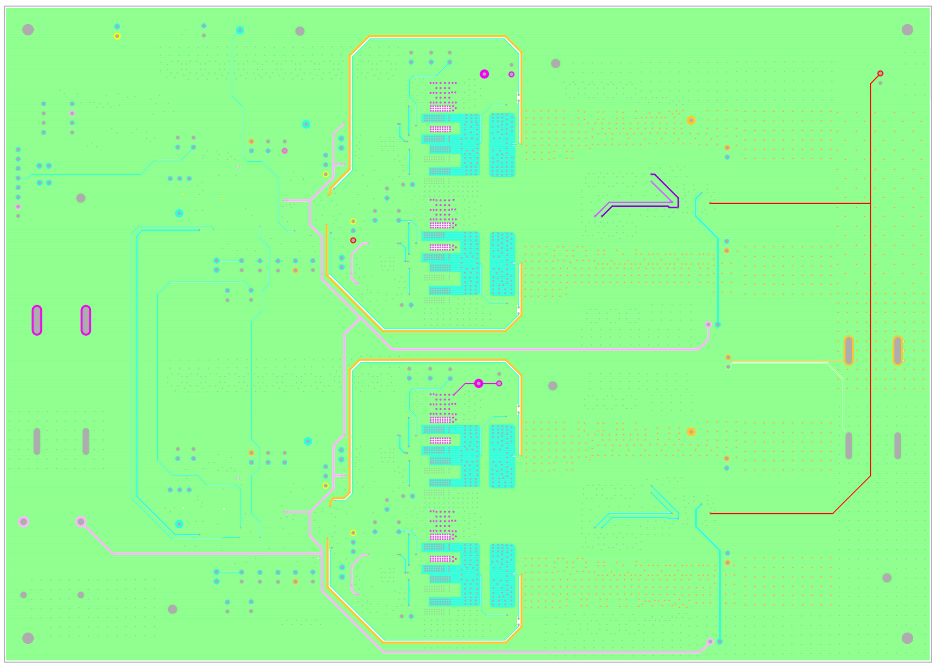

Figure 15. Layer 3

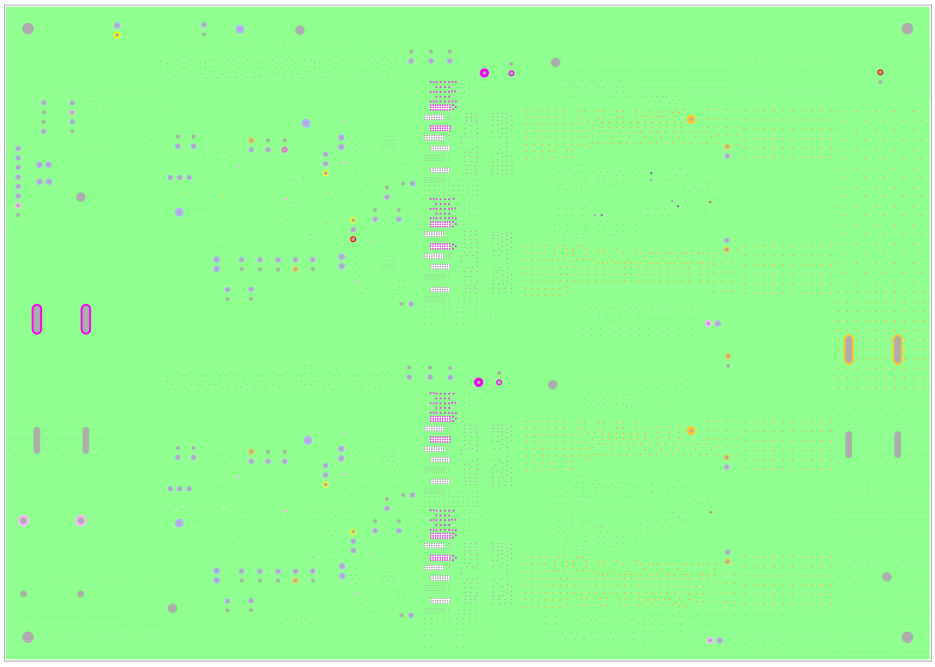

Figure 16. Layer 4

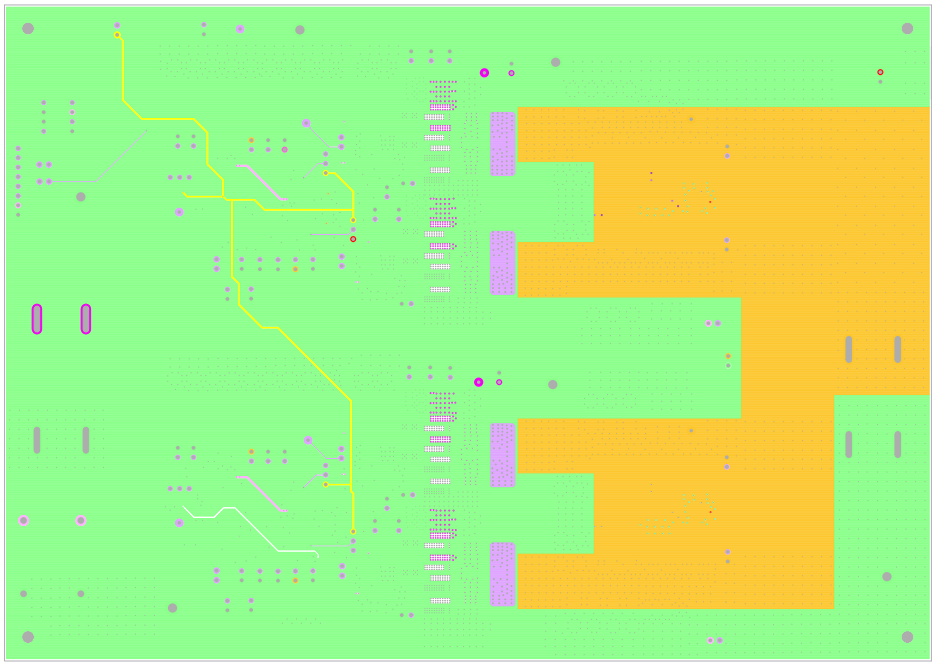

Figure 17. Layer 5

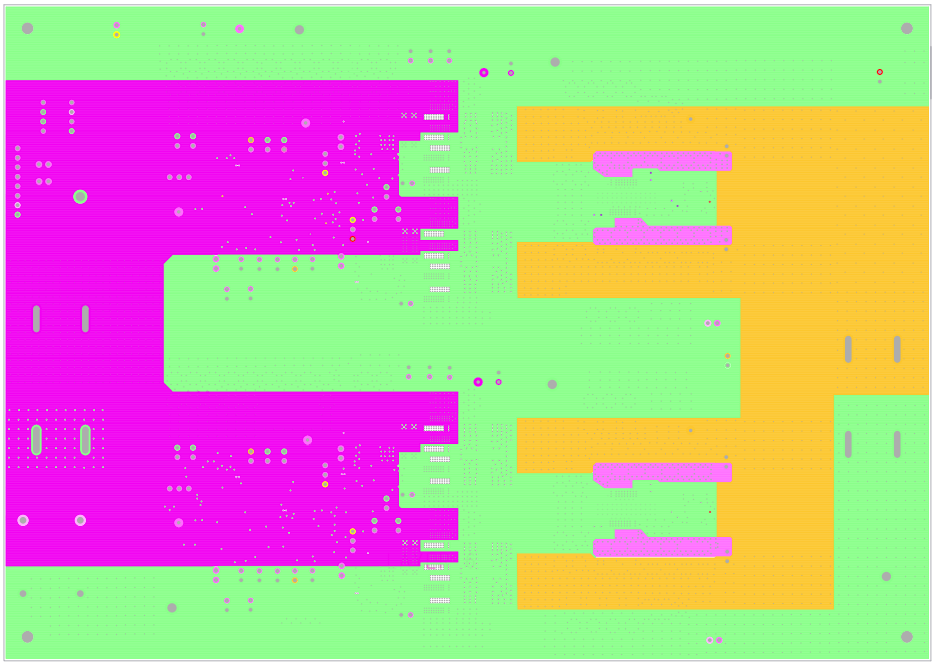

Figure 18. Layer 6

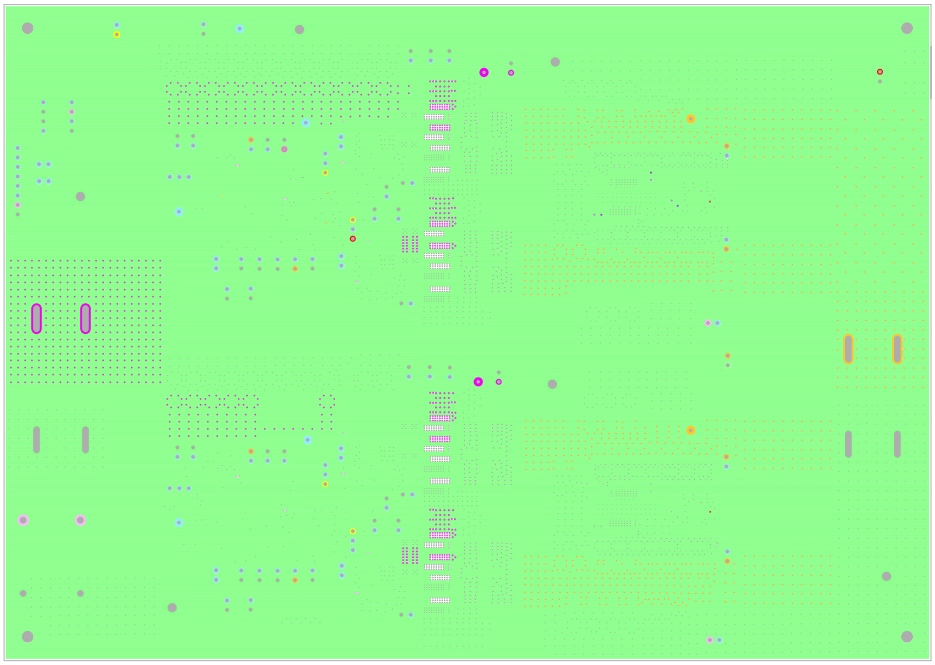

Figure 19. Layer 7

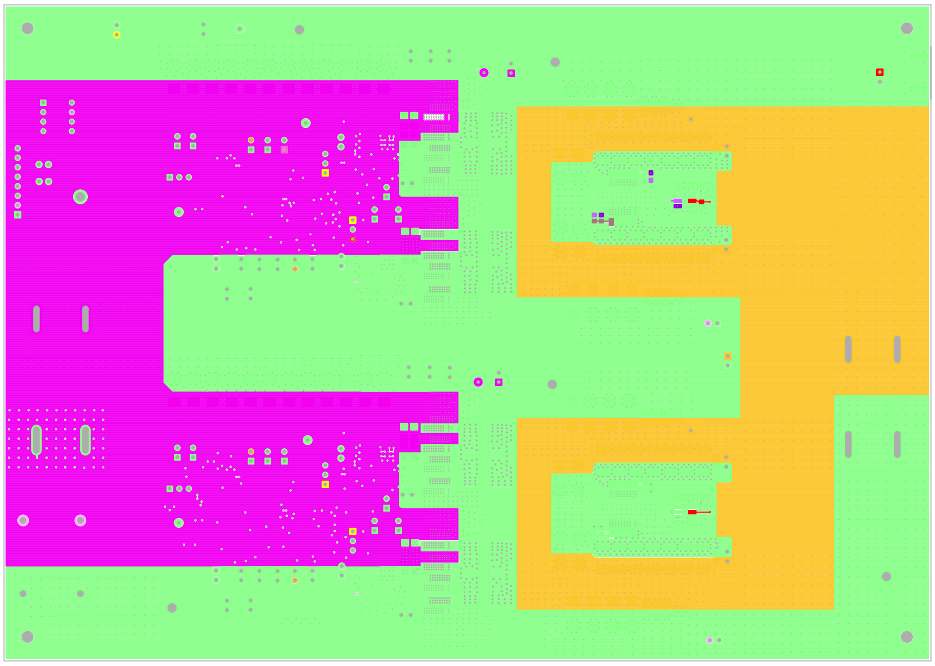

Figure 20. Bottom Layer

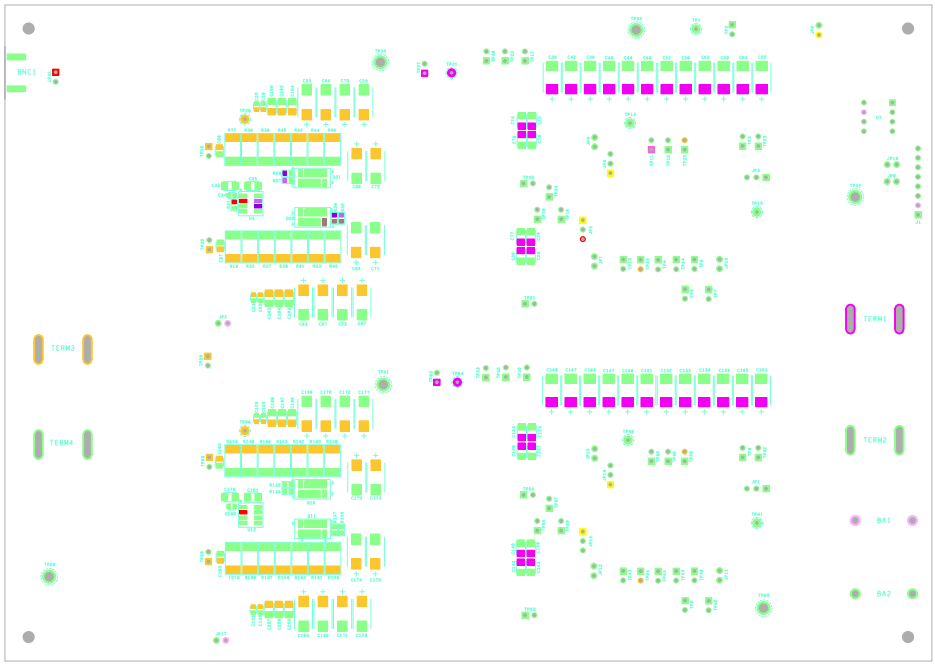

Figure 21. Silkscreen Bottom Layer

4. Typical Performance Graphs

Unless otherwise noted, V_{DD} = 12V, P_{VIN}= 5V, $V_{OUT(no-load)}$ = 0.807V; L_{OUT} = 120nH per phase, C_{OUT} = 1.54mF per phase, C_{DROOP} = 47nF, C_{VREF} = 100nF, R_{DROOP} = 392Ω, R_{FS} = 43.2kΩ, C_{SS} = 22nF, C_{COMP} = 4.7nF, R_{COMP} = 4.22kΩ, C_{POLE} = 330pF, C_{VCC} = 1µF, R_{SLP} = 30.1kΩ, C_{SLP} = 100pF, T_A = +25°C

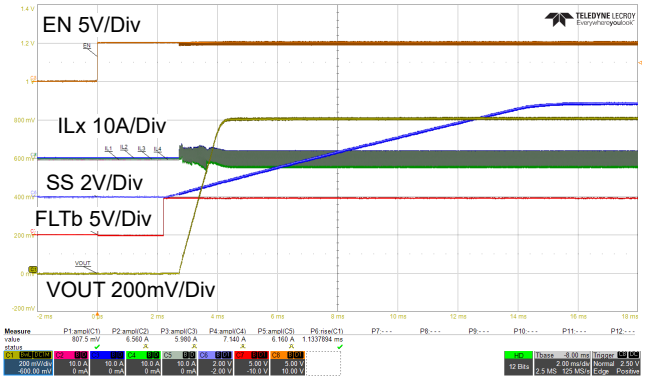

Figure 22. Soft-Start Enable (I_{LOAD} = 0A)

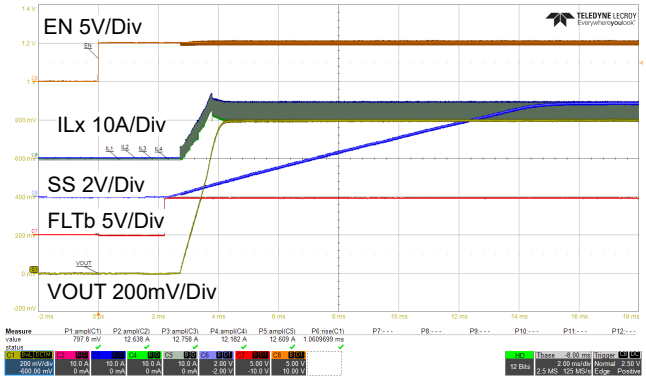

Figure 23. Soft-Start Enable (I_{LOAD} = 50A)

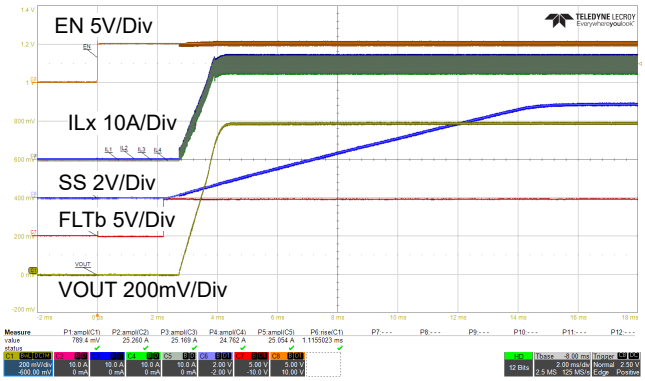

Figure 24. Soft-Start Enable (I_{LOAD} = 100A)

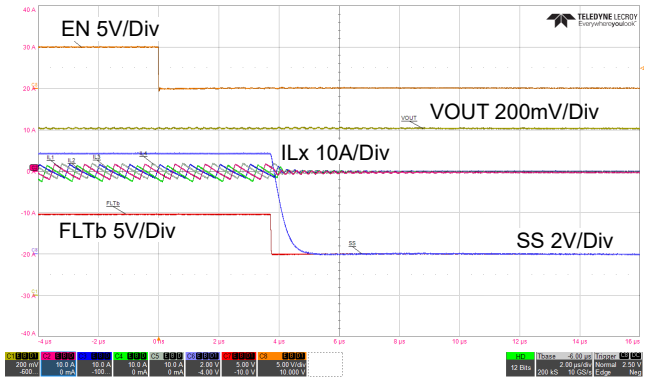

Figure 25. Disable Power-Down (I_{LOAD} = 0A)

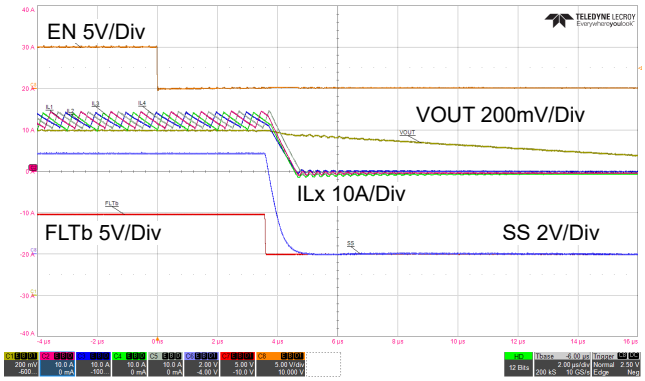

Figure 26. Disable Power-Down (I_{LOAD} = 50A)

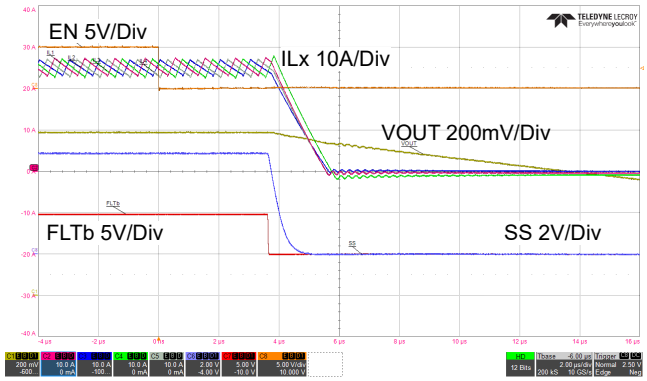

Figure 27. Disable Power-Down (I_{LOAD} = 100A)

Unless otherwise noted, V_{DD} = 12V, P_{VIN}= 5V, $V_{OUT(no\text{-}load)}$ = 0.807V; L_{OUT} = 120nH per phase, C_{OUT} = 1.54mF per phase, C_{DROOP} = 47nF, C_{VREF} = 100nF, R_{DROOP} = 392Ω, R_{FS} = 43.2kΩ, C_{SS} = 22nF, C_{COMP} = 4.7nF, R_{COMP} = 4.22kΩ, C_{POLE} = 330pF, C_{VCC} = 1µF, R_{SLP} = 30.1kΩ, C_{SLP} = 100pF, T_A = +25°C (Cont.)

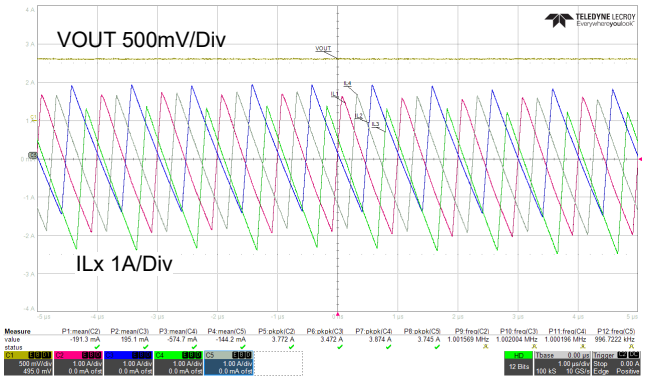

Figure 28. 4-Phase Current Sharing (I_{LOAD} = 0A)

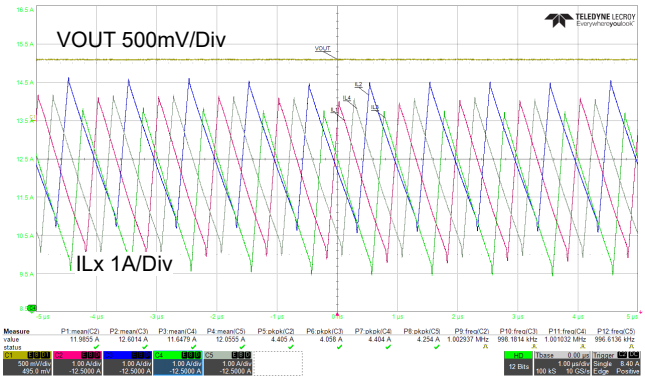

Figure 29. 4-Phase Current Sharing (I_{LOAD} = 50A)

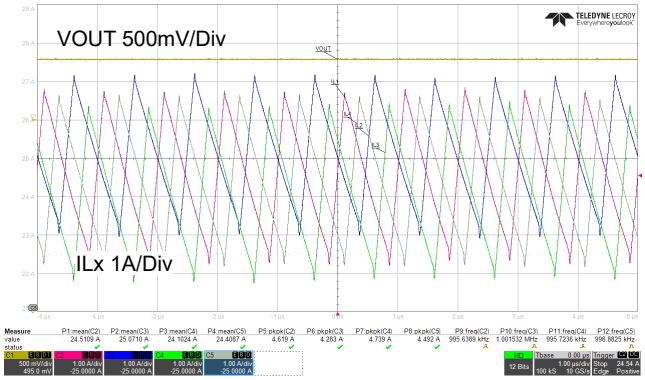

Figure 30. 4-Phase Current Sharing (I_{LOAD} = 100A)

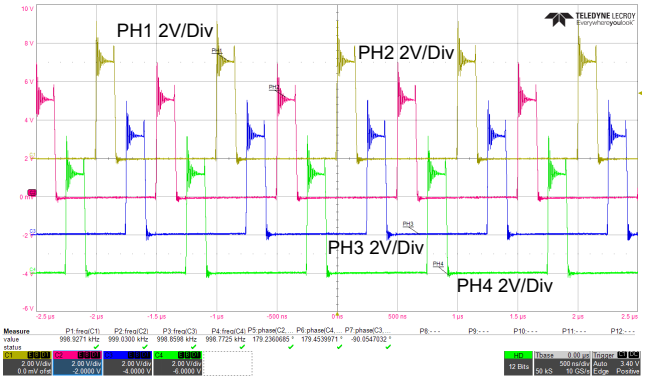

Figure 31. 4-Phase Clock Phase Shifting (I_{LOAD} = 0A)

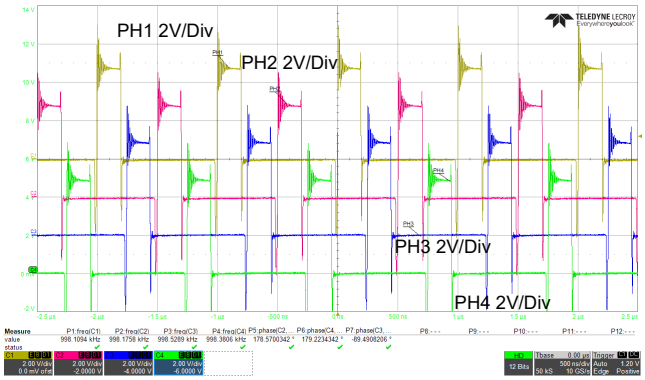

Figure 32. 4-Phase Clock Phase Shifting (I_{LOAD} = 50A)

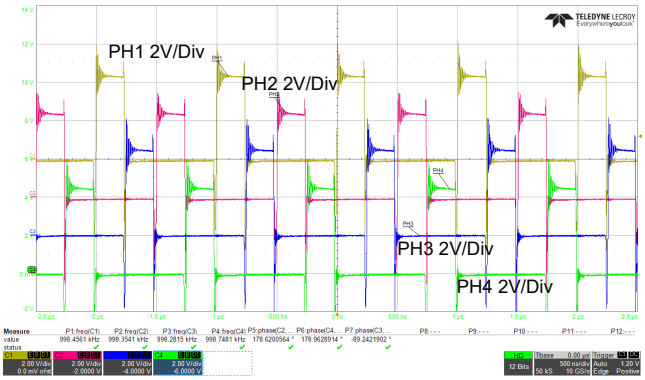

Figure 33. 4-Phase Clock Phase Shifting (I_{LOAD} = 100A)

Unless otherwise noted, V_{DD} = 12V, P_{VIN}= 5V, $V_{OUT(no-load)}$ = 0.807V; L_{OUT} = 120nH per phase, C_{OUT} = 1.54mF per phase, C_{DROOP} = 47nF, C_{VREF} = 100nF, R_{DROOP} = 392Ω, R_{FS} = 43.2kΩ, C_{SS} = 22nF, C_{COMP} = 4.7nF, R_{COMP} = 4.22kΩ, C_{POLE} = 330pF, C_{VCC} = 1µF, R_{SLP} = 30.1kΩ, C_{SLP} = 100pF, T_A = +25°C (Cont.)

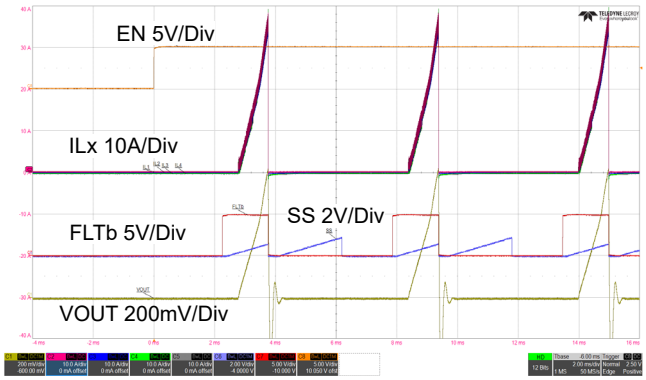

Figure 34. Overcurrent Protection Fault Response on Power-Up

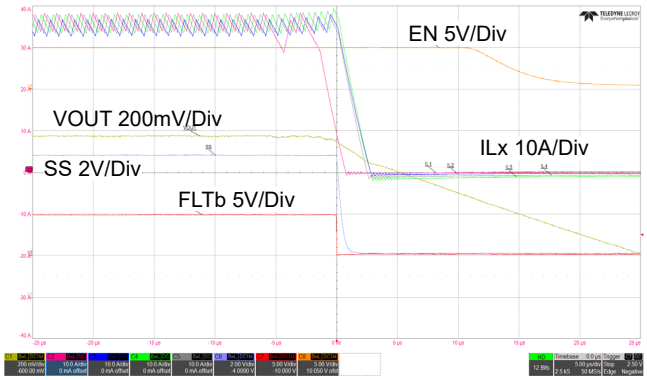

Figure 35. Overcurrent Protection Fault Response

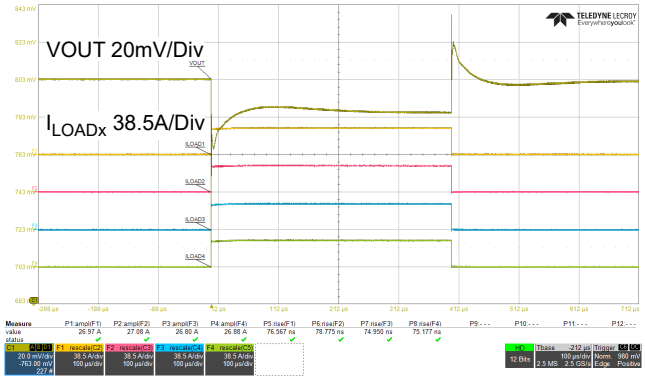

Figure 36. Load Transient Response with DROOP Regulation (ΔI_{LOAD} = 100A)

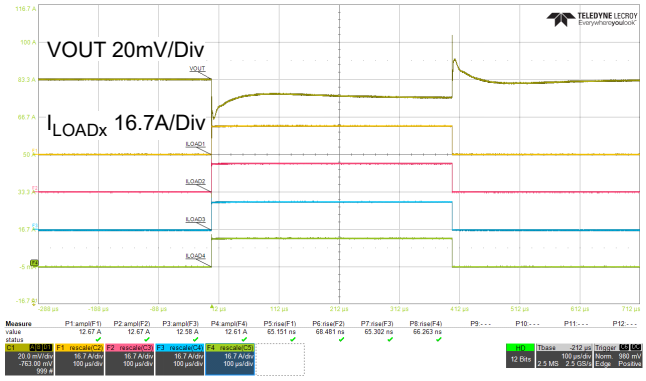

Figure 37. Load Transient Response with DROOP Regulation (ΔI_{LOAD} = 50A)

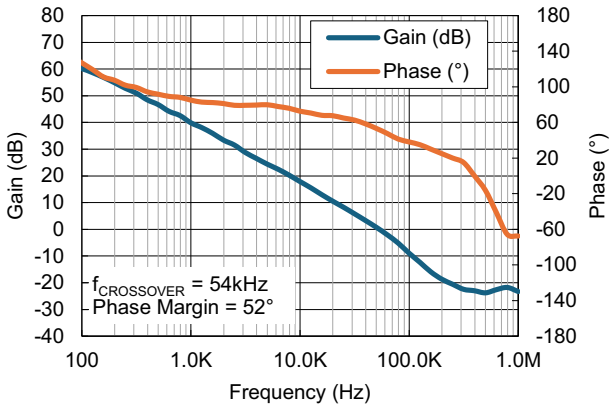

Figure 38. Gain and Phase vs Frequency (I_{LOAD} = 0A, f_{SW} = 1MHz)

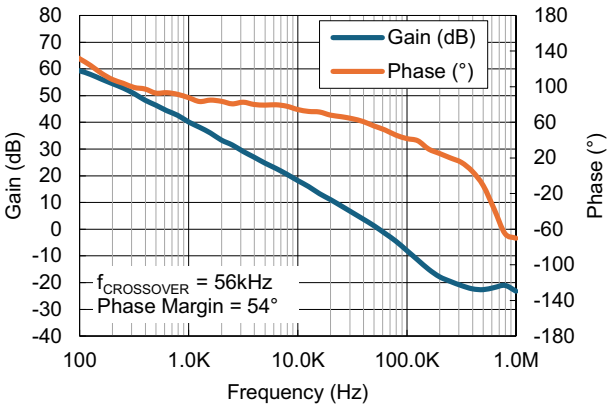

Figure 39. Gain and Phase vs Frequency (I_{LOAD} = 25A, f_{SW} = 1MHz)

Unless otherwise noted, V_{DD} = 12V, P_{VIN}= 5V, $V_{OUT(no-load)}$ = 0.807V; L_{OUT} = 120nH per phase, C_{OUT} = 1.54mF per phase, C_{DROOP} = 47nF, C_{VREF} = 100nF, R_{DROOP} = 392Ω, R_{FS} = 43.2kΩ, C_{SS} = 22nF, C_{COMP} = 4.7nF, R_{COMP} = 4.22kΩ, C_{POLE} = 330pF, C_{VCC} = 1µF, R_{SLP} = 30.1kΩ, C_{SLP} = 100pF, T_A = +25°C (Cont.)

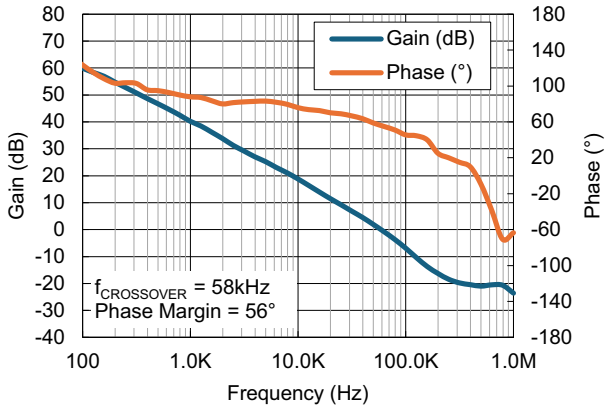

Figure 40. Gain and Phase vs Frequency (I_{LOAD} = 50A, f_{SW} = 1MHz)

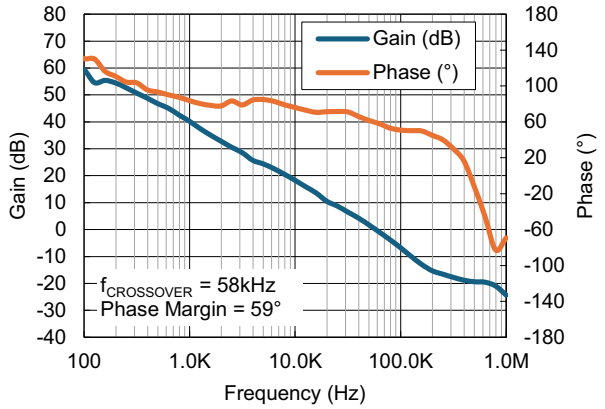

Figure 41. Gain and Phase vs Frequency (I_{LOAD} = 100A, f_{SW} = 1MHz)

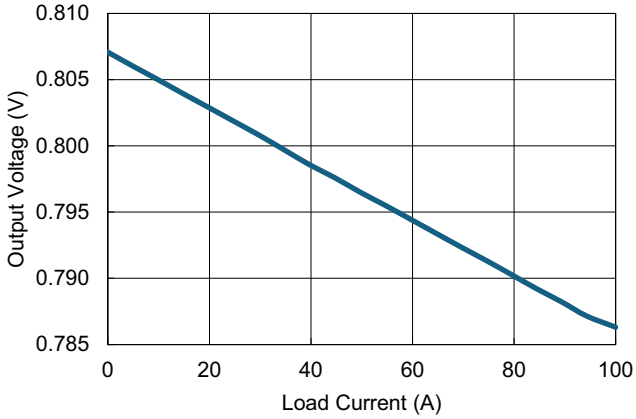

Figure 42. Load Regulation with DROOP (I_{LOAD} = 50A, f_{SW} = 1MHz)

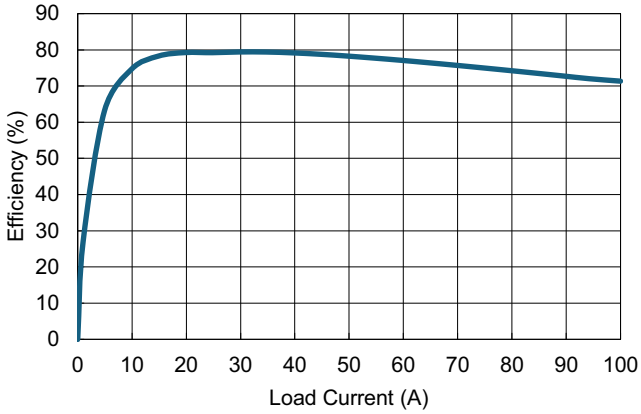

Figure 43. Conversion Efficiency vs Load Current (f_{SW} = 1MHz)

5. Ordering Information

Part Number	Description
ISL73847SEHEV3Z	ISL73847SEH evaluation board

6. Revision History

Revision	Date	Description
1.00	May 31, 2024	Initial release

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