ISL6238xxxEVAL1Z

ISL62381, ISL62382 Quad-Output Evaluation Board User Guide

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The ISL62381 and ISL62382 evaluation boards demonstrate the performance of ISL62381 and ISL62382 Quad-output controllers. The ISL62381 and ISL62382 controller include two pulse-width modulation (PWM) controllers featured with Intersil's patented R^3 technology, adjustable from 0.6V to 5.5V, and two linear regulators, LDO5 and LDO3, that generate a fixed 5V and an adjustable output respectively.

The evaluation board includes two independent Enable switches, two LED Power-Good indicators and various test points. Included with each switching channel is an on-board dynamic load generator for evaluating the transient-load response. There are four different evaluation boards which provide flexible evaluation options. Table 1 shows a brief description of the evaluation boards.

TABLE 1. EVALUATION BOARD DESCRIPTION

EVALUATION BOARD	CHANNEL-1	CHANNEL-2	OCP
ISL62381LOEVAL1Z	3.3V/8A	5V/8A	~10A
ISL62381HIEVAL1Z	1.05V/15A	1.5V/15A	~20A
ISL62382LOEVAL1Z	3.3V/8A	5V/8A	~10A
ISL62382HIEVAL1Z	1.05V/15A	1.5V/15A	~20A

What's Inside

The Evaluation Board Kit contains the following materials:

- ISL6238xxxEVAL1Z Evaluation Board
- ISL62381 and ISL62382 Datasheet
- ISL62381 And ISL62382 Evaluation Board User Guide (this document)

What's Needed

The following materials will be needed to perform testing:

- Adjustable +25V, 30A Power Supply
- +12V, 100mA Power Supply
- Precision digital multi-meter
- 4 Electronic Loads
- 4-Channel Oscilloscope

Enable Control

The evaluation board provides flexible control logic to enable or disable the outputs, and to program the two PWM channels' start-up sequence. For start-up timing sequence, please refer to the datasheet waveforms. Table 2 is the Enable controller truth table.

TABLE 2. ENABLE TRUTH TABLE

EN1	EN2	START-UP SEQUENCE
Low	Low	Both Channel outputs OFF simultaneously
Low	Float	Both Channel outputs OFF simultaneously
Float	Low	Both Channel outputs OFF simultaneously
Float	Float	Both Channel outputs OFF simultaneously
Low	High	Channel-1 OFF, Channel-2 ON
High	Low	Channel-1 ON, Channel-2 OFF
High	High	Both Channel outputs ON simultaneously
Float	High	Channel-1 enabled after Channel-2 is in regulation
High	Float	Channel-2 enabled after Channel-1 is in regulation

Resistor Current Sense Configuration

The evaluation board is pre-configured with inductor DCR current sense. For more precise overcurrent protection, it also provides the option of resistor current sense. Figure 1 shows the configuration for resistor current sense.

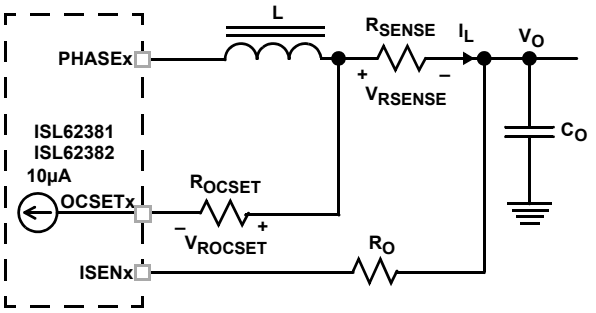


FIGURE 1. RESISTOR CURRENT SENSE CIRCUIT

For Channel-1, the ISL62381 and ISL62382 monitors the OCSET1 pin and the ISEN1 pin voltages. Once the OCSET1 pin voltage is higher than the ISEN1 pin voltage for more than 10µs, the ISL62381 and ISL62382 declare an overcurrent fault. For a chosen overcurrent, set point I_{OC} and current sense resistor R_{SENSE}, the value of R_{OCSET} is determined by Equation 1

$$R_{OCSET} = \frac{I_{OC} \cdot R_{SENSE}}{10\mu A} \quad \text{(EQ. 1)}$$

Where:

- R_{OCSET} (Ω) is the resistor used to program the overcurrent setpoint
- I_{OC} is the output current threshold that will activate the OCP circuit
- R_{SENSE} is current sense resistor (R_3 for Channel-1 and R_{25} for Channel-2)

Take Channel-1 as an example, once the value of R_{OCSET} is calculated, follow the following procedure to configure the resistor current sense circuit:

Step 1: Open the “DCR SENSE” solder bridge and connect the “RESISTOR SENSE” solder bridge on the PCB bottom layer;

Step 2: Remove R_7 (R_{22} for Channel 2);

Step 3: Replace R_3 (R_{25} for Channel 2) with R_{SENSE};

Step 4: Replace C_6 (C_{25} for Channel 2) with R_{OCSET};

Step 5: Replace replace R_{19} (R_{18} for Channel 2) with R_{OCSET}.

Dynamic Load Generator

The evaluation board provides each PWM channel an on-board dynamic load generator for evaluating the transient-load response, which are controlled by SW1 and SW2 respectively. The dynamic load generator applies a 300µs pulse load across V_{OUT} and GND. The transient load slew-rate can be trimmed by adjusting the resistors R_{34}, R_{40} for the rising edge, and R_{38}, R_{39} for the falling edge. +12V power supply is needed to power the dynamic load generator.

Connections and Test Points

The following table describes the function and operation of the evaluation boards.

NUMBER	NAME	FUNCTION/OPERATION
INTERFACES AND CONNECTIONS		
TP3	VBAT	V_{IN} positive power input
TP4	GND	V_{IN} return power input
TP1	VOUT1	Channel-1 positive power output
TP2	GND	Channel-1 return power output
TP11	VOUT2	Channel-2 positive power output
TP12	GND	Channel-2 return power output
TP20	+12V	+12V positive power input, used for the power supply of the on-board dynamic-load generator
TP19	GND	+12V return power input
TEST POINTS		
J1	PHASE2	Scope-probe socket for measuring Channel-2 phase node
J3	PHASE1	Scope-probe socket for measuring Channel-1 phase node
J2	VOUT1	Scope-probe socket for measuring Channel-1 output
J5	VOUT2	Scope-probe socket for measuring Channel-2 output
J4	FLOAT_FCCM	Remove the jumper will float the FCCM pin
J6	FLOAT_EN1	Remove the jumper will float the EN1 pin
J7	FLOAT_EN2	Remove the jumper will float the EN2 pin
TP17	EN1	Test point of EN1 pin
TP8	EN2	Test point of EN2 pin
TP9	LDO3EN	Test point of LDO3EN pin
TP10	FCCM	Test point of FCCM pin
POWER-GOOD INDICATORS		
TP13	PGOOD1	Test point of PGOOD1 pin
TP5	PGOOD2	Test point of PGOOD2 pin
D1		Channel-1 Power-Good indicator. Green when VOUT1 is in regulation.
D2		Channel-2 Power-Good indicator. Green when VOUT2 is in regulation.
LINEAR REGULATORS		
TP14	LDO5	LDO5 linear regulator positive power output
TP15	GND	LDO5 linear regulator return power output
TP16	LDO3IN	Input of LDO3 linear regulator. Connect to connected to a voltage greater than the LDO3 set point plus the dropout voltage.
TP18	LDO3FB	LDO3 linear regulator output voltage feedback test point
TP6	LDO3	LDO3 linear regulator positive power output
TP7	GND	LDO3 linear regulator return power output

Connections and Test Points

The following table describes the function and operation of the evaluation boards. **(Continued)**

SWITCHES		
SW1		ON/OFF control of Channel-2 dynamic-load generator. Toggle to ON will enable the dynamic load, toggle to OFF will disable the transient load
SW2		ON/OFF control of Channel-1 dynamic-load generator. Toggle to ON will enable the dynamic load, toggle OFF will disable the transient load
U2		ON: High level for EN1, EN2, LDO3EN and FCCM, respectively OFF: Low level for EN1, EN2, LDO3EN and FCCM, respectively

Test Set-up

Figure 2 shows a typical test configuration.

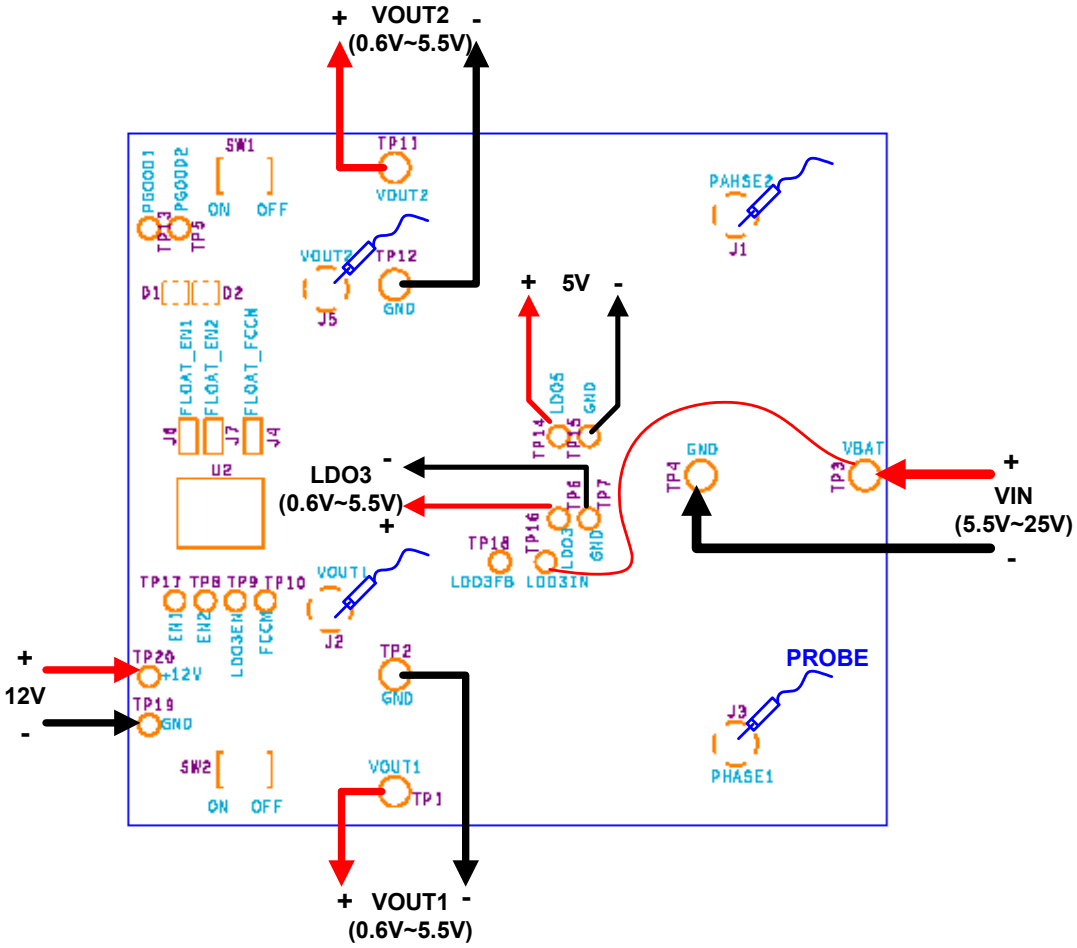


FIGURE 2. TYPICAL TEST CONFIGURATION

ISL62381LOEVAL1Z, ISL62382LOEVAL1Z Evaluation Board Bill of Materials

ISL62381LOEVAL1Z and ISL62382LOEVAL1Z evaluation boards use the same PCB and schematic, thus the same bill of materials except for the controller U1.

NO.	REFERENCE DESIGNATOR	QTY	VALUE	VOLTAGE/ POWER	TOL. (%)	MANUFACTURER	DESCRIPTION
1	C6, C25	2	0.022µF	25V	10	GENERIC	SM_CAP_0603, 0.022µF, 25V, 10%, X7R, ROHS
2	C8, C9	2	0.01µF	16V	10	GENERIC	SM_CAP_0603, 0.01µF, 16V, 10%, X7R, ROHS
3	C17, C19	2	0.22µF	16V	10	GENERIC	SM_CAP_0603, 0.22µF, 16V, 10%, X7R, ROHS
4	C13, C15, C22, C23	4	10µF	25V	10	GENERIC	SM_CAP_1206, 10µF, 25V, 10%, X7R, ROHS
5	C12, C14	2	1200pF	16V	10	GENERIC	SM_CAP_0603, 1200PF, 16V, 10%, X7R, ROHS
6	C7, C10	2	1µF	10V	10	GENERIC	SM_CAP_0603, 1µF, 10V, 10%, X7R, ROHS
7	C30	1	1µF	25V	10	GENERIC	SM_CAP_0805, 1µF, 25V, 10%, X7R, ROHS
8	C11, C24	2	1µF	25V	10	GENERIC	SM_CAP_1206, 1µF, 25V, 10%, X7R, ROHS
9	C1, C2, C28, C29	4	4.7µF	10V	10	GENERIC	SM_CAP_0805, 4.7µF, 10V, 10%, X7R, ROHS
10	C20, C21	2	4.7µF	10V	10	GENERIC	SM_CAP_1206, 4.7µF, 10V, 10%, X7R, ROHS
11	C16, C18, C31, C32	4	10µF	16V	10	GENERIC	SM_CAP_0805, 10µF, 16V, 10%, X5R, ROHS
12	C3	1	56µF	25V	20	SANYO-OSCON	RADIAL_POLCAP_RADIAL, 25SP56M, 56µF, 25V, 20%, CASE-CC
13	C4, C26	2	330µF	6.3V	10	SANYO-POSCAP	SM_POLCAP_SMD, 6TPF330M9L, 330UF, 6.3V, 10%, CAP_7343
14	R12, R15	2	750	1/10W	1	GENERIC	SM_RES_0603, 750, 1/10W, 1%, TF, ROHS
15	R11, R30	2	10k	1/10W	1	GENERIC	SM_RES_0603, 10k, 1/10W, 1%, TF, ROHS
16	R14	1	9.09k	1/10W	1	GENERIC	SM_RES_0603, 9.09k, 1/10W, 1%, TF, ROHS
17	R13	1	68.1k	1/10W	1	GENERIC	SM_RES_0603, 68.1k, 1/10W, 1%, TF, ROHS
18	R7, R18, R19, R22	4	15.8k	1/10W	1	GENERIC	SM_RES_0603, 15.8k, 1/10W, 1%, TF, ROHS
19	R29	1	17.4k	1/10W	1	GENERIC	SM_RES_0603, 17.4k, 1/10W, 1%, TF, ROHS
20	R8	1	19.6k	1/10W	1	GENERIC	SM_RES_0603, 19.6k, 1/10W, 1%, TF, ROHS
21	R9	1	24.3k	1/10W	1	GENERIC	SM_RES_0603, 24.3k, 1/10W, 1%, TF, ROHS
22	R16	1	45.3k	1/10W	1	GENERIC	SM_RES_0603, 45.3k, 1/10W, 1%, TF, ROHS
23	R20, R33, R39	3	1k	1/10W	1	GENERIC	SM_RES_0603, 1k, 1/10W, 1%, TF, ROHS
24	R38	1	1.58k	1/10W	1	GENERIC	SM_RES_0603, 1.58k, 1/10W, 1%, TF, ROHS
25	R17, R32	2	48.7k	1/10W	1	GENERIC	SM_RES_0603, 48.7k, 1/10W, 1%, TF, ROHS
26	R1, R2, R10	3	0	1/10W	1	GENERIC	SM_RES_0603, 0, 1/10W, 1%, TF, ROHS
27	R34, R40	2	200	1/10W	1	GENERIC	SM_RES_0603, 200, 1/10W, 1%, TF, ROHS
28	R5, R27	2	499	1/10W	1	GENERIC	SM_RES_0603, 499, 1/10W, 1%, TF, ROHS
29	R6, R21, R23, R24, R28, R31	6	100k	1/10W	1	GENERIC	SM_RES_0603, 100k, 1/10W, 1%, TF, ROHS
30	R35	1	0.7	1W	1	GENERIC	SM_RES_2512, 0.7, 1W, 1%, TF, ROHS
31	R37	1	0.5	1W	1	GENERIC	SM_RES_2512, 0.5, 1W, 1%, TF, ROHS
32	D1, D2	2	SSL_LXA3025IGC			LUMEX	SSL_LXA3025IGC_SMD-SSL-LXA3025IGC, LED_3x2_5MM
33	D3, D4	2	BAT54S			DIODES	SM_SCHOTTKY_BAT54S-BAT54S, SOT23
34	Q2, Q4	2	IRF7821PBF			IR	30V 13.6A N-Channel HEXFET Power MOSFET (Pb-free)

ISL62381LOEVAL1Z, ISL62382LOEVAL1Z Evaluation Board Bill of Materials

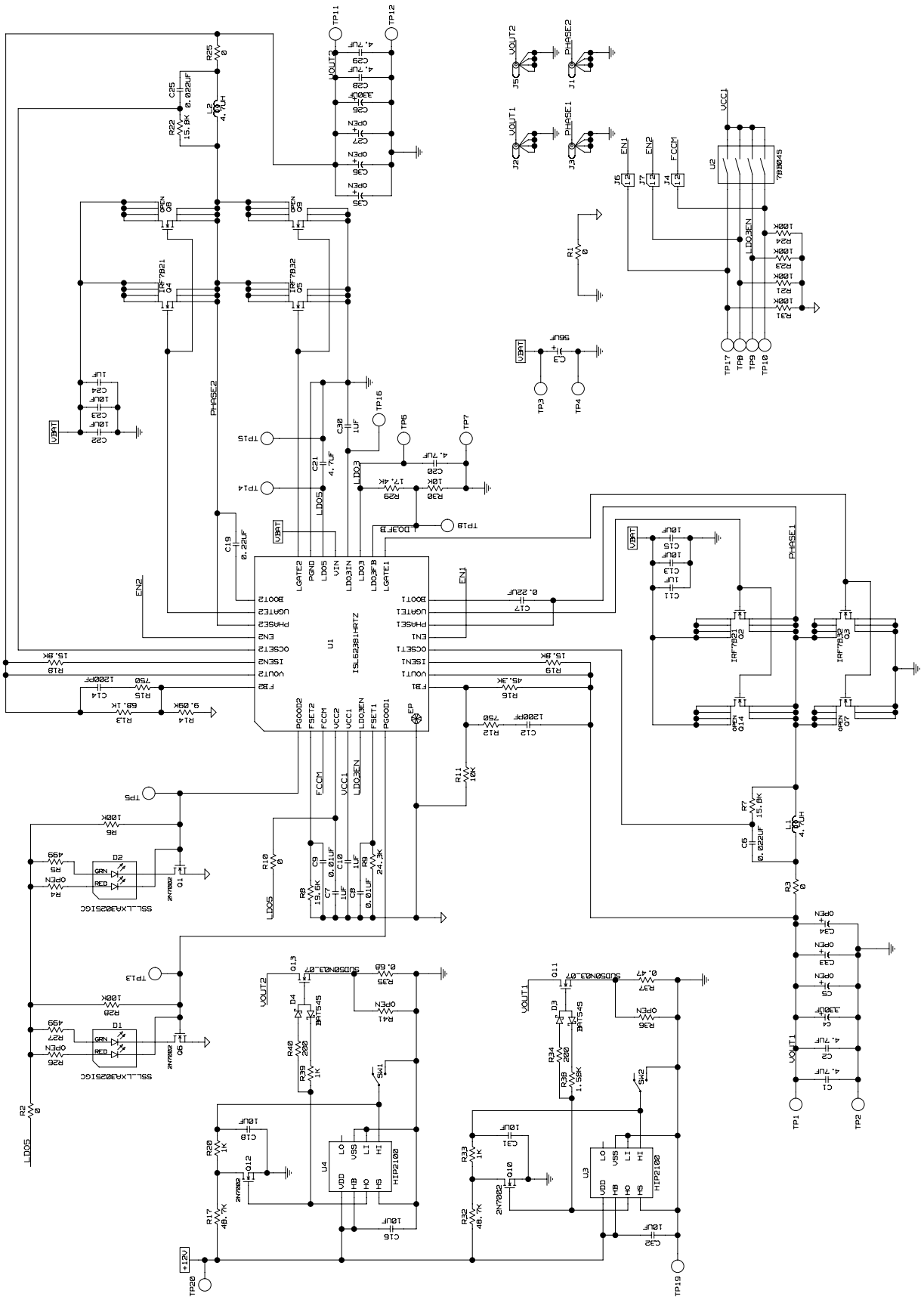
ISL62381LOEVAL1Z and ISL62382LOEVAL1Z evaluation boards use the same PCB and schematic, thus the same bill of materials except for the controller U1. **(Continued)**

NO.	REFERENCE DESIGNATOR	QTY	VALUE	VOLTAGE/ POWER	TOL. (%)	MANUFACTURER	DESCRIPTION
35	Q3, Q5	2	IRF7832PBF			IR	30V 20A N-Channel HEXFET Power MOSFET (Pb-FREE)
36	Q1, Q6, Q10, Q12	4	2N7002-7-F			FAIRCHILD	2N7002_SOT23-2N7002-7-F,SOT23
37	Q11, Q13	2	SUD50N03-07			VISHAY	SUD50N03_07_TO252-SUD50N03-07, TO-252AA
38	SW1, SW2	2	GT11MSCBE-T			C&K	GT11MSCKE_SMT-GT11MSCBE-T, GT13MSCKE
39	TP5, TP6, TP7, TP8, TP9, TP10, TP13, TP14, TP15, TP16, TP17, TP18, TP19,	14	5002			KEYSTONE	TEST_POINT_THOLE-5002,MTP500X
40	TP1, TP2, TP3, TP4, TP11, TP12	6	1514-2			KEYSTONE	TEST_POINT_THOLE-1514-2,TP-150C100P
41	J1, J2, J3, J5	4	131-5031-00			TEKTRONIX	SCOPE_PROBE_5P_CONN-131-5031-00, TEK131-5031-00
42	J4, J6, J7	3	68000-236			FCI	CONN2_DIP2-68000-236, CONN2
43	U2	1	78B04S			GRAYHILL	DIP_SW4_SPST_DIP-78B04S, DIP8-SW4
44	U1	1	ISL62381HRTZ (ISL62382HRTZ)			INTERSIL	ISL62381HRTZ, 32 LD 5x5 TQFN (ISL62382HRTZ, 32 LD 5x5 TQFN)
45	U3, U4	2	HIP2100IBZ			INTERSIL	HIP2100_SOIC-HIP2100IBZ,SOIC8_150_50
46	L1, L2	2	4.7µH		20%	VISHAY	VISHAY_IHLP_5050CE_SMT-20%-IHLP-5050CE-01-4R7M, 4.7µH, 24A, 20%, VISHAY_IHLP-5050CE
47	R3, R25	2	Wire			GENERIC	Wire short
48	DCR SENSE	4	Wire			GENERIC	Wire short
49	Jumper Connector	3	SPC02SYAN			SULLINS	Connector Jumper for J4, J6, J7
50		1	PCB			TBD	ISL62381EVAL1ZREVA PCB
51		1	Label			TBD	LABEL, FOR SERIAL NUMBER AND BOM REV #
52	C5, C27, C33, C34, C35, C36	6	No-pop				
53	R4, R26, R36, R41	4	No-pop				
54	Q7, Q8, Q9, Q14	4	No-pop				

ISL62381HIEVAL1Z, ISL62382HIEVAL1Z Evaluation Board Bill of Materials

The ISL62381HIEVAL1Z, ISL62382HIEVAL1Z evaluation boards use the same PCB and schematic as the ISL62381LOEVAL1Z, ISL62382LOEVAL1Z evaluation boards but different bill of materials (BOM). The following table shows the BOM difference of ISL62381HIEVAL1Z, ISL62382HIEVAL1Z in comparison with ISL62381LOEVAL1Z, ISL62382LOEVAL1Z.

NO.	REFERENCE DESIGNATOR	QTY	VALUE	VOLTAGE /POWER	TOL. (%)	MANUFACTURER	DESCRIPTION
1	Q8, Q14	2	IRF7821PBF			IR	30V 13.6A N-Channel HEXFET Power MOSFET (Pb-free)
2	Q7, Q9	2	IRF7832PBF			IR	30V 20A N-Channel HEXFET Power MOSFET (Pb-free)
3	R8	1	14k	1/10W	1	GENERIC	SM_RES_0603, 14k, 1/10W, 1%, TF, ROHS
4	R9	1	17.4k	1/10W	1	GENERIC	SM_RES_0603, 17.4k, 1/10W, 1%, TF, ROHS
5	R11	1	23.2k	1/10W	1	GENERIC	SM_RES_0603, 23.2k, 1/10W, 1%, TF, ROHS
6	R16	1	17.8k	1/10W	1	GENERIC	SM_RES_0603, 17.8k, 1/10W, 1%, TF, ROHS
7	R13	1	15k	1/10W	1	GENERIC	SM_RES_0603, 15k, 1/10W, 1%, TF, ROHS
8	R14	1	10k	1/10W	1	GENERIC	SM_RES_0603, 10k, 1/10W, 1%, TF, ROHS
9	R7, R18, R19, R22	4	16.2k	1/10W	1	GENERIC	SM_RES_0603, 16.2k, 1/10W, 1%, TF, ROHS
10	R35	1	0.2	1W	1	GENERIC	SM_RES_2512, 0.2, 1W, 1%, TF, ROHS
11	R37	1	0.1	1W	1	GENERIC	SM_RES_2512, 0.1, 1W, 1%, TF, ROHS
12	R38	1	4.02k	1/10W	1	GENERIC	SM_RES_0603, 4.02k, 1/10W, 1%, TF, ROHS
13	R12, R15	2	590	1/10W	1	GENERIC	SM_RES_0603, 590, 1/10W, 1%, TF, ROHS
14	C12, C14	2	1800pF	16V	10	GENERIC	SM_CAP_0603, 1800PF, 16V, 10%, X7R, ROHS
15	C33, C36	2	330µF	6.3V	10	SANYO-POSCAP	SM_POLCAP_SMD, 6TPF330M9L, 330µF, 6.3V, 10%, CAP_7343
16	L1, L2	2	2.2µH		20	VISHAY	VISHAY_IHLP_5050CE_SMT-20%-IHLP-5050CE-01-2R2M,2.2µH, 29A, 20%, VISHAY_IHLP-5050CE



ISL6238xxxEVAL1Z Evaluation Board Schematic

ISL6238xxxEVAL1Z Evaluation Board Layout

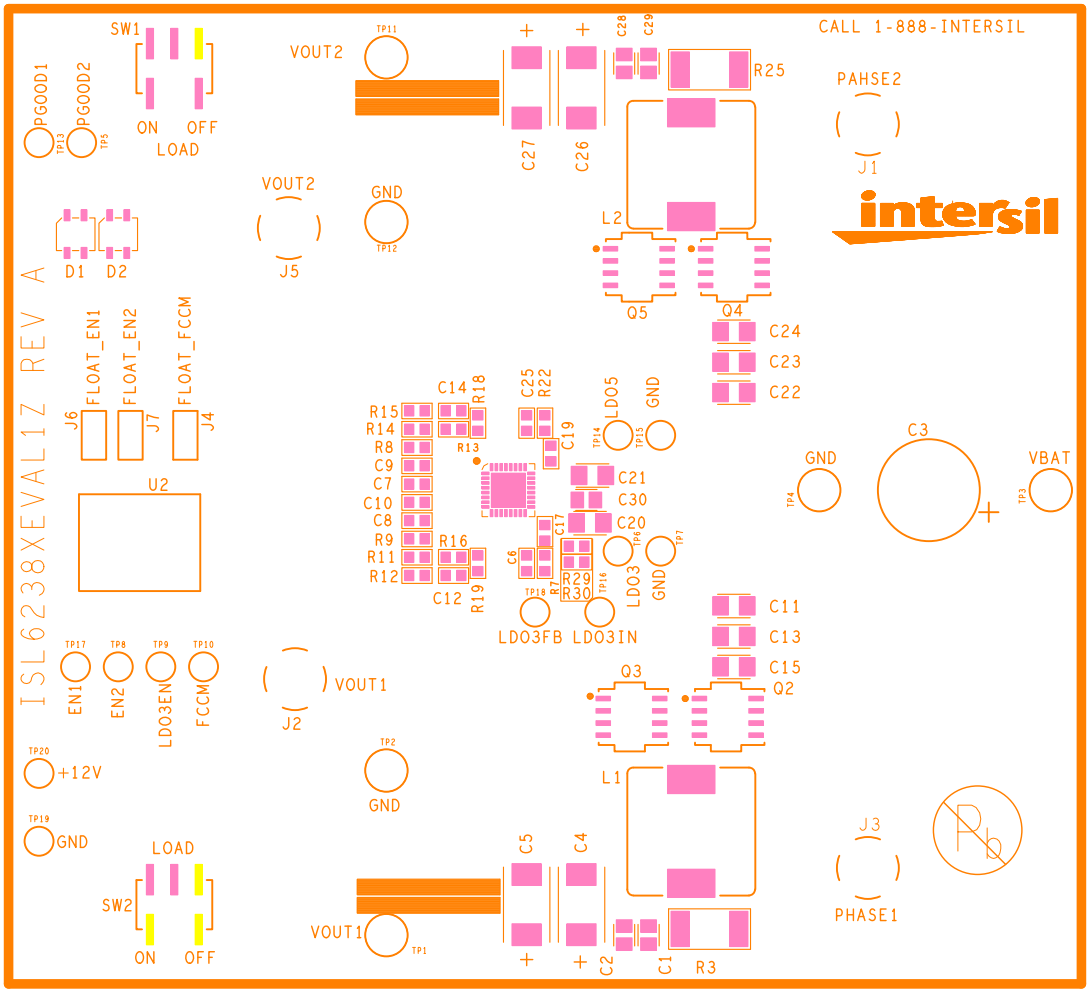


FIGURE 3. TOP SILKSCREEN

ISL6238xxxEVAL1Z Evaluation Board Layout (Continued)

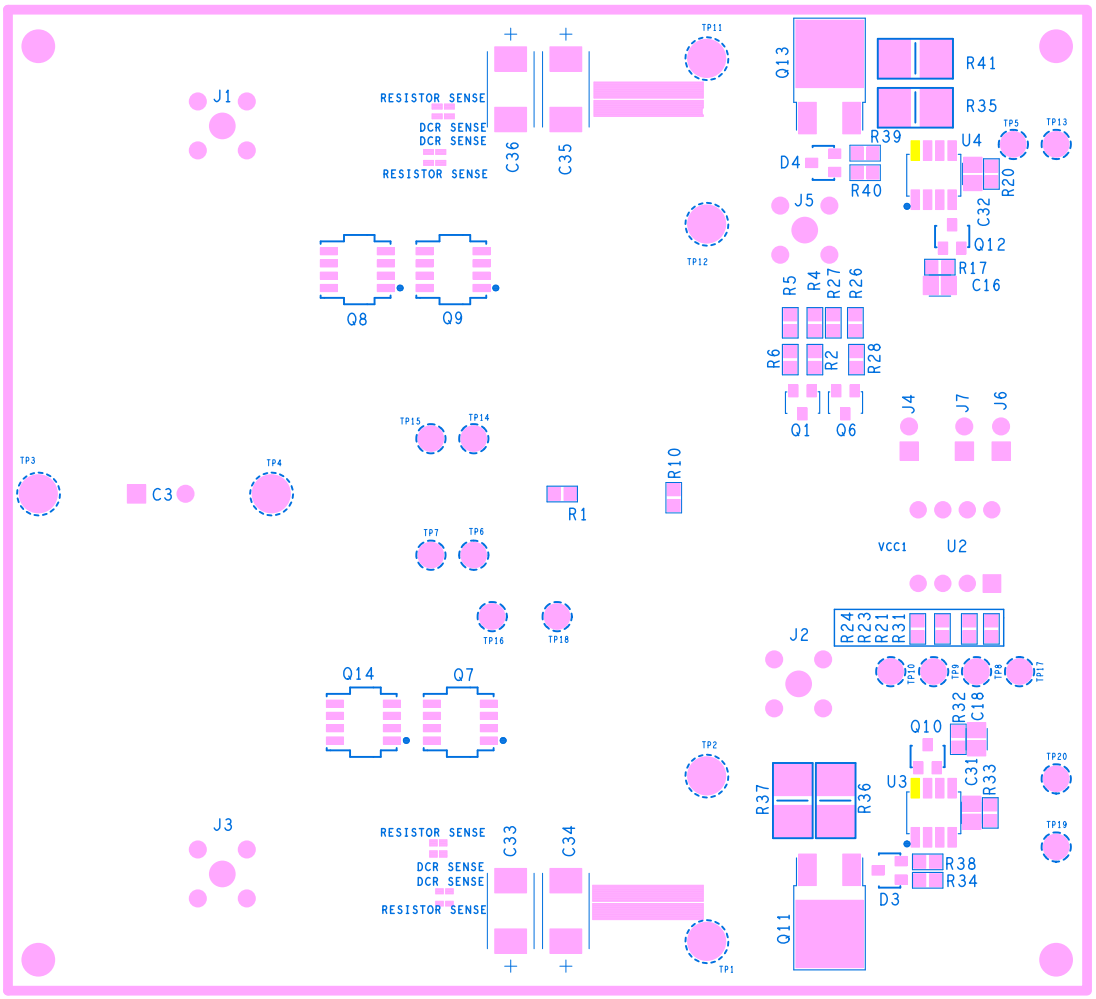


FIGURE 4. BOTTOM SILKSCREEN

ISL6238xxxEVAL1Z Evaluation Board Layout (Continued)

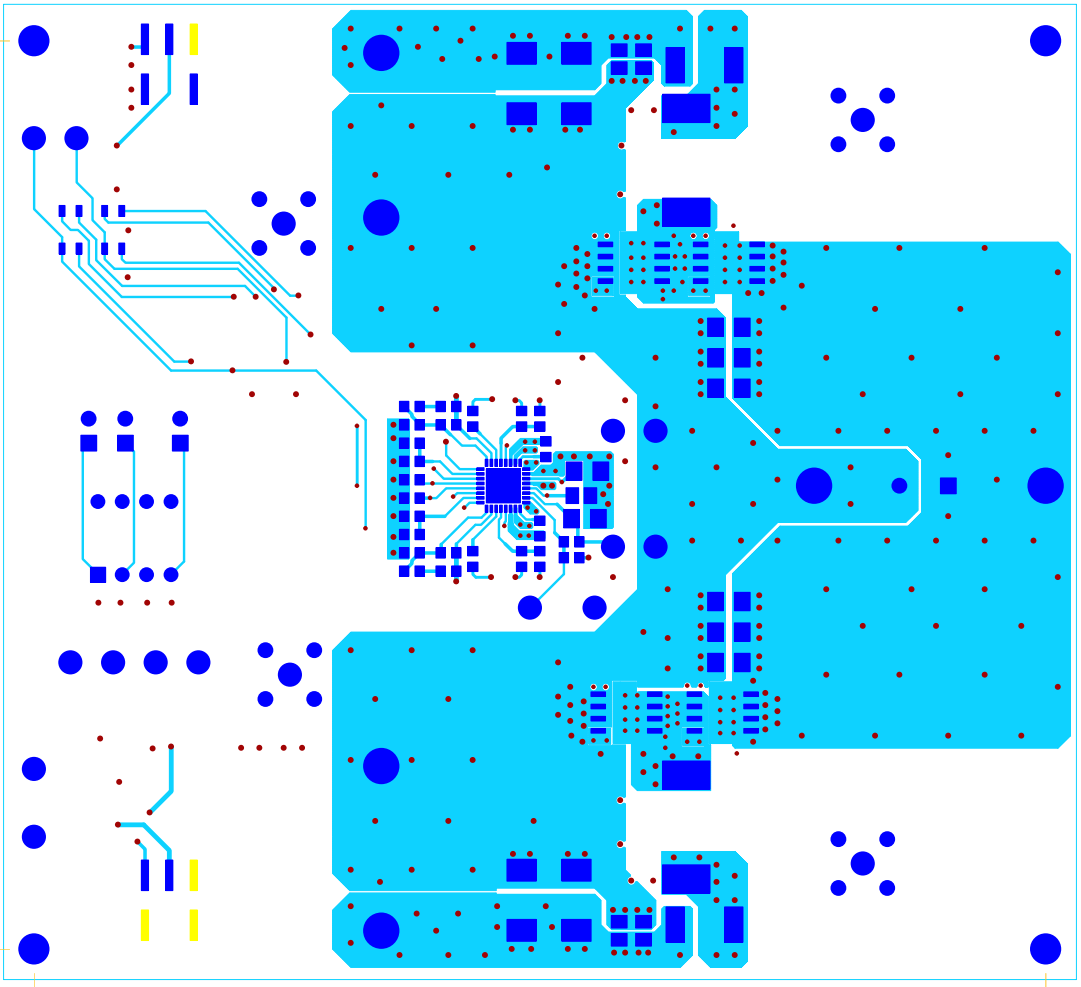


FIGURE 5. LAYER 1

ISL6238xxxEVAL1Z Evaluation Board Layout (Continued)

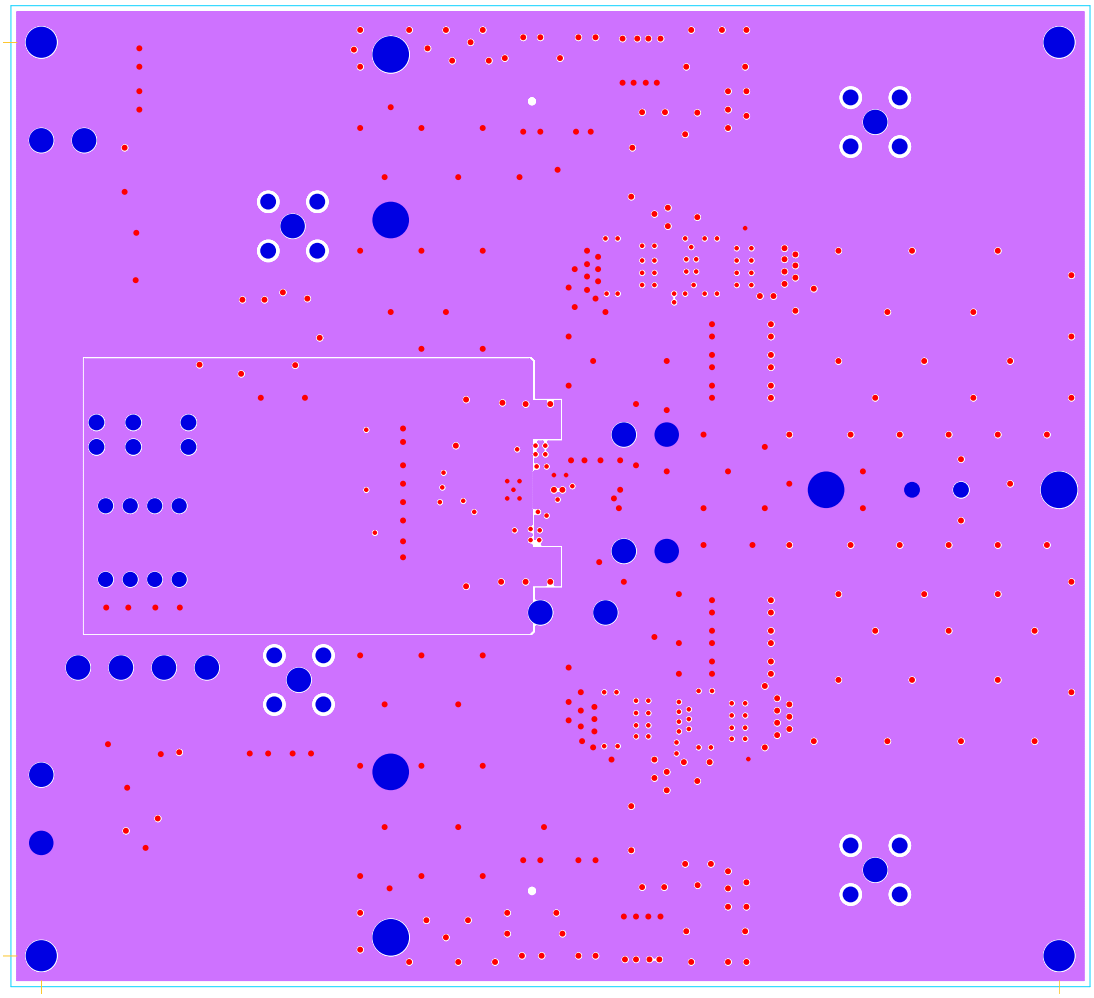


FIGURE 6. LAYER 2

ISL6238xxxEVAL1Z Evaluation Board Layout (Continued)

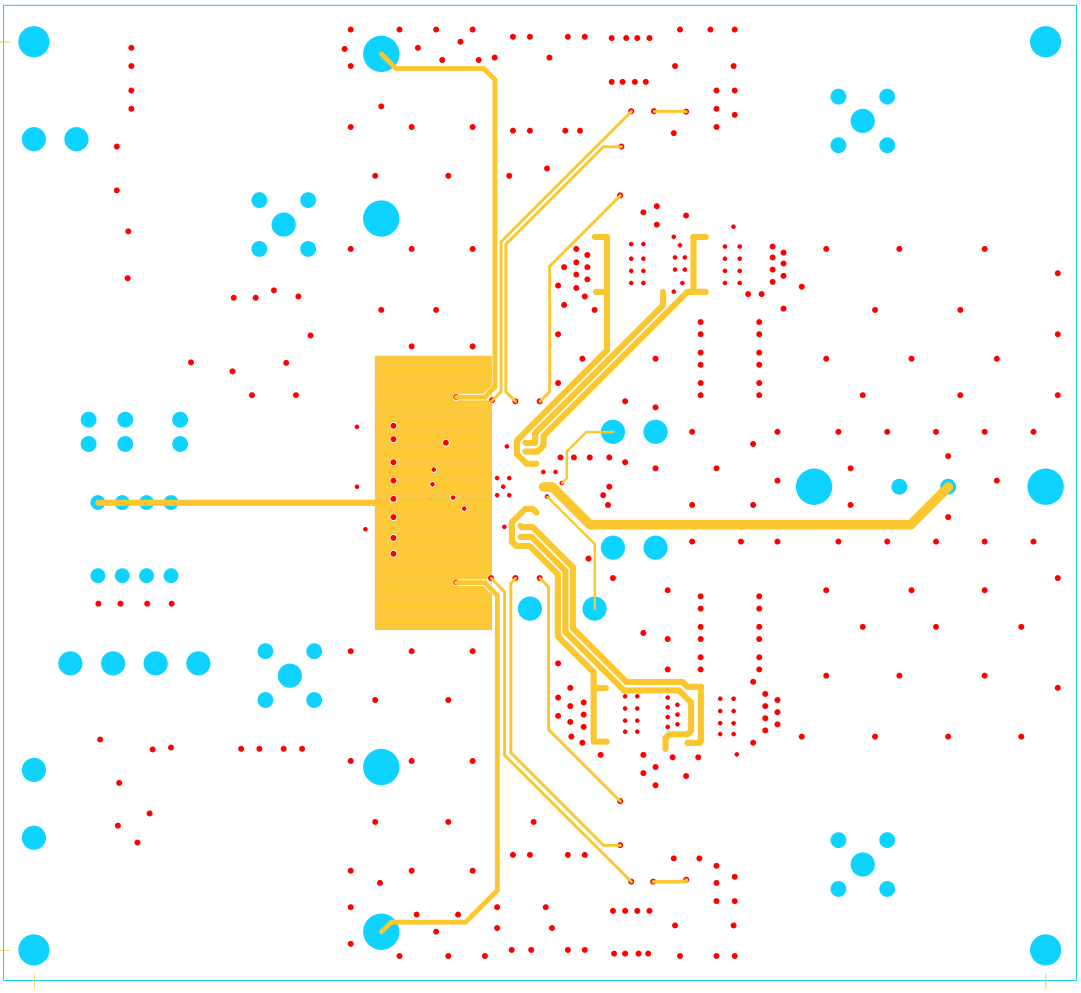


FIGURE 7. LAYER 3

ISL6238xxxEVAL1Z Evaluation Board Layout (Continued)

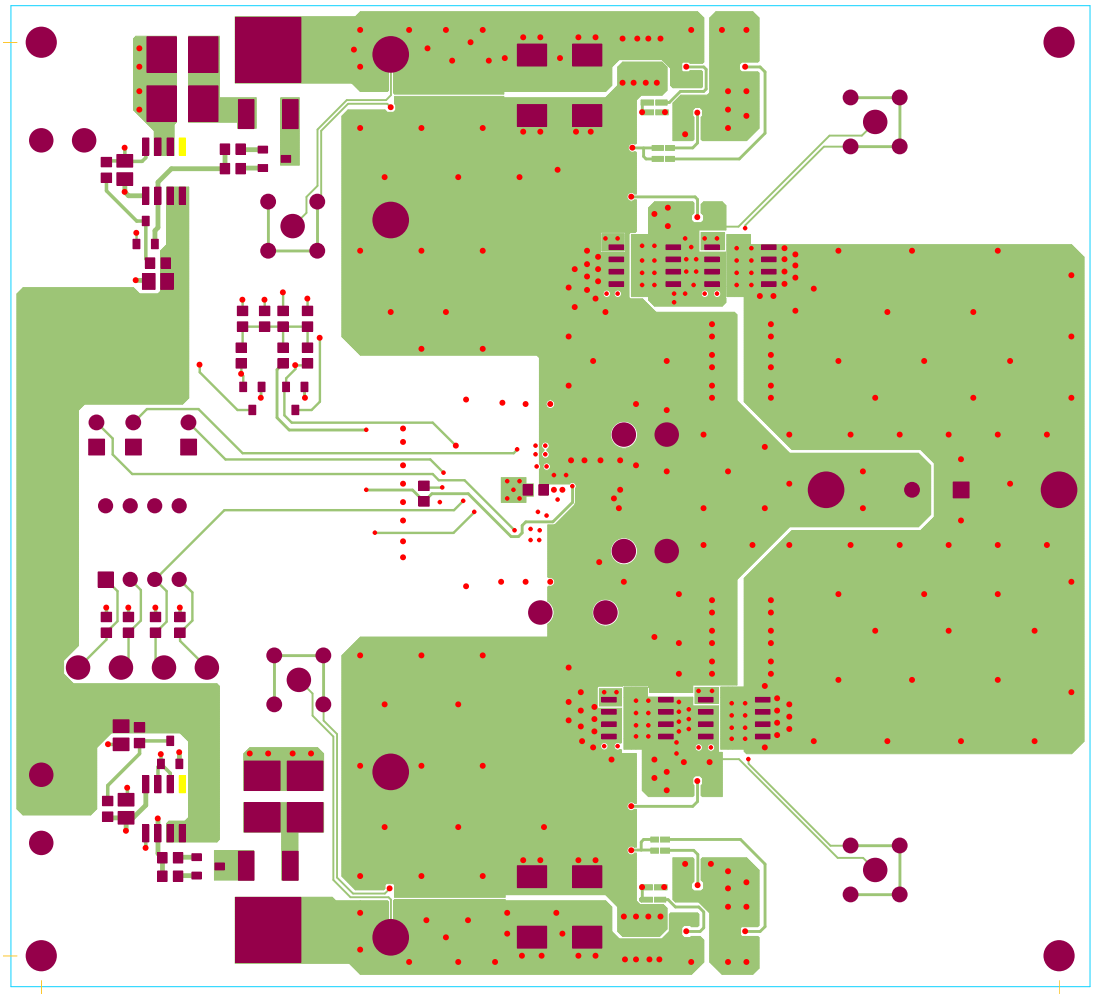


FIGURE 8. LAYER 4

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