

ISL6228LOEVAL3Z

Evaluation Board

AN1321
Rev 0.00
May 17, 2007

Introduction

The ISL6228LOEVAL3Z evaluation board demonstrates the performance of the ISL6228 dual-channel PWM controller. The ISL6228 features Intersil's Robust Ripple Regulator (R³) technology. Channel-1 output voltage is 1.5V or 1.8V, pending the state of switch S5. Channel-2 output voltage is 1.8V. Each channel has an on-board dynamic-load generator included for evaluating the transient-load response. It applies a 300μs pulse of 8A load across V_{O1} and GND, and also a 300μs pulse of 8A load across V_{O2} and GND.

Contents of this document include:

- Recommended Test Equipment
- Interface Connections
- Test Set-up
- Switch Descriptions
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 - Steady State, DCM
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TABLE 1. DC/DC DESIGN CRITERIA

PARAMETER	VALUE	UNITS
V _{IN}	3.3 to 25	VDC
V _O	0.6 to 5	VDC
Full-load	8	ADC
PWM Frequency	270, 300	kHz

Recommended Equipment

- (QTY 2) Adjustable 25V, 3A Power Supply
- (QTY 1) Fixed 5V, 100mA Power Supply
- (QTY 1) Fixed 12V, 100mA Power Supply
- (QTY 1) Adjustable 20A Constant Current Electronic Load
- (QTY 1) Digital Voltmeter
- (QTY 1) Four-Channel Oscilloscope

Interface Connections

- V_{IN1}: Input voltage to the power stage of Channel-1
 - J14: V_{IN1} positive power input
 - TP20: V_{IN1} positive voltage sense
 - J14: V_{IN1} return power input
 - TP21: V_{IN1} return voltage sense
- V_{IN2}: Input voltage to the power stage of Channel-2
 - J1: V_{IN2} positive power input
 - TP9: V_{IN2} positive voltage sense
 - J2: V_{IN2} return power input
 - TP10: V_{IN2} return voltage sense
- V_{O1}: Regulated output voltage from Channel-1
 - J9: V_{O1} positive power output
 - TP13: V_{O1} positive voltage sense
 - J10: V_{O1} return power output
 - TP14: V_{O1} return voltage sense
- V_{O2}: Regulated output voltage from Channel-2
 - J7: V_{O2} positive power output
 - TP11: V_{O2} positive voltage sense
 - J8: V_{O2} return power output
 - TP12: V_{O2} return voltage sense
- VCC: +5V input voltage
 - TP1: 5V positive input
 - TP2: 5V return input
- +12V: Input voltage for the dynamic-load generator
 - TP15: 12V positive input
 - TP16: 12V return input

Test Set-up

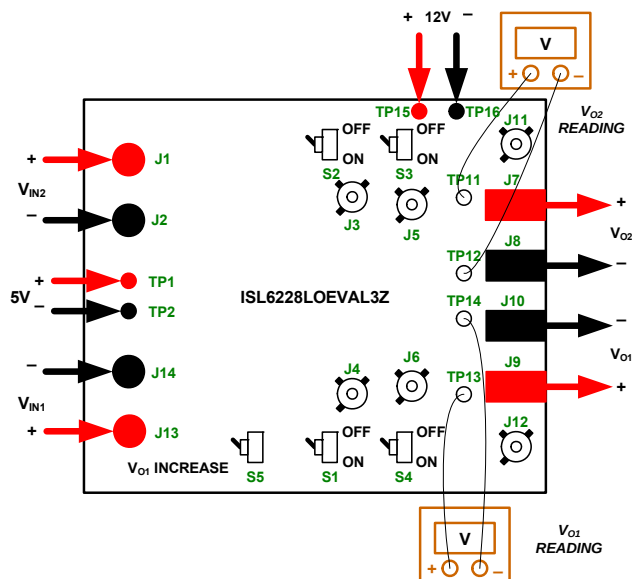


FIGURE 1. TEST SET-UP

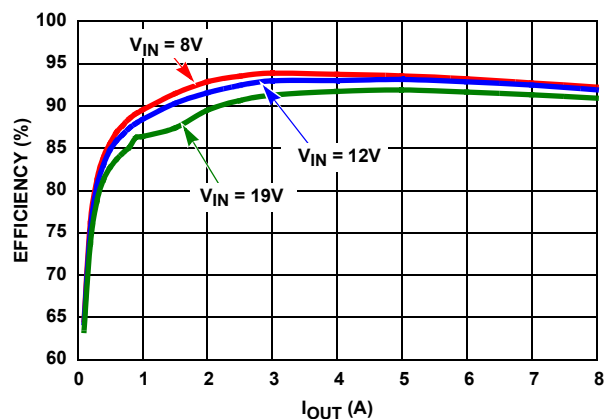
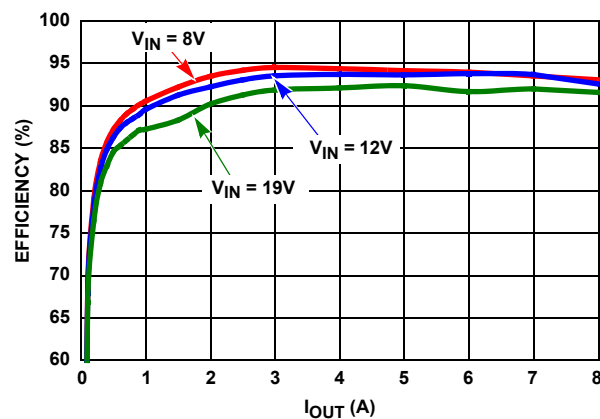
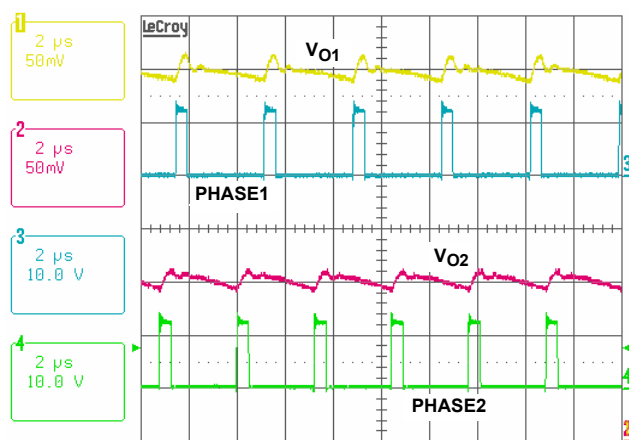
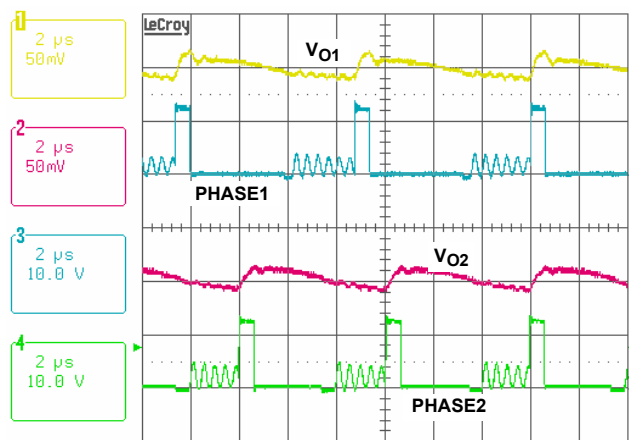
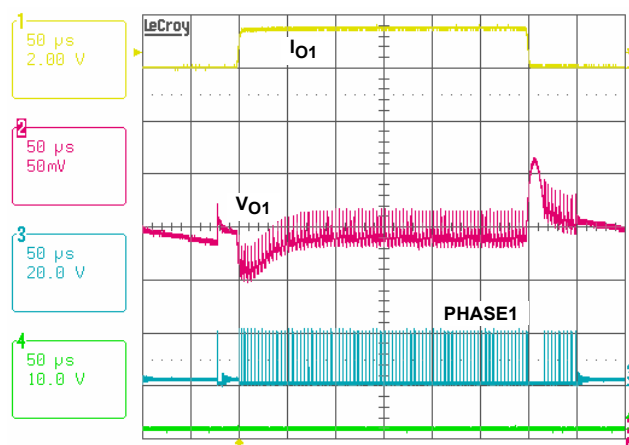
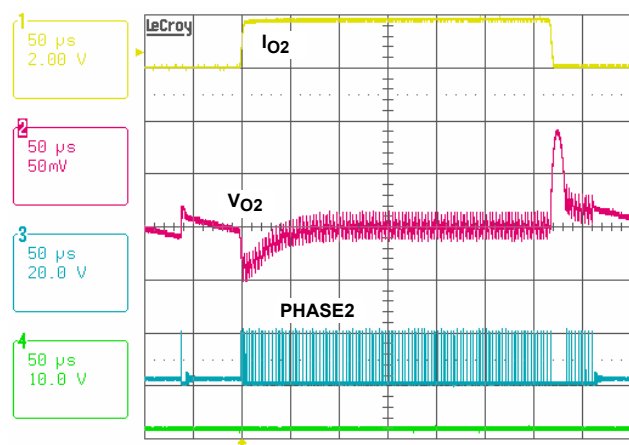
Switch Descriptions

- S1: Channel-1 Enable
 - OFF: Short the Channel-1 EN pin to GND (disable PWM)
 - ON: Allow the Channel-1 EN pin to pull-up to +5V (enable PWM)
- S4: Channel-1 Dynamic Load
 - OFF: On-board Channel-1 dynamic load disabled
 - ON: On-board Channel-1 dynamic load enabled
- S5: Channel-1 V_{O1} Increase
 - OFF: V_{O1} is 1.5V, determined by R_{15} and R_{23} .
 - ON: Parallel R_{49} with R_{15} . V_{O1} is 1.8V.
- S2: Channel-2 Enable
 - OFF: Short the Channel-2 EN pin to GND (disable PWM)
 - ON: Allow the Channel-2 EN pin to pull-up to +5V (enable PWM)
- S3: Channel-2 Dynamic Load
 - OFF: On-board Channel-2 dynamic load disabled
 - ON: On-board Channel-2 dynamic load enabled

Test-point Descriptions

- J4: Scope-probe socket for measuring PHASE1
- J6: Scope-probe socket for measuring V_{O1}
- J12: Scope-probe socket for measuring the current of the Channel-1 on-board transient-load emulator
- J3: Scope-probe socket for measuring the PHASE2 node
- J5: Scope-probe socket for measuring V_{O2}
- J11: Scope-probe socket for measuring the current of the Channel-2 on-board transient-load emulator
- TP1: Monitor the 5V positive input
- TP2: Monitor the 5V return input
- TP3: Monitor the PGOOD2 pin
- TP4: Monitor the PGOOD1 pin
- TP5: The common node of R_{24} and R_{20} ; Useful for Channel-1 loop gain measurement.
- TP6: The common node of R_{25} and R_{23} ; Useful for Channel-2 loop gain measurement
- TP7: The V_{O1} side of R_{24} ; Useful for Channel-1 loop gain measurement.
- TP8: The V_{O2} side of R_{25} ; Useful for Channel-1 loop gain measurement.
- TP9: Monitor the V_{IN1} positive input
- TP10: Monitor the V_{IN1} return input
- TP11: Monitor the positive V_{O1} output
- TP12: Monitor the V_{O1} return output
- TP13: Monitor the positive V_{O2} output
- TP14: Monitor the V_{O2} return output
- TP15: Monitor the 12V positive input
- TP16: Monitor the 12V return input
- TP17: Monitor the EN1 pin
- TP18: Monitor the gate of transistor Q_{18}
- TP19: Monitor the EN2 pin
- TP20: Monitor the V_{IN2} positive input
- TP21: Monitor the V_{IN2} return input

Typical Performance

FIGURE 2. CHANNEL-1 EFFICIENCY AT $V_O = 1.5V$ FIGURE 3. CHANNEL-2 EFFICIENCY AT $V_O = 1.8V$ FIGURE 4. CCM STEADY-STATE OPERATION, $V_{IN} = 12V$, $V_{O1} = 1.5V$, $I_{O1} = 3A$, $V_{O2} = 1.8A$, $I_{O2} = 4A$ FIGURE 5. DCM STEADY-STATE OPERATION, $V_{IN} = 12V$, $V_{O1} = 1.5V$, $I_{O1} = 1A$, $V_{O2} = 1.8V$, $I_{O2} = 1A$ FIGURE 6. TRANSIENT RESPONSE, $V_{IN} = 19V$, $V_O = 1.5V$, $I_O = 0.1A/8.1A @ 2.55A/\mu s$ FIGURE 7. TRANSIENT RESPONSE, $V_{IN} = 19V$, $V_O = 1.8V$, $I_O = 0.1A/8.1A @ 2.55A/\mu s$

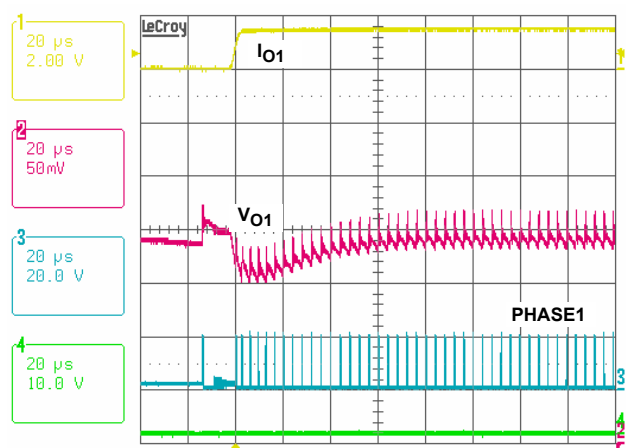
Typical Performance (Continued)

FIGURE 8. LOAD INSERTION RESPONSE, $V_{IN} = 19V$, $V_O = 1.5V$, $I_O = 0.1A/8.1A @ 2.55A/\mu s$

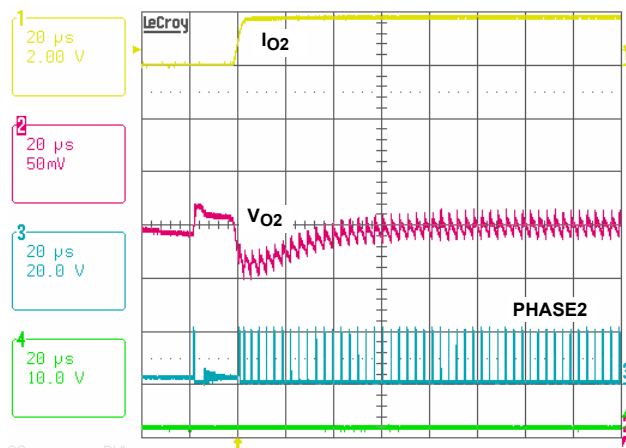


FIGURE 9. LOAD INSERTION RESPONSE, $V_{IN} = 19V$, $V_O = 1.8V$, $I_O = 0.1A/8.1A @ 2.55A/\mu s$

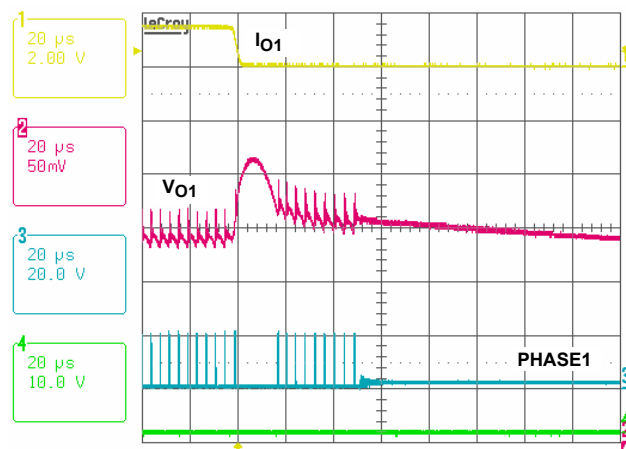


FIGURE 10. LOAD RELEASE RESPONSE, $V_{IN} = 19V$, $V_O = 1.5V$, $I_O = 0.1A/8.1A @ 2.55A/\mu s$

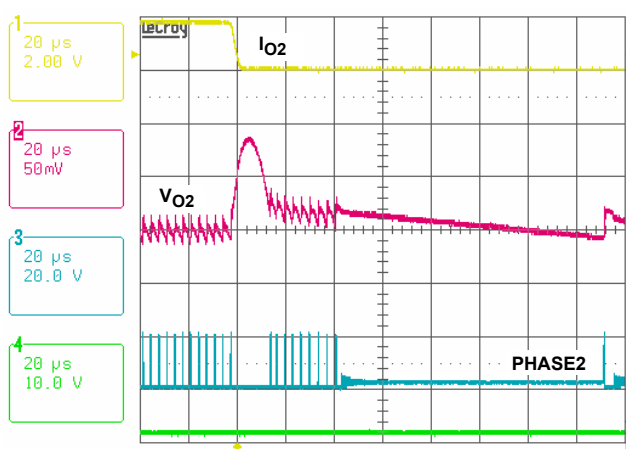


FIGURE 11. LOAD RELEASE RESPONSE, $V_{IN} = 19V$, $V_O = 1.8V$, $I_O = 0.1A/8.1A @ 2.55A/\mu s$

Bill of Materials

QTY	REFERENCE	DESCRIPTION	MANUFACTURER	PART NUMBER
0	DNP (C8, C9)	CAP, RADIAL, 56μF, 25V, ROHS	SANYO	25SP56M
2	C1, C3	CAP, SMD, 0603, 1000pF, 16V, 10%, X7R, ROHS	VENKEL	H1045-00102-16V10-T
3	C37, C40, C41	CAP, SMD, 0603, 0.1μF, 16V, 10%, X7R, ROHS	MURATA	H1045-00104-16V10-T
6	C2, C7, C30, C31, C36, C39	CAP, SMD, 0603, 1μF, 16V, 20%, Y5V, ROHS	MURATA	H1045-00105-16V20-T
2	C18, C19	CAP, SMD, 0603, 10μF, 6.3V, 20%, X5R, ROHS	TDK	H1045-00106-6R3V20-T
2	C5, C6	CAP, SMD, 0603, 2200pF, 50V, 10%, X7R, ROHS	MURATA	H1045-00222-50V10-T
2	C20, C21	CAP, SMD, 0603, 0.15μF, 16V, 10%, X7R, ROHS	VENKEL	H1045-00154-25V10-T
2	C14, C15	CAP, SMD, 0603, 0.22μF, 25V, 10%, X7R, ROHS	TDK	H1045-00224-16V10-T
2	C4, C38	CAP, SMD, 0603, 0.22μF, 25V, 20%, X7R, ROHS	VENKEL	H1045-00224-25V20-T
2	C34, C35	CAP, SMD, 0805, 4.7μF, 16V, 10%, X5R, ROHS	PANASONIC	H1046-00475-16V10-T
0	DNP (C32, C33)	CAP, SMD, 0805, 4.7μF, 16V, 10%, X5R, ROHS	PANASONIC	H1046-00475-16V10-T
2	C16, C17	CAP, SMD, 1206, 1μF, 25V, 20%, X5R, ROHS	PANASONIC	H1065-00105-25V20-T
4	C10 to C13	CAP, SMD, 1206, 10μF, 25V, 20%, X5R, ROHS	PANASONIC	H1065-00106-25V20-T
2	C27, C29	CAP-LOW ESR, SMD, D3L, 330μF, 6.3V, 20%, POSCAP, ROHS	SANYO	6TPF330M9L
2	C22, C24	CAP-LOW ESR, SMD, D3L, 220μF, 6.3V, 20%, POSCAP, ROHS	NEC	PSLV0J227M(12)
0	DNP (C23, C25, C26, C28)	CAP-LOW ESR, SMD, D3L, 330μF, 6.3V, 20%, POSCAP, ROHS	SANYO	6TPF330M9L
2	J1, J13	CONN-GEN, BIND.POST, INSUL-RED, THMBNUT-GND	JOHNSON COMPONENTS	111-0702-001
2	J2, J14	CONN-GEN, BIND.POST, INSUL-BLK, THMBNUT-GND	JOHNSON COMPONENTS	111-0703-001
0	J3 to J6, J11, J12	CONN-SCOPE PROBE TEST POINT, PCB MNT	TEKTRONIX	131-4353-00
4	TP1, TP2, TP15, TP16	CONN-TURRET, TERMINAL POST, TH, ROHS	KEYSTONE	1514-2
15	TP3 to TP14, TP17 to TP19	CONN-MINI TEST POINT, VERTICAL, WHITE, ROHS	KEYSTONE	5002
0	DNP (D3, D4)	DIODE-SCHOTTKY, SMD, SMB, 2P, 40V, 3A LOW VF, Pb-FREE	DIODES INC.	B340LB-13-F-T
2	D5, D6	DIODE-SCHOTTKY, SMD, SOT23, 3P, 30V, 200mA, DUAL DIODE	FAIRCHILD	BAT54S-T
2	D1, D2	LED, SMD, 4P, OTHER, POLARIZEDRED/GRN	LUMEX	SSL-LXA3025IGC
2	L1, L2	PWR CHOKE COIL, SMD, 13x12.9, 2.2μH, 20%, 18A, ROHS	Vishay	IHLP5050FDER2R2M01
2	U2, U3	IC-HI FREQ BRIDGE DRIVER, 8P, SOIC, 100V, ROHS	INTERSIL	HIP2100IBZ
1	U1	IC-DUAL CHANNEL CONTROLLER, 28P, QFN, ROHS	INTERSIL	ISL6228HRZ
5	Q11 to Q14, Q18	TRANSISTOR, N-CHANNEL, 3LD, SOT-23, 60V, 115mA, ROHS	DIODES INC.	2N7002-7-F-T
0	DNP (Q5, Q10)	TRANSISTOR-DUAL N-CHANNEL, 8P, SOIC, 30V, 7.5A, ROHS	FAIRCHILD	FDS6990AS
0	DNP (Q2, Q7)	TRANSISTOR-MOS, N-CHANNEL, 8P, SOIC, 30V, 9.1mΩ RDS, ROHS	INTERNATIONAL RECTIFIER	IRF7821PBF
2	Q1, Q6	TRANSIST-MOS, N-CHANNEL, 8P, SOIC, 30V, 9.1mΩ RDS, ROHS	INTERNATIONAL RECTIFIER	IRF7821PBF

Bill of Materials (Continued)

QTY	REFERENCE	DESCRIPTION	MANUFACTURER	PART NUMBER
0	DNP (Q4, Q9)	TRANSISTOR-MOS, N-CHANNEL, 8P, SOIC, 30V, 4.0mΩ RDS, ROHS	INTERNATIONAL RECTIFIER	IRF7832PBF
2	Q3, Q8	TRANSISTOR-MOS, N-CHANNEL, 8P, SOIC, 30V, 4.0mΩ RDS, ROHS	INTERNATIONAL RECTIFIER	IRF7832PBF
2	Q15, Q16	TRANSISTOR-MOS, N-CHANNEL, SMD, TO-252, 30V, 20A, ROHS	VISHAY	SUD50N03-07-E3
4	R9, R52, R53, R54	RES, SMD, 0603, 2Ω, 1/10W, 1%, TF, ROHS	YAGEO	H2511-00020-1/10W1-T
0	DNP (R12, R13, R57, R58)	RESISTOR, SMD, 0603, 0Ω, 1/10W, TF, ROHS	KOA	H2511-00R00-1/10W-T
10	R10, R11, R24, R25, R48, R50, R55, R56, R59, R60	RESISTOR, SMD, 0603, 0Ω, 1/10W, TF, ROHS	KOA	H2511-00R00-1/10W-T
5	R7, R8, R21, R22, R51	RES, SMD, 0603, 10k, 1/10W, 1%, TF, ROHS	KOA	H2511-01002-1/10W1-T
2	R20, R23	RES, SMD, 0603, 105k, 1/10W, 1%, TF, ROHS	PANASONIC	H2511-01053-1/10W1-T
2	R35, R37	RES, SMD, 0603, 1.62k, 1/10W, 1%, TF, ROHS	PANASONIC	H2511-01621-1/10W1-T
1	R49	RES, SMD, 0603, 210k, 1/10W, 1%, TF, ROHS	YAGEO	H2511-02103-1/10W1-T
2	R26, R27	RES, SMD, 0603, 2k, 1/10W, 1%, TF, ROHS	KOA	H2511-02001-1/10W1-T
1	R3	RES, SMD, 0603, 19.6k, 1/10W, 1%, TF, ROHS	KOA	H2511-01962-1/10W1-T
1	R4	RES, SMD, 0603, 24.3k, 1/10W, 1%, TF, ROHS	PANASONIC	H2511-02432-1/10W1-T
2	R34, R36	RES, SMD, 0603, 4.02k, 1/10W, 1%, TF, ROHS	KOA	H2511-04021-1/10W1-T
1	R14	RES, SMD, 0603, 52.3k, 1/16W, 1%, TF, ROHS	VENKEL	H2511-05232-1/10W1-T
4	R1, R2, R5, R6	RES, SMD, 0603, 499Ω, 1/10W, 1%, TF, ROHS	KOA	H2511-04990-1/10W1-T
2	R30, R31	RES, SMD, 0603, 49.9k, 1/10W, 1%, TF, ROHS	VENKEL	H2511-04992-1/10W1-T
1	R15	RES, SMD, 0603, 69.8k, 1/10W, 1%, TF, ROHS	YAGEO	H2511-06982-1/10W1-T
4	R16, R17, R28, R29	RES, SMD, 0603, 3.83k, 1/10W, 1%, TF, ROHS	ROHM	H2511-03831-1/10W1-T
2	R18, R19	RES, SMD, 0603, 845Ω, 1/10W, 1%, TF, ROHS	VENKEL	H2511-08450-1/10W1-T
2	R20, R23	RES, SMD, 0603, 80.6k, 1/10W, 1%, TF, ROHS	VENKEL	H2511-08062-1/10W1-T
1	R32	RES, SMD, 1206, 1Ω, 1/4W, 1%, TF, ROHS	VENKEL	H2513-001R0-1/4W1-T
9	R38, R40 to R47	RES, SMD, 1206, 1.5Ω, 1/4W, 1%, TF, ROHS	VENKEL	H2513-001R5-1/4W1-T
2	R33, R39	RES, SMD, 1206, 0.75Ω, 1/4W, 1%, TF, ROHS	SUSUMU	RL1632R-R750-F
5	S1 to S5	SWITCH-TOGGLE, SMD, ULTRAMINI, 1P, SPST MINI	C&K COMPONENTS	GT11MSCBE-T
4	J7 to J10	MTG HDWR, CBL.TERMINAL-LUG and SCREW, 6 to 14AWG	BERG/FCI	KPA8CTP

ISL6228LOEVAL3Z Evaluation Board Schematic

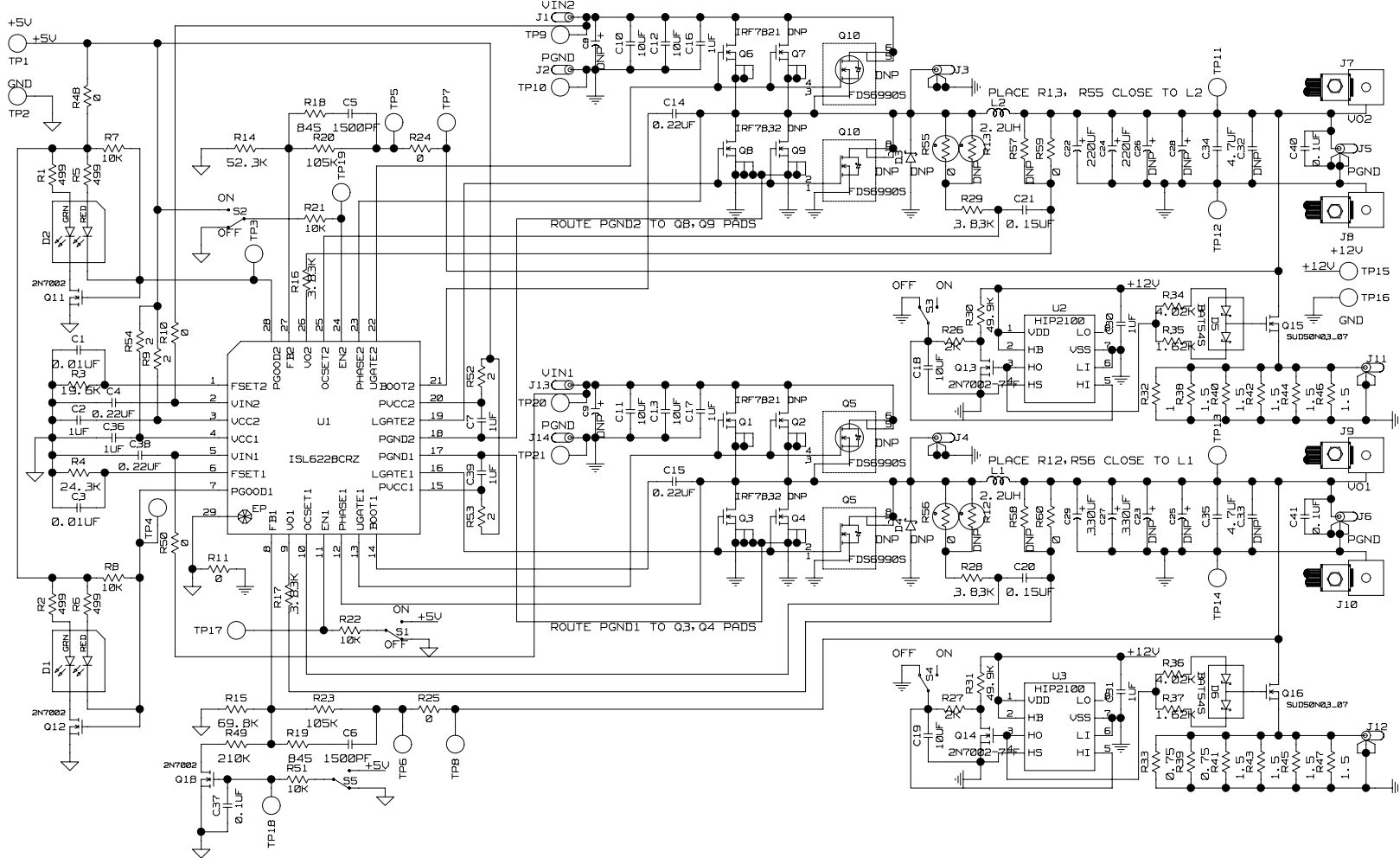


FIGURE 12. ISL6228LOEVAL3Z SCHEMATIC

ISL6228LOEVAL3Z Evaluation Board Layout

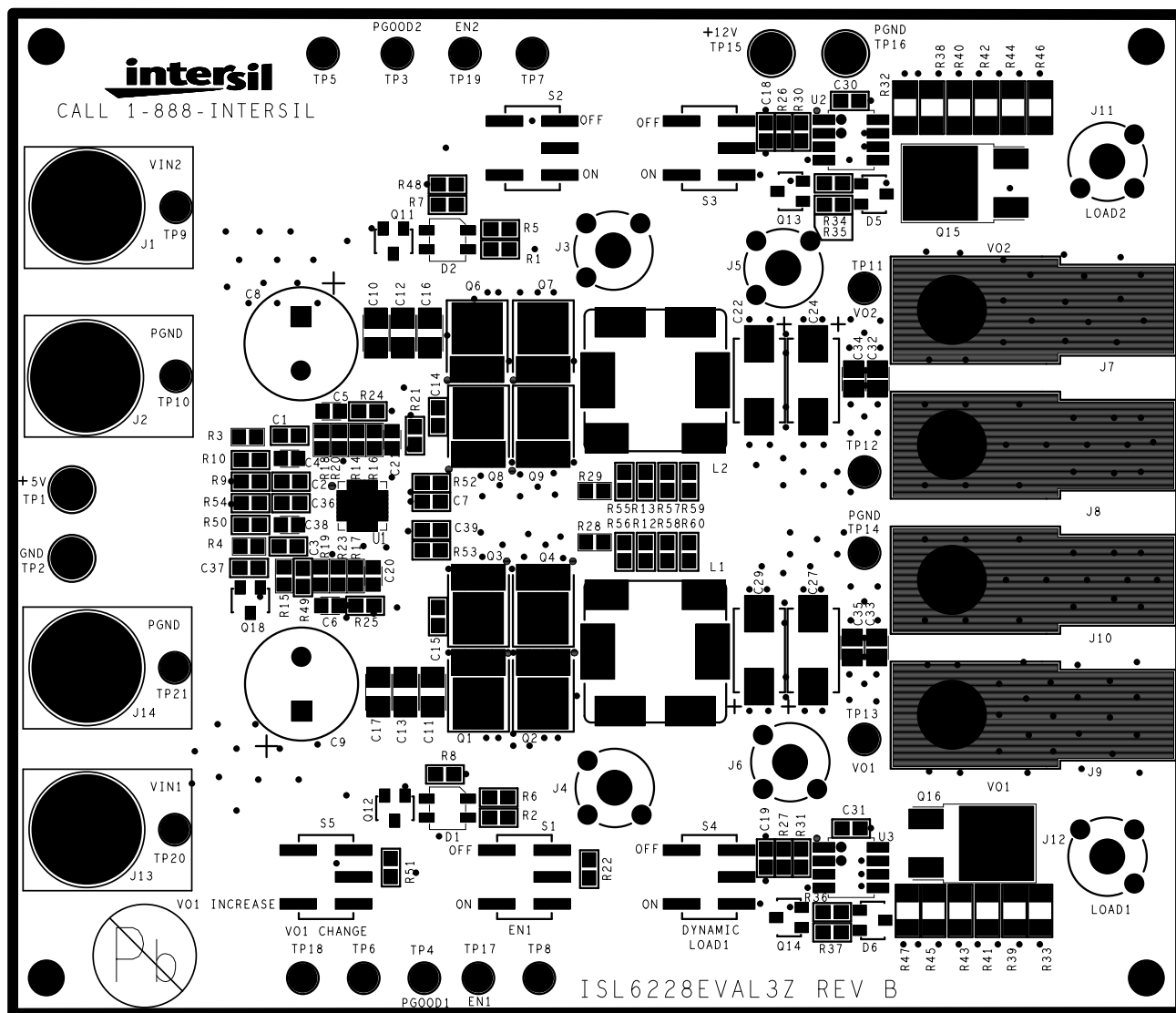
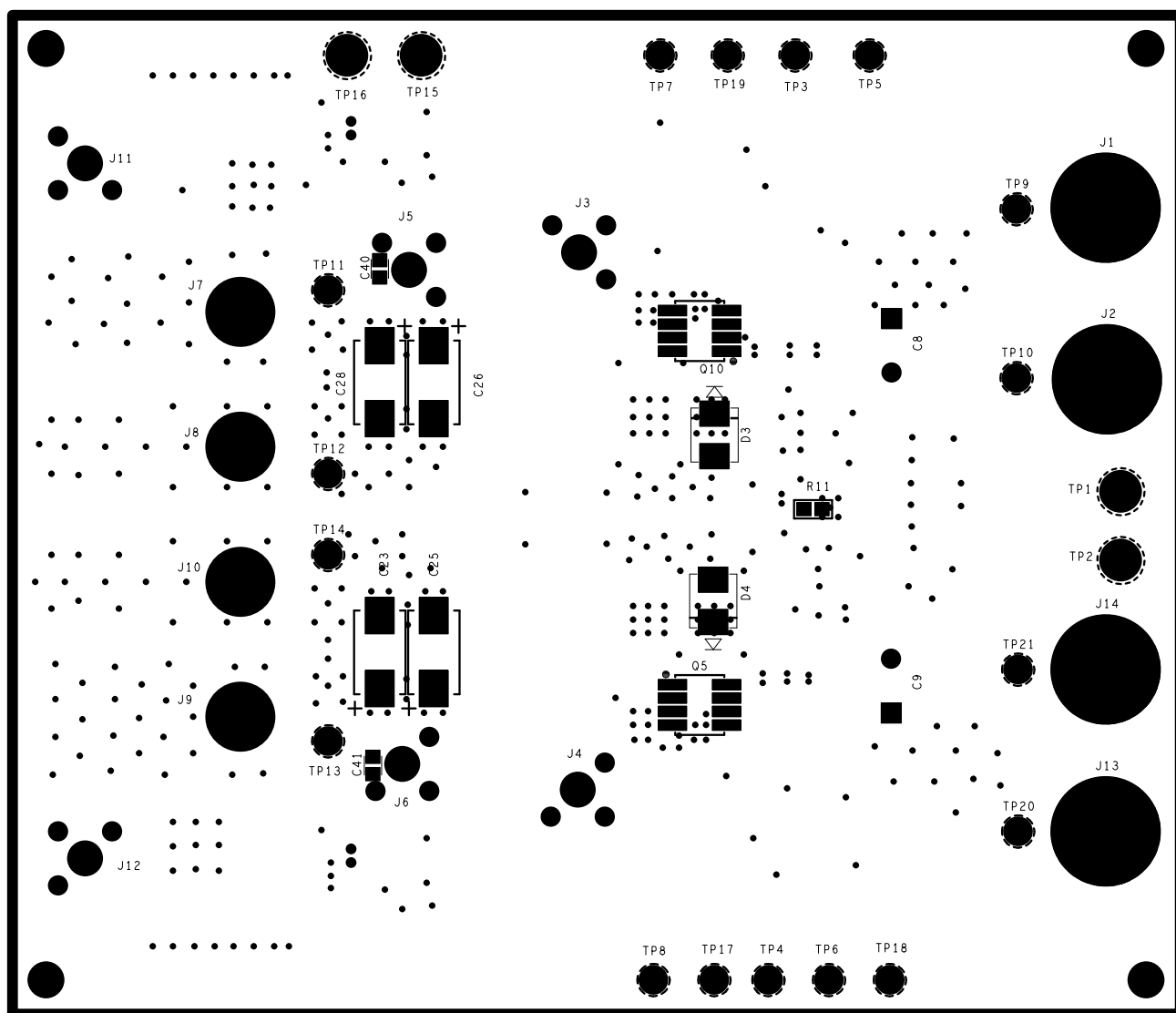


FIGURE 13. TOP SILKSCREEN

ISL6228LOEVAL3Z Evaluation Board Layout (Continued)**FIGURE 14. BOTTOM SILKSCREEN**

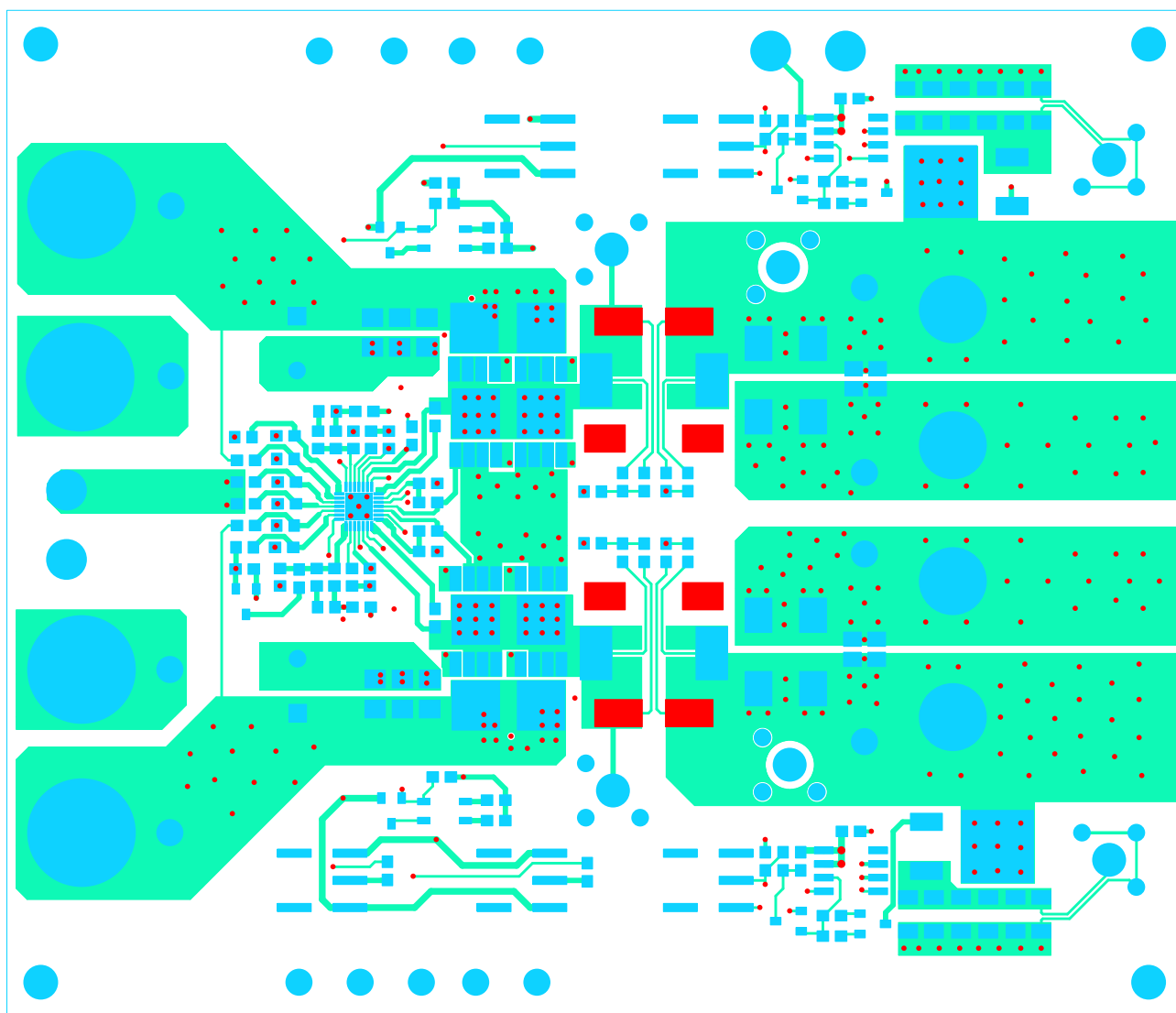
ISL6228LOEVAL3Z Evaluation Board Layout (Continued)

FIGURE 15. LAYER 1

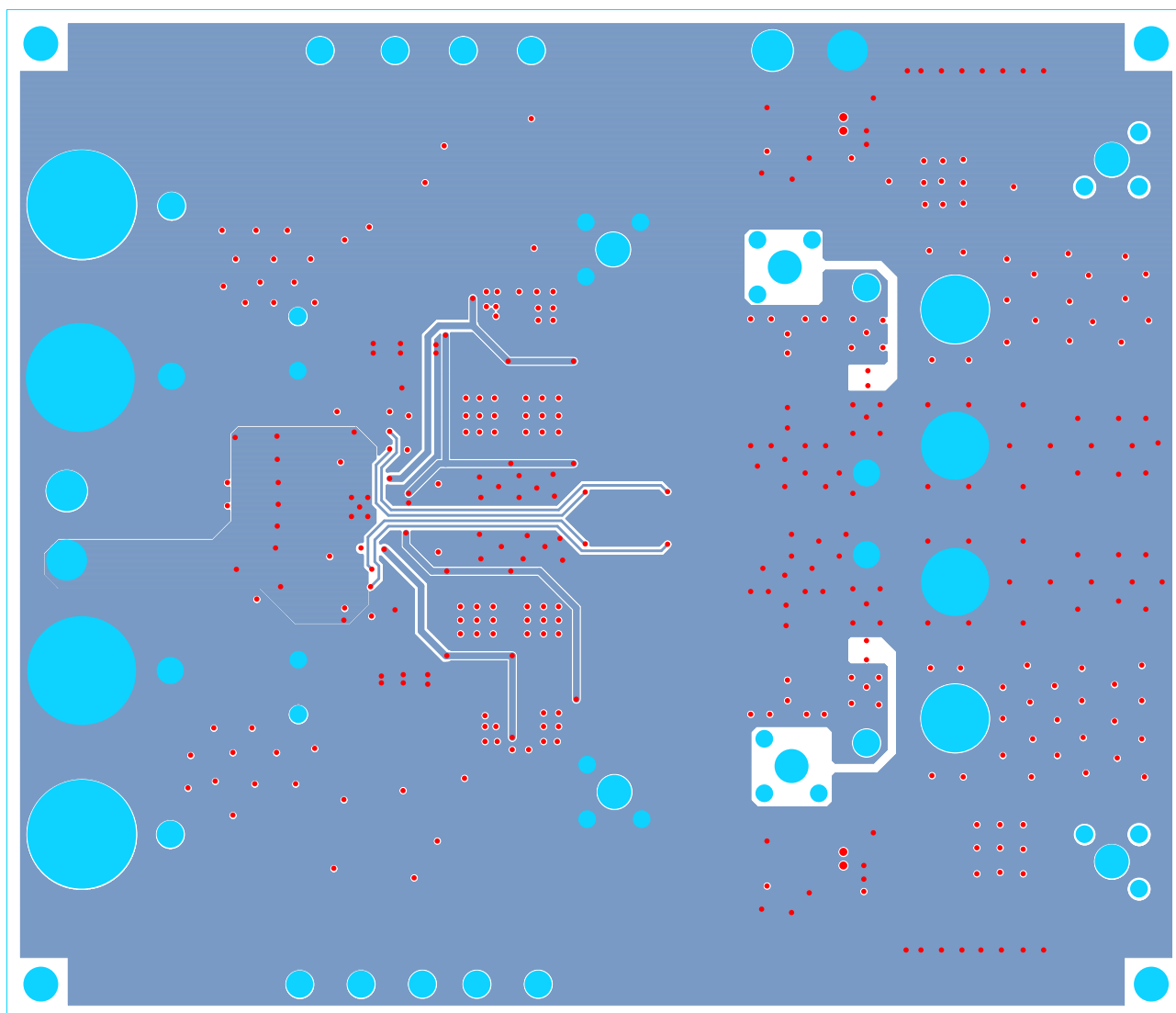
ISL6228LOEVAL3Z Evaluation Board Layout (Continued)

FIGURE 16. LAYER 2

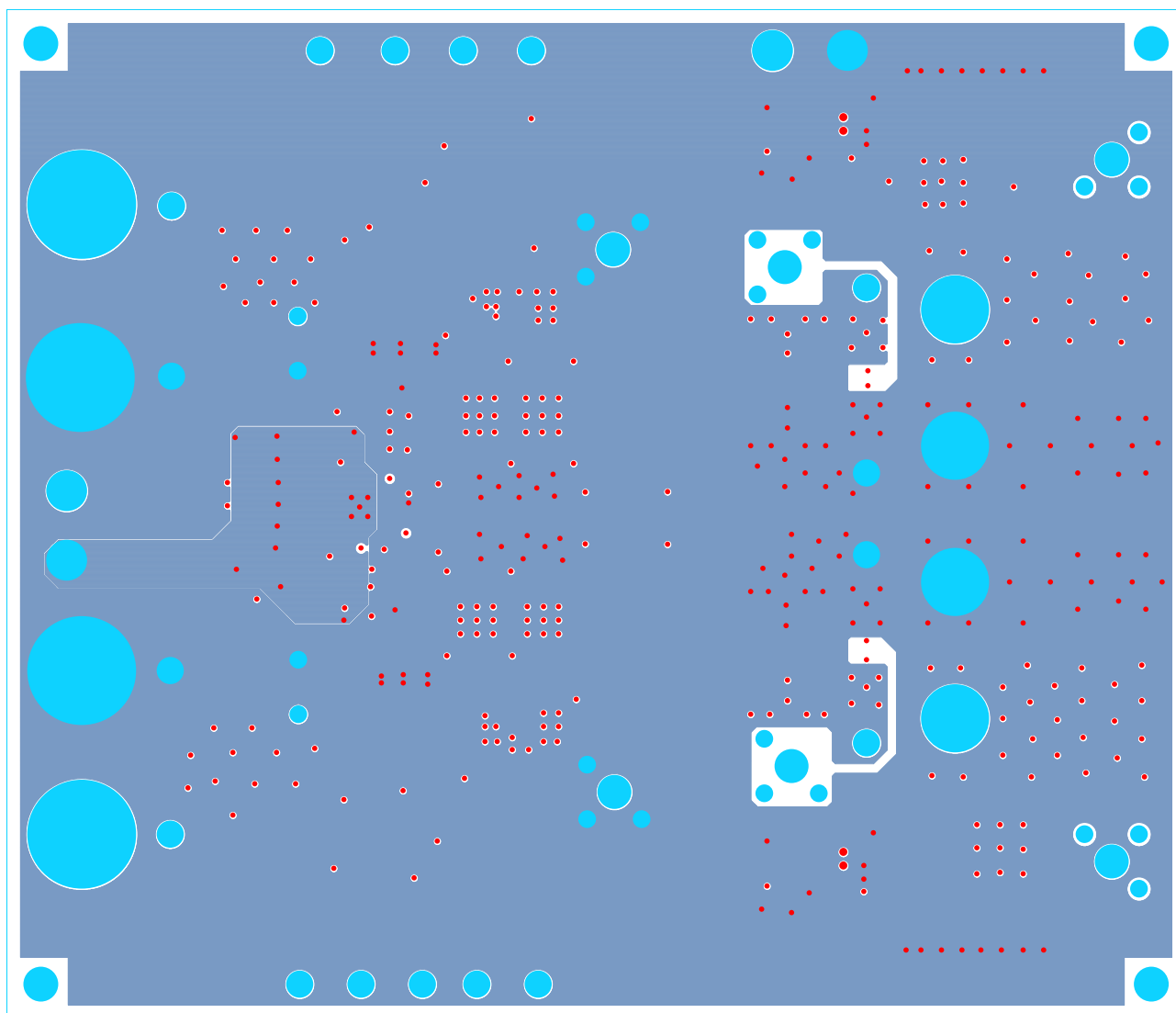
ISL6228LOEVAL3Z Evaluation Board Layout (Continued)

FIGURE 17. LAYER 3

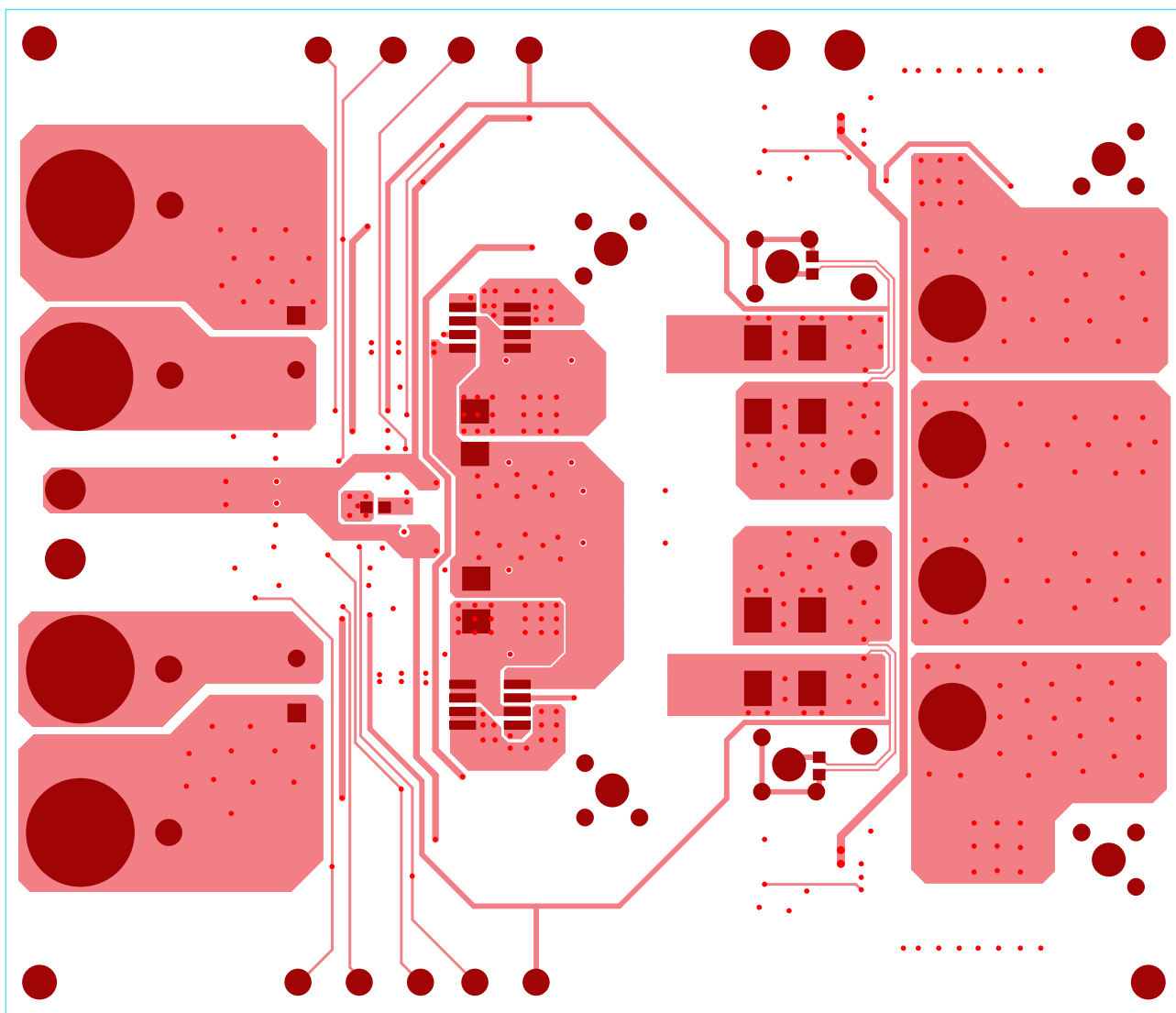
ISL6228LOEVAL3Z Evaluation Board Layout (Continued)

FIGURE 18. LAYER 4

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