

ISL6420BEVAL6Z - User Guide

Introduction

The ISL6420B is a wide input range, synchronous buck controller. It is designed to drive N-Channel MOSFETs in a synchronous rectified buck topology for up to 25A load current. The ISL6420B integrates control, output adjustment, monitoring and protection functions into a single package. All the necessary components are within the 2.1 inch by 1.25 inch PCB area.

The ISL6420B provides simple, voltage mode control with fast transient response. The operating frequency can be adjustable from 100kHz to 1.4MHz.

The 6420B is offered in space saving 4x4 QFN and easy-to-use 20 Ld QSOP packages.

Key Features

- Operates From:
 - - 4.5V to 5.5V Input
 - - 5.5V to 28V Input
- Resistor-Selectable Switching Frequency from 100kHz to 1.4MHz
- Voltage Margining and External Reference Tracking Modes
- Upper MOSFET $r_{DS(ON)}$ for Current Sensing
- Programmable Soft-start
- Extensive Protection Functions:
 - Overvoltage, Overcurrent, Undervoltage
- Power-Good Indicator

Recommended Equipment

The following equipment is recommended for evaluation:

- 0V to 30V power supply with 15A source current capability
- Electronic load capable of sinking 25A
- Digital Multimeters (DMMs)
- 100MHz Quad-Trace Oscilloscope

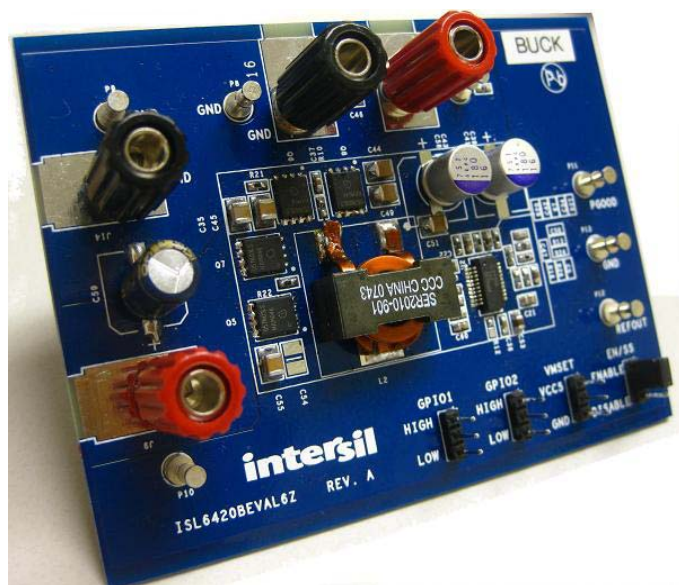


FIGURE 1. ISL6420BEVAL6Z TOP VIEW (ONE-SIDE PLACEMENT)

TABLE 1. RECOMMENDED COMPONENT SELECTION FOR QUICK EVALUATION

VOUT	IOUT	UPPER MOSFET	LOWER MOSFET	INDUCTOR	FSW/RT
5V	25A	2 X BSC057N03 LS	2 X BSC057N03 LS	SER2010-901ML	300kHz/52.3kΩ
5V	15A	1 X BSC057N03 LS	1 X BSC030N03 LS	SER2009-901ML	500kHz/31.6kΩ
3.3V	25A	2 X BSC057N03 LS	2 X BSC030N03 LS	SER2010-901ML	300kHz/52.3kΩ
3.3V	15A	1 X BSC057N03 LS	1 X BSC030N03 LS	SER2009-901ML	500kHz/31.6kΩ

NOTE: Please contact Intersil Sales for assistance.

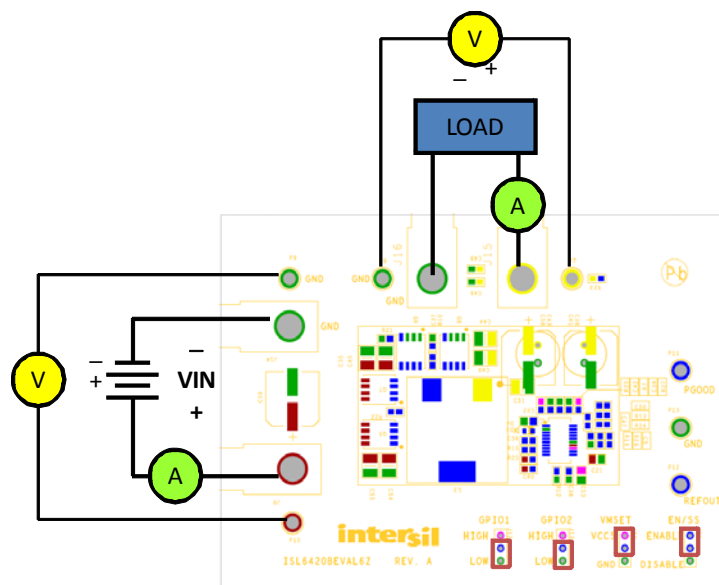


FIGURE 2. ISL6420BEVAL6Z TEST SET-UP

TABLE 2. JUMPER POSITION

JUMPER #/NAME	J12/GPIO1	J13/GPIO2	J10/VMSET	J11/EN/SS
SHUTDOWN	LOW	LOW	DOES NOT MATTER	DISALBLE
NORMAL	LOW	LOW	VCC5	ENABLE
Margining Up	LOW	HIGH	OPEN/R12 set ΔV_O	ENABLE
Margining Down	HIGH	LOW	OPEN/R12 set ΔV_O	ENABLE

Quick Test Setup

1. Ensure that the evaluation board is correctly connected to the power supply and the electronic load prior to applying any power. Please refer to Figure 2 for proper set-up.
2. Connect jumpers J12, J13, J10 and J11 in the positions specified in Table 2.
3. Turn on the power supply, $V_{IN} < 16V$
4. Adjust input voltage V_{IN} within the specified range and observe output voltage. The output voltage variation should be within 5%.
5. Adjust load current within 25A. The output voltage variation should be within 5%.
6. Use oscilloscope to observe output ripple voltage and phase node ringing. For accurate measurement, please refer to Figure 3 for proper probe set-up.
7. Optimization. Please refer to Table 1 on page 1 for optimization recommendation.
8. For 5V input applications, please tie VCC5V to V_{IN} and do not allow V_{IN} to go above 5.5V.

NOTE: Test points: P7, 8, 9, 10(VOUT, GND, GND, VIN) are for voltage measurement only. Do not allow high current through these test points.

Probe Set-up

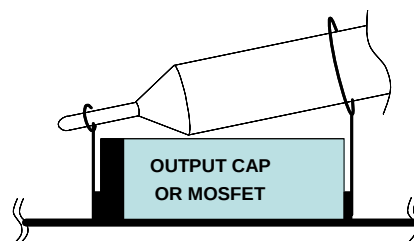


FIGURE 3. OSCILLASCOPE PROBE SET-UP

Margining Features

The ISL6420B margin function can be enabled by connecting a resistor from the VMSET pin to GND, which is R12 on the ISL6402BEVAL6Z. R12 and the feedback resistor, R24 together set the margin amount. Please refer to Equation 1.

$$\frac{\Delta V_{\text{MARGIN}}}{V_{\text{OUT}}} = \frac{2.468V \times R_{24}}{R_{12} \times V_{\text{OUT}}} \quad (\text{EQ. 1})$$

For example, if 5% margin is desired, R12 should be:

$$R_{12} = \frac{2.468V \times R_{24}}{0.05 \times V_{\text{OUT}}} = \frac{2.468V \times 121K\Omega}{0.05 \times 5V} = 1210K\Omega \quad (\text{EQ. 2})$$

Table 2 shows the position of GPIO1 and GPIO2 for margin up/down.

Typical Performance Curves

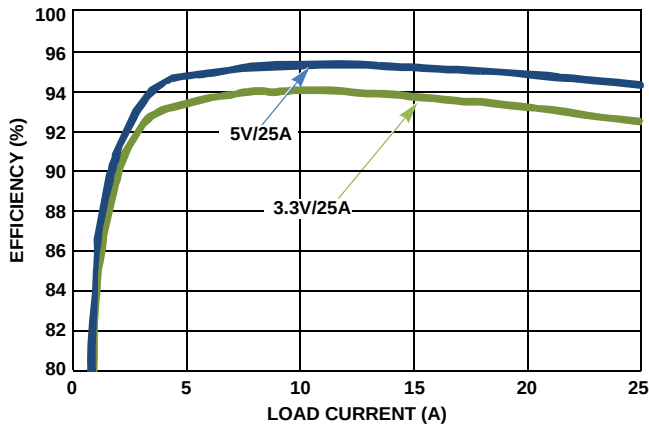


FIGURE 4. EFFICIENCY vs LOAD CURRENT

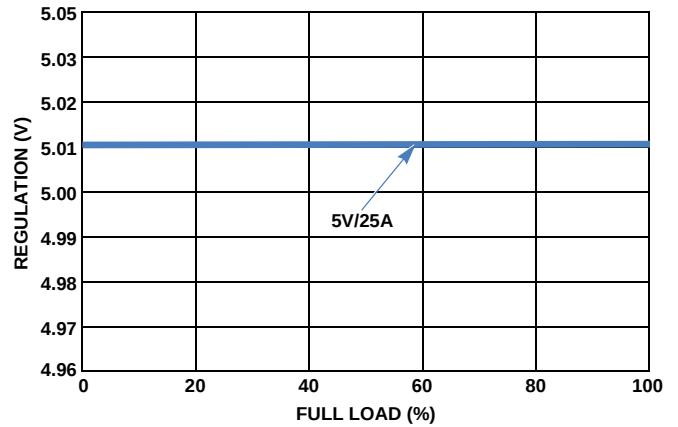


FIGURE 5. LOAD REGULATION, ($V_{IN} = 12V$, $I_{MAX} = 25A$)

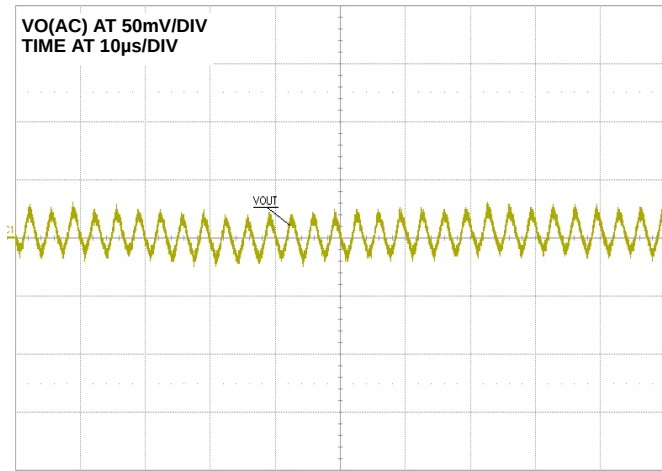


FIGURE 6. OUTPUT RIPPLE ($V_O = 5V$, $LOAD = 25A$)

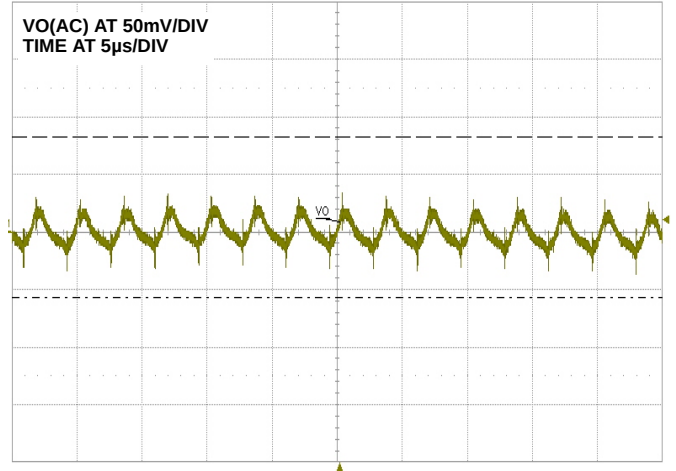


FIGURE 7. OUTPUT RIPPLE ($V_O = 3.3V$, $LOAD = 25A$)

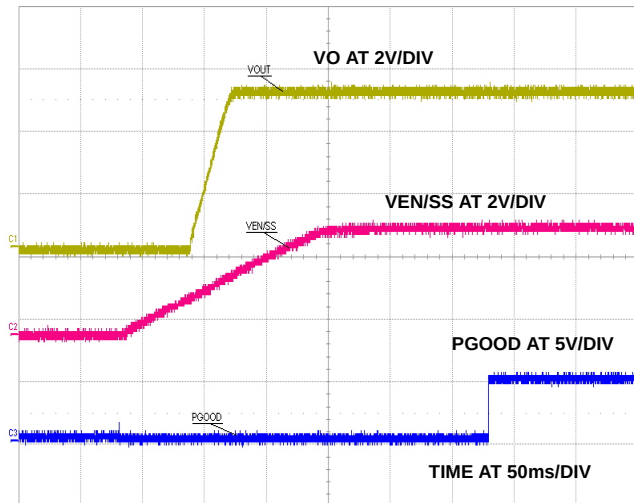


FIGURE 8. SOFT-START ($C_{SS} = 0.47\mu F$, $C_{DEL} = 0.1\mu F$)

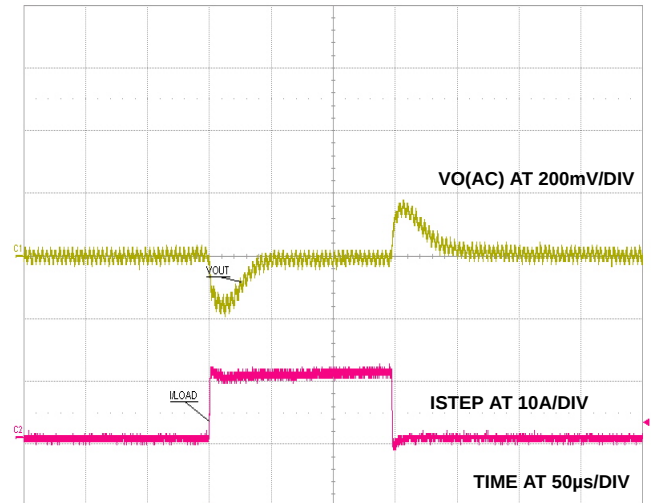


FIGURE 9. LOAD TRANSIENT (LOADSTEP FROM 6.25A TO 18.75A)

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Application Note 1714

TABLE 3. BILL OF MATERIALS

ITEM	QTY	PART REFERENCE	VALUE	DESCRIPTION	PART NUMBER	MANUFACTURER
ESSENTIAL COMPONENTS						
1	1	C5	470pF	Ceramic CAP, NPO or COG, sm0603	GENERIC	GENERIC
2	2	C21, C42	0.1μF	Ceramic CAP, X5R, 50V, sm0603	GENERIC	GENERIC
3	2	C22, C53	10μF	Ceramic CAP, X5R, 10V, sm0805	GENERIC	GENERIC
4	1	C34	0.47μF	Ceramic CAP, X5R, 16V, sm0603	GENERIC	GENERIC
5	3	C35, C45, C55	22μF	Ceramic CAP, X5R, 25V, sm1210	GENERIC	GENERIC
6	1	C36	2.2μF	Ceramic CAP, X5R, 16V, sm0603	GENERIC	GENERIC
7	2	C37, C60	1000pF	Ceramic CAP, NPO or COG, sm0603	GENERIC	GENERIC
8	2	C41, C43	180μF	OSCON, 16V, Radial 8 X 9	16SEPC180MX	SANYO
9	2	C44, C49	47μF	Ceramic CAP, X5R, 10V, sm1210	GENERIC	GENERIC
10	1	C47	100pF	Ceramic CAP, NPO or COG, sm0603	GENERIC	GENERIC
11	1	C48	1μF	Ceramic CAP, X5R, 25V, sm0603	GENERIC	GENERIC
12	1	C50	1500pF	Ceramic CAP, NPO or COG, sm0603	GENERIC	GENERIC
13	1	C56	0.22μF	Ceramic CAP, X5R, 16V, sm0603	GENERIC	GENERIC
14	1	C59	100μF	Alum. Cap, 50V	EMVA500ADA101MHA0G	United Chemi-Con
15	1	D4		Schottky Diode, 30V, SOD523	BAT54-02-V-G	Vishay
16	1	L2	0.9μH	Inductor	SER2010-901ML	Coilcraft
17	4	Q5, Q7, Q8, Q6		Single Channel NFET, 30V	BSC057N03LS G	Infineon
18	2	R7, R27	52.3kΩ	Resistor, sm0603, 1%	GENERIC	GENERIC
19	1	R10	1.2Ω	Resistor, sm0603, 10%	GENERIC	GENERIC
20	1	R13	12.1kΩ	Resistor, sm0603, 1%	GENERIC	GENERIC
21	2	R15, R23	0Ω	Resistor, sm0603, 10%	GENERIC	GENERIC
22	1	R16	16.5kΩ	Resistor, sm0603, 1%	GENERIC	GENERIC
23	1	R20	1Ω	Resistor, sm0603, 1%	GENERIC	GENERIC
24	2	R21, R22	51kΩ	Resistor, sm0603, 10%	GENERIC	GENERIC
25	1	R24	121kΩ	Resistor, sm0603, 1%	GENERIC	GENERIC
26	1	R25	2.26kΩ	Resistor, sm0603, 1%	GENERIC	GENERIC
27	1	R26	1kΩ	Resistor, sm0603, 1%	GENERIC	GENERIC
28	1	U2		PWM CONTROLLER, 20 Ld QSOP	ISL6420BIAZ	INTERSIL
OPTIONAL COMPONENTS						
29		D3, R12, C38, C39, C40, C46, C51, C52, C54, C58	DO NOT POPULATE			
EVALUATION HARDWARE						
30	4	J9, J14, J15, 16		HDWARE, MTG, CABLE TERMINAL, 6-14AWG, LUG & SCREW, ROHS	KPA8CTP	BERG/FCI
31	4	J10, J11, J12, J13		1X3 Header	GENERIC	GENERIC
32	4	J10, J11, J12, J13		Connector Jumper	SPC02SYAN	Sullins
33	7	P11, P10, P12, P8, P9, P13, P7		Test Points	1514-2	Keystone

ISL6420BEVAL6Z PCB Layout

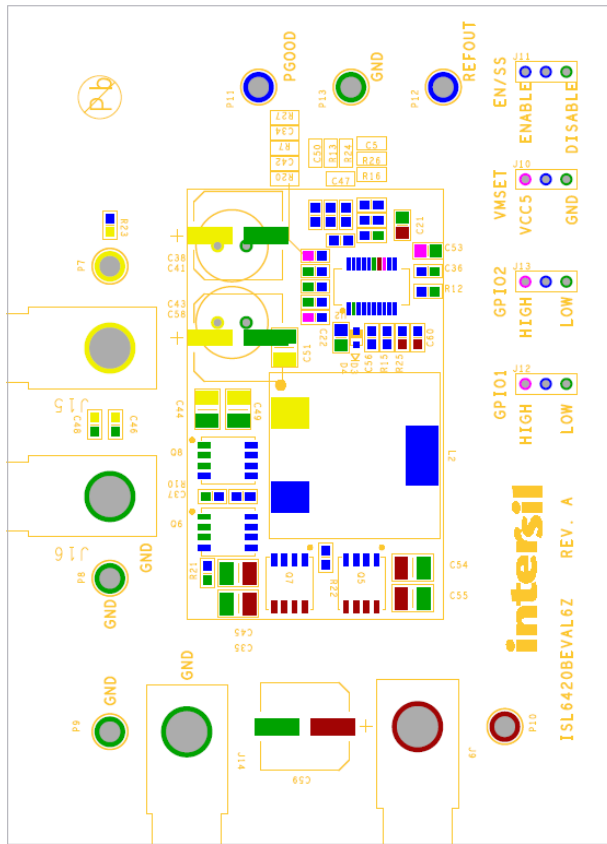


FIGURE 10. TOP SILKSCREEN

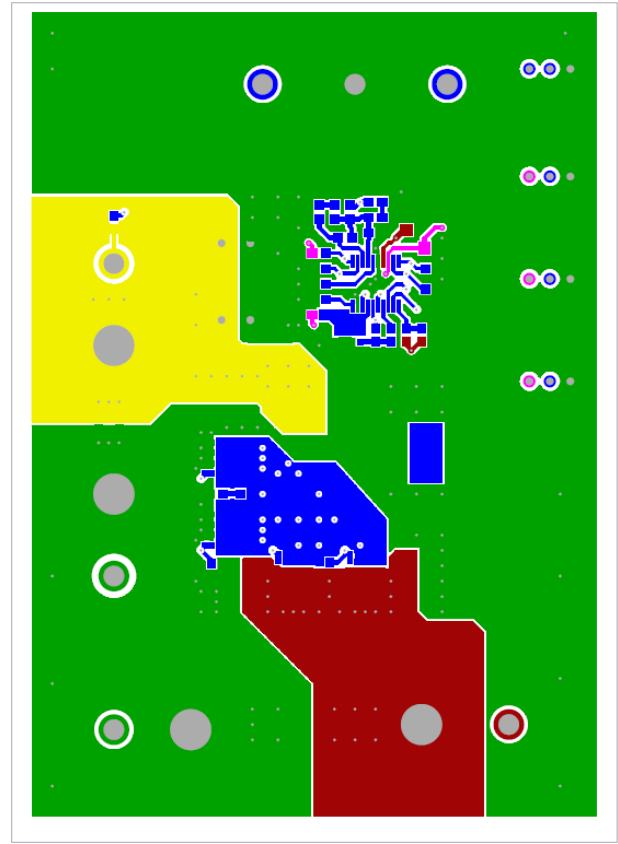


FIGURE 11. TOP LAYER

ISL6420BEVAL6Z PCB Layout (Continued)

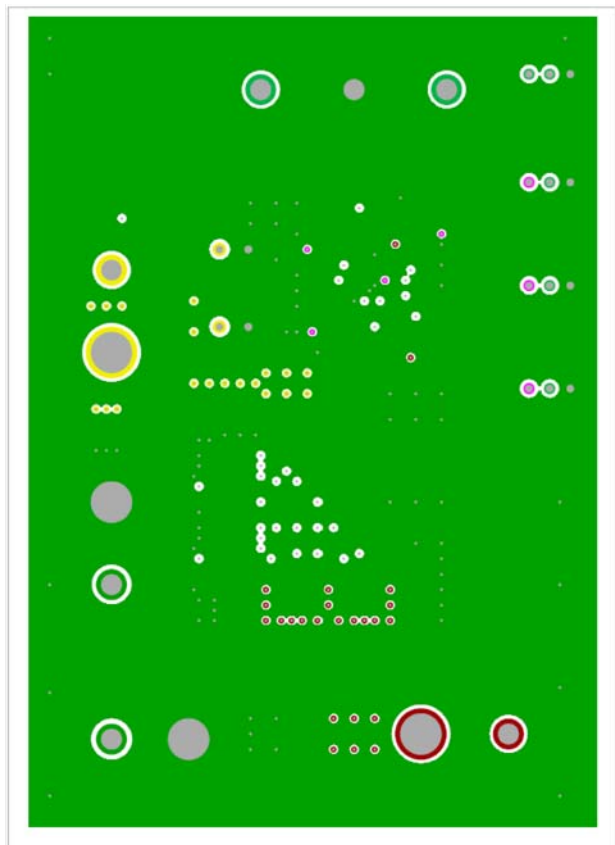


FIGURE 12. SECOND LAYER(SOLID GROUND)

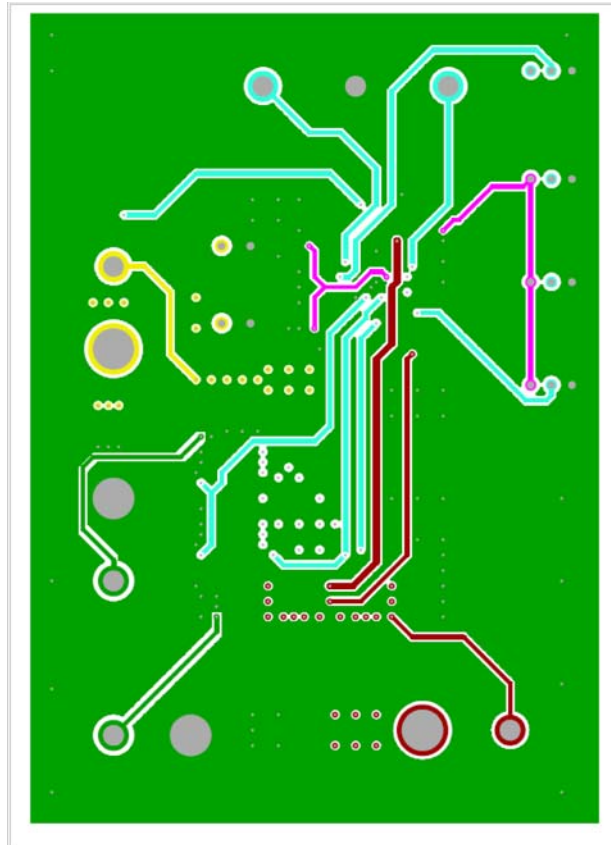


FIGURE 13. THIRD LAYER

ISL6420BEVAL6Z PCB Layout (Continued)

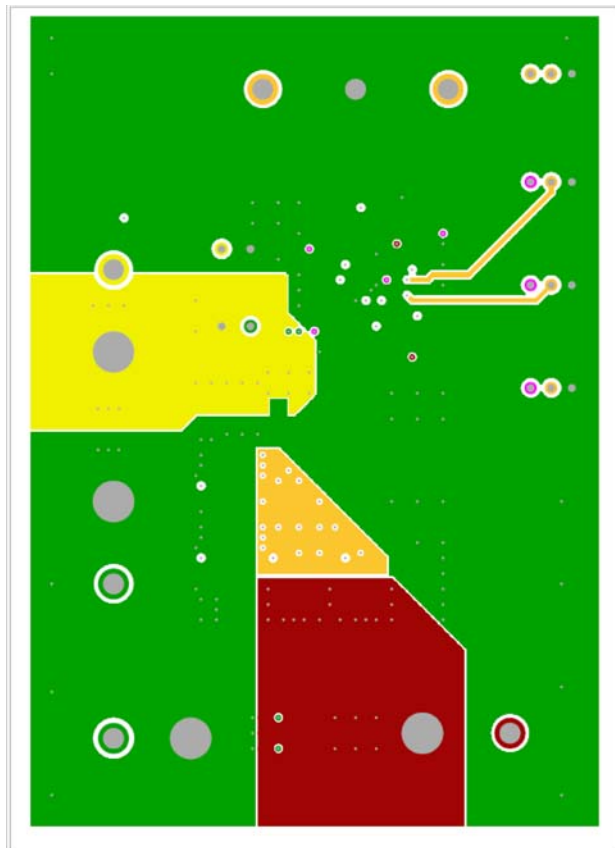


FIGURE 14. BOTTOM LAYER

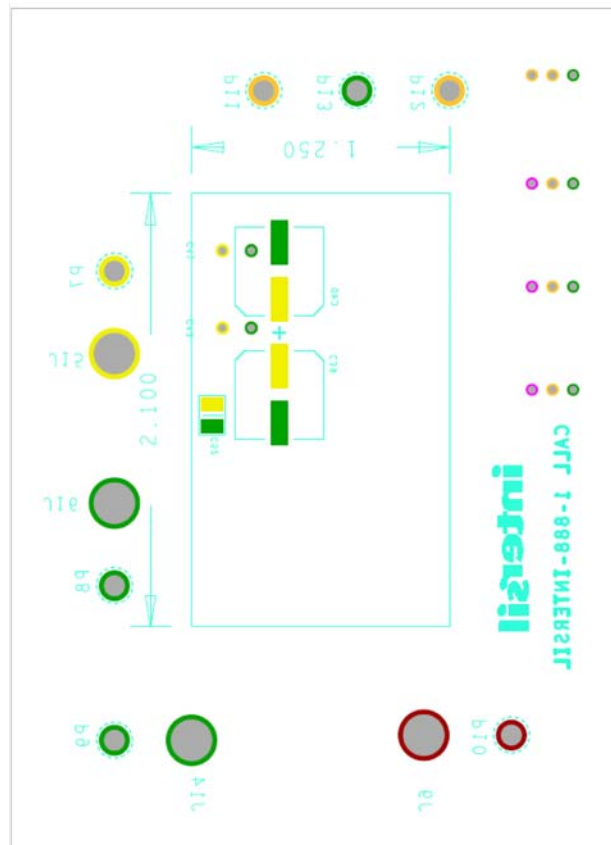


FIGURE 15. BOTTOM SILKSCREEN

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