# ISL8023AEVAL3Z, ISL8024AEVAL3Z

Evaluation Board

AN1755
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## Description

The ISL8023AEVAL3Z, ISL8024AEVAL3Z boards are intended for use by individuals with requirements for point-of-load applications sourcing from 2.7V to 5.5V. The ISL8023AEVAL3Z, ISL8024AEVAL3Z simple smallest factor evaluation boards are used for a quick and easy demonstration of the performance of the ISL8023A, ISL8024A low quiescent high efficiency synchronous buck regulator.

The ISL8023A and ISL8024A are offered in a 3mmx3mm 16 Ld TQFN package with 1mm maximum height. The complete area that the converter occupies can be as small as $0.22in^2$.

## Specifications

| PART NUMBER | $V_{IN}$ RANGE (V) | $V_{OUT}$ RANGE (V) | $I_{OUT}$ (MAX) (A) | $f_{SW}$ RANGE (MHz) | PART SIZE (2mm) |
|---|---|---|---|---|---|
| 8023A | 2.7V to 5.5V | | 3 | Programmable 0.5 to 4MHz | 3x3 |
| 8024A | | | 4 | | |

NOTES:

1. The evaluation boards default configuration is $V_{OUT}$ = 1.8V, $f_{SW}$ = 2MHz (FS tied to $V_{IN}$)
2. $V_{REF}$ is 0.6V

## Key Features

- High efficiency synchronous buck regulator with up to 95% efficiency
- 0.8% reference accuracy over temperature/load/line
- Start-up with prebiased output
- Internal soft-start - 1ms or adjustable
- Soft-stop output discharge during disabled
- Adjustable frequency from 500kHz to 4MHz - default at 2MHz
- External synchronization up to 4MHz
- Negative OC protection

## References

ISL8023, ISL8024 Datasheet

## Ordering Information

| PART NUMBER | DESCRIPTION |
|---|---|
| ISL8023AEVAL3Z | 3A low quiescent current high efficiency synchronous buck regulator |
| ISL8024AEVAL3Z | 4A low quiescent current high efficiency synchronous buck regulator |

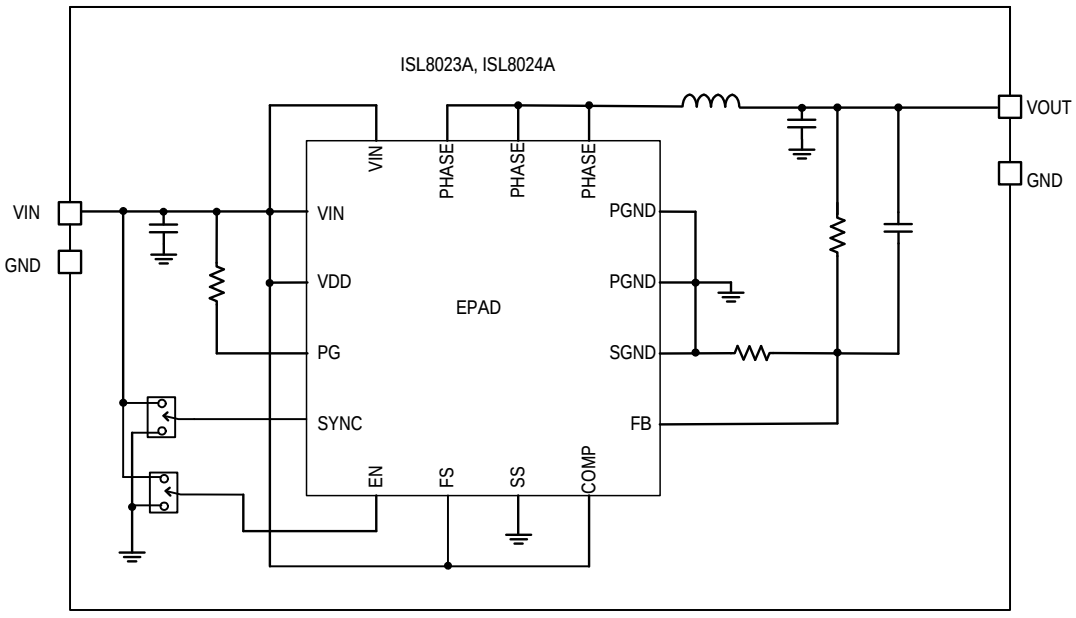


FIGURE 1. BLOCK DIAGRAM

# Recommended Equipment

The following materials are recommended to perform testing:

- 0V to 10V power supply with at least 10A source current capability or 5V battery
- Electronic loads capable of sinking current up to 7A
- Digital Multimeters (DMMs)
- 100MHz quad-trace oscilloscope
- Signal generator

# Quick Setup Guide

1. Ensure that the circuit is correctly connected to the supply and loads prior to applying any power.
2. Connect the bias supply to VIN, the plus terminal to VIN, P4 and the negative return to PGND, P5.
3. Connect the output load to VOUT, the plus terminal to VOUT, P3 and the negative return to PGND, P7.
4. Verify that the position is PWM for SW2.
5. Verify that the position is ON for SW1.
6. Turn on the power supply.
7. Verify the output voltage is 1.8V for VOUT.

## Evaluating the Other Output Voltage

The ISL8023AEVAL3Z, ISL8024AEVAL3Z kit output is preset to 1.8V for VOUT, however, output voltages can be adjusted from 0.6V to 5V. The output voltage programming resistor, $R_1$, will depend on the desired output voltage of the regulator. The value for the feedback resistor is typically between 0Ω and 200kΩ, as shown in Equation 1.

$$R_2 = R_1\left(\frac{VFB}{VOUT - VFB}\right) \quad \text{(EQ. 1)}$$

If the output voltage desired is 0.6V, then $R_2$ is left unpopulated and $R_1$ is shorted. For faster response performance, add 10pF to 47pF in parallel to $R_1$. Check bode plot to insure optimum performance.

## Frequency Control

The ISL8023A, ISL8024A has an FS pin that controls the frequency of operation. Programmable frequency allows for optimization between efficiency and external component size. Default switching frequency is 2MHz when FS is tied to VIN ($R_{11}$ = 0 and $R_{12}$ is open). By connecting $R_{12}$ to GND, the switching frequency could be changed from 1MHz ($R_{12}$ = 206k) to 4MHz ($R_{12}$ = 40k) according to Equation 2:

$$R_T[k\Omega] = \frac{220 \cdot 10^3}{f_{OSC}[kHz]} - 14 \quad \text{(EQ. 2)}$$

When using $R_{12}$ to adjust the operational frequency, this also sets external compensation mode. Please refer to the ISL8023, ISL8024 datasheet for more details.

## Soft-start Control

Short CSS to SGND for internal soft-start (approximately 1ms). Populate CSS to adjust the soft-start time. This capacitor, along with an internal 1.6µA current source, sets the soft-start interval of the converter, $t_{SS}$.

$$CSS[\mu F] = 3.33 \cdot t_{SS}[s] \quad \text{(EQ. 3)}$$

CSS must be less than 33nF to insure proper soft-start reset after fault condition.

## Switches Control

The ISL8023A, ISL8024A evaluation boards contain SW1 and SW2 for various controls of the ISL8023A, ISL8024A circuitries. Table 1 details this function.

**TABLE 1. SWITCH SETTINGS**

| SW1 | ENABLE | FUNCTION |
|---|---|---|
| 1 | OFF | Disable VOUT |
| 3 | ON | Enable VOUT |
| | | |
| **SW2** | **MODE** | **FUNCTION** |
| 1 | PWM | Fixed PWM frequency at light load |
| 3 | PFM | Force continuous mode |

# ISL8023AEVAL3Z and ISL8024AEVAL3Z Evaluation Boards


FIGURE 2. ISL8023AEVAL3Z TOP


FIGURE 3. ISL8023AEVAL3Z BOTTOM


FIGURE 4. ISL8024AEVAL3Z TOP


FIGURE 5. ISL8024AEVAL3Z BOTTOM

# ISL8023AEVAL3Z, ISL8024AEVAL3Z Schematic

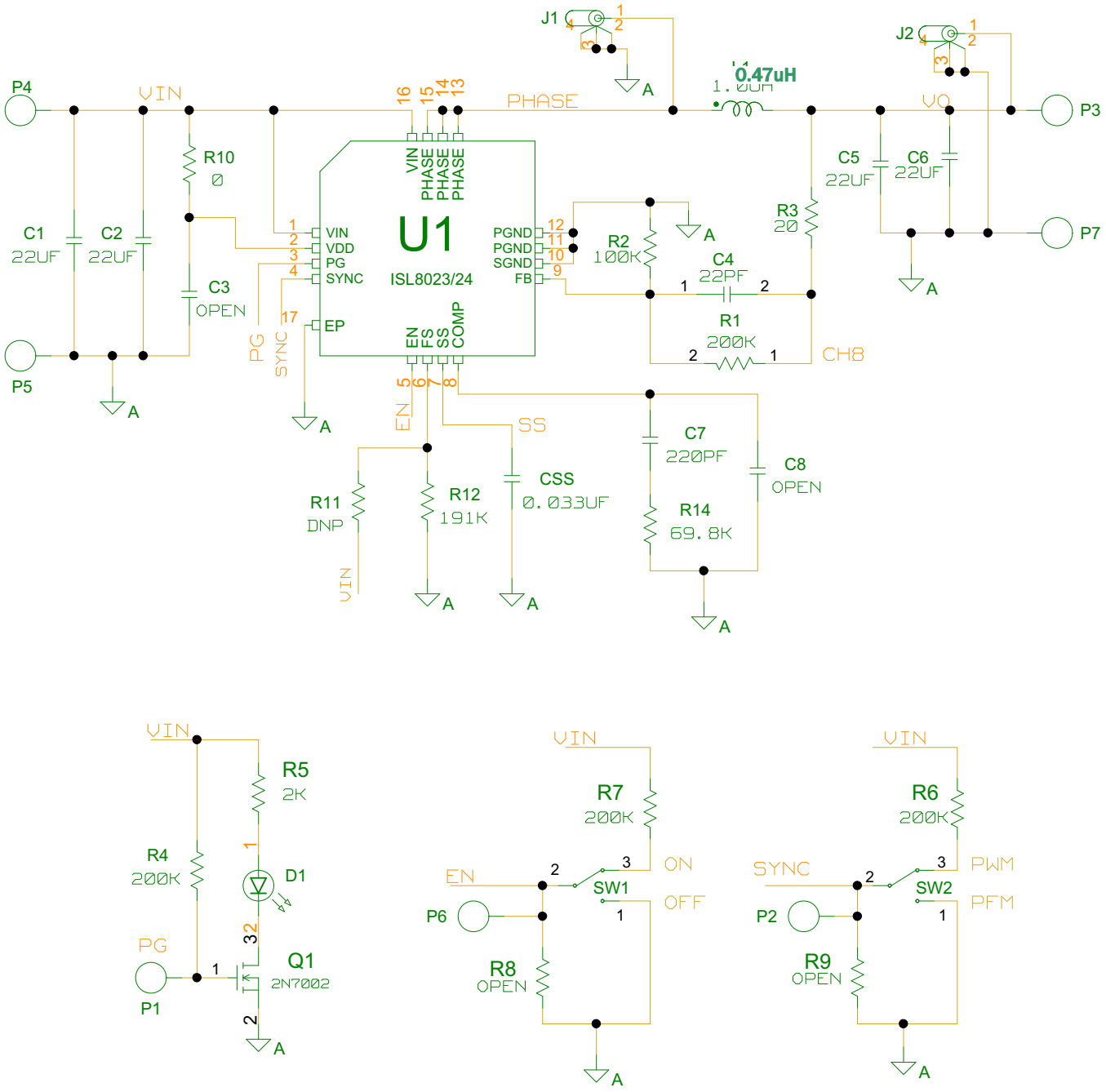


**FIGURE 6. SCHEMATIC**

**TABLE 2. BILL OF MATERIALS**

| MANUFACTURER PART | QTY | UNITS | REFERENCE DESIGNATOR | DESCRIPTION | MANUFACTURER |
|---|---|---|---|---|---|
| ISL8023_24AEVAL3ZREVAPCB | 1 | ea. | | PWB-PCB, ISL8023_24EVAL3Z, REVA, ROHS | Generic |
| C0603C0G500-220JNE | 1 | ea. | C4 | CAP, SMD, 0603, 22pF, 50V, 5%, C0G, ROHS | VENKEL |
| GRM188R71H221KA01D | 1 | ea. | C7 | CAP, SMD, 0603, 220pF, 50V, 10%, X7R, ROHS | MURATA |
| C0603X7R160-333KNE | 1 | ea. | CSS | CAP, SMD, 0603, 33000pF, 16V, 10%, X7R, ROHS | VENKEL |
| | 0 | ea. | C3, C8 | CAP, SMD, 0603, DNP-PLACE HOLDER, ROHS | |
| GRM31CR60J226KE19L | 2 | ea. | C2, C5 | CAP, SMD, 1206, 22µF, 6.3V, 10%, X5R, ROHS | MURATA |
| | 0 | ea. | C1, C6 | CAP, SMD, 1206, DNP-PLACE HOLDER, ROHS | |
| FDVE0630-R47M | 1 | ea. | L1 | COIL-PWR INDUCTOR, SMD, 7.4x6.7, 0.47µH, 20%, 14, 1A, ROHS | TOKO |
| 131-4353-00 | 2 | ea. | J1, J2 | CONN-SCOPE PROBE TEST PT, COMPACT, PCB MNT, ROHS | TEKTRONIX |
| 1514-2 | 4 | ea. | P4, P5, P7, P8 | CONN-TURRET, TERMINAL POST, TH, ROHS | KEYSTONE |
| 5002 | 3 | ea. | P1, P2, P6 | CONN-MINI TEST POINT, VERTICAL, WHITE, ROHS | KEYSTONE |
| LTST-C170CKT | 1 | ea. | D1 | LED-GaAs RED, SMD, 2X1.25mm, 100mW, 40mA, 10mcd, ROHS | LITEON/VISHAY |
| ISL8023/24AIRZ | 1 | ea. | U1 | IC-3A/4A BUCK REGULATOR, 16P, QFN, 3X3, ROHS | INTERSIL |
| 2N7002-7-F | 1 | ea. | Q1 | TRANSISTOR, N-CHANNEL, 3 LD, SOT-23, 60V, 115mA, ROHS | DIODES, INC. |
| | 0 | ea. | R11 | RESISTOR, SMD, 0603, 0.1%, MF, DNP-PLACE HOLDER | |
| ERJ-3EKF20R0V | 1 | ea. | R3 | RES, SMD, 0603, 20Ω, 1/10W, 1%, TF, ROHS | PANASONIC |
| CR0603-10W-000T | 1 | ea. | R10 | RES, SMD, 0603, 0Ω,1/10W, TF, ROHS | VENKEL |
| CR0603-10W-1003FT | 2 | ea. | R2, R14 | RES, SMD, 0603, 100k, 1/10W, 1%, TF, ROHS | VENKEL |
| CR-0603-10W-1913FT | 1 | ea. | R12 | RES, SMD, 0603, 191k, 1/10W, 1%, TF, ROHS | VENKEL |
| CR0603-10W-2003FT | 4 | ea. | R1, R4, R6, R7 | RES, SMD, 0603, 200k, 1/10W, 1%, TF, ROHS | VENKEL |
| | 0 | ea. | R5, R8, R9 | RES, SMD, 0603, DNP-PLACE HOLDER, ROHS | |
| GT11MSCBE | 2 | ea. | SW1, SW2 | SWITCH-TOGGLE, SMD, 6 PIN, SPDT, 2POS, ON-ON, ROHS | ITT INDUSTRIES/C&K DIVISION |
| | 0 | ea. | P3 (3VH30/1JN5) | DO NOT POPULATE OR PURCHASE | |

# ISL8023AEVAL3Z, ISL8024AEVAL3Z Board Layout

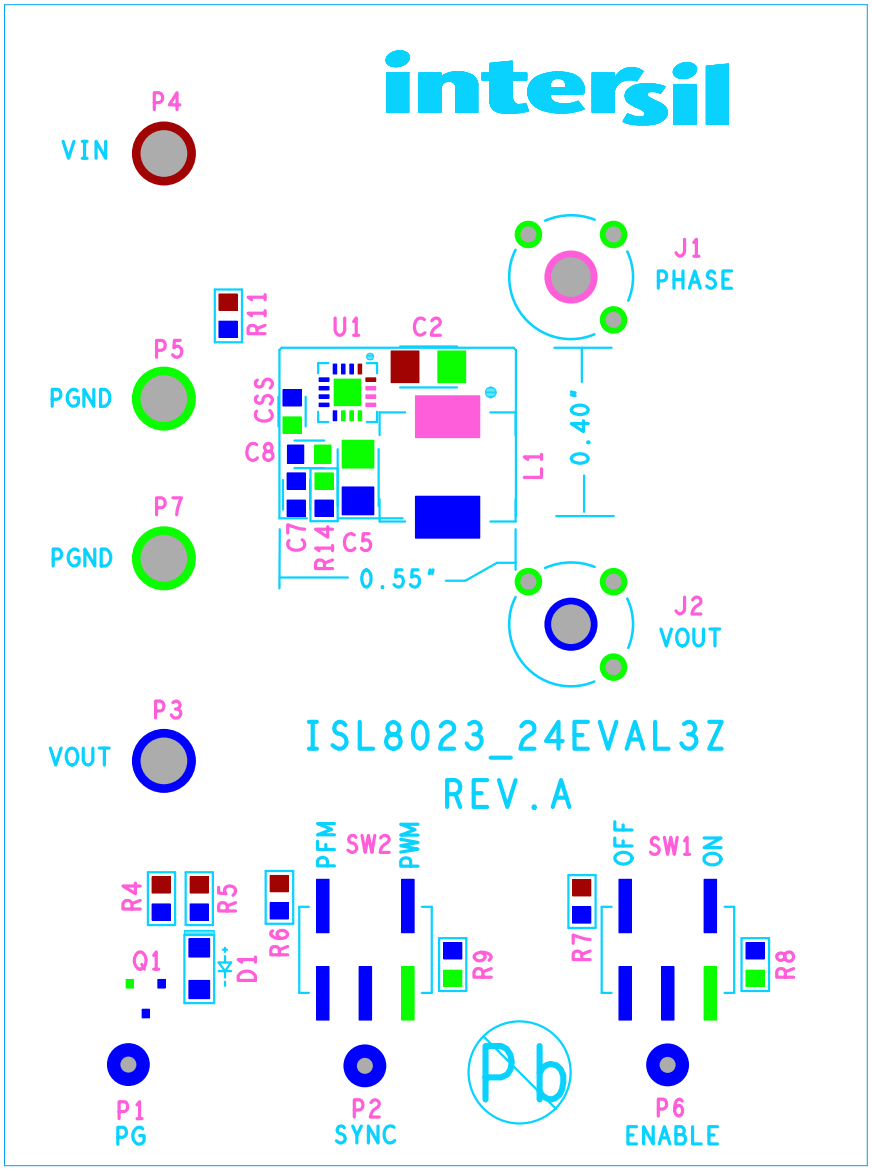


FIGURE 7. TOP LAYER COMPONENTS

## ISL8023AEVAL3Z, ISL8024AEVAL3Z Board Layout (Continued)

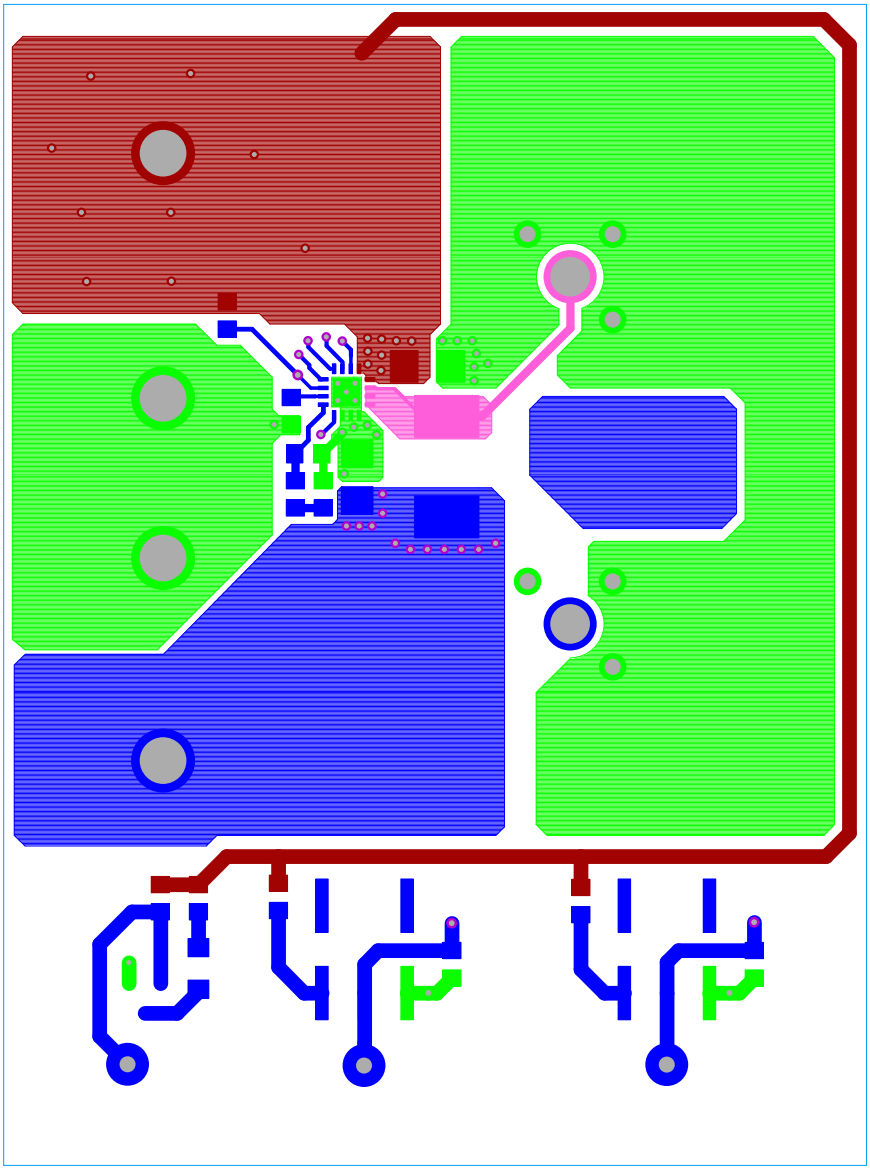

FIGURE 8. TOP LAYER ETCH

# ISL8023AEVAL3Z, ISL8024AEVAL3Z Board Layout (Continued)

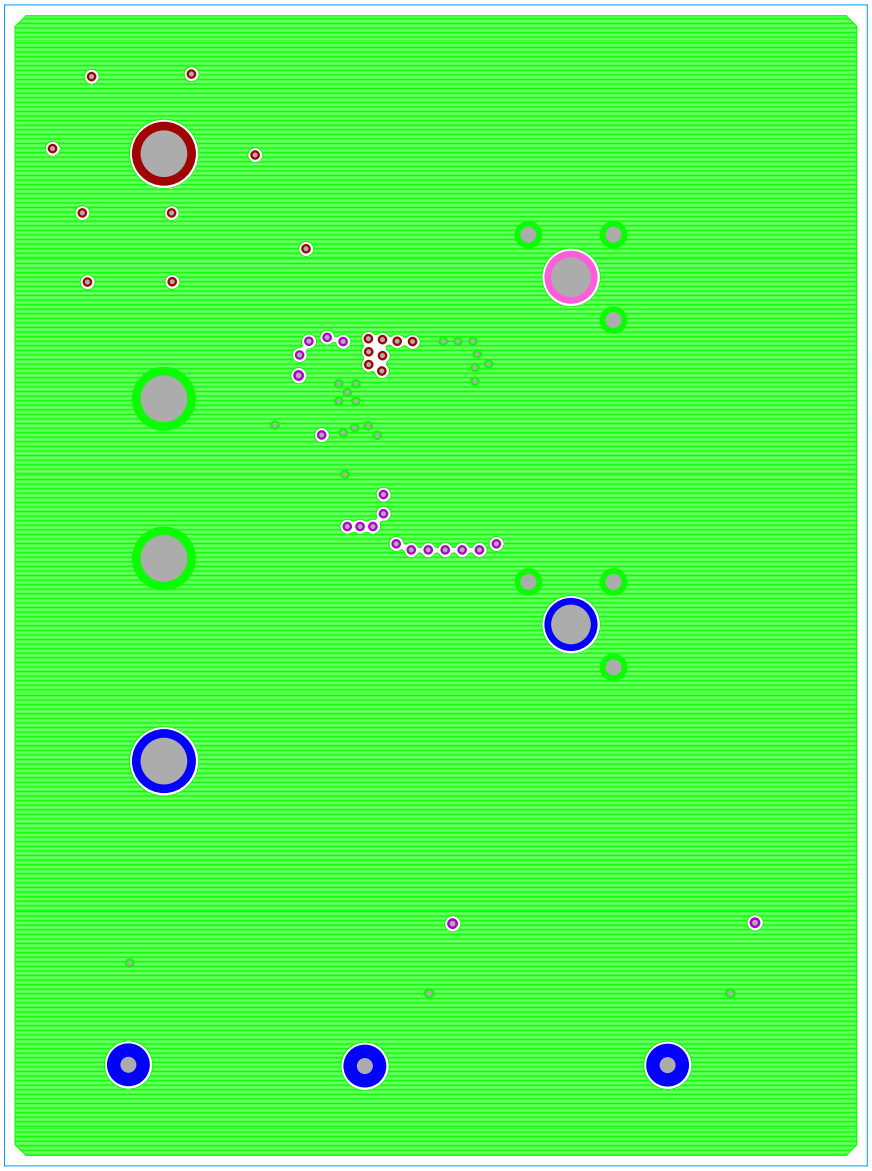

FIGURE 9. SECOND LAYER ETCH

# ISL8023AEVAL3Z, ISL8024AEVAL3Z Board Layout (Continued)

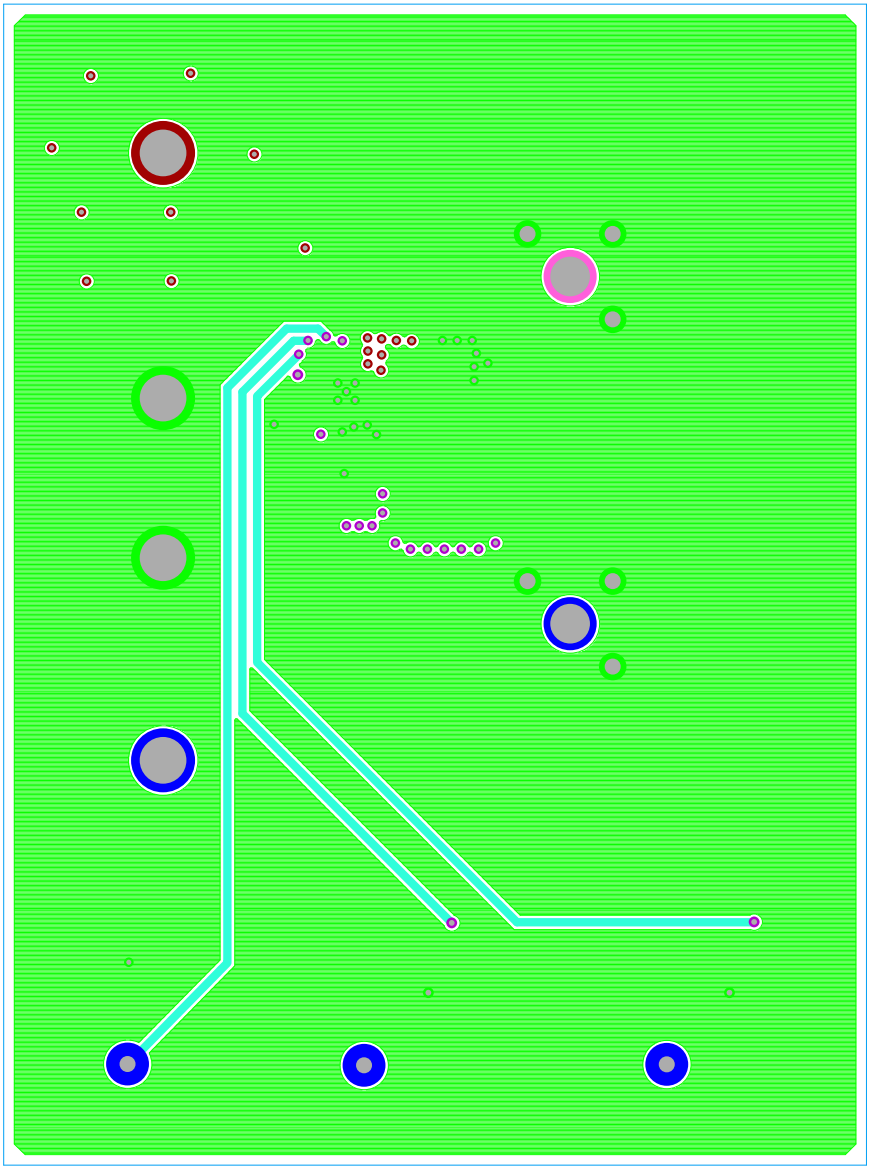

FIGURE 10. THIRD LAYER ETCH

# ISL8023AEVAL3Z, ISL8024AEVAL3Z Board Layout (Continued)

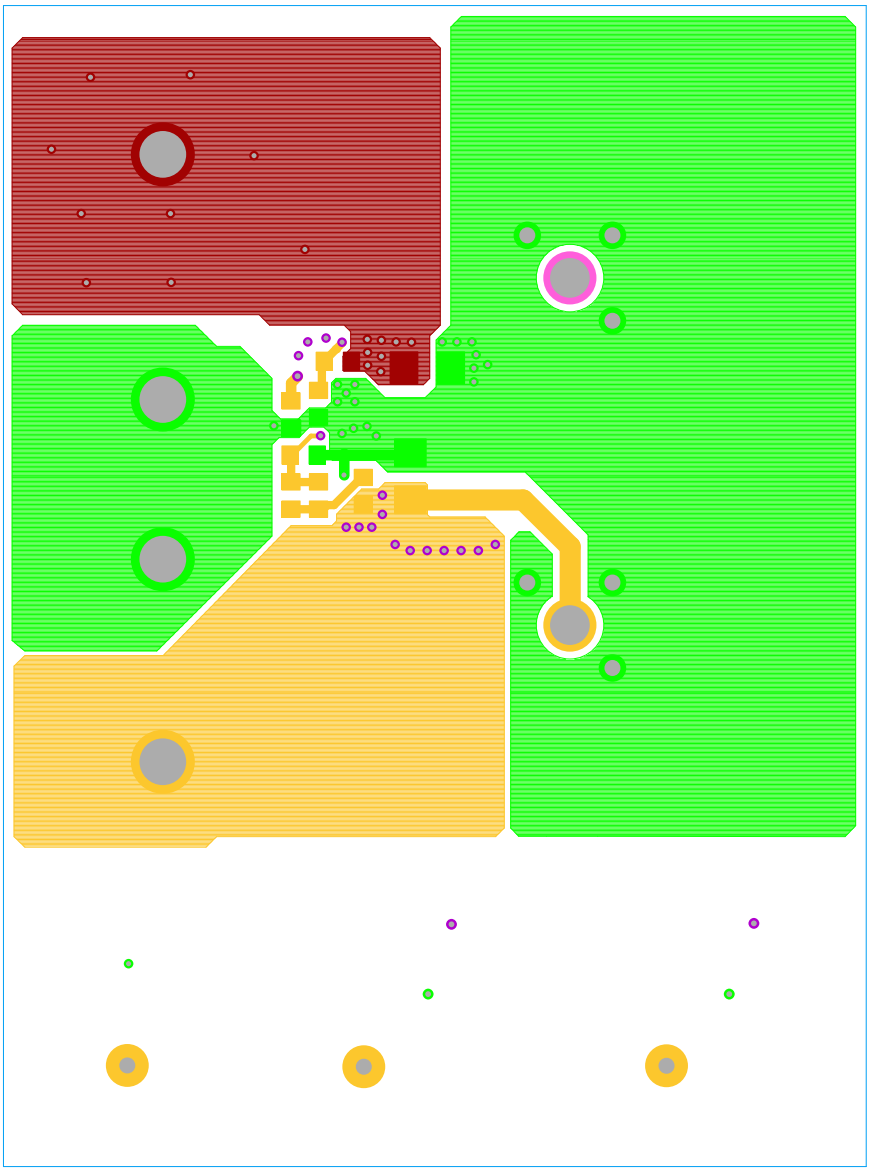

FIGURE 11. BOTTOM LAYER ETCH

## ISL8023AEVAL3Z, ISL8024AEVAL3Z Board Layout (Continued)

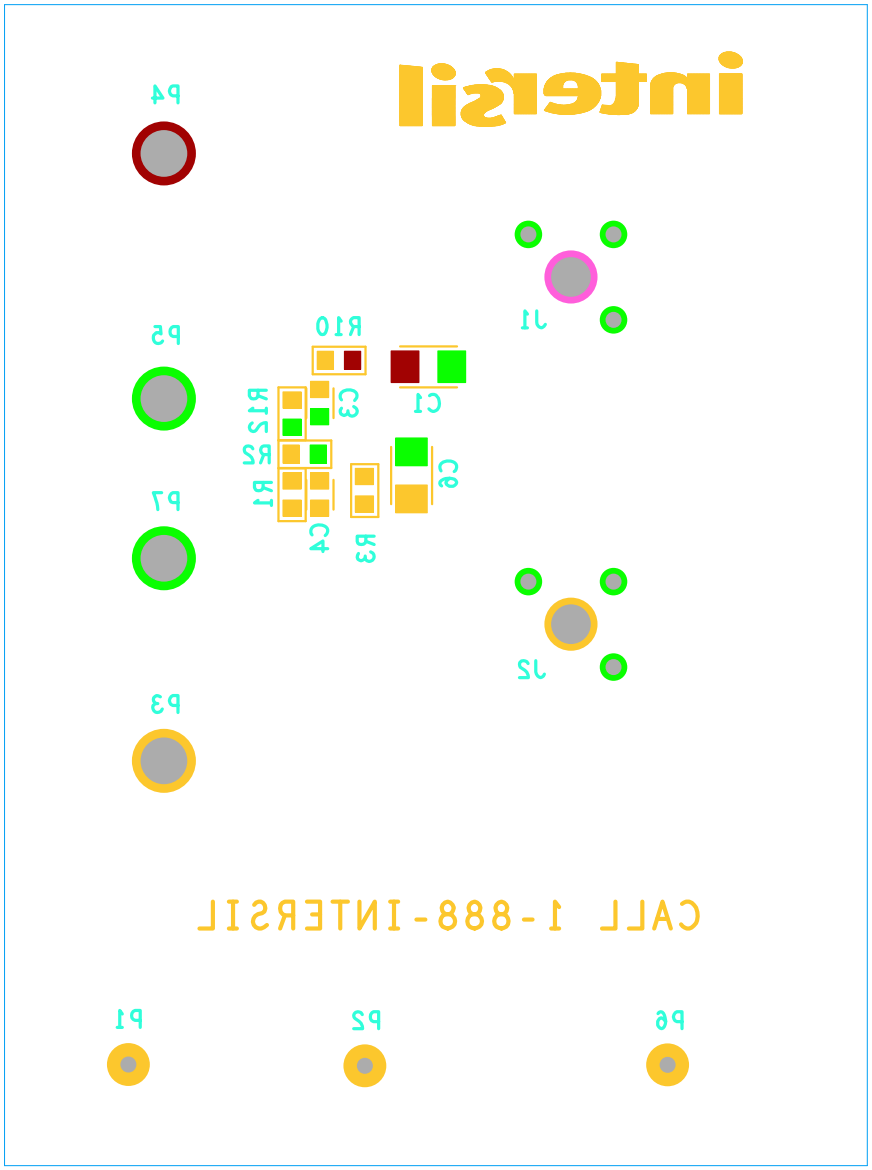


FIGURE 12. BOTTOM LAYER COMPONENTS

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