

ISL8026xEVAL3Z

Evaluation Board

UG033  
Rev 1.00  
July 15, 2016

**Description**

The ISL8026EVAL3Z and ISL8026AEVAL3Z are intended for use by customers with requirements for point-of-load applications sourcing from 2.5V to 5.5V. The ISL8026EVAL3Z and ISL8026AEVAL3Z are used to demonstrate the performance of the [ISL8026](#) and [ISL8026A](#), low quiescent high efficiency synchronous buck regulators.

The ISL8026 and ISL8026A 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 141.935mm<sup>2</sup>.

**Specifications**

| PART NUMBER | I <sub>OUT</sub> (MAX) (A) | f <sub>SW</sub> RANGE (MHz) | V <sub>IN</sub> RANGE (V) | V <sub>OUT</sub> RANGE (V) | PART SIZE (2mm) |
|-------------|----------------------------|-----------------------------|---------------------------|----------------------------|-----------------|
| ISL8026     | 6                          | Programmable 0.5 to 4       | 2.5 to 5.5                | 0.6 to 5.5                 | 3x3             |
| ISL8026A    |                            | Programmable 1 to 4         |                           |                            |                 |

NOTES:

1. The evaluation boards' default configuration are V<sub>OUT</sub> = 1.8V for ISL8026EVAL3Z (f<sub>SW</sub> = 1MHz) and ISL8026AEVAL3Z (f<sub>SW</sub> = 2MHz).
2. V<sub>REF</sub> is 0.6V.

**Key Features**

- High efficiency synchronous buck regulator with up to 95% efficiency
- 1% reference accuracy over load/line/temperature (-40 °C to +85 °C)
- 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 1MHz (2MHz for ISL8026A)
- External synchronization up to 4MHz
- Negative OC protection

**References**

[ISL8026](#), [ISL8026A](#) Datasheet

**Ordering Information**

| PART NUMBER    | DESCRIPTION                   |
|----------------|-------------------------------|
| ISL8026EVAL3Z  | Evaluation Board For ISL8026  |
| ISL8026AEVAL3Z | Evaluation Board For ISL8026A |

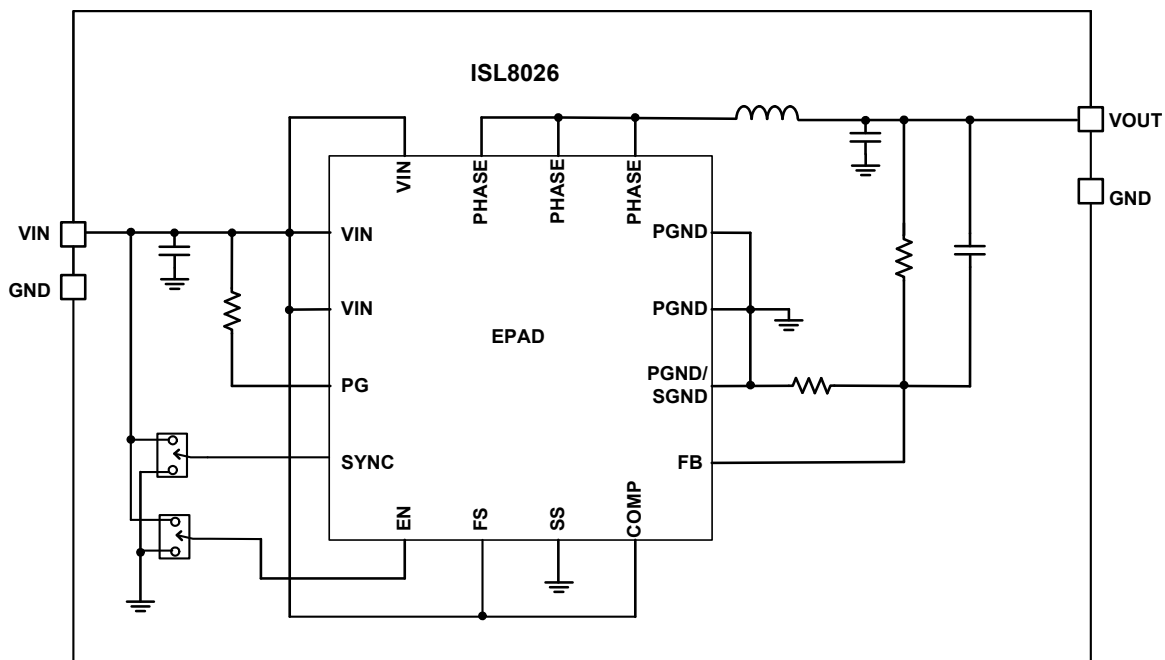


FIGURE 1. BLOCK DIAGRAM



FIGURE 2. ISL8026EVAL3Z



FIGURE 3. ISL8026AEVAL3Z

## 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  $V_{IN}$ , the plus terminal to  $V_{IN}$ , P4 and the negative return to PGND, P5.
3. Connect the output load to  $V_{OUT}$ , the plus terminal to  $V_{OUT}$ , P3 and the negative return to PGND, P7.
4. Verify that the position is set to PWM for SW2.
5. Verify that the position is set to ON for SW1.
6. Turn on the power supply.
7. Verify that the output voltage is 1.8V for  $V_{OUT}$ .

## Operating Range

By default, the ISL8026EVAL3Z is configured for the operating conditions shown in the “Quick Setup Guide”. The board can also support a wider operating range. Modifying the operating conditions will change the performance results.

The ISL8026EVAL3Z and ISL8026AEVAL3Z outputs are preset to 1.8V for  $V_{OUT}$ , 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  $0\Omega$  and 200k $\Omega$ , as shown in [Equation 1](#).

$$R_2 = R_1 \left( \frac{V_{FB}}{V_O - V_{FB}} \right) \quad (\text{EQ. 1})$$

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 the Bode plot to insure optimum performance.

## Frequency Control

The ISL8026 and ISL8026A have an FS pin that controls the frequency of operation. Programmable frequency allows for optimization between efficiency and external component size. Default switching frequency is 1MHz for ISL8026EVAL3Z and 2MHz for ISL8026AEVAL3Z when FS is tied to  $V_{IN}$  ( $R_{11} = 0$  and  $R_{12}$  is open). By changing the value of  $R_{12}$ , the switching frequency can be changed from 500kHz to 4MHz according to [Equation 2](#):

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

When using  $R_{12}$  to adjust the operational frequency, this also sets the external compensation mode. Please refer to the [ISL8026](#), [ISL8026A](#) 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,  $t_{SS}$ .

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

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

## Switches Control

The ISL8026EVAL3Z and ISL8026AEVAL3Z boards contain SW1 and SW2 for various controls of the ISL8026, ISL8026A circuitries. [Table 1](#) details this function.

**TABLE 1. SWITCH SETTINGS**

| SW1 | ENABLE | FUNCTION                          |
|-----|--------|-----------------------------------|
| 1   | OFF    | DISABLE VO                        |
| 3   | ON     | ENABLE VO                         |
|     |        |                                   |
| SW2 | MODE   | FUNCTION                          |
| 1   | PWM    | Fixed PWM frequency at light load |
| 3   | PFM    | Force continuous mode             |

## PCB Layout Recommendation

The PCB layout is a very important converter design step to make sure the designed converter works well. For ISL8026, ISL8026A, the power loop is composed of the output inductor L's, the output capacitor (COUT), the PHASE pins and the PGND pin. It is necessary to make the power loop as small as possible and the connecting traces among them should be direct, short and wide. The switching node of the converter, the PHASE pins and the traces connected to the node are very noisy, so keep the voltage feedback trace away from these noisy traces. The input capacitor should be placed as close as possible to the VIN pin. The ground of input and output capacitors should be connected as close as possible. The heat of the IC is mainly dissipated through the thermal pad. Maximizing the copper area connected to the thermal pad is preferable. In addition, a solid ground plane is helpful for better EMI performance. It is recommended to add at least 5 vias ground connection within the pad for the best thermal relief.



## Bill Of Materials

| QTY | UNIT | REFERENCE DESIGNATOR | DESCRIPTION   | MANUFACTURER                         | MANUFACTURER PART  |
|-----|------|----------------------|---|--------------------------------------|--------------------|
| 1   | ea.  |                      | PWB-PCB, ISL8026, REVA, ROHS                          | IMAGINEERING INC                     | ISL8026REVAPCB     |
| 1   | ea.  | C4                   | CAP, SMD, 0603, 22pF, 50V, 5%, COG, ROHS              | VENKEL                               | C0603C0G500-220JNE |
| 1   | ea.  | C7                   | CAP, SMD, 0603, 220pF, 50V, 10%, X7R, ROHS            | MURATA                               | GRM188R71H221KA01D |
| 1   | ea.  | CSS                  | CAP, SMD, 0603, 33000pF, 16V, 10%, X7R, ROHS          | VENKEL                               | C0603X7R160-333KNE |
| 1   | ea.  | C3                   | CAP, SMD, 0603, 0.1μF, 16V, 10%, X7R, ROHS            | VENKEL                               | C0603X7R160-104KNE |
| 0   | ea.  | C8                   | CAP, SMD, 0603, DNP-PLACE HOLDER, ROHS                |                                      |                    |
| 4   | ea.  | C1, C2, C5, C6       | CAP, SMD, 1206, 22μF, 6.3V, 10%, X5R, ROHS            | MURATA                               | GRM31CR60J226KE19L |
| 1   | ea.  | L1 (ISL8026)         | 1μH, 6.9mΩ, 8.1A, ROHS, SHIELDED                      | PANASONIC ( <a href="#">Note 3</a> ) | ETQP3W1ROWFN       |
|     |      |                      |   | TDK ( <a href="#">Note 3</a> )       | SPM6530T-1R0M120   |
| 1   | ea.  | L1 (ISL8026A)        | 0.68μH, 4.9mΩ, 9.6A, ROHS, SHIELDED                   | PANASONIC ( <a href="#">Note 3</a> ) | ETQP3WR68WFN       |
|     |      |                      |   | TDK ( <a href="#">Note 3</a> )       | SPM6530T-R68M140   |
| 2   | ea.  | J1, J2               | CONN-SCOPE PROBE TEST PT, COMPACT, PCB MNT, ROHS      | TEKTRONIX                            | 131-4353-00        |
| 4   | ea.  | P4, P5, P7, P8       | CONN-TURRET, TERMINAL POST, TH, ROHS                  | KEYSTONE                             | 1514-2             |
| 3   | ea.  | P1, P2, P6           | CONN-MINI TEST POINT, VERTICAL, WHITE, ROHS           | KEYSTONE                             | 5002               |
| 1   | ea.  | D1                   | LED-GaAs RED, SMD, 2x1.25mm, 100mW, 40mA, 10mcd, ROHS | LITEON/VISHAY                        | LTST-C170CKT       |
| 1   | ea.  | U1                   | IC-5A BUCK REGULATOR, 16P, QFN, 3x3, ROHS             | INTERSIL                             | ISL8026            |
| 1   | ea.  | Q1                   | TRANSISTOR, N-CHANNEL, 3 LD, SOT-23, 60V, 115mA, ROHS | DIODES, INC.                         | 2N7002-7-F         |
| 0   | ea.  | R11 (ISL8026)        | RES, SMD, 0603, 0.1%, MF, DNP-PLACE HOLDER            |                                      |                    |
| 1   | ea.  | R11 (ISL8026A)       | RES, SMD, 0603, 0Ω, 1/16W, 1%, TF, ROHS               | GENERIC                              |                    |
| 1   | ea.  | R3                   | RES, SMD, 0603, 20Ω, 1/10W, 1%, TF, ROHS              | PANASONIC                            | ERJ-3EKF20R0V      |
| 1   | ea.  | R2, R14              | RES, SMD, 0603, 100k, 1/10W, 1%, TF, ROHS             | VENKEL                               | CR0603-10W-1003FT  |
| 1   | ea.  | R12 (ISL8026)        | RES, SMD, 0603, 191k, 1/10W, 1%, TF, ROHS             | VENKEL                               | CR-0603-10W-1913FT |
| 1   | ea.  | R12 (ISL8026A)       | RES, SMD, 0603, 0.1%, MF, DNP-PLACE HOLDER            |                                      |                    |
| 4   | ea.  | R1, R4, R6, R7       | RES, SMD, 0603, 200k, 1/10W, 1%, TF, ROHS             | VENKEL                               | CR0603-10W-2003FT  |
| 0   | ea.  | R5, R8, R9           | RES, SMD, 0603, DNP-PLACE HOLDER, ROHS                |                                      |                    |
| 2   | ea.  | SW1, SW2             | SWITCH-TOGGLE, SMD, 6 PIN, SPDT, 2POS, ON-ON, ROHS    | ITT INDUSTRIES/<br>C&K DIVISION      | GT11MSCBE          |

## NOTE:

3. Two manufacturers are provided as options for the inductor.

# ISL8026xEVAL3Z Board Layout

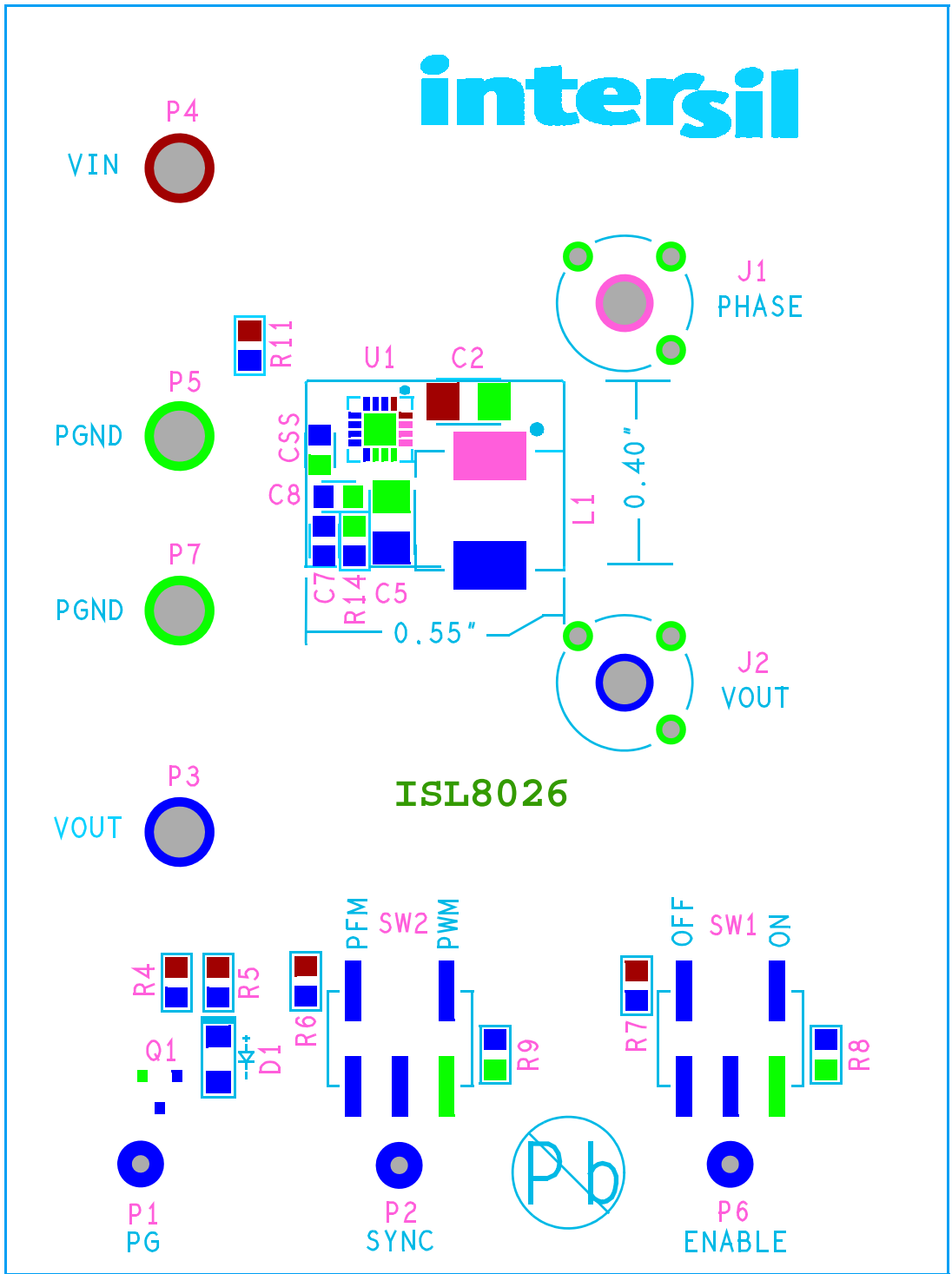


FIGURE 5. TOP LAYER COMPONENTS

# ISL8026xEVAL3Z Board Layout (Continued)

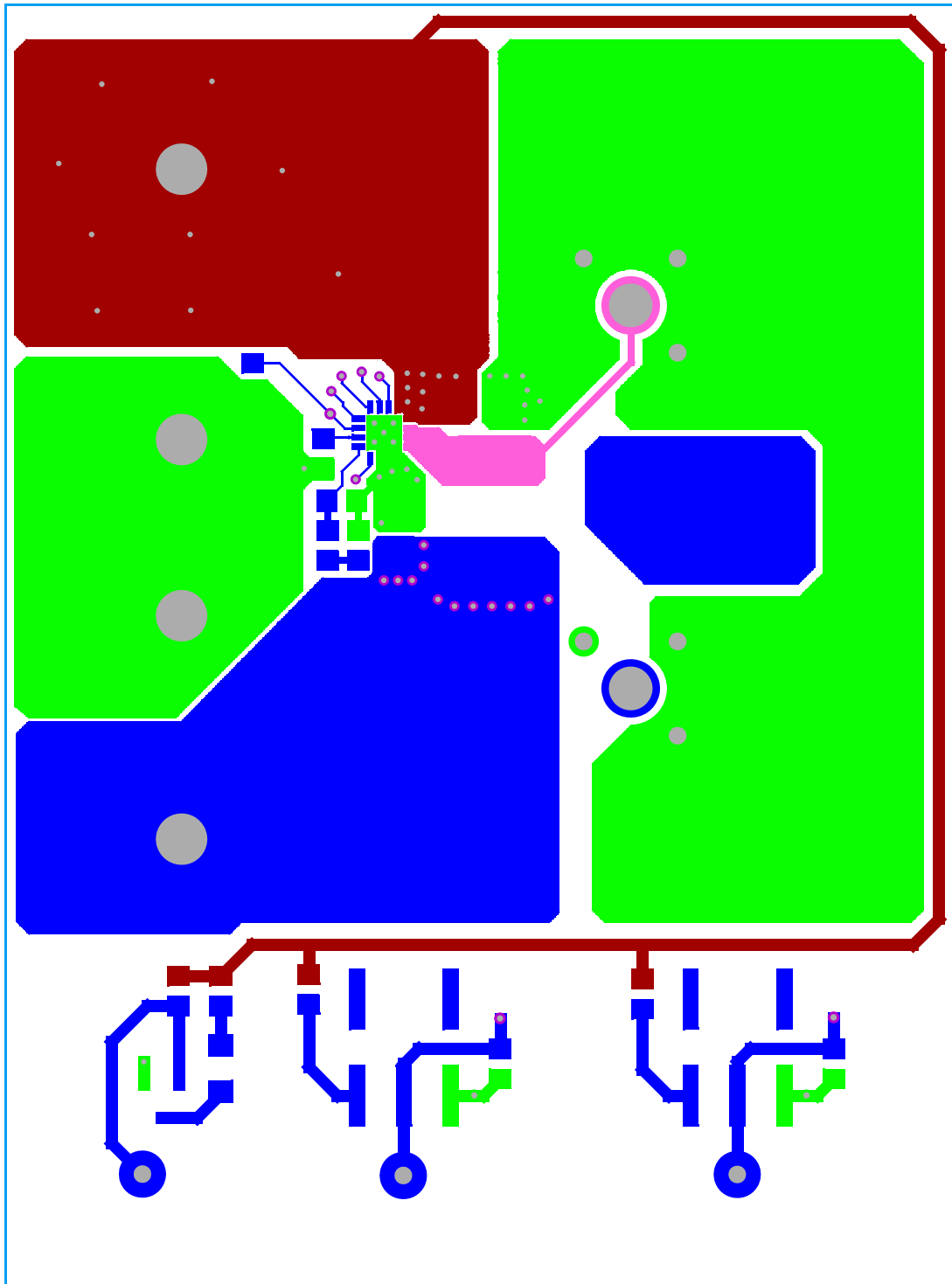


FIGURE 6. TOP LAYER ETCH





# ISL8026xEVAL3Z Board Layout (Continued)

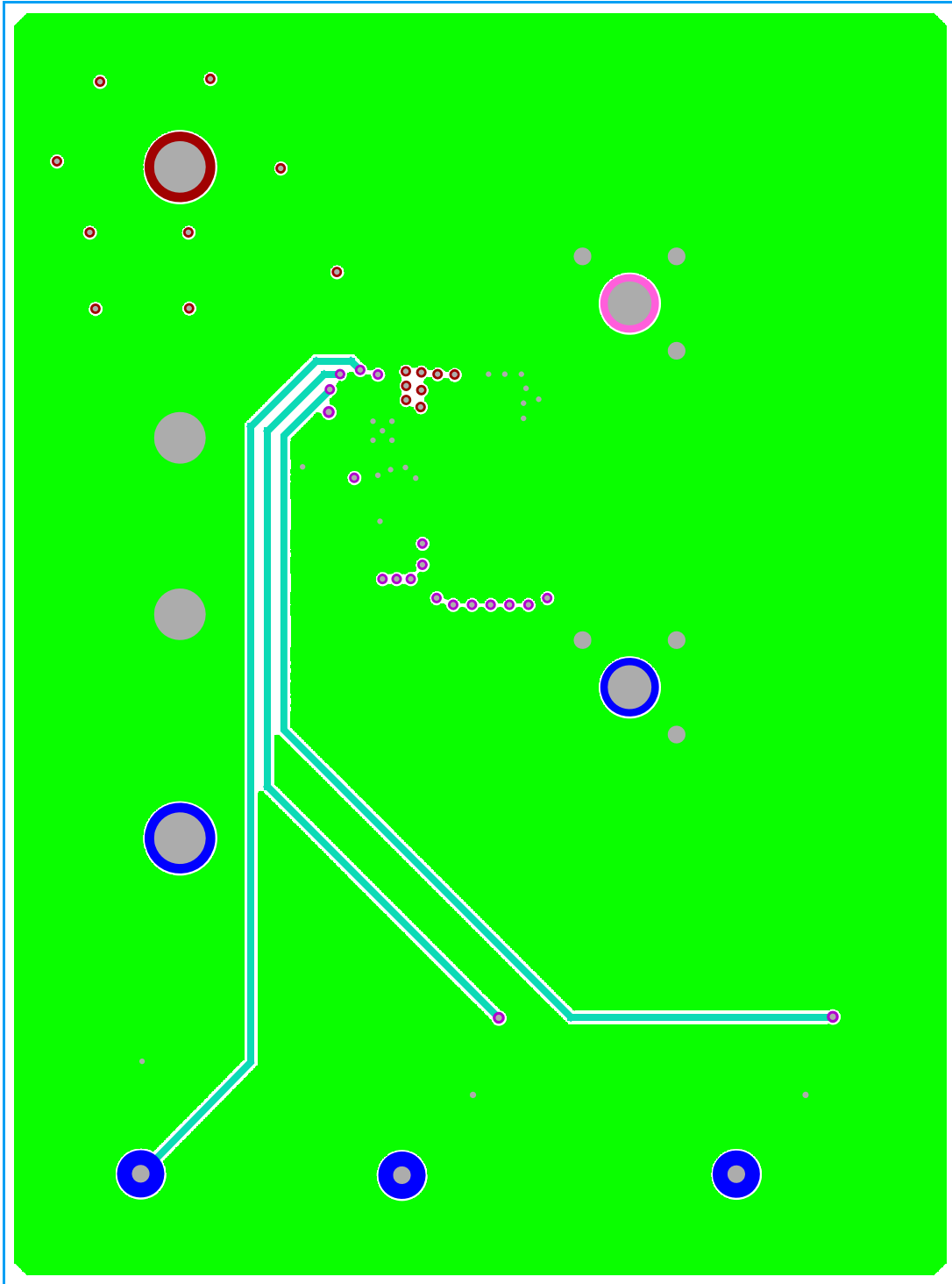


FIGURE 8. THIRD LAYER ETCH

# ISL8026xEVAL3Z Board Layout (Continued)

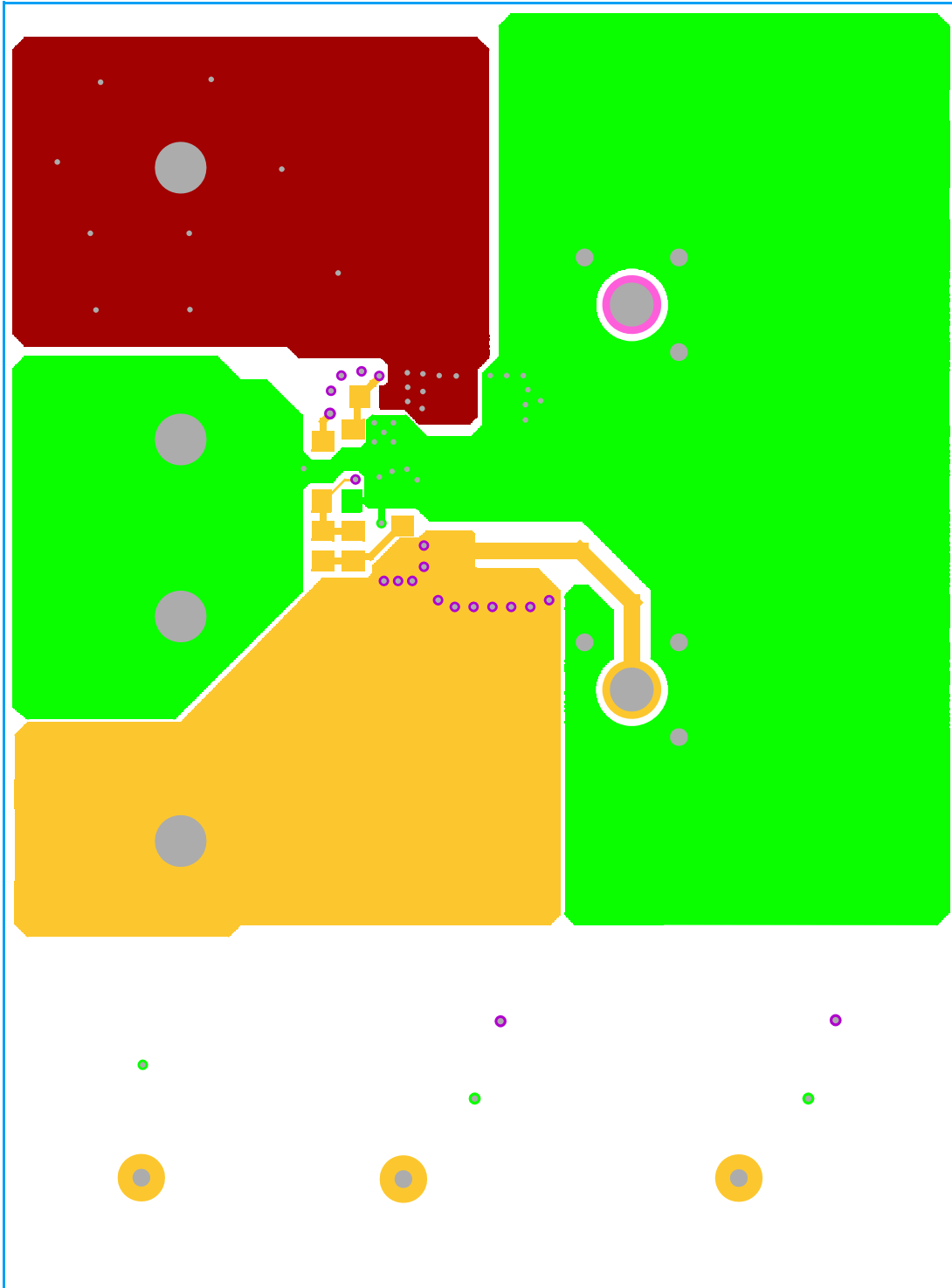


FIGURE 9. BOTTOM LAYER ETCH

**ISL8026xEVAL3Z Board Layout** (Continued)

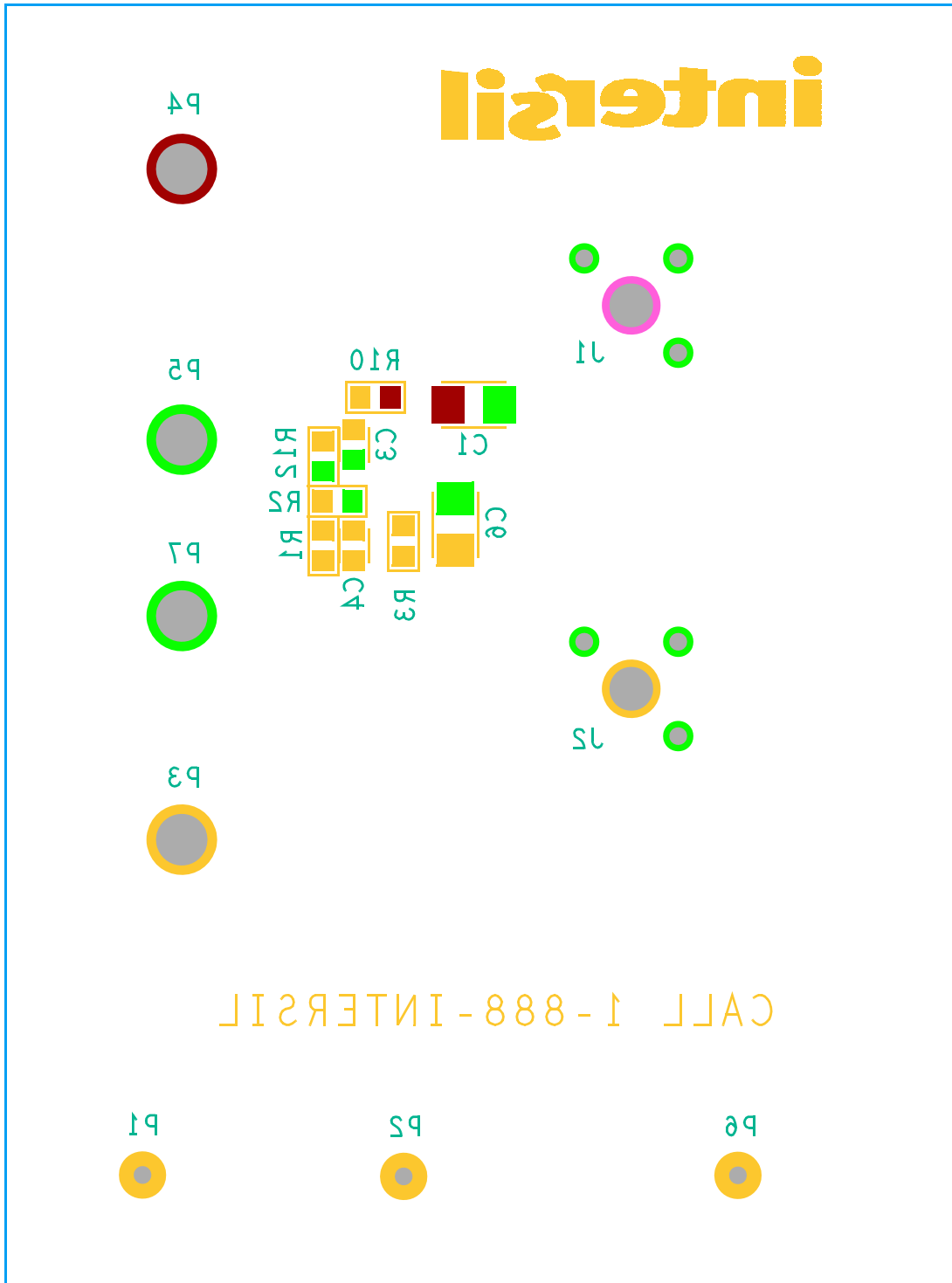


FIGURE 10. BOTTOM LAYER COMPONENTS

## Typical Performance Curves

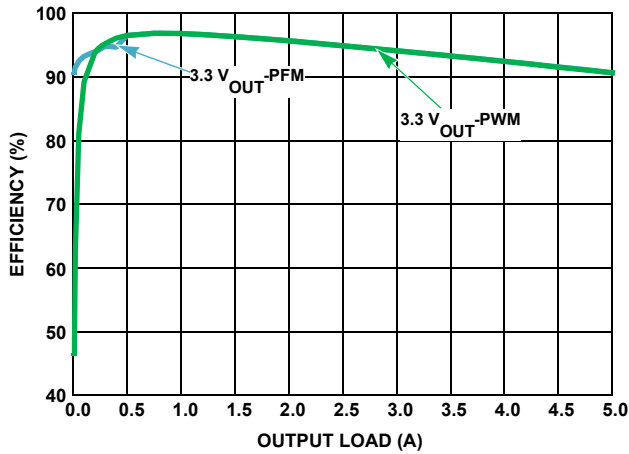


FIGURE 11. EFFICIENCY vs LOAD (1MHz 5VIN)

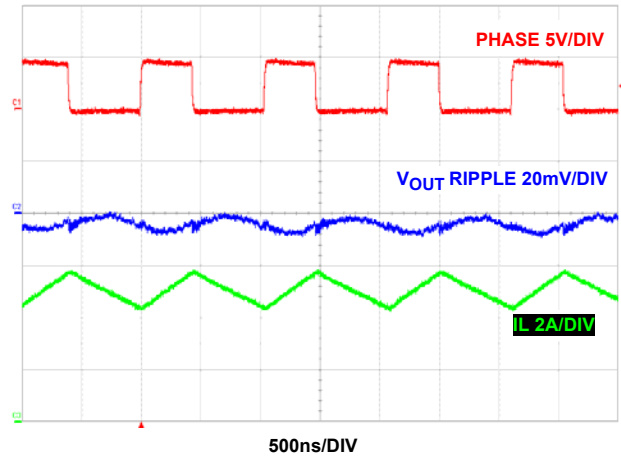


FIGURE 12. STEADY STATE AT 5A PWM

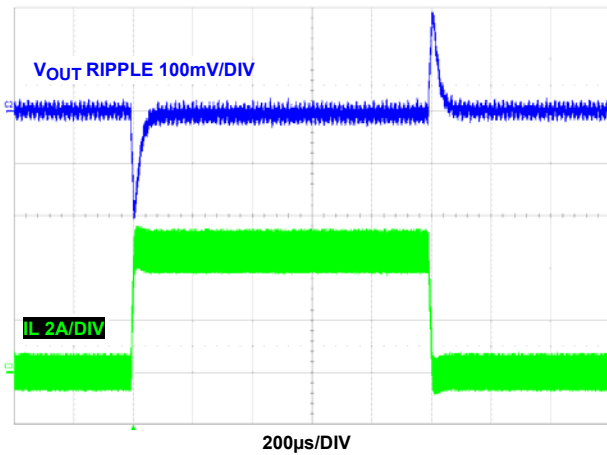


FIGURE 13. LOAD TRANSIENT (PWM)

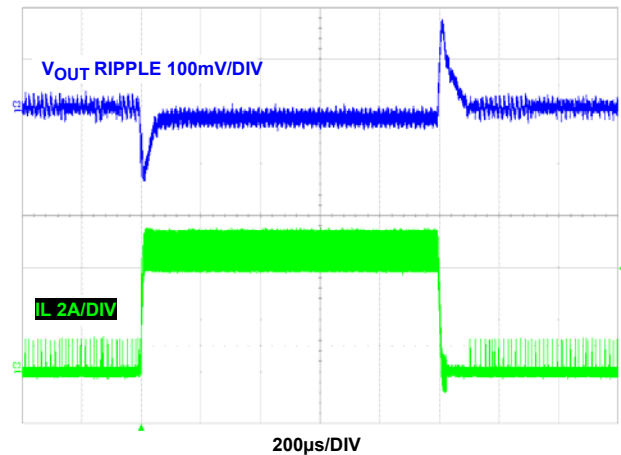


FIGURE 14. LOAD TRANSIENT (PFM)

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