

ISL8013AEVAL2Z

3A Low Quiescent Current 1MHz High Efficiency Synchronous Buck Regulator

AN1365
Rev 3.00
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Description

The ISL8013AEVAL2Z kit is intended for use by individuals with requirements for Point-of-Load applications sourcing from 2.7V to 5.5V. The ISL8013AEVAL2Z evaluation board is used to demonstrate the performance of the ISL8013A low quiescent current mode converter.

The ISL8013A is offered in a 4mmx4mm 16 Ld QFN package with 1mm maximum height. The complete converter occupies less than 0.4in² area. The ISL8014A is pin-to-pin compatible with the ISL8013A.

Key Features

- High Efficiency Synchronous Buck Regulator with up to 95% Efficiency
- Power-Good (PG) Output with 1ms Delay
- 2.7V to 5.5V Supply Voltage
- 3% Output Accuracy Over-Temperature/Load/Line
- 3A Guaranteed Output Current
- Start-up with Pre-biased Output
- Internal Digital Soft-Start - 1ms
- Soft-Stop Output Discharge During Disabled
- 35µA Quiescent Supply Current in PFM Mode
- Selectable Forced PWM Mode and PFM Mode
- External Synchronization up to 4MHz
- Less than 1µA Logic Controlled Shutdown Current
- 100% Maximum Duty Cycle for Lowest Dropout
- Internal Current Mode Compensation
- Peak Current Limiting and Hiccup Mode Short Circuit Protection
- Over-Temperature Protection

Recommended Equipment

The following materials are recommended to perform testing:

- 0V to 10V Power Supply with at least 5A source current capability or 5V battery
- Electronic Loads capable of sinking current up to 5A
- 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. Plus terminal to P4 (VIN) and negative return to P5 (GND).
3. Verify that position is ON for SW1.
4. Turn on the power supply.
5. Verify the output voltage is 1.8V for V_{OUT}

Evaluating the Other Output Voltage

The ISL8013AEVAL2Z kit output is preset to 1.8V; however, output voltages can be adjusted from 0.8V to 3.3V using Equations 1 and 2:

$$V_{OUT} = 0.8 \left(1 + \frac{R_1}{R_2} \right) \quad (\text{EQ. 1})$$

Let's set R₁ = 124kΩ

$$R_2 = \frac{R_1}{\left(\frac{V_{OUT}}{0.8} \right) - 1} \quad (\text{EQ. 2})$$

Note: If desired output is 0.8V, then short R₁ and open R₂.

Mode Control

The ISL8013A has a SKIP pin that controls the operation mode. When the SKIP pin is driven to low or shorted to ground, the regulator operates in a PFM mode. Set SKIP pin high forced PWM mode. The controller remains in the fixed PWM frequency at light load instead of entering the skip mode. In an application where a situation requires the ISL8013A regulator to sink more than 2A valley inductor current, it is recommended to operate in PFM to avoid any possible over stress.

TABLE 1. SWITCH 1 SETTINGS

| SW1 | ENABLE | ON/OFF CONTROL |
|-----|--------|-----------------------------------|
| 1 | OFF | Disable V _{OUT} |
| 3 | ON | Enable V _{OUT} |
| | | |
| SW2 | SKIP | FUNCTION |
| 1 | PWM | Fixed PWM frequency at light load |
| 3 | PFM | Force continuous mode |

ISL8013AEVAL2Z Bill of Materials

| PART NUMBER | QTY | REFERENCE DESIGNATOR | DESCRIPTION | MANUFACTURER | MANUFACTURER PART |
|----------------------|-----|----------------------|---|-------------------------|-----------------------|
| ISL8013AEVAL2Z | 1 | | PWB-PCB, ISL8013AEVAL2Z, REVA, ROHS | | ISL8013AEVAL2ZREVAPCB |
| H1045-00470-50V5-T | 1 | C4 | CAP, SMD, 0603, 47pF, 50V, 5%, NPO, ROHS | AVX | 06035A470JAT2A |
| | | | | PHILLIPS | 0603X7R500-562KNE |
| H1045-DNP | 0 | C3 | CAP, SMD, 0603, DNP-PLACE HOLDER, ROHS | | |
| H1065-00226-6R3V10-T | 4 | C1, C2, C5, C6 | CAP, SMD, 1206, 22µF, 6.3V, 10%, X5R, ROHS | MURATA | GRM31CR60J226KE19L |
| | | | | KEMET | C1206C226K9PACTU |
| | | | | AVX | 12066D226KAT2A |
| DR73-1R5-R | 1 | L1 | COIL-PWR INDUCTOR, SMD, 7.5mm, 1.5µH, 20%, 6.52A, ROHS | COOPER ELECTRONIC TECH. | DR73-1R5-R |
| 131-4353-00 | 2 | J1, J2 | CONN-SCOPE PROBE TEST PT, COMPACT, PCB MNT, ROHS | TEKTRONIX | 131-4353-00 |
| 1514-2 | 4 | P4, P5, P7, P8 | CONN-TURRET, TERMINAL POST, TH, ROHS | KEYSTONE | 1514-2 |
| 5002 | 3 | P2, P3, P6 | CONN-MINI TEST POINT, VERTICAL, WHITE, ROHS | KEYSTONE | 5002 |
| LTST-C170CKT | 1 | D1 | LED-GaAs RED, SMD, 2mmx1.25mm, 100mW, 40mA, 10mcd, ROHS | LITEON/VISHAY | LTST-C170CKT |
| | | | | ROHM | SML-210LTT86 |
| | | | | STANLEY ELECTRIC | BR112H-TR |
| ISL8013AIRZ | 1 | U1 | IC-3A, 1MHZ, BUCK REGULATOR, 16P, QFN, 4x4, ROHS | INTERSIL | ISL8013AIRZ |
| 2N7002-7-F-T | 1 | Q1 | TRANSISTOR, N-CHANNEL, 3LD, SOT-23, 60V, 115mA, ROHS | DIODES, INC. | 2N7002-7-F |
| | | | | ON SEMICONDUCTOR | 2N7002LT1G |
| H2511-00R00-1/10W-T | 1 | R10 | RESISTOR, SMD, 0603, 0Ω, 1/10W, TF, ROHS | | |
| H2511-01003-1/10W1-T | 4 | R2, R4, R6, R7 | RES, SMD, 0603, 100k, 1/10W, 1%, TF, ROHS | | |
| H2511-01243-1/10W1-T | 1 | R1 | RES, SMD, 0603, 124k, 1/10W, 1%, TF, ROHS | YAGEO | 9C06031A1243FKHFT |
| | | | | PANASONIC | ERJ-3EK1243V |
| H2511-02001-1/10W1-T | 1 | R5 | RES, SMD, 0603, 2k, 1/10W, 1%, TF, ROHS | KOA | RK73H1JT2D2001F |
| | | | | VENKEL | CR0603-10W-2001FT |
| H2511-DNP | 0 | R8, R9 | RES, SMD, 0603, DNP-PLACE HOLDER, ROHS | | |
| GT11MSCBE-T | 2 | SW1, SW2 | SWITCH-TOGGLE, SMD, ULTRAMINI, 1P, SPST MINI | C&K COMPONENTS | GT11MSCKE |
| LABEL-SERIAL NUMBER | 1 | | LABEL, FOR SERIAL NUMBER AND BOM REV # | | |

ISL8013AEVAL2Z Board Layout

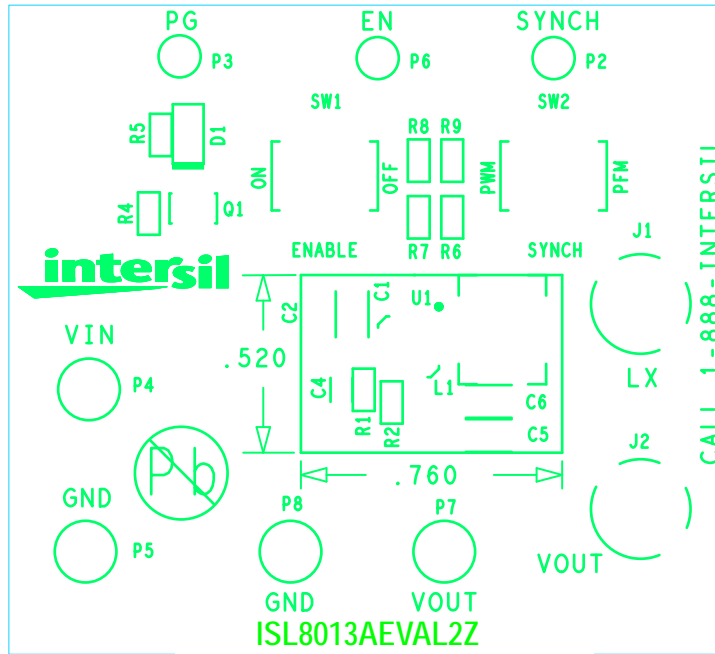


FIGURE 1. TOP COMPONENTS

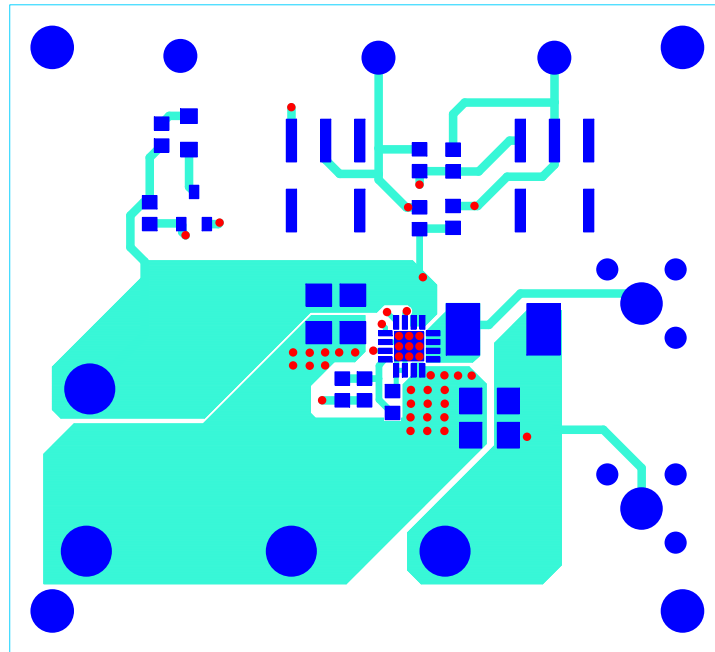


FIGURE 2. TOP LAYER ETCH

ISL8013AEVAL2Z Board Layout (Continued)

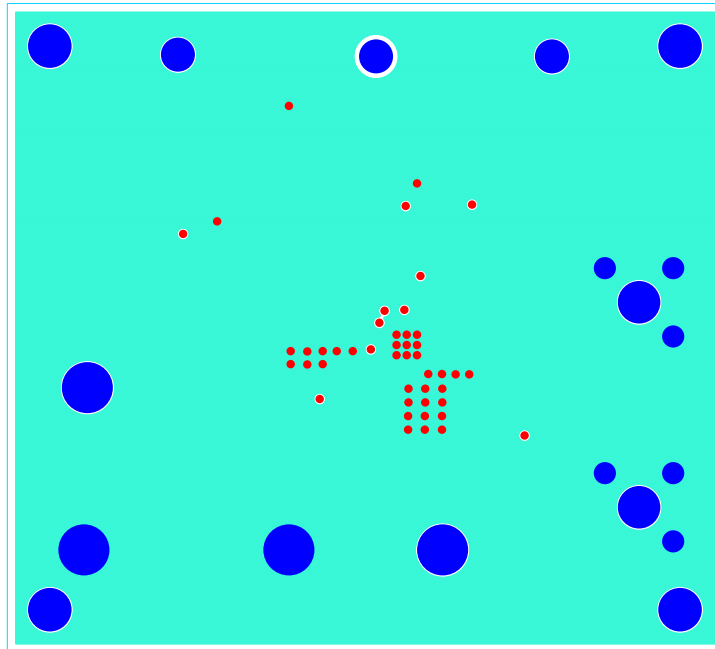


FIGURE 3. 2ND LAYER ETCH

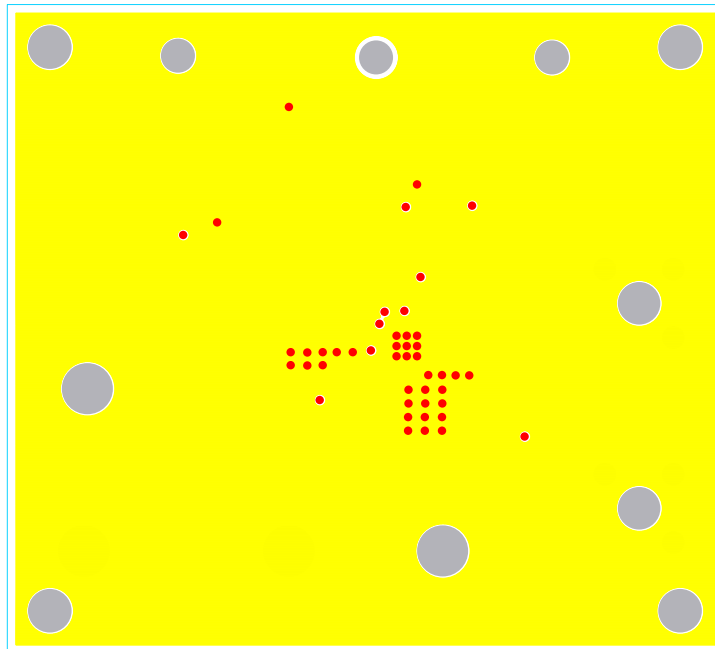


FIGURE 4. 3RD LAYER ETCH

ISL8013AEVAL2Z Board Layout (Continued)

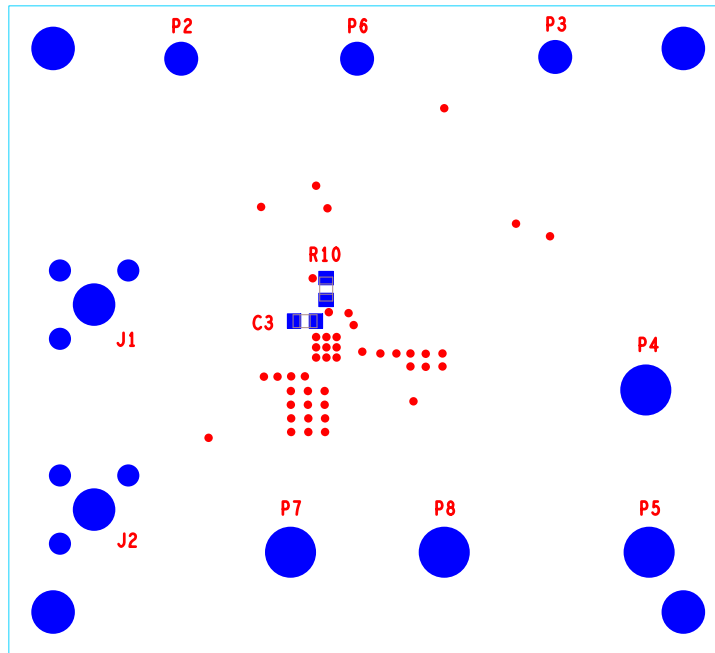


FIGURE 5. BOTTOM LAYER COMPONENTS (MIRRORS)

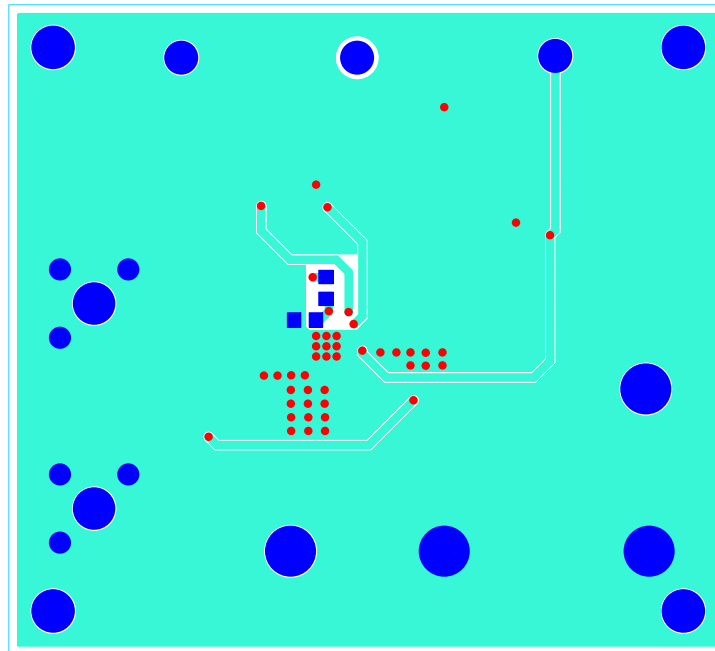


FIGURE 6. BOTTOM LAYER ETCH (MIRROR)