

ISL8560EVAL2Z

Evaluation Board

AN1324
Rev 3.00
February 13, 2008

The ISL8560 is a step down DC/DC power switching regulator which accepts a 9V to 60V input, and provides up to 2A of output current. The output voltage can be set between 1.21V and 35V by means of an external resistor divider. The device uses an internal power DMOS transistor with a typical $r_{DS(ON)}$ of 0.19Ω to obtain very high efficiency and high switching speed. A switching frequency in the range of 100kHz to 600kHz can be realized (the maximum power dissipation of the various packages must be observed). Notable features of this next generation DC/DC converter include pulse-by-pulse current limit for FET protection, hiccup-mode short circuit protection, voltage feedforward, frequency SYNC, soft-start, low standby current of $60\mu A$ typical in the disabled state and thermal shut-down. The device is available in a 20 Ld QFN package.

Ordering Information

PART NUMBER (Note)	PART MARKING	TEMP. RANGE (°C)	PACKAGE (Pb-free)	PKG. DWG. #
ISL8560IRZ	ISL 8560IRZ	-40 to +85	20 Ld 6x6 QFN	L20.6x6B
ISL8560IRZ-T*	ISL 8560IRZ	-40 to +85	20 Ld 6x6 QFN	L20.6x6B
ISL8560EVAL2Z	Evaluation Board			

*Please refer to TB347 for details on reel specifications.

NOTE: These Intersil Pb-free plastic packaged products employ special Pb-free material sets; molding compounds/die attach materials and 100% matte tin plate PLUS ANNEAL - e3 termination finish, which is RoHS compliant and compatible with both SnPb and Pb-free soldering operations. Intersil Pb-free products are MSL classified at Pb-free peak reflow temperatures that meet or exceed the Pb-free requirements of IPC/JEDEC J STD-020.

Features

- Voltage feedforward
- Step down DC/DC supporting up to 2A
- Input voltage range of 9V to 60V
- Internal reference of $1.21V \pm 1\%$
- Adjustable output voltage range of 1.21V to 35V
- Adjustable switching frequency 100kHz to 600kHz
- Frequency SYNC pin
- Zero load current operation
- Pulse-by-pulse mode current limit
- Hiccup mode short-circuit protection
- Low standby current of $60\mu A$ typical
- Thermal shut-down
- Transient survival up at 100V for 400ms
- Pb-free (RoHS compliant)

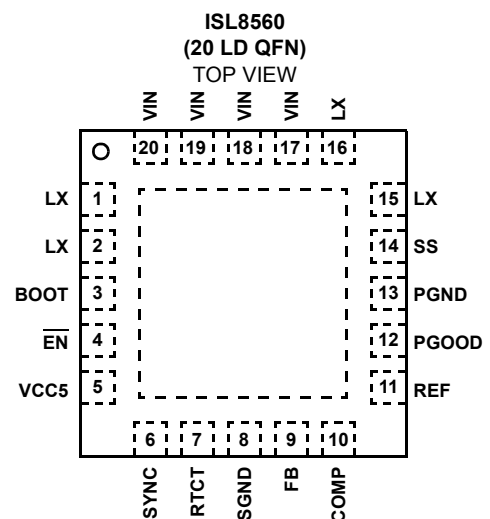
Applications

- Industrial and automotive power supplies
- Portable computers
- Battery chargers
- Distributed power systems

Related Literature

- Technical Brief TB363 "Guidelines for Handling and Processing Moisture Sensitive Surface Mount Devices (SMDs)"

Pinouts



What's Inside

The Evaluation Board Kit contains the following materials:

- The ISL8560EVAL2Z REVB board.
- The ISL8560 datasheet.
- ISL8560 Evaluation Board Application Note.

Recommended Equipment

The following equipment is recommended to evaluate the performance of the board:

- 0V to 100V power supply with at least 5A current sourcing capability.
- Electronic Loads capable of sinking current up to 5A.
- Digital Multimeters (DMMs.)
- 100MHz quad-trace Oscilloscope.
- Signal generator (to test the SYNC feature only).

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, with the positive terminal connected to P1(VIN), and the return to P2(GND).
3. Connect the load across the output terminals, between pins P3 (positive) and P4 (return).
4. Verify that the jumper JP1 is connected.
5. Apply a voltage between 9V and 60V across the input.
6. Verify that the output voltage is 5V.

Evaluating the Other Output Voltage

The ISL8560EVAL2Z kit output is preset to 5V. The output voltage can be adjusted from 1.21V to 55V by Equation 1:

$$R_1 = (R_2) / ((V_{OUT} / V_{FB1}) - 1) \quad (\text{EQ. 1})$$

with $R_2 = 51.1\text{k}\Omega$ and $V_{FB1} = 1.21\text{V}$.

Note: The inductor, output capacitors and the compensation network may need to be tweaked, along with the corresponding compensation network, for optimal performance with change in output voltage and/or load. Also, additional heatsinking or airflow may required to insure that the junction temperature does not exceed +125°C.

Frequency

The ISL8560EVAL2Z kit is preset at 500kHz. The ISL8560EVAL2Z can be adjusted to operate at switching frequencies from 100kHz to 600kHz. Use C₁₆ to program the switching frequency using Equation 2:

$$C_{16}[\text{nF}] = \frac{6.25}{R_7[\text{k}\Omega]} \left(\frac{1000}{f_{\text{OSC}}[\text{kHz}]} - 0.3 \right) \quad (\text{EQ. 2})$$

Synchronization

The ISL8560EVAL2Z circuit may be synchronized to a TTL signal that is set at a higher switching frequency than the pre-set frequency. The range of the external synchronizing frequency is from 100kHz to 600kHz. It is recommended to use an RTCT capacitor (C₁₆) of 2700pF in this configuration.

TABLE 1. SWITCH 1 SETTINGS

JP1	ENABLE	OPERATING MODE
1	OPEN	Unit Disabled
2	GND	Unit Enabled

Schematic

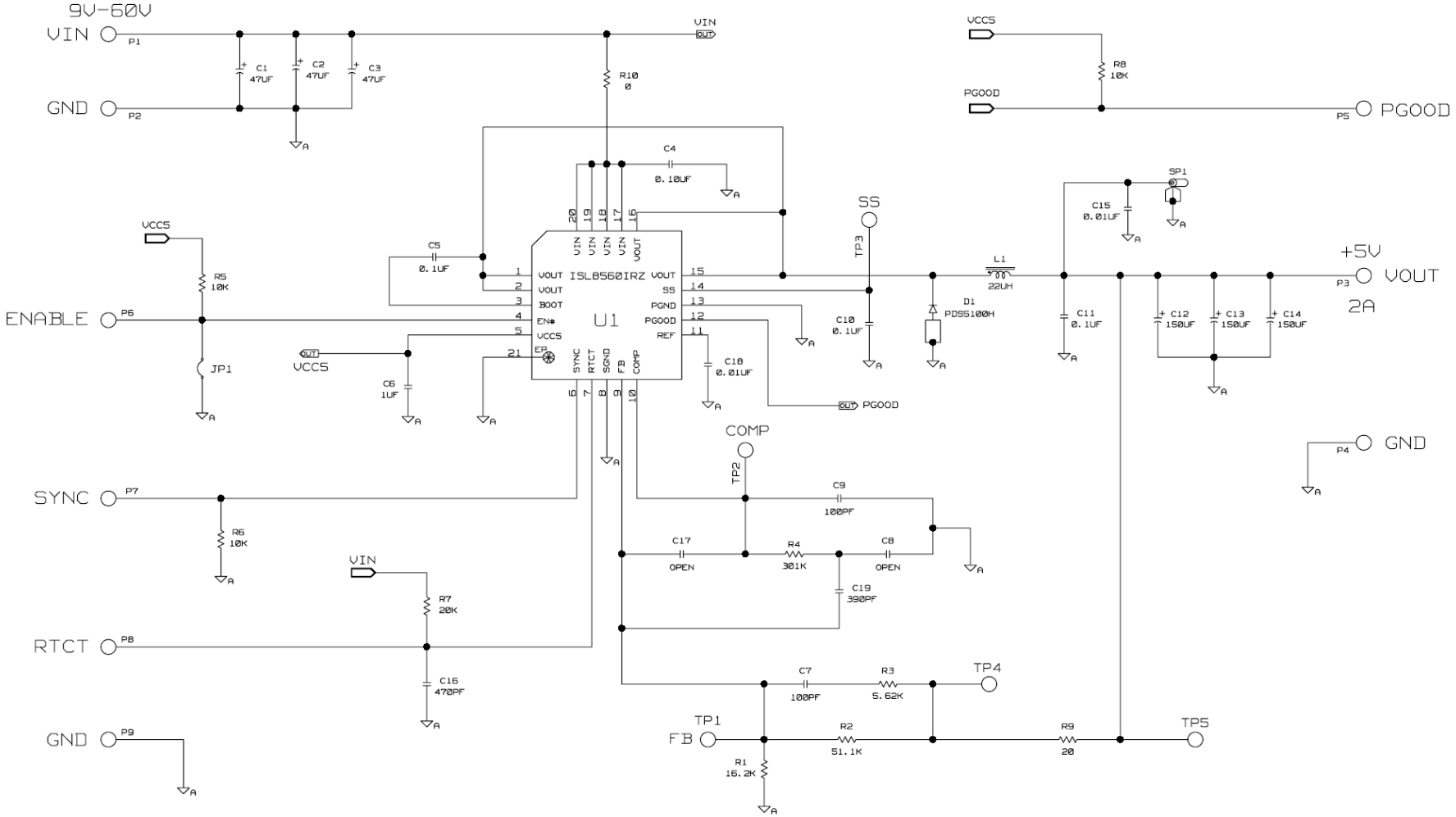


TABLE 2. COMPONENT LIST

REF DES	QTY	VALUE	TOL.	VOLTAGE	PACKAGE	PART NUMBER	MANUFACTURER	DESCRIPTION
C5, C10, C11	3	0.10 μ F	10%	50V	0603	C1608X7R1H104K-T	TDK	CAPACITOR, SMD, 0603, 0.10 μ F, 50V, 10%, X7R
C12-C14	3	150 μ F	20%	25V	8mmx10mm	EEE-FK1E151P-T	PANASONIC	CAPACITOR, SMD, 10.3mm, 150 μ F, 25V, 20%, ROHS, ALUM. ELEC.
C1-C3	3	47 μ F	20	100V	12.5mmx13.5mm	EEV-FK2A470Q-T	PANASONIC	CAPACITOR, SMD, H13, 47 μ F, 100V, 20%, ROHS, ALUM. ELEC.
C7,C9	2	100pF	5%	50V	0603	H1045-00101-50V5-T	AVX, Samsung, TDK, Murata, Vishay	CAPACITOR, SMD, 0603, 100pF, 50V, 5%, NPO, ROHS
C15	1	0.01 μ F	10%	50V	0603	H1045-00103-50V10-T	AVX, Samsung, TDK, Murata, Vishay	CAPACITOR, SMD, 0603, 0.01 μ F, 50V, 10%, X7R, ROHS
C18	1	1 μ F	10%	16V	0603	H1045-00105-16V10-T	AVX, Samsung, TDK, Murata, Vishay	CAPACITOR, SMD, 0603, 1 μ F, 16V, 10%, X7R, ROHS
C19	1	390pF	5%	50V	0603	H1045-00391-50V5-T	AVX, Samsung, TDK, Murata, Vishay	CAPACITOR, SMD, 0603, 390pF, 50V, 5%, NPO, ROHS
C8, C17	0	OPEN	-	-	-	H1045-DNP	AVX, Samsung, TDK, Murata, Vishay	CAPACITOR, SMD, 0603, DNP-PLACE HOLDER, ROHS
C6	1	1.0 μ F	10%	25V	0805	H1046-00105-25V10-T	AVX, Samsung, TDK, Murata, Vishay	CAPACITOR, SMD, 0805, 1.0 μ F, 25V, 10%, X7R, ROHS
C4	1	0.1 μ F	10%	100V	1206	H1065-00104-100V10-T	AVX, Samsung, TDK, Murata, Vishay	CAPACITOR, SMD, 1206, 0.1 μ F, 100V, 10%, X7R, ROHS
C16	1	47pF	5%	50V	1206	H1065-00471-100V5-T	AVX, Samsung, TDK, Murata, Vishay	CAPACITOR, SMD, 1206, 47pF, 50V, 5%, NPO, ROHS
L1	1	22 μ H	20%	-	18mmx15mm	DO5010H-223MLB	COILCRAFT	COIL-PWR INDUCTOR, SMD, 18x15, 22 μ H, 20%, 7A, ROHS, 47m Ω
JP1	1	0 Ω	-	-	Header	SPC02SYAN	SULLINS	CONN-JUMPER, 2 PIN, SHUNT, ROHS
D1	1	5A		100V	Power DI-5	PDS5100H	DIODES INC.	DIODE-RECTIFIER, SMD, Power DI-5,100V, 5A, ROHS, SCHOTTKY
U1	1	2A	-	72V	6x6 QFN	ISL8560IRZ	INTERSIL	IC-STEP DOWN DC/DC CONVERTER, 20P, QFN, 6x6, ROHS
R9	1	20 Ω	1%	100V	0603	H2511-0200-1/10W1-T	PANASONIC	RESISTOR, SMD, 0603, 20 Ω , 1/10W, 1%, TF, ROHS
R5, R6, R8	3	10k	1%	100V	0603	H2511-1002-1/16W1-T	PANASONIC	RESISTOR, SMD, 0603, 10k, 1/16W, 1%, TF, ROHS
R1	1	16.2k	1%	100V	0603	H2511-1622-1/16W1-T	PANASONIC	RESISTOR, SMD, 0603, 16.2k, 1/16W, 1%, TF, ROHS
R4	1	301k	1%	100V	0603	H2511-3013-1/10W1-T	YAGEO	RESISTOR, SMD, 0603, 301k, 1/10W, 1%, TF, ROHS
R2	1	51.1k	1%	100V	0603	H2511-05112-1/16W1-T	PANASONIC	RESISTOR, SMD, 0603, 51.1k, 1/16W, 1%, TF, ROHS
R3	1	5.62k	1%	100V	0603	H2511-5621-1/16W1-T	PANASONIC	RESISTOR, SMD, 0603, 5.62k, 1/16W, 1%, TF, ROHS
R7	1	20k	1%	100V	0603	H2513-02002-1/4W1-T	PANASONIC	RESISTOR, SMD, 1206, 20k, 1/4W, 1%, TF, ROHS
R10	1	0 Ω	1%	100V	0603	H2515-00R00-1W-T	VENKEL	RESISTOR, SMD, 2512, 0 Ω , 1W, TF, ROHS

ISL8560EVAL2Z Board Layout

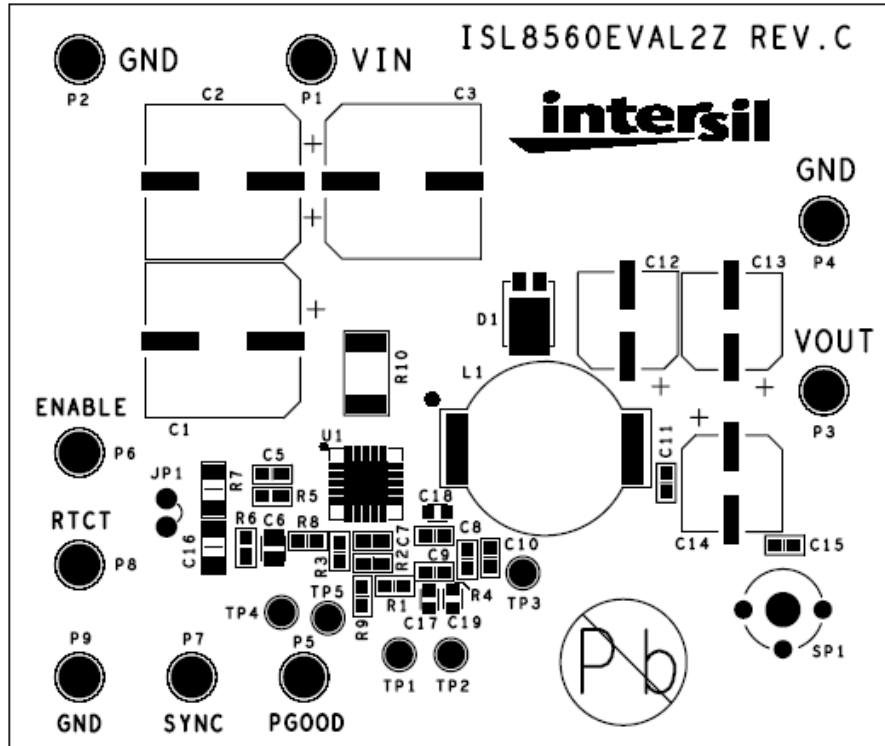


FIGURE 1. TOP COMPONENTS

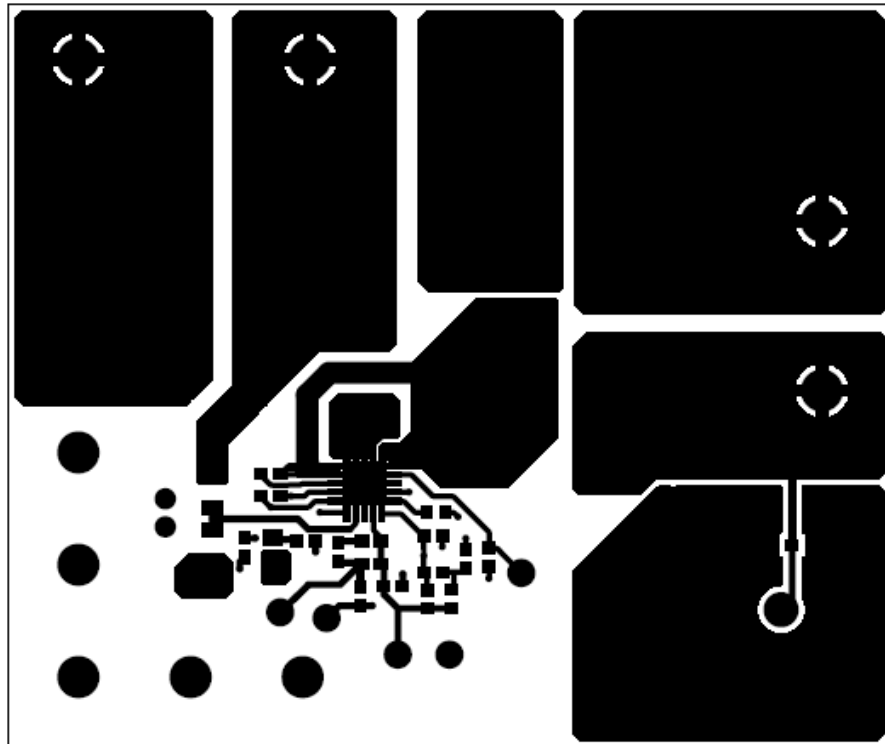


FIGURE 2. TOP LAYER ETCH

ISL8560EVAL2Z Board Layout (Continued)

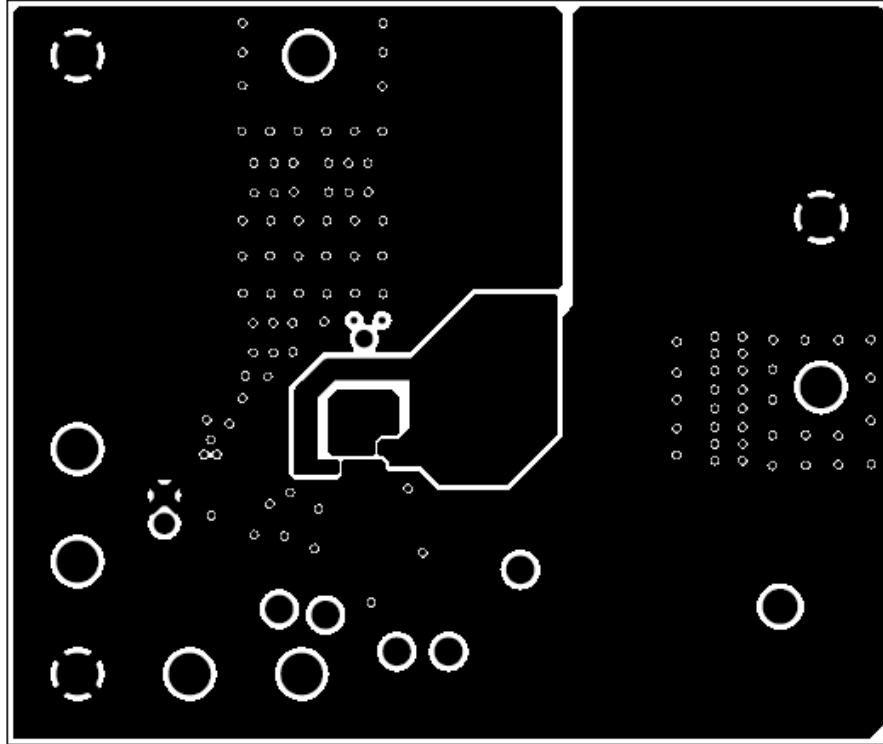


FIGURE 3. 2ND LAYER ETCH

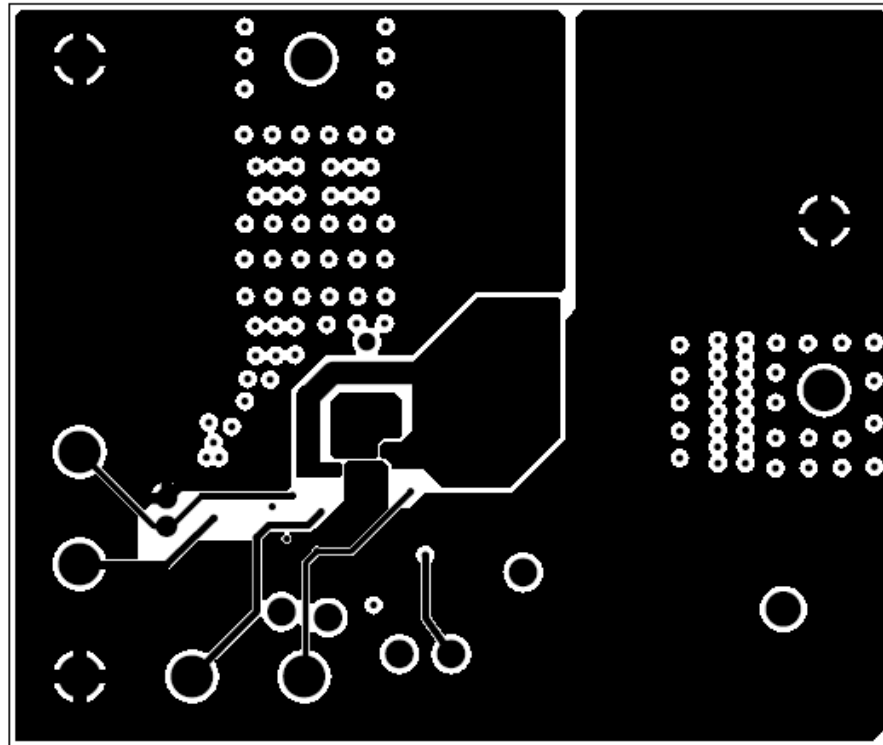


FIGURE 4. 3RD LAYER ETCH

ISL8560EVAL2Z Board Layout (Continued)

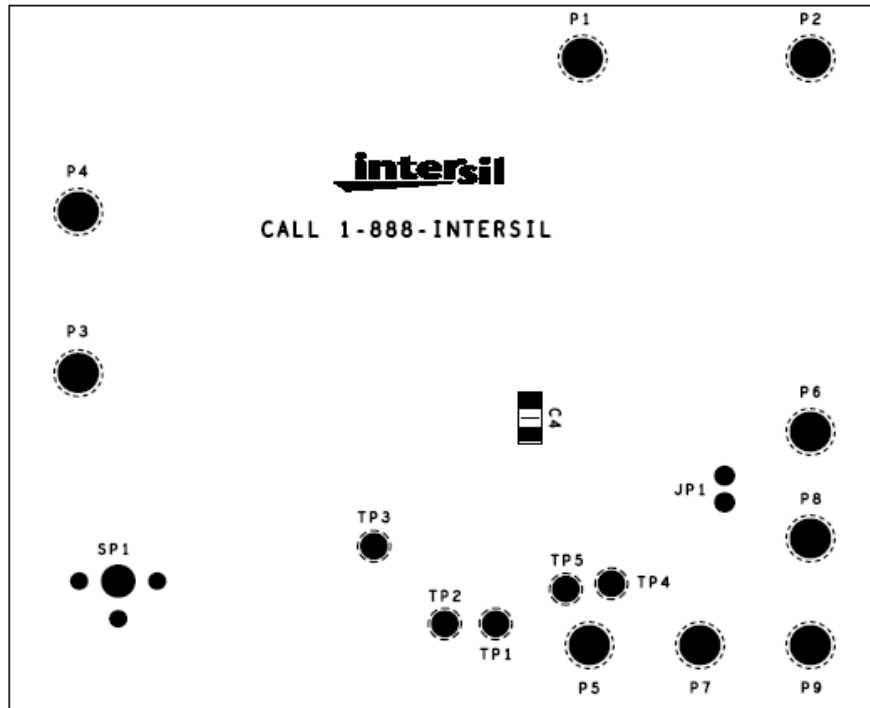


FIGURE 5. BOTTOM LAYER COMPONENTS (MIRRORED)

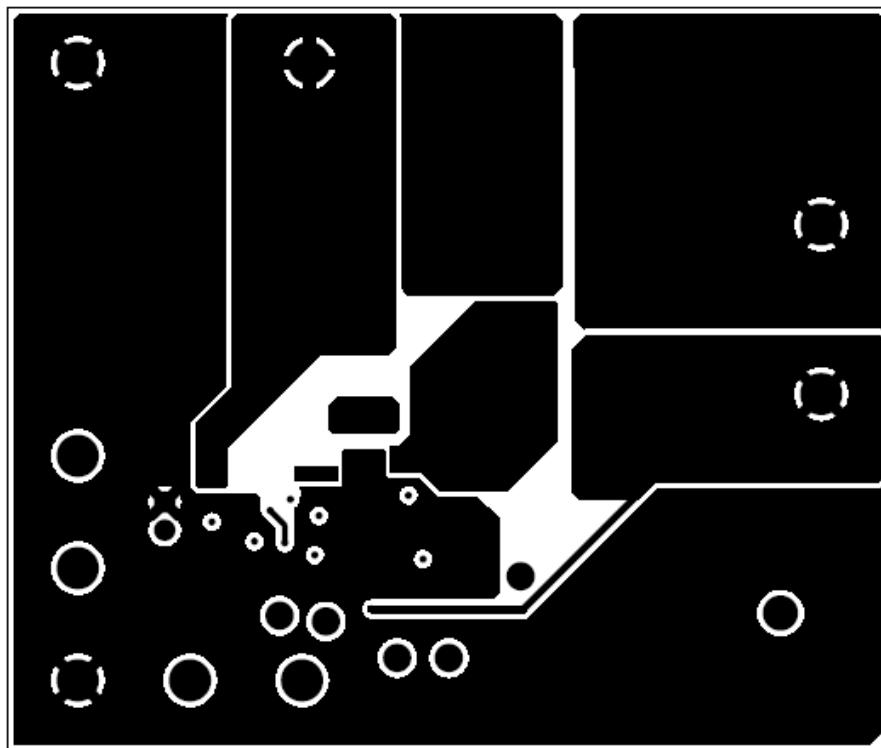


FIGURE 6. BOTTOM LAYER ETCH (MIRRORED)

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
"Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.
"High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.
Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.
6. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
10. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.
(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.
(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.4.0-1 November 2017)



SALES OFFICES

Renesas Electronics Corporation

<http://www.renesas.com>

Refer to "<http://www.renesas.com/>" for the latest and detailed information.

Renesas Electronics America Inc.
1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A.
Tel: +1-408-432-8888, Fax: +1-408-434-5351

Renesas Electronics Canada Limited
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-651-700, Fax: +44-1628-651-804

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
Room 1709 Quantum Plaza, No.27 ZhichunLu, Haidian District, Beijing, 100191 P. R. China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, 200333 P. R. China
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852-2886-9022

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886-2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics India Pvt. Ltd.
No.777C, 100 Feet Road, HAL 2nd Stage, Indiranagar, Bangalore 560 038, India
Tel: +91-80-67208700, Fax: +91-80-67208777

Renesas Electronics Korea Co., Ltd.
17F, KAMCO Yangjae Tower, 262, Gangnam-daero, Gangnam-gu, Seoul, 06265 Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5338