

ISL8012EVAL1Z: 2A Synchronous Buck Regulator with Integrated MOSFETs

2A Low Quiescent Current 1MHz High Efficiency Synchronous Buck Regulator

ISL8012 is an integrated power controller rate for the 2A, 1MHz step-down regulator, which is ideal for any low power, low-voltage application. It is optimized for generating low output voltages down to 0.8V. The supply voltage range is from 2.7V to 5.5V, allowing for the use of a single Li+ cell, three NiMH cells or a regulated 5V input. It has a guaranteed minimum output current of 2A. 1MHz pulse-width modulation (PWM) switching frequency allows using small external components. It has flexible operation mode selection of forced PWM mode and PFM mode with as low as 35µA quiescent current for highest light load efficiency to maximize battery life.

The ISL8012 includes a pair of low ON-resistance P-Channel and N-Channel internal MOSFETs to maximize efficiency and minimize external component count. 100% duty-cycle operation allows less than 400mV dropout voltage at 2A.

The ISL8012 offers a 1ms Power-On-Reset (PG) timer at power-up. The timer output can be reset by RSI. When shutdown, ISL8012 discharges the output capacitor. Other features include internal digital soft-start, enable for power sequence, overcurrent protection and thermal shutdown.

The ISL8012 is offered in a 3mmx3mm 10 Ld DFN package with 1mm maximum height. The complete converter occupies less than 1cm² area.

Ordering Information

PART NUMBER (Notes 1, 2, 3)	PART MARKING	TEMP. RANGE (°C)	PACKAGE (Pb-Free)	PKG. DWG. #
ISL8012IRZ	012Z	-40 to +85	10 Ld 3x3 DFN	L10.3x3C

NOTES:

1. Add "-T" or suffix for tape and reel. Please refer to [TB347](#) for details on reel specifications.
2. 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.
3. For Moisture Sensitivity Level (MSL), please see device information page for [ISL8012](#). For more information on MSL please see techbrief [TB363](#).

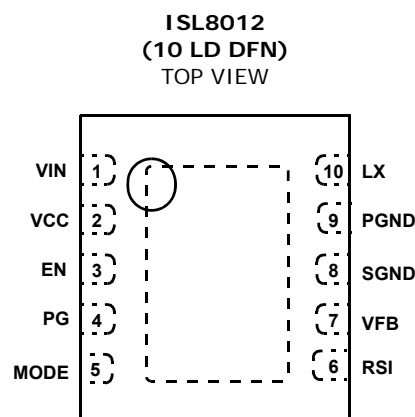
Features

- High Efficiency Synchronous Buck Regulator with up to 95% Efficiency
- 1ms Reset Timer
- Soft Discharge Output Cap During Enable
- 2.7V to 5.5V Supply Voltage
- 3% Output Accuracy Over-Temperature/Load/Line
- 2A Guaranteed Output Current
- 25µA Quiescent Supply Current in PFM Mode
- Selectable Forced PWM Mode and PFM Mode
- Less Than 1µA Logic Controlled Shutdown Current
- 100% Maximum Duty Cycle for Lowest Dropout
- Internal Current Mode Compensation
- Internal Digital Soft-Start
- Peak Current Limiting, Short Circuit Protection
- Over-Temperature Protection
- Enable
- Small 10 Ld 3mmx3mm DFN
- Pb-Free (RoHS Compliant)

Applications

- DC/DC POL Modules
- µC/µP, FPGA and DSP Power
- Plug-in DC/DC Modules for Routers and Switchers
- PGtable Instruments
- Test and Measurement Systems

Pinout



What's Inside

The Evaluation Board Kit contains the following materials:

- The ISL8012EVAL1Z REVC Board
- The ISL8012 Data Sheet
- This EVAL KIT Application Note

Recommended Equipment

The following materials are recommended to perform testing:

- 0V to 10V power supply with at least 3A source current capability, battery and notebook AC adapter
- Two 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, the plus terminal to P4 (VIN) and the negative return to P5 (GND).
3. Verify that SW1 is in the ON position.
4. Turn on the power supply.
5. Verify the output voltage is 1.8V for V_{OUT}

Evaluating the Other Output Voltage

The ISL8012EVAL1Z 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 $R_2 = 100\text{k}\Omega$

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

If the desired output is 0.8V, short R_1 and open R_2 .

Mode Control

The ISL8012 has a MODE pin that controls the operation mode. When the MODE pin is driven to low or shorted to ground, the regulator operates in a forced PWM mode. The forced PWM mode remains the fixed PWM frequency at light load instead of entering the skip mode.

TABLE 1. SWITCH SETTINGS

SW2	SKIP	FUNCTION
	PWM	Fixed PWM Frequency at Light Load
	PFM	Force Continuous Mode
SW1	ENABLE	ON/OFF CONTROL
	OFF	Disable V _{OUT}
	ON	Enable V _{OUT}

ISL8012EVAL1Z Schematic

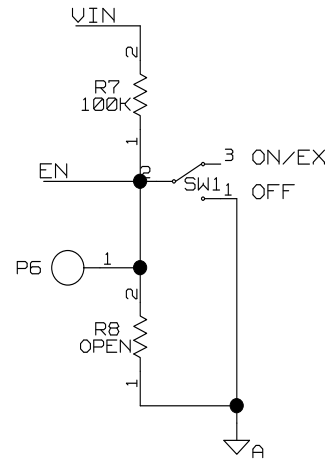
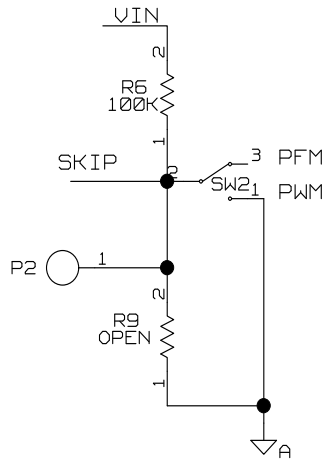
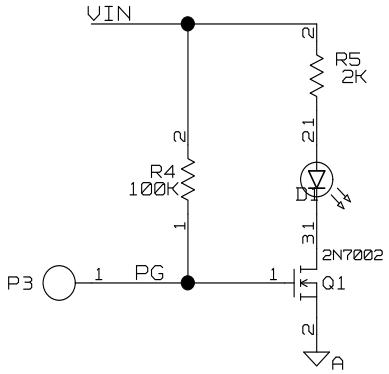
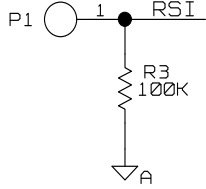
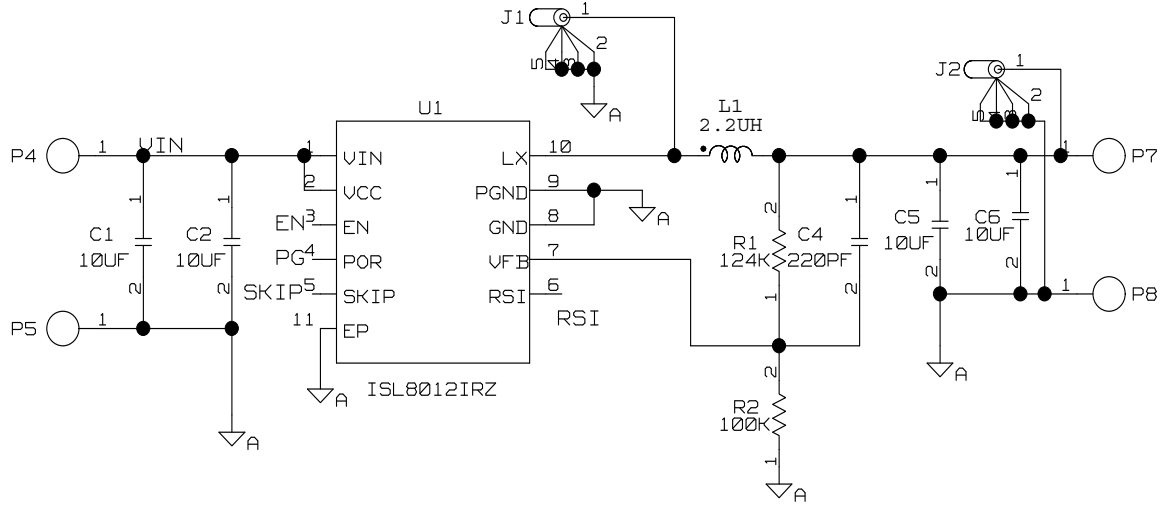


TABLE 2. BILL OF MATERIALS

PART NUMBER	QTY	UNITS	REFERENCE DESIGNATOR	DESCRIPTION	MANUFACTURER	MANUFACTURER PART
ISL8012EVAL1ZREVCPCB	1	ea		PWB-PCB, ISL8012EVAL1Z, REVC, ROHS	IMAGINEERING INC	ISL8012EVAL1ZREVCPCB
GRM31CR71A106KA01L-T	4	ea	C1, C2, C5, C6	CAP, SMD, 1206, 10µF, 10V, 10%, X7R, ROHS, MONOLITHIC	MURATA	GRM31CR71A106KA01L
H1045-00221-50V5-T	1	ea	C4	CAP, SMD, 0603, 220pF, 50V, 5%, COG, ROHS	VENKEL	C0603COG500-221JNE
DR73-2R2-R	1	ea	L1	COIL-PWR INDUCTOR, SMD, 7.6X6, 2.2uH, 20%, 4.15A, ROHS	COOPER ELECTRONIC TECH.	DR73-2R2-R
131-5031-00	2	ea	J1, J2	CONN-SCOPE PROBE TEST PT, COMPACT, PCB MNT, ROHS	TEKTRONIX	131-5031-00
1514-2	4	ea	P4, P5, P7, P8	CONN-TURRET, TERMINAL POST, TH, ROHS	KEYSTONE	1514-2
5002	4	ea	P1-P3, P6	CONN-MINI TEST POINT, VERTICAL, WHITE, ROHS	KEYSTONE	5002
LTST-C170CKT	1	ea	D1	LED-GaAs RED, SMD, 2mmX1.25mm, 100mW, 40mA, 10mcd, ROHS	LITEON/VISHAY	LTST-C170CKT
ISL8012IRZ	1	ea	U1	IC-2A SYNCH. BUCK REGULATOR, 10P, DFN, 2X3, ROHS	INTERSIL	ISL8012IRZ
2N7002-7-F-T	1	ea	Q1	TRANSISTOR, N-CHANNEL, 3LD, SOT-23, 60V, 115mA, ROHS	DIODES, INC.	2N7002-7-F
H2511-01003-1/10W1-T	5	ea	R2-R4, R6, R7	RES, SMD, 0603, 100k, 1/10W, 1%, TF, ROHS		
H2511-01243-1/10W1-T	1	ea	R1	RES, SMD, 0603, 124k, 1/10W, 1%, TF, ROHS	YAGEO	9C06031A1243FKHFT
H2511-02001-1/10W1-T	1	ea	R5	RES,SMD,0603, 2k, 1/10W, 1%, TF, ROHS	KOA	RK73H1JTTD2001F
H2511-DNP	0	ea	R8, R9	RES, SMD, 0603, DNP-PLACE HOLDER, ROHS		
GT11MSCBE-T	2	ea	SW1, SW2	SWITCH-TOGGLE, SMD, 6PIN, SPDT, 2POS, ON-ON, ROHS	ITT INDUSTRIES/ C&K DIVISION	GT11MSCBE
4-40X1/2-SCREW	4	ea	Four corners.	SCREW, 4-40X1/2in, PAN, NYLON, PHILLIPS, ROHS		
4-40X3/4-STANDOFF	4	ea	Four corners.	STANDOFF, 4-40X3/4in, F/F, HEX, NYLON	KEYSTONE	1902D
5X8-STATIC-BAG	1	ea	Place assy in bag.	BAG, STATIC, 5X8, ZIP LOC	INTERSIL	212403-013
LABEL-SERIAL NUMBER	1	ea		LABEL, FOR SERIAL NUMBER AND BOM REV #		

ISL8012EVAL1Z Board Layout

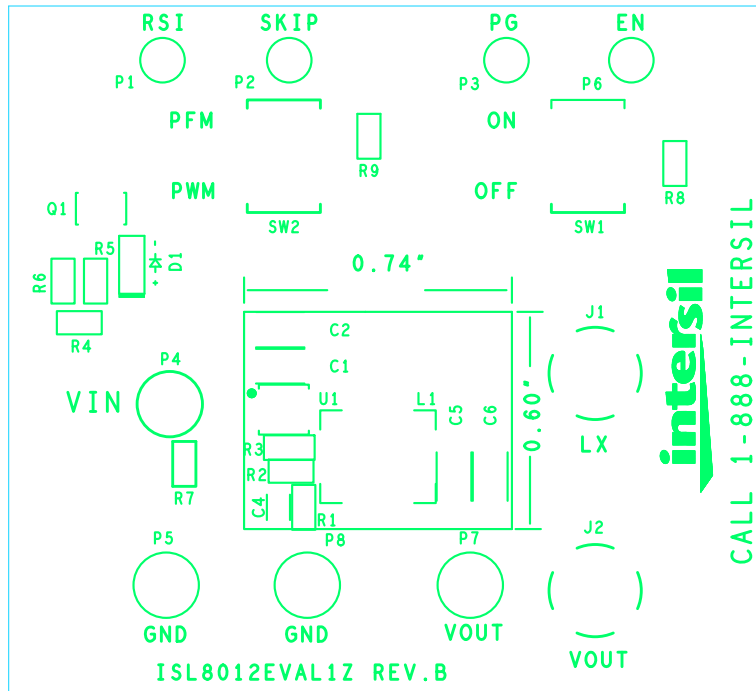


FIGURE 1. TOP COMPONENTS

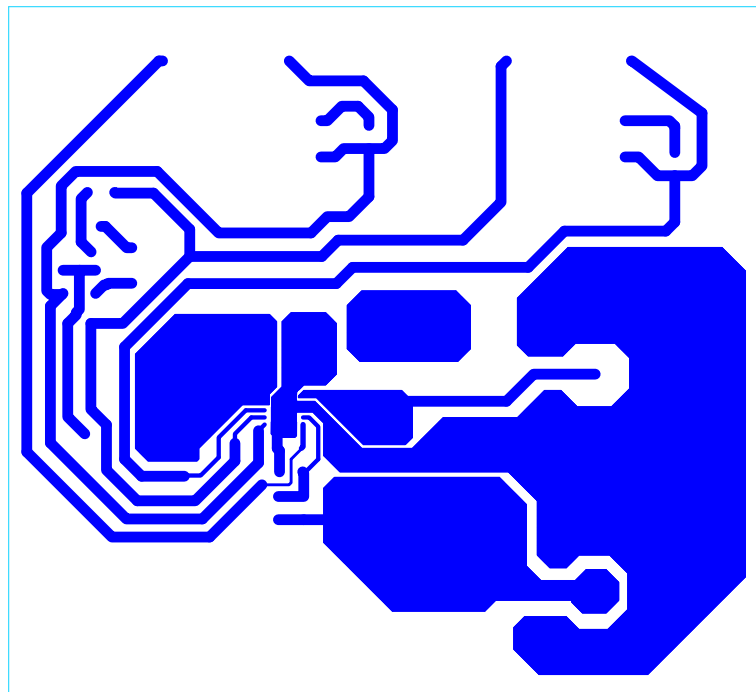


FIGURE 2. TOP LAYER ETCH

ISL8012EVAL1Z Board Layout (Continued)

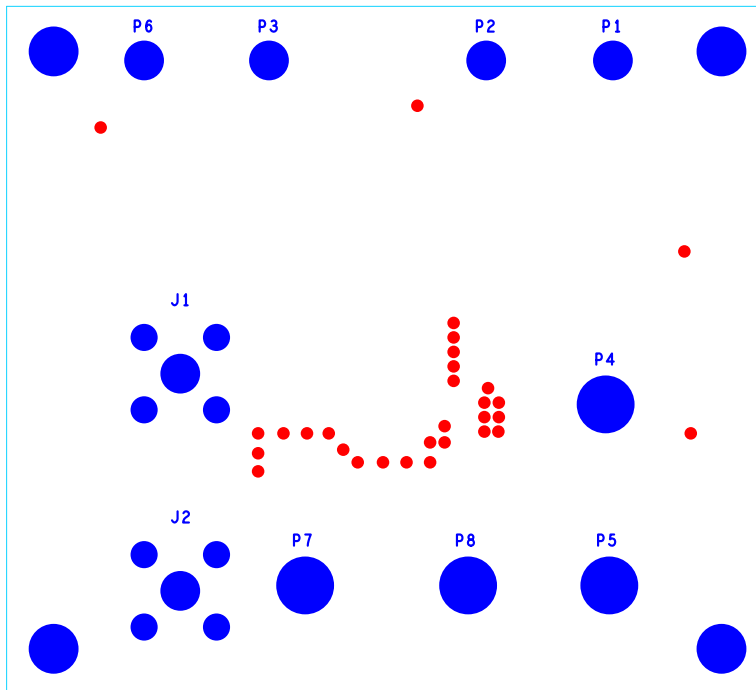


FIGURE 3. BOTTOM LAYER COMPONENTS (MIRRORED)

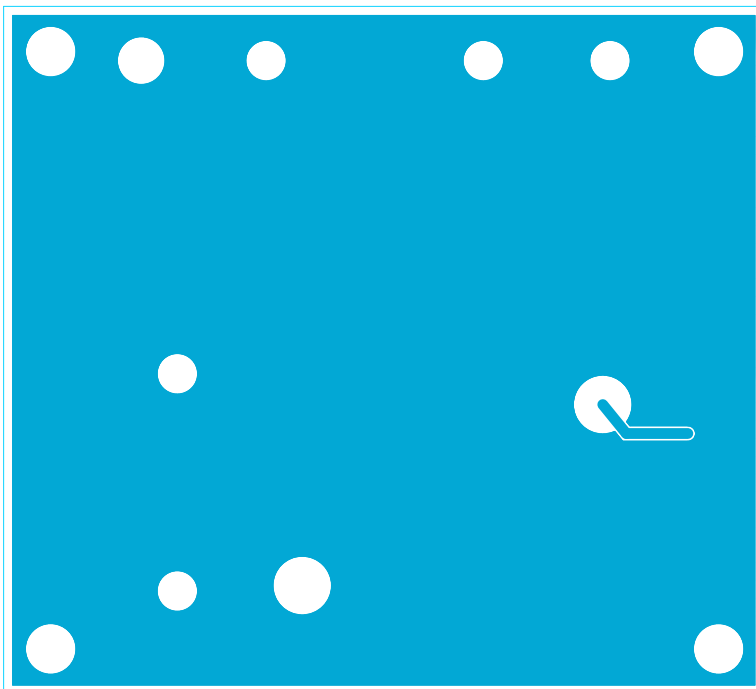


FIGURE 4. BOTTOM LAYER ETCH (MIRRORED)

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