

## ISL85003EVAL2Z, ISL85003AEVAL2Z

Evaluation Board User Guide

AN1930  
Rev.1.00  
Aug 28, 2014

### Description

The ISL85003 and ISL85003A kits are intended for use for point-of-load applications sourcing from 4.5V to 18V. The kits are used to demonstrate the performance of the ISL85003 and ISL85003A, low quiescent current high efficiency synchronous buck regulators.

The ISL85003 and ISL85003A are offered in a 4x3mm dual flat no lead (DFN) package.

### Specifications

The boards are designed to operate at the following operating conditions:

- Input voltage range from 4.5V to 18V
- Resistor programmable output voltage from 0.8V, ±1%
- Up to 3A output current
- Current mode control
  - DCM/CCM
  - Internal or external compensation options
  - 500kHz switching frequency option
  - External synchronization up to 2MHz on ISL85003
- Adjustable soft-start time on the ISL85003A
- Operating junction temperature range: -40 °C to +125 °C

### 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 VO, the plus terminal to VO (P8) and the negative return to PGND (P9).
4. Verify that the position is PWM or PFM for SW2.
5. Verify that the position is ON for SW1.
6. Turn on the power supply.
7. Verify the output voltage is 5V for VO.

### Recommended Equipment

The following materials are recommended to perform testing:

- 0V to 25V power supply with at least 10A source current capability
- Electronic loads capable of sinking current up to 7A
- Digital multimeters (DMMs)
- 100MHz quad-trace oscilloscope
- Signal generator

### Key Board Features

- Small, compact design
- Switch selectable EN (enabled/disabled)
- Switch selectable MODE (auto-DCM/forced-PWM)
- Connectors and test points for easy probing

### References

- [ISL85003](#), [ISL85003A](#) datasheet

### Ordering Information

PART NUMBER	DESCRIPTION
ISL85003EVAL2Z	Evaluation Board for ISL85003FRZ and ISL85003AFRZ

### Evaluating the Other Output Voltage

The ISL85003 and ISL85003A kit outputs are preset to 5V for V<sub>OUT</sub>; however, the output voltages are programmed using an external resistor divider that scales the feedback relative to the internal reference voltage. The output voltage programming resistor, R<sub>2</sub>, will depend on the value chosen for the feedback resistor, R<sub>1</sub>, and the desired regulator output voltage, V<sub>OUT</sub>. The value for the feedback resistor R<sub>1</sub> is typically between 10kΩ and 400kΩ, as shown in [Equation 1](#).

$$R_2 = \frac{R_1 \cdot 0.8V}{V_{OUT} - 0.8V} \quad (\text{EQ. 1})$$

If the output voltage desired is 0.8V, then R<sub>2</sub> is left unpopulated. R<sub>1</sub> is still required to set the low frequency pole of the modulator compensation.

### Switch Control

The ISL85003 and ISL85003A evaluation boards contain SW1 and SW2 for various controls of the ISL85003 and ISL85003A 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	DCM	Force DCM
3	PWM	Fixed PWM frequency at light load

## Components Selection

V <sub>OUT</sub>	0.8V	1V	1.2V	1.5V	1.8V	2.5V	3.3V	5V
C <sub>1</sub> , C <sub>2</sub>	10μF	10μF	10μF	10μF	10μF	10μF	10μF	10μF
C <sub>5</sub>	22μF	22μF	22μF	47μF	47μF	47μF	47μF	47μF
C <sub>6</sub>	22μF	22μF	22μF	22μF	22μF	22μF	22μF	22μF
C <sub>4</sub>	Open	Open	Open	4.7pF	4.7pF	4.7pF	4.7pF	4.7pF
L <sub>1</sub>	1.8μH	2.2μH	2.2μH	3.3μH	3.3μH	3.3μH	4.7μH	4.7μH
R <sub>1</sub>	301kΩ	301kΩ	301kΩ	301kΩ	301kΩ	301kΩ	301kΩ	301kΩ
R <sub>2</sub>	Open	1.2MΩ	604kΩ	344kΩ	241kΩ	142kΩ	96.3kΩ	57.6kΩ

NOTE: V<sub>IN</sub> = 12V, I<sub>OUT</sub> = 3A; The components selection table is a suggestion for typical application using internal compensation mode. For applications that require high output capacitance greater than 200μF, R<sub>1</sub> should be adjusted to maintain a loop response bandwidth about 40kHz.

## ISL85003EVAL2Z Evaluation Board

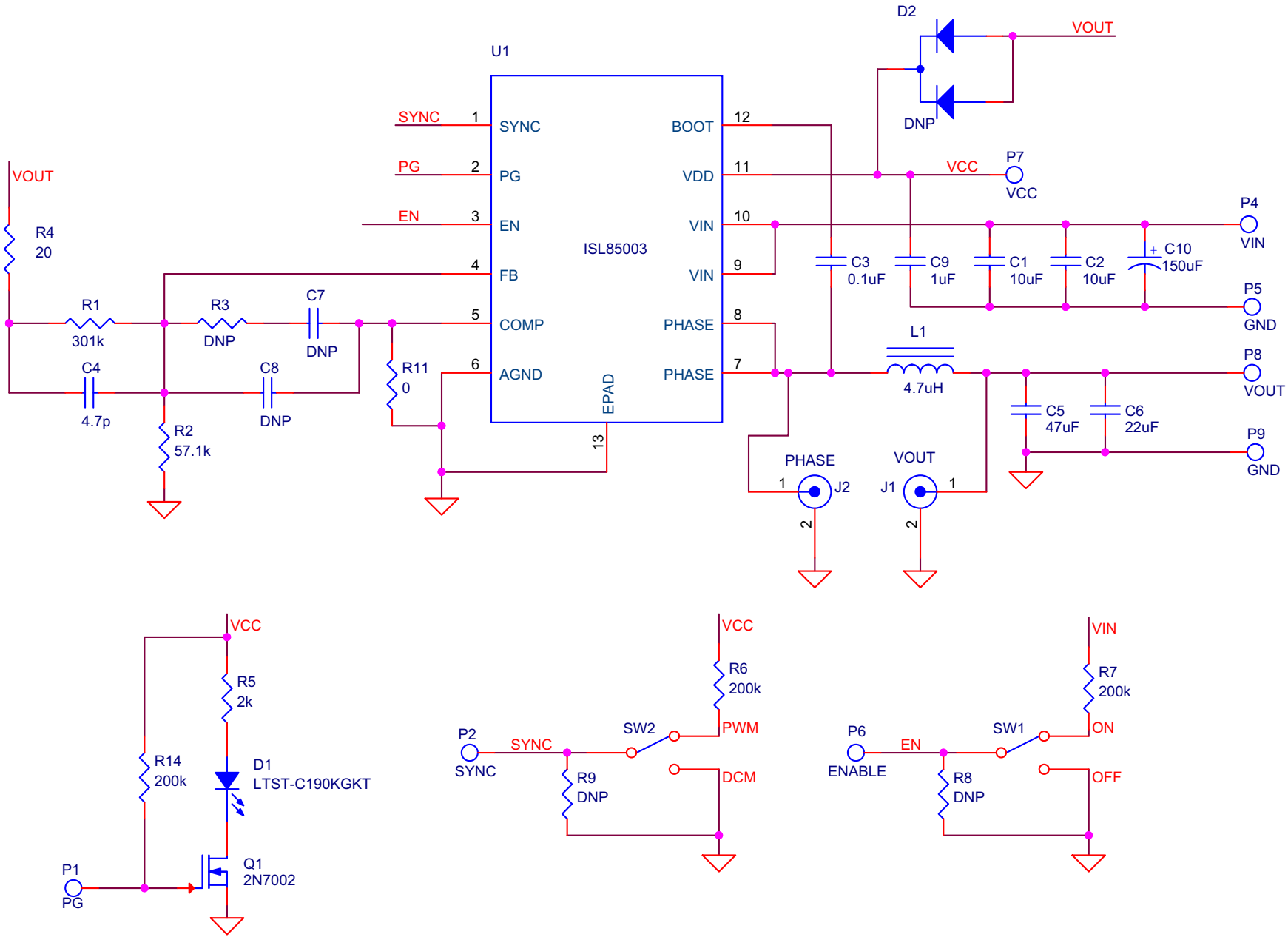


FIGURE 1. TOP VIEW



FIGURE 2. BOTTOM VIEW

# ISL85003EVAL2Z Rev B Schematic



## Bill of Materials

PART NUMBER	QTY	UNITS	REFERENCE DESIGNATOR	DESCRIPTION	MFR	MFR PART #
ISL85003FRZ	1	ea	U1	IC-3A BUCK REGULATOR, 12P, DFN, 4X3, ROHS	INTERSIL	ISL85003FRZ
ISL85003AFRZ	1	ea	U1	IC-3A BUCK REGULATOR PWM, 12P, DFN, 4X3, ROHS	INTERSIL	ISL85003AFRZ
EEE-FK1H151P-T	1	ea	C10	CAP, SMD, 10.3mm, 150µF, 50V, 20%, ROHS, ALUM.ELEC.	PANASONIC	EEE-FK1H151P
H1044-004R7-50VR25-T	1	ea	C4	CAP, SMD, 0402, 4.7pF, 50V, 0.25pF, NPO, ROHS	MURATA	GRM36COG4R7C050AQ
H1044-DNP	0	ea	C7, C8, CSS	CAP, SMD, 0402, DNP-PLACE HOLDER, ROHS		
H1045-00104-50V10-T	1	ea	C3	CAP, SMD, 0603, 0.1µF, 50V, 10%, X7R, ROHS	AVX	06035C104KAT2A
H1045-00105-16V10-T	1	ea	C9	CAP, SMD, 0603, 1µF, 16V, 10%, X5R, ROHS	MURATA	GRM188R61C105KA12D
H1065-00106-25V10-T	2	ea	C1, C2	CAP, SMD, 1206, 10µF, 25V, 10%, X7R, ROHS	VENKEL	C1206X7R250-106KNE
H1065-00226-25V10-T	2	ea	C5, C6	CAP, SMD, 1206, 22µF, 25V, 10%, X5R, ROHS	MURATA	GRM31CR61E226KE15L
RLF7030T-4R7M3R4	1	ea	L1	COIL-PWR INDUCTOR, SMD, 7.3X6.8mm, 4.7µH, 20%, 3.5A, ROHS	TDK	RLF7030T-4R7M3R4
131-4353-00	2	ea	J1, J2	CONN-SCOPE PROBE TEST PT, COMPACT, PCB MNT, ROHS	TEKTRONIX	131-4353-00
1514-2	4	ea	P4, P5, P8, P9	CONN-TURRET, TERMINAL POST, TH, ROHS	KEYSTONE	1514-2
5002	4	ea	P1, P2, P6, P7	CONN-MINI TEST POINT, VERTICAL, WHITE, ROHS	KEYSTONE	5002
BAT54C-T	1	ea	D2	DIODE-RECTIFIER, SMD, SOT23, 3P, 30V, 200mA, ROHS	FAIRCHILD	BAT54C
LTST-C190KGKT-T	1	ea	D1	LED, SMD, 0603, GREEN CLEAR, 2V, 20mA, 571nm, 35mcd, ROHS	LITEON/VISHAY	LTST-C190KGKT
2N7002LT1G-T	1	ea	Q1	TRANSISTOR-MOS, N-CHANNEL, SMD, SOT23, 60V, 115mA, ROHS	ON SEMICONDUCTOR	2N7002LT1G
H2510-00R00-1/16W-T	1	ea	R11	RES, SMD, 0402, 0Ω, 1/16W, 5%, TF, ROHS	VENKEL	CR0402-16W-00T
H2510-03013-1/16W1-T	1	ea	R1	RES, SMD, 0402, 301k, 1/16W, 1%, TF, ROHS	YAGEO	RC0402FR-07301KL
H2510-05762-1/16W1-T	1	ea	R2	RES, SMD, 0402, 57.6k, 1/16W, 1%, TF, ROHS	PANASONIC	ERJ-2RKF5762X
H2510-DNP	0	ea	R3	RES, SMD, 0402, DNP, DNP, DNP, TF, ROHS		
H2511-00200-1/10W1-T	1	ea	R4	RES, SMD, 0603, 20Ω, 1/10W, 1%, TF, ROHS	PANASONIC	ERJ-3EKF20R0V
H2511-02001-1/10W1-T	1	ea	R5	RES, SMD, 0603, 2k, 1/10W, 1%, TF, ROHS	KOA	RK73H1JTTD2001F
H2511-02003-1/10W1-T	3	ea	R6, R7, R14	RES, SMD, 0603, 200k, 1/10W, 1%, TF, ROHS	VENKEL	CR0603-10W-2003FT
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
SJ-5003-BLACK	4	ea	Bottom four corners	BUMPONS, 0.44inW x 0.20inH, DOMETOP, BLACK	3M	SJ-5003SPBL

## PCB Layout

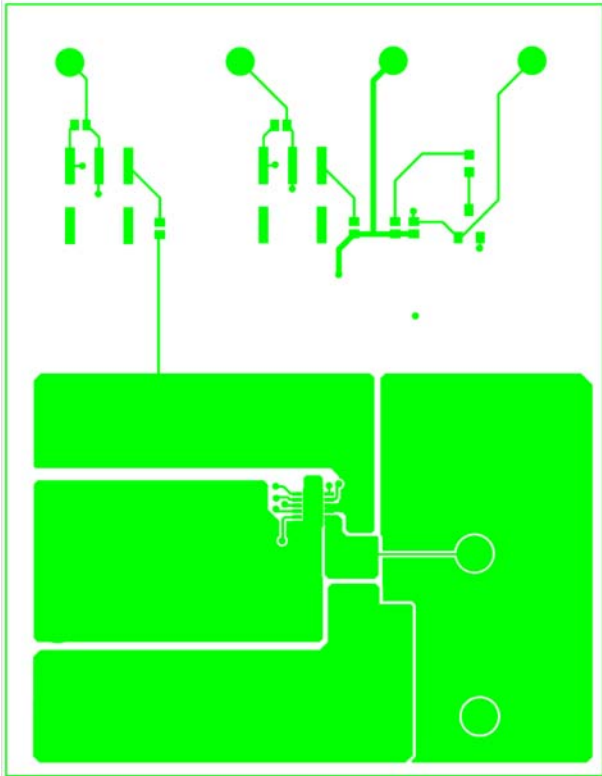


FIGURE 3. TOP LAYER

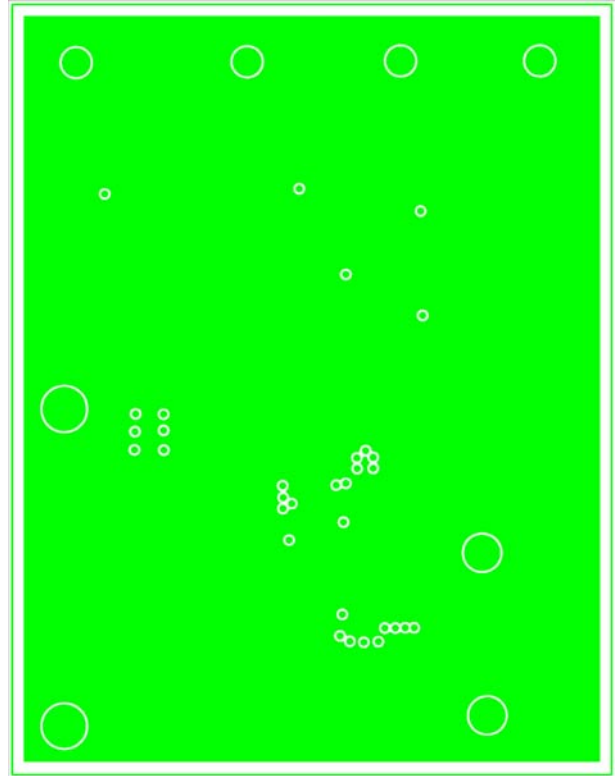


FIGURE 4. INNER LAYER 1

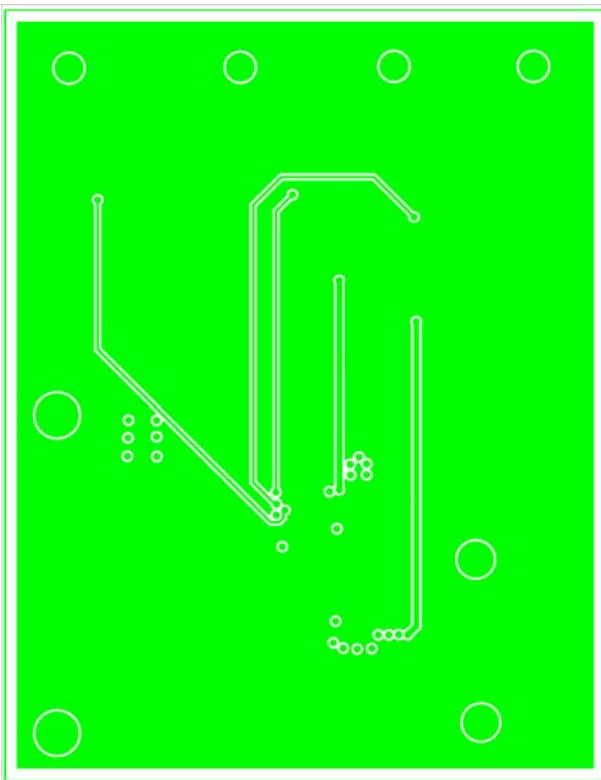


FIGURE 5. INNER LAYER 2

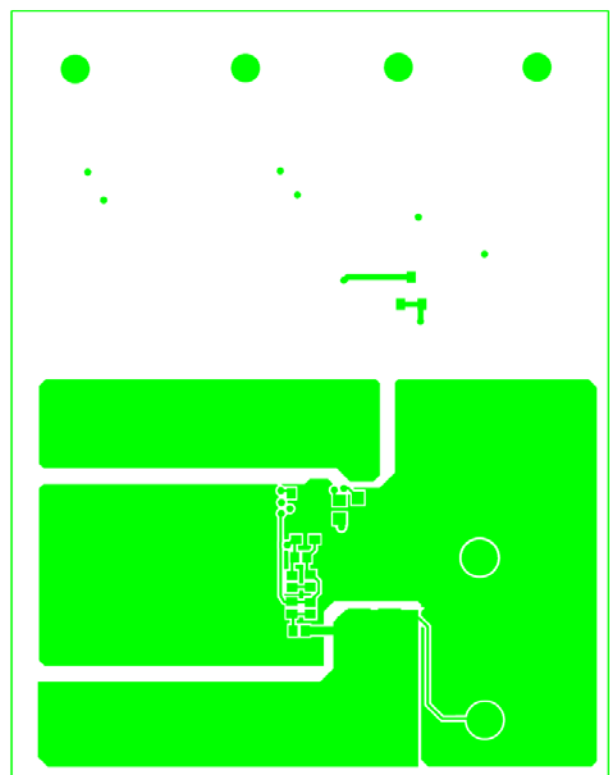


FIGURE 6. BOTTOM LAYER

## 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