

ISL54065EVAL1Z

Evaluation Board

AN1370
Rev 0.00
February 3, 2009

Description

The ISL54065EVAL1Z evaluation board is designed to provide a quick and easy method for evaluating the ISL54065 IC.

The ISL54065 IC is a single supply Dual Single-Pole Double Throw (SPDT) analog switch with negative swing capability, sub- Ω ON-resistance and low power dissipation. The ISL54065 is designed for applications that require an analog switch that may see voltages below ground at the switch terminals, such as audio and video. The ISL54065EVAL1Z evaluation board is developed to evaluate the ISL54065 IC, integrating many features for ease of use in examining the performance of the device under various operating conditions. To help understand the operation of the ISL54065 IC and the ISL54065EVAL1Z evaluation board, it is recommended to study the Evaluation Board Schematic on page 5 of this application note, and refer to the datasheet for the ISL54065 IC.

The ISL54065 IC is a dual SPDT analog switch that is capable of swinging down to 6.5V below the positive supply rail. For example, if the supply is at +1.8V, the switch terminal analog operating range is from -4.3V to +1.8V. The ISL54065 also integrates Click and Pop Elimination Circuitry to remove transient noises at the speaker during power ON/OFF of an audio system. The evaluation board contains standard RCA/BNC connectors and a single headphone jack to allow the user to easily interface with the IC to evaluate its functions, features, and performance. The evaluation board has selectable output loads of 20k Ω and 32 Ω resistors to simulate an audio amplifier pre-amp or stereo headphones. The board also has DC blocking capacitors at the switch input to remove the DC bias of single supply amplifiers.

This application note will guide the user through the process of configuring and using the evaluation board to evaluate the ISL54065 device.

Key Features

- Selectable Output Resistive Loads and Input DC Blocking Capacitors
- RCA Audio Input/Output Jacks, Stereo Headphone Output Jack and BNC Connectors
- Convenient Test Points and Connections for Test Equipment
- Click and Pop Elimination Circuitry
- Manual or External Logic Input Control

Picture of Evaluation Board (Top View)

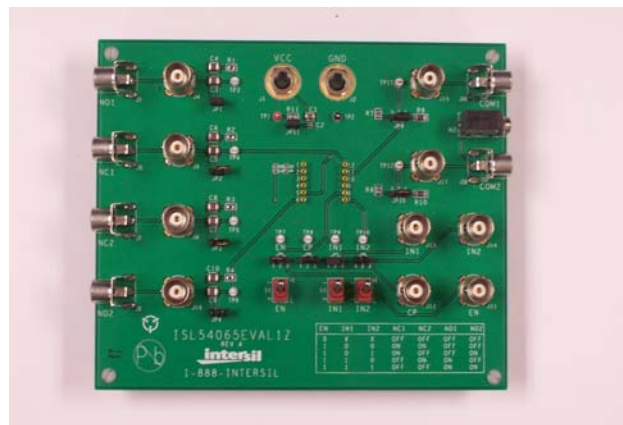


FIGURE 1. ISL54065EVAL1Z EVALUATION BOARD

Board Architecture/Layout

Basic Layout of Evaluation Board

A picture of the evaluation board is located in Figure 1. The ISL54065 IC is soldered onto a 12 Ld wide DIP header board. The DIP header board is mounted to the center of the evaluation board. The evaluation board integrates the necessary connections and components to interface with the ISL54065 for ease of operation.

Power Supply

The ISL54065 IC requires a supply voltage in the range of +1.8V to +6.5V for proper operation. Banana jacks for V_{CC} (J1) and GND (J2) are located at the top of the board. The evaluation board contains a 10 μ F bulk capacitor and a 0.1 μ F high frequency decoupling capacitor at the supply lines.

Logic Control

The evaluation board contains two types of logic control to the digital logic inputs of the ISL54065 IC available to the user. The logic pins can be controlled either through manual or external operation. The logic control pins are manually toggled by the SPST switches mounted on the evaluation board (S1-S3). When the switch is in the up position (H) the associated logic pin is pulled to V_{CC} for logic HIGH. When the switch is in the down position (L) the associated logic pin is pulled to GND for logic LOW. For manual operation, the jumpers JP5-JP8 need to be in the 1-2 position.

Note: When JP6 is in the 1-2 position, the CP pin is automatically logic HIGH.

For external control via a function generator or switched source, set the jumpers JP5-JP8 in the 2-3 position. This by-passes the SPST switches and routes the logic control to

the BNC connectors (J11-J14 located on the right side of the board).

Note: S2 and S3 have a 3.9M Ω pull-down resistor hard-wired from the INx pin to GND. These resistors do not appear on the ISL54065EVAL1Z Board Schematic on page 5.

Switch Terminals

The evaluation board contains components to interface with all six terminals of the Dual SPDT switch. The common (COM) terminals of the switch are located in the upper right section of the evaluation board. The Normally Open (NO) and Normally Closed (NC) terminals of the switch are located on the left side of the evaluation board. All switch terminals include both RCA jacks and BNC connectors. The COM terminals also include a headphone jack (HJ1) for connecting a stereo headphone or line level plug.

Refer to Table 1 for a list of the pins on the ISL54065 IC and the associated components on the evaluation board. The evaluation board also includes Test Points for convenient locations to probe specific pins on the IC.

TABLE 1. BOARD COMPONENT TABLE

ISL54065 PIN	EVALUATION BOARD CONNECTION	TEST POINT
VCC	J1	TP1
GND	J2	TP2
EN	S1, J11	TP7
CP	J12	TP8
IN1	S2, J13	TP9
IN2	S3, J14	TP10
NO1	J3, J4	TP3
NC1	J5, J6	TP4
COM1	J15, J16, HJ1	TP11
NO2	J9, J10	TP6
NC2	J7, J8	TP5
COM2	J17, J18, HJ1	TP12

Note: The audio inputs (NCx and NOx) have a 200 μ F series DC blocking capacitance that can be used for AC coupling audio signals that are DC biased in single supply systems. If the audio source is not DC biased or if the audio source already has a DC blocking capacitor, it is recommended to bypass the capacitors (C3-C10) by placing jumpers on JP1-JP4. The capacitance can be reduced to 100 μ F by depopulating the 0 Ω resistor on R1-R4.

The audio outputs (COM1 and COM2) have selectable output loads on the evaluation board. Jumpers JP9 and JP10 configure the output load resistance. When the jumpers are in the 1-2 position, the load impedance is 32 Ω . When the jumpers are in the 2-3 position, the load

impedance is 20k Ω . If the user decides to have no load impedance on the evaluation board, simply remove the jumpers.

Power Supply

The DC power supply connected at banana jacks J1 (VCC) and J2 (GND) provides power to the evaluation board. The evaluation board requires a +1.8V to +6.5V DC power supply for proper operation. The power supply should be capable of delivering 100 μ A of current.

Logic Control

The state of the ISL54065 device is determined by the Truth Table as defined in the ISL54065 datasheet. When in manual operation mode, the logic being toggled by the SPST switches (S1-S3) will always drive the voltage of the logic pin to V_{CC} for a HIGH and GND for a LOW. In external control mode, the voltages being driven by an external source must meet appropriate V_{IH} and V_{IL} levels as defined in the datasheet.

The control pins are 1.8V logic compatible up to a +3.3V supply, which allows for control via a standard μ controller.
Logic "0" (LOW) when $\leq 0.5V$
Logic "1" (HIGH) when $\geq 1.4V$

When operating above +3.3V supply, refer to the datasheet for appropriate logic levels to drive the logic pins. It is always recommended to drive the logic pins to the positive supply rail (V_{CC}) and GND to minimize power consumption.

Logic States

INPUT SELECT (INX) PINS

If the INx Pins are logic "HIGH", then the NOx switches are turned ON and the NCx switches are turned OFF. If the INx Pins are logic "LOW", then the NCx switches are turned ON, and the NCx switches are turned OFF.

ENABLE (EN) PIN

If the EN Pin is logic "HIGH" the switches are active and their logic state dependent on the INx pins. If the EN Pin is logic "LOW", both COMx terminals are turned OFF from the NCx and NOx switch terminals. The part is disabled and no signals will pass through the switch.

CLICK AND POP (CP) PIN

If the CP Pin is logic "HIGH", shunt resistors are activated on the NOx and NCx terminals to ground when the switch is OFF. For example, if INx is logic "HIGH", the NCx switches are turned OFF. There will be a shunt resistance from the NCx to ground. The value of this resistor is dependent on supply voltage, but is typically 140 Ω with a 3.3V supply.

Driving the CP pin logic "LOW" will deactivate the Click and Pop Elimination Circuitry and there will be no active shunt resistors on the switch terminals when a switch is turned OFF.

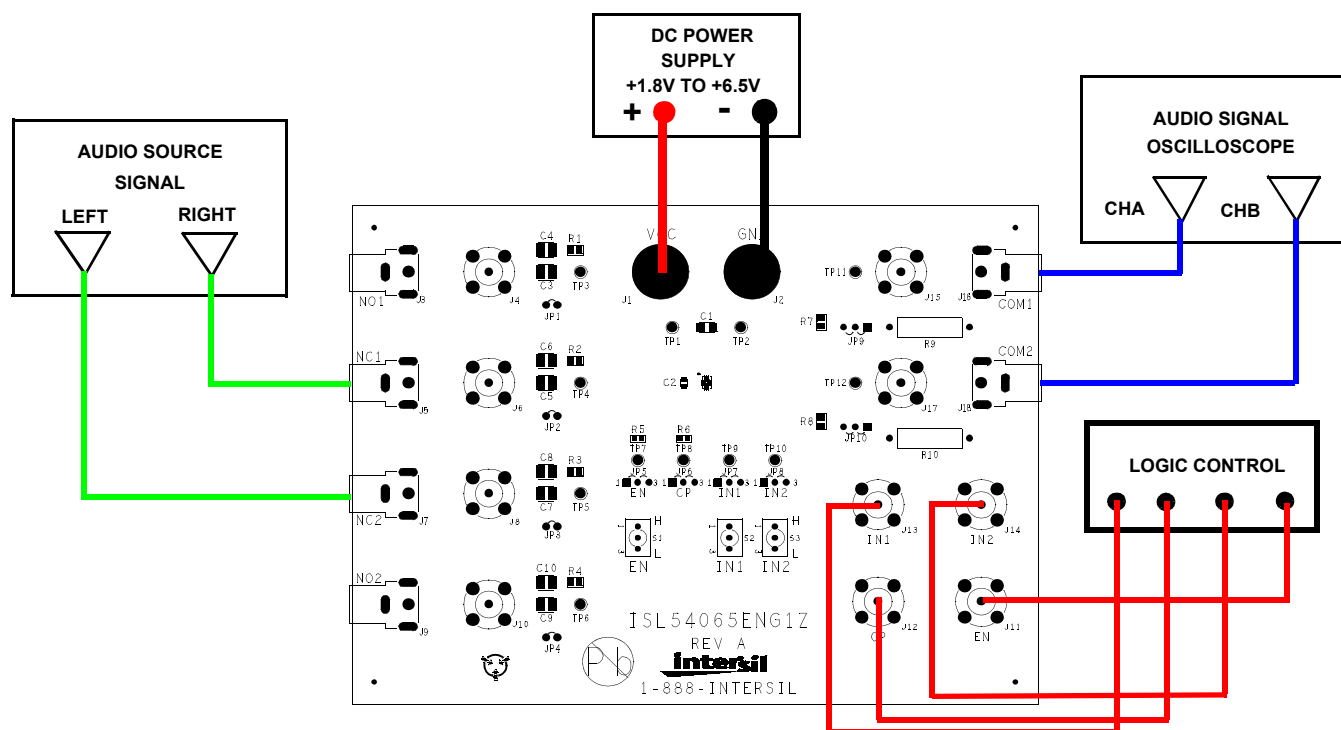


FIGURE 2. BASIC EVALUATION TEST SETUP BLOCK DIAGRAM

Note: If the CP is logic "HIGH", and EN is logic "LOW", the NCx and the NOx switch terminals will have the Click and Pop Elimination Circuitry active. Under this scenario, both switch terminals will have a shunt resistor to ground.

CLICK AND POP OPERATION

Single supply audio sources are biased at a DC offset that generates transients during power ON/OFF of the audio source. This DC offset is coupled through a blocking capacitor that is needed to remove the DC bias to the speaker, causing a transient voltage at the load. For example, when the source is OFF and suddenly turned ON with a DC offset, the capacitor will develop a voltage equal to the DC offset. If the ISL54065 does not have the Click and Pop Elimination Circuitry active, a transient discharge will occur in the speaker, generating a Click and Pop noise.

For proper operation of Click and Pop elimination, the switch terminal that is being connected to the speaker should be

connected through the shunt resistor before connecting to the load. This allows any transients generated by the source to be discharged through the shunt resistor first, eliminating any audible click and pop noises. With a typical DC blocking capacitor of 200μF and the shunt resistance having a typical value of 140Ω, allowing a 250ms dead time in for discharging a transient will eliminate the click and pop noise.

Applications

The ISL54065 is designed to be a Dual SPDT switch for multiplexing or switching of signals that require low insertion loss, low power consumption, and negative voltage swing capability. Such applications include Audio/Video equipment, battery or portable devices and medical equipment. In addition, the Click and Pop Elimination Circuitry makes it ideal for portable audio such as MP3 players and cell phones.

Using The Board (Refer to Figure 2)

Lab Equipment

The equipment, external supplies and signal sources needed to operate the board are listed below:

1. +1.8V to +6.5V DC Power Supply
2. Audio Signal Generator
3. Audio Signal Oscilloscope
4. Logic Control Generator and/or Pulse Generator

Initial Board Setup Procedure

1. Attach the evaluation board to the DC power supply at J1 (VCC) and J2 (GND). Positive terminal at J1 and negative terminal at J2. The supply should be capable of delivering +1.8V to +6.5V and 100 μ A of current.
2. Connect the Audio Source Signal to the NOx or NCx BNC inputs. The analog input voltage range can be from VCC-6.5V up to VCC.
3. Connect the Audio Signal Oscilloscope to the COMx BNC outputs.
4. Connect the Logic Control generator to the INx logic inputs.
5. Set the EN pin to logic "HIGH" to have the switches active.

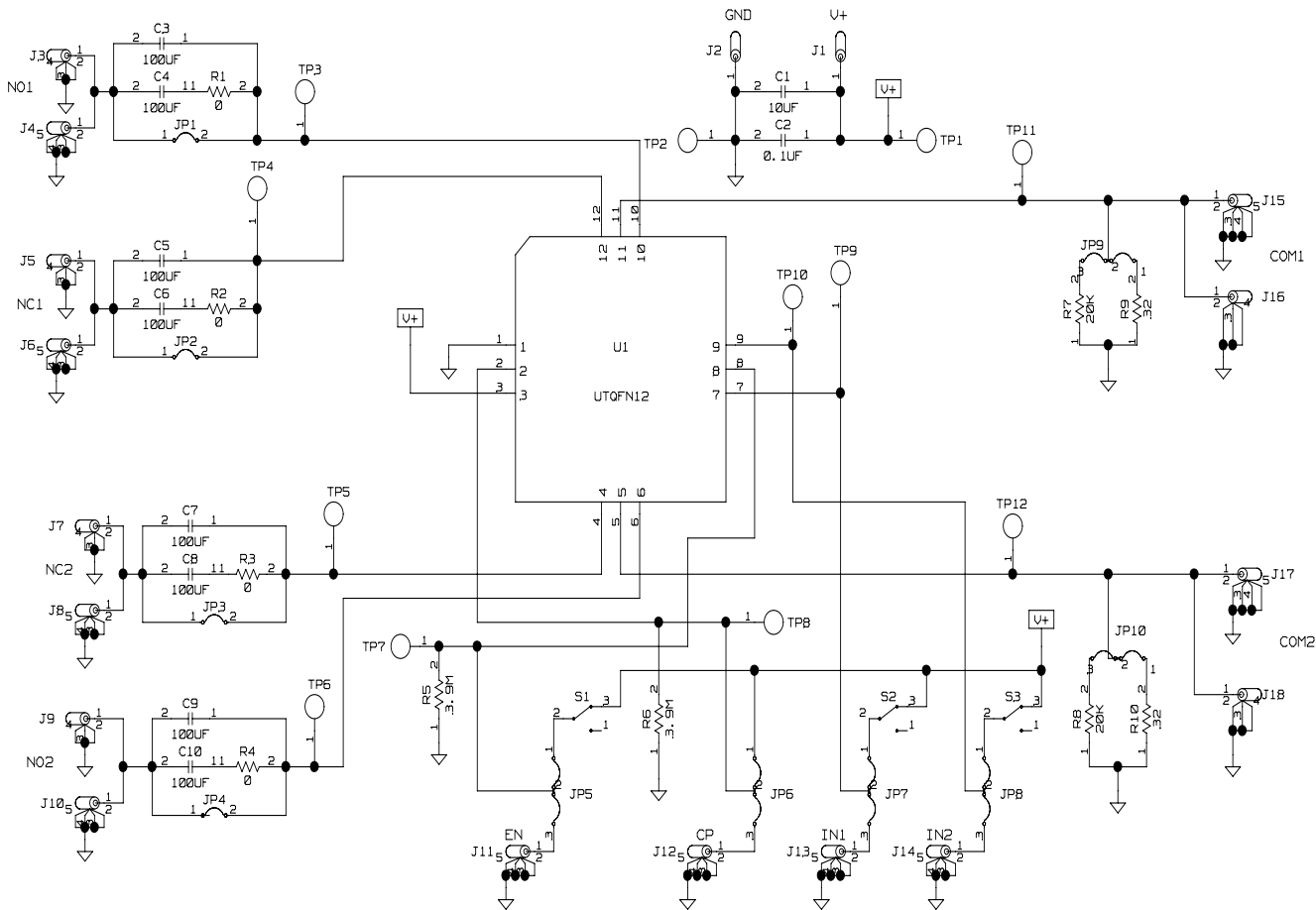
NCx Switches Active

1. Drive the INx pins to logic "LOW".
2. The NCx switches are now connected to the COMx terminals.
3. The NOx switches have shunt resistors on the terminals to ground.

NOx Switches Active

1. Drive the INx pins to logic "HIGH".
2. The NOx switches are now connected to the COMx terminals.
3. The NCx switches have shunt resistors on the terminals to ground.

ISL54065EVAL1Z Evaluation Board Schematic



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