

## Description

The ISL29501-ST-EV1Z is a distance measurement reference design. It combines the [ISL29501](#) chip with an OSRAM SFH 4550 IR emitting LED and OSRAM SFH 213FA photodiode. The circuit board is enclosed in an opaque plastic chassis designed to optically isolate components. Included is a USB flash drive containing the evaluation software for a PC and related technical documents.

The ISL29501-ST-EV1Z board also allows quick evaluation of the ISL29501 performance for a 2m sensing system.

## Specifications

This board has been configured and optimized for the following operating conditions:

- Micro USB 2.0 connection
- $V_{IN} = 5V$  (USB Power)
- $I_{DD}$  maximum = 225mA
- P optical maximum = 70mW
- Wavelength = 860nm
- Optical duty cycle maximum = 50%
- Emission angle =  $\pm 3^\circ$
- Coherent light - No

## Key Features

- Self contained measurement system
- Enables proximity detection and distance measurement
- Emitter DAC with programmable current up to 255mA
- Operates in continuous or single shot mode
- On-chip active ambient light rejection
- Regulated power 2.7V to 3.3V USB or external supply
- I<sup>2</sup>C interface supporting 1.8V and 3.3V bus

## References

- [ISL29501](#) Datasheet
- [AN1966](#), "ISL29501 Sand Tiger Optics Application Note"
- [AN1917](#), "ISL29501 Layout Design Guide"
- [UG054](#), "ISL29501 Evaluation Software User Guide"
- [AN1967](#), "Temperature and Ambient Light Data Collection"

## Ordering Information

PART NUMBER	DESCRIPTION
ISL29501-ST-EV1Z	ISL29501 Sand Tiger demonstration kit, (EVB, USB cable, software, technical documentation)

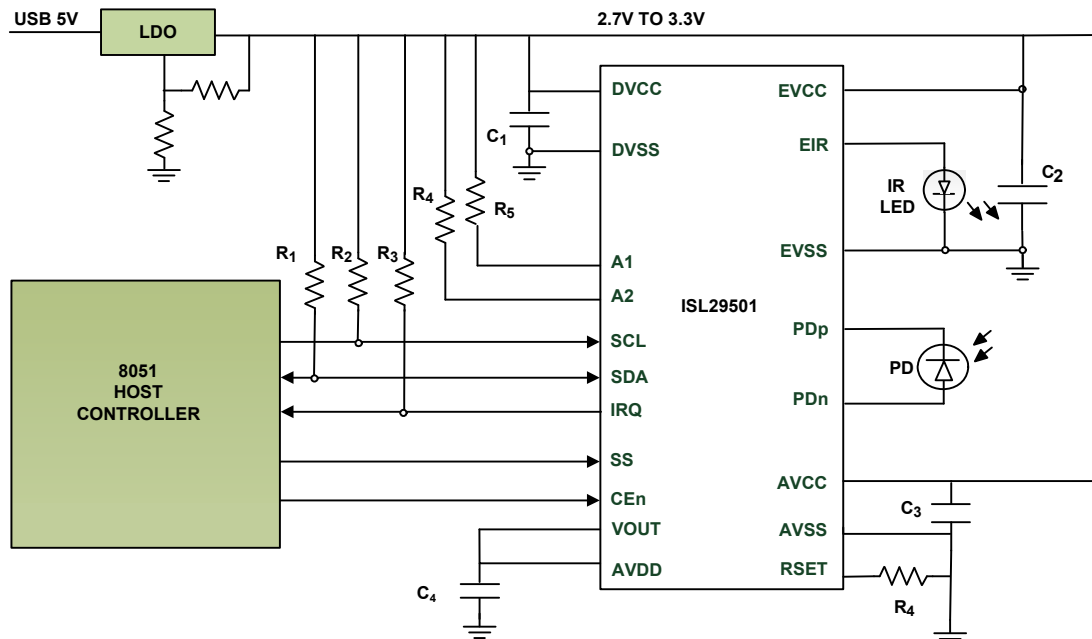


FIGURE 1. SAND TIGER BLOCK DIAGRAM

## Functional Description

The ISL29501-ST-EV1Z is both a reference design and demonstration board that provides a single platform to demonstrate the features of the ISL29501. The ISL29501-ST-EV1Z circuit board and supplied enclosure have been designed to deliver maximum electrical and optical performance.

The system sends out light pulses through the emitter LED and receives returned light pulses that reflected off a target. The difference in phase of the emitted signal and the return signal is converted to distance by the ISL29501 and is graphed in the evaluation software. The magnitude of the return signal is graphed as well. This and additional data is available in chip registers, see UG054, "ISL29501 Evaluation Software User Guide" for additional details.

## Operating Features

The ISL29501-ST-EV1Z demonstration board is shown in [Figures 4](#) and [5](#). The hardware enable function is controlled by a software switch, which can be overridden shorting J9 pins 1 and 2. See the schematic for details. A Power-Good (PG) LED indicates that the LDO is regulating properly.

### External Power Supply

For high current/high duty cycle setups USB power may not be able to power the board. In the default condition, jumper J10 shorts pins 1 and 2 to connect to USB power to the LDO. To power the board with an external power supply, remove this jumper and connect the positive (+) terminal to J10-2 and the negative (-) to J10-4.

If you want to bypass the LDO and power the ISL29501 directly with a power supply, remove the jumper on J10. Use J10-4 for your ground connection and apply the positive voltage to TP7.

### External Microprocessor

For debug of customer written software, it might be useful to connect the Sand Tiger to a different microprocessor. The I<sup>2</sup>C pins SCL and SDA are available on pins J4-4 and J4-3 respectively. The remaining support pins are available on J5: SS - J5-4, IRQ - J5-3 and CEn - J5-2. The support pins are generally connected to GP pins on the microprocessor. SCL and SDA are compatible with 1.8V microprocessors but unfortunately the support pins require 3V signaling.

### System Calibration

Before meaningful measurements can be made the calibration registers in the chip need to be loaded. This can be done in two ways. The first is to load a profile that contains data into the GUI. This could be one of the Intersil provided profiles or one that was saved previously by the user. See UG054, "ISL29501 Evaluation Software User Guide" for further details. The second is to calibrate the board directly.

### Calibrating Sand Tiger

There are 3 separate standard calibrations that need to be executed in order to calibrate the system. These are magnitude, crosstalk and distance calibrations.

### MAGNITUDE CALIBRATION

Magnitude calibration is done after the emitter current and duty cycle settings are programmed. It is a dark (no light) calibration that takes less than 1s to run. Run this calibration from the GUI.

### CROSSTALK CALIBRATION

Crosstalk is defined as a signal that reaches the ISL29501 chip directly without bouncing off the target. This can be electrical or optical. At close range and large return signal values, crosstalk has a minor impact on distance measurements. At the far end of the distance range the crosstalk might exceed the signal, adding error to measurements.

For this calibration the user makes a distance measurement with the return signal blocked from reaching the photodiode. This can be done in two ways. The first is to cover the emitter or photodiode optically preventing any of the emitted signal from reaching the photodiode. The second is to point the board toward infinity so there is no return signal. Care must be taken since small amounts of signal will be returned by objects up to 4 meters away. The emitting angle of the light is  $\pm 3^\circ$  so you must be sure that there are no objects within this cone when doing this calibration.

Since the chip sees none of the emitted signal anything received is crosstalk. Run this calibration from the GUI after running Magnitude calibration.

### DISTANCE CALIBRATION

Variation in delay of emitters, photodiodes and the ISL29501 will change the signal path delay. To compensate for this a reference point at a known distance needs to be established. This reference is calculated during distance calibration. The process involves making a distance measurement at a known distance. While it is not critical it is best to use a reference distance about 25% of the intended range. The GUI will write the correct registers that establish the reference distance inside the chip.

It is important that there are no objects inside the  $\pm 3^\circ$  emitting angle other than the target.

Once these calibration registers are written, all succeeding distance will have this value subtracted real time from the measured value. Run this calibration from the GUI after running crosstalk calibration. See UG054, "ISL29501 Evaluation Software User Guide" for details on how to run the calibrations in the GUI.

## Operating Range

The circuit board contains an LDO to convert the input voltage to the ISL29501 operating voltage range, 2.7V - 3.3V. By default the board is configured for USB power but can be alternately powered by an external power supply. The LDO resistors are ratioed to create a 3.0V power rail. All other set-up conditions can be configured through the chip registers and evaluation software.

## PCB Layout Guidelines

The ISL29501-ST-EV1Z PCB layout has been optimized for electrical and thermal performance. Care needs to be placed in decoupling circuits and noise isolation. Sand Tiger follows good design techniques but additional suggestions are available in AN1917, "ISL29501 Layout Design Guide".

## Quick Start Guide

To start making distance measurements follow these simple steps.

1. Plug the USB cable into the reference design and the PC.
2. Point the emitter toward the desired target.
3. Double click "TOF.exe" to start the GUI.
4. From the GUI do a File -> Load Profile -> filename to load safe initial register settings and calibration data.
5. Click either "Start" or "Step" to begin making distance measurements.

## Changing Settings

Once the board is running and making measurements, the user may want to change settings. The user has the ability to change any of the chip registers with the evaluation software, see UG054, "ISL29501 Evaluation Software User Guide" for details. It is important to note that if the pulse duty cycle or the emitter current is changed, the user must redo the standard calibrations. This process is described in the sections under ["Calibrating Sand Tiger"](#).

## Sand Tiger Enclosure

The Sand Tiger chassis is designed to allow easy handling of the board to make distance measurements. The threaded hole fits most camera tripod screws, which create a stable mount for precision measurements and characterization. The holes in the top isolate the emitter and photodiode to minimize optical crosstalk. The chassis top connects to the bottom with an interference fit. It is snug but the two can be easily separated by hand. Two threaded 4-40 holes are provided to allow attachment of glass. Shown on the side are a micro USB that connects to a PC to run the evaluation software and the power-good LED.



FIGURE 2. SAND TIGER CHASSIS



FIGURE 3. SAND TIGER CHASSIS WITH GLASS

## ISL29501-ST-EV1Z Demonstration Board

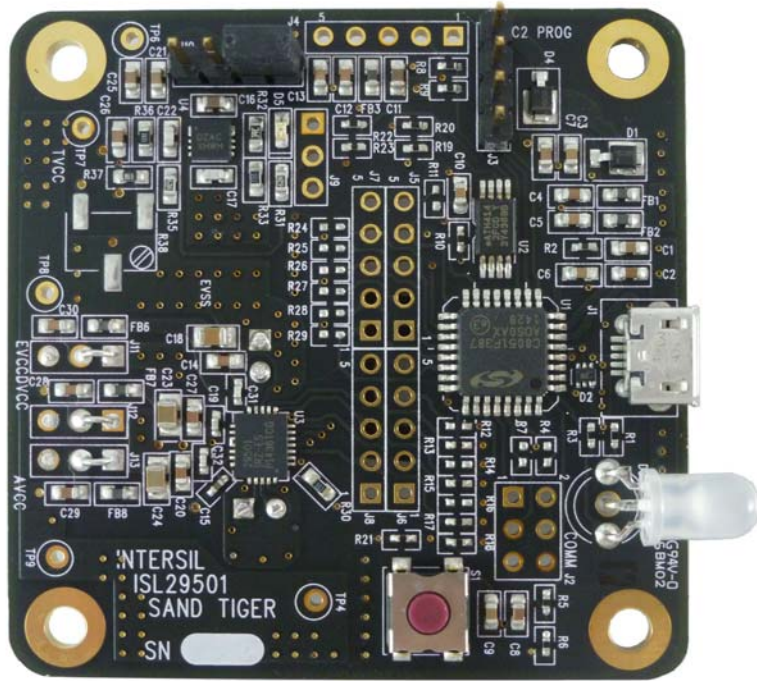


FIGURE 4. SAND TIGER BOARD TOP SIDE



FIGURE 5. SAND TIGER BOARD BOTTOM SIDE

NOTE: Visible on the bottom side of the board are the emitter LED and photodiode. Each is surrounded by a brass tube. These tubes are grounded and serve as terminators for any electric fields. They prevent crosstalk from the emitter to the photodiode.





## ISL29501-ST-EV1Z Bill of Materials

MANUFACTURER PART	QTY	UNIT	REFERENCE DESIGNATOR	DESCRIPTION	MANUFACTURER
ISL29501-ST-EV1ZREVCPCB	1	ea.		PWB-PCB-ISL29501-ST-EV1Z, REVC, ROHS	TBD
0402YA101KAT2A	3	ea.	C19, C31, C32	CAP, SMD, 0402, 100pF, 16V, 10%, NPO, ROHS	AVX
AMK105BJ335MV-F	1	ea.	C15	CAP, SMD, 0402, 3.3μF, 4V, 20%, X5R, ROHS	TAIYO YUDEN
ECJ-1VC1H101J	2	ea.	C17, C22	CAP, SMD, 0603, 100pF, 50V, 5%, C0G, ROHS	PANASONIC
GRM188R71E104KA01D	8	ea.	C1, C3, C5, C6, C9, C10, C13, C21	CAP, SMD, 0603, 0.1μF, 25V, 10%, X7R, ROHS	MURATA
0603ZC105KAT2A	13	ea.	a) C2, C4, C7, C8, C12, C14, C20, C25, C26, C27, C28, C29, C30	CAP, SMD, 0603, 1.0μF, 10V, 10%, X7R, ROHS	AVX
GRM188R61C106KAALD	2	ea.	C11, C16	CAP, SMD, 0603, 10μF, 16V, 10%, X5R, ROHS	MURATA
C2012X5R1A476M125AC	3	ea.	C18, C23, C24	CAP, SMD, 0805, 47μF, 10V, 20%, X5R, ROHS	TDK
1050170001	1	ea.	J1	CONN-RECEPTACLE, USB-MICRO B, SMD, 5 CONTACT, R/A, ROHS	MOLEX
68000-236HLF	2	ea.	J3, J10	CONN-HEADER, 1x4, BRKAWY 1x36, 2.54mm, ROHS	BERG/FCI
	3	ea.	J11-Pins1-2, J12-Pins1-2, J13-Pins1-2 ONLY	CONN-JUMPER, SOLDER SHORT,	
SPC02SYAN	1	ea.	J10-Pins 1-2	CONN-JUMPER, SHORTING, 2PIN, BLACK, GOLD, ROHS	SULLINS
MBRM130LT1G	2	ea.	D1, D4	DIODE-SCHOTTKY, 30V, 1A, SMD, 2P, DO-216AA, ROHS	ON SEMICONDUCTOR
LTST-C191KGKT	1	ea.	D5	LED, SMD, 0603, GREEN CLEAR, 2V, 20mA, 574nm, 35mcd, ROHS	LITEON/VISHAY
SFH4550	1	ea.	D6	LED-EMITTER IR, TH, T1 3/4, 1.5V, 100mA, 850nm, ROHS	OSRAM
SPR-54MVWF	1	ea.	D3 - *Leads should stand approximately two tenths off board and part is bent to right side before being soldered.	LED, TH, RND, 5mm, GREEN/RED, 2.1V/2V, 10mA, 10mcd/6.3mcd, ROHS	ROHM
BLM18PG471SN1D	6	ea.	FB1, FB2, FB3, FB6, FB7, FB8	FERRITE BEAD, SMD, 0603, 470Ω, 1A, 200mΩ, ROHS	MURATA
AT24C512C-XHD	1	ea.	U2	IC-2-WIRE SERIAL EEPROM, 8P, TSSOP, 1MHz, 512kBIT, ROHS	ATMEL
C8051F387-GQ	1	ea.	U1	C-USB MICROCONTROLLER, 32P, LQFP, 8BIT, 48MIPS, ROHS	SILICON LABORATORIES
ISL29501IRZ-T7	1	ea.	U3	IC-TOF SIGNAL PROCESSOR, 24P, QFN, ROHS	INTERSIL

**ISL29501-ST-EV1Z Bill of Materials (Continued)**

MANUFACTURER PART	QTY	UNIT	REFERENCE DESIGNATOR	DESCRIPTION	MANUFACTURER
ISL80101AIRAJZ	1	ea.	U4	IC-1A LDO ADJ.VOLT REGULATOR, 10P, DFN, 3x3, ROHS	INTERSIL
TPD4S012DRYR	1	ea.	D2	IC-TVS, 4-CHANNEL ESD SOLUTION, 6P, SON6, ROHS	TEXAS INSTRUMENTS
CR0402-16W-1000FT	1	ea.	R2	RES, SMD, 0402, 100Ω, 1/16W, 1%, TF, ROHS	VENKEL
CR0402-16W-102JT	4	ea.	R5, R6, R19, R23	RES, SMD, 0402, 1k, 1/16W, 1%, TF, ROHS	VENKEL
ERJ-2RKF1002X	7	ea.	R9, R10, R13, R15, R17, R18, R21	RES, SMD, 0402, 10k, 1/16W, 1%, TF, ROHS	PANASONIC
RC0402FR-0722R1L	3	ea.	R8, R20, R22	RES, SMD, 0402, 22.1Ω, 1/16W, 1%, TF, ROHS	YAGEO
CR0402-16W-4320FT	2	ea.	R1, R3	RES, SMD, 0402, 432Ω, 1/16W, 1%, TF, ROHS	VENKEL
	0	ea.	a) R4, R7, R11, R12, R14, R16, R24, R25, R26,	RES, SMD, 0402, DNP, DNP, DNP, TF, ROHS	
	0	ea.	b) R27, R28, R29	RES, SMD, 0402, DNP, DNP, DNP, TF, ROHS	
CR0603-10W-1000FT	1	ea.	R37	RES, SMD, 0603, 100Ω, 1/10W, 1%, TF, ROHS	VENKEL
CR0603-10W-1002FT	2	ea.	R30, R33	RES, SMD, 0603, 10k, 1/10W, 1%, TF, ROHS	VENKEL
ERJ-3EKF2492V	1	ea.	R32	RES, SMD, 0603, 24.9k, 1/10W, 1%, TF, ROHS	PANASONIC
CR0603-10W-2611FT	1	ea.	R36	RES, SMD, 0603, 2.61k, 1/10W, 1%, TF, ROHS	VENKEL
RC0603FR-07432RL(PbFREE)	2	ea.	R31, R35	RES, SMD, 0603, 432Ω, 1/10W, 1%, TF, ROHS	YAGEO
SKHUAME010	1	ea.	S1	SWITCH-TACTILE, SMD, 6.3x6.2, 12V, 50mA, 2.6N, 260gf, ROHS	ALPS ELECTRIC INC
3025010-03	1	ea.	BAG & SHIP W/ BOARD	CABLE-USB TYPE A MALE to TYPE MICRO-B MALE, 3FT, ROHS	QUALTEK ELECTRONICS
ISL29501-ST-EZCHASSISBOM	1	ea.	COMPLETED ASSEMBLY	PWB-ASSY, ISL29501-ST-EV1ZCHASSIS, ROHS	INTERSIL
212403-013	1	ea.	Place assy in bag	BAG, STATIC, 5x8, ZIPLOC, ROHS	INTERSIL
	0	ea.	J2, J4, J5, J6, J7, J8, J9	DO NOT POPULATE OR PURCHASE	
	0	ea.	R38	DO NOT POPULATE OR PURCHASE	
	0	ea.	TP4, TP6, TP7, TP8 (5001)	DO NOT POPULATE OR PURCHASE	
LABEL-DATE CODE	1	ea.	AFFIX TO BACK OF PCB	LABEL-DATE CODE_LINE 1: YRWK/REV#, LINE 2: BOM NAME	INTERSIL
SFH213-FA	1	ea.	D7	IC-PHOTODIODE, RADIAL, 2P, 5mm, 50V, 900nm, 1nA, ROHS	OSRAM



## Chassis Bill of Materials

MANUFACTURER PART	QTY	UNIT	REFERENCE DESIGNATOR	DESCRIPTION	MANUFACTURER
ISL29501-ST-EV1ZFG	1	ea.	ASSY INSTRUCTIONS	PWB-FG, ISL29501-ST-EV1Z, ROHS	INTERSIL
92185A105	2	ea.	PCB TO CHASSIS BOTTOM	SCREW, 4-40x3/16in, SOCKET HEAD, CAP, SS, ROHS	MCMaster-CARR
29501-01-08	1	ea.	SANDTIGER-CHASSISBOTTOM	CHASSIS BOTTOM, 2.5x2.5, ACETAL HOMOPOLYMER, BLK, ROHS	PROTOLABS
29501-02-05	1	ea.	SANDTIGER-CHASSISTOP	CHASSIS TOP, 2.5x2.5, ACETAL HOMOPOLYMER, BLK, ROHS	PROTOLABS
4701-60-20031-04	1	ea.	D6, D7 (PCB) GASKET	GASKET-URETHANE FOAM, VERY FIRM, BLK, CUSTOM CUT 28.5x14.6mm	ROGERS CORP.
6035-04BR219	4	ea.	a) CHASSIS TOP	HARDWARE, ULTRASERT II-LONG, 4-40, 0.219x0.172, BRASS, ROHS	DODGE INSERTS
6035-04BR219	0	ea.	b) CHASSIS BOTTOM	HARDWARE, ULTRASERT II-LONG, 4-40, 0.219x0.172, BRASS, ROHS	DODGE INSERTS
6035-4BR300	1	ea.	CHASSIS BOTTOM SIDE HOLE	HARDWARE, ULTRASERT II-SHORT, 1/4-20, 0.30x0.375, BRASS, ROHS	DODGE INSERTS
ASSEMBLY INSTRUCTIONS	0	ea.	a) Ensure J1 (USB connector) and D5 (LED) are facing the side opening in CHASSIS BOTTOM when PCB is mounted face down.	Instructions for assembly.	INTERSIL
90145A473	2	ea.	CHASSIS BOTTOM TO PCB	HARDWARE, DOWEL PIN, 3/4x1/8, STAINLESS, ROHS	MCMaster-CARR
SANDTIGER-BRASSTUBE	2	ea.	D6, D7 (PCB)	TUBE-BRASS, Alloy#260/270, 1/2-3/4, Length 0.275, 0.250D, 0.238ID	K&S Precision Metals

## Board Layout - 4 Layers

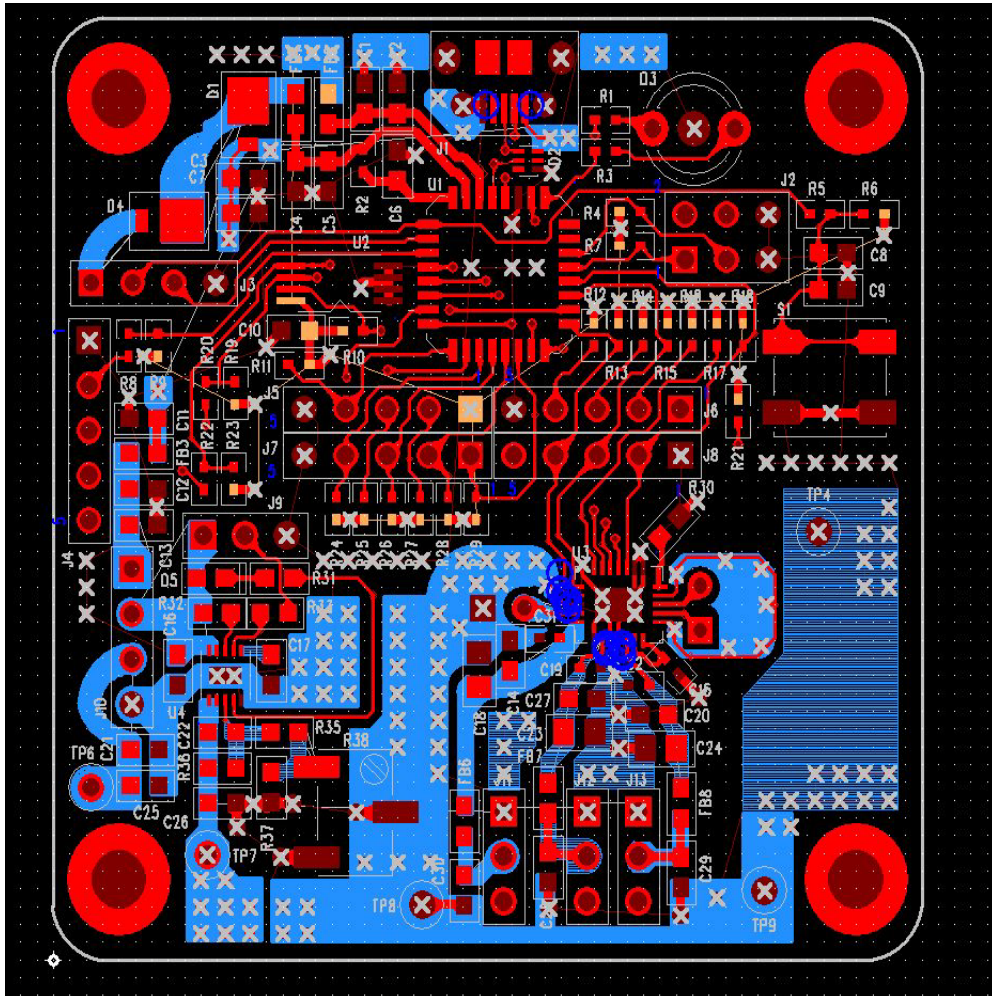


FIGURE 8. TOP LAYER

## Board Layout - 4 Layers (Continued)

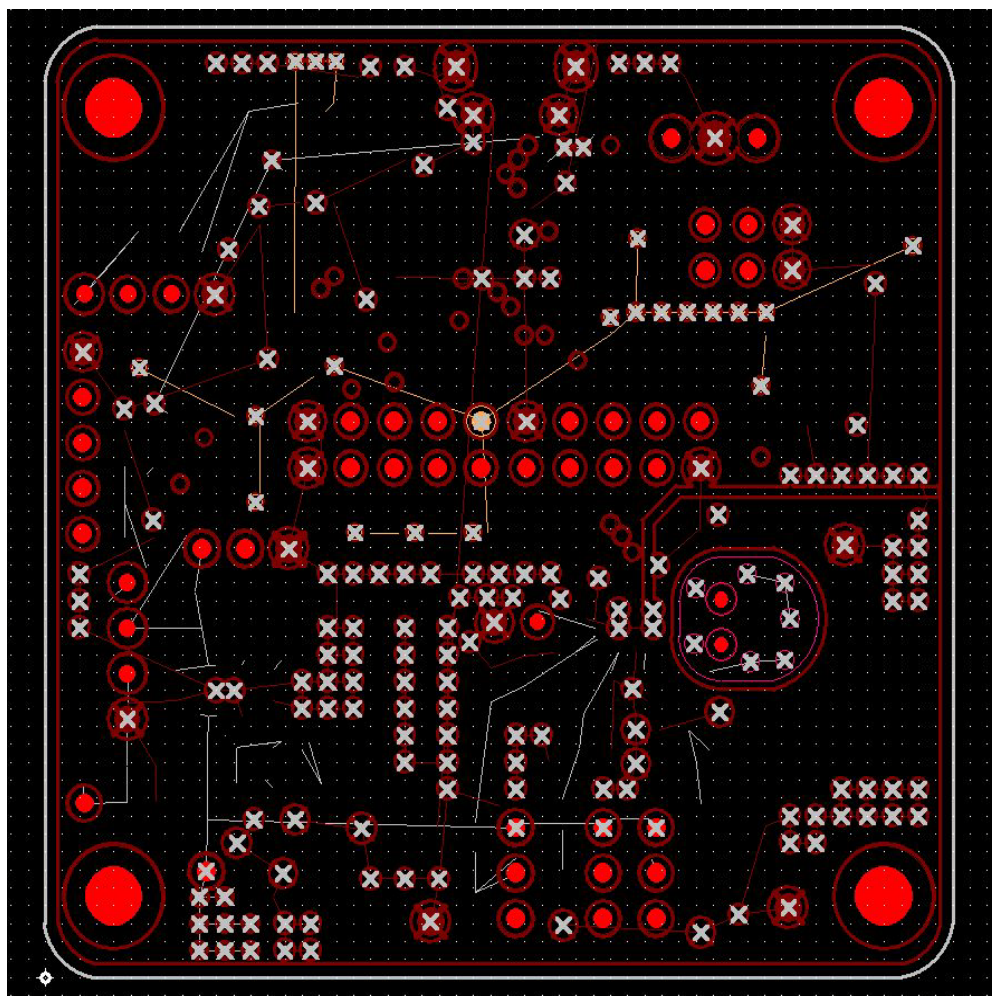


FIGURE 9. PCB - LAYER 2 (VIEWED FROM TOP)

## Board Layout - 4 Layers (Continued)

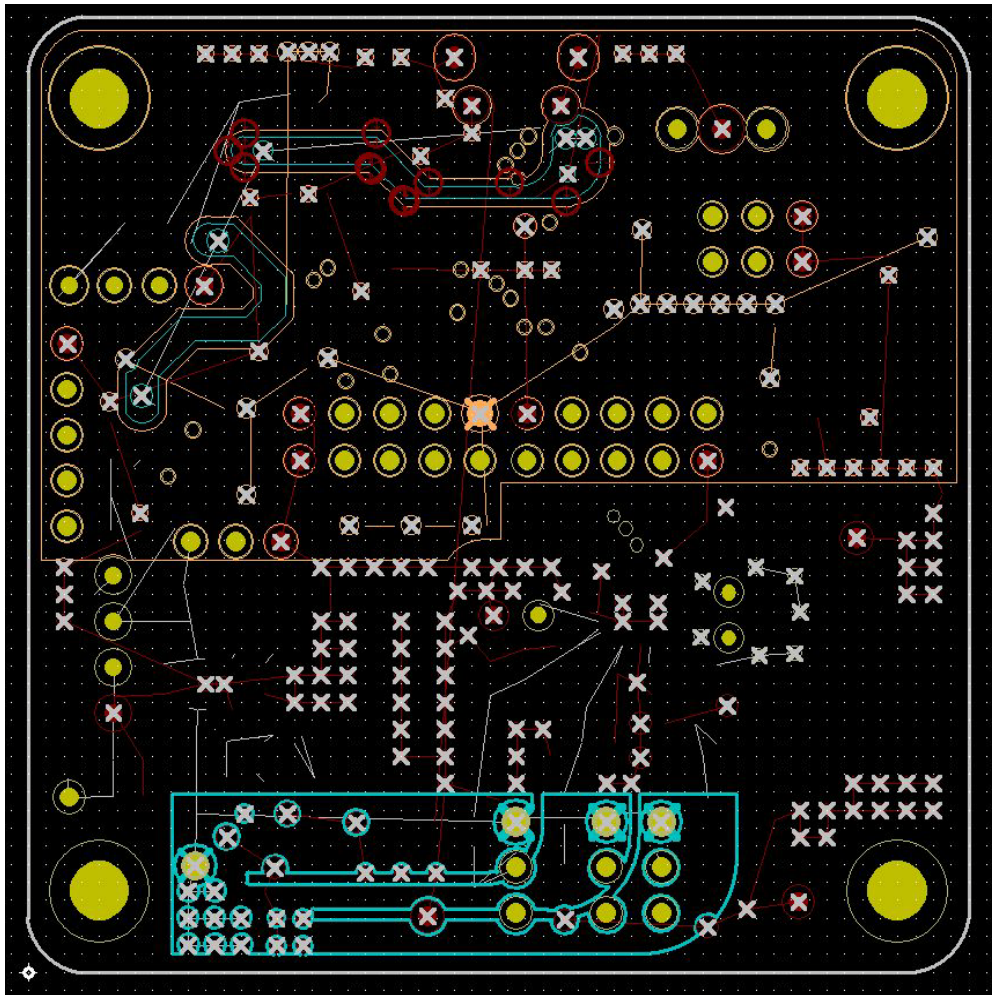


FIGURE 10. PCB - LAYER 3 (VIEWED FROM TOP)

## Board Layout - 4 Layers (Continued)

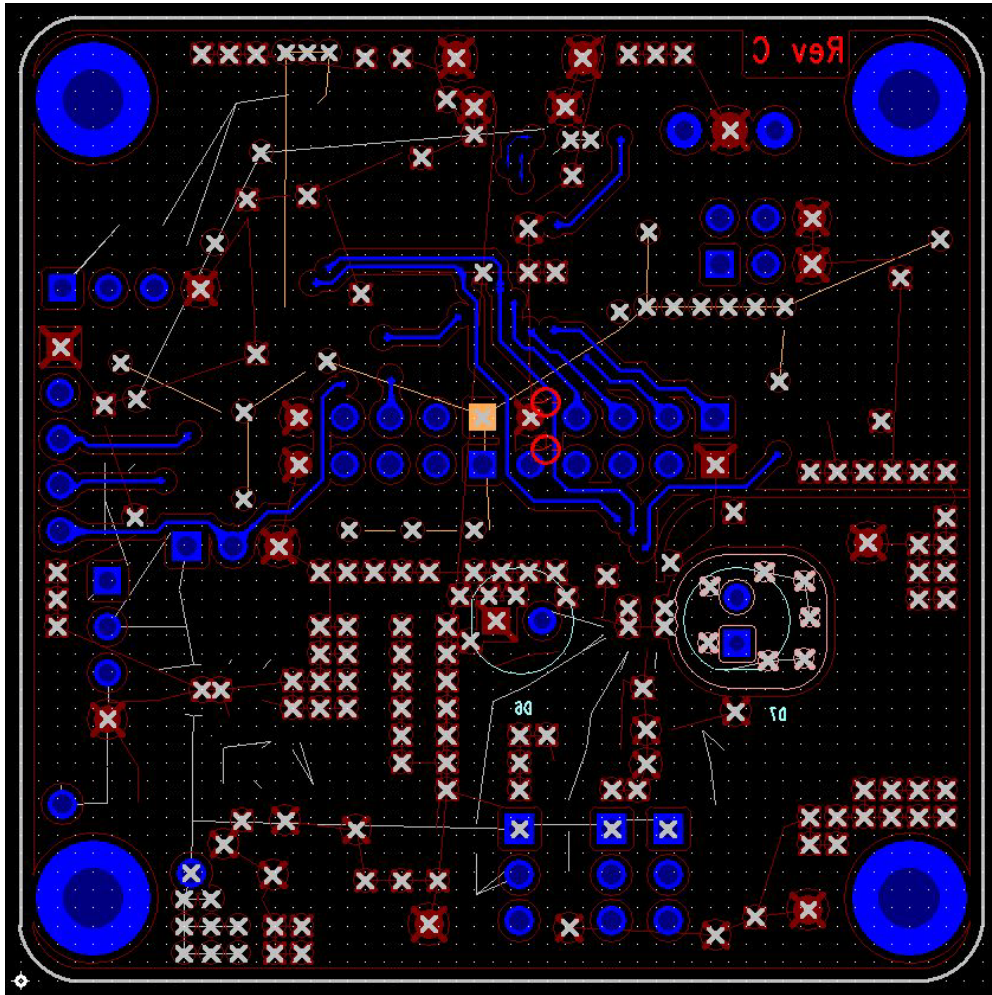


FIGURE 11. PCB - BOTTOM LAYER (VIEWED FROM TOP)

The measured distance will drift with changes in temperature as shown in [Figure 14 on page 14](#). The ISL29501 has temperature compensation built into the chip. This is an advanced calibration, which involves collecting temperature vs. distance data and programming the compensation registers. Initially Intersil will generate these coefficients from customer collected data. The process for collecting data is described in AN1967, "Temperature and Ambient Data Collection".

It is strongly recommended that customers should evaluate these parameters as a last step in their evaluation. To avoid temperature effects low integration times, reg 0x10 < 0x06 should be used.

## Typical Performance Curves

USB Powered  $V_{IN} = 5V$ ,  $V_{reg} = 3.3V$ ,  $T_A = +25^\circ C$ , Sample size = 5, integration time = 140ms.

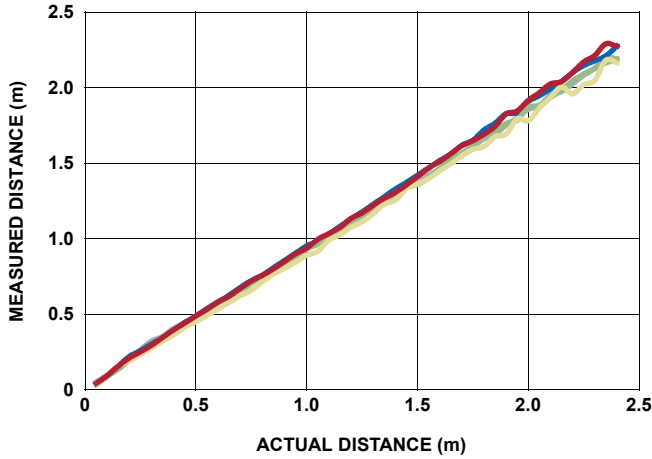


FIGURE 12. MEASURED vs ACTUAL DISTANCE

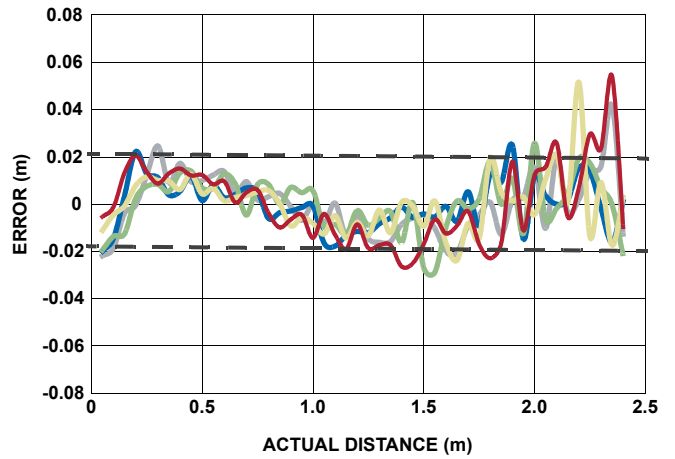


FIGURE 13. ERROR vs ACTUAL DISTANCE

## Temperature Performance

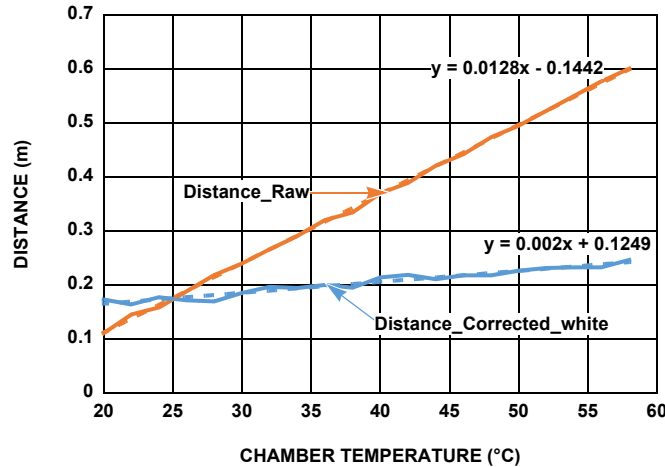


FIGURE 14. TEMPERATURE PERFORMANCE BEFORE AND AFTER CORRECTION

## 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

## X-ON Electronics

Largest Supplier of Electrical and Electronic Components

*Click to view similar products for [Distance Sensor Development Tool](#) category:*

*Click to view products by [Renesas](#) manufacturer:*

Other Similar products are found below :

[SEN0004](#) [MIKROE-2509](#) [172](#) [DFR0315](#) [SEN0006](#) [SEN0007](#) [SEN0008](#) [SEN0187](#) [SEN0202](#) [SEN0208](#) [DM160234](#) [SEN0143](#) [SEN-13968](#)  
[3316](#) [SEN-08504](#) [SEN-08502](#) [DFR0445](#) [3317](#) [984](#) [SEN0014](#) [SEN0001](#) [SEN0171](#) [3942](#) [979](#) [981](#) [982](#) [985](#) [AFBR-S50MV85G-EK](#)  
[TMF8701-DB](#) [TMF8801-DB](#) [TMF8801-EVM](#) [AD8283CP-EBZ](#) [AD8285CP-EBZ](#) [ADUX1020-EVAL-SDP](#) [SEN0245](#)  
[EVALBGT24LTR22TOBO1](#) [DM160238](#) [MIKROE-3339](#) [MIKROE-3439](#) [MIKROE-1589](#) [MIKROE-1991](#) [MIKROE-2086](#) [MIKROE-3103](#)  
[SECO-RANGEFINDER-GEVK](#) [PIM058](#) [PIM062](#) [PIM373](#) [101020083](#) [101020353](#) [101020532](#)