

ISL54103

DDC Accelerator (DDCA)

**EOL PRODUCT
NO RECOMMENDED REPLACEMENT
contact our Technical Support Center at
<https://www.renesas.com/support/contact.html>**

FN6303
Rev 2.00
October 14, 2011

The ISL54103 DDC Accelerator (DDCA) is a dual active pull-up bus terminator designed to improve data transmission speed on the DDC 2-wire serial bus interfaces.

The DDCA detects rising input transitions with two internal voltage references and two comparators per channel. After the voltage on a data line crosses the first threshold (V_{TRIPL}), the boost pull-up current source is activated to speed transition. After the voltage crosses the second threshold (V_{TRIPH}), the boost pull-up current source is de-activated, leaving an active pull-up current of 275µA on the line. When both channels are HIGH, the pull-up current for both lines is reduced to 100µA to save power. Internal logic ensures that the active and boost pull-up current sources are not activated during downward transitions.

The level for V_{TRIPH} is controlled by a bandgap voltage referred to V_{DD} . This feature makes the switching behavior invariant for all power supply voltages between 2.7V and 5.5V.

A noise filter on each channel prevents the circuit from responding to input transitions that do not exceed a voltage-time threshold. To activate the boost circuit, the input must exceed V_{TRIPL} by 100Vns (typical) (See Figure 10).

The DDCA permits operation of the bus at frequencies up to 100kHz, despite the capacitive loads of multiple devices and/or long PC board traces. Enhanced ESD protection on the accelerator pins are guaranteed to withstand 8kV ESD (HBM) events.

The DDC Accelerator provides an essential function in DDC applications because of distributed capacitance of the DDC wires in long video cables. By incorporating DDCA, systems using DDC can reliably increase their bus load, allowing longer cables, without the risk of data corruption.

Features

- Active Termination for DDC Lines
- Enhances System Bus Signal Rise Time
- More Reliable HDCP Performance In Video Multiplexers and Cable Extenders
- Increases Maximum Cable Length While Guaranteeing Data Integrity
- 2.2mA Current Boost on Low to High Transitions
- 8kV ESD Protection on SDA and SCL Pins
- Wide Operating Voltage Range: 2.7V to 5.5V
- Small Package - 5 Ld SOT-23
- Pb-free (RoHS Compliant)

Target Applications

- Video Multiplexers
- Video Cable Extenders
- Video Distribution Amplifiers
- Televisions
- Computer Monitors
- Projectors

Pinout

ISL54103
(5 LD SOT-23)
TOP VIEW



Pin Descriptions

SOT-23	SYMBOL	DESCRIPTION
1	V _{DD}	Supply Voltage
2	GND	Ground
3	N.C.	No Connect
4	DDC1	Active Pull-Up for DDC Signal
5	DDC2	Active Pull-Up for DDC Signal

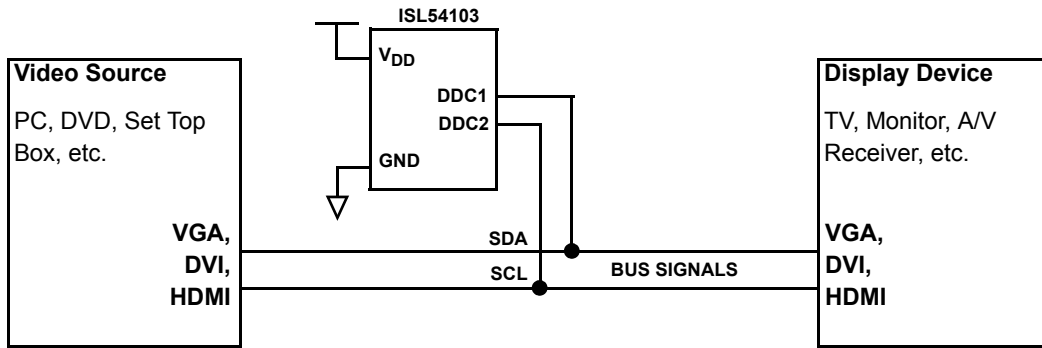
Ordering Information

PART NUMBER (Notes 1, 2, 3)	PART MARKING (Note 4)	TEMP RANGE (°C)	PACKAGE (Pb-free)	PKG. DWG. #
ISL54103IHZ-T7	103Z	-40 to +85	5 Ld SOT-23	P5.064
ISL54103IHZ-T7A	103Z	-40 to +85	5 Ld SOT-23	P5.064

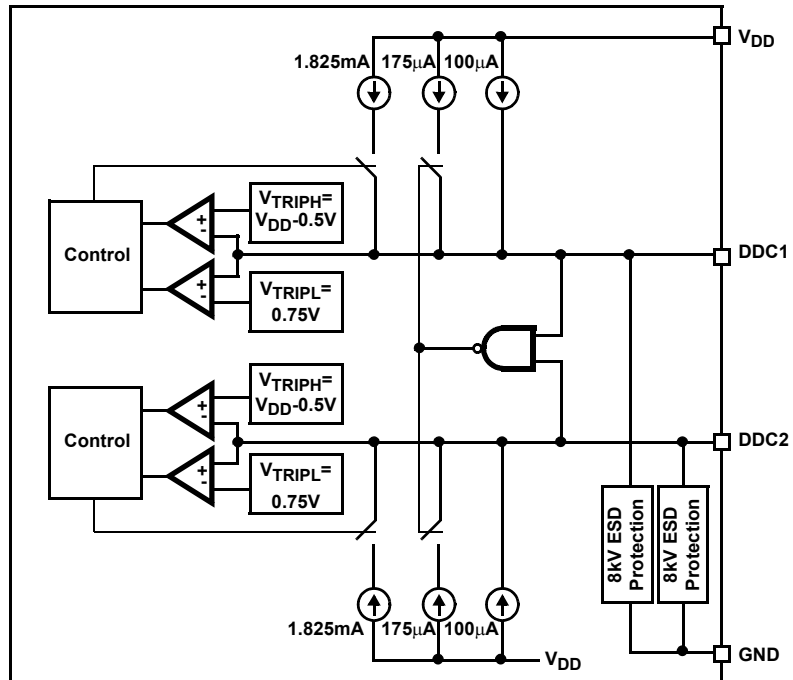
NOTES:

1. 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 [ISL54103](#). For more information on MSL please see techbrief [TB363](#).
4. The part marking is located on the bottom of the part.

System Diagram



IC Block Diagram



Absolute Maximum Ratings

Supply Voltage Range	-1V to 6.5V
Operating Junction Temperature	+135°C
Storage Temperature Range	-65°C to +150°C
Voltage on Pins	-0.3V to $V_{DD}+0.3V$
ESD Min Other Pins (HBM)	>2kV
ESD DDC1 and DDC2 Pins (HBM)	>8kV

Thermal Information

Pb-Free Reflow Profile. see link below
<http://www.intersil.com/pbfree/Pb-FreeReflow.asp>

Recommended Operating Conditions

Temperature -40°C to +85°C
 Supply Voltage. 2.7V to 5.5V

CAUTION: Do not operate at or near the maximum ratings listed for extended periods of time. Exposure to such conditions may adversely impact product reliability and result in failures not covered by warranty.

Electrical Specifications Over all operating conditions unless otherwise specified, Typical values are measured at $V_{DD} = 3.3V$ and $T_A = +25^\circ C$

SYMBOL	PARAMETER	CONDITIONS	MIN (Note 6)	TYP	MAX (Note 6)	UNIT
ANALOG PARAMETERS						
V_{DD}	Supply Voltage Range		2.7		5.5	V
$V_{DD\ RAMP}$	V_{DD} Ramp Rate		0.05		50	V/ms
I_{DD}	Supply Current	DDC1 = DDC2 = Open		80	100	μA
I_{OUT_SB}	Standby Pull-Up Current	DDC1 = DDC2 = $V_{DD} - 1.0V$		80	125	μA
I_{OUT_A1}	Active Pull-Up Current	DDC1 = GND; DDC2 = Open	125	275	350	μA
I_{OUT_A2}		DDC1 = Open; DDC2 = GND	125	275	350	μA
I_{OUT_B1}	Boost Pull-Up Current (Figure 2)	$V_{TRIPL} < DDC1 < V_{TRIPH}$, DDC2 = Open	1.6	2.2		mA
I_{OUT_B2}		$V_{TRIPL} < DDC2 < V_{TRIPH}$, DDC1 = Open	1.6	2.2		mA
V_{TRIPL}	Input Voltage Threshold Low		0.65	0.75	0.85	V
V_{TRIPH}	Input Voltage Threshold High		$V_{DD} - 0.60$	$V_{DD} - 0.50$	$V_{DD} - 0.40$	V
f_{MAX}	DDC Max Frequency				100	kHz
NSS	Noise Spike Suppression (Note 5) (Figure 10)			20		V-ns

NOTES:

5. Measured as area under triangular waveform above V_{TRIPL} , with time as base and V_{IN} as height (See Figure 10).
6. Compliance to datasheet limits is assured by one or more methods: production test, characterization and/or design.

Typical Performance Curves

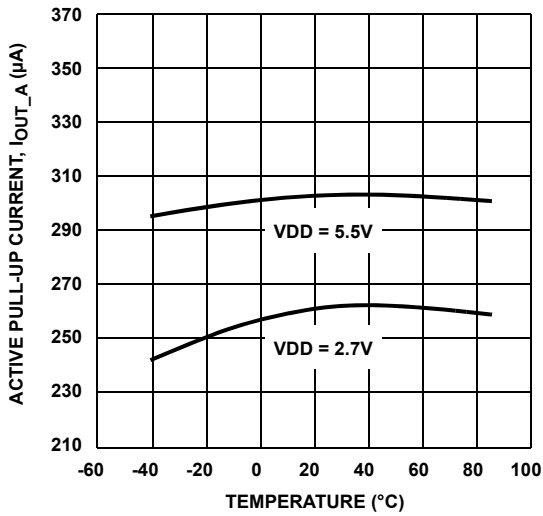


FIGURE 1. ACTIVE PULL-UP CURRENT, DDC PIN = 0V

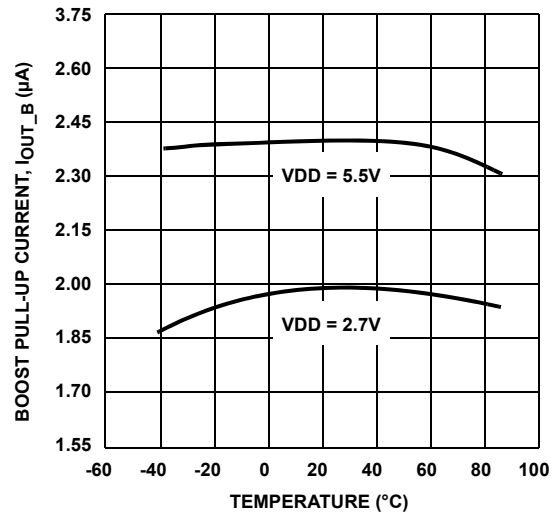


FIGURE 2. BOOST PULL-UP CURRENT, DDC PIN = V_{DD}/2

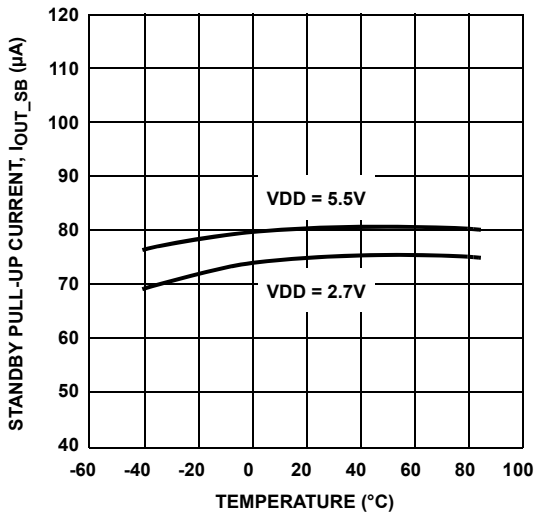


FIGURE 3. STANDBY PULL-UP CURRENT, DDC1, 2 = V_{DD} - 0.5V

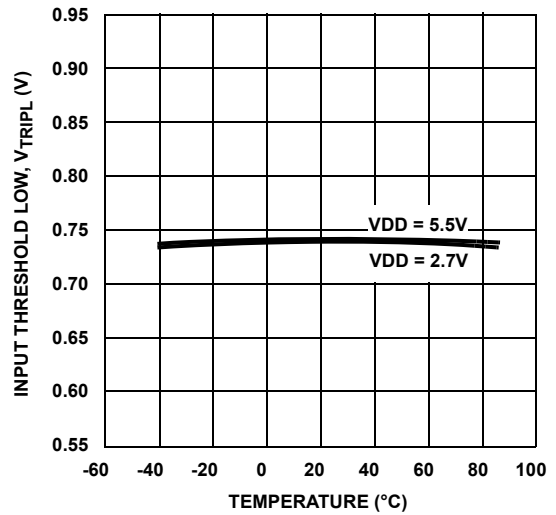


FIGURE 4. V_{TRIPL} VOLTAGE

Typical Performance Curves (Continued)

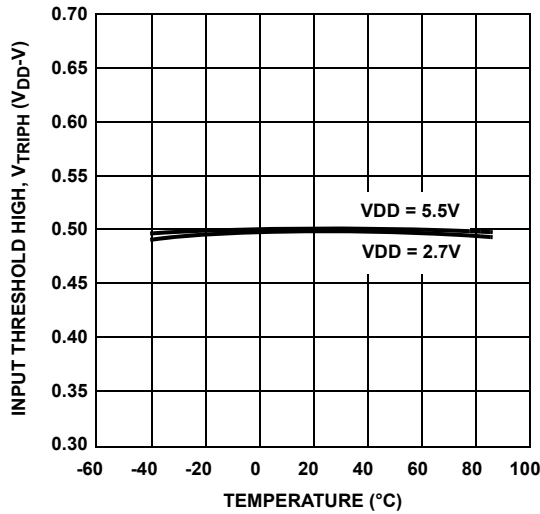
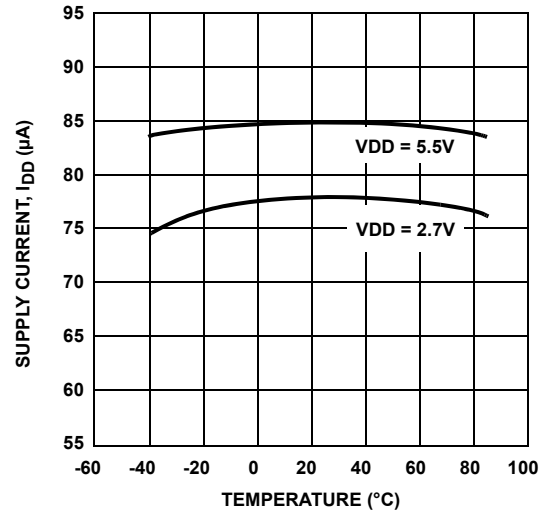
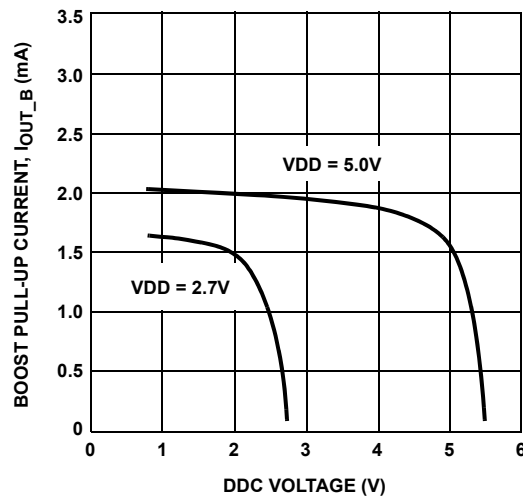
FIGURE 5. V_{TRIP_H} VOLTAGEFIGURE 6. I_{DD} CURRENT, DDC1 = DDC2 = OPEN

FIGURE 7. BOOST PULL-UP CURRENT vs DDC VOLTAGE

Functional Description

DDC Overview

DDC is a 2-wire serial communication standard based on the I²C standard. Devices communicate to each other using one clock (SCL) and one data (SDA) line. These are both bidirectional.

Each signal is connected to a positive supply voltage via a current-source or pull-up resistor (see “System Diagram” on page 3). When the bus is free, both lines are HIGH. The output stages of all devices connected to the bus must have an open-drain or open-collector to perform the wired-AND function.

Simple pull-up resistors on the clock and data lines work well unless there are long signal lines. The combined capacitance of long cables increases the rise time on the signal to such an

extent that the communication becomes unreliable or fails to meet the bus timing specifications. Smaller value resistors can sometimes compensate for the extra capacitance, but this increases the current consumption when the signal lines are pulled LOW.

ISL54103 Operation

To improve the operation of the DDC where larger bus capacitance exists, the ISL54103 provides active pull-up using switched current sources. When the bus is idle and both lines are HIGH, a standby pull-up current of 100µA is used to maintain the signal level while minimizing power consumption. When either of the two signals is pulled LOW, an active pull-up current of 275µA maintains a good V_{OL} noise margin.

When the bus line is released, it is pulled high by the ISL54103 active current until the voltage exceeds the V_{TRIP_L} level for a

period of time. This voltage-time combination filters out noise on the signal line. Once the ISL54103 detects a valid rising edge, a 2.2mA boost current pulls the bus line high very quickly (see Figure 8). This boost current turns off when the input level reaches the V_{TRIPH} threshold and the pull-up current returns to the active level. If both inputs are HIGH, the pull-up current drops to the standby level of $100\mu A$.

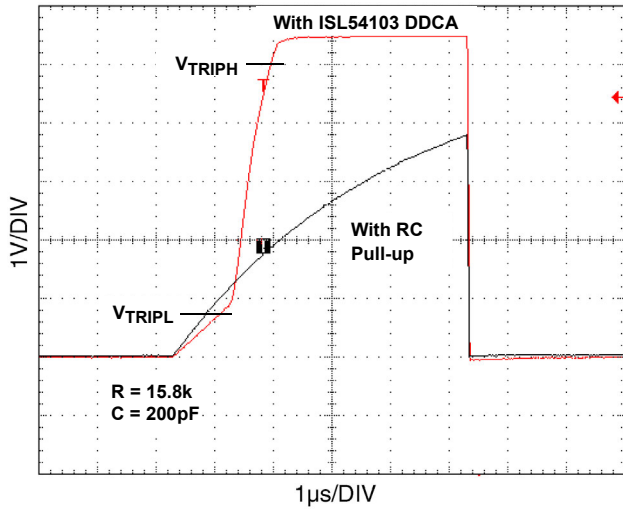


FIGURE 8. ISL54103 DDC SYSTEM BOOST PULL-UP COMPARED TO RESISTOR PULL-UP ($V_{DD} = 5.5V$)

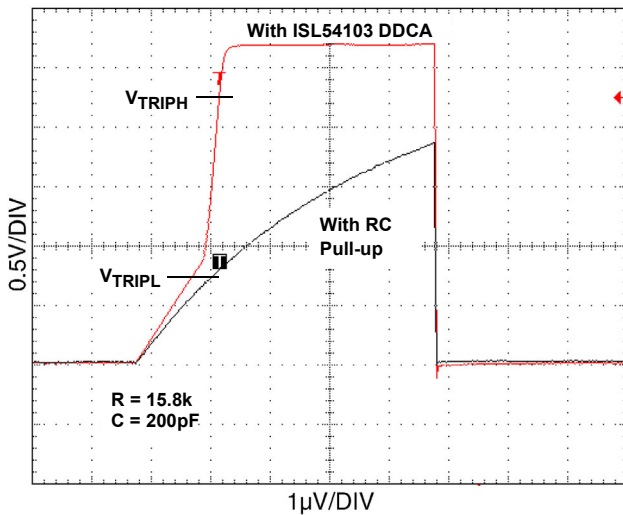


FIGURE 9. ISL54103 DDC SYSTEM BOOST PULL-UP COMPARED TO RESISTOR PULL-UP ($V_{DD} = 2.7V$)

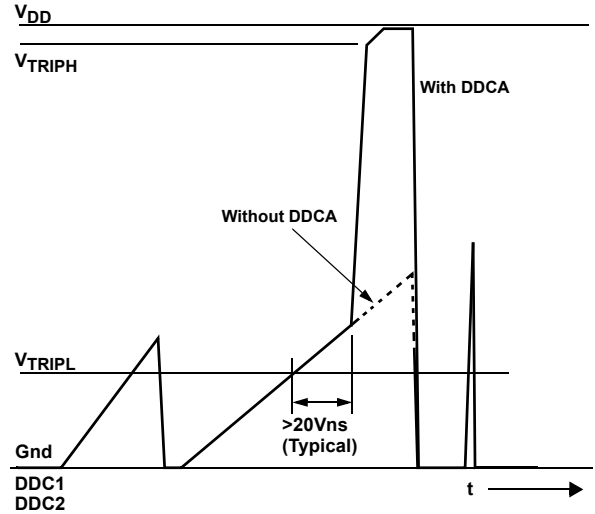


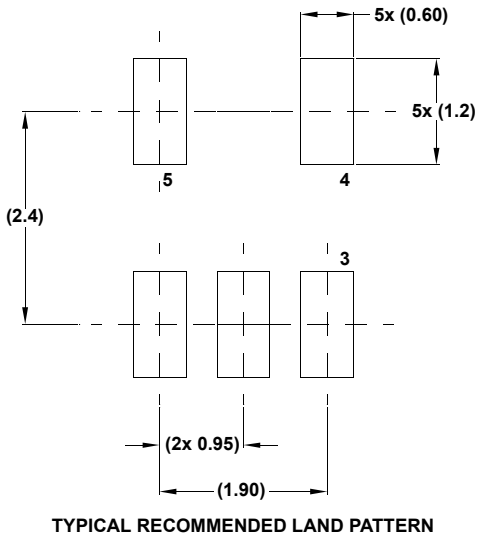
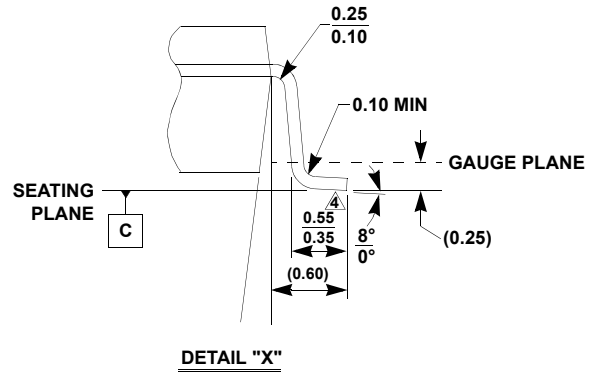
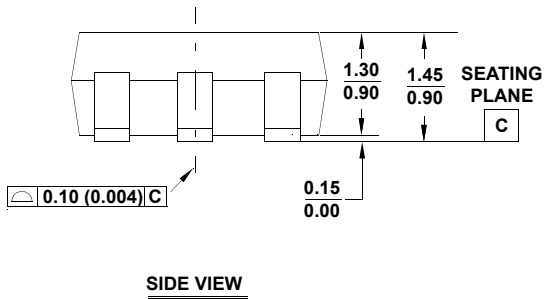
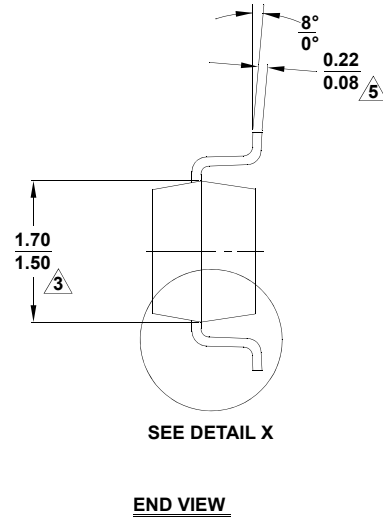
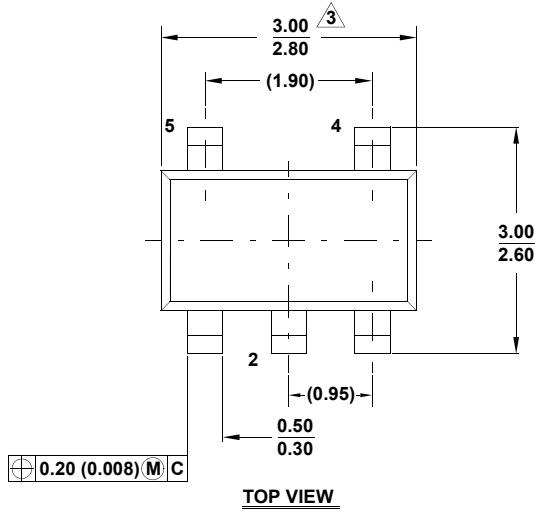
FIGURE 10. NOISE SUPPRESSION. BOOST CURRENT APPLIED WHEN INPUT SIGNAL EXCEEDS 20Vns (TYPICAL)

Package Outline Drawing

P5.064

5 LEAD SMALL OUTLINE TRANSISTOR PLASTIC PACKAGE

Rev 3, 4/11



NOTES:

1. Dimensioning and tolerance per ASME Y14.5M-1994.
2. Package conforms to EIAJ SC-74 and JEDEC MO178AA.
3. Package length and width are exclusive of mold flash, protrusions, or gate burrs.
4. Footlength measured at reference to gauge plane.
5. Lead thickness applies to the flat section of the lead between 0.08mm and 0.15mm from the lead tip.
6. Controlling dimension: MILLIMETER.
Dimensions in () for reference only.

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 Corporation

TOYOSU FORESIA, 3-2-24 Toyosu, Koto-ku, Tokyo 135-0061, Japan

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

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, Jin 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