To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

Send any inquiries to http://www.renesas.com/inquiry.

Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of 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. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. 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 of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may 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.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: "Standard", "High Quality", and "Specific". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as "Specific" without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as "Specific" or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is "Standard" unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.

   "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.

   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.

   "Specific": Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, 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, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be 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, or if you have any other inquiries.

(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

HAF2001

Silicon N Channel MOS FET Series
Power Switching

REJ03G1134-0700
(Previous: ADE-208-353D)
Rev.7.00
Apr 27, 2006

Description

This FET has the over temperature shut-down capability sensing to the junction temperature.

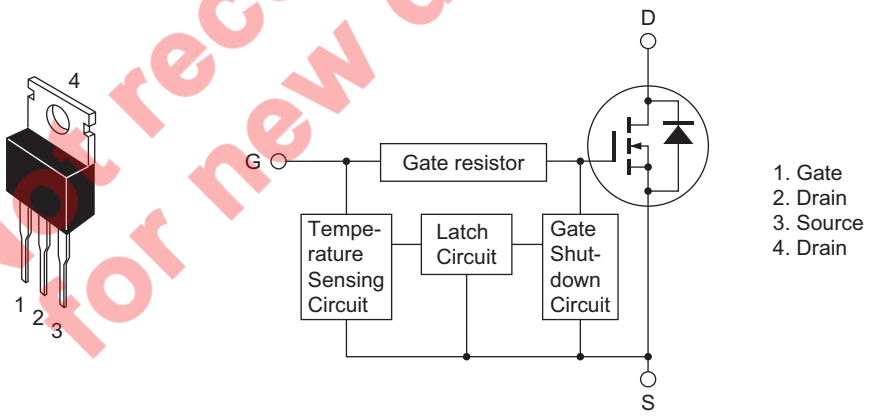
This FET has the built-in over temperature shut-down circuit in the gate area. And this circuit operation to shut-down the gate voltage in case of high junction temperature like applying over power consumption, over current etc.

Features

- Logic level operation (4 to 6 V Gate drive)
- High endurance capability against to the short circuit
- Built-in the over temperature shut-down circuit
- Latch type shut-down operation (Need 0 voltage recovery)

Outline

RENESAS Package code: PRSS0004AC-A
(Package name: TO-220AB)



Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Value	Unit
Drain to source voltage	V_{DSS}	60	V
Gate to source voltage	V_{GSS}	16	V
	V_{GSS}	–2.8	V
Drain current	I_D	20	A
Drain peak current	$I_{D\ (pulse)}$ Note 1	40	A
Body-drain diode reverse drain current	I_{DR}	20	A
Channel dissipation	Pch Note 2	50	W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

Notes: 1. PW ≤ 10 µs, duty cycle ≤ 1%
2. Value at Ta = 25°C

Typical Operation Characteristics

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Input voltage	V_{IH}	3.5	—	—	V	
	V_{IL}	—	—	1.2	V	
Input current (Gate non shut down)	I_{IH1}	—	—	100	µA	Vi = 8 V, V_{DS} = 0
	I_{IH2}	—	—	50	µA	Vi = 3.5 V, V_{DS} = 0
	I_{IL}	—	—	1	µA	Vi = 1.2 V, V_{DS} = 0
Input current (Gate shut down)	$I_{IH\ (sd)\ 1}$	—	0.8	—	mA	Vi = 8 V, V_{DS} = 0
	$I_{IH\ (sd)\ 2}$	—	0.35	—	mA	Vi = 3.5 V, V_{DS} = 0
Shut down temperature	Tsd	—	175	—	°C	Channel temperature
Gate operation voltage	V_{OP}	3.5	—	13	V	

Electrical Characteristics

(Ta = 25°C)

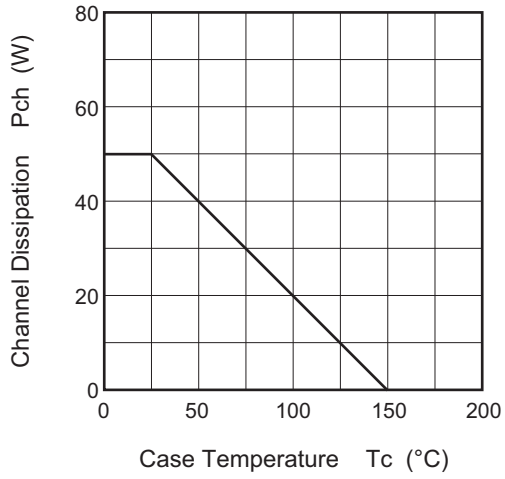
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	I_{D1}	10	—	—	A	V_{GS} = 3.5 V, V_{DS} = 2 V
	I_{D2}	—	—	10	mA	V_{GS} = 1.2 V, V_{DS} = 2 V
Drain to source breakdown voltage	$V_{(BR)\ DSS}$	60	—	—	V	I_D = 10 mA, V_{GS} = 0
Gate to source breakdown voltage	$V_{(BR)\ GSS}$	16	—	—	V	I_G = 100 µA, V_{DS} = 0
	$V_{(BR)\ GSS}$	–2.8	—	—	V	I_G = –100 µA, V_{DS} = 0
Gate to source leak current	I_{GSS1}	—	—	100	µA	V_{GS} = 8 V, V_{DS} = 0
	I_{GSS2}	—	—	50	µA	V_{GS} = 3.5 V, V_{DS} = 0
	I_{GSS3}	—	—	1	µA	V_{GS} = 1.2 V, V_{DS} = 0
	I_{GSS4}	—	—	–100	µA	V_{GS} = –2.4 V, V_{DS} = 0
Input current (shut down)	$I_{GS\ (op)\ 1}$	—	0.8	—	mA	V_{GS} = 8 V, V_{DS} = 0
	$I_{GS\ (op)\ 2}$	—	0.35	—	mA	V_{GS} = 3.5 V, V_{DS} = 0
Zero gate voltage drain current	I_{DSS}	—	—	250	µA	V_{DS} = 50 V, V_{GS} = 0
Gate to source cutoff voltage	$V_{GS\ (off)}$	1.0	—	2.25	V	I_D = 1 mA, V_{DS} = 10 V
Static drain to source on state resistance	$R_{DS\ (on)}$	—	50	65	mΩ	I_D = 10 A, V_{GS} = 4 V Note 3
	$R_{DS\ (on)}$	—	30	43	mΩ	I_D = 10 A, V_{GS} = 10 V Note 3
Forward transfer admittance	$\|y_{fs}\|$	6	12	—	S	I_D = 10 A, V_{DS} = 10 V Note 3
Output capacitance	Coss	—	630	—	pF	V_{DS} = 10 V, V_{GS} = 0 f = 1 MHz
Turn-on delay time	$t_{d\ (on)}$	—	7.5	—	µs	I_D = 5 A V_{GS} = 5 V R_L = 6 Ω
Rise time	t_r	—	29	—	µs	
Turn-off delay time	$t_{d\ (off)}$	—	34	—	µs	
Fall time	t_f	—	26	—	µs	
Body-drain diode forward voltage	V_{DF}	—	1.0	—	V	I_F = 20 A, V_{GS} = 0
Body-drain diode reverse recovery time	t_{rr}	—	110	—	ns	I_F = 20 A, V_{GS} = 0 di_F/dt = 50 A/µs
Over load shut down operation time Note4	t_{os1}	—	1.8	—	ms	V_{GS} = 5 V, V_{DD} = 12 V
	t_{os2}	—	0.7	—	ms	V_{GS} = 5 V, V_{DD} = 24 V

Notes: 3. Pulse test

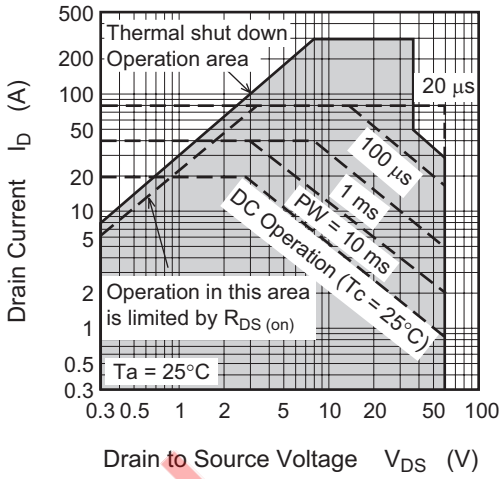
4. Include the time shift based on increasing of channel temperature when operate under over load condition.

Main Characteristics

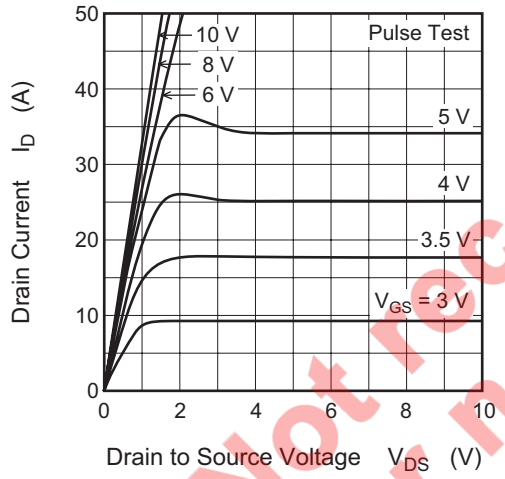
Power vs. Temperature Derating



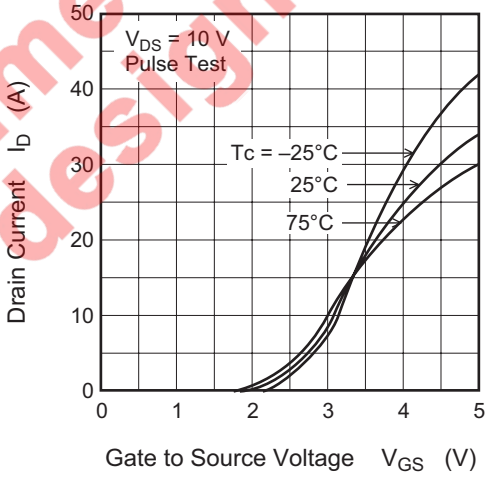
Maximum Safe Operation Area



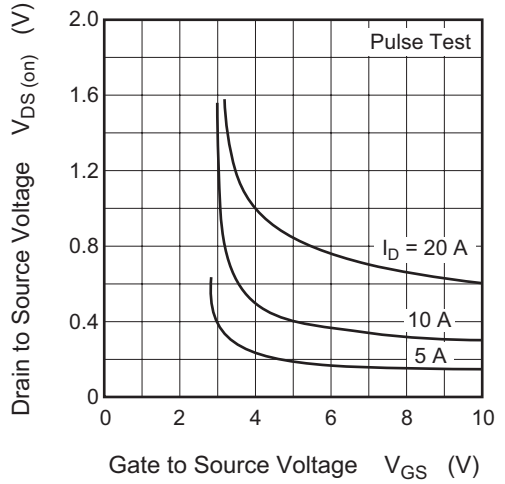
Typical Output Characteristics



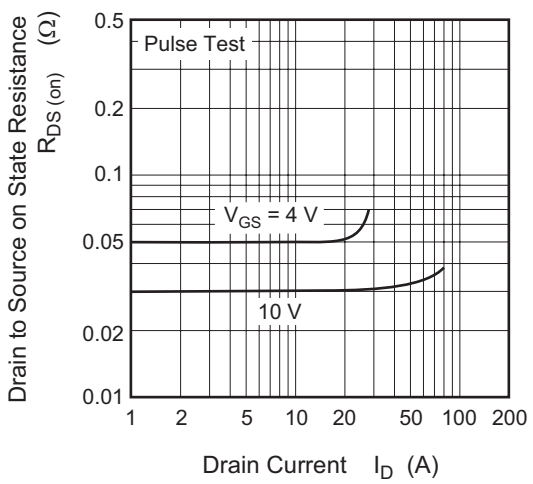
Typical Transfer Characteristics



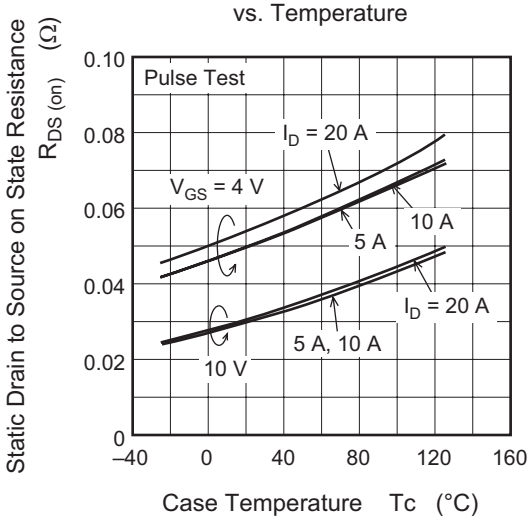
Drain to Source Saturation Voltage vs. Gate to Source Voltage



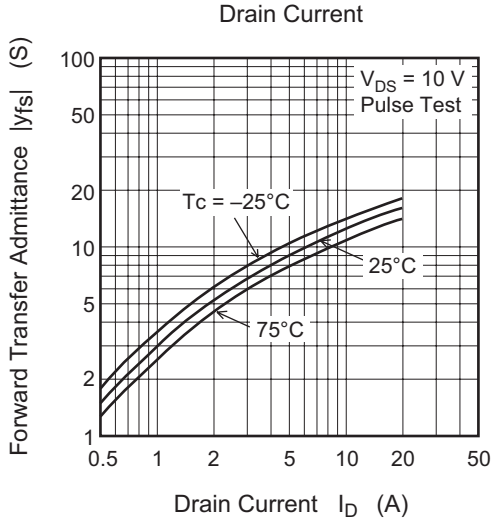
Static Drain to Source on State Resistance vs. Drain Current



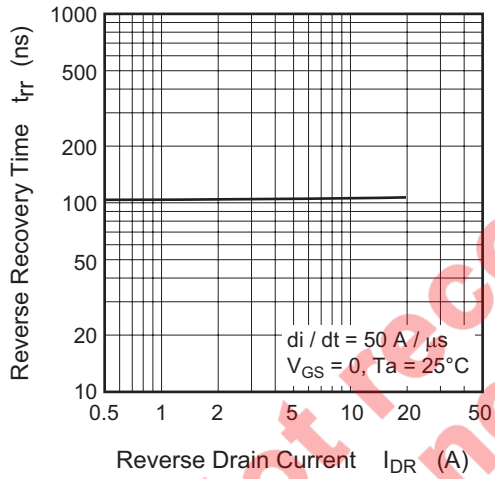
Static Drain to Source on State Resistance vs. Temperature



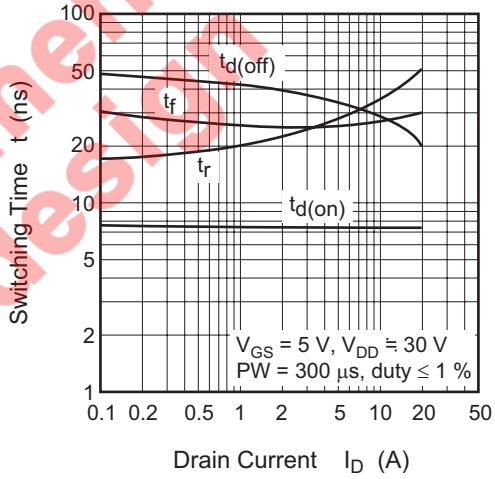
Forward Transfer Admittance vs. Drain Current



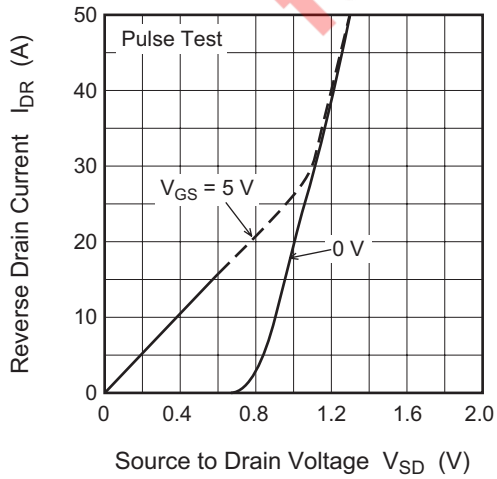
Body-Drain Diode Reverse Recovery Time



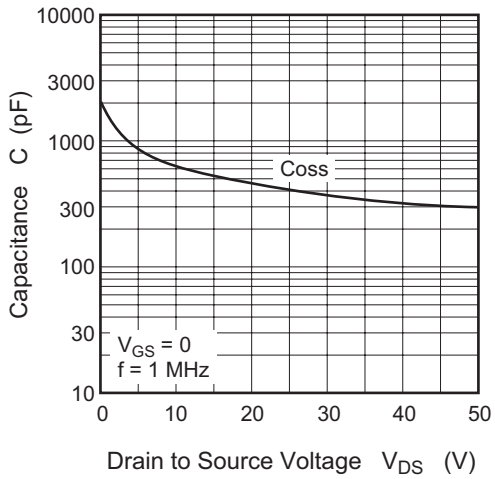
Switching Characteristics



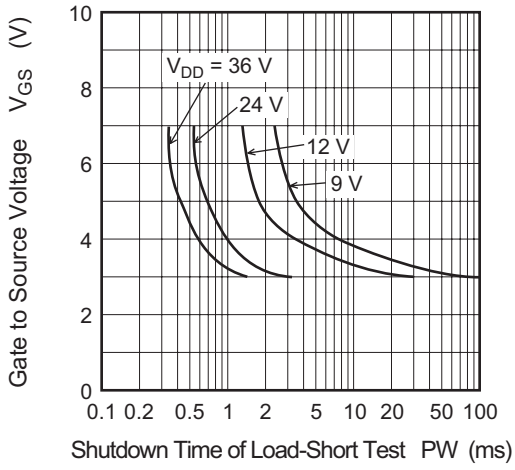
Reverse Drain Current vs. Source to Drain Voltage



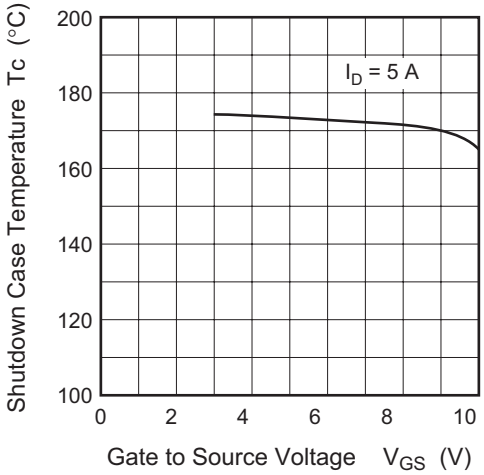
Typical Capacitance vs. Drain to Source Voltage



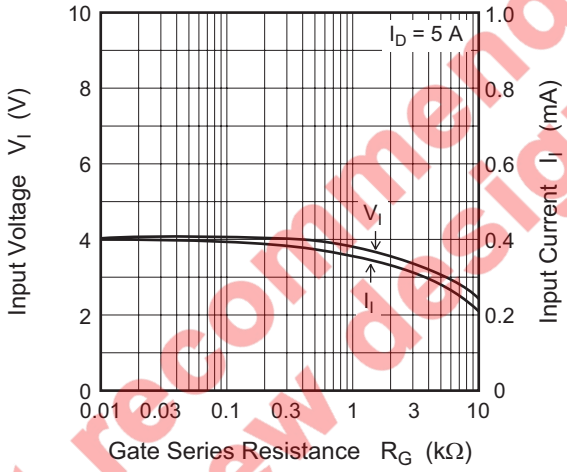
Gate to Source Voltage vs.
Shutdown Time of Load-Short Test



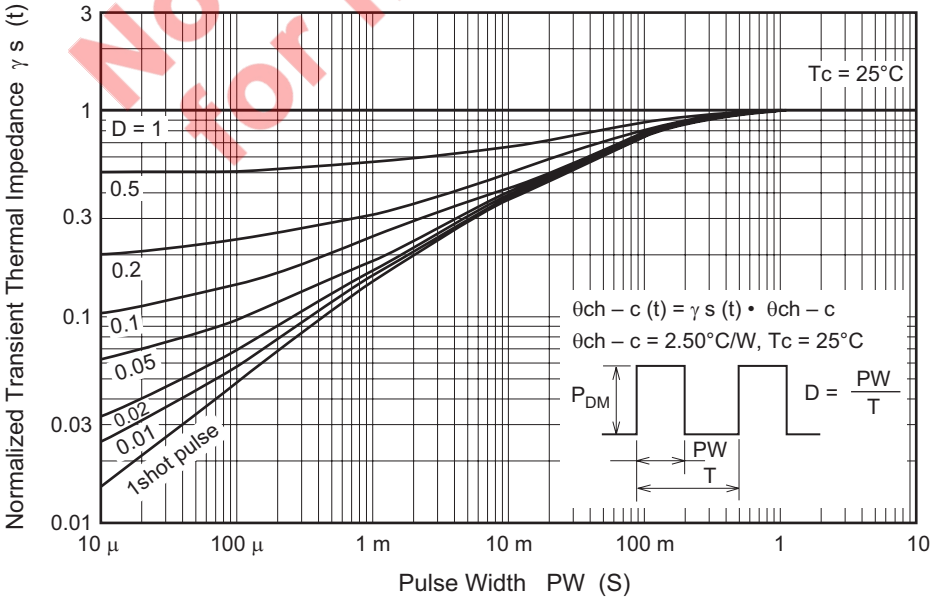
Shutdown Case Temperature vs.
Gate to Source Voltage



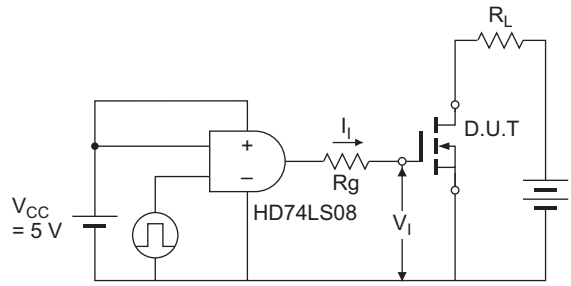
TTL Drive Characteristics

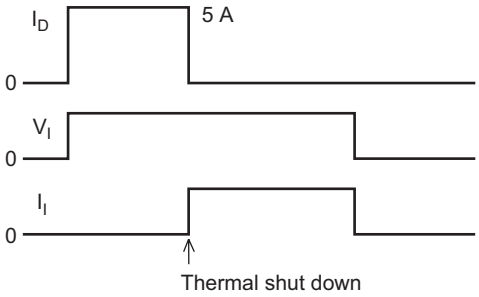


Normalized Transient Thermal Impedance vs. Pulse Width

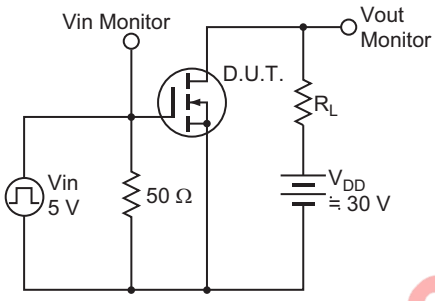


Test Circuit

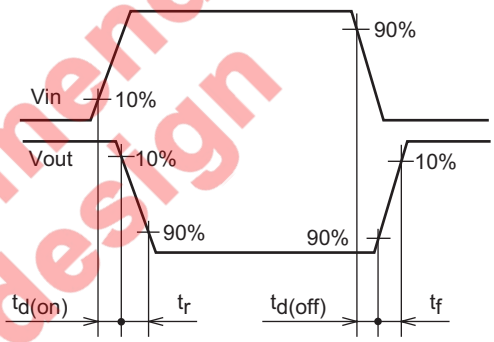




Switching Time Test Circuit



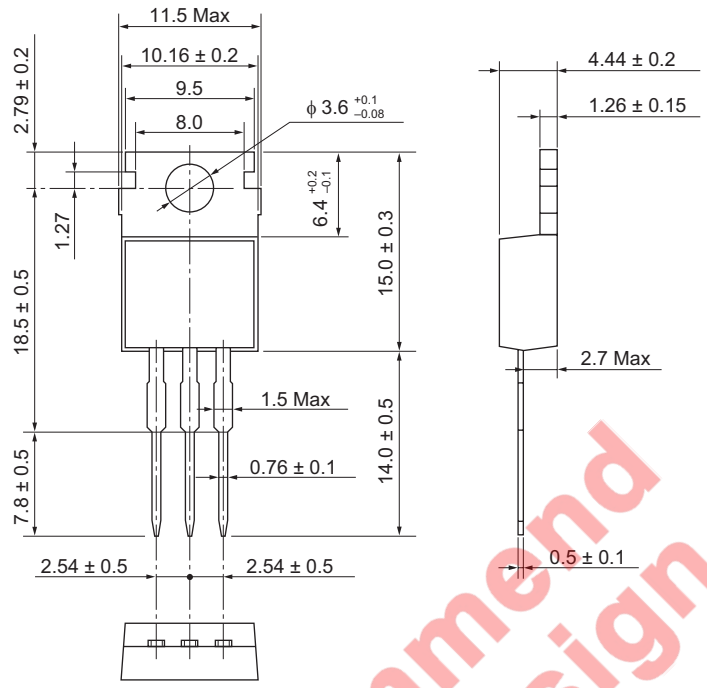
Waveform



Package Dimensions

JEITA Package Code	RENESAS Code	Package Name	MASS[Typ.]
SC-46	PRSS0004AC-A	TO-220AB / TO-220ABV	1.8g

Unit: mm



Ordering Information

Part Name	Quantity	Shipping Container
HAF2001-90	Max: 50 pcs/sack	Sack

Note: For some grades, production may be terminated. Please contact the Renesas sales office to check the state of production before ordering the product.

Renesas Technology Corp. Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

RENESAS SALES OFFICES

http://www.renesas.com

Refer to "**http://www.renesas.com/en/network**" for the latest and detailed information.

Renesas Technology America, Inc.
450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500, Fax: <1> (408) 382-7501

Renesas Technology Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.
Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

Renesas Technology (Shanghai) Co., Ltd.
Unit 204, 205, AZIACenter, No.1233 Lujiazui Ring Rd, Pudong District, Shanghai, China 200120
Tel: <86> (21) 5877-1818, Fax: <86> (21) 6887-7898

Renesas Technology Hong Kong Ltd.
7th Floor, North Tower, World Finance Centre, Harbour City, 1 Canton Road, Tsimshatsui, Kowloon, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2730-6071

Renesas Technology Taiwan Co., Ltd.
10th Floor, No.99, Fushing North Road, Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

Renesas Technology Singapore Pte. Ltd.
1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001

Renesas Technology Korea Co., Ltd.
Kukje Center Bldg. 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea
Tel: <82> (2) 796-3115, Fax: <82> (2) 796-2145

Renesas Technology Malaysia Sdn. Bhd
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No.18, Jalan Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: <603> 7955-9390, Fax: <603> 7955-9510

Colophon .6.0