To all our customers

Regarding the change of names mentioned in the document, such as Hitachi Electric and Hitachi XX, to Renesas Technology Corp.

The semiconductor operations of Mitsubishi Electric and Hitachi were transferred to Renesas Technology Corporation on April 1st 2003. These operations include microcomputer, logic, analog and discrete devices, and memory chips other than DRAMs (flash memory, SRAMs etc.) Accordingly, although Hitachi, Hitachi, Ltd., Hitachi Semiconductors, and other Hitachi brand names are mentioned in the document, these names have in fact all been changed to Renesas Technology Corp. Thank you for your understanding. Except for our corporate trademark, logo and corporate statement, no changes whatsoever have been made to the contents of the document, and these changes do not constitute any alteration to the contents of the document itself.

Renesas Technology Home Page: http://www.renesas.com

Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

Cautions

H7N0203AB

Silicon N Channel MOS FET
High Speed Power Switching

ADE-208-1490C (Z)

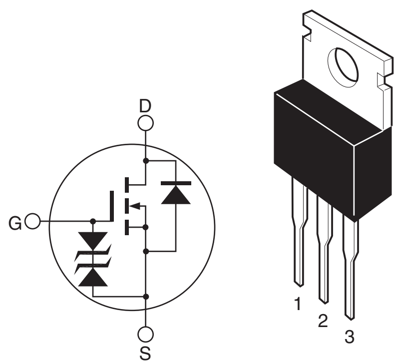
4th. Edition
Aug. 2002

Features

- Low on-resistance
- $R_{DS(on)}$ =2.4 mΩ typ.
- Low drive current
- 4.5 V gate drive device can be driven from 5 V source

Outline

TO-220AB



1. Gate
2. Drain (Flange)
3. Source

Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DSS}	20	V
Gate to source voltage	V_{GSS}	±20	V
Drain current	I_D	90	A
Drain peak current	$I_{D(pulse)}$ Note 1	360	A
Body-drain diode reverse drain current	I_{DR}	90	A
Avalanche current	I_{AP} Note2	20	A
Avalanche energy	E_{AR} Note2	40	mJ
Channel dissipation	Pch Note 3	100	W
Channel to Case Thermal Impedance	θch-c	1.25	°C/W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

Notes: 1. PW ≤ 10 µs, duty cycle ≤ 1%
2. Value at Tch = 25°C, Rg ≥ 50 Ω
3. Value at Tc = 25°C

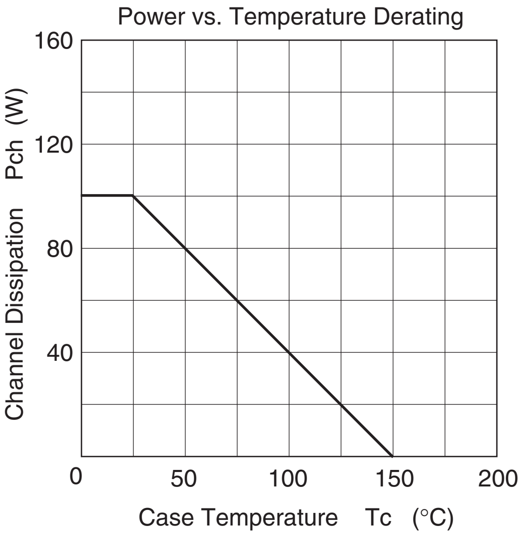
Electrical Characteristics

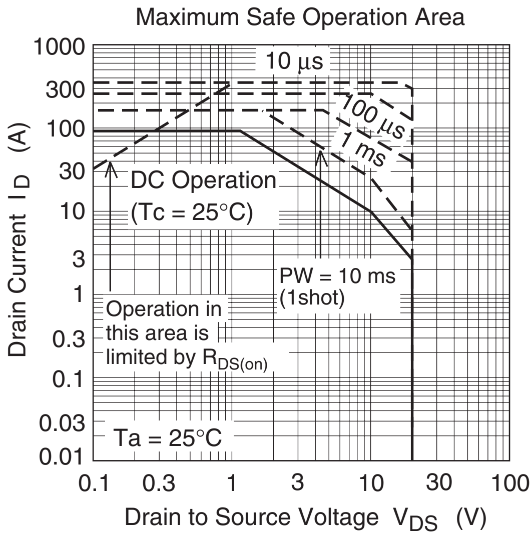
(Ta = 25°C)

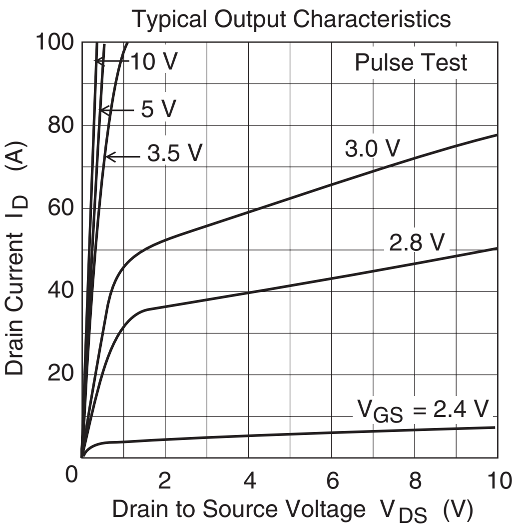
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	20	—	—	V	I_D = 10 mA, V_{GS} = 0
Gate to source breakdown voltage	$V_{(BR)GSS}$	±20	—	—		I_G = ±100 µA, V_{DS} = 0
Gate to source leak current	I_{GSS}	—	—	±10	µA	V_{GS} = ±16 V, V_{DS} = 0
Zero gate voltage drain current	I_{DSS}	—	—	10	µA	V_{DS} = 20 V, V_{GS} = 0
Gate to source cutoff voltage	$V_{GS(off)}$	1.0	—	2.5	V	I_D = 1 mA, V_{DS} = 10 V*[1]
Static drain to source on state resistance	$R_{DS(on)}$	—	2.4	3.0	mΩ	I_D = 45 A, V_{GS} = 10 V*[1]
		—	3.5	5.1	mΩ	I_D = 45 A, V_{GS} = 4.5 V*[1]
Forward transfer admittance	$\|y_{fs}\|$	80	140	—	S	I_D = 45 A, V_{DS} = 10 V*[1]
Input capacitance	Ciss	—	6800	—	pF	V_{DS} = 10 V
Output capacitance	Coss	—	1850	—	pF	V_{GS} = 0
Reverse transfer capacitance	Crss	—	750	—	pF	f = 1 MHz
Total gate charge	Qg	—	110	—	nc	V_{DD} = 10 V
Gate to source charge	Qgs	—	22	—	nc	V_{GS} = 10 V
Gate to drain charge	Qgd	—	20	—	nc	I_D = 90 A
Turn-on delay time	$t_{d(on)}$	—	32	—	ns	V_{GS} = 10 V, I_D = 45 A
Rise time	t_r	—	380	—	ns	R_L =0.22 Ω
Turn-off delay time	$t_{d(off)}$	—	110	—	ns	R_g =4.7 Ω
Fall time	t_f	—	35	—	ns	
Body–drain diode forward voltage	V_{DF}	—	0.90	—	V	I_F = 90 A, V_{GS} = 0
Body–drain diode reverse recovery time	t_{rr}	—	60	—	ns	I_F = 90 A, V_{GS} = 0 diF/ dt =50 A/µs

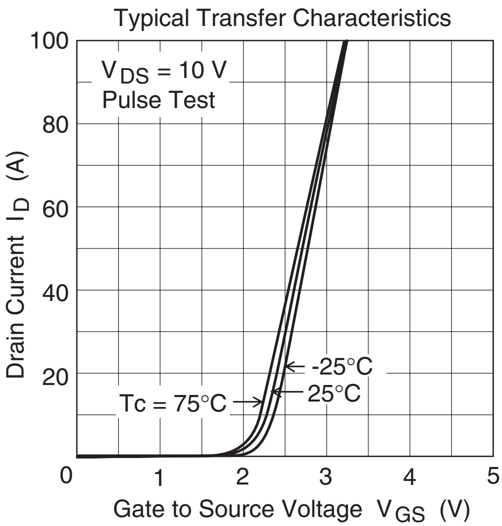
Note: 1. Pulse test

Main Characteristics

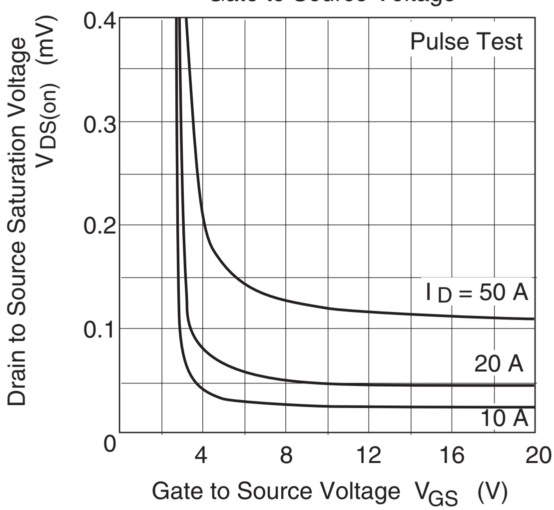




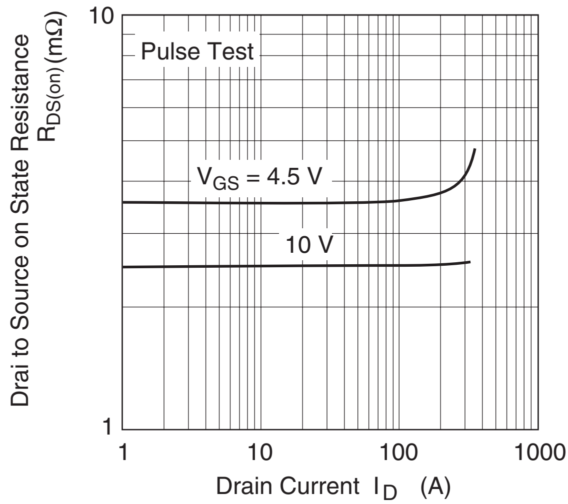




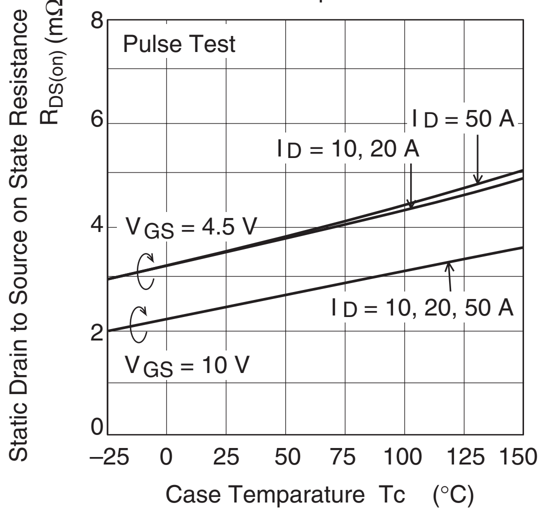
Drain to Source Saturation Voltage VS.
Gate to Source Voltage



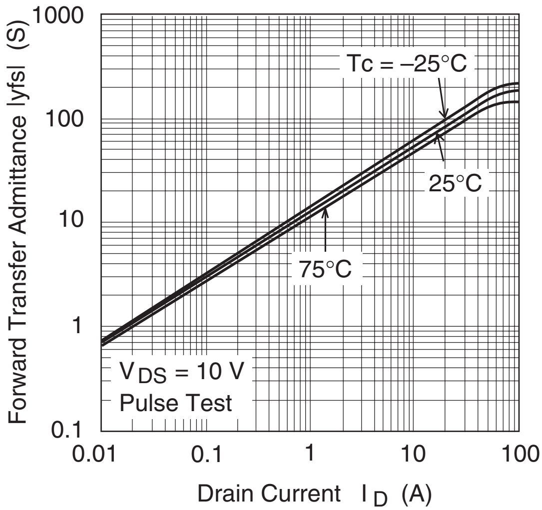
Static Drain to Source on State Resistance
vs. Drain Current

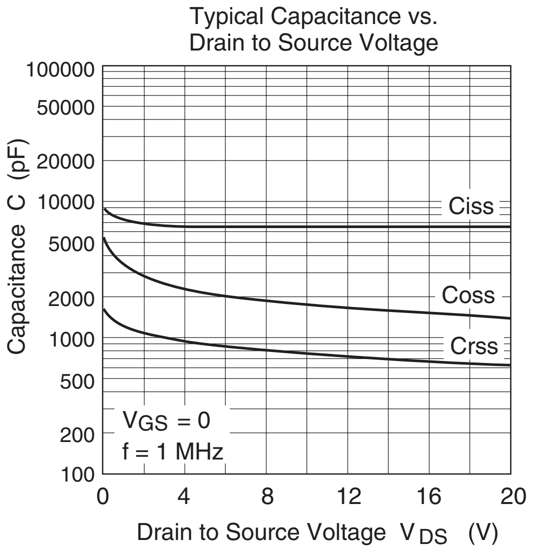


Static Drain to Source on State Resistance
vs. Temperature

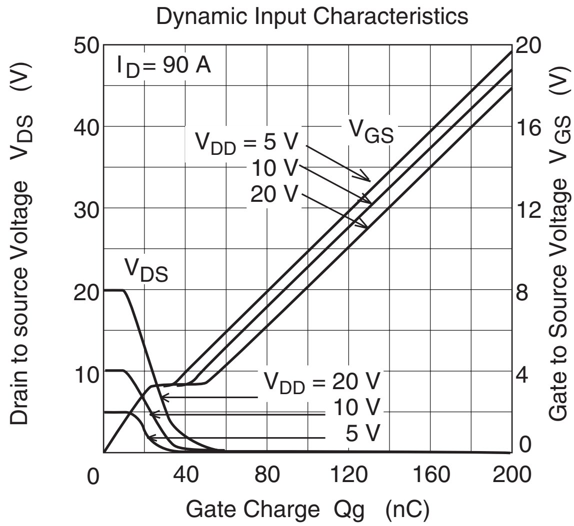


Forward Transfer Admittance vs.
Drain Current

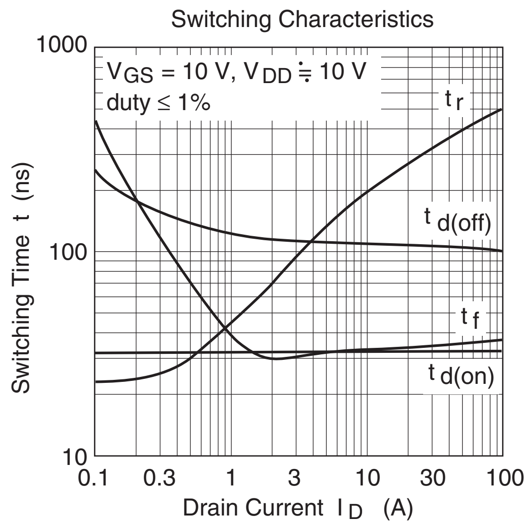




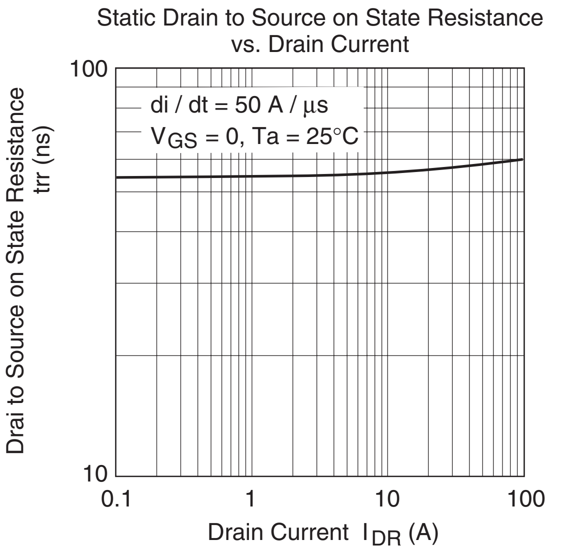
Typical Capacitance vs.
Drain to Source Voltage
Capacitance C (pF)
100000
50000
20000
10000
5000
2000
1000
500
200
100
Ciss
Coss
Crss
VGS = 0
f = 1 MHz
0
4
8
12
16
20
Drain to Source Voltage VDS (V)



Dynamic Input Characteristics
Drain to source Voltage VDS (V)
Gate to Source Voltage VGS (V)
ID = 90 A
VDD = 5 V
10 V
20 V
VGS
VDS
VDD = 20 V
10 V
5 V
0
40
80
120
160
200
Gate Charge Qg (nC)

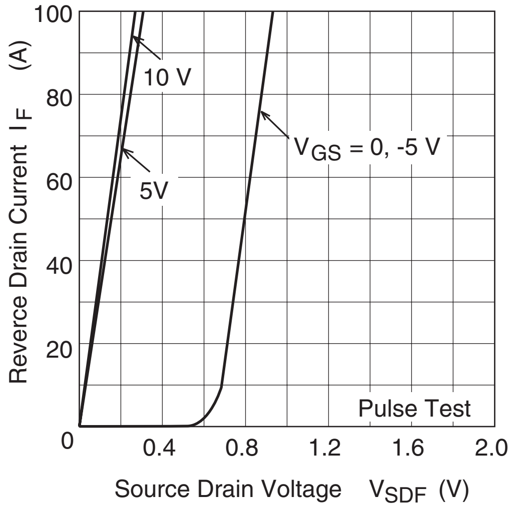


Switching Characteristics
Switching Time t (ns)
1000
100
10
VGS = 10 V, VDD ≒ 10 V
duty ≤ 1%
tr
td(off)
tf
td(on)
0.1
0.3
1
3
10
30
100
Drain Current ID (A)

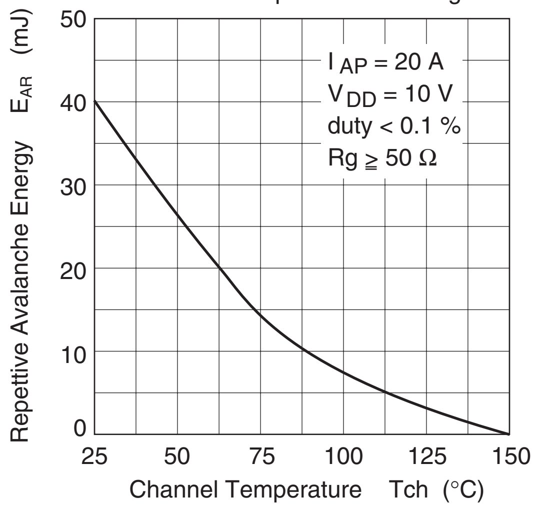


Static Drain to Source on State Resistance
vs. Drain Current
Drai to Source on State Resistance
trr (ns)
100
10
di / dt = 50 A / µs
VGS = 0, Ta = 25°C
0.1
1
10
100
Drain Current IDR (A)

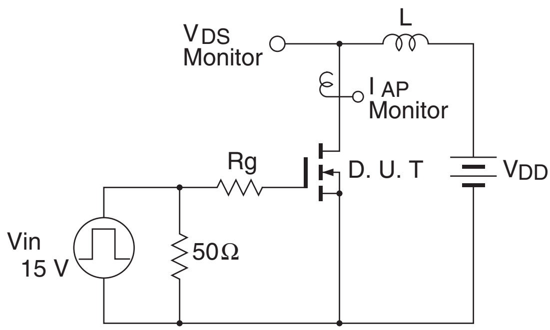
Reverce Drain Current vs.
Source to Drain Voltage



Maximum Avalanche Energy vs.
Channel Temperature Derating

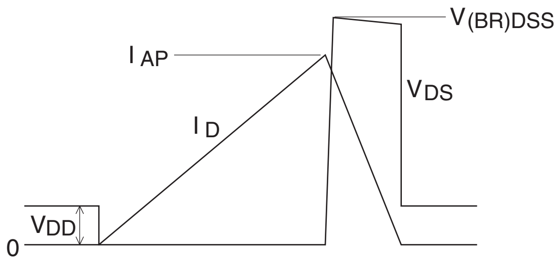


Avalanche Test Circuit

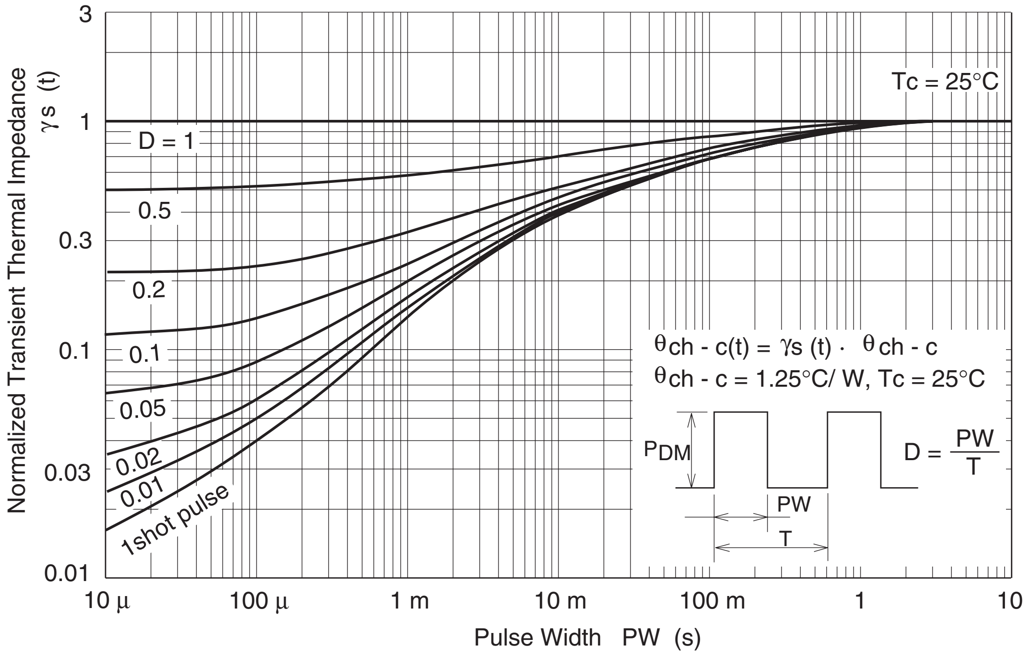


Avalanche Waveform

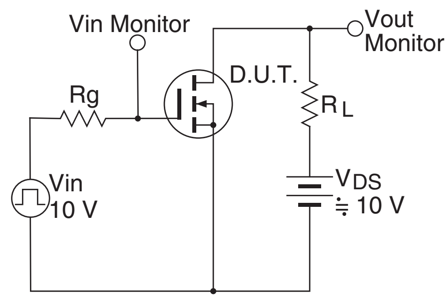
$$E_{AR} = \frac{1}{2} \bullet L \bullet I_{AP}^{2} \bullet \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$



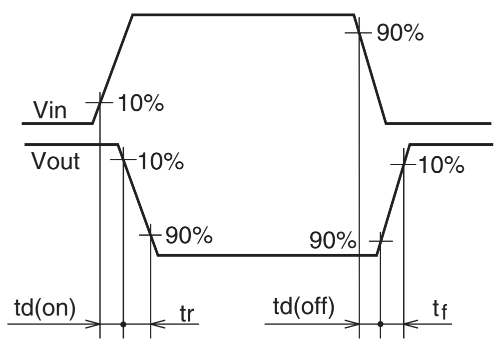
Normalized Transient Thermal Impedance vs. Pulse Width



Switching Time Test Circuit

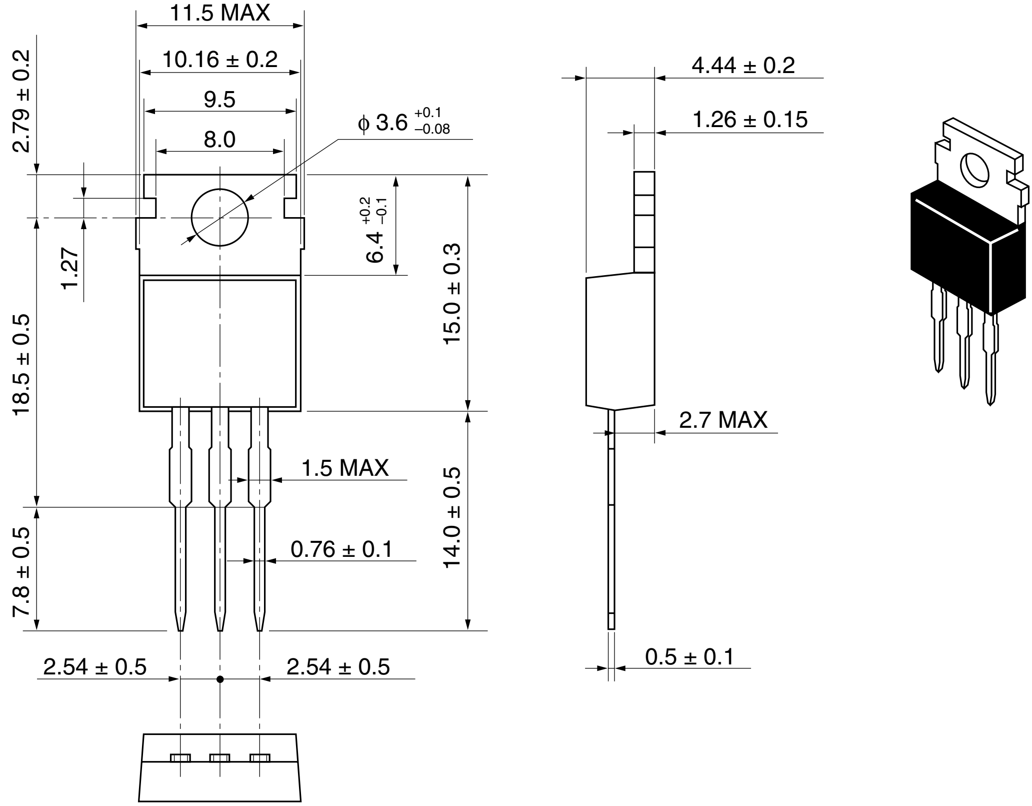


Switching Time Waveform



Package Dimensions

As of January, 2002
Unit: mm



Hitachi Code	TO-220AB
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	1.8 g

Disclaimer

1. Hitachi neither warrants nor grants licenses of any rights of Hitachi's or any third party's patent, copyright, trademark, or other intellectual property rights for information contained in this document. Hitachi bears no responsibility for problems that may arise with third party's rights, including intellectual property rights, in connection with use of the information contained in this document.
2. Products and product specifications may be subject to change without notice. Confirm that you have received the latest product standards or specifications before final design, purchase or use.
3. Hitachi makes every attempt to ensure that its products are of high quality and reliability. However, contact Hitachi's sales office before using the product in an application that demands especially high quality and reliability or where its failure or malfunction may directly threaten human life or cause risk of bodily injury, such as aerospace, aeronautics, nuclear power, combustion control, transportation, traffic, safety equipment or medical equipment for life support.
4. Design your application so that the product is used within the ranges guaranteed by Hitachi particularly for maximum rating, operating supply voltage range, heat radiation characteristics, installation conditions and other characteristics. Hitachi bears no responsibility for failure or damage when used beyond the guaranteed ranges. Even within the guaranteed ranges, consider normally foreseeable failure rates or failure modes in semiconductor devices and employ systemic measures such as fail-safes, so that the equipment incorporating Hitachi product does not cause bodily injury, fire or other consequential damage due to operation of the Hitachi product.
5. This product is not designed to be radiation resistant.
6. No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without written approval from Hitachi.
7. Contact Hitachi's sales office for any questions regarding this document or Hitachi semiconductor products.

Sales Offices

HITACHI

Hitachi, Ltd.
Semiconductor & Integrated Circuits
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: (03) 3270-2111 Fax: (03) 3270-5109

URL http://www.hitachisemiconductor.com/

For further information write to:

Hitachi Semiconductor (America) Inc.
179 East Tasman Drive
San Jose,CA 95134
Tel: <1> (408) 433-1990
Fax: <1>(408) 433-0223

Hitachi Europe Ltd.
Electronic Components Group
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: <44> (1628) 585000
Fax: <44> (1628) 585200

Hitachi Europe GmbH
Electronic Components Group
Dornacher Straße 3
D-85622 Feldkirchen
Postfach 201, D-85619 Feldkirchen
Germany
Tel: <49> (89) 9 9180-0
Fax: <49> (89) 9 29 30 00

Hitachi Asia Ltd.
Hitachi Tower
16 Collyer Quay #20-00
Singapore 049318
Tel : <65>-6538-6533/6538-8577
Fax : <65>-6538-6933/6538-3877
URL : http://semiconductor.hitachi.com.sg

Hitachi Asia Ltd.
(Taipei Branch Office)
4/F, No. 167, Tun Hwa North Road
Hung-Kuo Building
Taipei (105), Taiwan
Tel : <886>-(2)-2718-3666
Fax : <886>-(2)-2718-8180
Telex : 23222 HAS-TP
URL : http://www.hitachi.com.tw

Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower
World Finance Centre,
Harbour City, Canton Road
Tsim Sha Tsui, Kowloon Hong Kong
Tel : <852>-2735-9218
Fax : <852>-2730-0281
URL : http://semiconductor.hitachi.com.hk

Colophon 6.0