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

RENESAS
Renesas Technology Corp.

Cautions

HAT3008R/HAT3008RJ

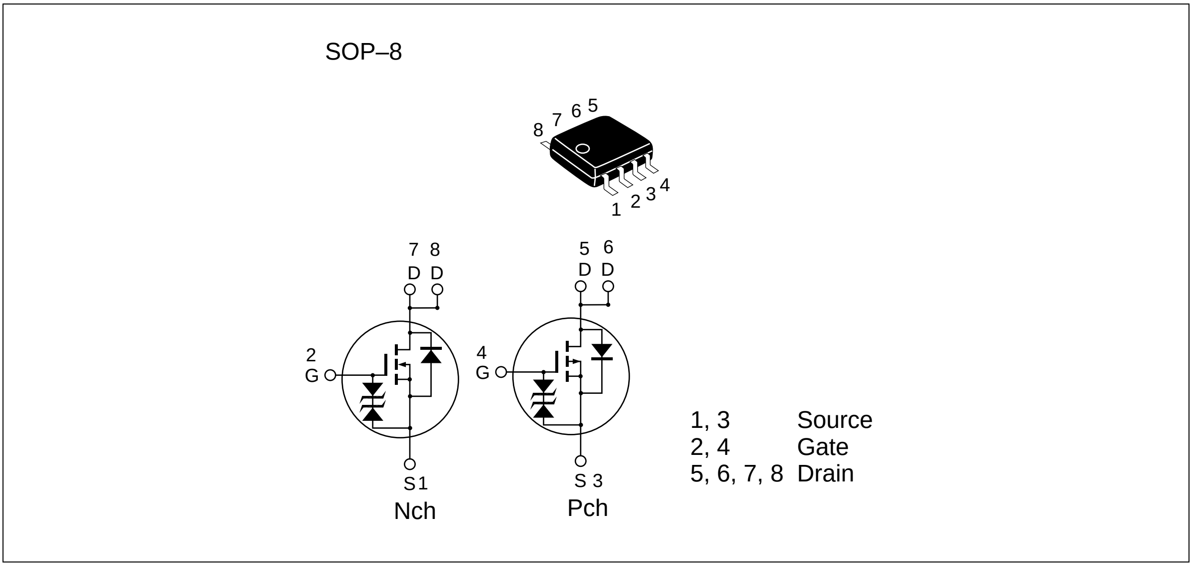
Silicon N/P Channel Power MOS FET
High Speed Power Switching

ADE-208-536B (Z)
3rd. Edition
Feb. 1999

Features

- For Automotive Application (at Type Code “J “)
- Low on-resistance
- Capable of 4 V gate drive
- High density mounting

Outline



Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings		Unit
			Nch	Pch	
Drain to source voltage		V_{DSS}	60	– 60	V
Gate to source voltage		V_{GSS}	±20	± 20	V
Drain current		I_D	5	– 3.5	A
Drain peak current		$I_{D(pulse)}$ Note1	40	– 28	A
Body-drain diode		I_{DR}	5	– 3.5	A
reverse drain current					
Avalanche current	HAT3008R	I_{AP} Note4	—	—	—
	HAT3008RJ		5	– 3.5	A
Avalanche energy	HAT3008R	E_{AR} Note4	—	—	—
	HAT3008RJ		2.14	1.05	mJ
Channel dissipation		Pch Note2	2	2	W
Channel dissipation		Pch Note3	3	3	W
Channel temperature		Tch	150	150	°C
Storage temperature		Tstg	– 55 to + 150	–55 to + 150	°C

Note: 1. PW ≤ 10µs, duty cycle ≤ 1 %
2. 1 Drive operation : When using the glass epoxy board (FR4 40 x 40 x 1.6 mm), PW≤ 10s
3. 2 Drive operation : When using the glass epoxy board (FR4 40 x 40 x 1.6 mm), PW≤ 10s
4. Value at Tch=25°C, Rg≥50Ω

Electrical Characteristics (Ta = 25°C)

(N Channel)

Item		Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage		$V_{(BR)DSS}$	60	—	—	V	I_D = 10 mA, V_{GS} = 0
Gate to source breakdown voltage		$V_{(BR)GSS}$	± 20	—	—	V	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	HAT3008R	I_{DSS}	—	—	1	µA	V_{DS} = 60 V, V_{GS} = 0
drain current	HAT3008RJ	I_{DSS}	—	—	0.1	µA	
Zero gate voltage	HAT3008R	I_{DSS}	—	—	—	µA	V_{DS} = 48 V, V_{GS} = 0
drain current	HAT3008RJ	I_{DSS}	—	—	10	µA	Ta = 125°C
Gate to source cutoff voltage		$V_{GS(off)}$	1.2	—	2.2	V	V_{DS} = 10 V, I_D = 1 mA
Static drain to source on state		$R_{DS(on)}$	—	0.043	0.058	Ω	I_D = 3 A, V_{GS} = 10 V Note4
resistance		$R_{DS(on)}$	—	0.056	0.084	Ω	I_D = 3 A, V_{GS} = 4 V Note4
Forward transfer admittance		$\|y_{fs}\|$	6	9	—	S	I_D = 3 A, V_{DS} = 10 V Note4
Input capacitance		Ciss	—	520	—	pF	V_{DS} = 10 V
Output capacitance		Coss	—	270	—	pF	V_{GS} = 0
Reverse transfer capacitance		Crss	—	100	—	pF	f = 1MHz
Turn-on delay time		$t_{d(on)}$	—	11	—	ns	V_{GS} =10 V, I_D = 3 A
Rise time		t_r	—	40	—	ns	V_{DD} ≅ 30 V
Turn-off delay time		$t_{d(off)}$	—	110	—	ns	
Fall time		t_f	—	80	—	ns	
Body–drain diode forward voltage		V_{DF}	—	0.84	1.1	V	IF = 5 A, V_{GS} = 0 Note4
Body–drain diode reverse recovery time		t_{rr}	—	40	—	ns	IF =5 A, V_{GS} = 0 diF/ dt = 50 A/µs

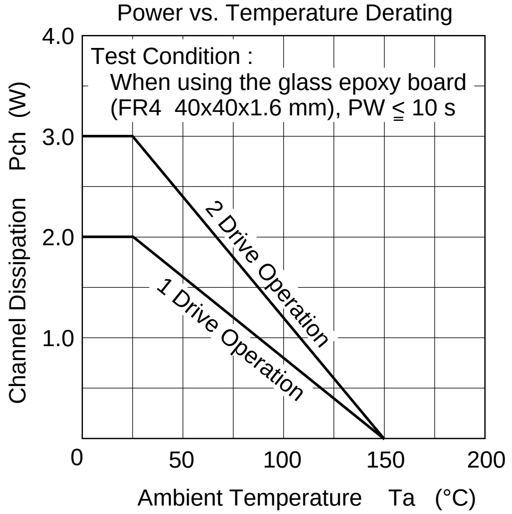
Note: 5. Pulse test

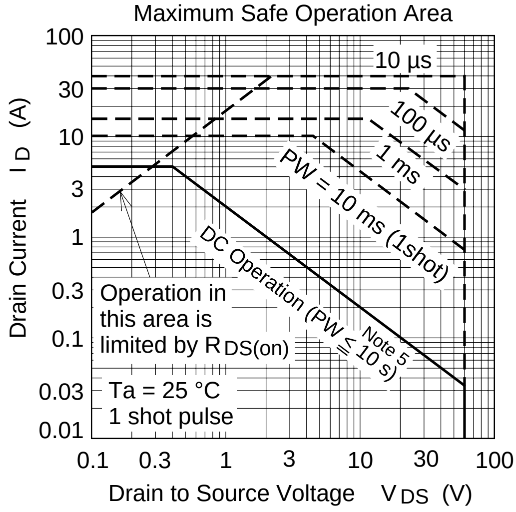
(P Channel)

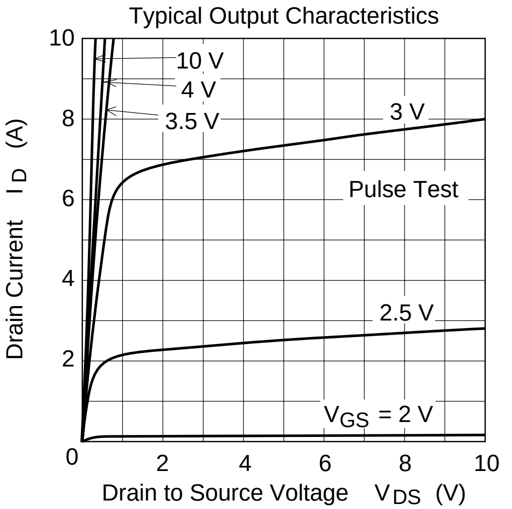
Item		Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage		$V_{(BR)DSS}$	– 60	—	—	V	I_D = – 10 mA, V_{GS} = 0
Gate to source breakdown voltage		$V_{(BR)GSS}$	± 20	—	—	V	I_G = ± 100 μA, V_{DS} = 0
Gate to source leak current		I_{GSS}	—	—	±10	μA	V_{GS} = ± 16 V, V_{DS} = 0
Zero gate voltage drain current	HAT3008R	I_{DSS}	—	—	–1	μA	V_{DS} = – 60 V, V_{GS} = 0
	HAT3008RJ	I_{DSS}	—	—	–0.1	μA	
Zero gate voltage drain current	HAT3008R	I_{DSS}	—	—	—	μA	V_{DS} = – 48 V, V_{GS} = 0
	HAT3008RJ	I_{DSS}	—	—	–10	μA	Ta = 125°C
Gate to source cutoff voltage		$V_{GS(off)}$	–1.2	—	–2.2	V	V_{DS} = – 10 V, I_D = – 1mA
Static drain to source on state resistance		$R_{DS(on)}$	—	0.12	0.15	Ω	I_D = – 2 A, V_{GS} = – 10 V Note4
		$R_{DS(on)}$	—	0.16	0.23	Ω	I_D = – 2 A, V_{GS} = – 4 V Note4
Forward transfer admittance		$\|y_{fs}\|$	3	4.5	—	S	I_D = – 2 A, V_{DS} = –10 V Note4
Input capacitance		Ciss	—	600	—	pF	V_{DS} = –10 V
Output capacitance		Coss	—	290	—	pF	V_{GS} = 0
Reverse transfer capacitance		Crss	—	75	—	pF	f = 1MHz
Turn-on delay time		$t_{d(on)}$	—	11	—	ns	V_{GS} = –10 V, I_D = – 2 A
Rise time		t_r	—	30	—	ns	V_{DD} ≅ – 30 V
Turn-off delay time		$t_{d(off)}$	—	100	—	ns	
Fall time		t_f	—	55	—	ns	
Body–drain diode forward voltage		V_{DF}	—	– 0.98	– 1.28	V	IF = – 3.5 A, V_{GS} = 0 Note4
Body–drain diode reverse recovery time		t_{rr}	—	70	—	ns	IF = – 3.5 A, V_{GS} = 0 diF/ dt = 50 A/μs

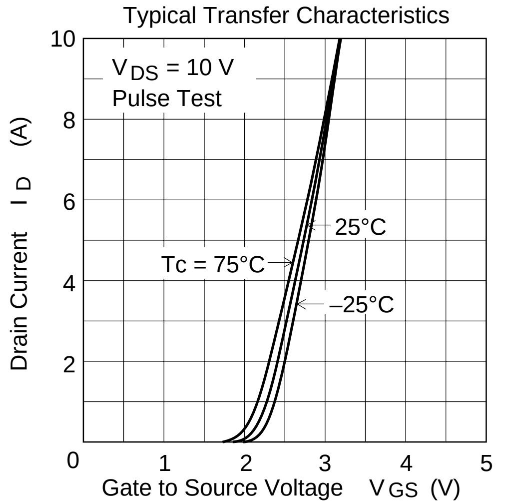
Note: 5. Pulse test

Main Characteristics (N Channel)

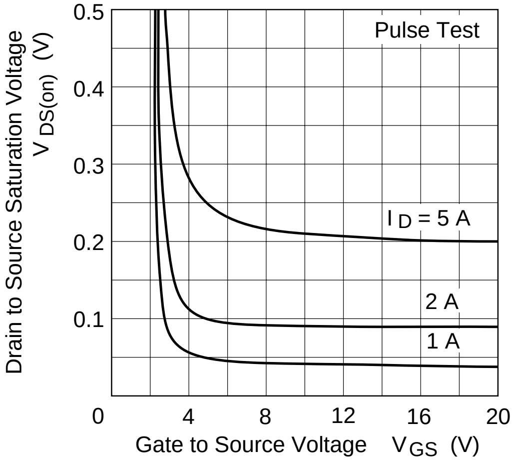




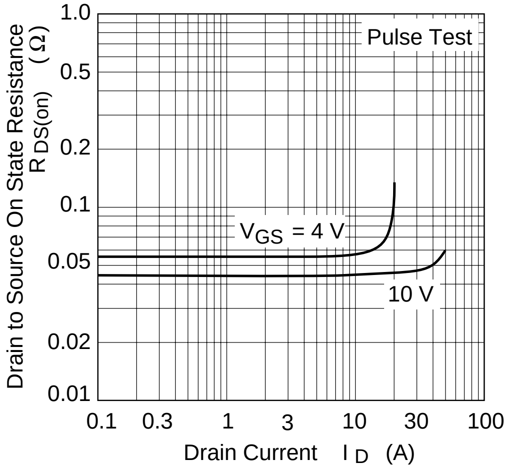




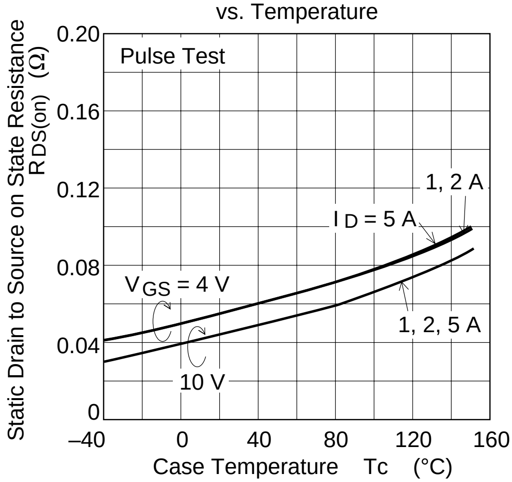
Drain to Source Saturation Voltage vs. Gate to Source Voltage



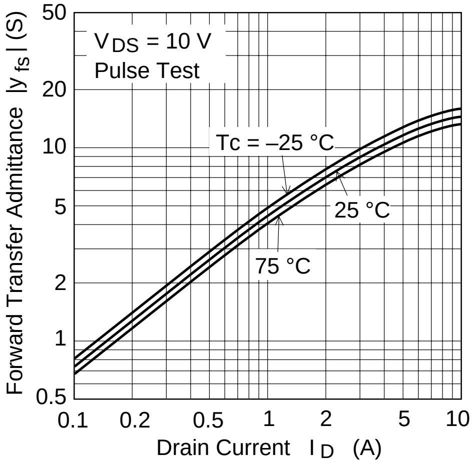
Static Drain to Source on State Resistance vs. Drain Current



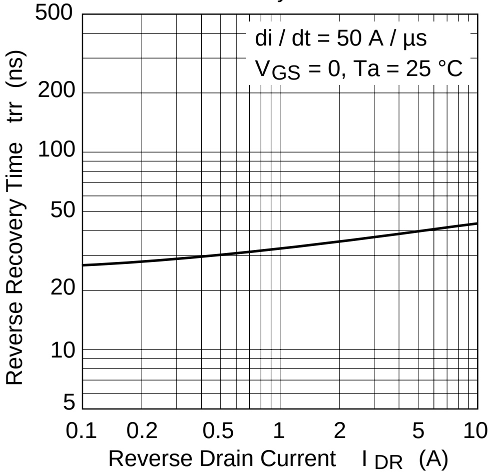
Static Drain to Source on State Resistance vs. Temperature



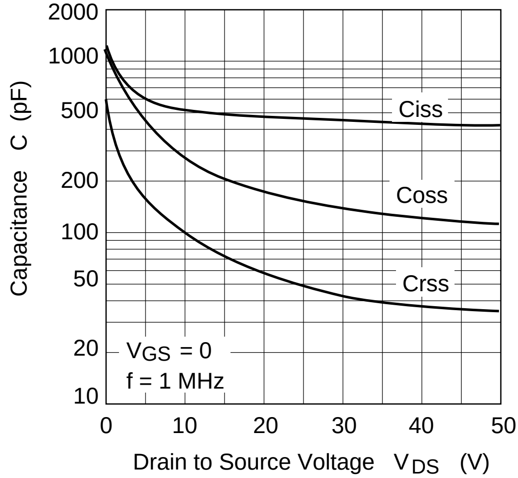
Forward Transfer Admittance vs. Drain Current



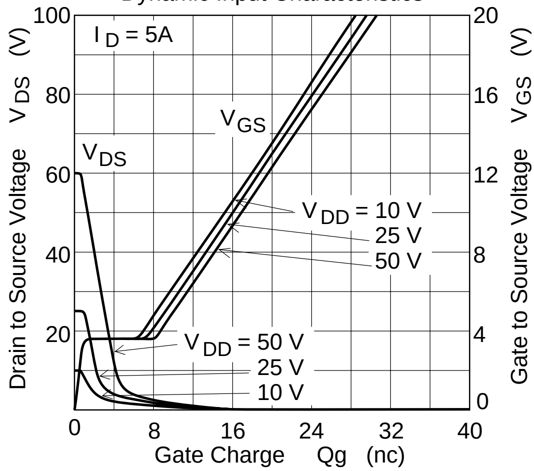
Body–Drain Diode Reverse Recovery Time



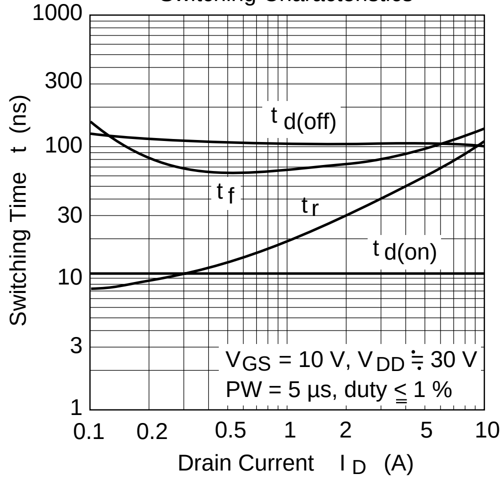
Typical Capacitance vs. Drain to Source Voltage



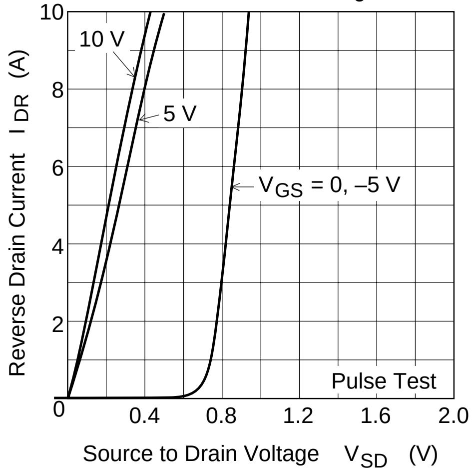
Dynamic Input Characteristics



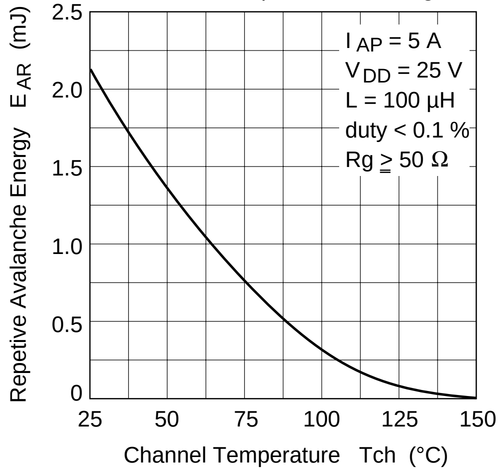
Switching Characteristics



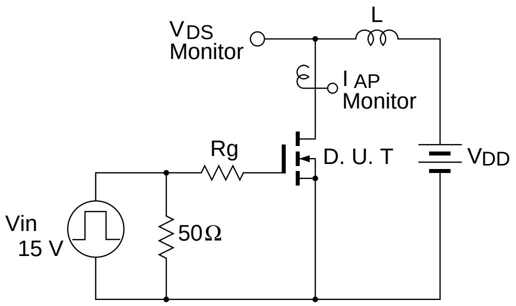
Reverse Drain Current vs. Source to Drain Voltage



Maximun Avalanche Energy vs. Channel Temperature Derating

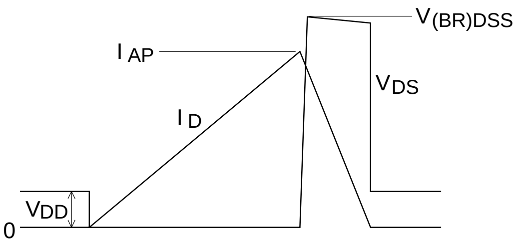


Avalanche Test Circuit

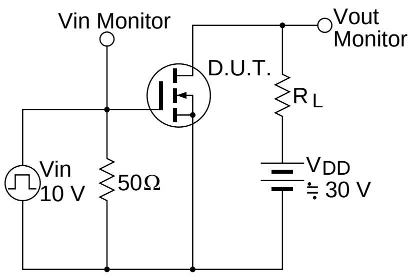


Avalanche Waveform

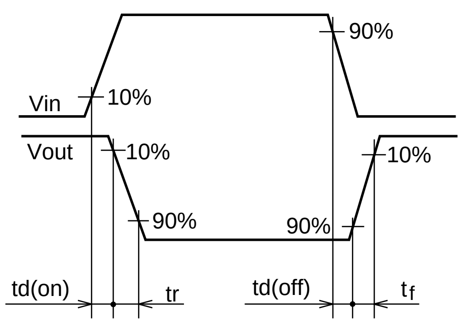
$$E_{AR} = \frac{1}{2} \cdot L \cdot I_{AP}{}^{2} \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$



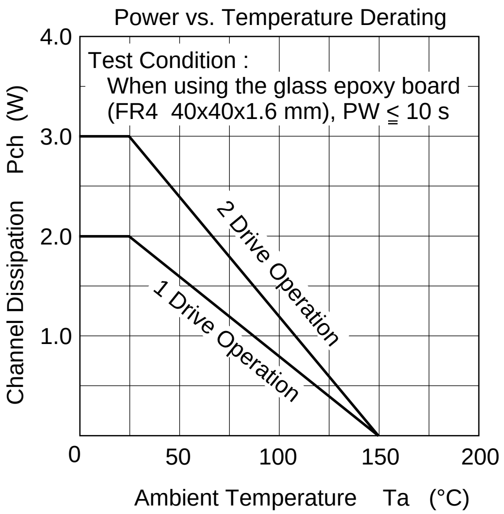
Switching Time Test Circuit

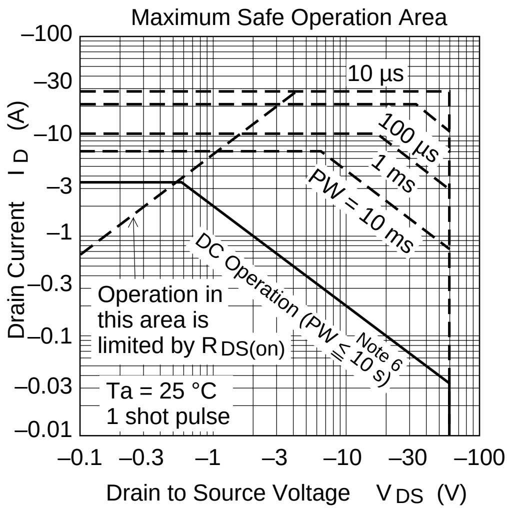


Switching Time Waveform

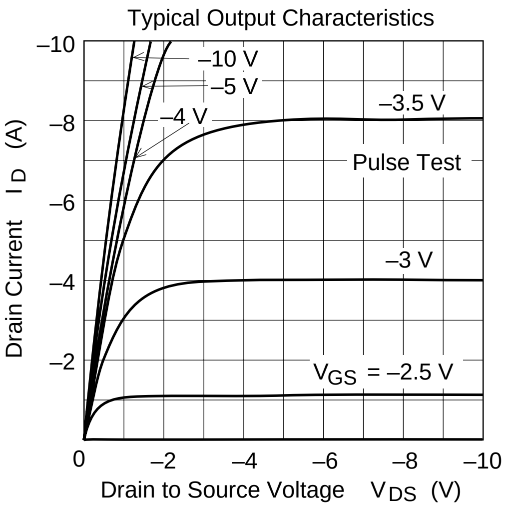


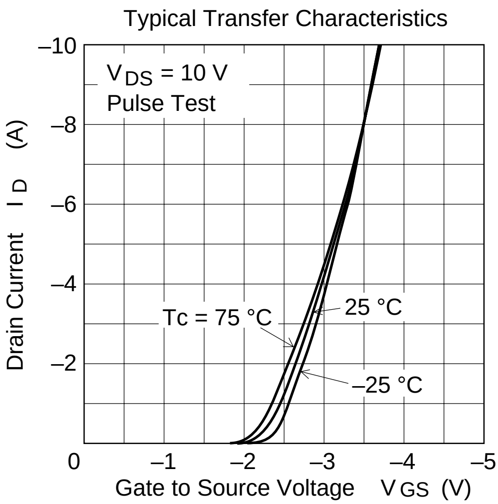
(P Channel)



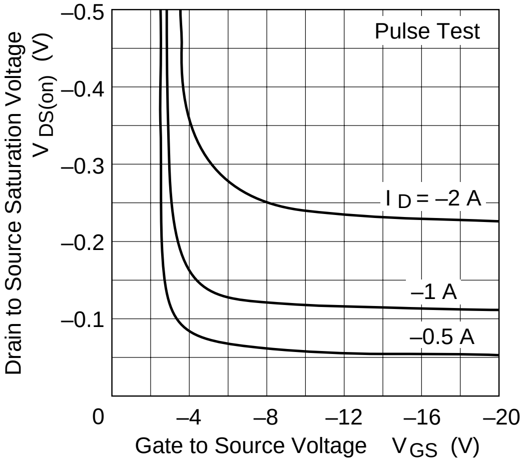


Note 6 :
When using the glass epoxy board
(FR4 40x40x1.6 mm)

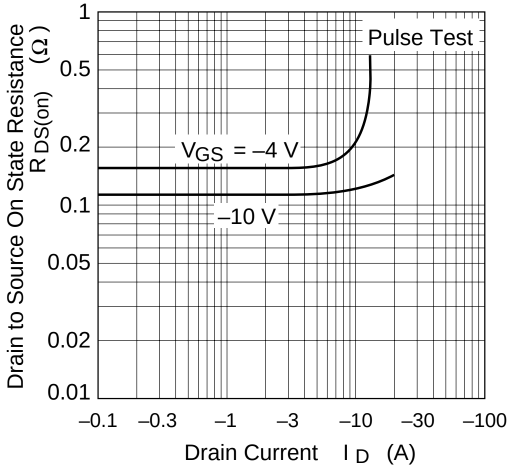




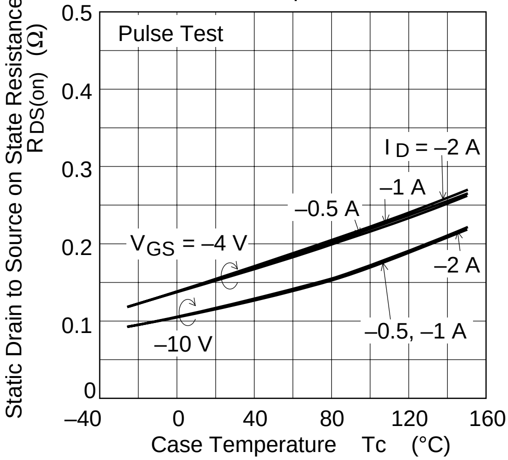
Drain to Source Saturation Voltage vs. Gate to Source Voltage



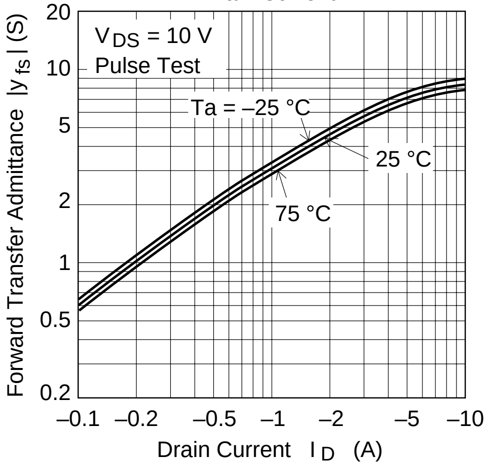
Static Drain to Source on State Resistance vs. Drain Current

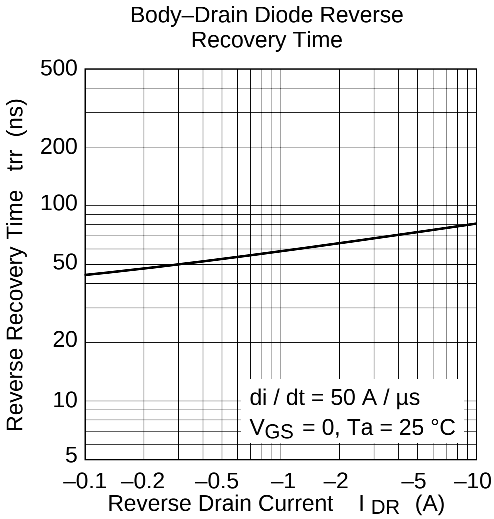


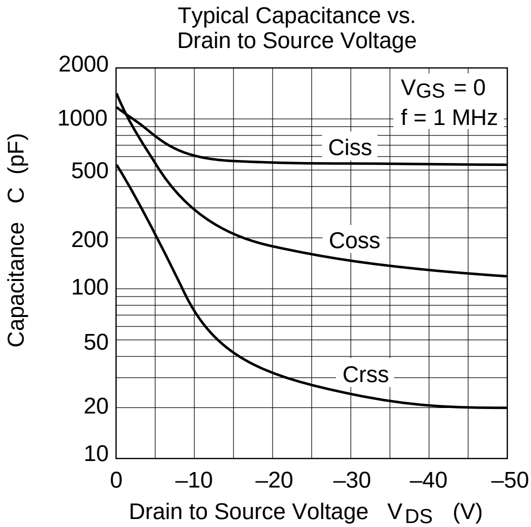
Static Drain to Source on State Resistance vs. Temperature

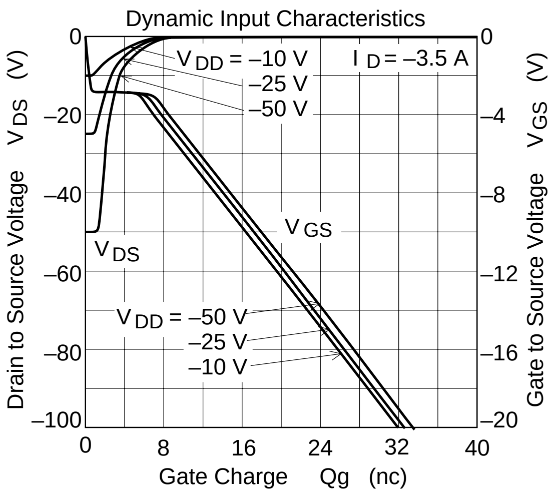


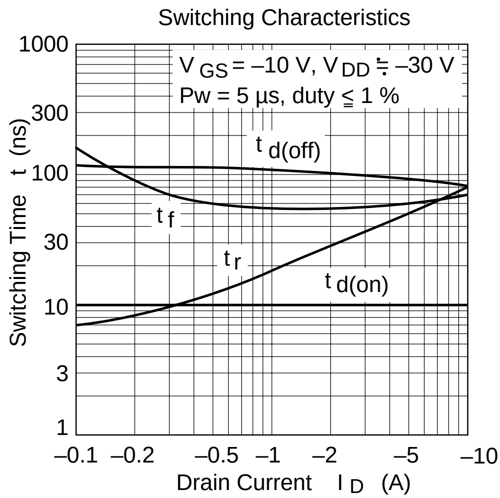
Forward Transfer Admittance vs. Drain Current



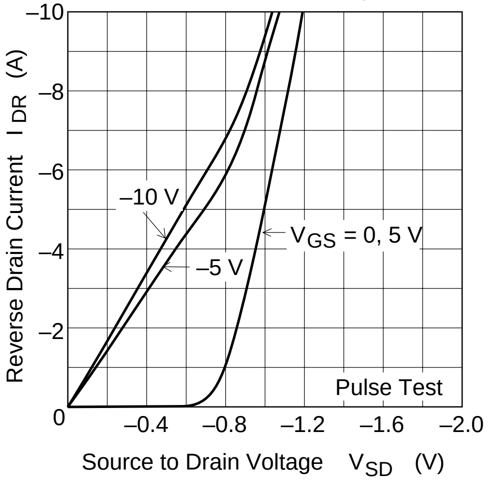

Body–Drain Diode Reverse Recovery Time
Reverse Recovery Time trr (ns)
500
200
100
50
20
10
5
di / dt = 50 A / µs
VGS = 0, Ta = 25 °C
–0.1 –0.2 –0.5 –1 –2 –5 –10
Reverse Drain Current I DR (A)


Typical Capacitance vs. Drain to Source Voltage
Capacitance C (pF)
2000
1000
500
200
100
50
20
10
VGS = 0
f = 1 MHz
Ciss
Coss
Crss
0 –10 –20 –30 –40 –50
Drain to Source Voltage VDS (V)

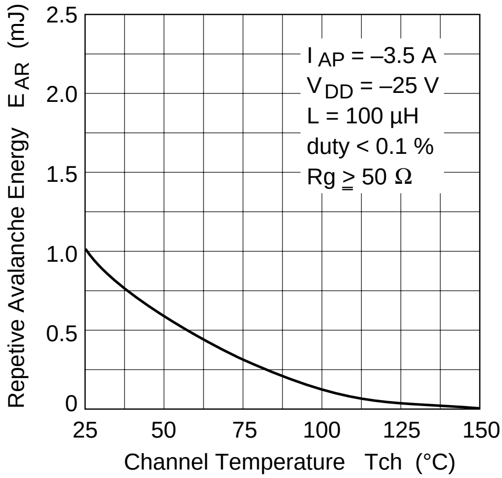

Dynamic Input Characteristics
Drain to Source Voltage VDS (V)
0
–20
–40
–60
–80
–100
V DD = –10 V
–25 V
–50 V
I D = –3.5 A
V GS
V DS
V DD = –50 V
–25 V
–10 V
0
–4
–8
–12
–16
–20
Gate to Source Voltage VGS (V)
0 8 16 24 32 40
Gate Charge Qg (nc)


Switching Characteristics
Switching Time t (ns)
1000
300
100
30
10
3
1
V GS = –10 V, V DD ≒ –30 V
Pw = 5 µs, duty ≦ 1 %
t d(off)
t f
t r
t d(on)
–0.1 –0.2 –0.5 –1 –2 –5 –10
Drain Current I D (A)

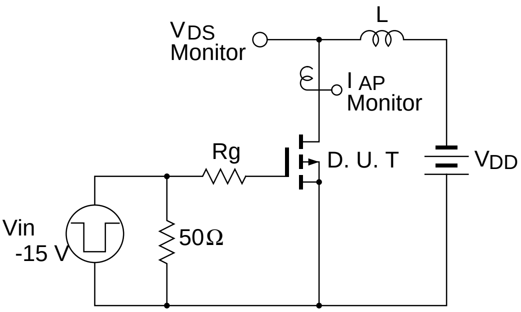
Reverse Drain Current vs.
Source to Drain Voltage



Maximun Avalanche Energy vs.
Channel Temperature Derating

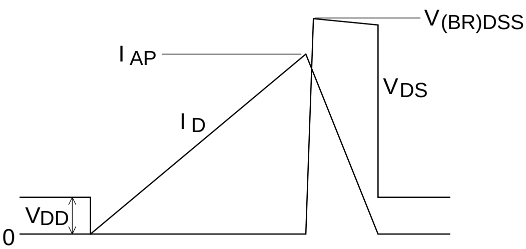


Avalanche Test Circuit

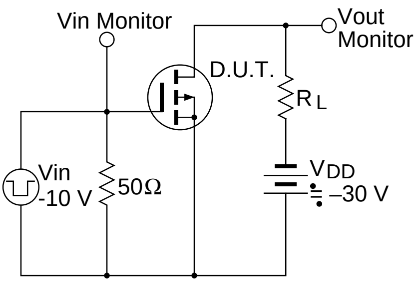


Avalanche Waveform

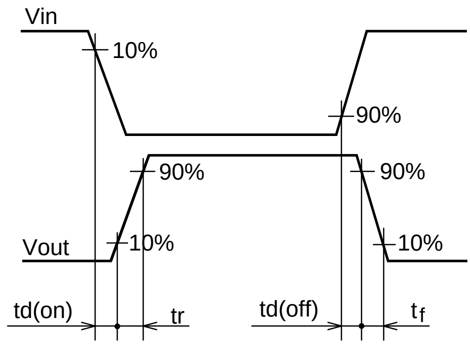
$$E_{AR} = \frac{1}{2} \bullet L \bullet I_{AP}{}^{2} \bullet \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$

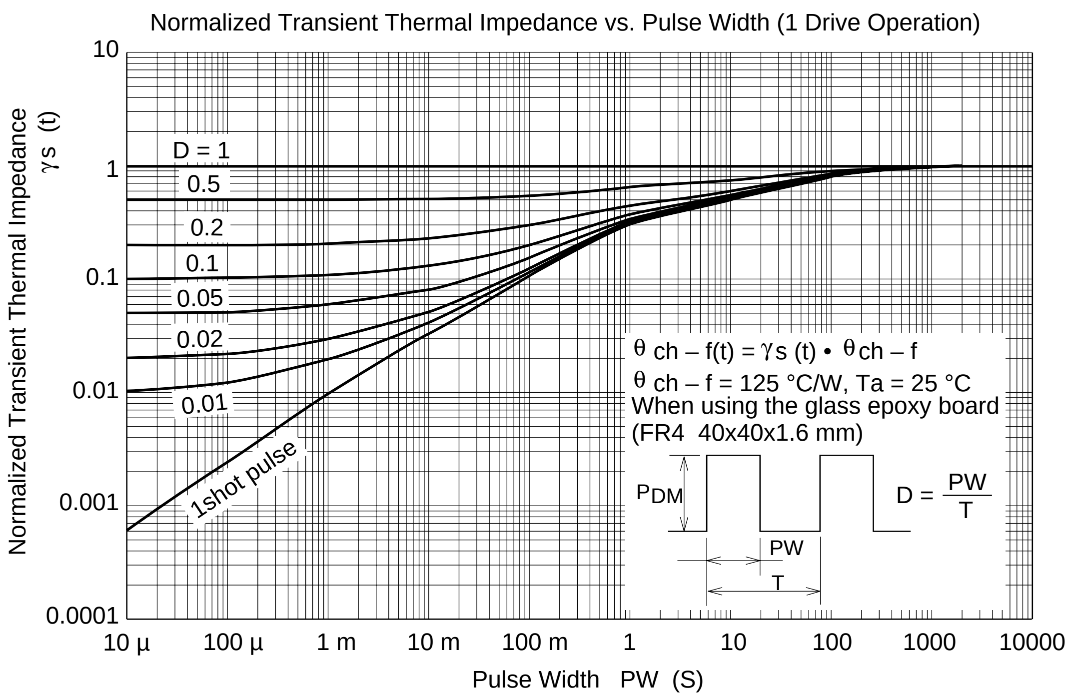


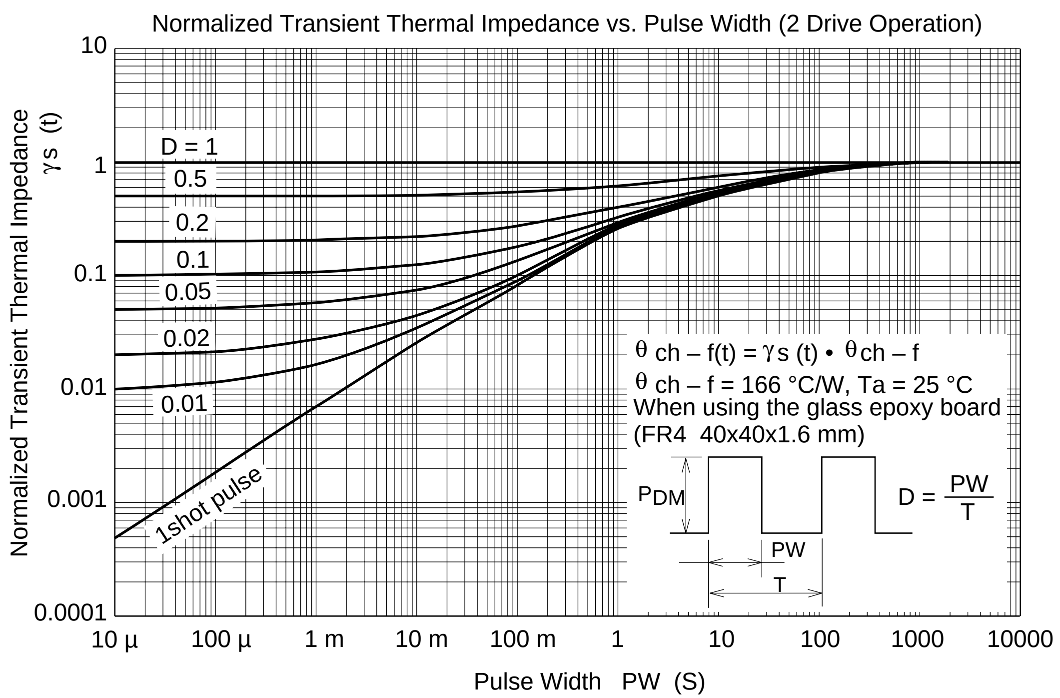
Switching Time Test Circuit



Switching Time Waveform

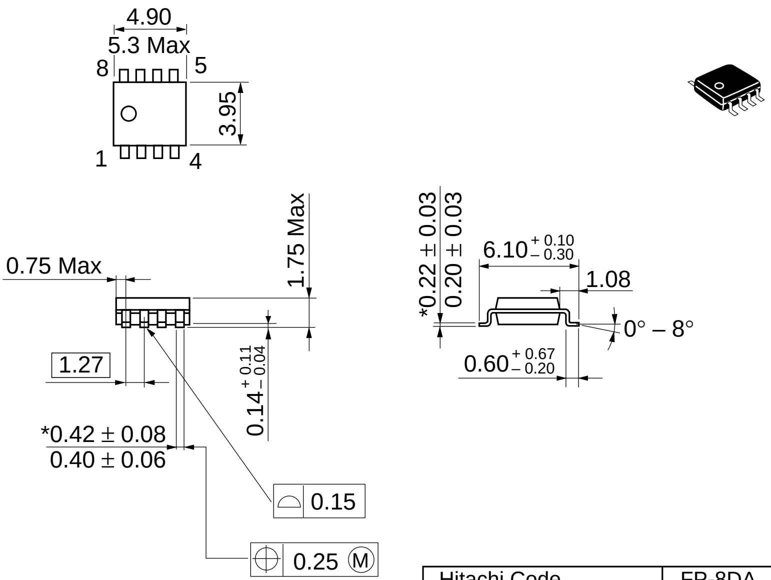



Normalized Transient Thermal Impedance vs. Pulse Width (1 Drive Operation)
Normalized Transient Thermal Impedance γs (t)
D = 1
0.5
0.2
0.1
0.05
0.02
0.01
1shot pulse
θ ch – f(t) = γs (t) • θch – f
θ ch – f = 125 °C/W, Ta = 25 °C
When using the glass epoxy board
(FR4 40x40x1.6 mm)
PDM
PW
T
D = PW / T
10
1
0.1
0.01
0.001
0.0001
10 μ
100 μ
1 m
10 m
100 m
1
10
100
1000
10000
Pulse Width PW (S)


Normalized Transient Thermal Impedance vs. Pulse Width (2 Drive Operation)
Normalized Transient Thermal Impedance γs (t)
D = 1
0.5
0.2
0.1
0.05
0.02
0.01
1shot pulse
θ ch – f(t) = γs (t) • θch – f
θ ch – f = 166 °C/W, Ta = 25 °C
When using the glass epoxy board
(FR4 40x40x1.6 mm)
PDM
PW
T
D = PW / T
10
1
0.1
0.01
0.001
0.0001
10 μ
100 μ
1 m
10 m
100 m
1
10
100
1000
10000
Pulse Width PW (S)

Package Dimensions

As of January, 2001
Unit: mm



Hitachi Code	FP-8DA
JEDEC	Conforms
EIAJ	—
Mass (reference value)	0.085 g

*Dimension including the plating thickness
Base material dimension

Cautions

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.

HITACHI

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

URL		
	NorthAmerica	: http://semiconductor.hitachi.com/
	Europe	: http://www.hitachi-eu.com/hel/ecg
	Asia	: http://sicapac.hitachi-asia.com
	Japan	: http://www.hitachi.co.jp/Sicd/indx.htm

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 GmbH
Electronic Components Group
Dornacher Straβe 3
D-85622 Feldkirchen, Munich
Germany
Tel: <49> (89) 9 9180-0
Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.
Electronic Components Group.
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: <44> (1628) 585000
Fax: <44> (1628) 585160

Hitachi Asia Ltd.
Hitachi Tower
16 Collyer Quay #20-00,
Singapore 049318
Tel : <65>-538-6533/538-8577
Fax : <65>-538-6933/538-3877
URL : http://www.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>-(2)-735-9218
Fax : <852>-(2)-730-0281
URL : http://www.hitachi.com.hk

Littlediode supplies new, hard to find or obsolete electronic components and semiconductors all over the world.

With over two million different components listed you are sure to find the part you need.

Feel free to visit us today at our online store:

LittleDiode.com

Looking forward to providing you with the best possible service.