HAT3008R/HAT3008RJ

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

HITACHI

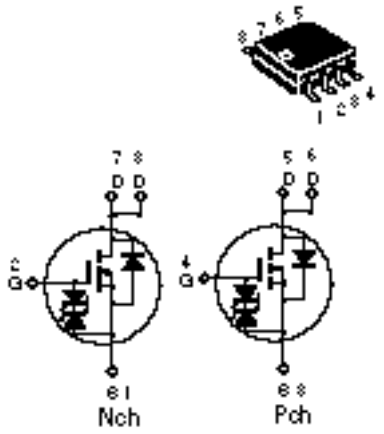
ADE-208-536B (Z)
3rd. Edition
February 1999

Features

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

Outline

SOP-8



Hitachi semiconductor

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 = 10mA, V_{GS} = 0
Gate to source breakdown voltage		$V_{(BR)GSS}$	±20	—	—	V	I_G = ±100µA, V_{DS} = 0
Gate to source leak current		I_{GSS}	—	—	±10	µA	V_{GS} = ±16V, V_{DS} = 0
Zero gate voltage	HAT3008R	I_{DSS}	—	—	1	µA	V_{DS} = 60V, V_{GS} = 0
drain current	HAT3008RJ	I_{DSS}	—	—	0.1	µA	
Zero gate voltage	HAT3008R	I_{DSS}	—	—	—	µA	V_{DS} =48V, 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} = 10V, I_D = 1mA
Static drain to source on state resistance		$R_{DS(on)}$	—	0.043	0.058	Ω	I_D = 3A, V_{GS} = 10V Note4
		$R_{DS(on)}$	—	0.056	0.084	Ω	I_D = 3A, V_{GS} = 4V Note4
Forward transfer admittance		$\|y_{fs}\|$	6	9	—	S	I_D = 3A, V_{DS} = 10V Note4
Input capacitance		Ciss	—	520	—	pF	V_{DS} = 10V
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} =10V, I_D = 3A
Rise time		t_r	—	40	—	ns	V_{DD} ≈ 30V
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 = 5A, V_{GS} = 0 Note4
Body–drain diode reverse recovery time		t_{rr}	—	40	—	ns	IF =5A, V_{GS} = 0 diF/ dt =50A/µs

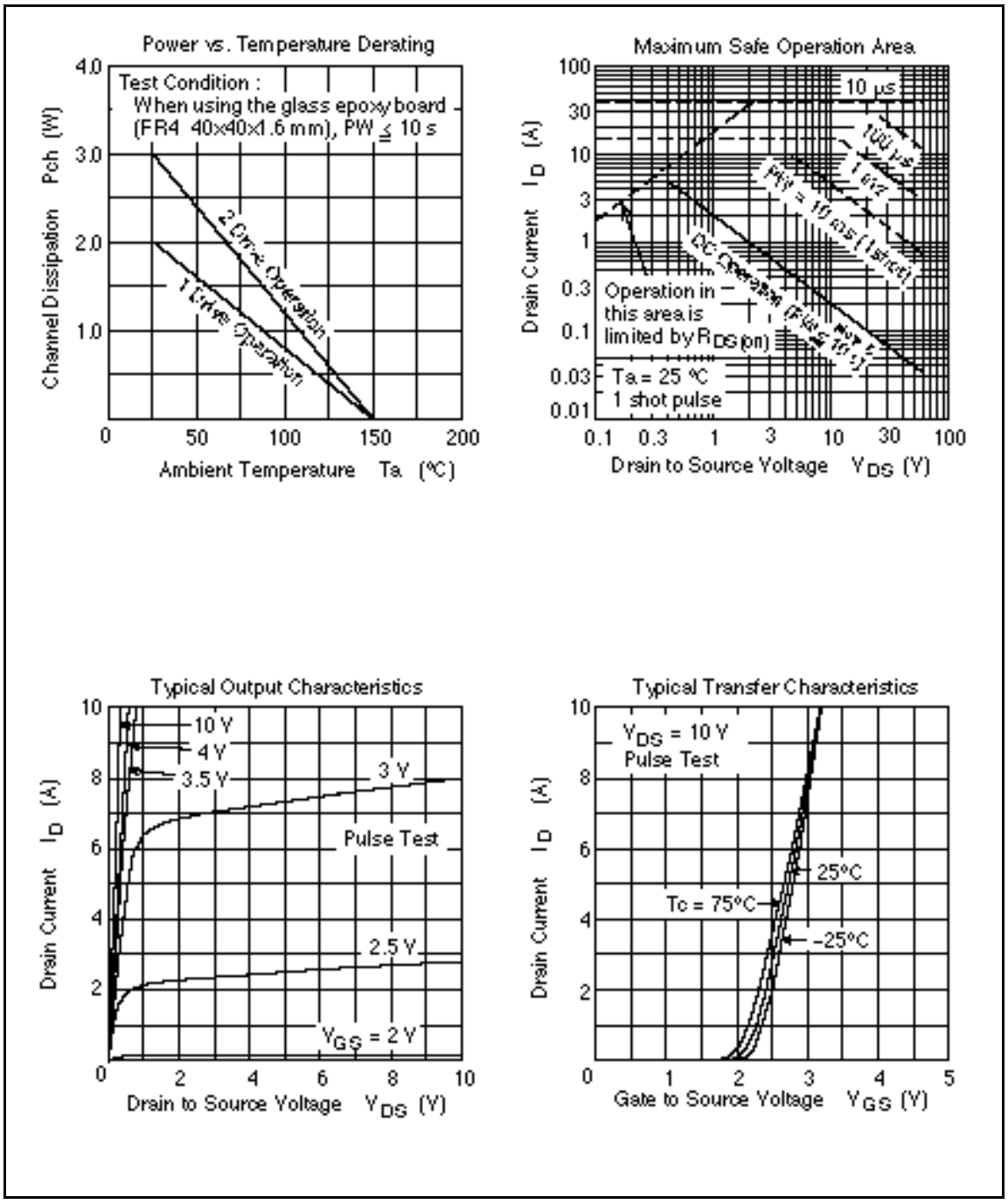
Note: 5. Pulse test

• **P Channel**

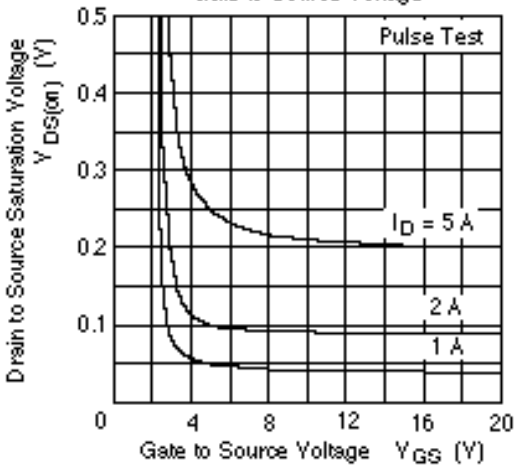
Item		Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage		$V_{(BR)DSS}$	–60	—	—	V	I_D = –10mA, V_{GS} = 0
Gate to source breakdown voltage		$V_{(BR)GSS}$	±20	—	—	V	I_G = ±100µA, V_{DS} = 0
Gate to source leak current		I_{GSS}	—	—	±10	µA	V_{GS} = ±16V, V_{DS} = 0
Zero gate voltage	HAT3008R	I_{DSS}	—	—	–1	µA	V_{DS} = –60V, V_{GS} = 0
drain current	HAT3008RJ	I_{DSS}	—	—	–0.1	µA	
Zero gate voltage	HAT3008R	I_{DSS}	—	—	—	µA	V_{DS} =– 48V, 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} = –10V, I_D = –1mA
Static drain to source on state		$R_{DS(on)}$	—	0.12	0.15	Ω	I_D = –2A, V_{GS} = –10V [Note4]
resistance		$R_{DS(on)}$	—	0.16	0.23	Ω	I_D = –2A, V_{GS} = – 4V [Note4]
Forward transfer admittance		$\|y_{fs}\|$	3	4.5	—	S	I_D = –2A, V_{DS} = –10V [Note4]
Input capacitance		Ciss	—	600	—	pF	V_{DS} = –10V
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} = –10V, I_D = –2A
Rise time		t_r	—	30	—	ns	V_{DD} ≈ –30V
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 = –3.5A, V_{GS} = 0 [Note4]
Body–drain diode reverse recovery time		t_{rr}	—	70	—	ns	IF = –3.5A, V_{GS} = 0 diF/ dt =50A/µs

Note: 5. Pulse test

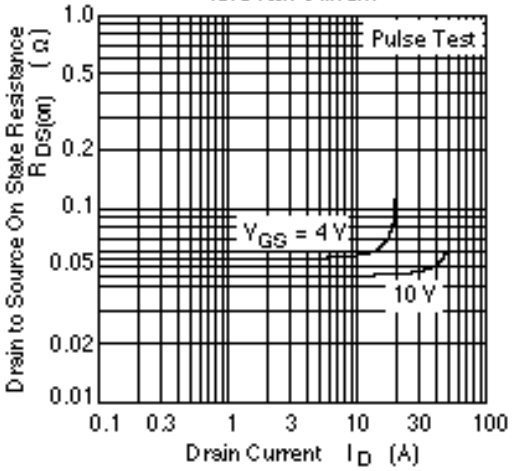
Main Characteristics (N Channel)



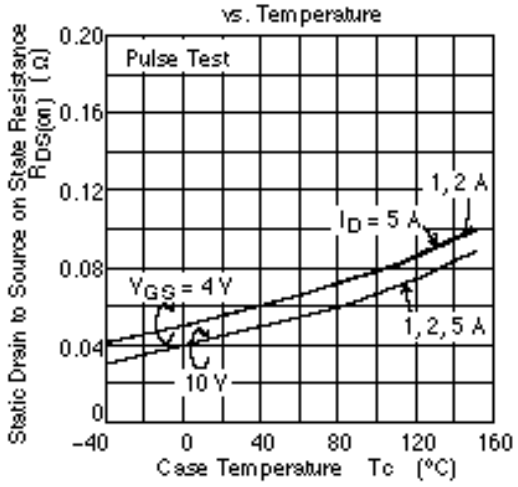
Drain to Source Saturation Voltage vs. Gate to Source Voltage



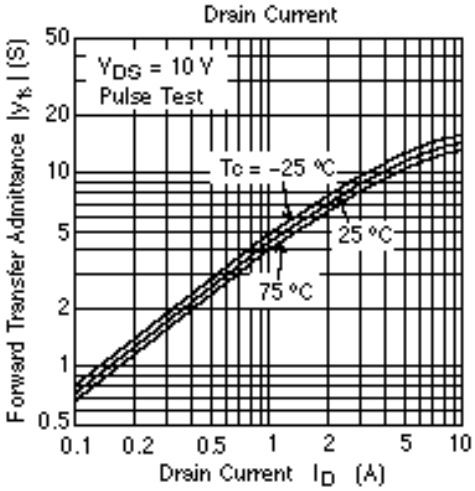
Static Drain to Source on State Resistance vs. Drain Current



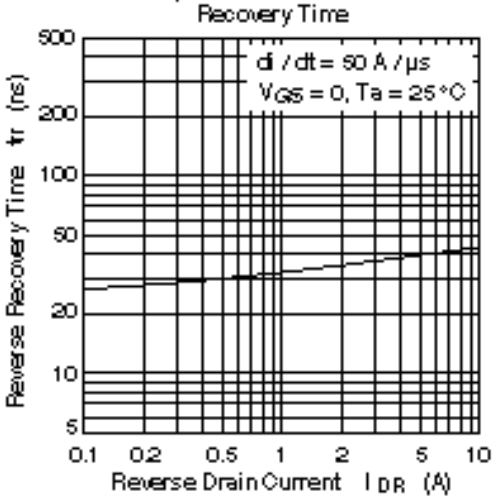
Static Drain to Source on State Resistance vs. Temperature



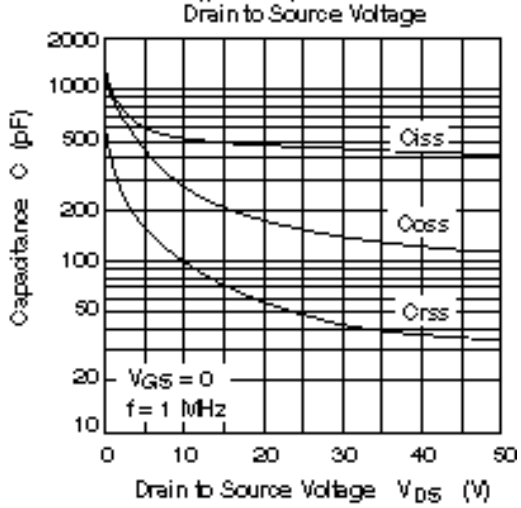
Forward Transfer Admittance vs. Drain Current



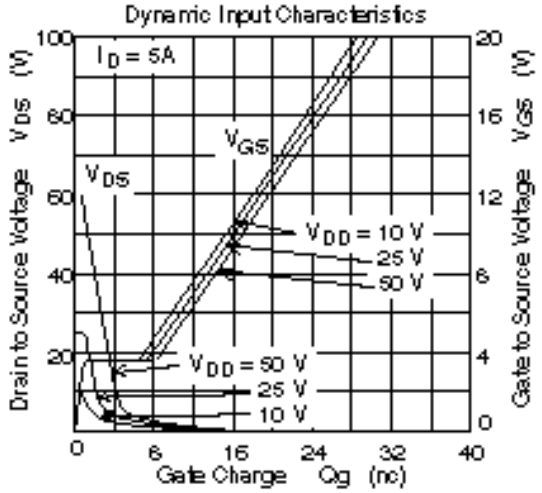
Body–Drain Diode Reverse Recovery Time



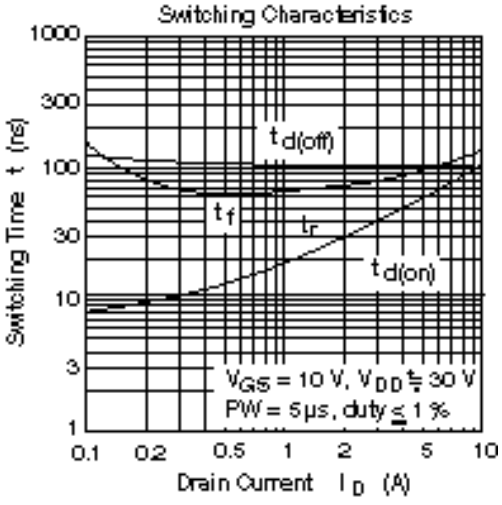
Typical Capacitance vs. Drain to Source Voltage



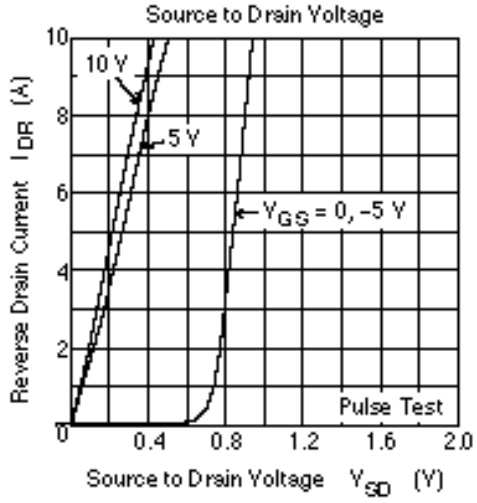
Dynamic Input Characteristics



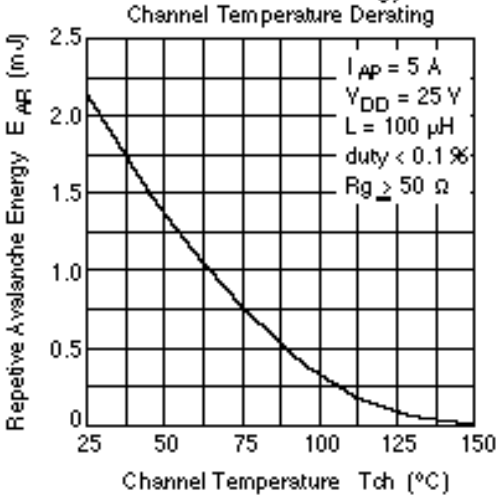
Switching Characteristics



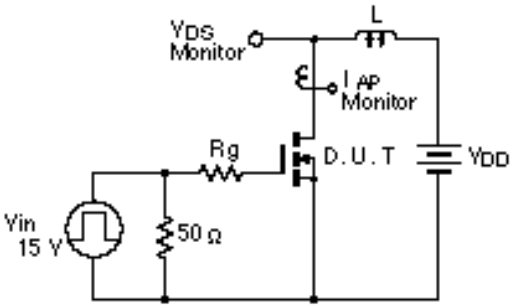
Reverse Drain Current vs. Source to Drain Voltage



Maximun Avalanche Energy vs. Channel Temperature Derating

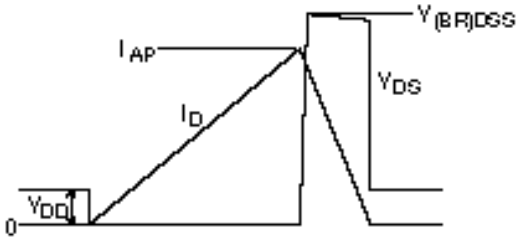


Avalanche Test Circuit

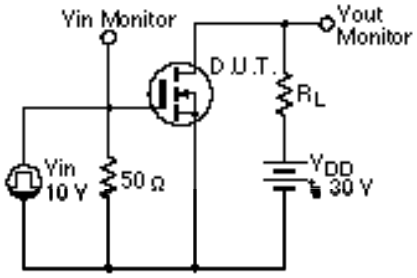


Avalanche Waveform

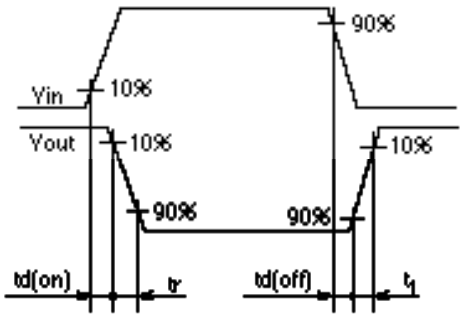
$$E_{AR} = \frac{1}{2} \cdot L \cdot I_{AP}^2 \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$



Switching Time Test Circuit

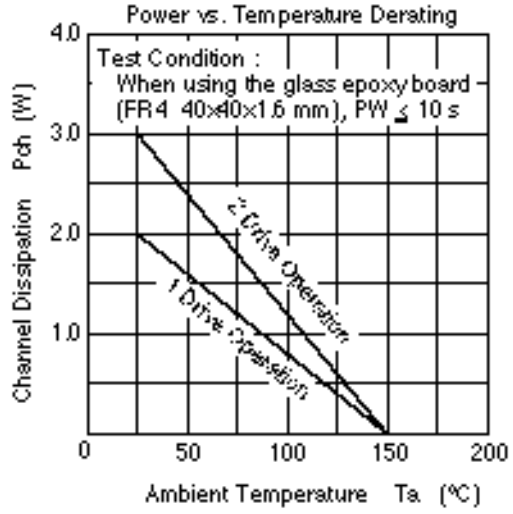


Switching Time Waveform

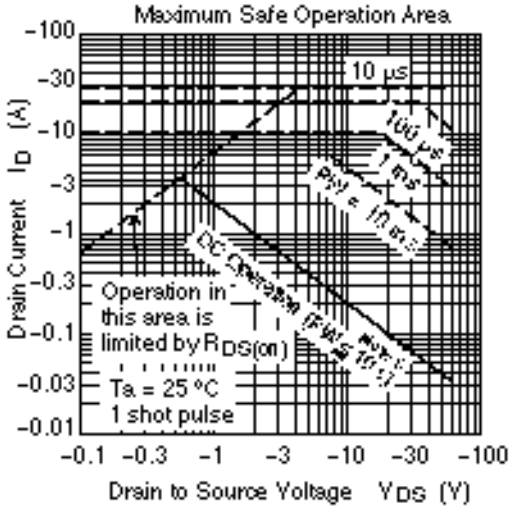


Main Characteristics (P Channel)

Power vs. Temperature Derating

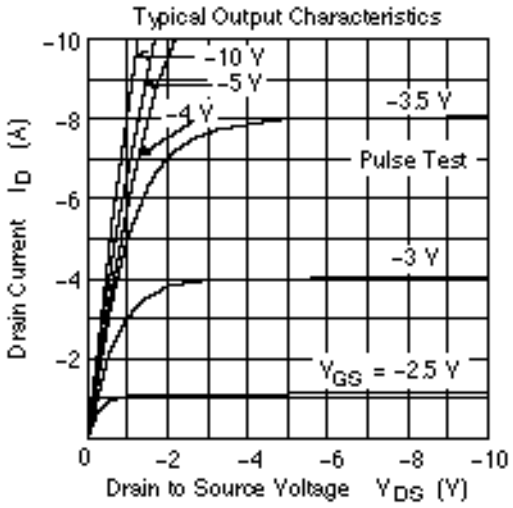


Maximum Safe Operation Area

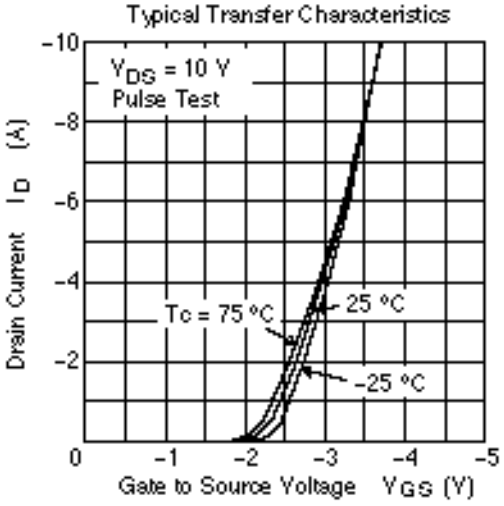


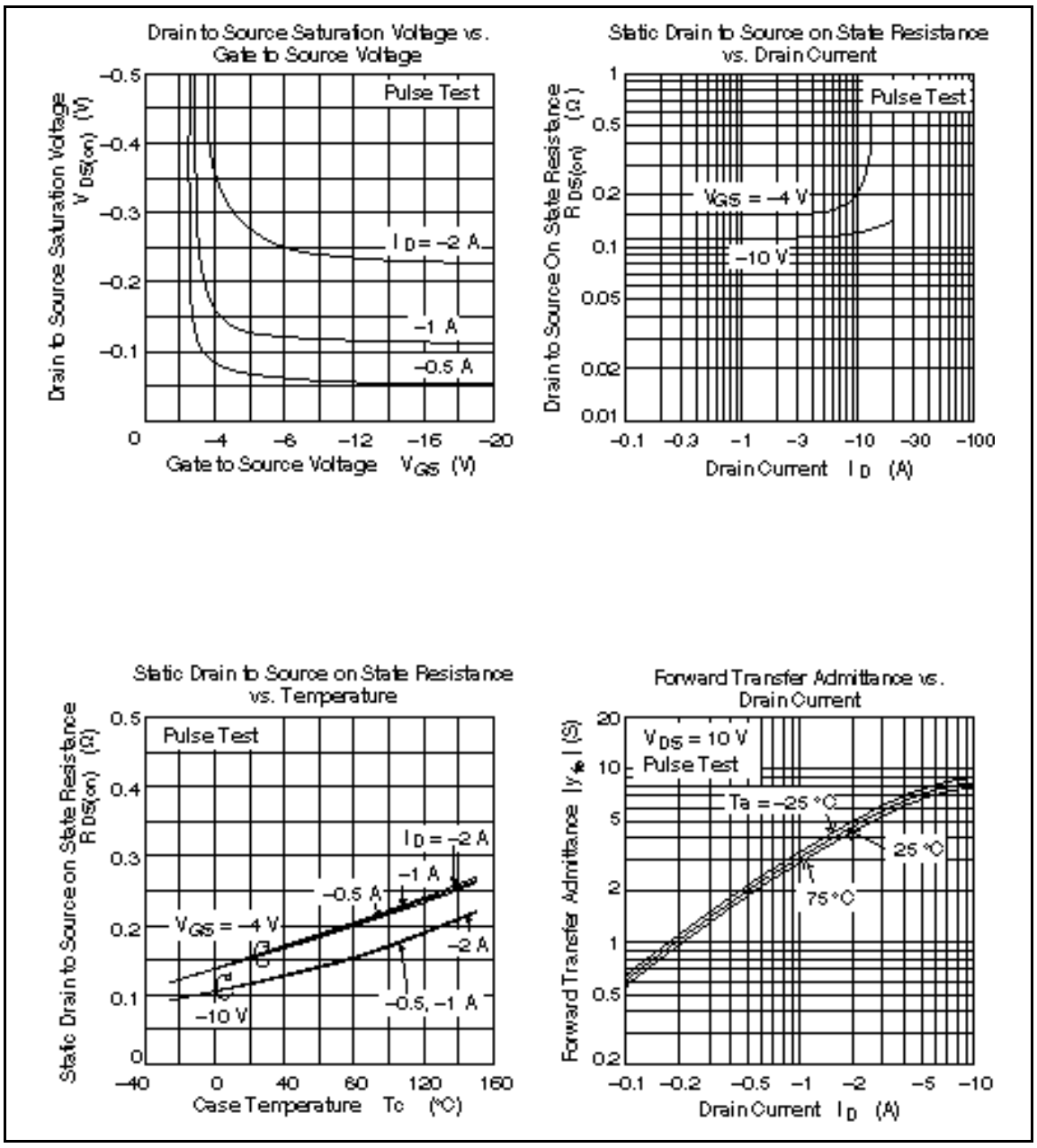
Note 6 :
When using the glass epoxy board
(FR4 40×40×1.6 mm)

Typical Output Characteristics

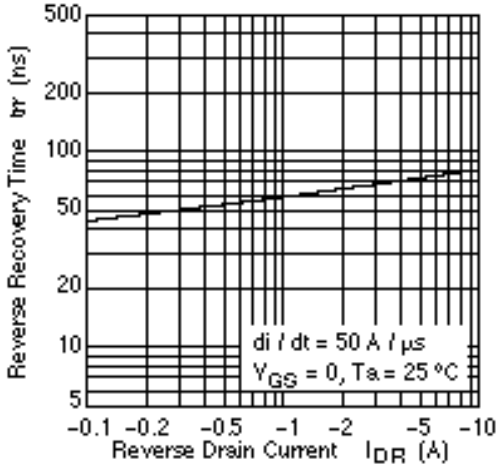


Typical Transfer Characteristics

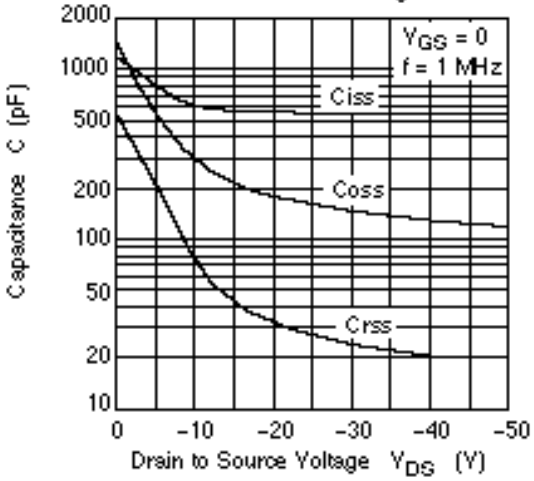



Drain to Source Saturation Voltage vs. Gate to Source Voltage
Drain to Source Saturation Voltage V DS(on) (V)
Pulse Test
I D = –2 A
–1 A
–0.5 A
Gate to Source Voltage V GS (V)
Static Drain to Source on State Resistance vs. Drain Current
Drain to Source On State Resistance R DS(on) (Ω)
Pulse Test
V GS = –4 V
–10 V
Drain Current I D (A)
Static Drain to Source on State Resistance vs. Temperature
Static Drain to Source on State Resistance R DS(on) (Ω)
Pulse Test
I D = –2 A
–1 A
–0.5 A
V GS = –4 V
–2 A
–10 V
–0.5, –1 A
Case Temperature Tc (°C)
Forward Transfer Admittance vs. Drain Current
Forward Transfer Admittance |y fs| (S)
V DS = 10 V
Pulse Test
Ta = –25 °C
25 °C
75 °C
Drain Current I D (A)

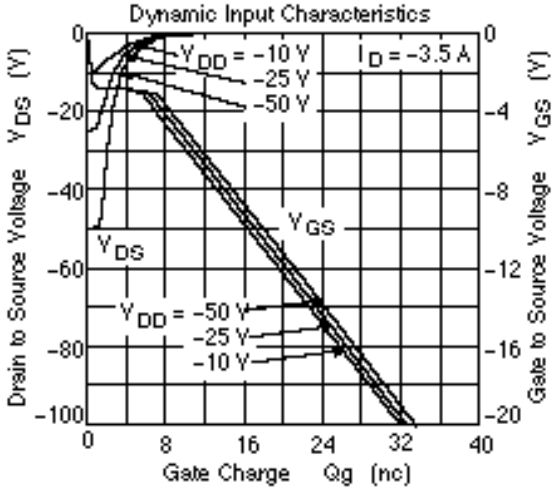
Body-Drain Diode Reverse Recovery Time



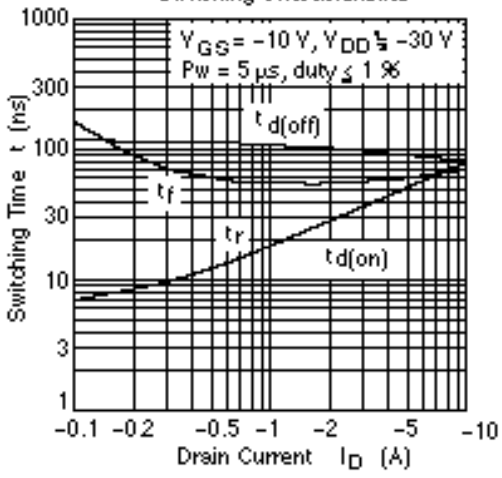
Typical Capacitance vs. Drain to Source Voltage



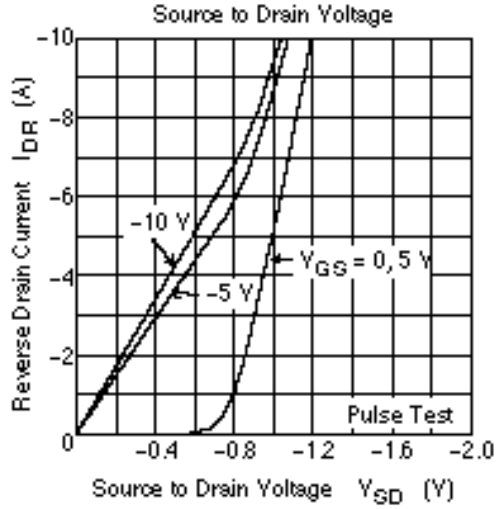
Dynamic Input Characteristics



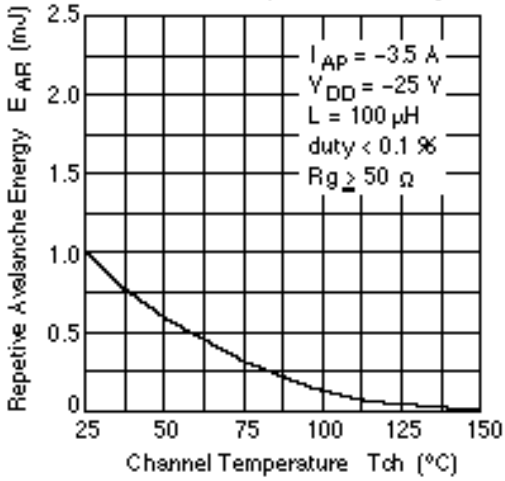
Switching Characteristics



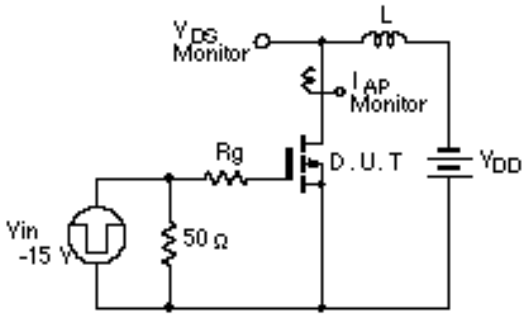
Reverse Drain Current vs. Source to Drain Voltage



Maximun Avalanche Energy vs. Channel Temperature Derating

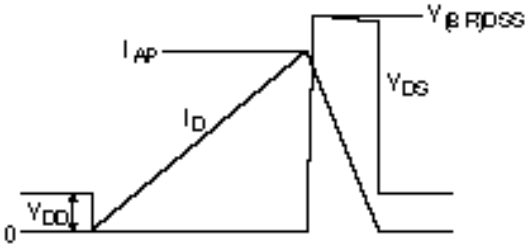


Avalanche Test Circuit

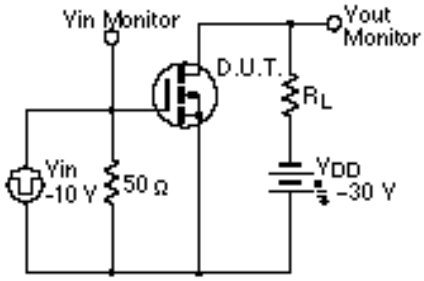


Avalanche Waveform

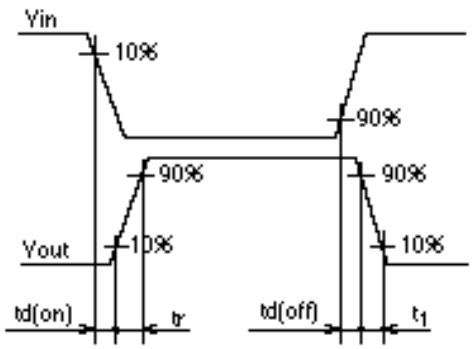
$$E_{AR} = \frac{1}{2} \cdot L \cdot I_{AP}^2 \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$

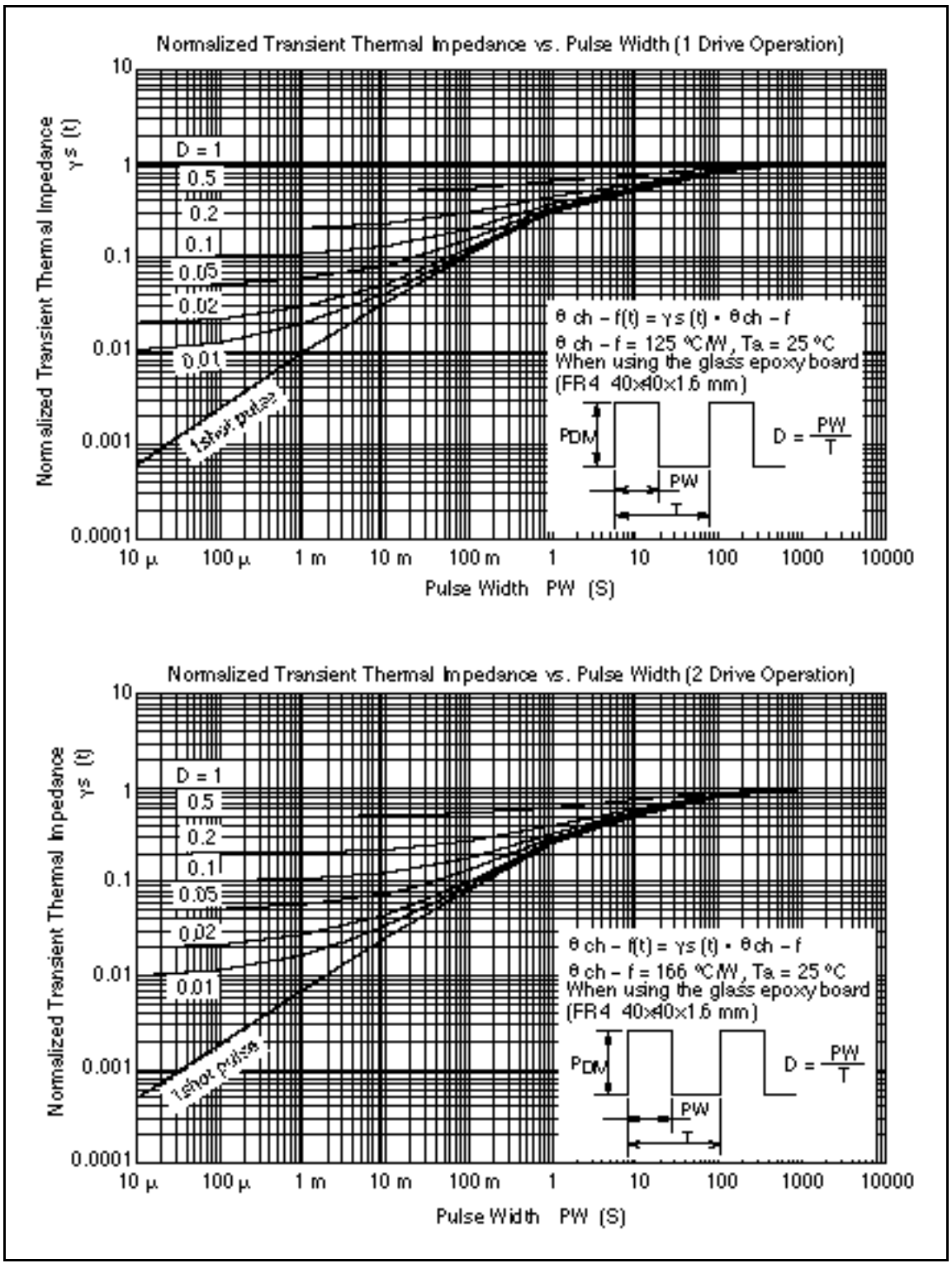


Switching Time Test Circuit



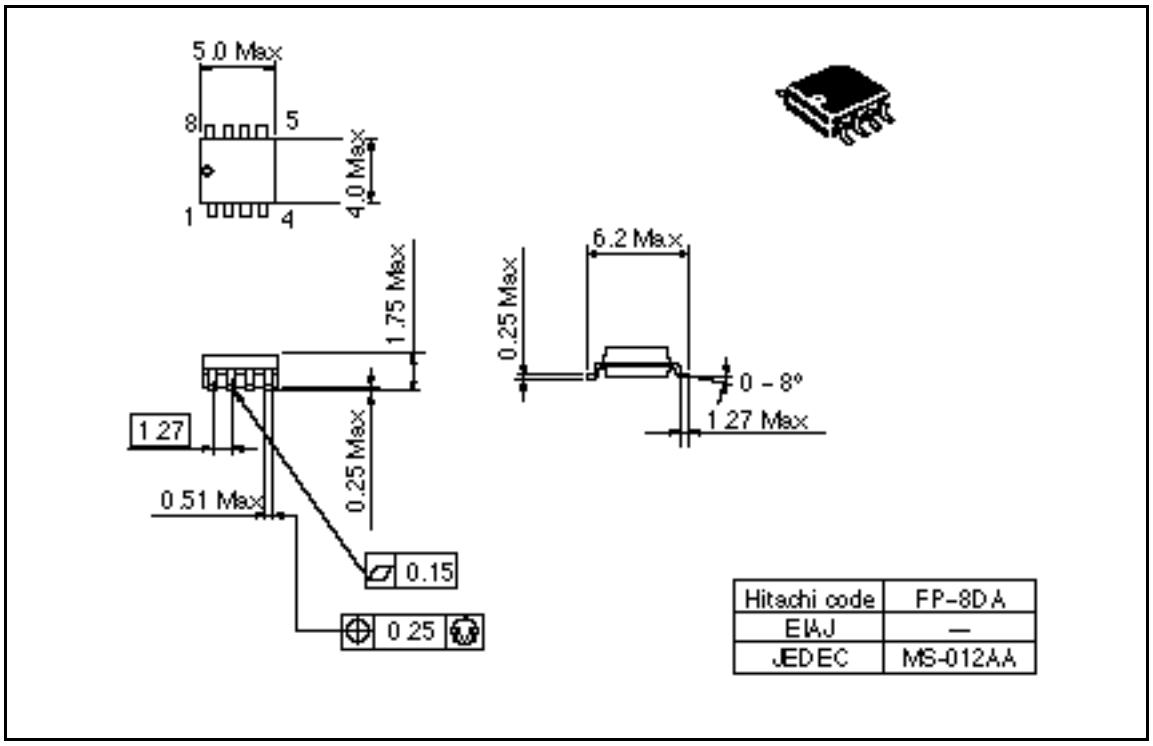
Switching Time Waveform




Normalized Transient Thermal Impedance vs. Pulse Width (1 Drive Operation)
Normalized Transient Thermal Impedance γs (t)
10
1
0.1
0.01
0.001
0.0001
D = 1
0.5
0.2
0.1
0.05
0.02
0.01
1shot pulse
θch – f(t) = γs (t) • θch – f
θch – f = 125 °C/W, Ta = 25 °C
When using the glass epoxy board
(FR4 40×40×1.6 mm)
PDM
PW
T
D = PW/T
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)
10
1
0.1
0.01
0.001
0.0001
D = 1
0.5
0.2
0.1
0.05
0.02
0.01
1shot pulse
θch – f(t) = γs (t) • θch – f
θch – f = 166 °C/W, Ta = 25 °C
When using the glass epoxy board
(FR4 40×40×1.6 mm)
PDM
PW
T
D = PW/T
10 µ
100 µ
1 m
10 m
100 m
1
10
100
1000
10000
Pulse Width PW (S)

Package Dimensions

Unit: mm



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

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For further information write to:

Hitachi Semiconductor (America) Inc.
2000 Sierra Point Parkway
Brisbane, CA. 94005-1897
Tel: c1s (800) 285-1601
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Hitachi Europe GmbH
Electronic components Group
Dornacher Straße 3
D-85622 Feldkirchen, Munich
Germany
Tel: c49s (89) 9 9180-0
Fax: c49s (89) 9 29 30 00

Hitachi Europe Ltd.
Electronic Components Group.
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: c44s (1628) 585000
Fax: c44s (1628) 778322

Hitachi Asia Pte. Ltd.
16 Collyer Quay #20-00
Hitachi Tower
Singapore 049318
Tel: 535-2100
Fax: 535-1533

Hitachi Asia Ltd.
Taipei Branch Office
3F, Hung Kuo Building. No.167,
Tun-Hwa North Road, Taipei (105)
Tel: c886s (2) 2718-3666
Fax: c886s (2) 2718-8180

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: c852s (2) 735 9218
Fax: c852s (2) 730 0281
Telex: 40815 HITECHX