

To all our customers

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

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Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

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# HAT3008R/HAT3008RJ

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

**RENESAS**

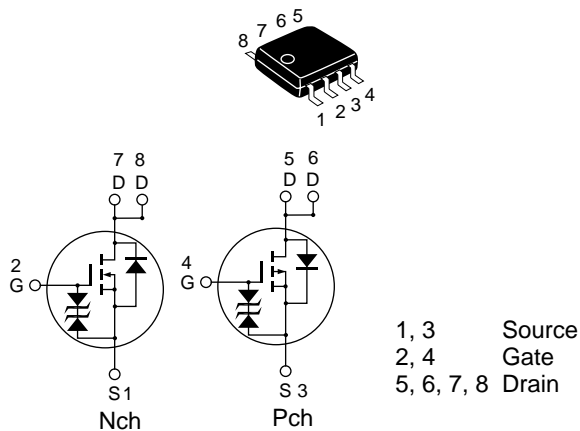
ADE-208-536B (Z)  
3rd. Edition  
Feb. 1999

## Features

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

## Outline

SOP-8



# HAT3008R/HAT3008RJ

## 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	$I_{D(pulse)}$ <sup>Note1</sup>	40	- 28	A
Body-drain diode reverse drain current	$I_{DR}$	5	- 3.5	A
Avalanche current	HAT3008R $I_{AP}$ <sup>Note4</sup>	—	—	—
	HAT3008RJ	5	- 3.5	A
Avalanche energy	HAT3008R $E_{AR}$ <sup>Note4</sup>	—	—	—
	HAT3008RJ	2.14	1.05	mJ
Channel dissipation	$Pch$ <sup>Note2</sup>	2	2	W
Channel dissipation	$Pch$ <sup>Note3</sup>	3	3	W
Channel temperature	Tch	150	150	°C
Storage temperature	Tstg	- 55 to + 150	-55 to + 150	°C

Note: 1.  $PW \leq 10\mu s$ , duty cycle  $\leq 1\%$

2. 1 Drive operation : When using the glass epoxy board (FR4 40 x 40 x 1.6 mm),  $PW \leq 10s$

3. 2 Drive operation : When using the glass epoxy board (FR4 40 x 40 x 1.6 mm),  $PW \leq 10s$

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	$I_D = 10 \text{ mA}, V_{GS} = 0$	
Gate to source breakdown voltage	$V_{(BR)GSS}$	$\pm 20$	—	—	V	$I_G = \pm 100 \text{ }\mu\text{A}, V_{DS} = 0$	
Gate to source leak current	$I_{GSS}$	—	—	$\pm 10$	$\mu\text{A}$	$V_{GS} = \pm 16 \text{ V}, V_{DS} = 0$	
Zero gate voltage drain current	HAT3008R HAT3008RJ	$I_{DSS}$	—	—	1 0.1	$\mu\text{A}$ $\mu\text{A}$	$V_{DS} = 60 \text{ V}, V_{GS} = 0$
Zero gate voltage drain current	HAT3008R HAT3008RJ	$I_{DSS}$	—	—	— 10	$\mu\text{A}$ $\mu\text{A}$	$V_{DS} = 48 \text{ V}, V_{GS} = 0$ $T_a = 125^\circ\text{C}$
Gate to source cutoff voltage	$V_{GS(off)}$	1.2	—	2.2	V	$V_{DS} = 10 \text{ V}, I_D = 1 \text{ mA}$	
Static drain to source on state resistance	$R_{DS(on)}$ $R_{DS(on)}$	—	0.043 0.056	0.058 0.084	$\Omega$ $\Omega$	$I_D = 3 \text{ A}, V_{GS} = 10 \text{ V}$ <sup>Note4</sup> $I_D = 3 \text{ A}, V_{GS} = 4 \text{ V}$ <sup>Note4</sup>	
Forward transfer admittance	$ y_{fs} $	6	9	—	S	$I_D = 3 \text{ A}, V_{DS} = 10 \text{ V}$ <sup>Note4</sup>	
Input capacitance	Ciss	—	520	—	pF	$V_{DS} = 10 \text{ V}$	
Output capacitance	Coss	—	270	—	pF	$V_{GS} = 0$	
Reverse transfer capacitance	Crss	—	100	—	pF	$f = 1 \text{ MHz}$	
Turn-on delay time	$t_{d(on)}$	—	11	—	ns	$V_{GS} = 10 \text{ V}, I_D = 3 \text{ A}$	
Rise time	$t_r$	—	40	—	ns	$V_{DD} \cong 30 \text{ V}$	
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	$I_F = 5 \text{ A}, V_{GS} = 0$ <sup>Note4</sup>	
Body–drain diode reverse recovery time	$t_{rr}$	—	40	—	ns	$I_F = 5 \text{ A}, V_{GS} = 0$ $diF/dt = 50 \text{ A}/\mu\text{s}$	

Note: 5. Pulse test

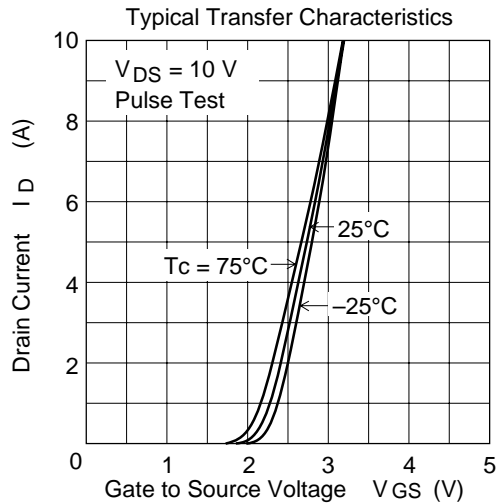
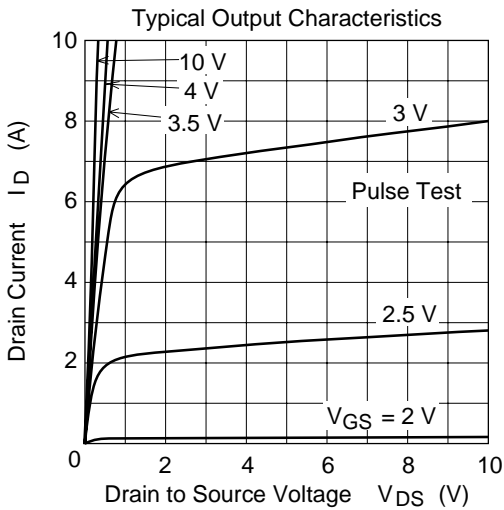
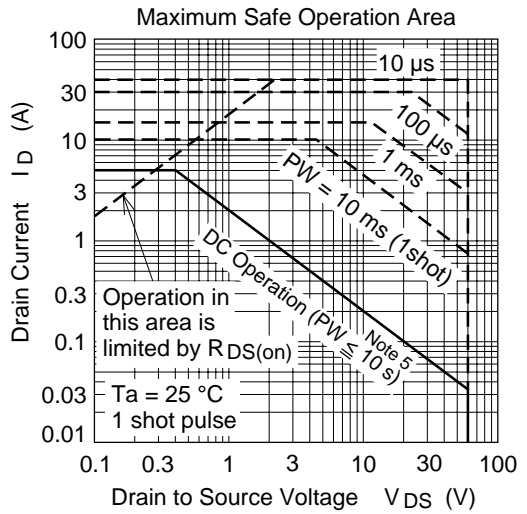
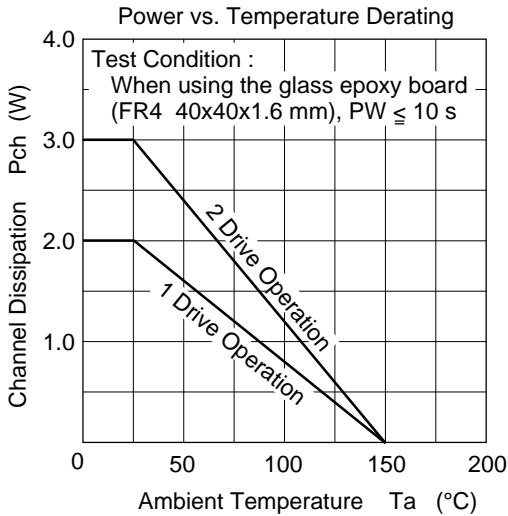
# HAT3008R/HAT3008RJ

## ( P Channel )

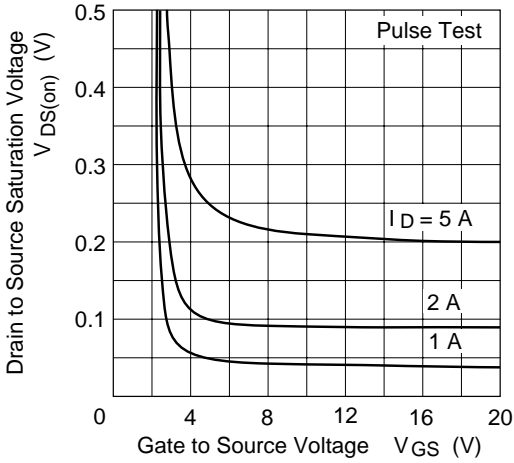
Item		Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage		$V_{(BR)DSS}$	-60	—	—	V	$I_D = -10 \text{ mA}, V_{GS} = 0$
Gate to source breakdown voltage		$V_{(BR)GSS}$	$\pm 20$	—	—	V	$I_G = \pm 100 \mu\text{A}, V_{DS} = 0$
Gate to source leak current		$I_{GSS}$	—	—	$\pm 10$	$\mu\text{A}$	$V_{GS} = \pm 16 \text{ V}, V_{DS} = 0$
Zero gate voltage drain current	HAT3008R	$I_{DSS}$	—	—	-1	$\mu\text{A}$	$V_{DS} = -60 \text{ V}, V_{GS} = 0$
	HAT3008RJ	$I_{DSS}$	—	—	-0.1	$\mu\text{A}$	
Zero gate voltage drain current	HAT3008R	$I_{DSS}$	—	—	—	$\mu\text{A}$	$V_{DS} = -48 \text{ V}, V_{GS} = 0$
	HAT3008RJ	$I_{DSS}$	—	—	-10	$\mu\text{A}$	$T_a = 125^\circ\text{C}$
Gate to source cutoff voltage		$V_{GS(off)}$	-1.2	—	-2.2	V	$V_{DS} = -10 \text{ V}, I_D = -1 \text{ mA}$
Static drain to source on state resistance		$R_{DS(on)}$	—	0.12	0.15	$\Omega$	$I_D = -2 \text{ A}, V_{GS} = -10 \text{ V}$ <sup>Note4</sup>
		$R_{DS(on)}$	—	0.16	0.23	$\Omega$	$I_D = -2 \text{ A}, V_{GS} = -4 \text{ V}$ <sup>Note4</sup>
Forward transfer admittance		$ y_{fs} $	3	4.5	—	S	$I_D = -2 \text{ A}, V_{DS} = -10 \text{ V}$ <sup>Note4</sup>
Input capacitance		$C_{iss}$	—	600	—	pF	$V_{DS} = -10 \text{ V}$
Output capacitance		$C_{oss}$	—	290	—	pF	$V_{GS} = 0$
Reverse transfer capacitance		$C_{rss}$	—	75	—	pF	$f = 1 \text{ MHz}$
Turn-on delay time		$t_{d(on)}$	—	11	—	ns	$V_{GS} = -10 \text{ V}, I_D = -2 \text{ A}$
Rise time		$t_r$	—	30	—	ns	$V_{DD} \cong -30 \text{ V}$
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	$I_F = -3.5 \text{ A}, V_{GS} = 0$ <sup>Note4</sup>
Body-drain diode reverse recovery time		$t_{rr}$	—	70	—	ns	$I_F = -3.5 \text{ A}, V_{GS} = 0$ $diF/dt = 50 \text{ A}/\mu\text{s}$

Note: 5. Pulse test

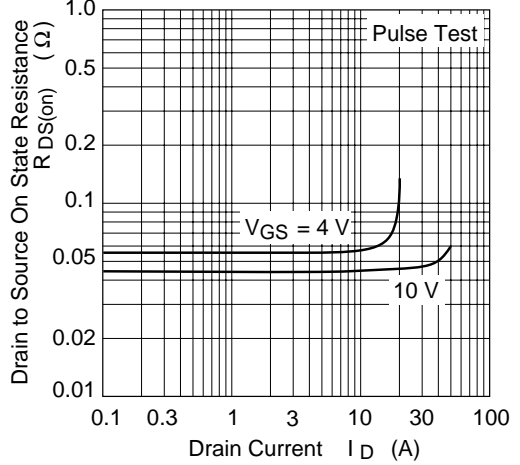
Main Characteristics ( N Channel )



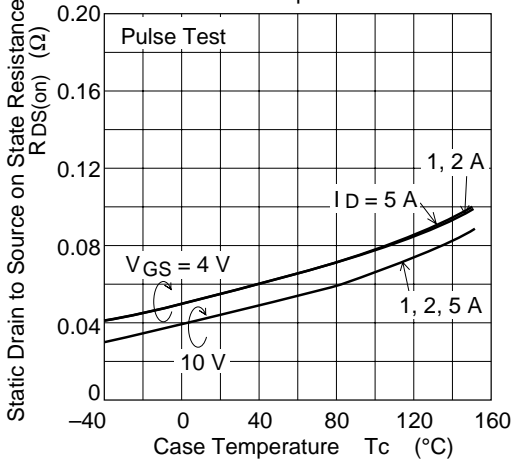
Drain to Source Saturation Voltage vs. Gate to Source Voltage



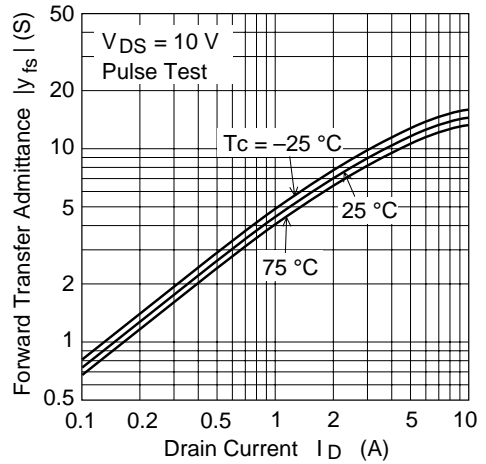
Static Drain to Source on State Resistance vs. Drain Current



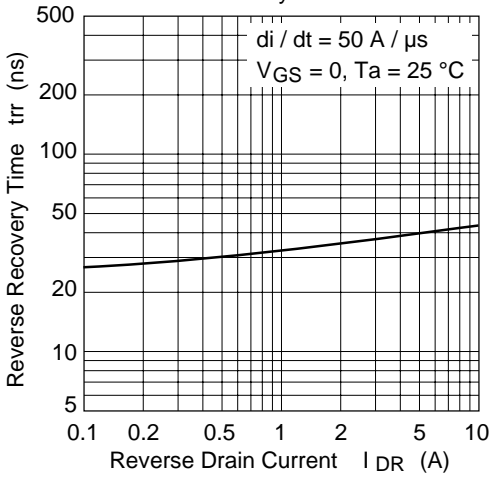
Static Drain to Source on State Resistance vs. Temperature



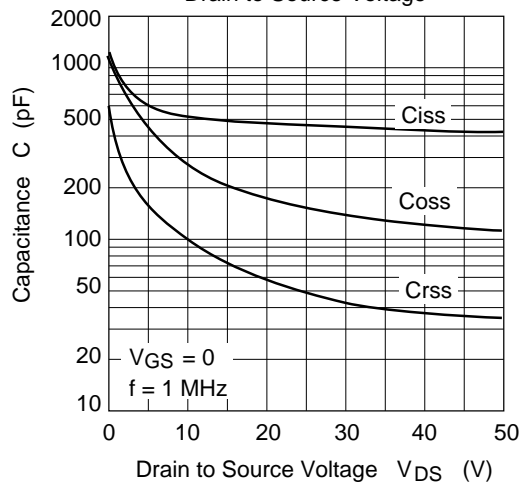
Forward Transfer Admittance vs. Drain Current



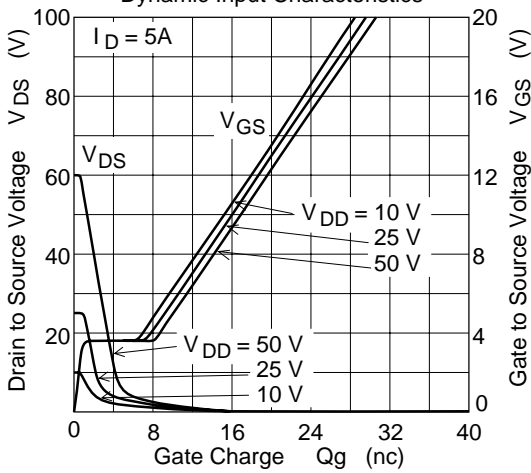
Body-Drain Diode Reverse Recovery Time



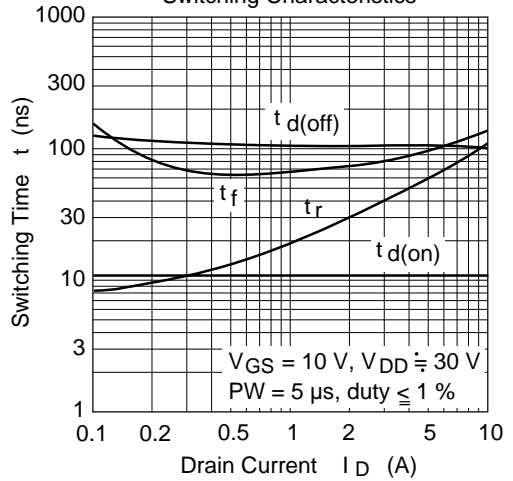
Typical Capacitance vs. Drain to Source Voltage

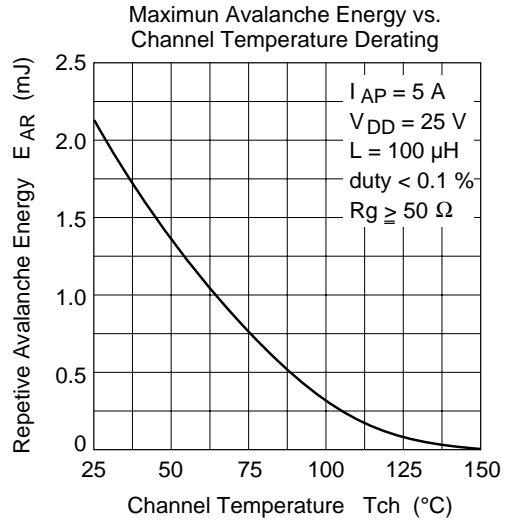
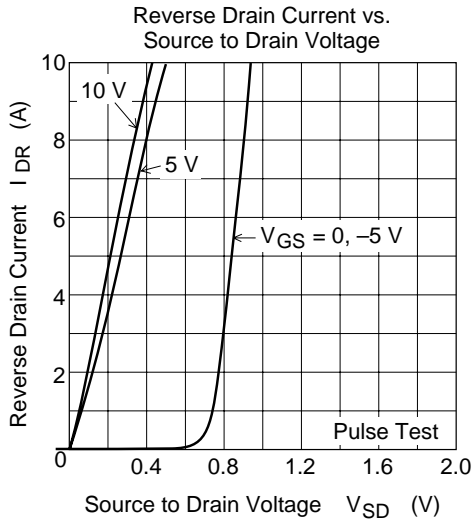


Dynamic Input Characteristics

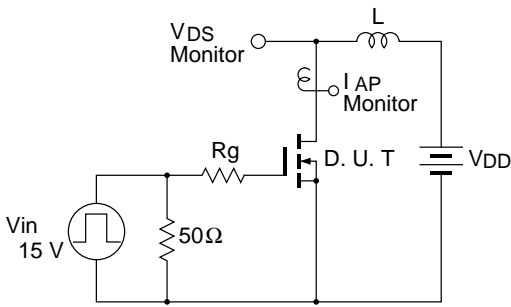


Switching Characteristics



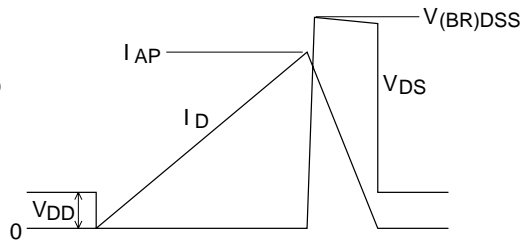


Avalanche Test Circuit

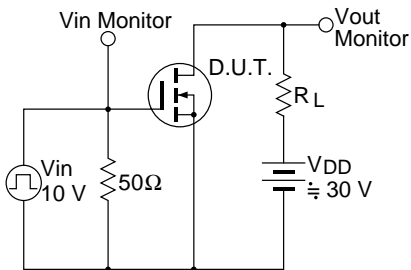


Avalanche Waveform

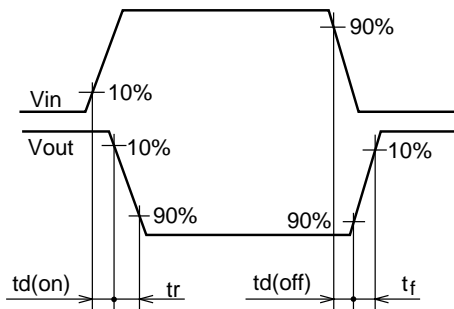
$$E_{AR} = \frac{1}{2} \cdot L \cdot I_{AP}^2 \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$



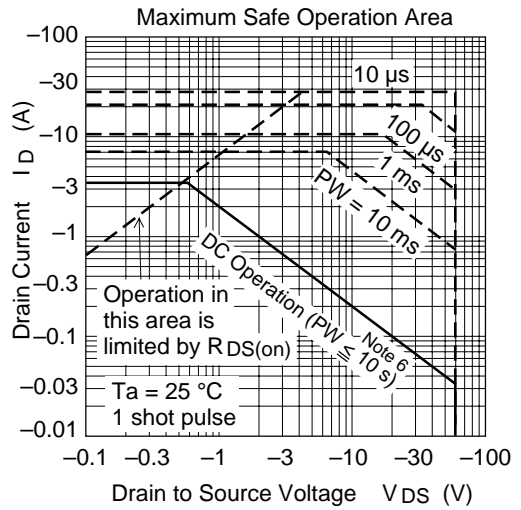
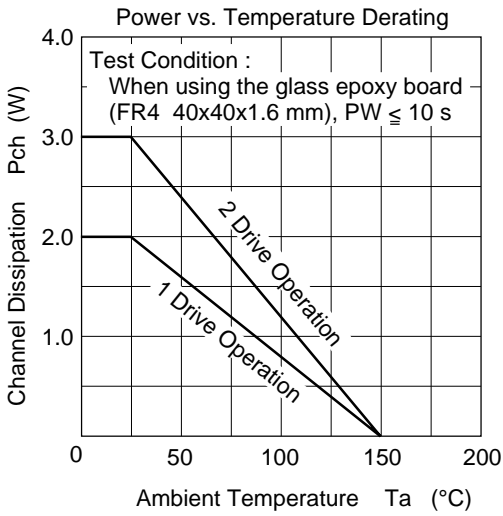
Switching Time Test Circuit



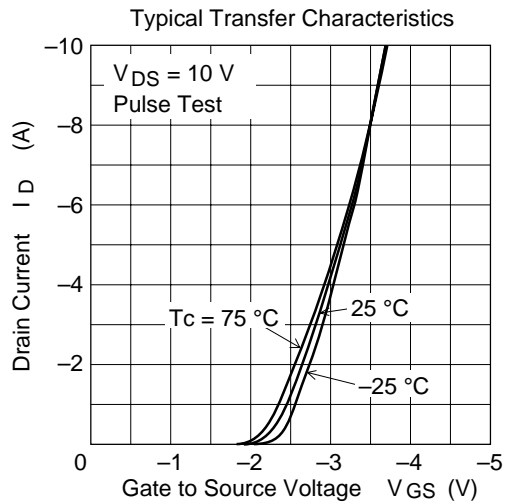
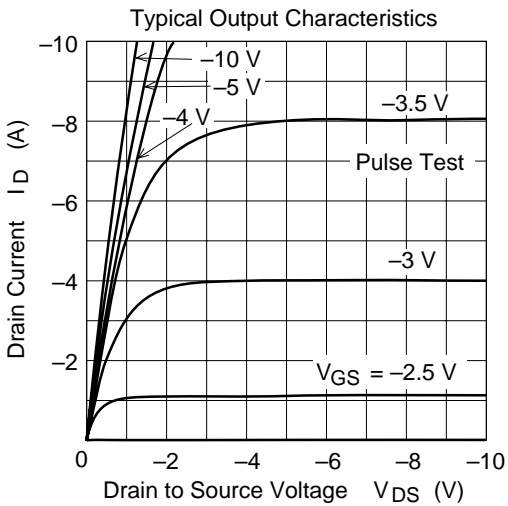
Switching Time Waveform



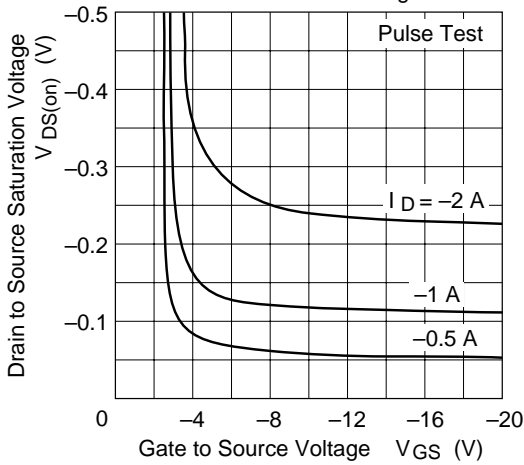
## ( P Channel )



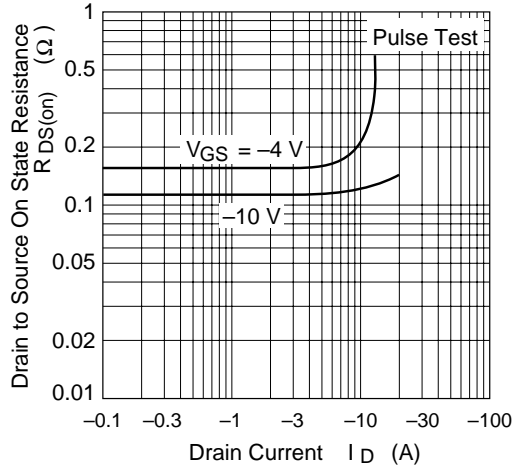
When using the glass epoxy board (FR4 40x40x1.6 mm)



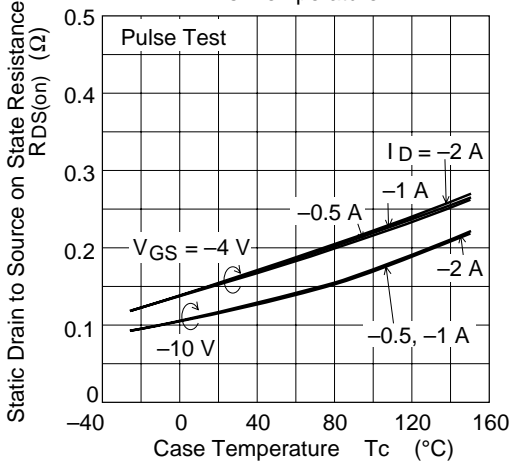
Drain to Source Saturation Voltage vs. Gate to Source Voltage



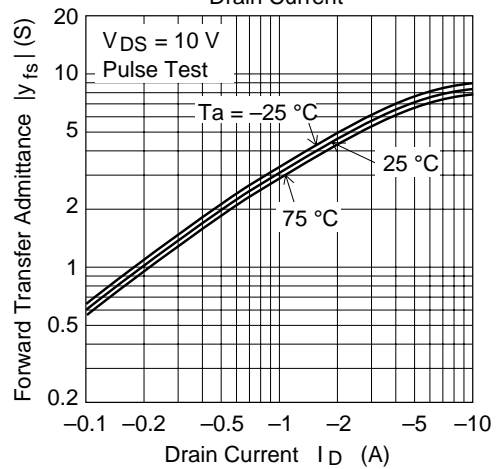
Static Drain to Source on State Resistance vs. Drain Current



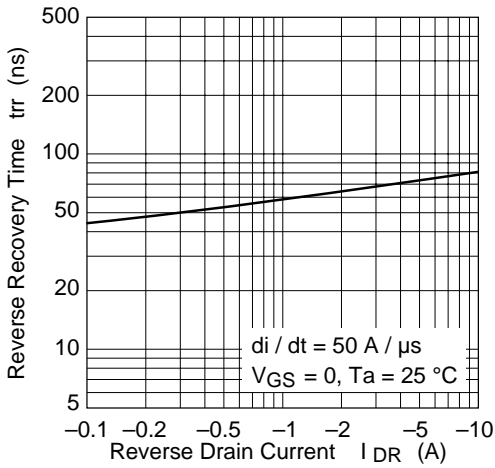
Static Drain to Source on State Resistance vs. Temperature



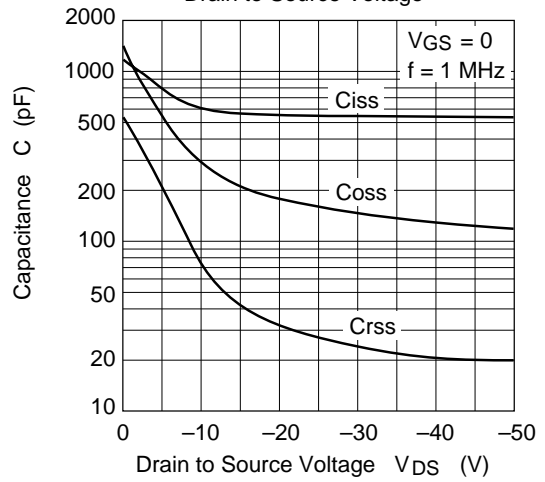
Forward Transfer Admittance vs. Drain Current



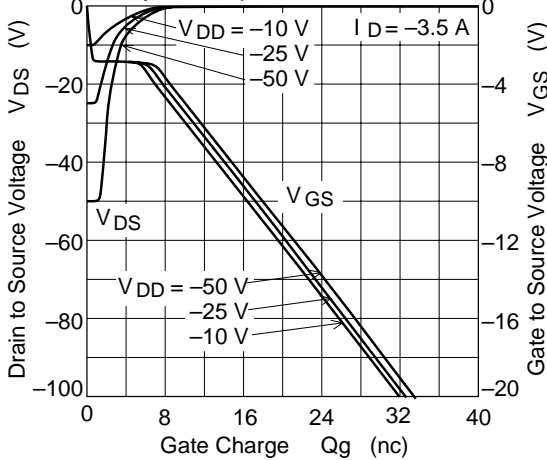
Body-Drain Diode Reverse Recovery Time



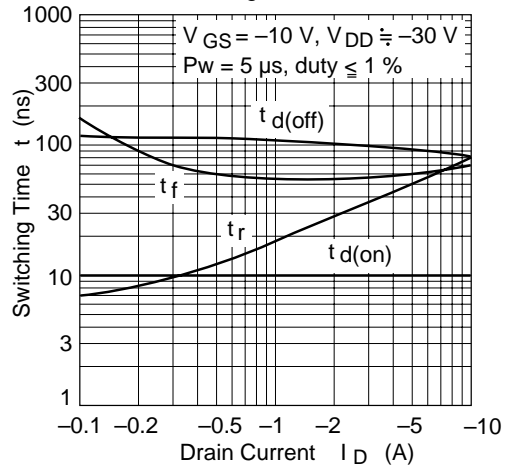
Typical Capacitance vs. Drain to Source Voltage

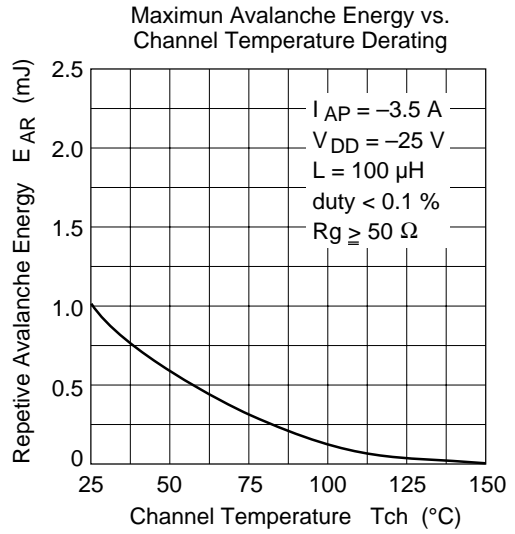
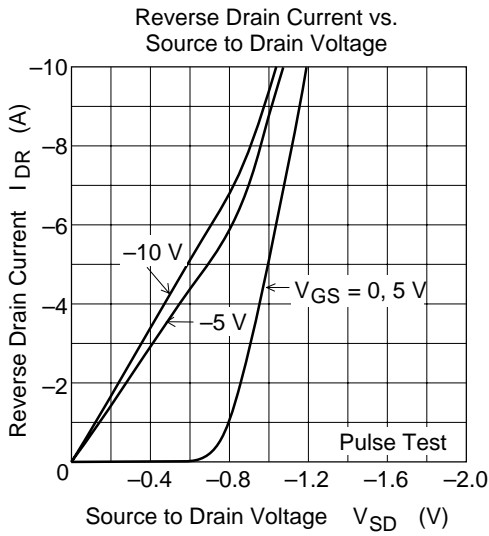


Dynamic Input Characteristics

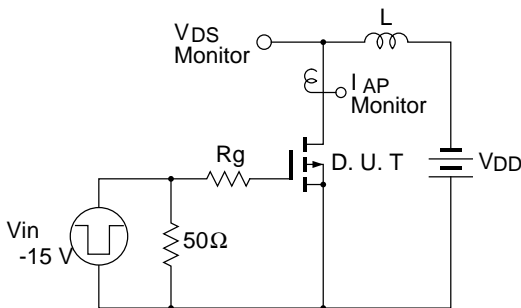


Switching Characteristics



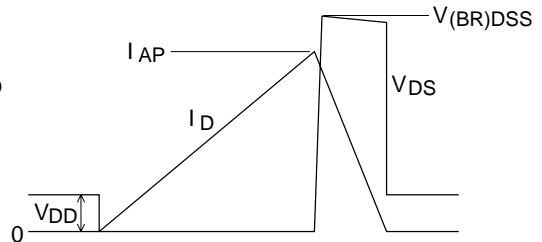


Avalanche Test Circuit

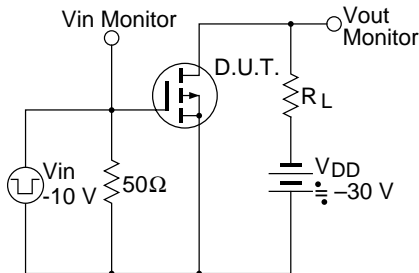


Avalanche Waveform

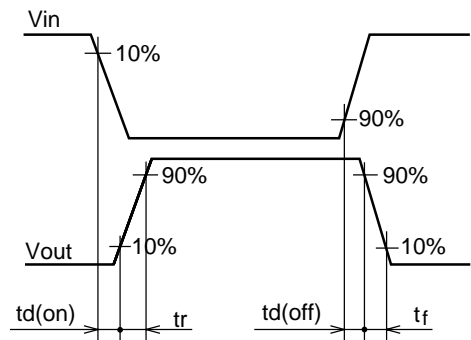
$$E_{AR} = \frac{1}{2} \cdot L \cdot I_{AP}^2 \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$

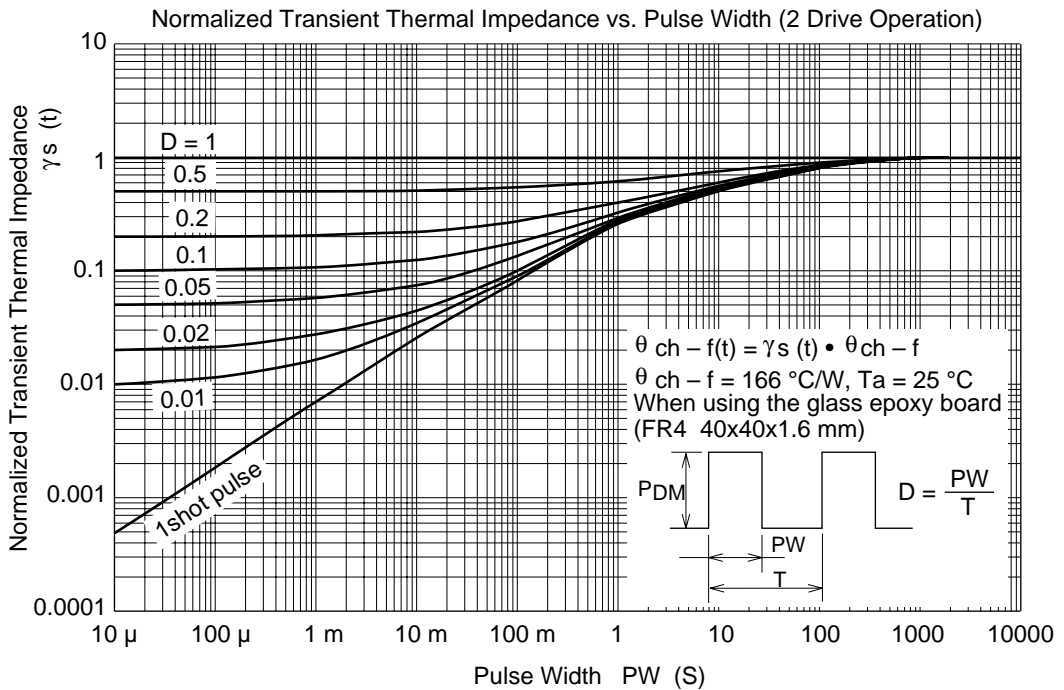
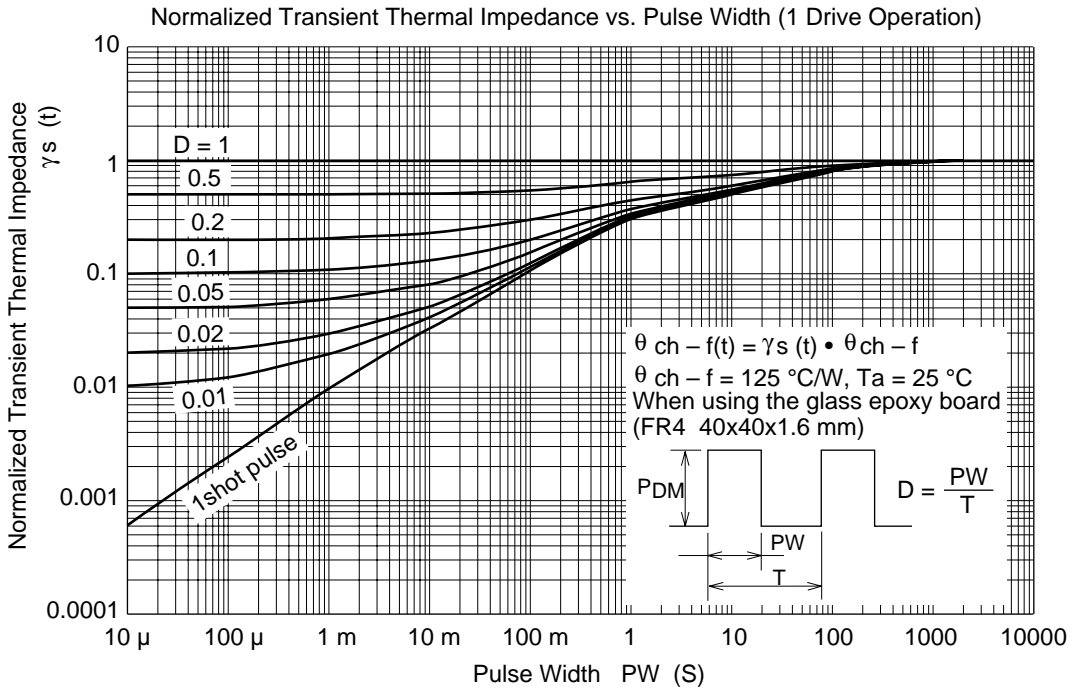


Switching Time Test Circuit



Switching Time Waveform

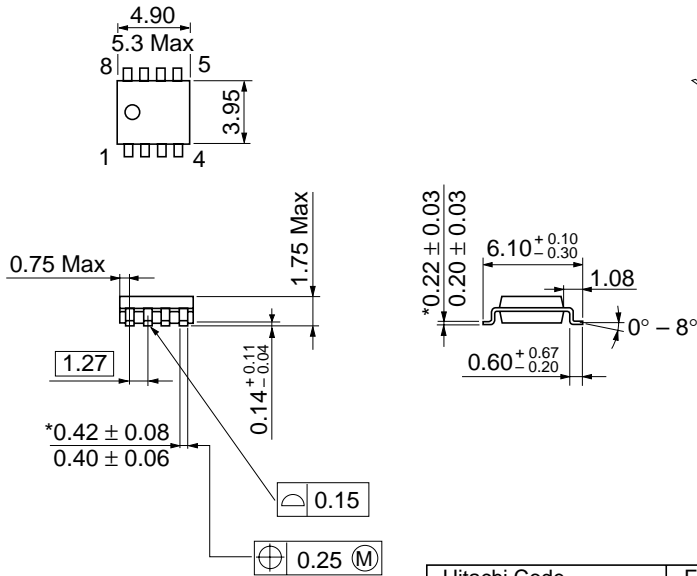




## Package Dimensions

As of January, 2001

Unit: mm



\*Dimension including the plating thickness  
 Base material dimension

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

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