

To all our customers

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

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Keep safety first in your circuit designs!

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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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# HAT2028R/HAT2028RJ

Silicon N Channel Power MOS FET  
High Speed Power Switching

**RENESAS**

ADE-208-524C (Z)

4th. Edition

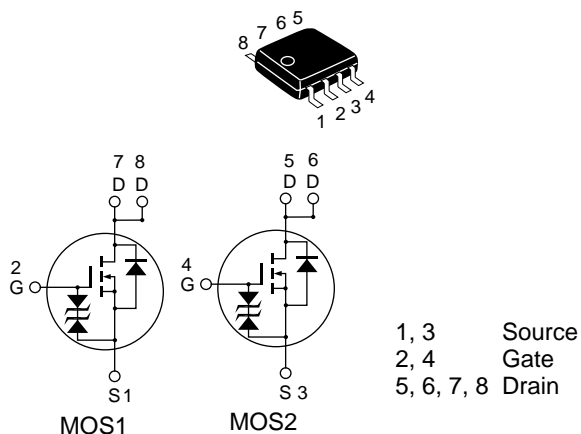
Feb. 1999

## Features

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

## Outline

SOP-8



Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Drain to source voltage		$V_{DSS}$	60	V
Gate to source voltage		$V_{GSS}$	$\pm 20$	V
Drain current		$I_D$	4	A
Drain peak current		$I_{D(pulse)}$ <sup>Note1</sup>	32	A
Body-drain diode reverse drain current		$I_{DR}$	4	A
Avalanche current	HAT2028R	$I_{AP}$ <sup>Note4</sup>	—	—
	HAT2028RJ		4	A
Avalanche energy	HAT2028R	$E_{AR}$ <sup>Note4</sup>	—	—
	HAT2028RJ		1.37	mJ
Channel dissipation		$P_{ch}$ <sup>Note2</sup>	2	W
Channel dissipation		$P_{ch}$ <sup>Note3</sup>	3	W
Channel temperature		$T_{ch}$	150	°C
Storage temperature		$T_{stg}$	– 55 to + 150	°C

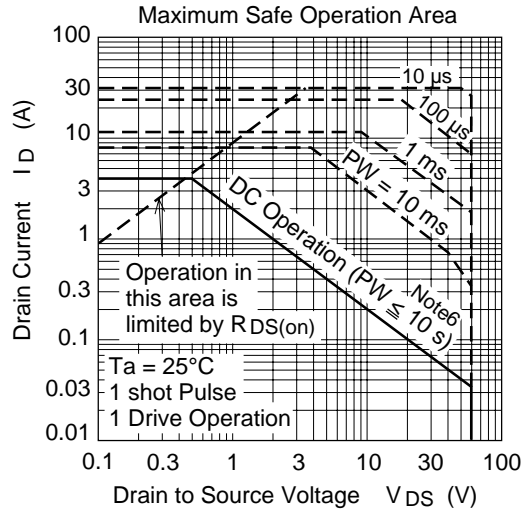
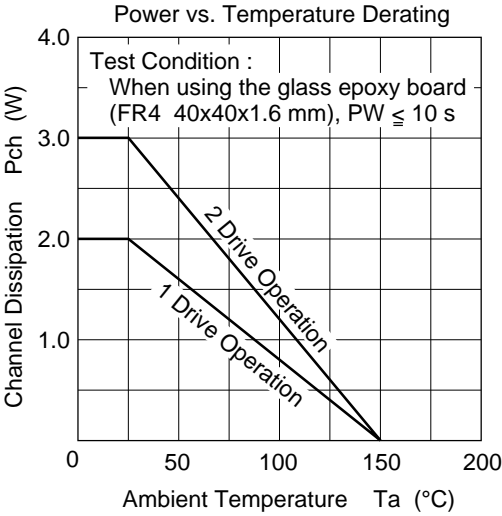
Note: 1.  $PW \leq 10\mu s$ , duty cycle  $\leq 1\%$   
2. 1 Drive operation : When using the glass epoxy board (FR4 40 x 40 x 1.6 mm),  $PW \leq 10s$   
3. 2 Drive operation : When using the glass epoxy board (FR4 40 x 40 x 1.6 mm),  $PW \leq 10s$   
4. Value at  $T_{ch}=25^{\circ}C$ ,  $R_g \geq 50\Omega$

## Electrical Characteristics (Ta = 25°C)

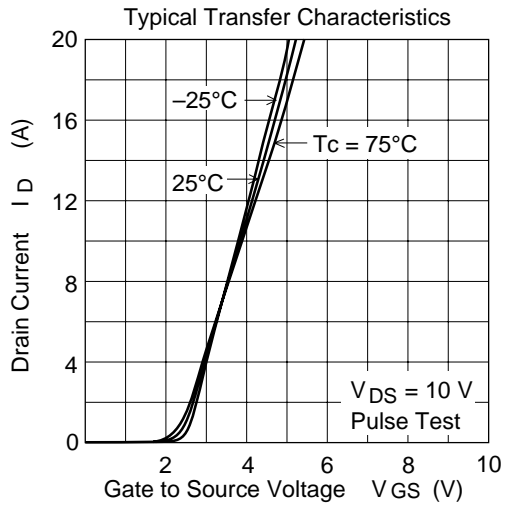
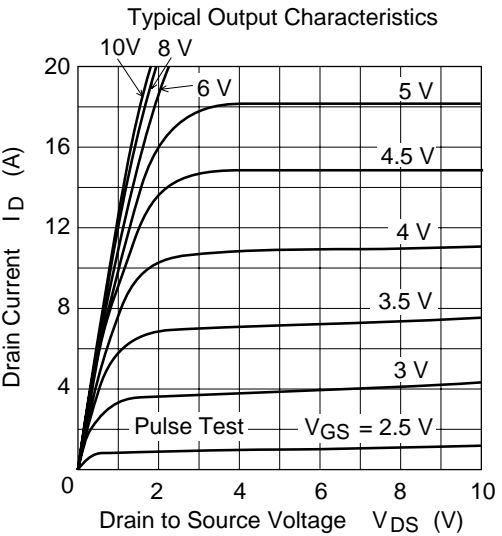
Item		Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdownvoltage		$V_{(BR)DSS}$	60	—	—	V	$I_D = 10 \text{ mA}$ , $V_{GS} = 0$
Gate to source breakdownvoltage		$V_{(BR)GSS}$	$\pm 20$	—	—	V	$I_G = \pm 100 \text{ }\mu\text{A}$ , $V_{DS} = 0$
Gate to source leak current		$I_{GSS}$	—	—	$\pm 10$	$\mu\text{A}$	$V_{GS} = \pm 16 \text{ V}$ , $V_{DS} = 0$
Zero gate voltage	HAT2028R	$I_{DSS}$	—	—	1	$\mu\text{A}$	$V_{DS} = 60 \text{ V}$ , $V_{GS} = 0$
drain current	HAT2028RJ	$I_{DSS}$	—	—	0.1	$\mu\text{A}$	
Zero gate voltage	HAT2028R	$I_{DSS}$	—	—	—	$\mu\text{A}$	$V_{DS} = 48 \text{ V}$ , $V_{GS} = 0$
drain current	HAT2028RJ	$I_{DSS}$	—	—	10	$\mu\text{A}$	
Gate to source cutoff voltage		$V_{GS(off)}$	1.3	—	2.3	V	$V_{DS} = 10 \text{ V}$ , $I_D = 1 \text{ mA}$
Static drain to source on state resistance		$R_{DS(on)}$	—	0.08	0.1	$\Omega$	$I_D = 2 \text{ A}$ , $V_{GS} = 10 \text{ V}$ <sup>Note5</sup>
		$R_{DS(on)}$	—	0.12	0.16	$\Omega$	$I_D = 2 \text{ A}$ , $V_{GS} = 4 \text{ V}$ <sup>Note5</sup>
Forward transfer admittance		$ y_{fs} $	3.3	5	—	S	$I_D = 2 \text{ A}$ , $V_{DS} = 10 \text{ V}$ <sup>Note5</sup>
Input capacitance		$C_{iss}$	—	280	—	pF	$V_{DS} = 10 \text{ V}$
Output capacitance		$C_{oss}$	—	150	—	pF	$V_{GS} = 0$
Reverse transfer capacitance		$C_{rss}$	—	55	—	pF	$f = 1 \text{ MHz}$
Turn-on delay time		$t_{d(on)}$	—	15	—	ns	$V_{GS} = 4 \text{ V}$ , $I_D = 2 \text{ A}$
Rise time		$t_r$	—	100	—	ns	$V_{DD} \cong 30 \text{ V}$
Turn-off delay time		$t_{d(off)}$	—	35	—	ns	
Fall time		$t_f$	—	45	—	ns	
Body-drain diode forwardvoltage		$V_{DF}$	—	0.88	1.15	V	$I_F = 4 \text{ A}$ , $V_{GS} = 0$ <sup>Note5</sup>
Body-drain diode reverse recovery time		$t_{rr}$	—	40	—	ns	$I_F = 4 \text{ A}$ , $V_{GS} = 0$ $diF/dt = 50 \text{ A}/\mu\text{s}$

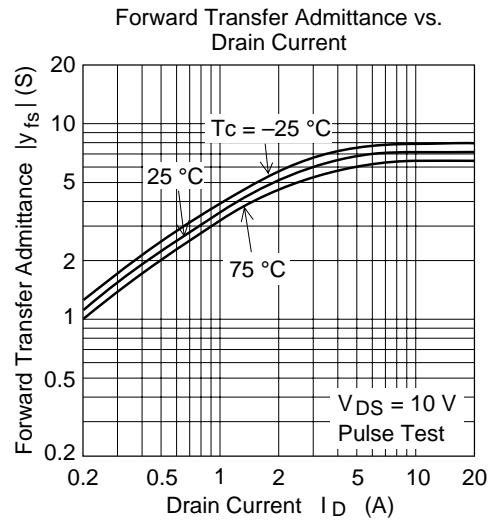
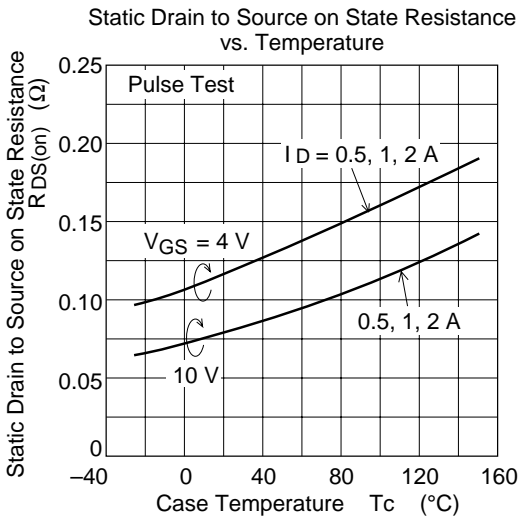
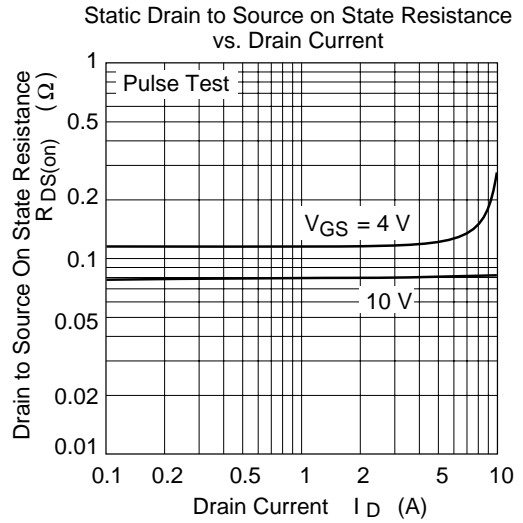
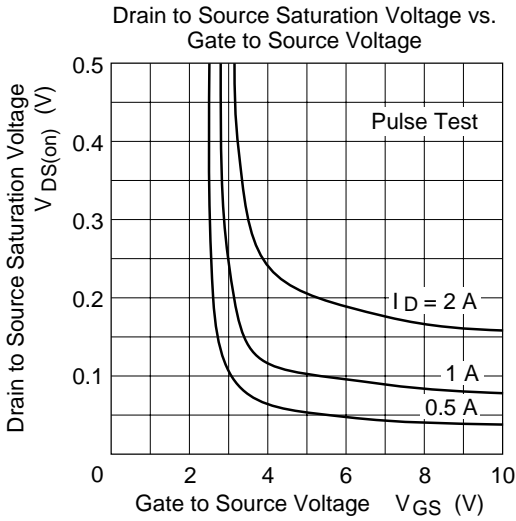
Note: 5. Pulse test

Main Characteristics

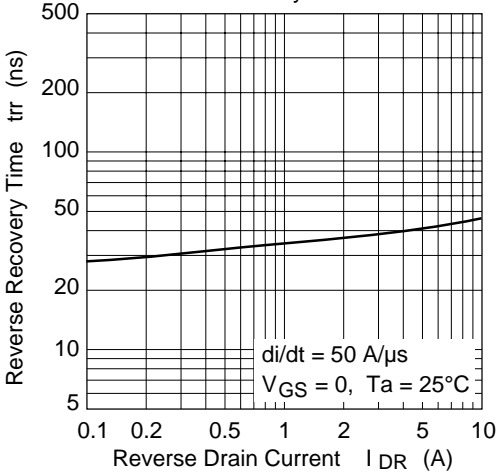


Note 6 :  
When using the glass epoxy board  
(FR4 40x40x1.6 mm)

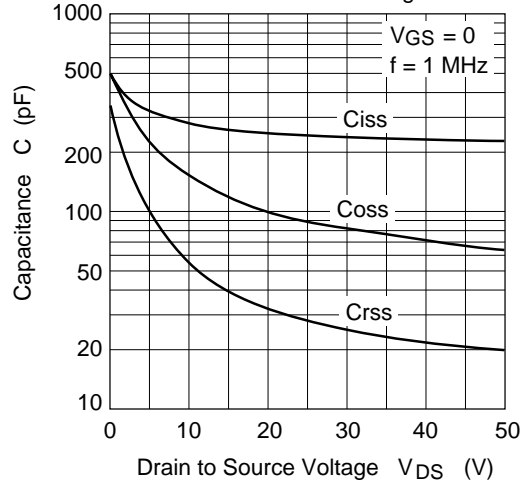




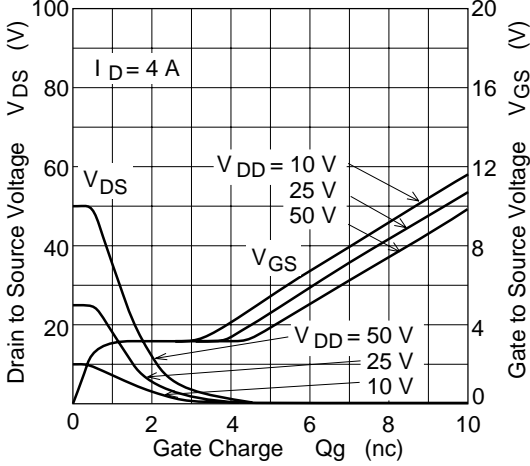
Body-Drain Diode Reverse Recovery Time



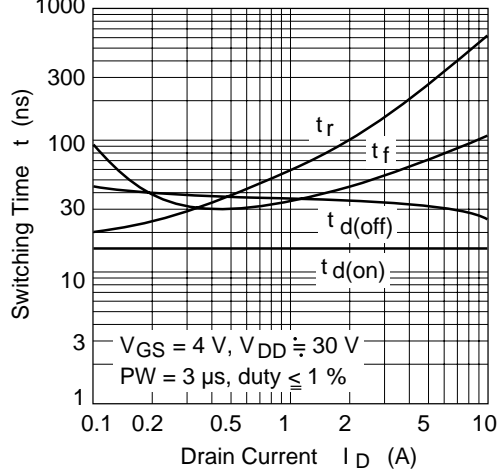
Typical Capacitance vs. Drain to Source Voltage



Dynamic Input Characteristics

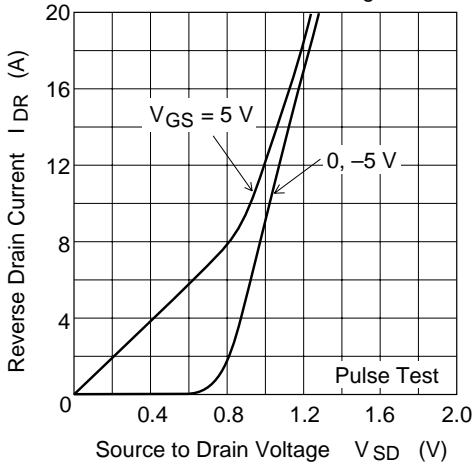


Switching Characteristics

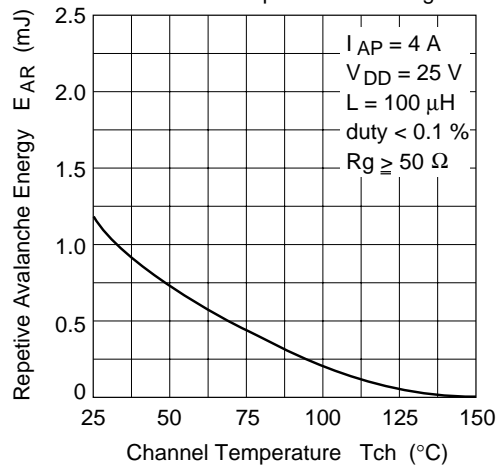




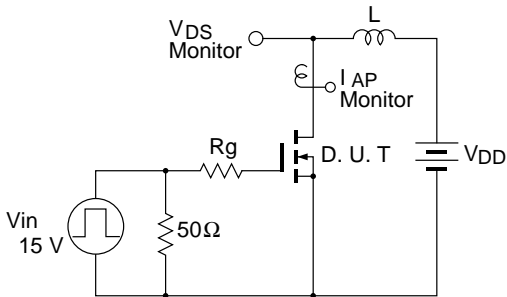
Reverse Drain Current vs. Source to Drain Voltage



Maximun Avalanche Energy vs. Channel Temperature Derating

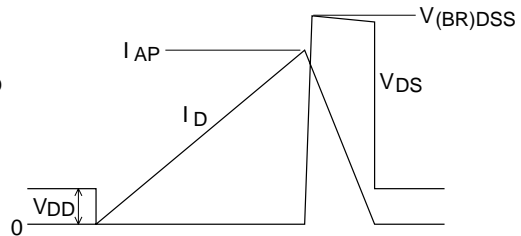


Avalanche Test Circuit

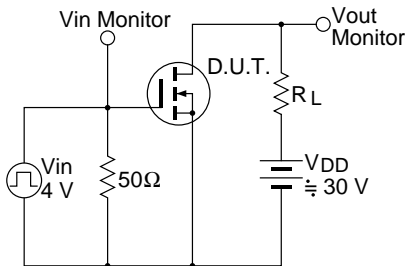


Avalanche Waveform

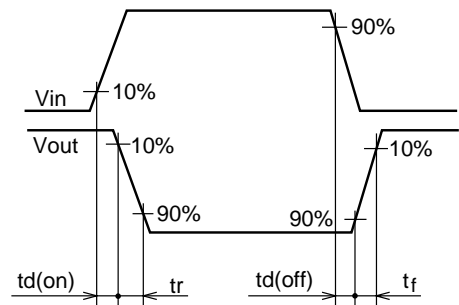
$$E_{AR} = \frac{1}{2} \cdot L \cdot I_{AP}^2 \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$

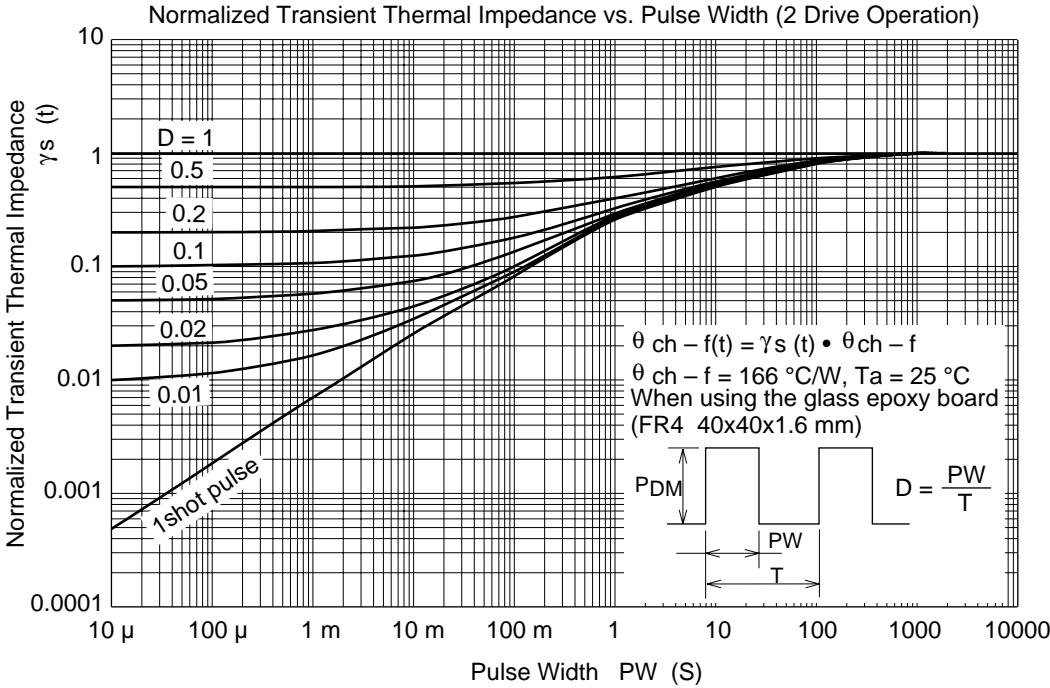
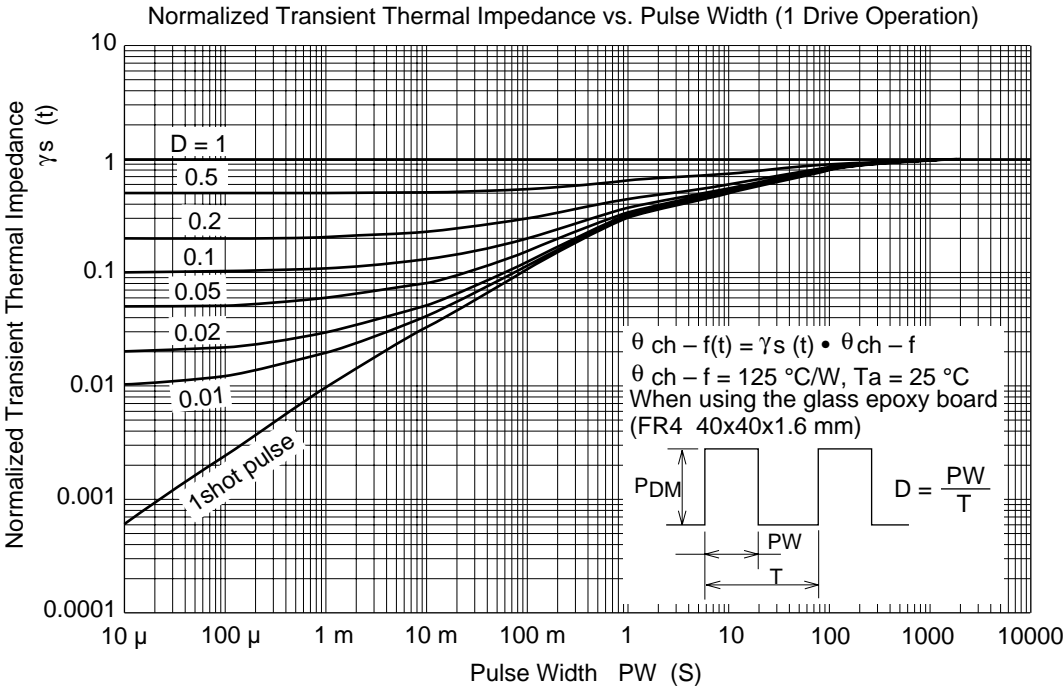


Switching Time Test Circuit



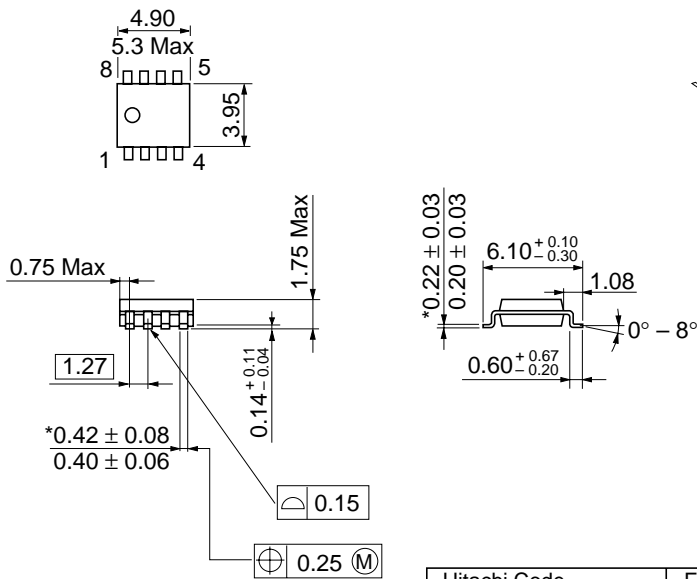
Switching Time Waveform





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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