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

Cautions

Keep safety first in your circuit designs!

1. Renesas Technology Corporation puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage.

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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HAT2038R/HAT2038RJ

Silicon N Channel Power MOS FET
High Speed Power Switching

RENESAS

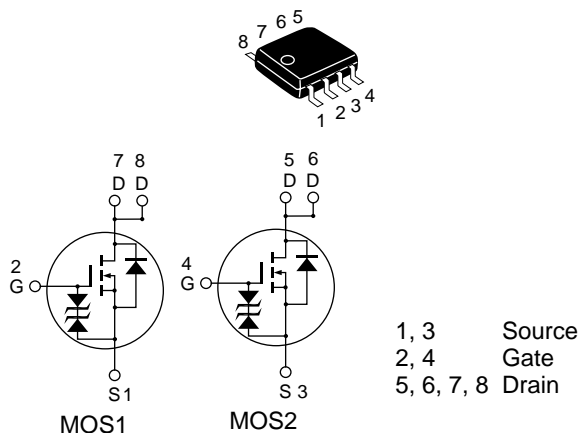
ADE-208-666C (Z)
4th. Edition
Feb. 1999

Features

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

Outline

SOP-8



HAT2038R/HAT2038RJ

Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DSS}	60	V
Gate to source voltage	V_{GSS}	± 20	V
Drain current	I_D	5	A
Drain peak current	$I_{D(pulse)}$ ^{Note1}	40	A
Body-drain diode reverse drain current	I_{DR}	5	A
Avalanche current	HAT2038R	I_{AP} ^{Note4}	—
	HAT2038RJ		5
Avalanche energy	HAT2038R	E_{AR} ^{Note4}	—
	HAT2038RJ		2.14
Channel dissipation	P_{ch} ^{Note2}	2	W
Channel dissipation	P_{ch} ^{Note3}	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), $PW \leq 10s$

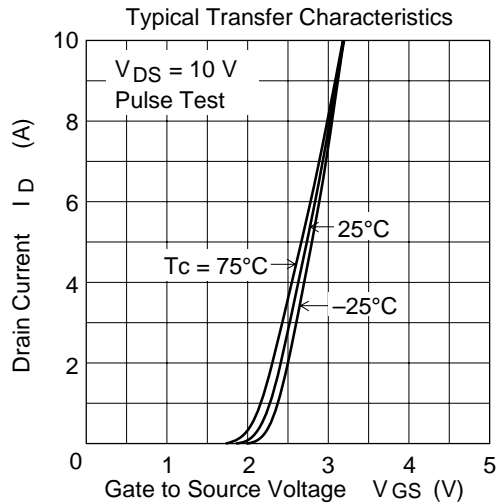
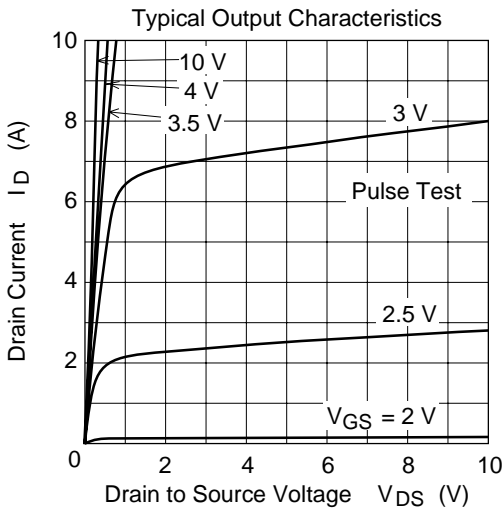
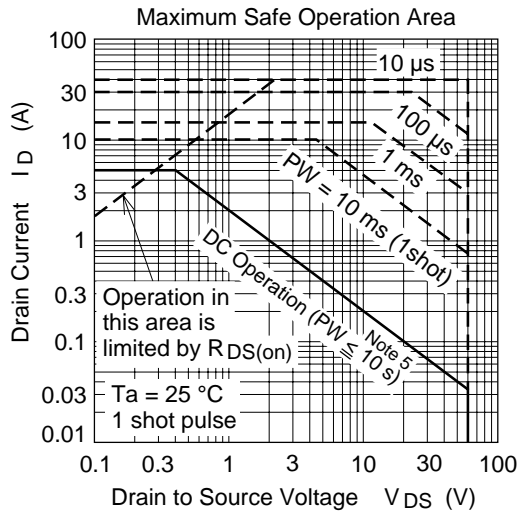
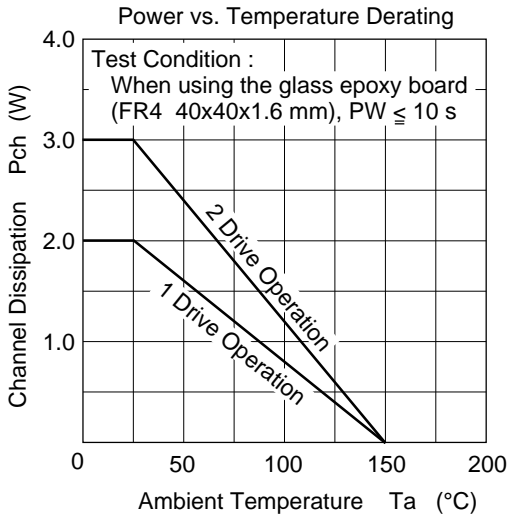
4. Value at $T_{ch}=25^\circ C$, $R_g \geq 50\Omega$

Electrical Characteristics (Ta = 25°C)

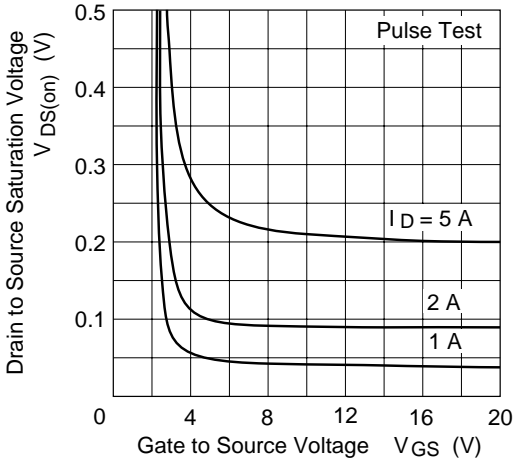
Item		Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage		$V_{(BR)DSS}$	60	—	—	V	$I_D = 10 \text{ mA}, V_{GS} = 0$
Gate to source breakdown voltage		$V_{(BR)GSS}$	± 20	—	—	V	$I_G = \pm 100 \text{ }\mu\text{A}, V_{DS} = 0$
Gate to source leak current		I_{GSS}	—	—	± 10	μA	$V_{GS} = \pm 16 \text{ V}, V_{DS} = 0$
Zero gate voltage drain current	HAT2038R	I_{DSS}	—	—	1	μA	$V_{DS} = 60 \text{ V}, V_{GS} = 0$
Zero gate voltage drain current	HAT2038RJ	I_{DSS}	—	—	0.1	μA	
Zero gate voltage drain current	HAT2038R	I_{DSS}	—	—	—	μA	$V_{DS} = 48 \text{ V}, V_{GS} = 0$
Zero gate voltage drain current	HAT2038RJ	I_{DSS}	—	—	10	μA	$T_a = 125^\circ\text{C}$
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		$R_{DS(on)}$	—	0.043	0.058	Ω	$I_D = 3 \text{ A}, V_{GS} = 10 \text{ V}$ ^{Note5}
Forward transfer admittance		$ y_{fs} $	6	9	—	S	$I_D = 3 \text{ A}, V_{DS} = 10 \text{ V}$ ^{Note5}
Input capacitance		C_{iss}	—	520	—	pF	$V_{DS} = 10 \text{ V}$
Output capacitance		C_{oss}	—	270	—	pF	$V_{GS} = 0$
Reverse transfer capacitance		C_{rss}	—	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	$I_F = 5 \text{ A}, V_{GS} = 0$ ^{Note5}
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

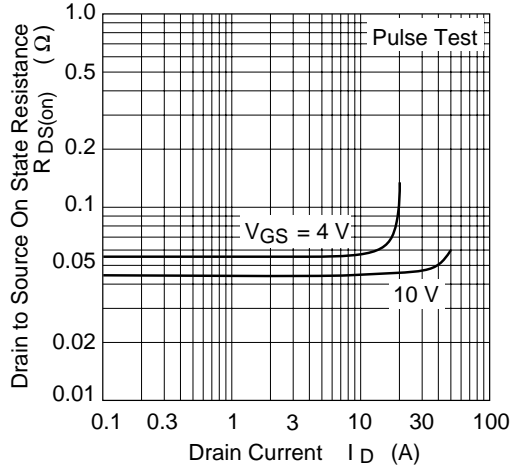
Main Characteristics



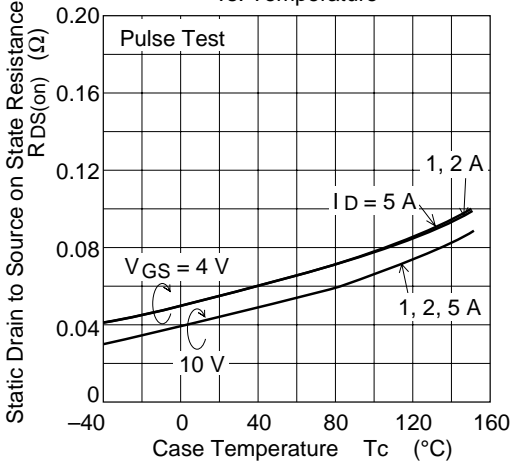
Drain to Source Saturation Voltage vs. Gate to Source Voltage



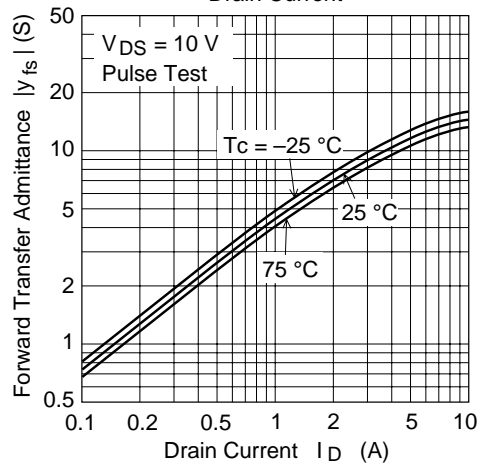
Static Drain to Source on State Resistance vs. Drain Current



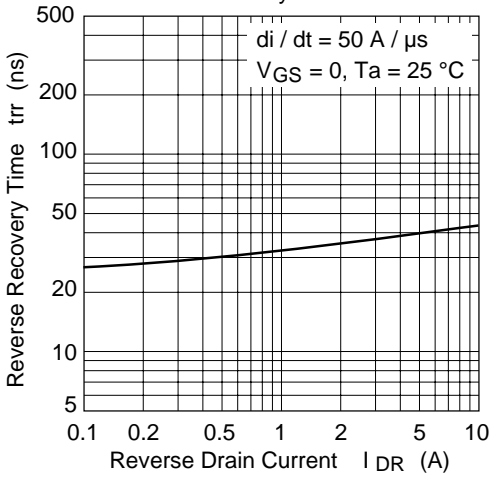
Static Drain to Source on State Resistance vs. Temperature



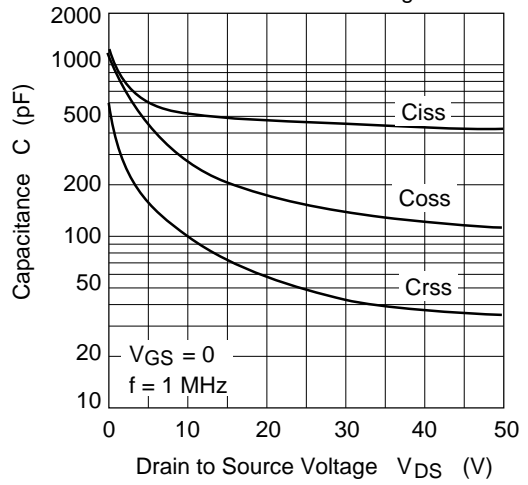
Forward Transfer Admittance vs. Drain Current



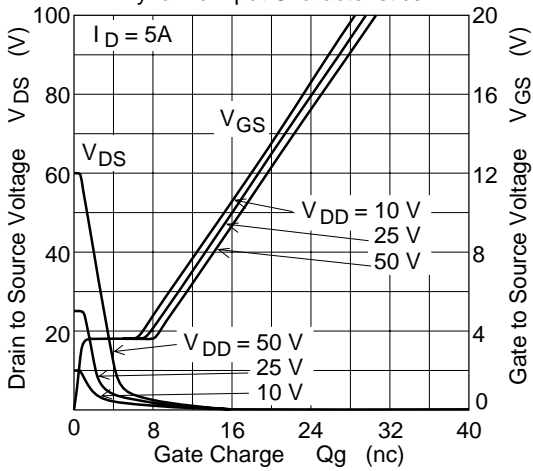
Body-Drain Diode Reverse Recovery Time



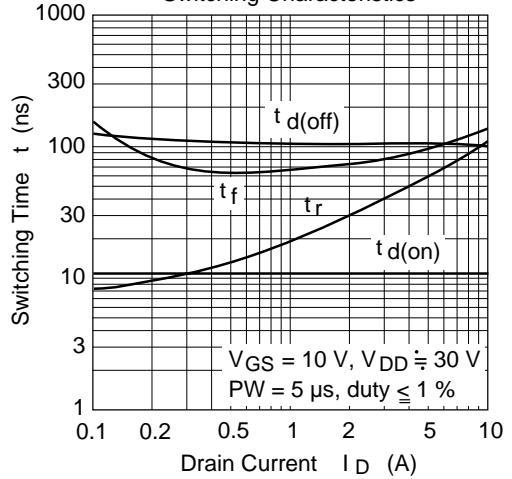
Typical Capacitance vs. Drain to Source Voltage

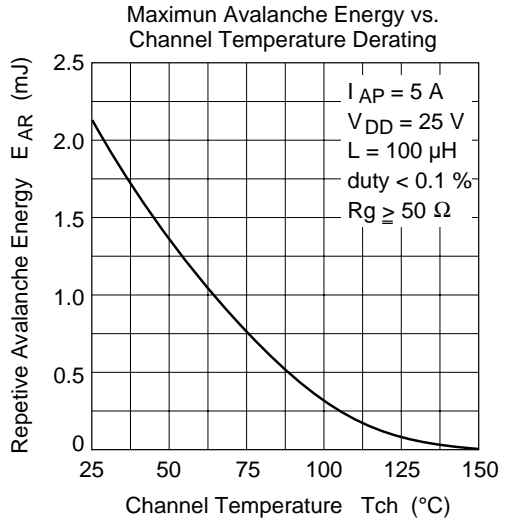
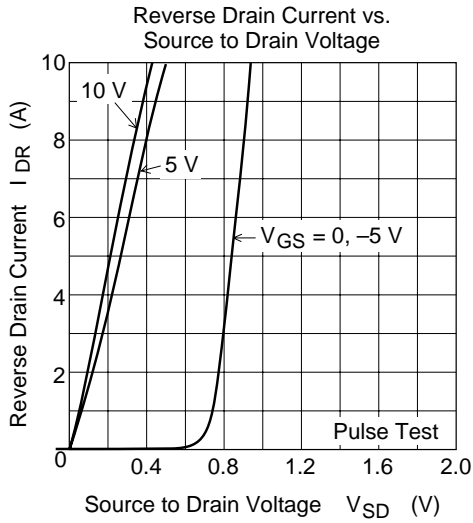


Dynamic Input Characteristics

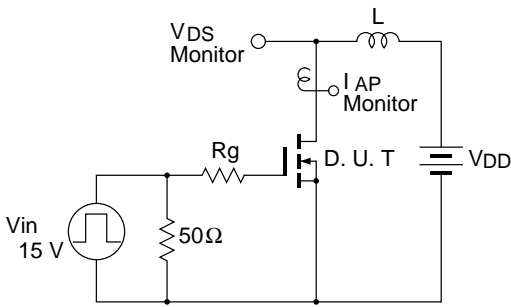


Switching Characteristics



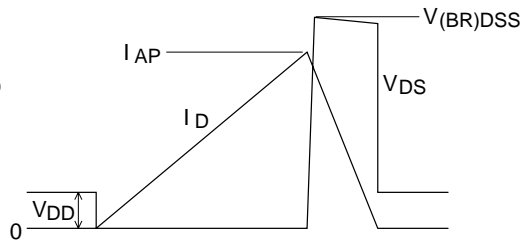


Avalanche Test Circuit

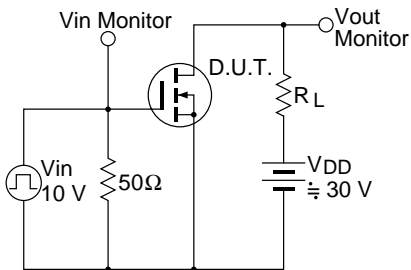


Avalanche Waveform

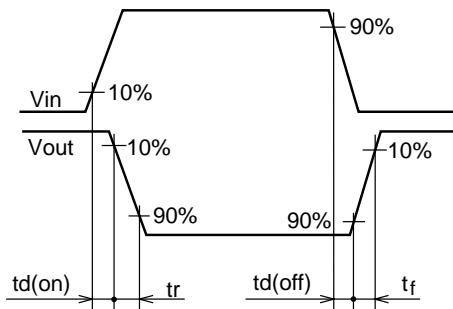
$$E_{AR} = \frac{1}{2} \cdot L \cdot I_{AP}^2 \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$



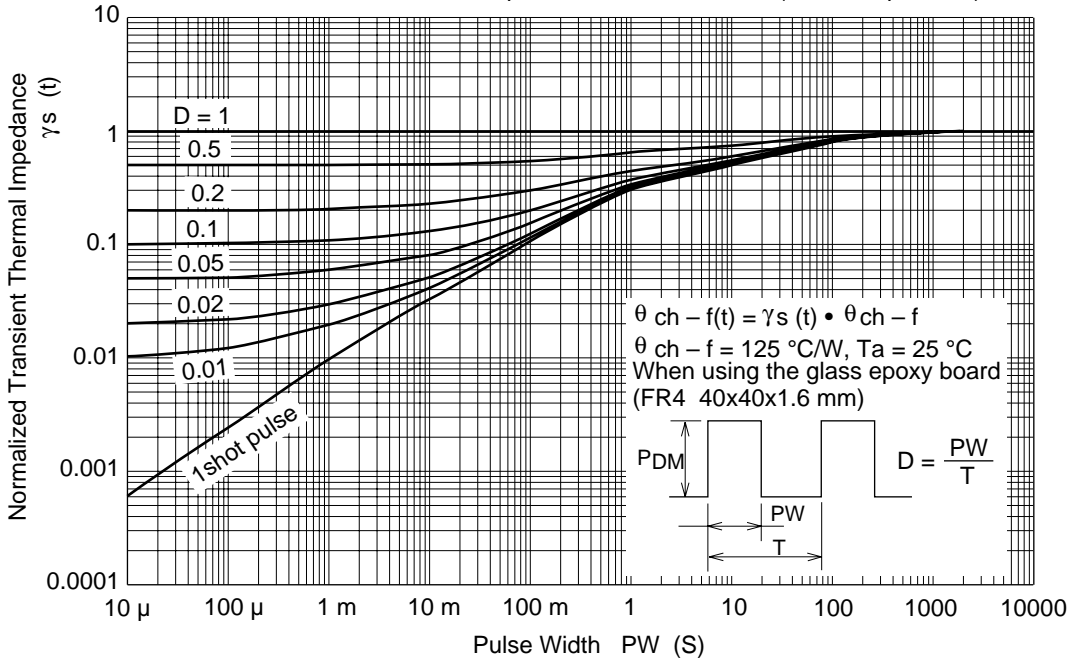
Switching Time Test Circuit



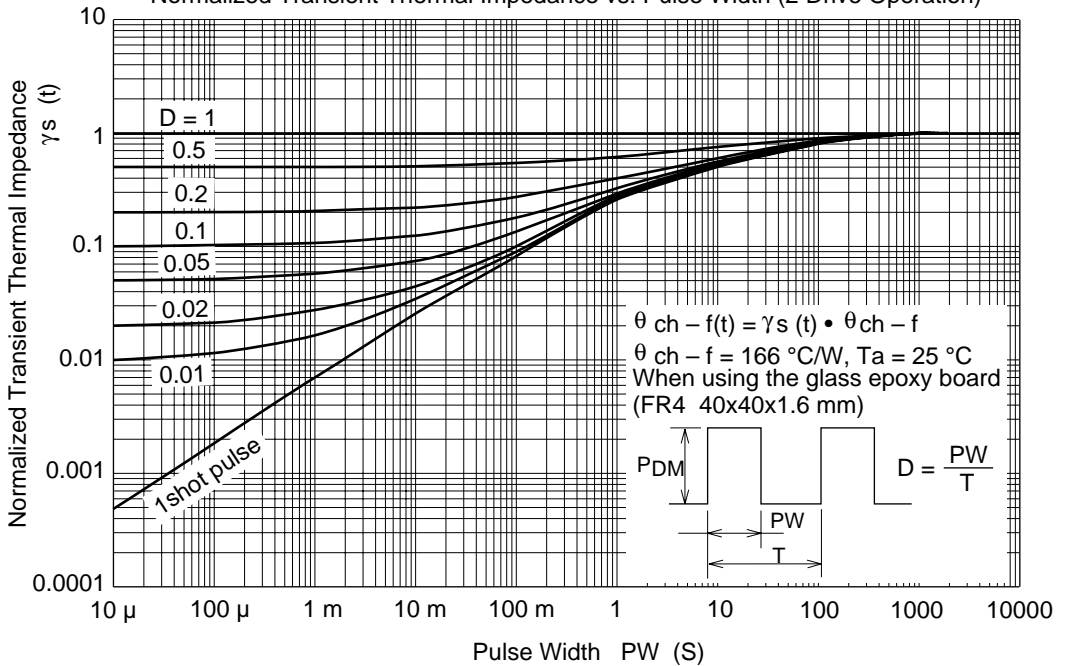
Switching Time Waveform



Normalized Transient Thermal Impedance vs. Pulse Width (1 Drive Operation)



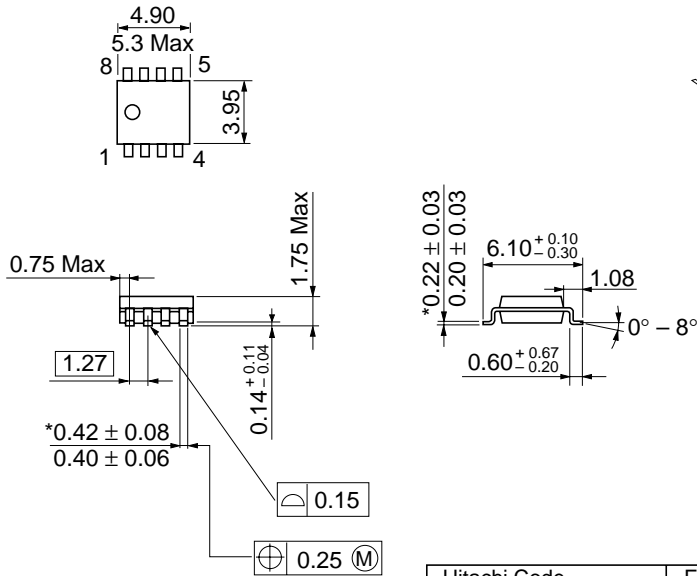
Normalized Transient Thermal Impedance vs. Pulse Width (2 Drive Operation)



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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