

HAT2038R/HAT2038RJ

Silicon N Channel Power MOS FET
High Speed Power Switching

HITACHI

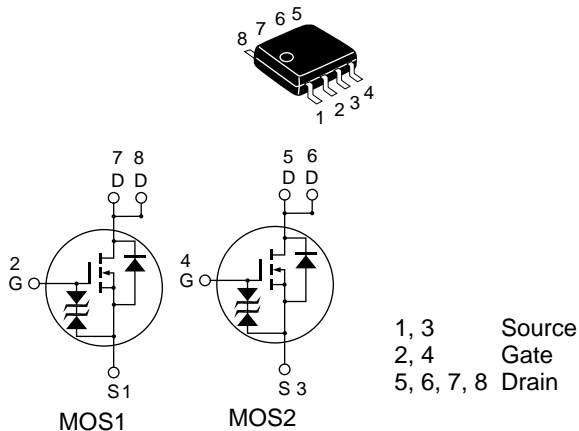
ADE-208-666C (Z)
4th. Edition
February 1999

Features

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

Outline

SOP-8



Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

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	A
Avalanche energy	HAT2038R	E_{AR} ^{Note4}	—	—
	HAT2038RJ		2.14	mJ
Channel dissipation		P_{ch} ^{Note2}	2	W
Channel dissipation		P_{ch} ^{Note3}	3	W
Channel temperature		T_{ch}	150	$^\circ\text{C}$
Storage temperature		T_{stg}	- 55 to + 150	$^\circ\text{C}$

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

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

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

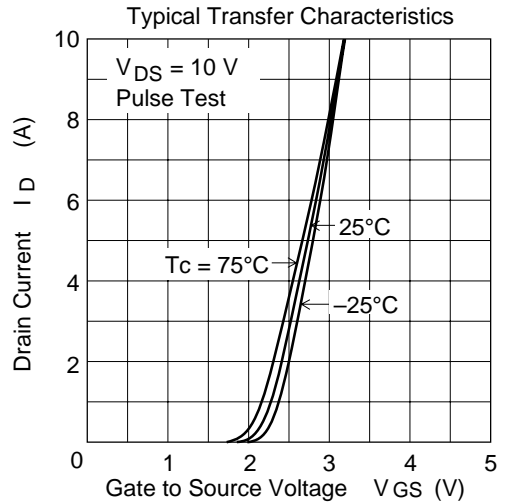
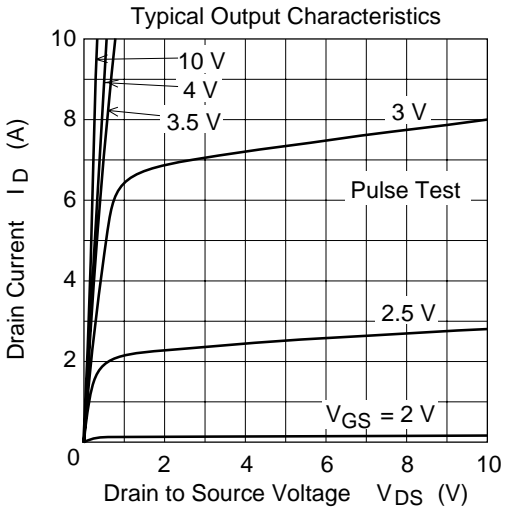
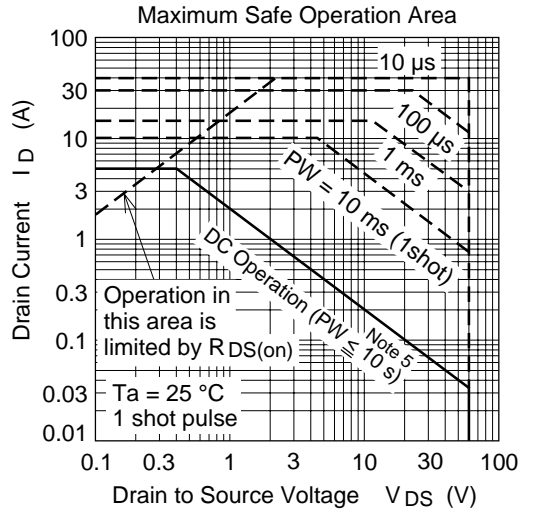
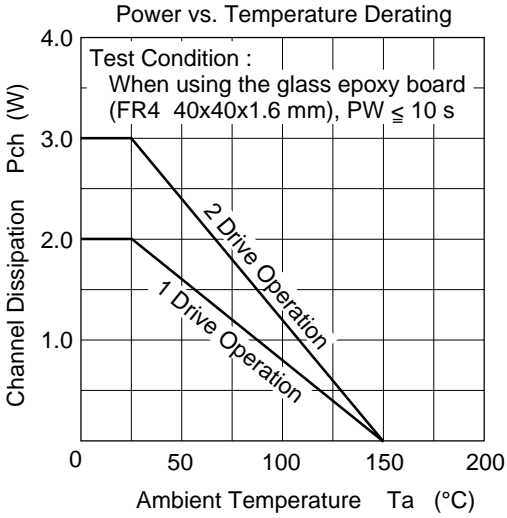
4. Value at $T_{ch}=25^\circ\text{C}$, $R_g \geq 50\Omega$

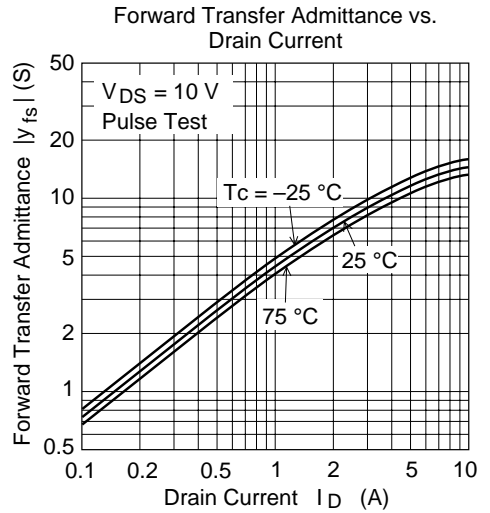
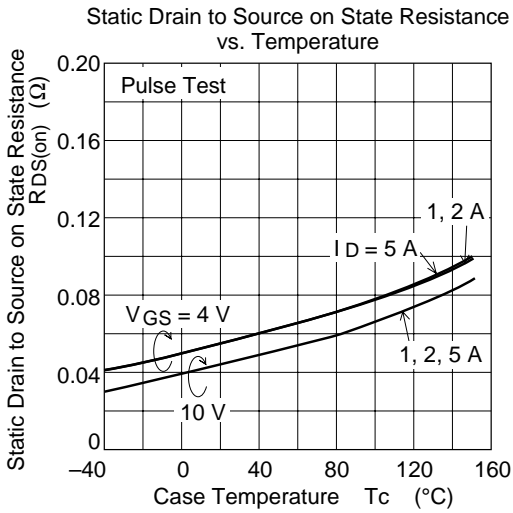
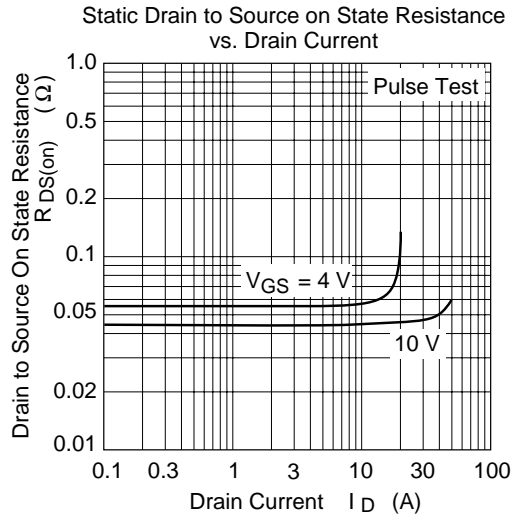
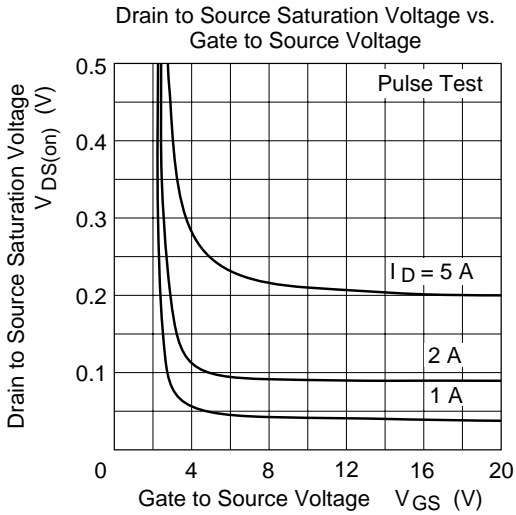
Electrical Characteristics (Ta = 25°C)

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	HAT2038R	I_{DSS}	—	—	1	μA	$V_{DS} = 60 \text{ V}$, $V_{GS} = 0$
drain current	HAT2038RJ	I_{DSS}	—	—	0.1	μA	
Zero gate voltage	HAT2038R	I_{DSS}	—	—	—	μA	$V_{DS} = 48 \text{ V}$, $V_{GS} = 0$
drain current	HAT2038RJ	I_{DSS}	—	—	10	μA	Ta = 125°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		$R_{DS(on)}$	—	0.043	0.058	Ω	$I_D = 3 \text{ A}$, $V_{GS} = 10 \text{ V}$ ^{Note5}
resistance		$R_{DS(on)}$	—	0.056	0.084	Ω	$I_D = 3 \text{ A}$, $V_{GS} = 4 \text{ V}$ ^{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 = 1MHz
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	$I_F = 5 \text{ A}$, $V_{GS} = 0$ $diF/dt = 50 \text{ A}/\mu\text{s}$

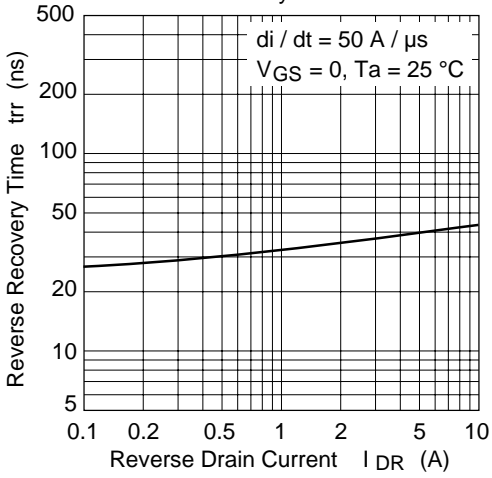
Note: 5. Pulse test

Main Characteristics

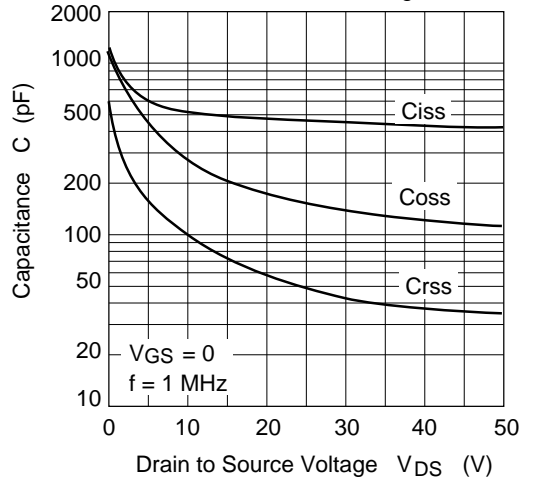




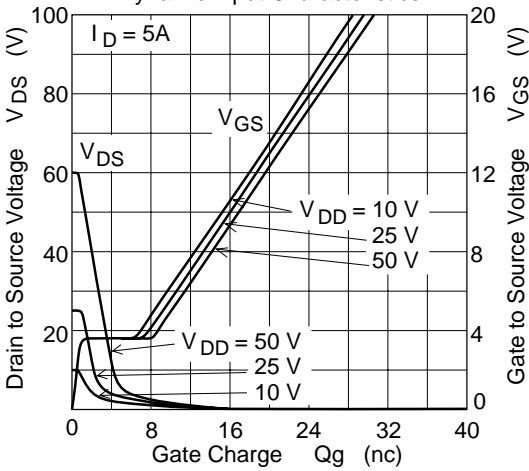
Body-Drain Diode Reverse Recovery Time



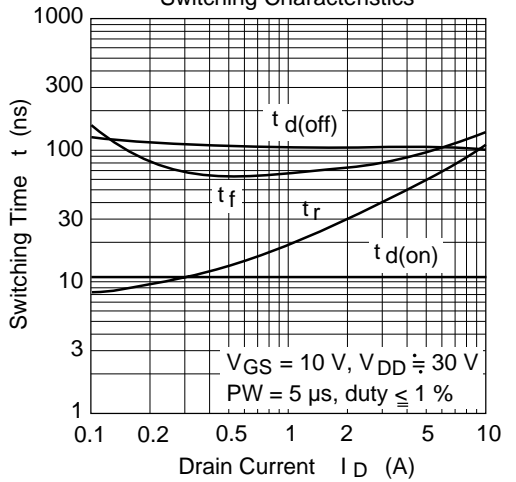
Typical Capacitance vs. Drain to Source Voltage

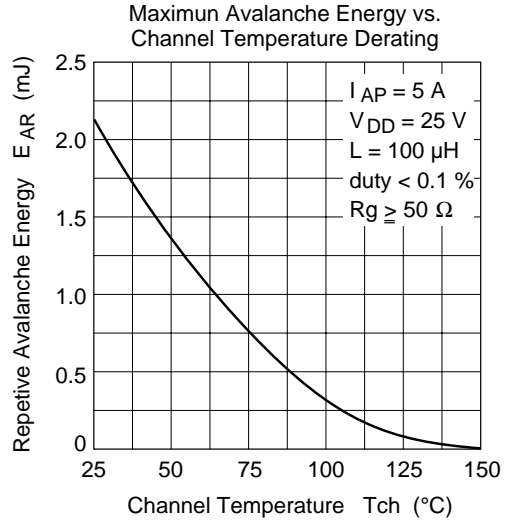
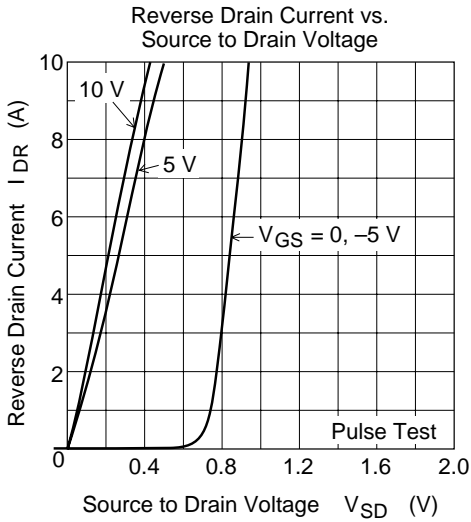


Dynamic Input Characteristics

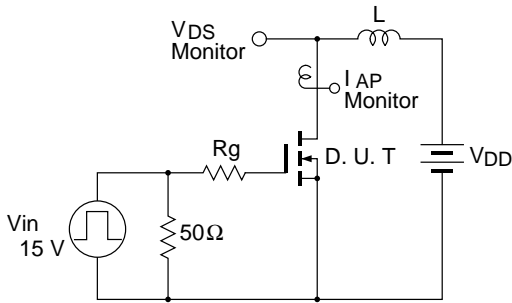


Switching Characteristics



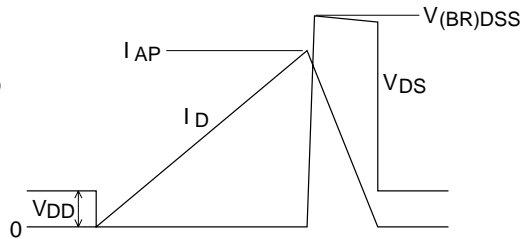


Avalanche Test Circuit

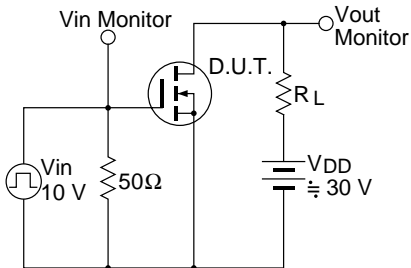


Avalanche Waveform

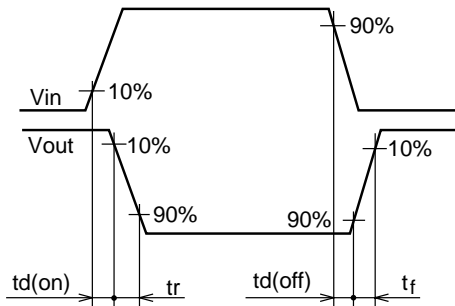
$$E_{AR} = \frac{1}{2} \cdot L \cdot I_{AP}^2 \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$



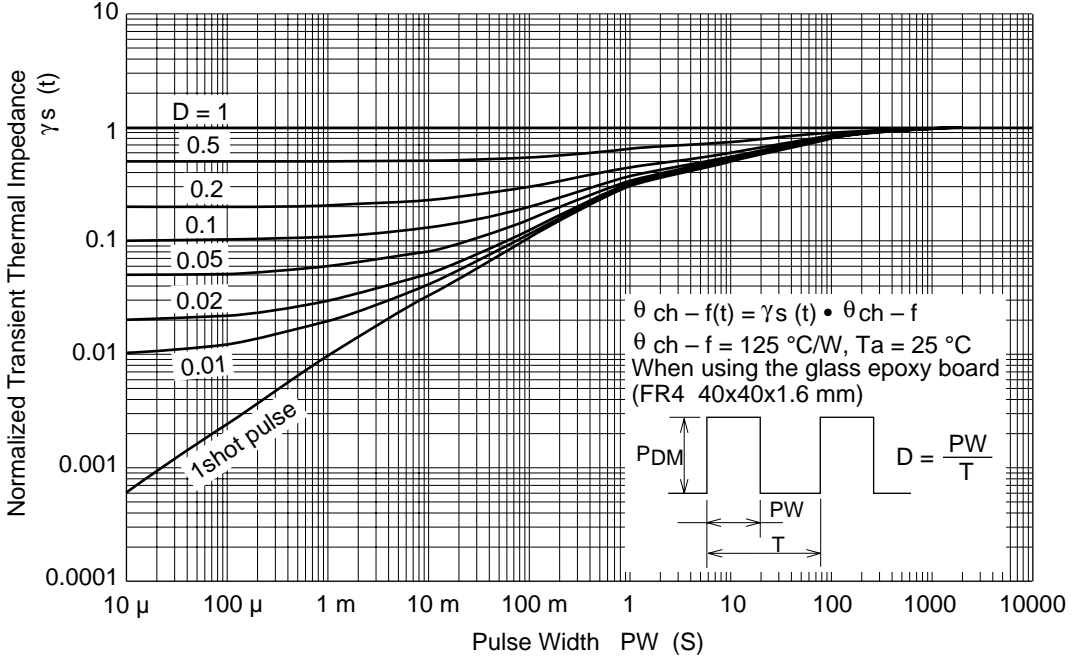
Switching Time Test Circuit



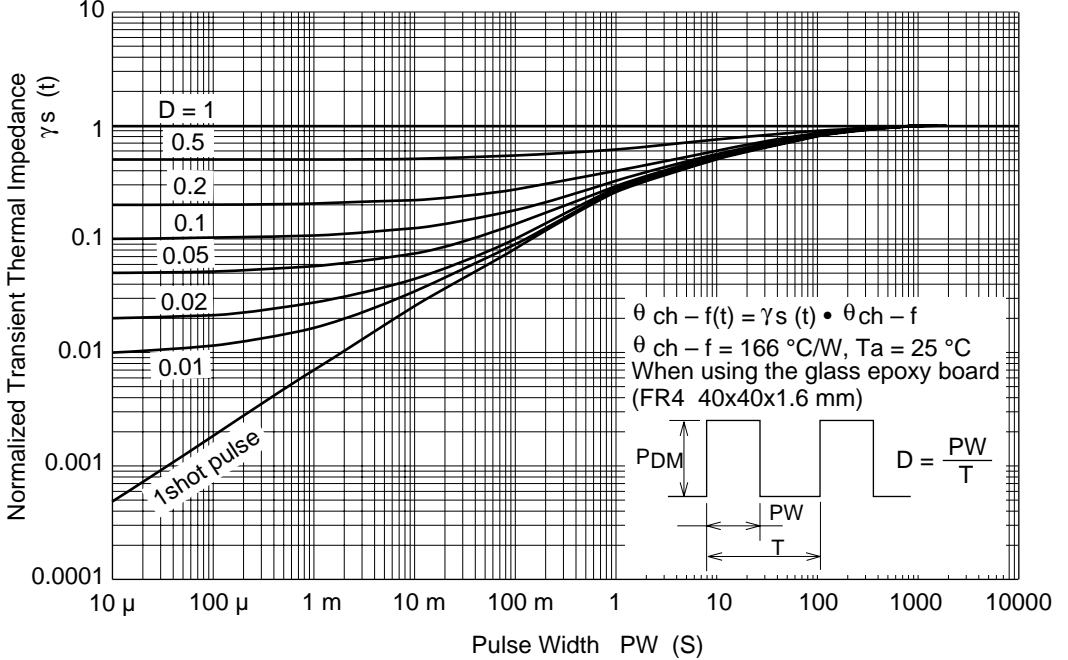
Switching Time Waveform



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

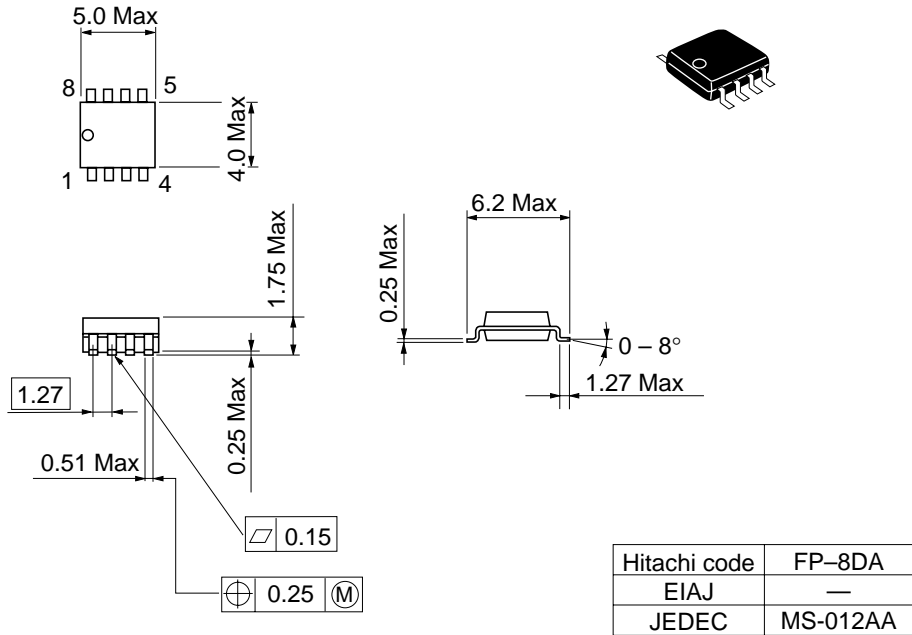


Normalized Transient Thermal Impedance vs. Pulse Width (2 Drive Operation)



Package Dimensions

Unit: mm



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