HAT2028R/HAT2028RJ

Silicon N Channel Power MOS FET
High Speed Power Switching

HITACHI

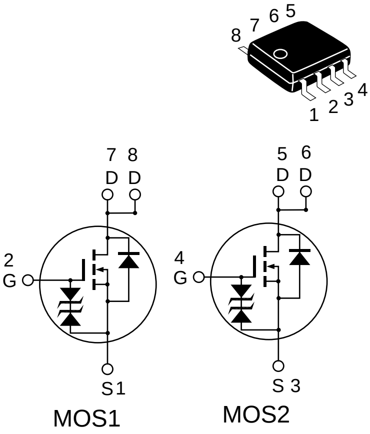
ADE-208-524C (Z)
4th. Edition
February 1999

Features

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

Outline

SOP–8



1, 3	Source
2, 4	Gate
5, 6, 7, 8	Drain

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	4	A
Drain peak current		$I_{D(pulse)}$ Note1	32	A
Body-drain diode reverse drain current		I_{DR}	4	A
Avalanche current	HAT2028R	I_{AP} Note4	—	—
	HAT2028RJ		4	A
Avalanche energy	HAT2028R	E_{AR} Note4	—	—
	HAT2028RJ		1.37	mJ
Channel dissipation		Pch Note2	2	W
Channel dissipation		Pch Note3	3	W
Channel temperature		Tch	150	°C
Storage temperature		Tstg	– 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

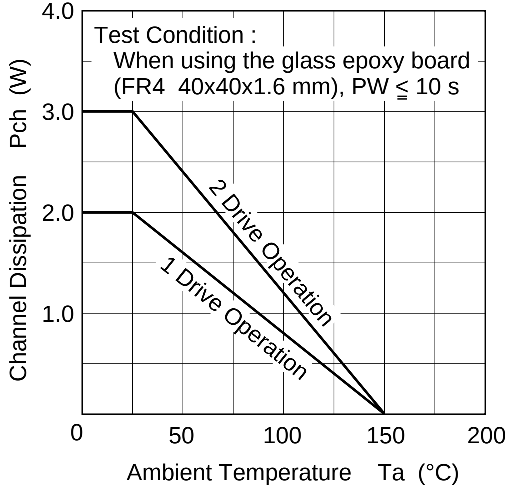
Electrical Characteristics (Ta = 25°C)

Item		**Symbol**	**Min**	**Typ**	**Max**	**Unit**	**Test Conditions**
Drain to source breakdownvoltage		$V_{(BR)DSS}$	60	—	—	V	I_D = 10 mA, V_{GS} = 0
Gate to source breakdownvoltage		$V_{(BR)GSS}$	± 20	—	—	V	I_G = ± 100 µA, V_{DS} = 0
Gate to source leak current		I_{GSS}	—	—	± 10	µA	V_{GS} = ± 16 V, V_{DS} = 0
Zero gate voltage drain current	HAT2028R	I_{DSS}	—	—	1	µA	V_{DS} = 60 V, V_{GS} = 0
	HAT2028RJ	I_{DSS}	—	—	0.1	µA	
Zero gate voltage drain current	HAT2028R	I_{DSS}	—	—	—	µA	V_{DS} = 48 V, V_{GS} = 0
	HAT2028RJ	I_{DSS}	—	—	10	µA	Ta = 125°C
Gate to source cutoff voltage		$V_{GS(off)}$	1.3	—	2.3	V	V_{DS} = 10 V, I_D = 1 mA
Static drain to source on state resistance		$R_{DS(on)}$	—	0.08	0.1	Ω	I_D = 2 A, V_{GS} = 10 V $^{\text{Note5}}$
		$R_{DS(on)}$	—	0.12	0.16	Ω	I_D = 2 A, V_{GS} = 4 V $^{\text{Note5}}$
Forward transfer admittance		$\lvert y_{fs}\rvert$	3.3	5	—	S	I_D = 2 A, V_{DS} = 10 V $^{\text{Note5}}$
Input capacitance		Ciss	—	280	—	pF	V_{DS} = 10 V
Output capacitance		Coss	—	150	—	pF	V_{GS} = 0
Reverse transfer capacitance		Crss	—	55	—	pF	f = 1MHz
Turn-on delay time		$t_{d(on)}$	—	15	—	ns	V_{GS} = 4 V, I_D = 2 A
Rise time		t_r	—	100	—	ns	V_{DD} ≅ 30 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	IF = 4 A, V_{GS} = 0 $^{\text{Note5}}$
Body–drain diode reverse recovery time		t_{rr}	—	40	—	ns	IF = 4 A, V_{GS} = 0 diF/ dt = 50 A/µs

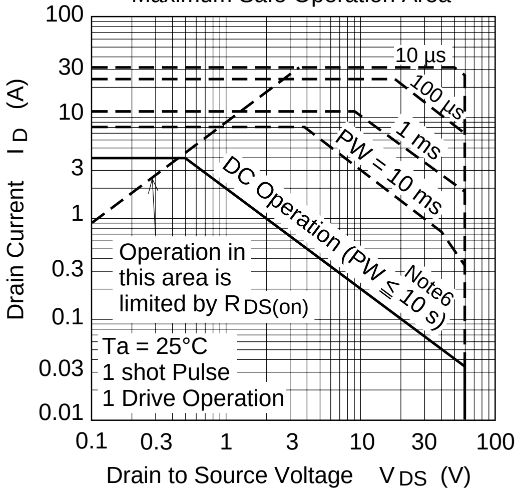
Note: 5. Pulse test

Main Characteristics

Power vs. Temperature Derating

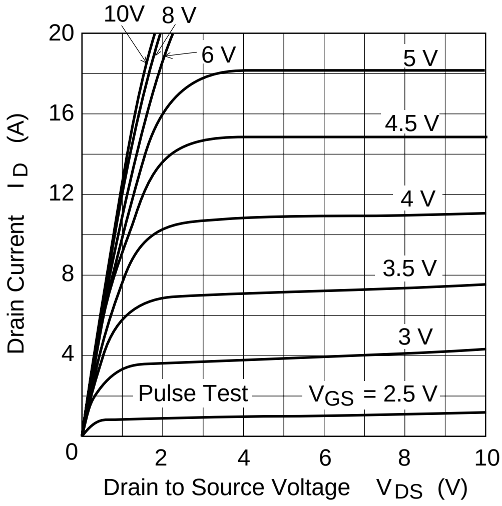


Maximum Safe Operation Area

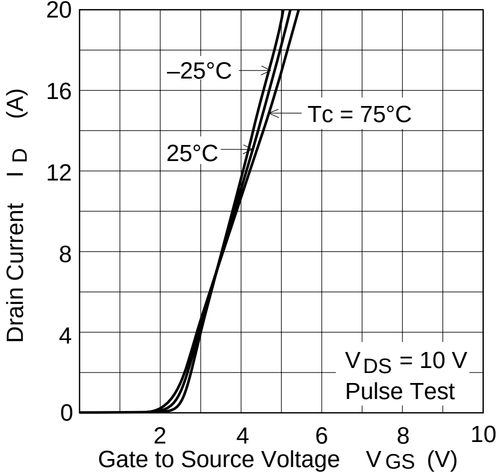


Note 6 :
When using the glass epoxy board
(FR4 40x40x1.6 mm)

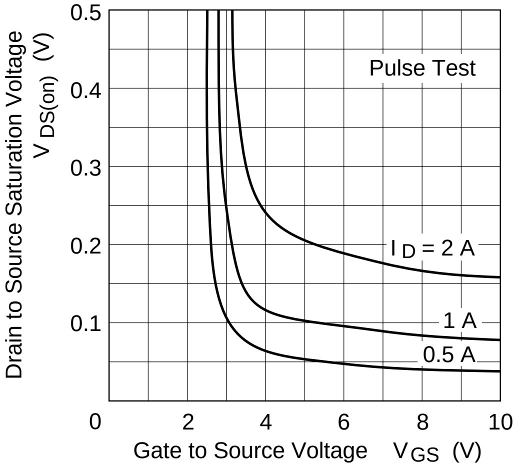
Typical Output Characteristics



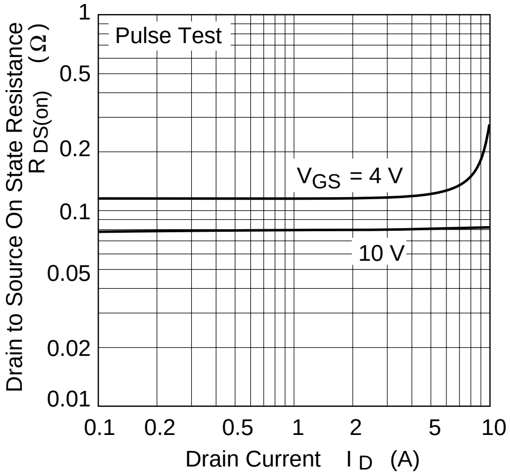
Typical Transfer Characteristics



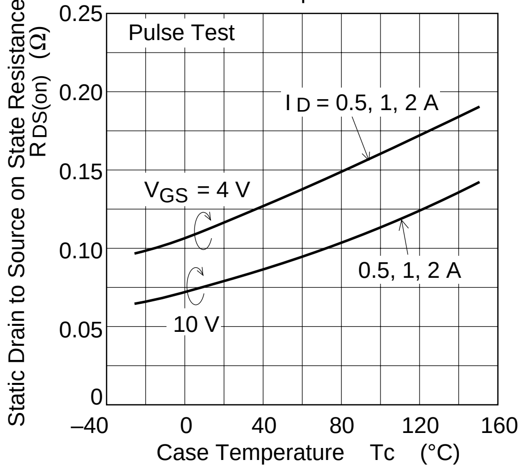
Drain to Source Saturation Voltage vs. Gate to Source Voltage



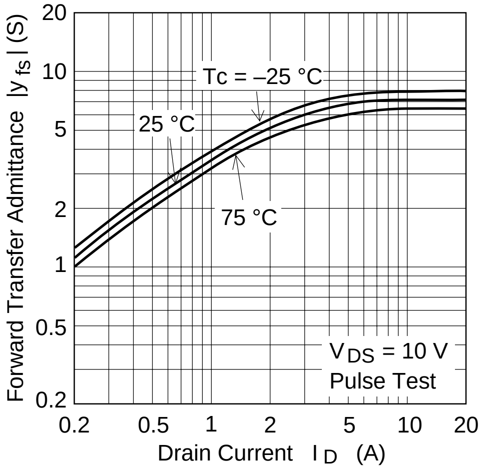
Static Drain to Source on State Resistance vs. Drain Current



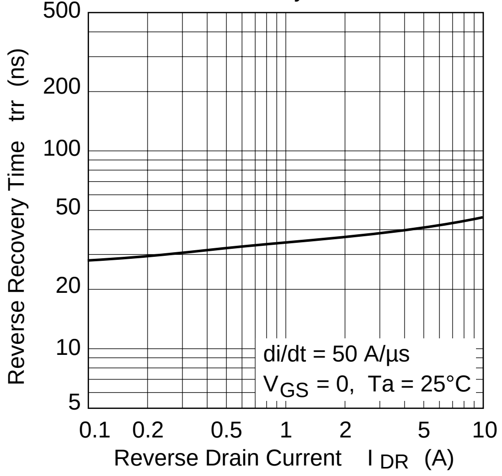
Static Drain to Source on State Resistance vs. Temperature



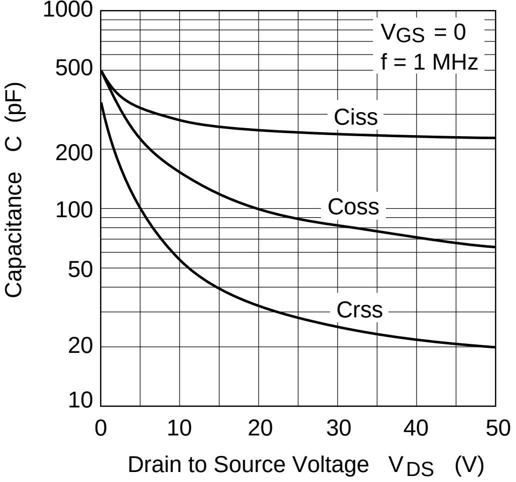
Forward Transfer Admittance vs. Drain Current



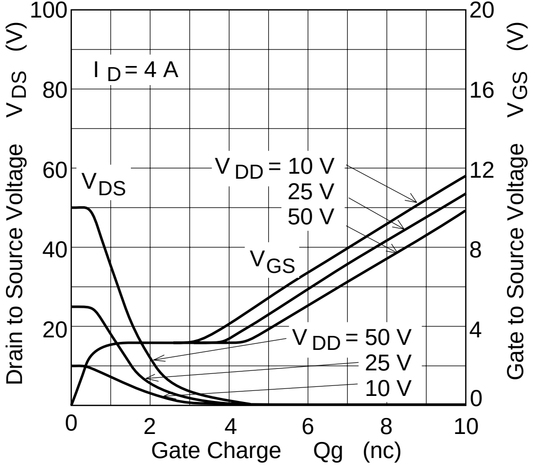
Body–Drain Diode Reverse Recovery Time



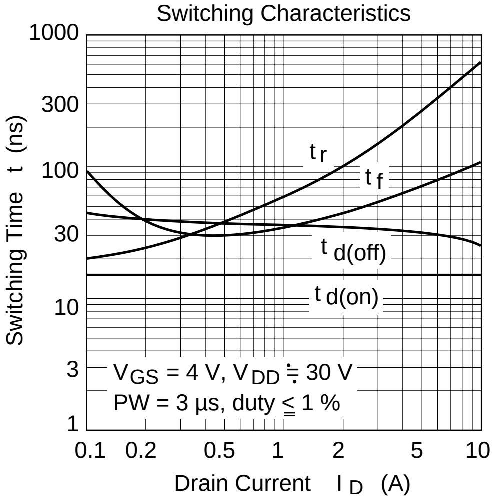
Typical Capacitance vs. Drain to Source Voltage



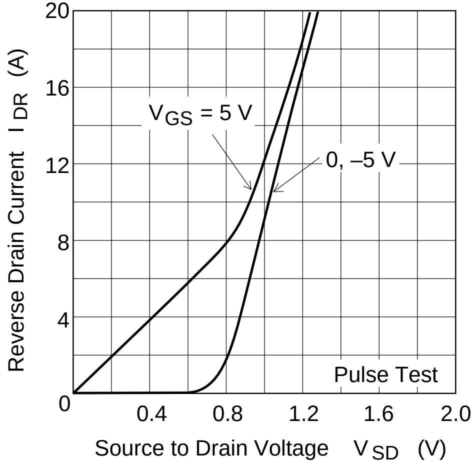
Dynamic Input Characteristics



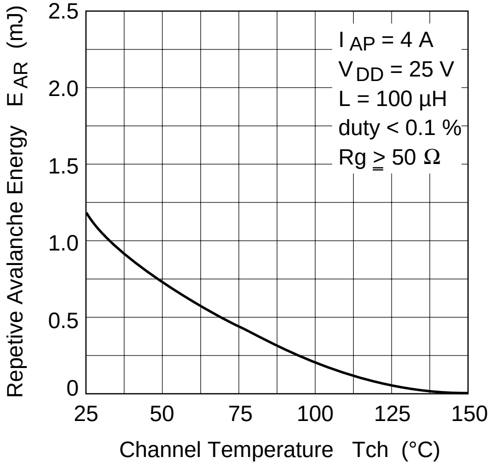
Switching Characteristics



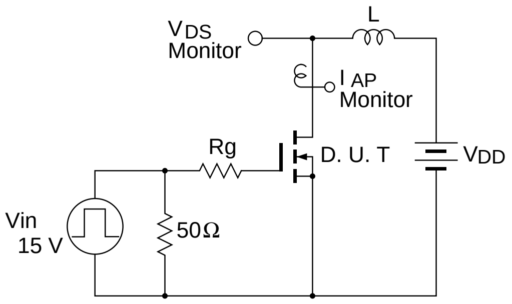
Reverse Drain Current vs.
Souece to Drain Voltage



Maximun Avalanche Energy vs.
Channel Temperature Derating

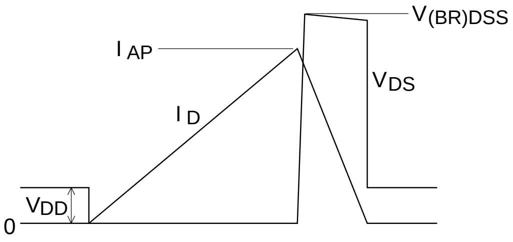


Avalanche Test Circuit

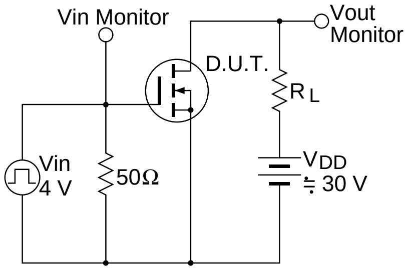


Avalanche Waveform

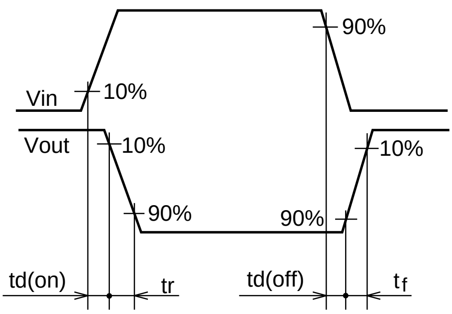
$$E_{AR} = \frac{1}{2} \bullet L \bullet I_{AP}{}^2 \bullet \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$

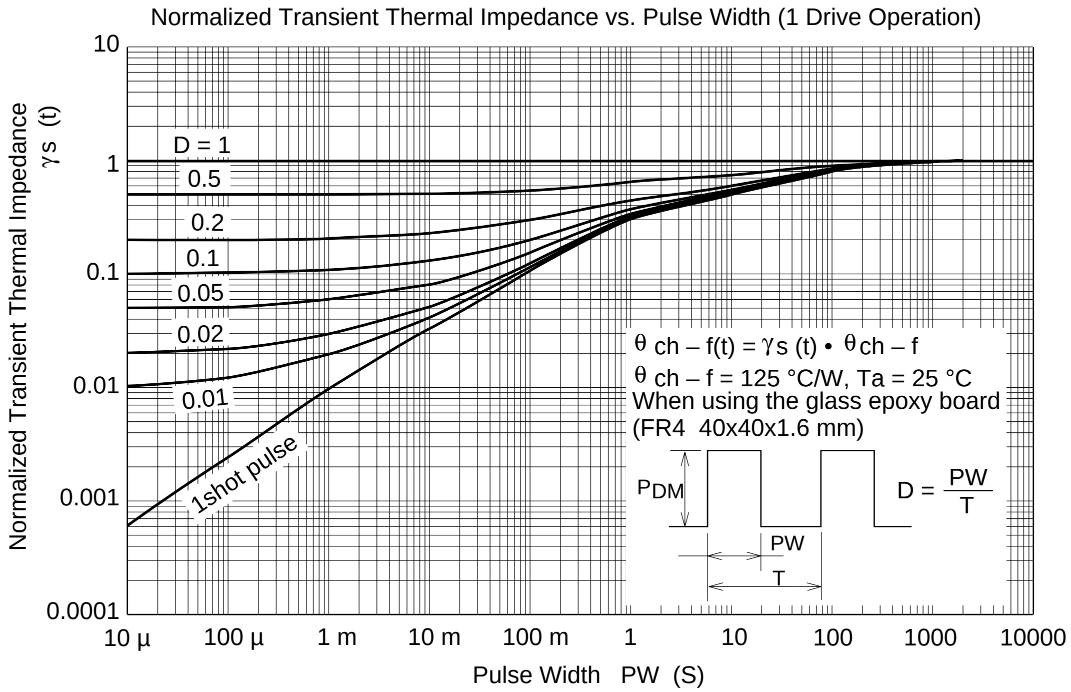


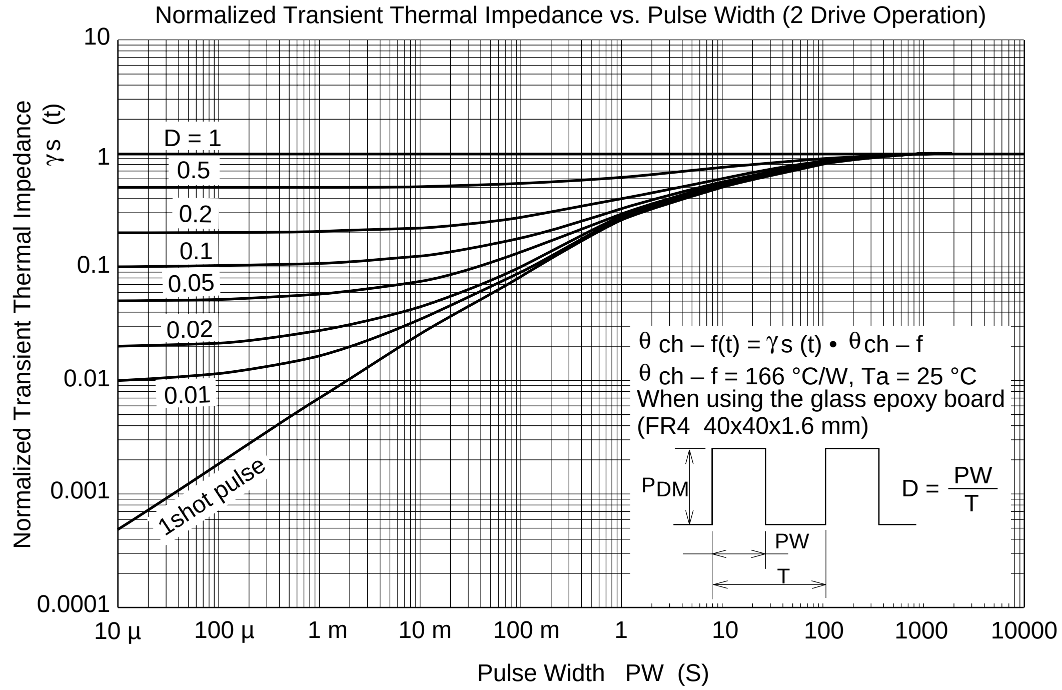
Switching Time Test Circuit



Switching Time Waveform

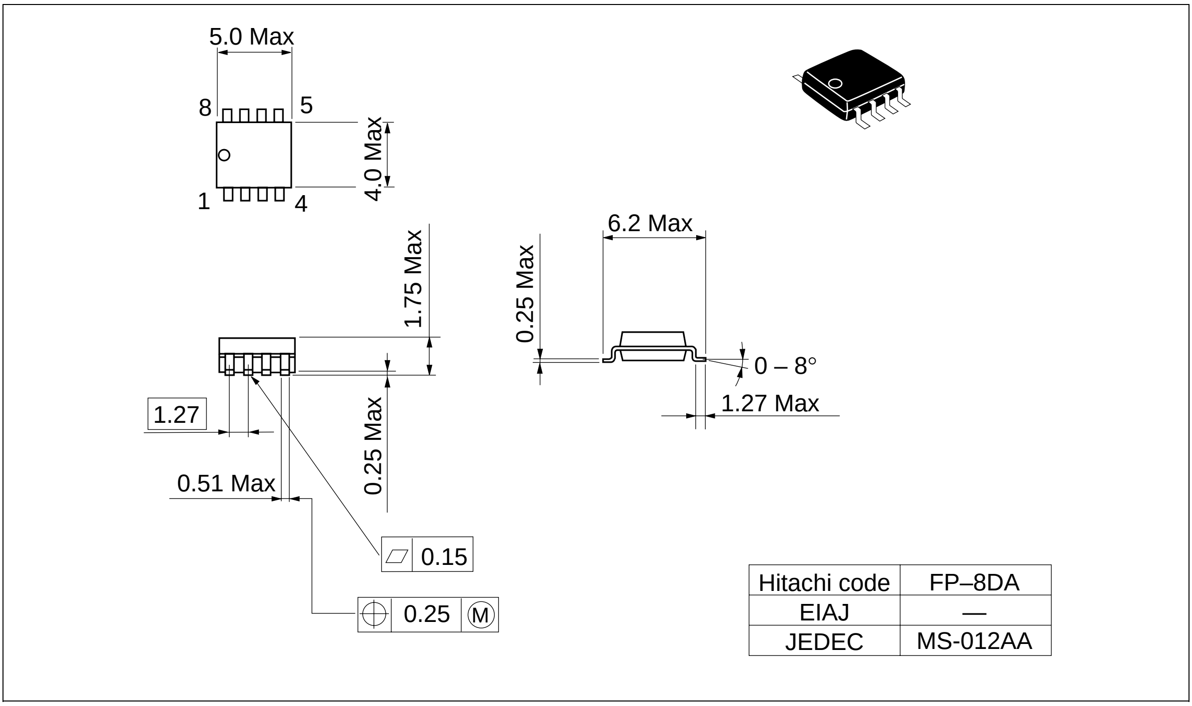



Normalized Transient Thermal Impedance vs. Pulse Width (1 Drive Operation)
Normalized Transient Thermal Impedance γs (t)
10
1
0.1
0.01
0.001
0.0001
D = 1
0.5
0.2
0.1
0.05
0.02
0.01
1shot pulse
θ ch – f(t) = γs (t) • θch – f
θ ch – f = 125 °C/W, Ta = 25 °C
When using the glass epoxy board
(FR4 40x40x1.6 mm)
PDM
D = PW/T
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
θ ch – f(t) = γs (t) • θch – f
θ ch – f = 166 °C/W, Ta = 25 °C
When using the glass epoxy board
(FR4 40x40x1.6 mm)
PDM
D = PW/T
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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