HAT2039R

Silicon N Channel Power MOS FET
High Speed Power Switching

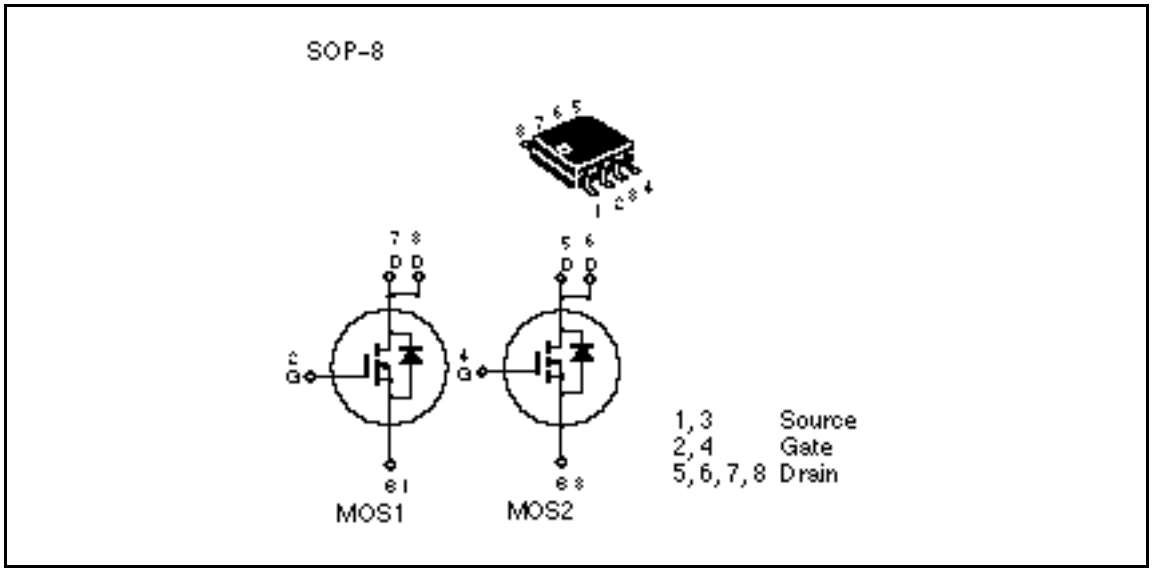
HITACHI

ADE-208-667C (Z)
4th. Edition
February 1999

Features

- Low on-resistance
- Capable of 2.5 V gate drive
- Low drive current
- High density mounting

Outline



Hitachi semiconductor

Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DSS}	30	V
Gate to source voltage	V_{GSS}	±12	V
Drain current	I_D	8.0	A
Drain peak current	$I_{D(pulse)}$ Note1	64	A
Body-drain diode reverse drain current	I_{DR}	8.0	A
Channel dissipation	Pch Note2	2.0	W
Channel dissipation	Pch Note3	3.0	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

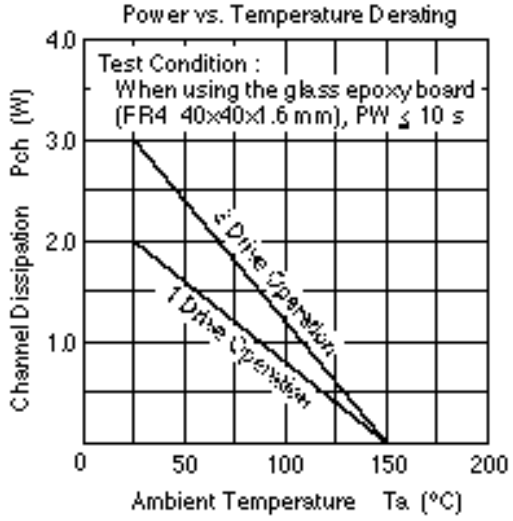
Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	30	—	—	V	I_D = 10mA, V_{GS} = 0
Gate to source leak current	I_{GSS}	—	—	±0.1	µA	V_{GS} = ±12V, V_{DS} = 0
Zero gate voltege drain current	I_{DSS}	—	—	1	µA	V_{DS} = 30 V, V_{GS} = 0
Gate to source cutoff voltage	$V_{GS(off)}$	0.4	—	1.4	V	V_{DS} = 10V, I_D = 1mA
Static drain to source on state resistance	$R_{DS(on)}$	—	0.017	0.022	Ω	I_D = 4A, V_{GS} = 4V Note4
	$R_{DS(on)}$	—	0.022	0.032	Ω	I_D = 4A, V_{GS} = 2.5V Note4
Forward transfer admittance	$\|y_{fs}\|$	13	20	—	S	I_D = 4A, V_{DS} = 10V Note4
Input capacitance	Ciss	—	1420	—	pF	V_{DS} = 10V
Output capacitance	Coss	—	410	—	pF	V_{GS} = 0
Reverse transfer capacitance	Crss	—	260	—	pF	f = 1MHz
Total gate charge	Qg	—	20	—	nc	V_{DD} = 10V
Gate to source charge	Qgs	—	12	—	nc	V_{GS} = 4V
Gate to drain charge	Qgd	—	8	—	nc	I_D = 8A
Turn-on delay time	$t_{d(on)}$	—	23	—	ns	V_{GS} = 4V, I_D = 4A
Rise time	t_r	—	165	—	ns	V_{DD} ≈ 10V
Turn-off delay time	$t_{d(off)}$	—	215	—	ns	
Fall time	t_f	—	185	—	ns	
Body–drain diode forward voltage	V_{DF}	—	0.85	1.1	V	IF =8.0A, V_{GS} = 0 Note4
Body–drain diode reverse recovery time	t_{rr}	—	30	—	ns	IF = 8.0A, V_{GS} = 0 diF/ dt =20A/µs

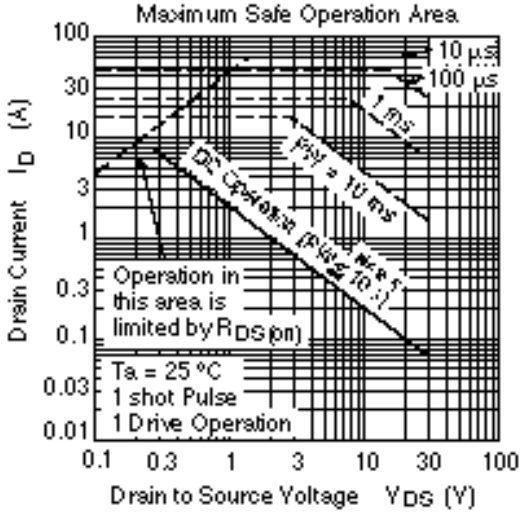
Note: 4. Pulse test

Main Characteristics

Power vs. Temperature Derating

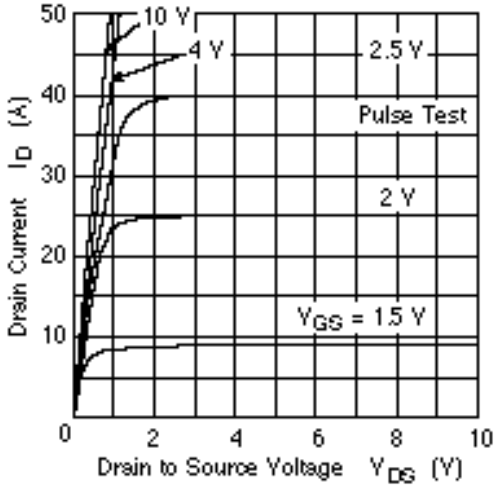


Maximum Safe Operation Area

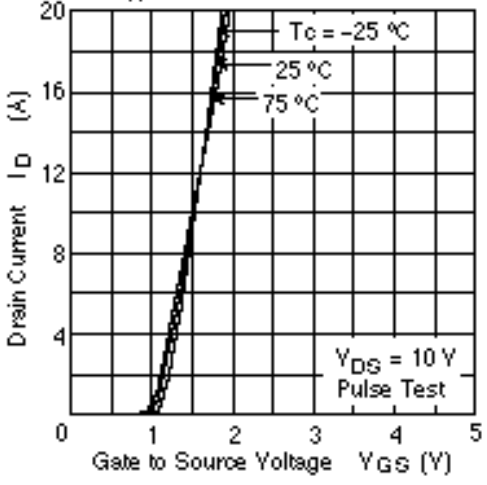


Note 5 :
When using the glass epoxy board
(FR4 40×40×1.6 mm)

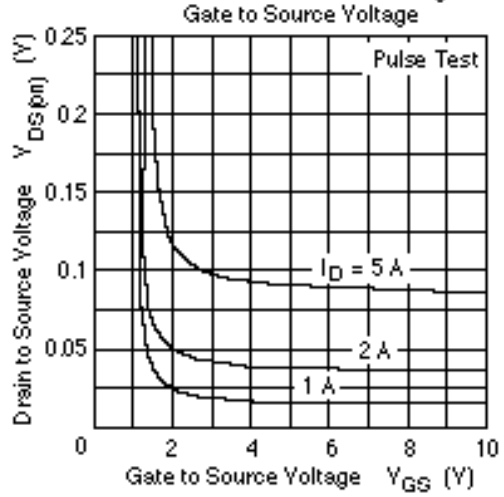
Typical Output Characteristics



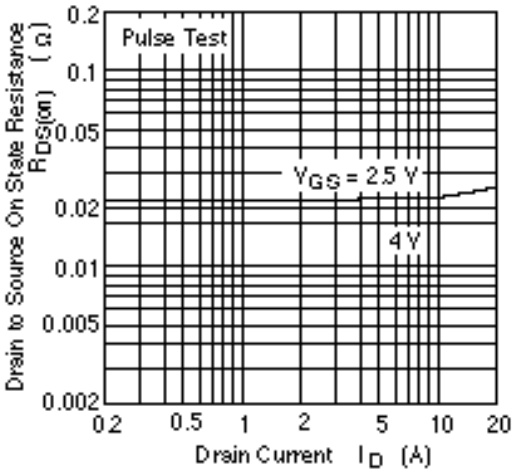
Typical Transfer Characteristics



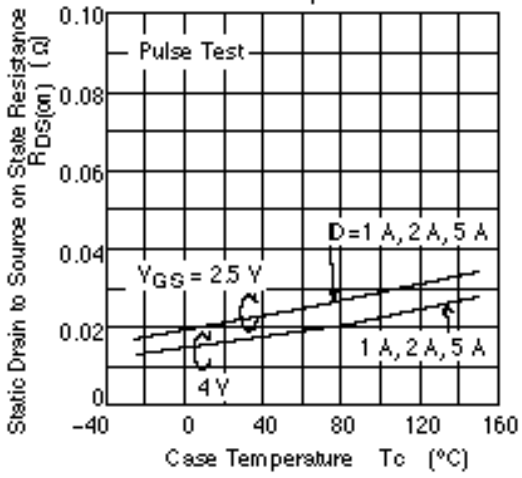
Drain to Source Saturation Voltage vs. Gate to Source Voltage



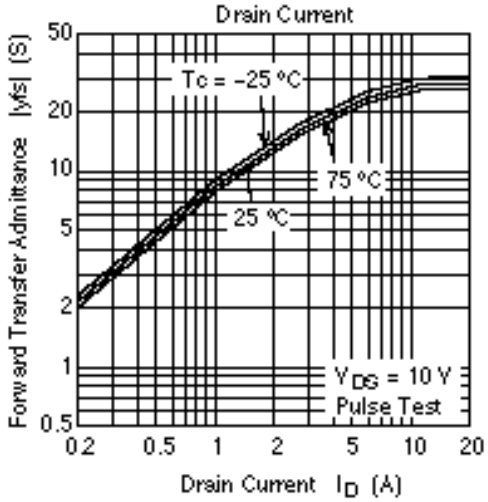
Static Drain to Source on State Resistance vs. Drain Current

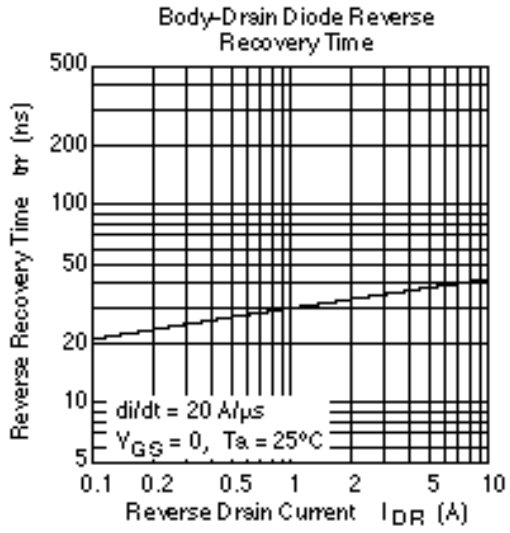


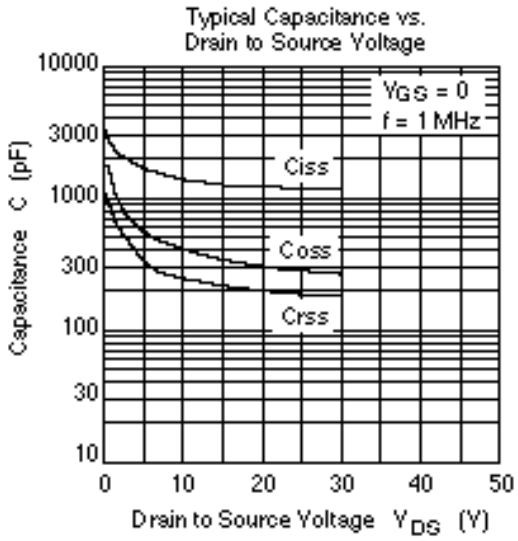
Static Drain to Source on State Resistance vs. Temperature

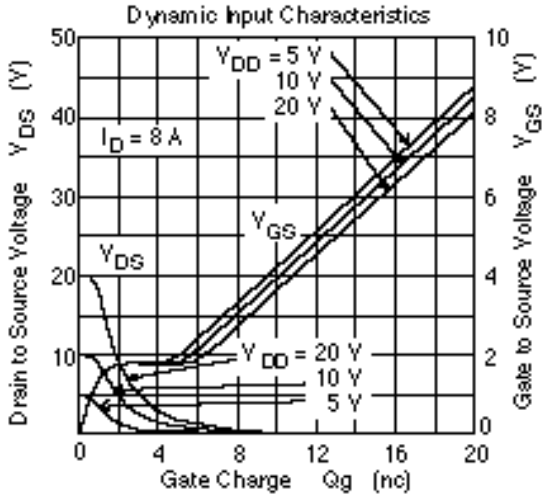


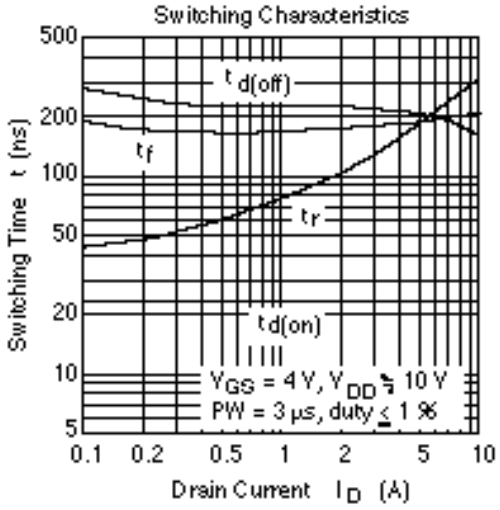
Forward Transfer Admittance vs. Drain Current



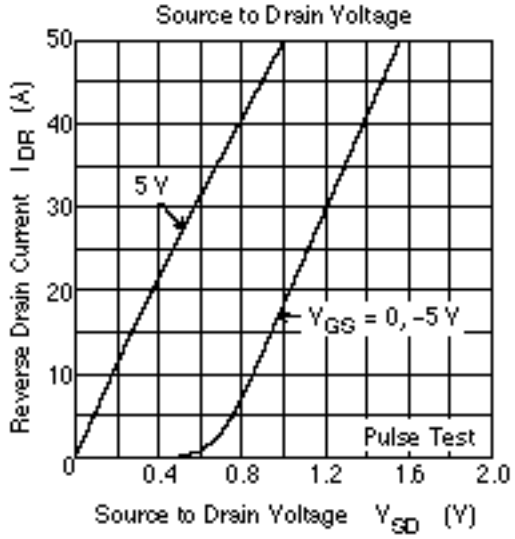

Body-Drain Diode Reverse Recovery Time
Reverse Recovery Time trr (ns)
500
200
100
50
20
10
5
di/dt = 20 A/µs
VGS = 0, Ta = 25°C
0.1 0.2 0.5 1 2 5 10
Reverse Drain Current IDR (A)


Typical Capacitance vs. Drain to Source Voltage
Capacitance C (pF)
10000
3000
1000
300
100
30
10
VGS = 0
f = 1 MHz
Ciss
Coss
Crss
0 10 20 30 40 50
Drain to Source Voltage VDS (V)

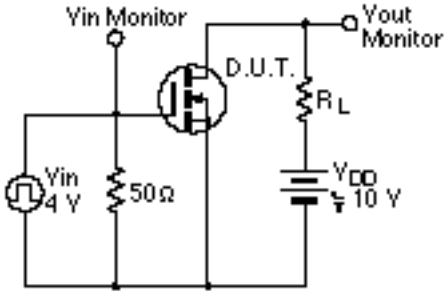

Dynamic Input Characteristics
Drain to Source Voltage VDS (V)
Gate to Source Voltage VGS (V)
VDD = 5 V
10 V
20 V
ID = 8 A
VGS
VDS
VDD = 20 V
10 V
5 V
0 4 8 12 16 20
Gate Charge Qg (nc)


Switching Characteristics
Switching Time t (ns)
500
200
100
50
20
10
5
td(off)
tf
tr
td(on)
VGS = 4 V, VDD = 10 V
PW = 3 µs, duty ≤ 1 %
0.1 0.2 0.5 1 2 5 10
Drain Current ID (A)

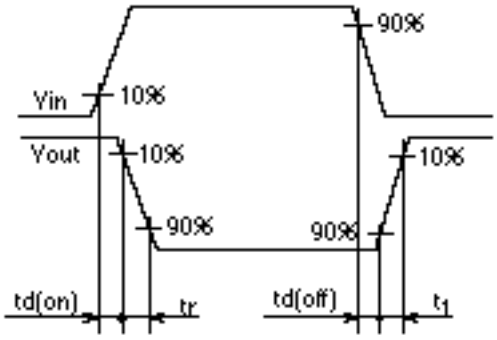
Reverse Drain Current vs.
Source to Drain Voltage

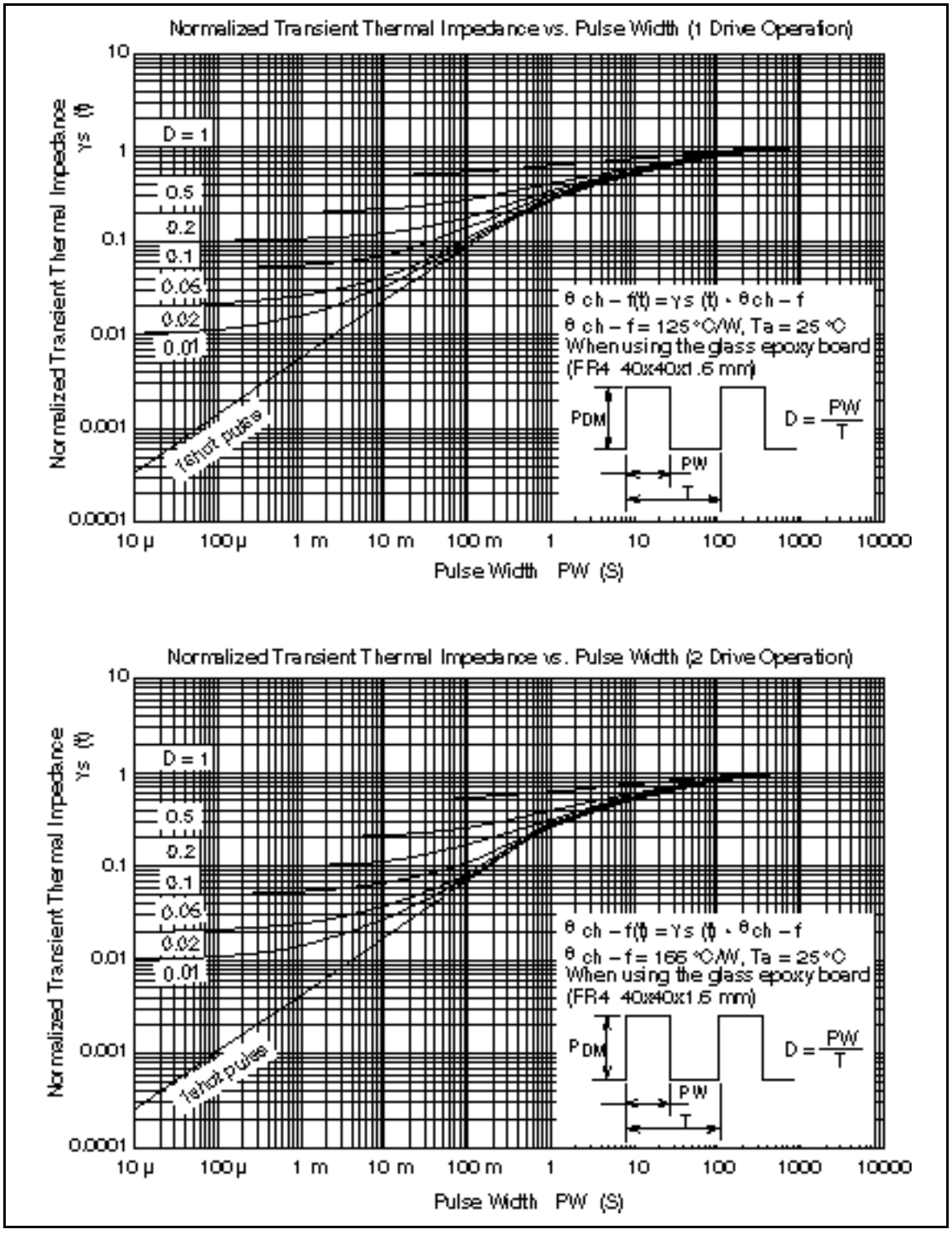


Switching Time Test Circuit



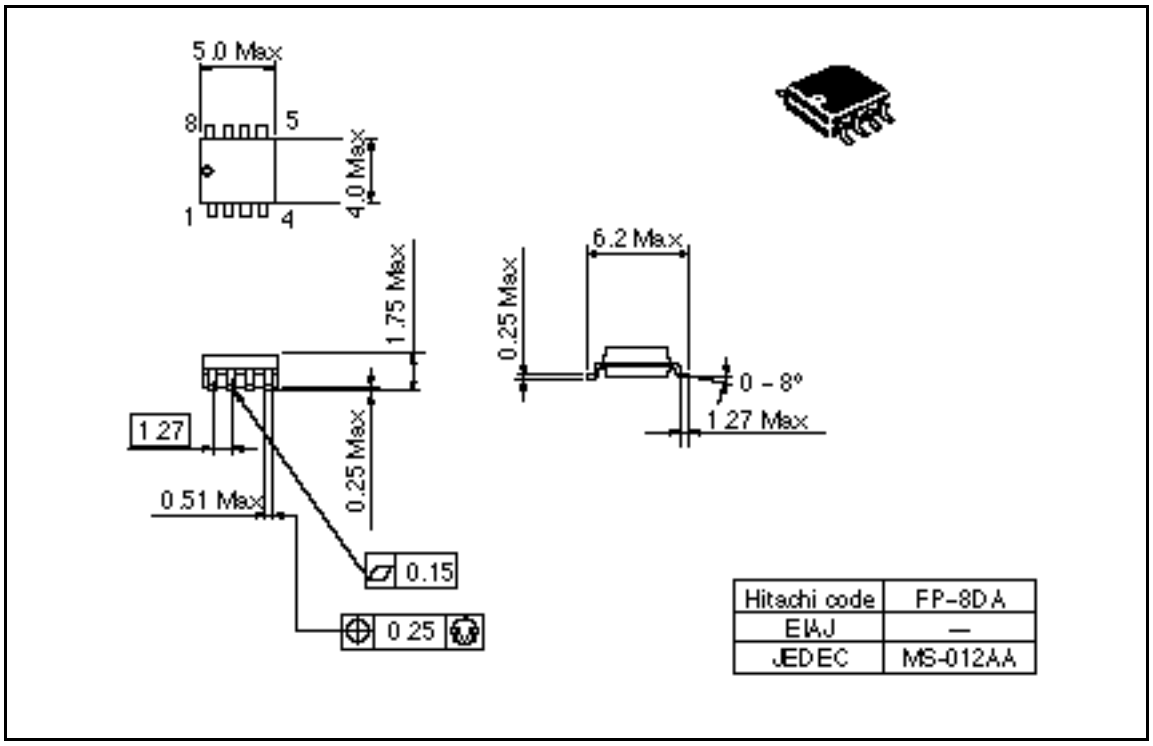
Switching Time Waveform




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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