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

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Renesas Technology Corp.

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2SK3233

Silicon N Channel MOS FET
High Speed Power Switching

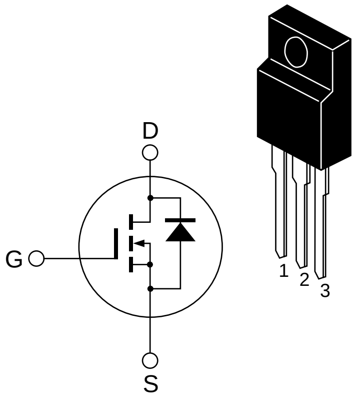
ADE-208-1369 (Z)
1st. Edition
Mar. 2001

Features

- Low on-resistance: $R_{DS(on)} = 1.1\ \Omega$ typ.
- Low leakage current: IDSS = 1 µA max (at VDS = 500 V)
- High speed switching: tf = 15 ns typ (at VGS = 10 V, VDD = 250 V, ID = 2.5 A)
- Low gate charge: Qg = 15 nC typ (at VDD = 400 V, VGS = 10 V, ID = 5 A)
- Avalanche ratings

Outline

TO–220CFM



1. Gate
2. Drain
3. Source

Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DSS}	500	V
Gate to source voltage	V_{GSS}	±30	V
Drain current	I_D	5	A
Drain peak current	$I_{D\ (pulse)}$ Note1	20	A
Body-drain diode reverse drain current	I_{DR}	5	A
Body-drain diode reverse drain peak current	$I_{DR\ (pulse)}$ Note1	20	A
Avalanche current	I_{AP} Note3	5	A
Channel dissipation	Pch Note2	30	W
Channel to case Tehrmal Impedance	θ ch-c	4.17	°C/W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

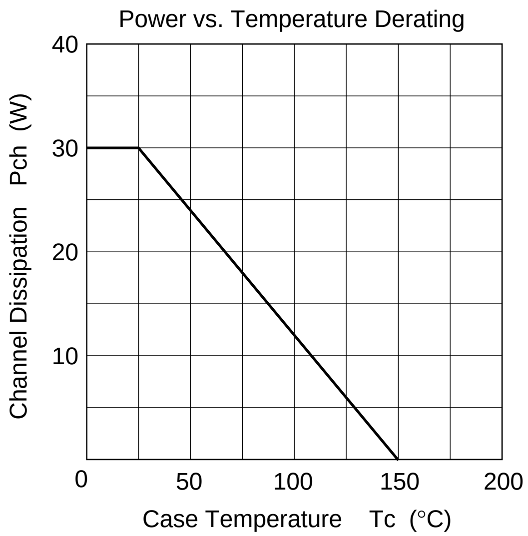
Notes: 1. PW ≤ 10 μs, duty cycle ≤ 1%
2. Value at Tc = 25°C
3. Tch ≤ 150°C

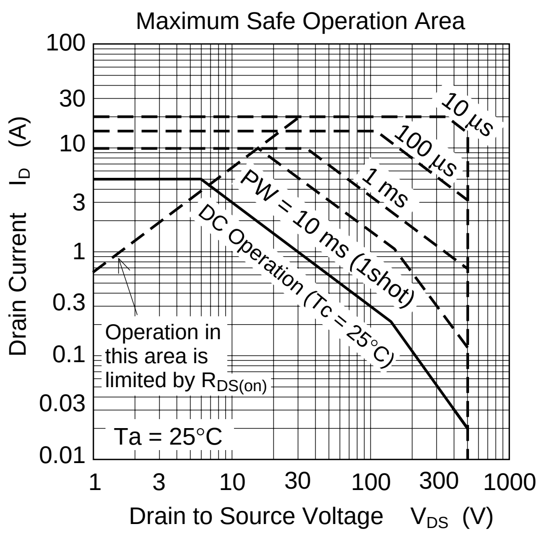
Electrical Characteristics (Ta = 25°C)

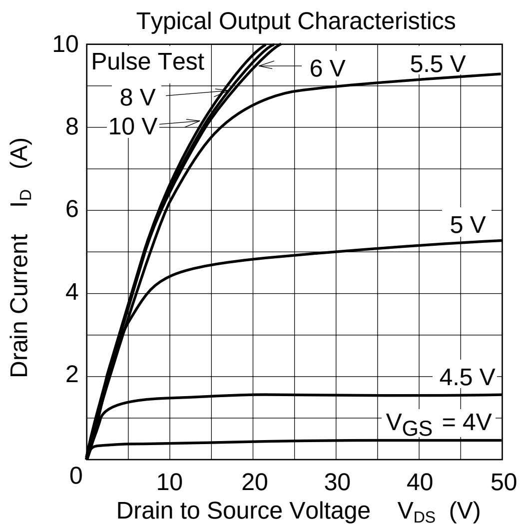
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	500	—	—	V	I_D = 10 mA, V_{GS} = 0
Gate to source leak current	I_{GSS}	—	—	±0.1	µA	V_{GS} = ±30 V, V_{DS} = 0
Zero gate voltage drain current	I_{DSS}	—	—	1	µA	V_{DS} = 500 V, V_{GS} = 0
Gate to source cutoff voltage	$V_{GS(off)}$	3.0	—	4.0	V	V_{DS} = 10 V, I_D = 1 mA
Static drain to source on state resistance	$R_{DS(on)}$	—	1.1	1.5	Ω	I_D = 2.5 A, V_{GS} = 10 V Note4
Forward transfer admittance	$\|y_{fs}\|$	3.0	4.5	—	S	I_D = 2.5 A, V_{DS} = 10 V Note4
Input capacitance	Ciss	—	580	—	pF	V_{DS} = 25 V
Output capacitance	Coss	—	70	—	pF	V_{GS} = 0
Reverse transfer capacitance	Crss	—	13	—	pF	f = 1 MHz
Turn-on delay time	td(on)	—	20	—	ns	I_D = 2.5 A
Rise time	tr	—	15	—	ns	V_{GS} = 10 V
Turn-off delay time	td(off)	—	65	—	ns	R_L = 100 Ω
Fall time	tf	—	15	—	ns	Rg = 10 Ω
Total gate charge	Qg	—	15	—	nC	V_{DD} = 400 V
Gate to source charge	Qgs	—	3	—	nC	V_{GS} = 10 V
Gate to drain charge	Qgd	—	8	—	nC	I_D = 5 A
Body-drain diode forward voltage	V_{DF}	—	0.85	1.3	V	I_F = 5 A, V_{GS} = 0
Body-drain diode reverse recovery time	trr	—	400	—	ns	I_F = 5 A, V_{GS} = 0
Body-drain diode reverse recovery charge	Qrr	—	1.5	—	µC	diF/dt = 100 A/µs

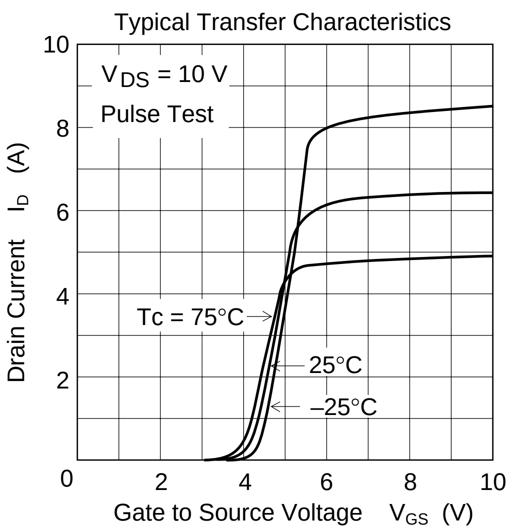
Note: 4. Pulse test

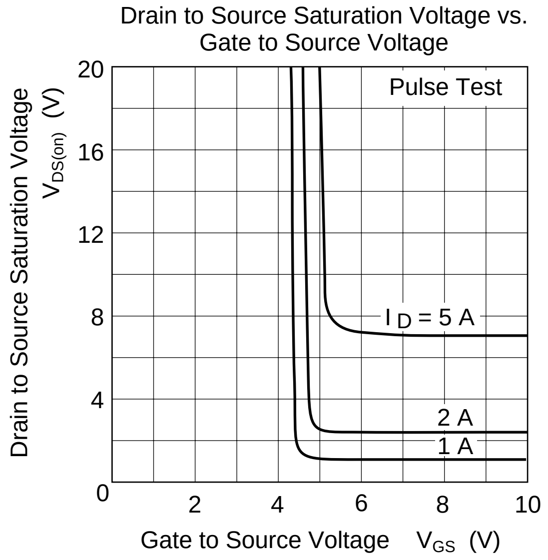
Main Characteristics

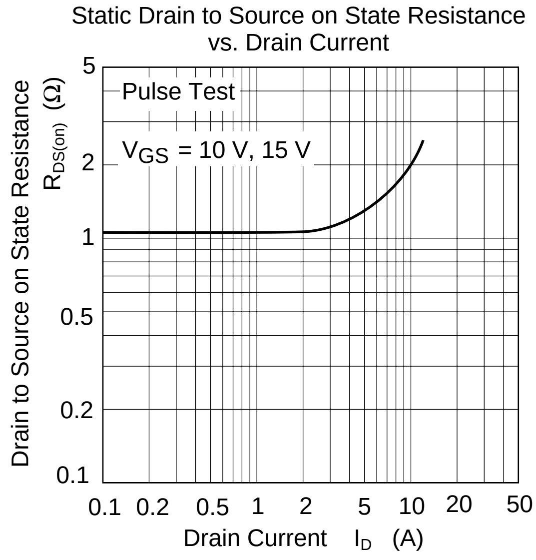


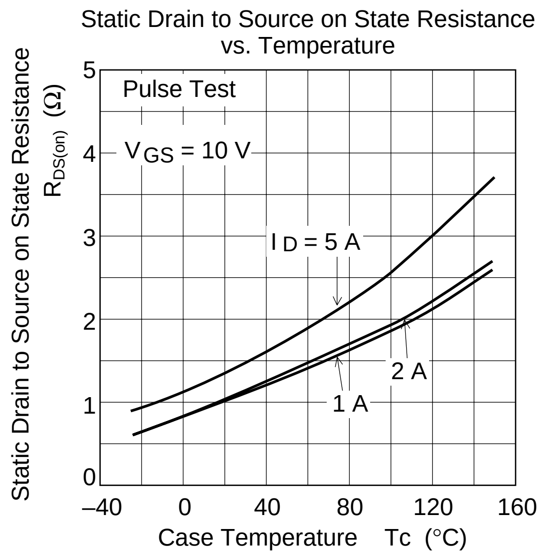


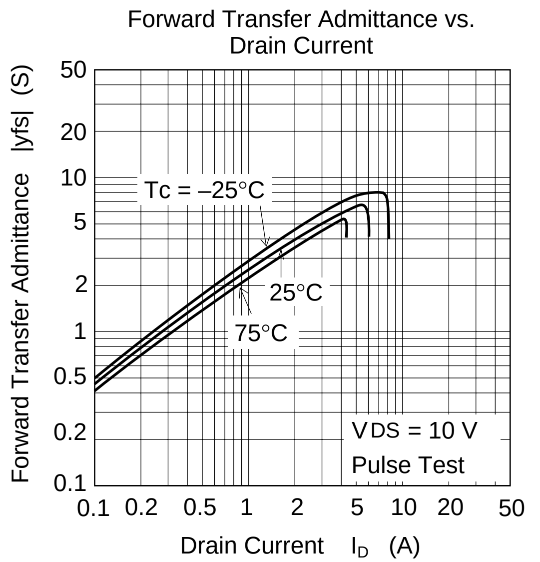





Drain to Source Saturation Voltage vs.
Gate to Source Voltage
Pulse Test
I D = 5 A
2 A
1 A
Drain to Source Saturation Voltage
VDS(on) (V)
20
16
12
8
4
0
2
4
6
8
10
Gate to Source Voltage VGS (V)


Static Drain to Source on State Resistance
vs. Drain Current
Pulse Test
VGS = 10 V, 15 V
Drain to Source on State Resistance
RDS(on) (Ω)
5
2
1
0.5
0.2
0.1
0.1
0.2
0.5
1
2
5
10
20
50
Drain Current ID (A)


Static Drain to Source on State Resistance
vs. Temperature
Pulse Test
VGS = 10 V
I D = 5 A
2 A
1 A
Static Drain to Source on State Resistance
RDS(on) (Ω)
5
4
3
2
1
0
–40
0
40
80
120
160
Case Temperature Tc (°C)


Forward Transfer Admittance vs.
Drain Current
Tc = –25°C
25°C
75°C
VDS = 10 V
Pulse Test
Forward Transfer Admittance |yfs| (S)
50
20
10
5
2
1
0.5
0.2
0.1
0.1
0.2
0.5
1
2
5
10
20
50
Drain Current ID (A)

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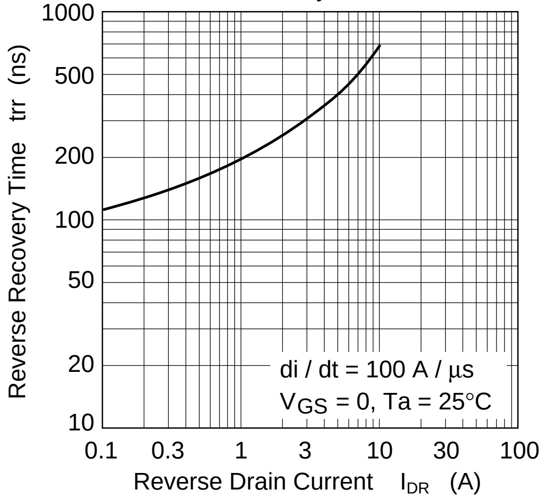
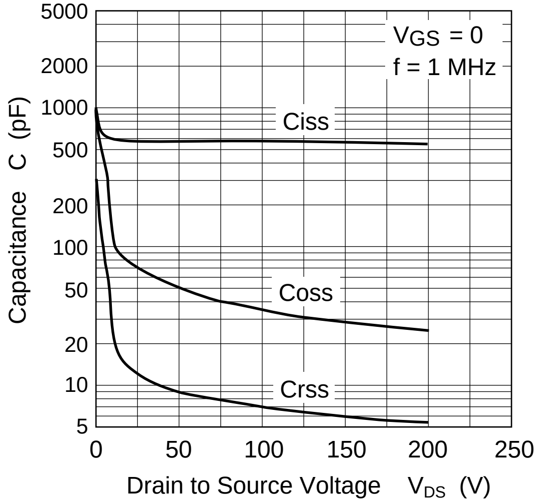
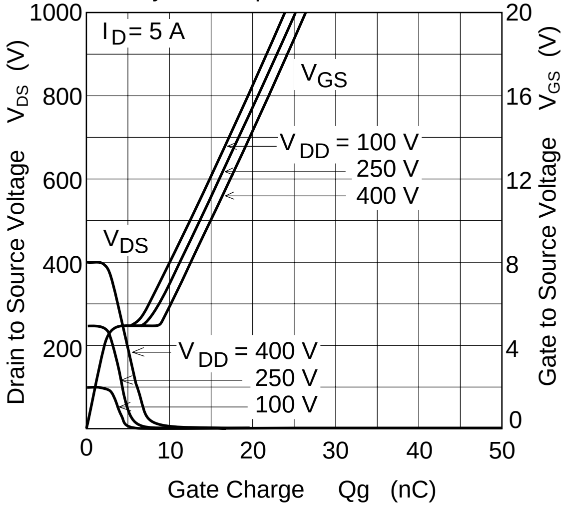
Body-Drain Diode Reverse Recovery Time



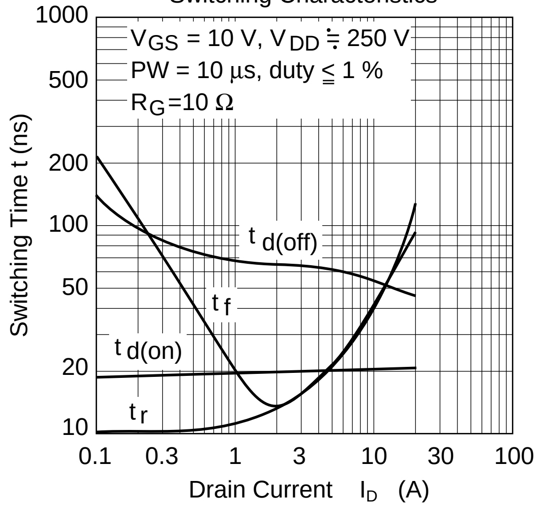
Typical Capacitance vs. Drain to Source Voltage



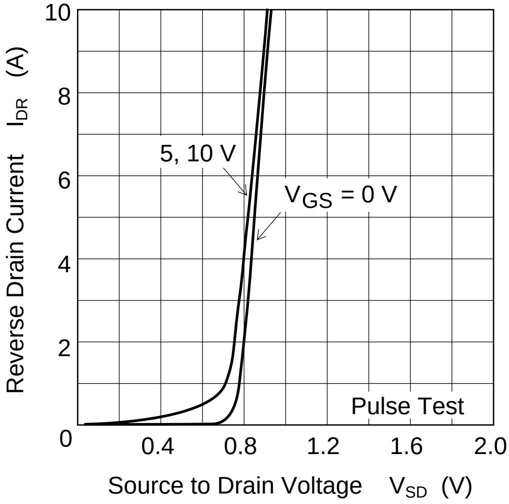
Dynamic Input Characteristics



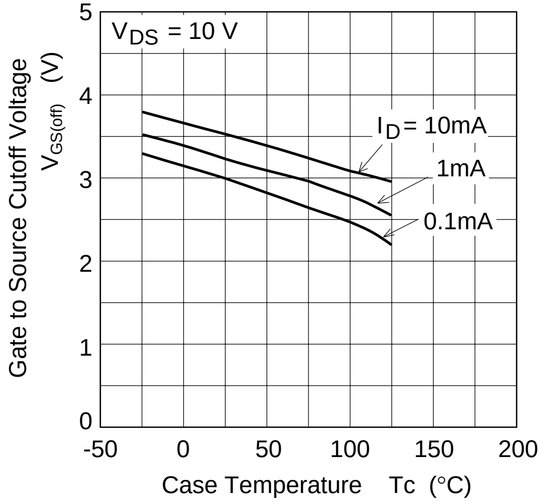
Switching Characteristics



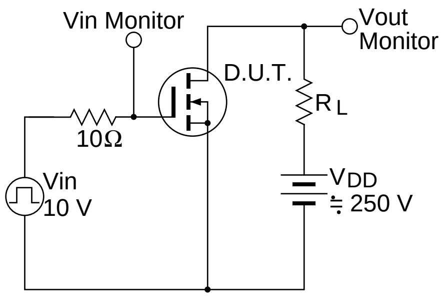
Reverse Drain Current vs.
Source to Drain Voltage



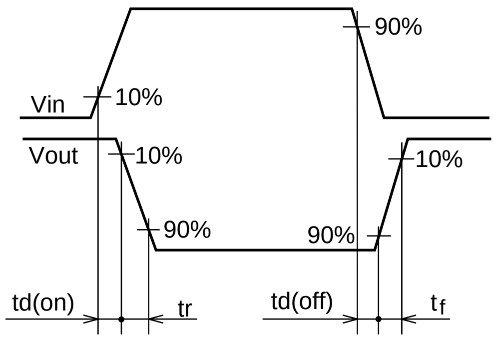
Gate to Source Cutoff Voltage
vs. Case Temperature

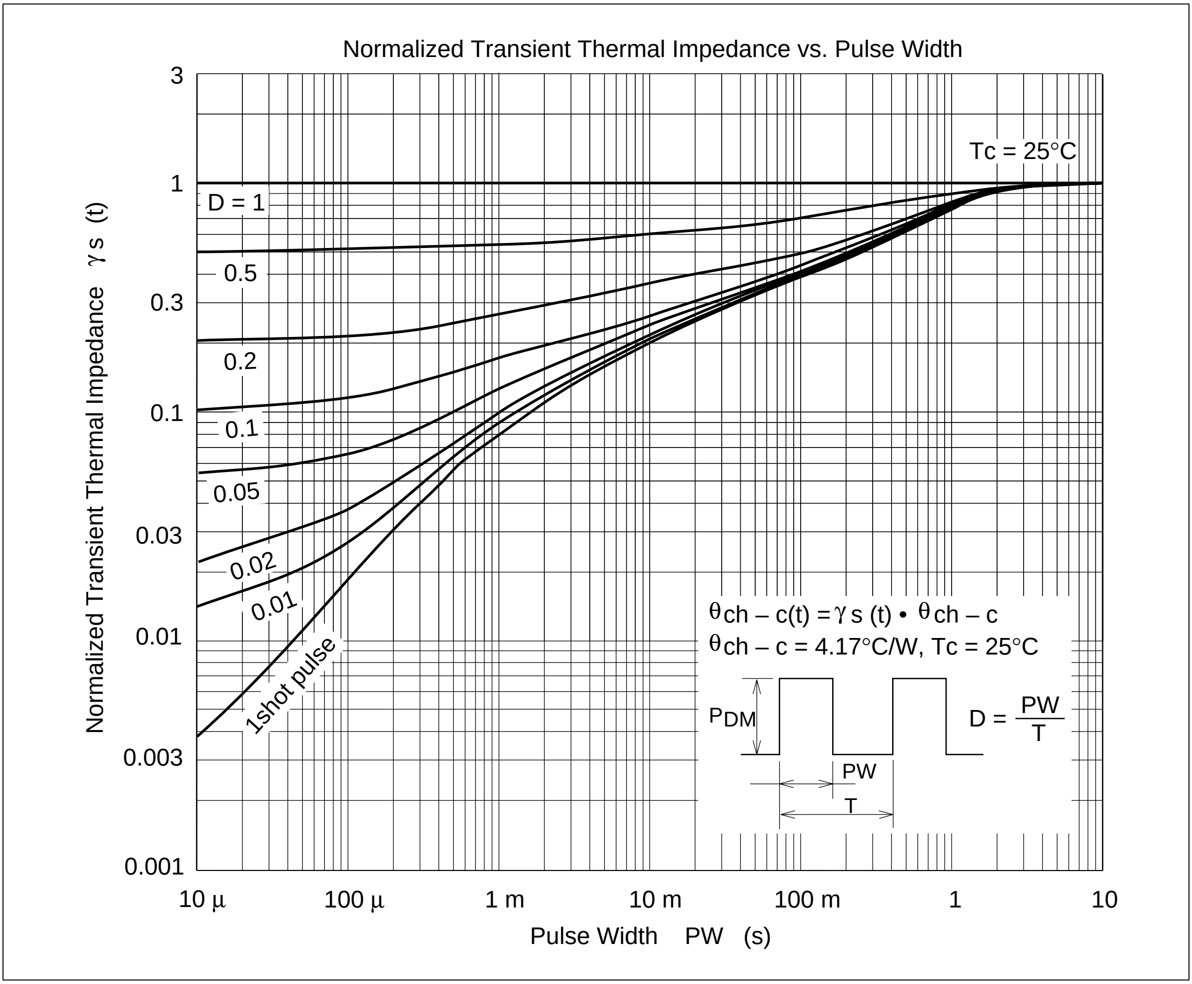


Switching Time Test Circuit



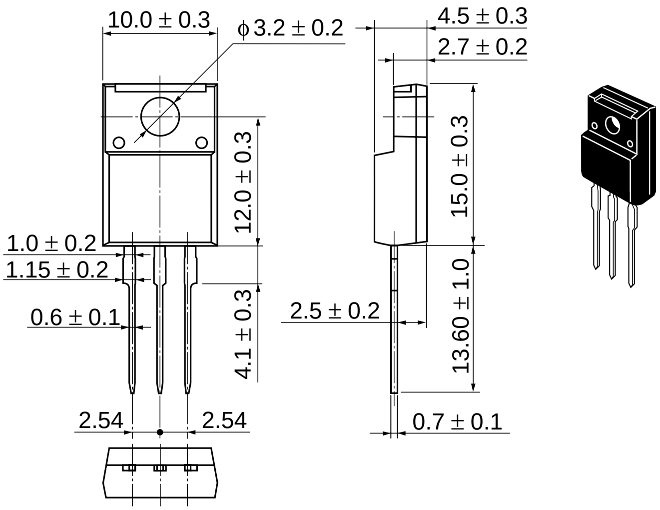
Waveform




Normalized Transient Thermal Impedance vs. Pulse Width
3
1
0.3
0.1
0.03
0.01
0.003
0.001
Normalized Transient Thermal Impedance γs (t)
Tc = 25°C
D = 1
0.5
0.2
0.1
0.05
0.02
0.01
1shot pulse
θch – c(t) = γs (t) • θch – c
θch – c = 4.17°C/W, Tc = 25°C
PDM
D = PW/T
PW
T
10 µ
100 µ
1 m
10 m
100 m
1
10
Pulse Width PW (s)

Package Dimensions

As of January, 2001
Unit: mm



Hitachi Code	TO-220CFM
JEDEC	—
EIAJ	—
Mass (reference value)	1.9 g

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