

To all our customers

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

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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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# H5N5006FM

Silicon N Channel MOS FET  
High Speed Power Switching

**RENESAS**

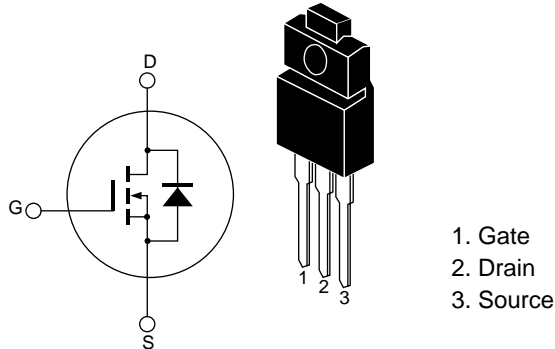
ADE-208-1112 (Z)  
1st. Edition  
Mar. 2001

## Features

- Low on-resistance:  $R_{DS(on)} = 2.5 \Omega$  typ.
- Low leakage current:  $IDSS = 1 \mu A$  max (at  $V_{DS} = 500 V$ )
- High speed switching:  $t_f = 15 ns$  typ (at  $V_{GS} = 10 V$ ,  $V_{DD} = 250 V$ ,  $I_D = 1.5 A$ )
- Low gate charge:  $Q_g = 14 nC$  typ (at  $V_{DD} = 400 V$ ,  $V_{GS} = 10 V$ ,  $I_D = 3 A$ )
- Avalanche ratings

## Outline

TO-220FM



## 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	$I_D$	3	A
Drain peak current	$I_{D (pulse)}$ <sup>Note1</sup>	12	A
Body-drain diode reverse drain current	$I_{DR}$	3	A
Body-drain diode reverse drain peak current	$I_{DR (pulse)}$ <sup>Note1</sup>	12	A
Avalanche current	$I_{AP}$ <sup>Note3</sup>	3	A
Channel dissipation	$P_{ch}$ <sup>Note2</sup>	25	W
Channel to case Thermal Impedance	$\theta_{ch-c}$	5.0	°C/W
Channel temperature	$T_{ch}$	150	°C
Storage temperature	$T_{stg}$	-55 to +150	°C

Notes: 1.  $PW \leq 10 \mu s$ , duty cycle  $\leq 1\%$

2. Value at  $T_c = 25^\circ C$

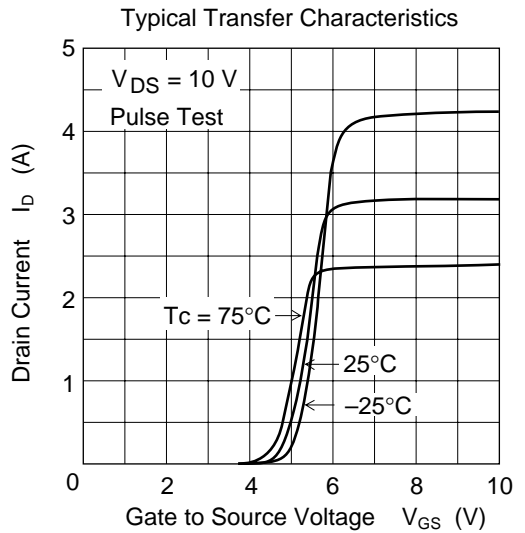
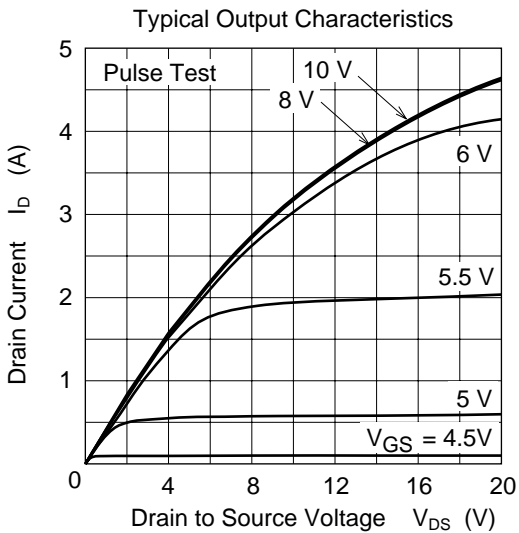
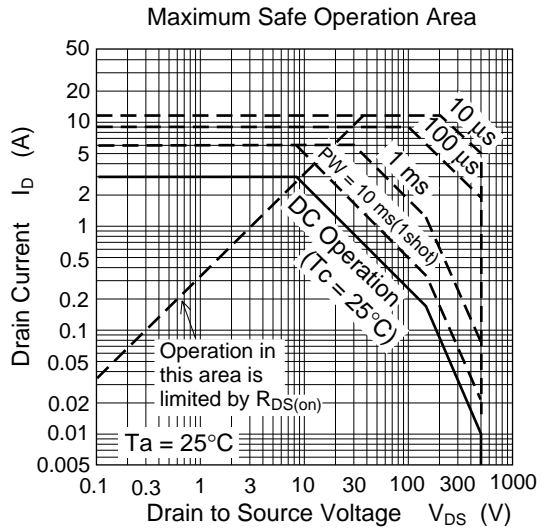
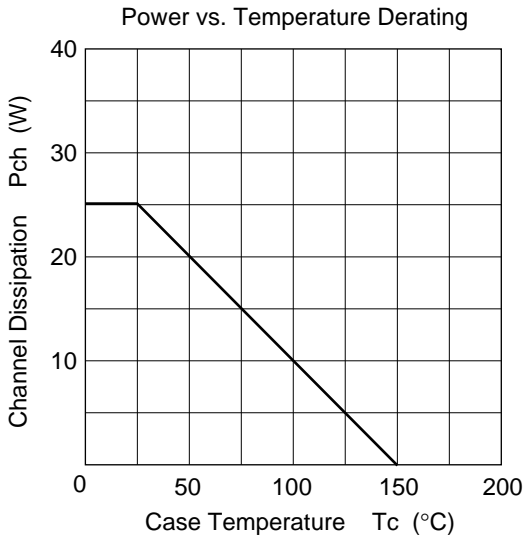
3.  $T_{ch} \leq 150^\circ C$

## Electrical Characteristics (Ta = 25°C)

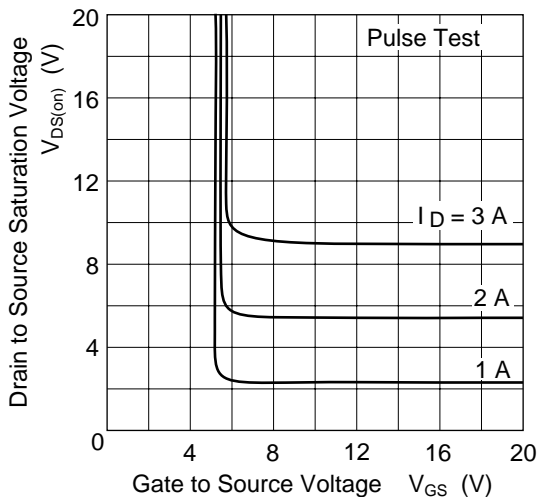
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	500	—	—	V	$I_D = 10 \text{ mA}$ , $V_{GS} = 0$
Gate to source leak current	$I_{GSS}$	—	—	$\pm 0.1$	$\mu\text{A}$	$V_{GS} = \pm 30 \text{ V}$ , $V_{DS} = 0$
Zero gate voltage drain current	$I_{DSS}$	—	—	1	$\mu\text{A}$	$V_{DS} = 500 \text{ V}$ , $V_{GS} = 0$
Gate to source cutoff voltage	$V_{GS(off)}$	3.0	—	4.5	V	$V_{DS} = 10 \text{ V}$ , $I_D = 1 \text{ mA}$
Static drain to source on state resistance	$R_{DS(on)}$	—	2.5	3.0	$\Omega$	$I_D = 1.5 \text{ A}$ , $V_{GS} = 10 \text{ V}$ <sup>Note4</sup>
Forward transfer admittance	$ y_{fs} $	1.5	2.5	—	S	$I_D = 1.5 \text{ A}$ , $V_{DS} = 10 \text{ V}$ <sup>Note4</sup>
Input capacitance	$C_{iss}$	—	365	—	pF	$V_{DS} = 25 \text{ V}$
Output capacitance	$C_{oss}$	—	35	—	pF	$V_{GS} = 0$
Reverse transfer capacitance	$C_{rss}$	—	8	—	pF	$f = 1 \text{ MHz}$
Turn-on delay time	$t_{d(on)}$	—	20	—	ns	$I_D = 1.5 \text{ A}$
Rise time	$t_r$	—	12	—	ns	$V_{GS} = 10 \text{ V}$
Turn-off delay time	$t_{d(off)}$	—	48	—	ns	$R_L = 167 \Omega$
Fall time	$t_f$	—	15	—	ns	$R_g = 10 \Omega$
Total gate charge	$Q_g$	—	14	—	nC	$V_{DD} = 400 \text{ V}$
Gate to source charge	$Q_{gs}$	—	2	—	nC	$V_{GS} = 10 \text{ V}$
Gate to drain charge	$Q_{gd}$	—	8	—	nC	$I_D = 3 \text{ A}$
Body-drain diode forward voltage	$V_{DF}$	—	0.85	1.3	V	$I_F = 3 \text{ A}$ , $V_{GS} = 0$
Body-drain diode reverse recovery time	$t_{rr}$	—	270	—	ns	$I_F = 3 \text{ A}$ , $V_{GS} = 0$
Body-drain diode reverse recovery charge	$Q_{rr}$	—	0.8	—	$\mu\text{C}$	$diF/dt = 100 \text{ A}/\mu\text{s}$

Note: 4. Pulse test

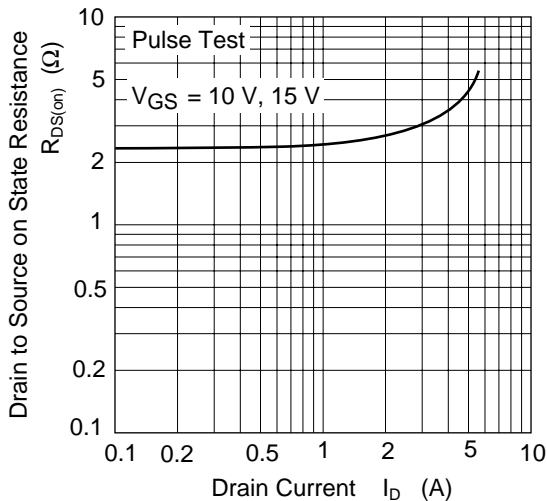
## Main Characteristics



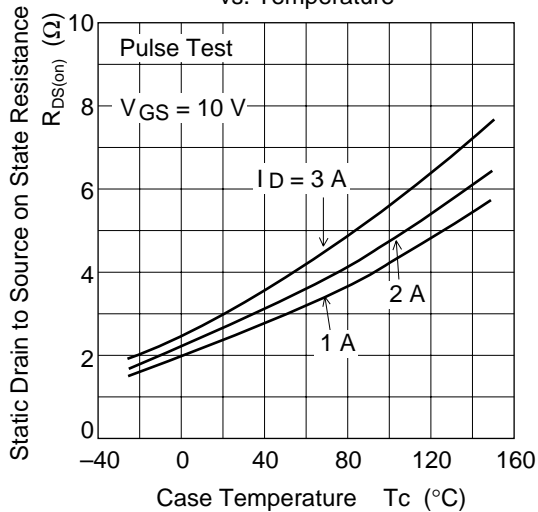
Drain to Source Saturation Voltage vs. Gate to Source Voltage



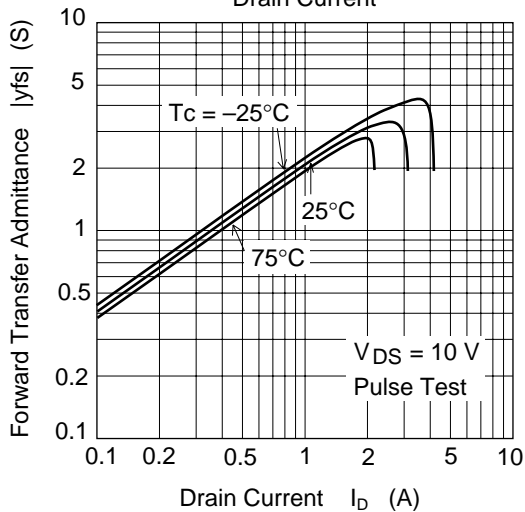
Static Drain to Source on State Resistance vs. Drain Current



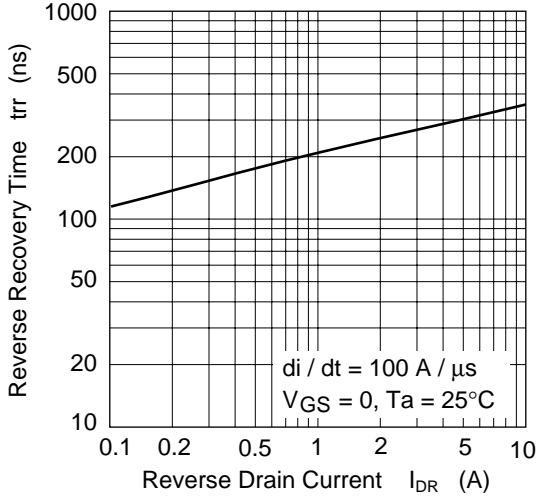
Static Drain to Source on State Resistance vs. Temperature



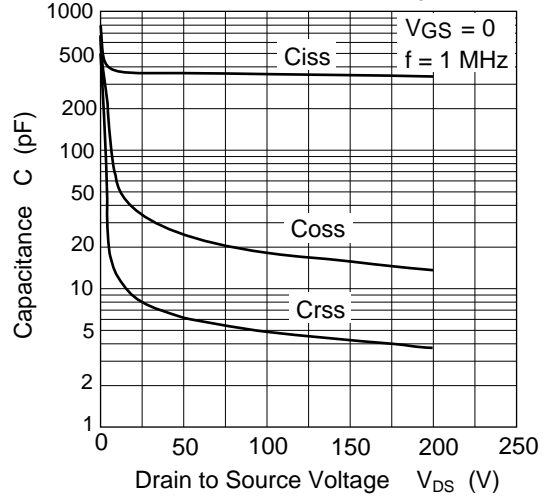
Forward Transfer Admittance vs. Drain Current



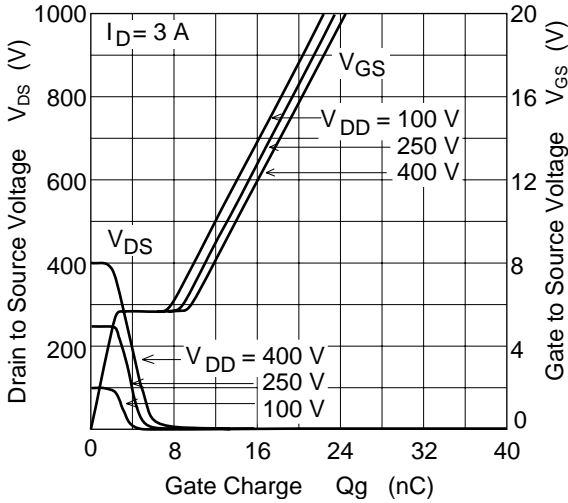
Body-Drain Diode Reverse Recovery Time



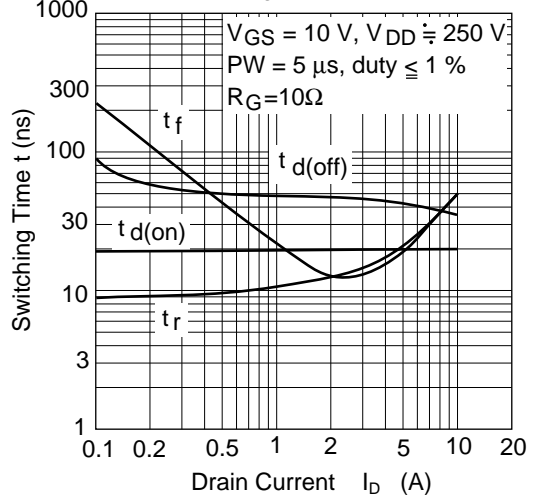
Typical Capacitance vs. Drain to Source Voltage



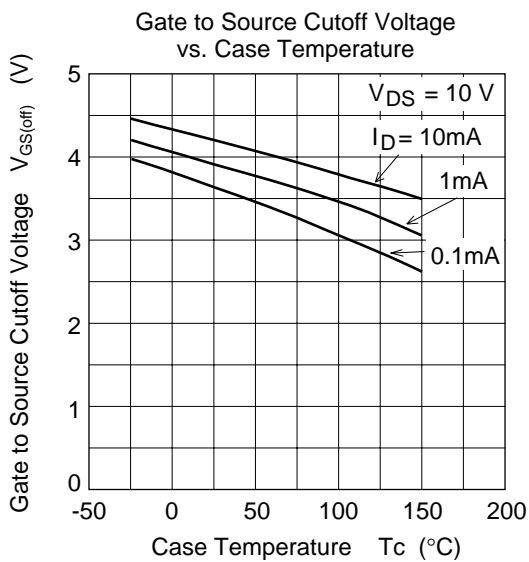
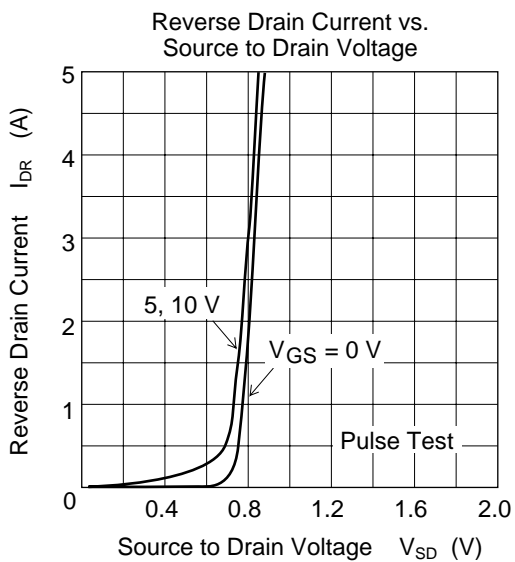
Dynamic Input Characteristics



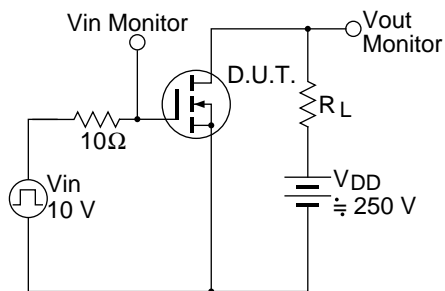
Switching Characteristics



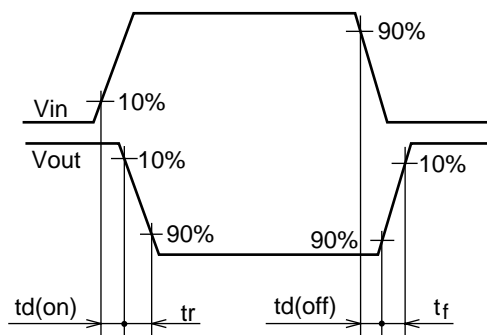


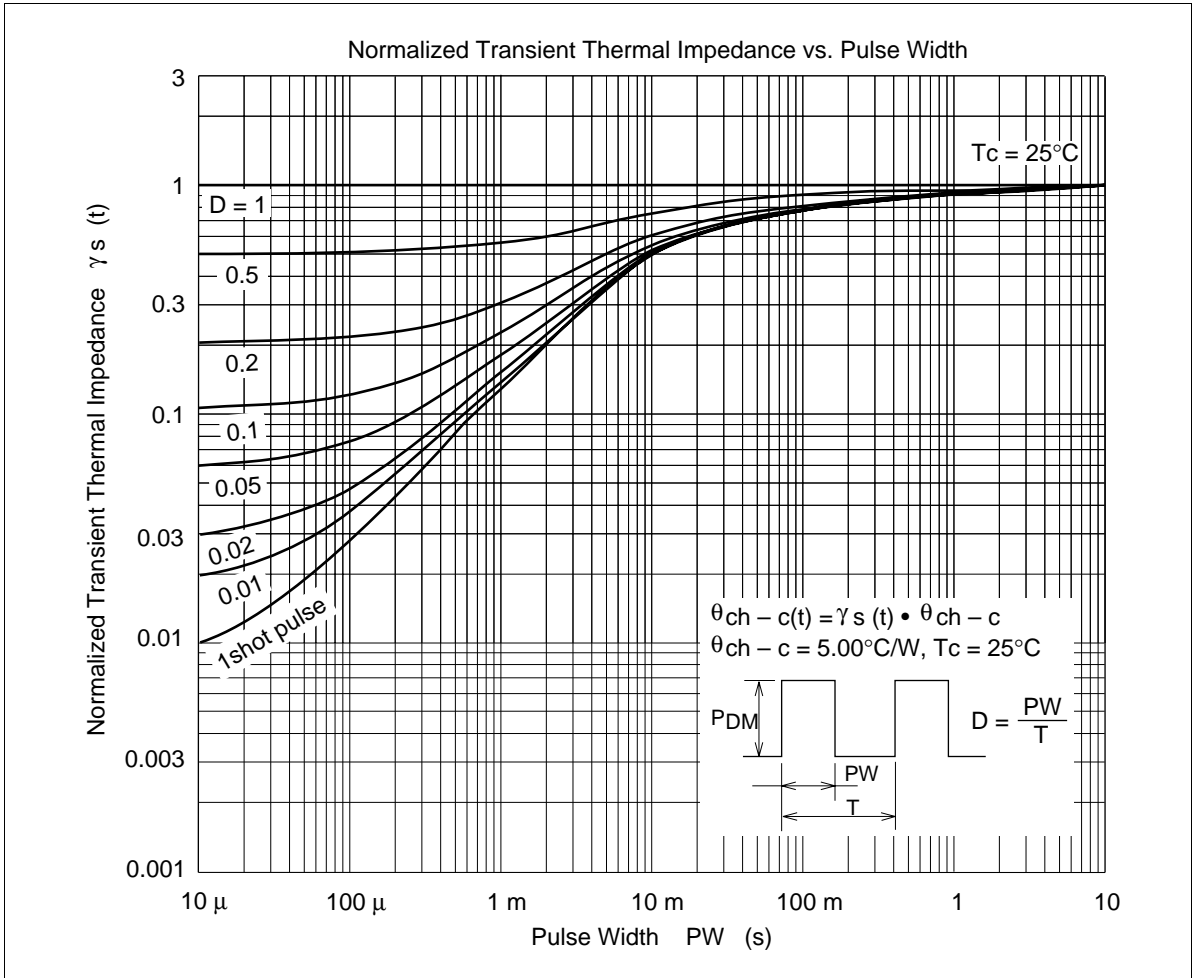


Switching Time Test Circuit



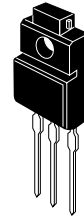
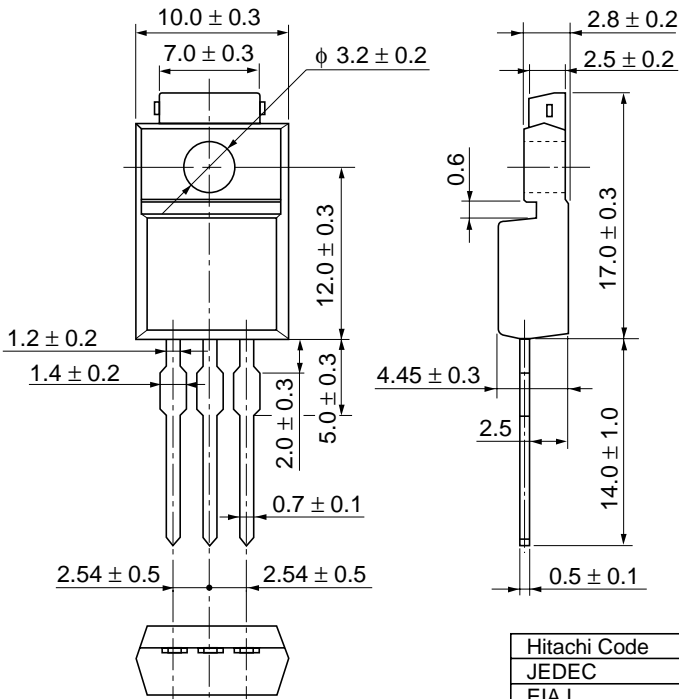
Waveform





Package Dimensions

As of January, 2001  
Unit: mm



Hitachi Code	TO-220FM
JEDEC	—
EIAJ	Conforms
Mass (reference value)	1.8 g

## Cautions

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