

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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# 2SK3160

Silicon N Channel MOS FET  
High Speed Power Switching

**RENESAS**

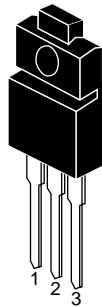
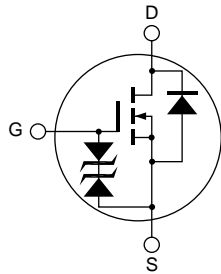
ADE-208-751A (Z)  
2nd. Edition  
Mar. 2001

## Features

- Low on-resistance  
 $R_{DS} = 130\text{m}\Omega$  typ.
- High speed switching
- 4V gate drive device can be driven from 5V source

## Outline

TO-220FM



1. Gate
2. Drain
3. Source

**Absolute Maximum Ratings** (Ta = 25°C)

<b>Item</b>	<b>Symbol</b>	<b>Ratings</b>	<b>Unit</b>
Drain to source voltage	V <sub>DSS</sub>	200	V
Gate to source voltage	V <sub>GSS</sub>	±20	V
Drain current	I <sub>D</sub>	10	A
Drain peak current	I <sub>D(pulse)</sub> <sup>Note1</sup>	40	A
Body-drain diode reverse drain current	I <sub>DR</sub>	10	A
Avalanche current	I <sub>AP</sub> <sup>Note3</sup>	10	A
Avalanche energy	E <sub>AR</sub> <sup>Note3</sup>	6.6	mJ
Channel dissipation	Pch <sup>Note2</sup>	30	W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	-55 to +150	°C

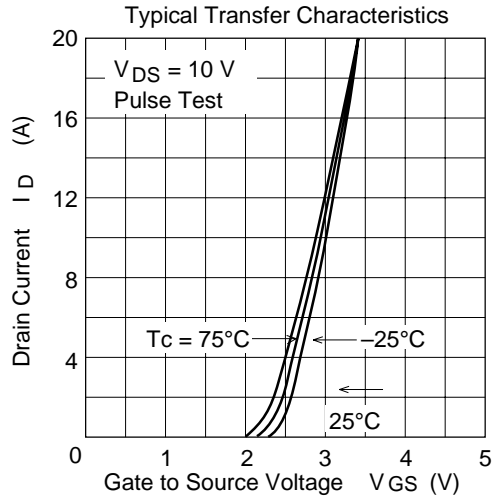
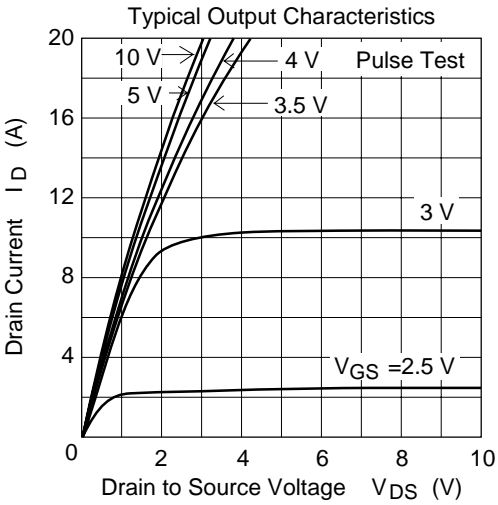
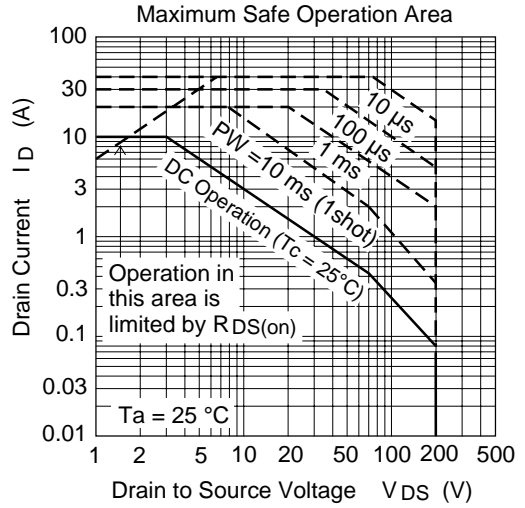
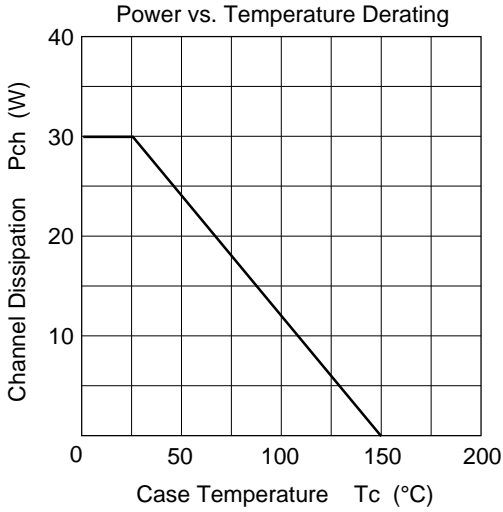
Note: 1. PW ≤ 10μs, duty cycle ≤ 1 %  
2. Value at Tc = 25°C  
3. Value at Tch = 25°C, Rg ≥ 50Ω

## Electrical Characteristics (Ta = 25°C)

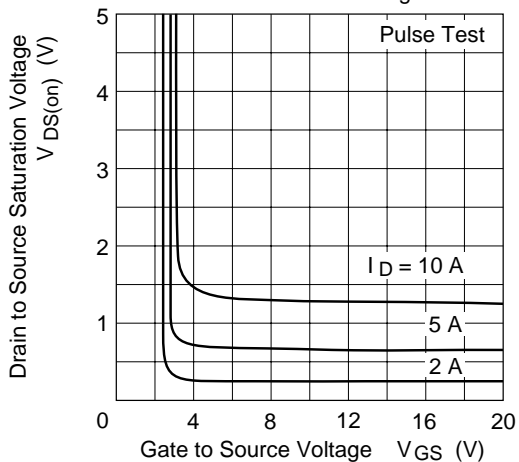
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	200	—	—	V	$I_D = 10\text{mA}$ , $V_{GS} = 0$
Gate to source breakdown voltage	$V_{(BR)GSS}$	±20	—	—	V	$I_G = \pm 100\mu\text{A}$ , $V_{DS} = 0$
Gate to source leak current	$I_{GSS}$	—	—	±10	μA	$V_{GS} = \pm 16\text{V}$ , $V_{DS} = 0$
Zero gate voltage drain current	$I_{DSS}$	—	—	10	μA	$V_{DS} = 200\text{V}$ , $V_{GS} = 0$
Gate to source cutoff voltage	$V_{GS(off)}$	1.0	—	2.5	V	$I_D = 1\text{mA}$ , $V_{DS} = 10\text{V}$
Static drain to source on state resistance	$R_{DS(on)}$	—	130	170	mΩ	$I_D = 5\text{A}$ , $V_{GS} = 10\text{V}$ <sup>Note4</sup>
	$R_{DS(on)}$	—	150	190	mΩ	$I_D = 5\text{A}$ , $V_{GS} = 4\text{V}$ <sup>Note4</sup>
Forward transfer admittance	$ y_{fs} $	8	13	—	S	$I_D = 5\text{A}$ , $V_{DS} = 10\text{V}$ <sup>Note4</sup>
Input capacitance	$C_{iss}$	—	1100	—	pF	$V_{DS} = 10\text{V}$
Output capacitance	$C_{oss}$	—	300	—	pF	$V_{GS} = 0$
Reverse transfer capacitance	$C_{rss}$	—	150	—	pF	$f = 1\text{MHz}$
Turn-on delay time	$t_{d(on)}$	—	15	—	ns	$I_D = 5\text{A}$ , $V_{GS} = 10\text{V}$
Rise time	$t_r$	—	75	—	ns	$R_L = 6\Omega$
Turn-off delay time	$t_{d(off)}$	—	280	—	ns	
Fall time	$t_f$	—	110	—	ns	
Body-drain diode forward voltage	$V_{DF}$	—	0.85	—	V	$I_F = 10\text{A}$ , $V_{GS} = 0$
Body-drain diode reverse recovery time	$t_{rr}$	—	100	—	ns	$I_F = 10\text{A}$ , $V_{GS} = 0$ $diF/dt = 50\text{A}/\mu\text{s}$

Note: 4. Pulse test

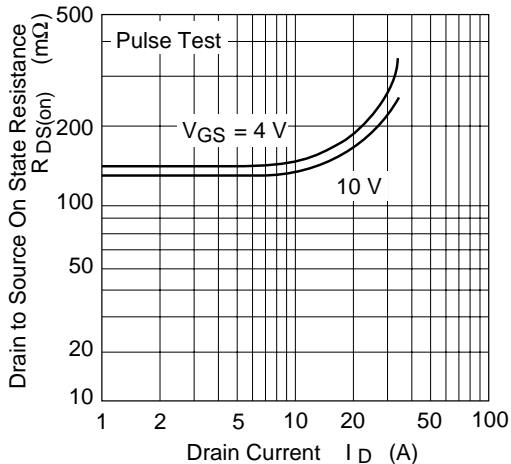
Main Characteristics



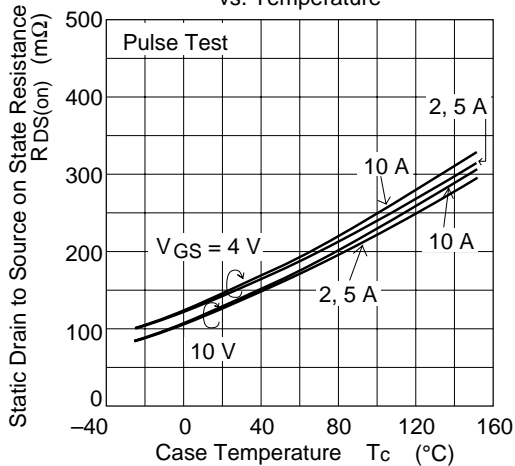
Drain to Source Saturation Voltage vs. Gate to Source Voltage



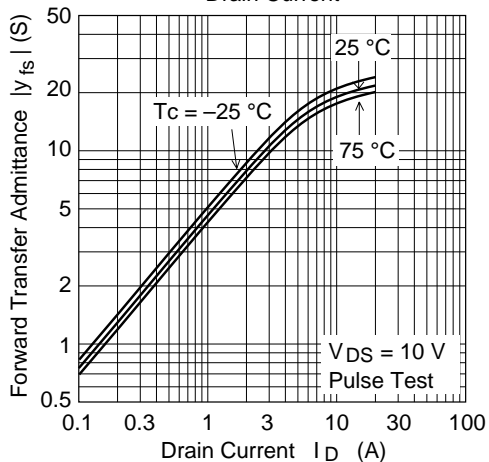
Static Drain to Source on State Resistance vs. Drain Current



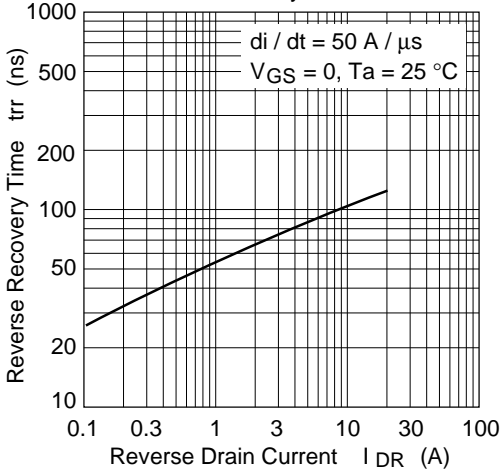
Static Drain to Source on State Resistance vs. Temperature



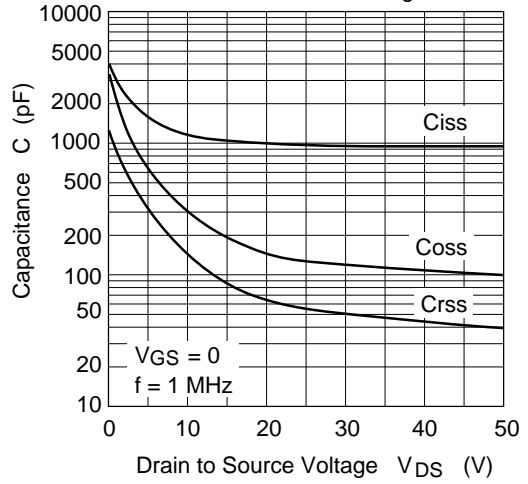
Forward Transfer Admittance vs. Drain Current



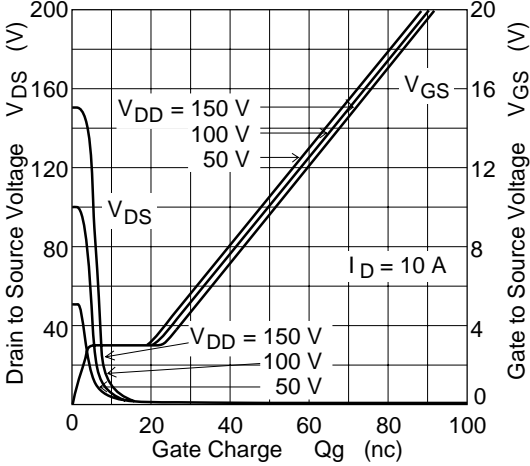
Body-Drain Diode Reverse Recovery Time



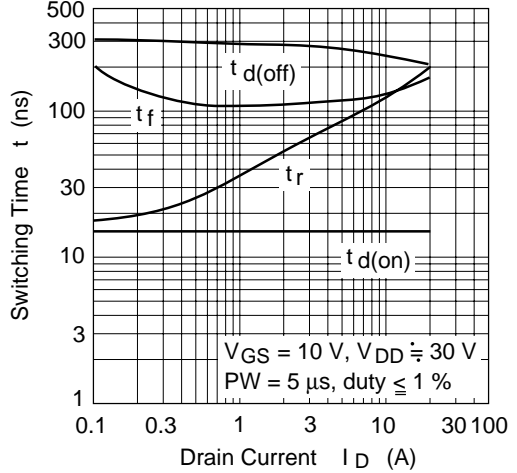
Typical Capacitance vs. Drain to Source Voltage

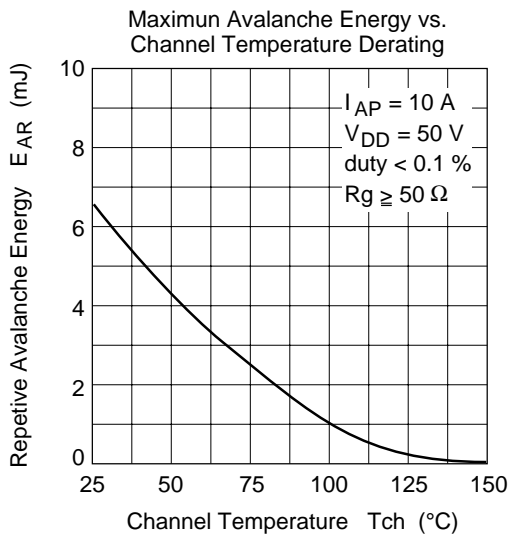
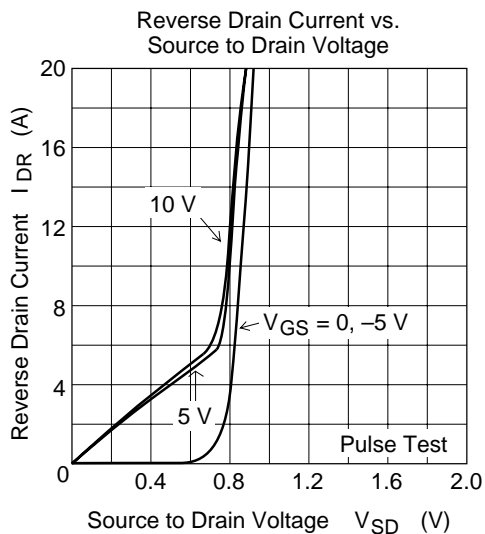


Dynamic Input Characteristics

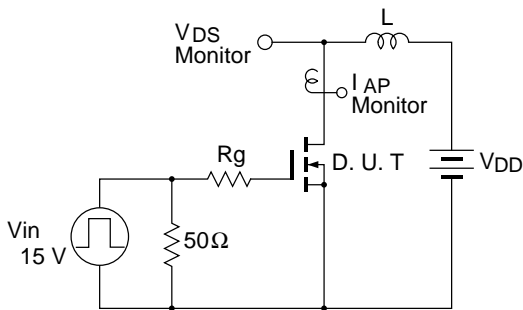


Switching Characteristics



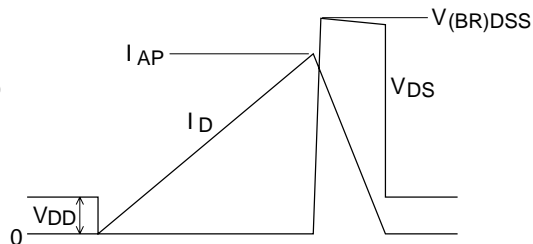


Avalanche Test Circuit

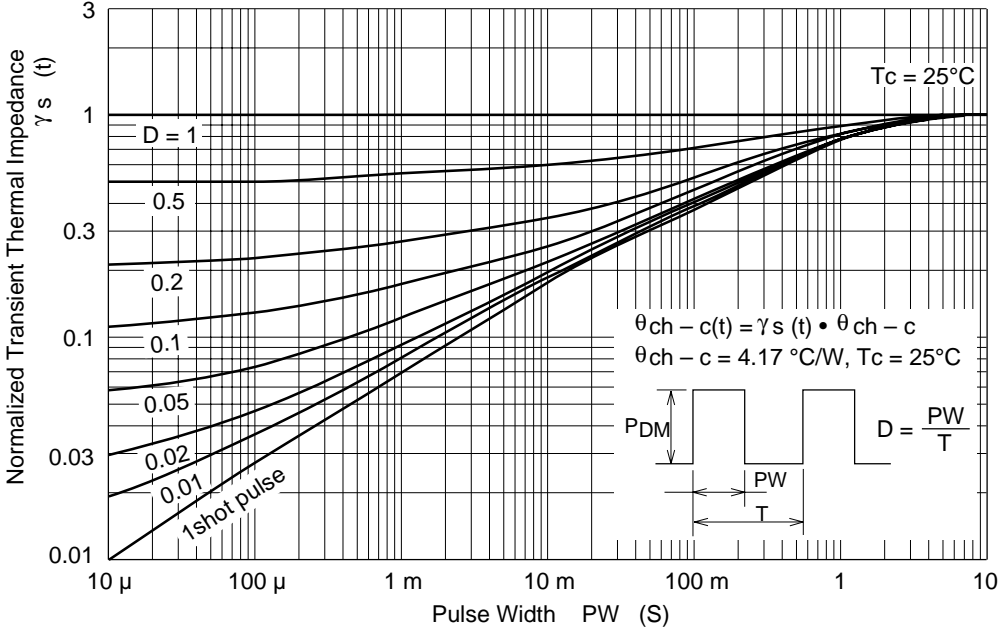


Avalanche Waveform

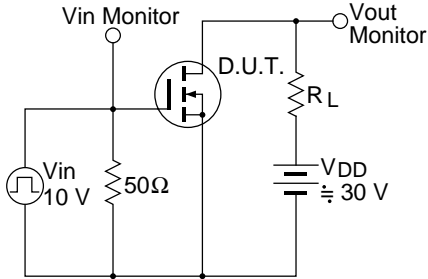
$$E_{AR} = \frac{1}{2} \cdot L \cdot I_{AP}^2 \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$



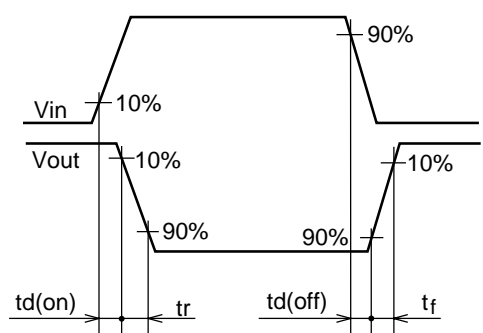
Normalized Transient Thermal Impedance vs. Pulse Width



Switching Time Test Circuit

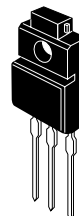
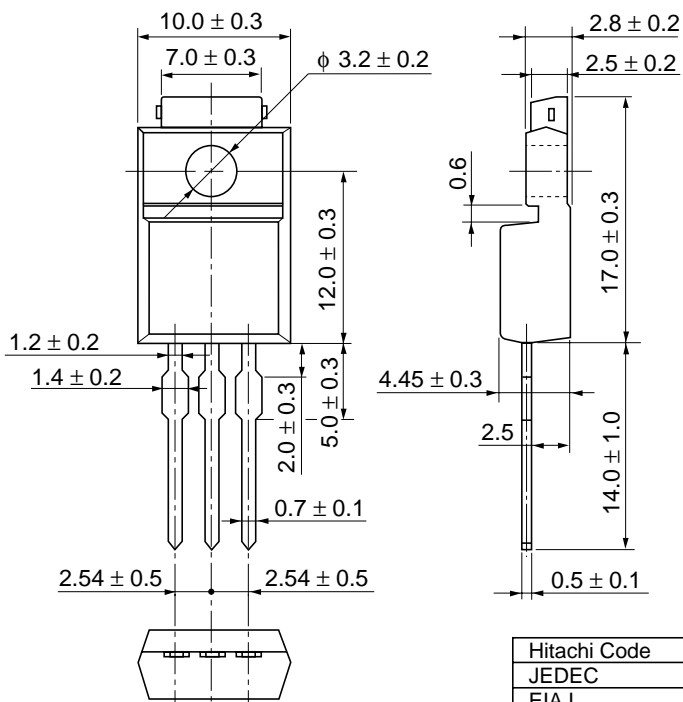


Waveform



Package Dimensions

As of January, 2001  
Unit: mm



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

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