

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!

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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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# 2SK3136

Silicon N Channel MOS FET  
High Speed Power Switching

**RENESAS**

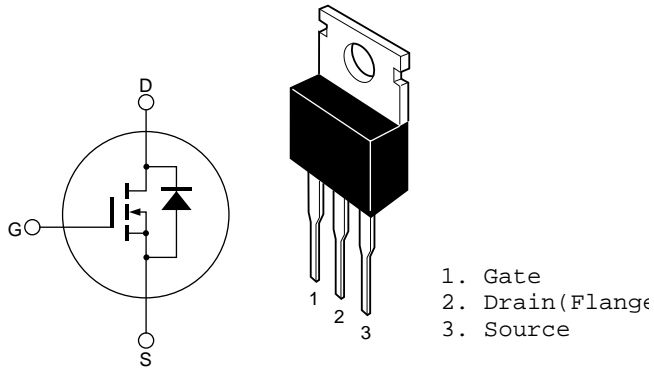
ADE-208-696B (Z)  
3rd. Edition  
Feb. 1999

## Features

- Low on-resistance  
 $R_{DS(on)} = 4.5m\Omega$  typ.
- Low drive current
- 4V gate drive device can be driven from 5V source

## Outline

TO-220AB



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

| Item                                   | Symbol                           | Ratings     | Unit |
|--|----------------------------------|-------------|------|
| Drain to source voltage                | $V_{DSS}$                        | 40          | V    |
| Gate to source voltage                 | $V_{GSS}$                        | ±20         | V    |
| Drain current                          | $I_D$                            | 75          | A    |
| Drain peak current                     | $I_{D(pulse)}$ <sup>Note 1</sup> | 300         | A    |
| Body-drain diode reverse drain current | $I_{DR}$                         | 75          | A    |
| Avalanche current                      | $I_{AP}$ <sup>Note 3</sup>       | 50          | A    |
| Avalanche energy                       | $E_{AR}$ <sup>Note 3</sup>       | 333         | mJ   |
| Channel dissipation                    | $P_{ch}$ <sup>Note 2</sup>       | 100         | W    |
| Channel temperature                    | $T_{ch}$                         | 150         | °C   |
| Storage temperature                    | $T_{stg}$                        | -55 to +150 | °C   |

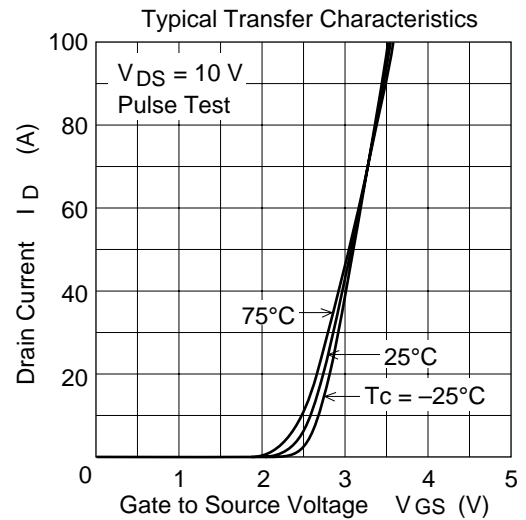
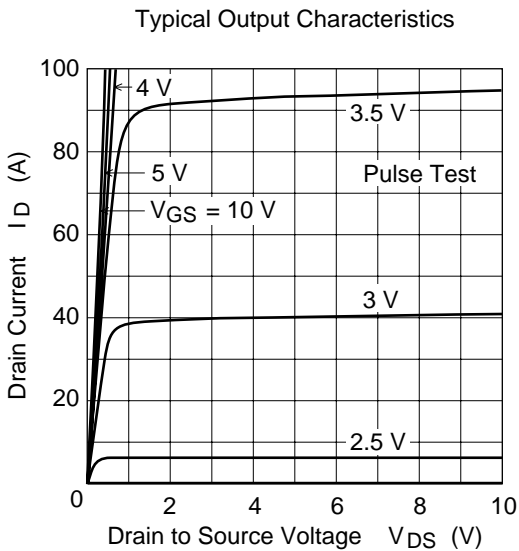
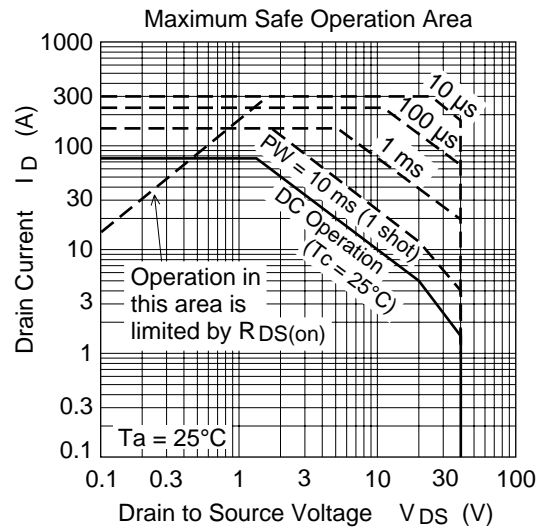
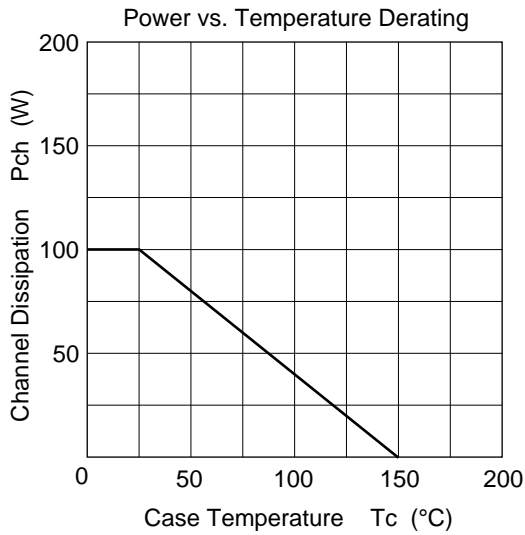
- Note:
1.  $PW \leq 10\mu s$ , duty cycle  $\leq 1\%$
  2. Value at  $T_c = 25^\circ C$
  3. Value at  $T_{ch} = 25^\circ C$ ,  $R_g = 50\Omega$

## Electrical Characteristics (Ta = 25°C)

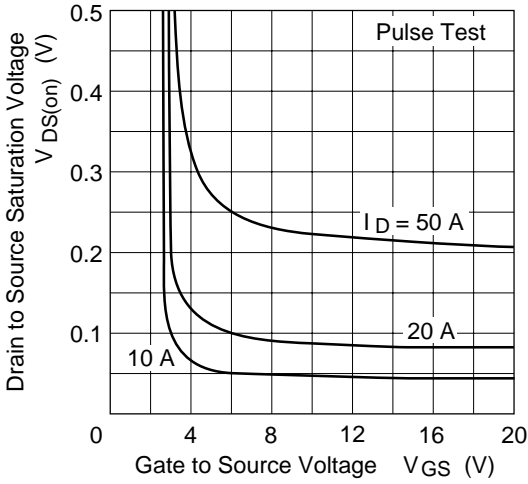
| Item                                       | Symbol        | Min | Typ  | Max       | Unit             | Test Conditions  |
|--|---------------|-----|------|-----------|------------------|--|
| Drain to source breakdown voltage          | $V_{(BR)DSS}$ | 40  | —    | —         | V                | $I_D = 10\text{mA}$ , $V_{GS} = 0$                                     |
| Gate to source leak current                | $I_{GSS}$     | —   | —    | $\pm 0.1$ | $\mu\text{A}$    | $V_{GS} = \pm 20\text{V}$ , $V_{DS} = 0$                               |
| Zero gate voltage drain current            | $I_{DSS}$     | —   | —    | 10        | $\mu\text{A}$    | $V_{DS} = 40\text{V}$ , $V_{GS} = 0$                                   |
| Gate to source cutoff voltage              | $V_{GS(off)}$ | 1.0 | —    | 2.5       | V                | $I_D = 1\text{mA}$ , $V_{DS} = 10\text{V}$ <sup>Note 1</sup>           |
| Static drain to source on state resistance | $R_{DS(on)}$  | —   | 4.5  | 5.8       | $\text{m}\Omega$ | $I_D = 40\text{A}$ , $V_{GS} = 10\text{V}$ <sup>Note 1</sup>           |
|  |               | —   | 6.5  | 10        | $\text{m}\Omega$ | $I_D = 40\text{A}$ , $V_{GS} = 4\text{V}$ <sup>Note 1</sup>            |
| Forward transfer admittance                | $ y_{fs} $    | 50  | 80   | —         | S                | $I_D = 40\text{A}$ , $V_{DS} = 10\text{V}$ <sup>Note 1</sup>           |
| Input capacitance                          | $C_{iss}$     | —   | 6800 | —         | pF               | $V_{DS} = 10\text{V}$  |
| Output capacitance                         | $C_{oss}$     | —   | 1300 | —         | pF               | $V_{GS} = 0$   |
| Reverse transfer capacitance               | $C_{rss}$     | —   | 380  | —         | pF               | $f = 1\text{MHz}$  |
| Total gate charge                          | $Q_g$         | —   | 130  | —         | nc               | $V_{DD} = 25\text{V}$  |
| Gate to source charge                      | $Q_{gs}$      | —   | 25   | —         | nc               | $V_{GS} = 10\text{V}$  |
| Gate to drain charge                       | $Q_{gd}$      | —   | 30   | —         | nc               | $I_D = 75\text{A}$   |
| Turn-on delay time                         | $t_{d(on)}$   | —   | 60   | —         | ns               | $V_{GS} = 10\text{V}$ , $I_D = 40\text{A}$                             |
| Rise time                                  | $t_r$         | —   | 300  | —         | ns               | $R_L = 0.75\Omega$   |
| Turn-off delay time                        | $t_{d(off)}$  | —   | 550  | —         | ns               |  |
| Fall time                                  | $t_f$         | —   | 400  | —         | ns               |  |
| Body-drain diode forward voltage           | $V_{DF}$      | —   | 1.05 | —         | V                | $I_F = 75\text{A}$ , $V_{GS} = 0$                                      |
| Body-drain diode reverse recovery time     | $t_{rr}$      | —   | 90   | —         | ns               | $I_F = 75\text{A}$ , $V_{GS} = 0$<br>$diF/dt = 50\text{A}/\mu\text{s}$ |

Note: 1. Pulse test

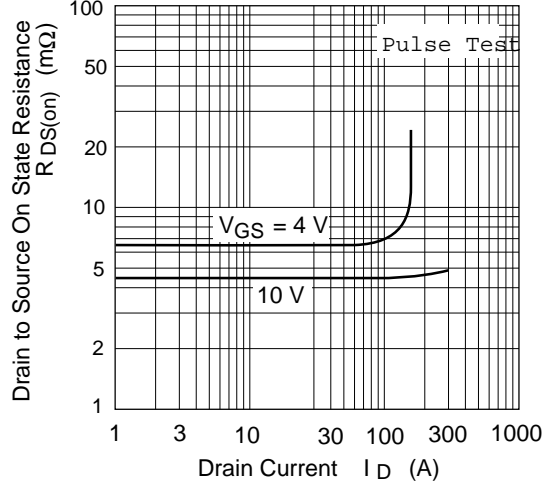
Main Characteristics



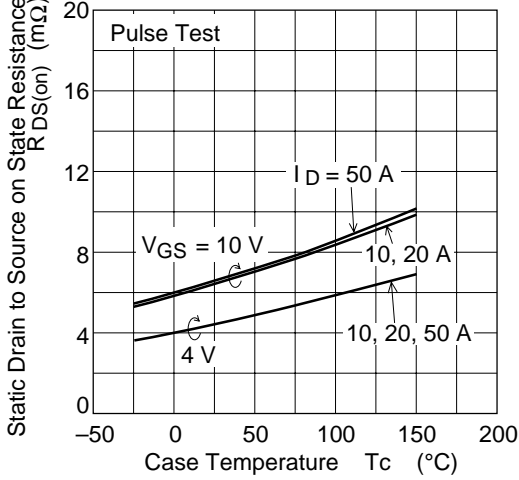
Drain to Source Saturation Voltage vs. Gate to Source Voltage



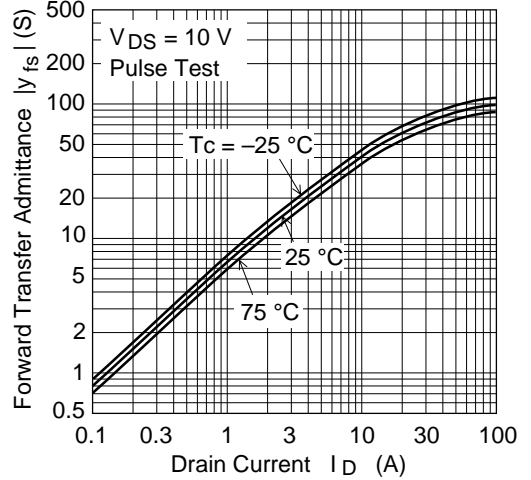
Static Drain to Source on State Resistance vs. Drain Current



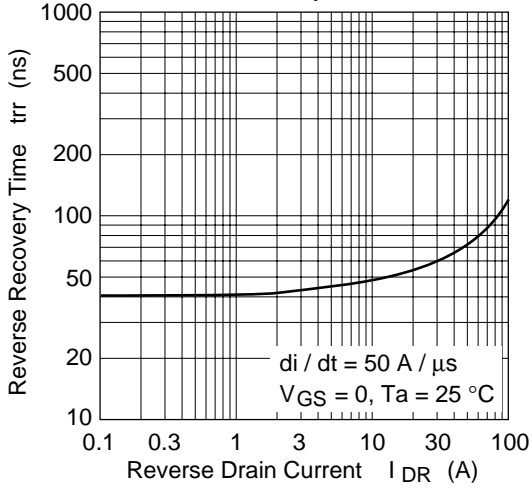
Static Drain to Source on State Resistance vs. Temperature



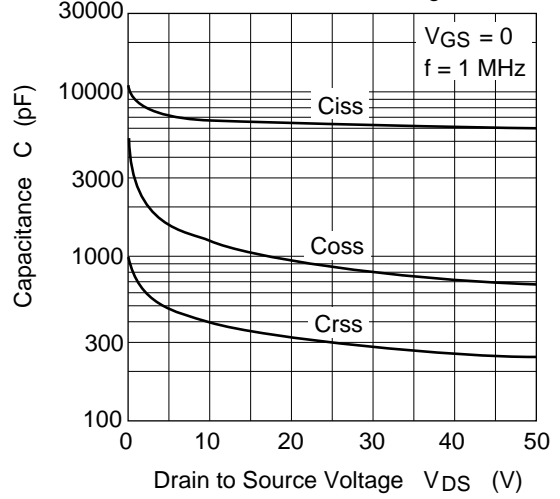
Forward Transfer Admittance vs. Drain Current



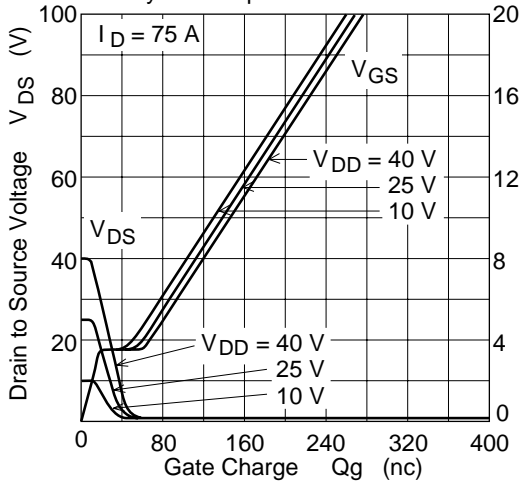
Body-Drain Diode Reverse Recovery Time



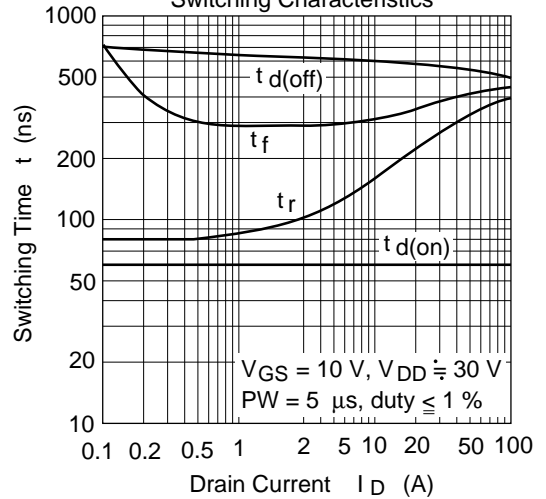
Typical Capacitance vs. Drain to Source Voltage



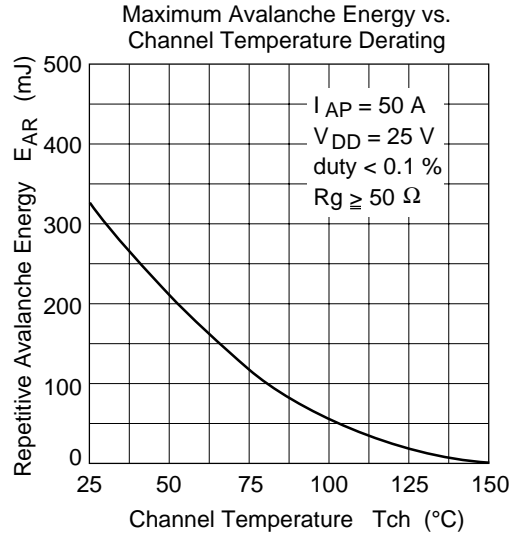
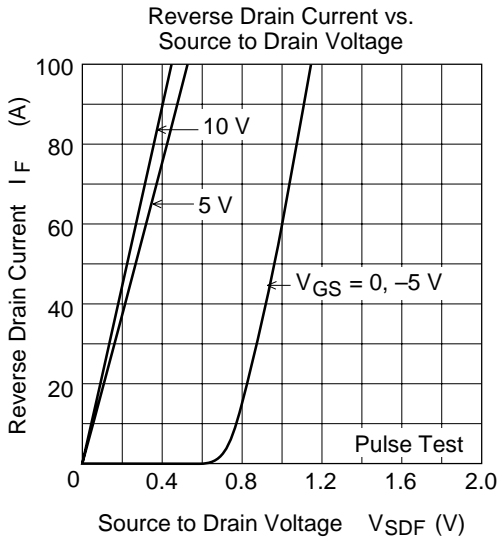
Dynamic Input Characteristics



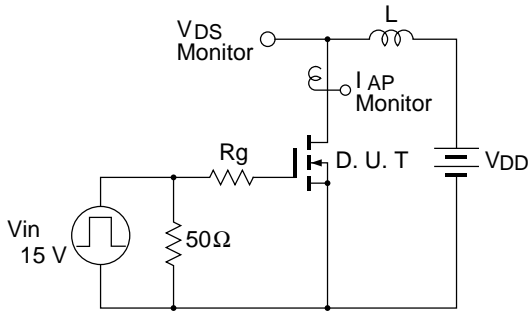
Switching Characteristics



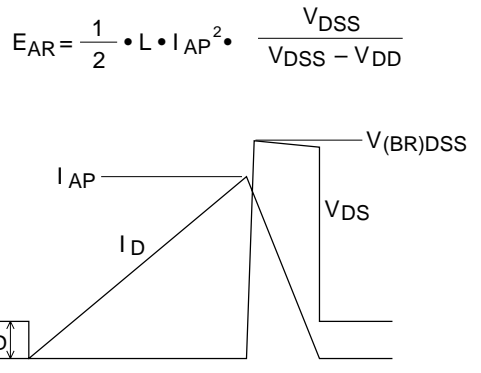




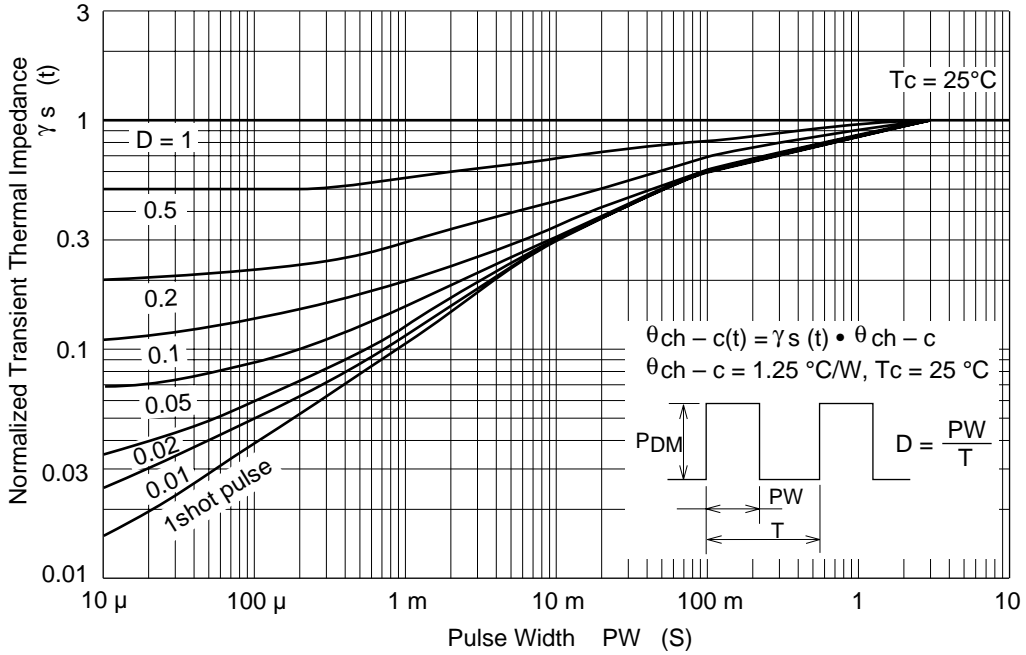
Avalanche Test Circuit



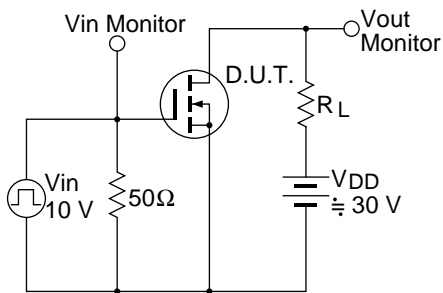
Avalanche Waveform



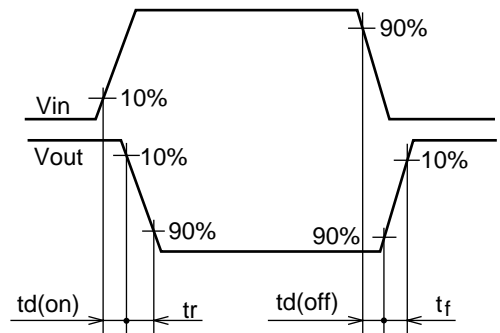
Normalized Transient Thermal Impedance vs. Pulse Width



Switching Time Test Circuit



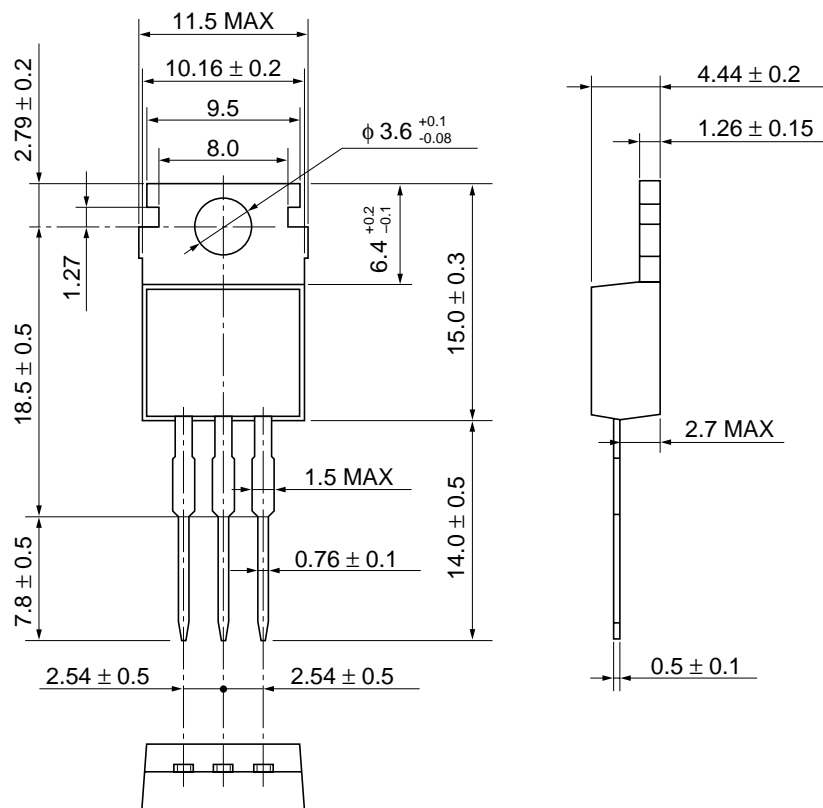
Waveform



## Package Dimensions

As of January, 2001

Unit: mm



|                        |          |
|------------------------|----------|
| Hitachi Code           | TO-220AB |
| JEDEC                  | Conforms |
| EIAJ                   | Conforms |
| Mass (reference value) | 1.8 g    |

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