

TK1Q90A

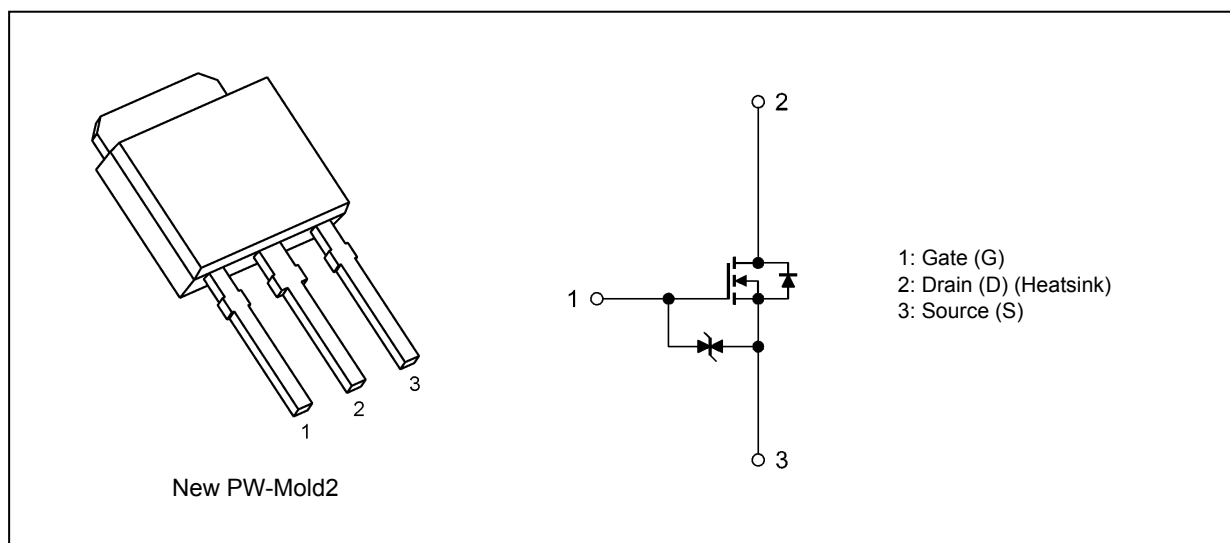
1. Applications

- Switching Voltage Regulators

2. Features

- (1) Low drain-source on-resistance: $R_{DS(ON)} = 6.7 \Omega$ (typ.)
- (2) High forward transfer admittance: $|Y_{fs}| = 1.0 \text{ S}$ (typ.)
- (3) Low leakage current: $I_{DSS} = 100 \mu\text{A}$ (max) ($V_{DS} = 720 \text{ V}$)
- (4) Enhancement mode: $V_{th} = 2.0$ to 4.0 V ($V_{DS} = 10 \text{ V}$, $I_D = 1 \text{ mA}$)

3. Packaging and Internal Circuit



4. Absolute Maximum Ratings (Note) ($T_a = 25^\circ\text{C}$ unless otherwise specified)

| Characteristics | Symbol | Rating | Unit |
|-------------------------------|------------------------------------|------------|------------------|
| Drain-source voltage | V_{DSS} | 900 | V |
| Gate-source voltage | V_{GSS} | ± 30 | |
| Drain current (DC) | (Note 1) I_D | 1 | A |
| Drain current (pulsed) | (Note 1) I_{DP} | 3 | |
| Power dissipation | ($T_c = 25^\circ\text{C}$) P_D | 20 | W |
| Single-pulse avalanche energy | (Note 2) E_{AS} | 216 | mJ |
| Avalanche current | I_{AR} | 1 | A |
| Repetitive avalanche energy | (Note 3) E_{AR} | 2.0 | mJ |
| Channel temperature | T_{ch} | 150 | $^\circ\text{C}$ |
| Storage temperature | T_{stg} | -55 to 150 | |

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Start of commercial production

2010-01

5. Thermal Characteristics

| Characteristics | Symbol | Max | Unit |
|---------------------------------------|----------------|------|------|
| Channel-to-case thermal resistance | $R_{th(ch-c)}$ | 6.25 | °C/W |
| Channel-to-ambient thermal resistance | $R_{th(ch-a)}$ | 125 | |

Note 1: Ensure that the channel temperature does not exceed 150°C.

Note 2: $V_{DD} = 90\text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 396\text{ mH}$, $R_G = 25\ \Omega$, $I_{AR} = 1\text{ A}$

Note 3: Repetitive rating; pulse width limited by maximum channel temperature

Note: This transistor is sensitive to electrostatic discharge and should be handled with care.

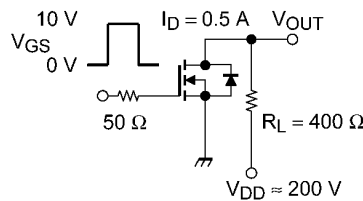
6. Electrical Characteristics

6.1. Static Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|--------------------------------|---------------|--|----------|------|----------|---------------|
| Gate leakage current | I_{GSS} | $V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$ | — | — | ± 10 | μA |
| Drain cut-off current | I_{DSS} | $V_{DS} = 720\text{ V}, V_{GS} = 0\text{ V}$ | — | — | 100 | |
| Gate-source breakdown voltage | $V_{(BR)GSS}$ | $I_G = \pm 10\ \mu\text{A}, V_{DS} = 0\text{ V}$ | ± 30 | — | — | V |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$ | 900 | — | — | |
| Gate threshold voltage | V_{th} | $V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$ | 2.0 | — | 4.0 | |
| Drain-source on-resistance | $R_{DS(ON)}$ | $V_{GS} = 10\text{ V}, I_D = 0.5\text{ A}$ | — | 6.7 | 9.0 | Ω |
| Forward transfer admittance | $ Y_{fs} $ | $V_{DS} = 10\text{ V}, I_D = 0.5\text{ A}$ | 0.3 | 1.0 | — | S |

6.2. Dynamic Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|--------------------------------|-----------|---|-----|------|-----|---------------|
| Input capacitance | C_{iss} | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | — | 320 | — | μF |
| Reverse transfer capacitance | C_{rss} | | — | 10 | — | |
| Output capacitance | C_{oss} | | — | 35 | — | |
| Switching time (rise time) | t_r | See Figure 6.2.1. | — | 25 | — | ns |
| Switching time (turn-on time) | t_{on} | | — | 60 | — | |
| Switching time (fall time) | t_f | | — | 30 | — | |
| Switching time (turn-off time) | t_{off} | | — | 155 | — | |



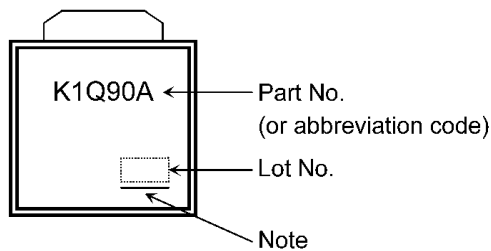
Duty $\leq 1\%$, $t_w = 10\ \mu\text{s}$
Fig. 6.2.1 Switching Time Test Circuit

6.3. Gate Charge Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|----------|---|-----|------|-----|------|
| Total gate charge (gate-source plus gate-drain) | Q_g | $V_{DD} \approx 400\text{ V}, V_{GS} = 10\text{ V}, I_D = 1\text{ A}$ | — | 13 | — | nC |
| Gate-source charge | Q_{gs} | | — | 6 | — | |
| Gate-drain charge | Q_{gd} | | — | 7 | — | |

6.4. Source-Drain Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|-----------|--|-----|------|------|---------------|
| Reverse drain current (DC) (Note 1) | I_{DR} | — | — | — | 1 | A |
| Reverse drain current (pulsed) (Note 1) | I_{DRP} | — | — | — | 3 | |
| Diode forward voltage | V_{DSF} | $I_{DR} = 1\text{ A}, V_{GS} = 0\text{ V}$ | — | — | -1.7 | V |
| Reverse recovery time | t_{rr} | $I_{DR} = 1\text{ A}, V_{GS} = 0\text{ V}$ $-di_{DR}/dt = 100\text{ A}/\mu\text{s}$ | — | 550 | — | ns |
| Reverse recovery charge | Q_{rr} | | — | 2.2 | — | μC |

7. Marking (Note)**Fig. 7.1 Marking**

Note: A line under a Lot No. identifies the indication of product Labels.

Not underlined: [[Pb]]/INCLUDES > MCV

Underlined: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.

The RoHS is the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

8. Characteristics Curves (Note)

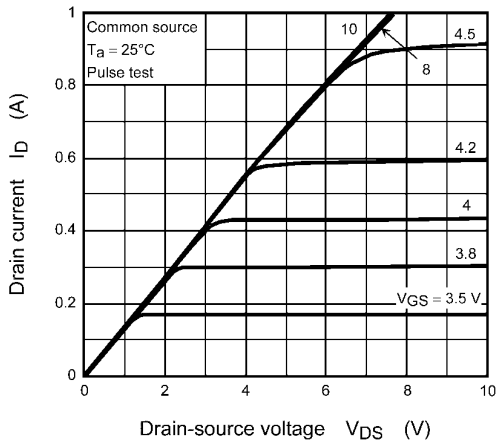


Fig. 8.1 $I_D - V_{DS}$

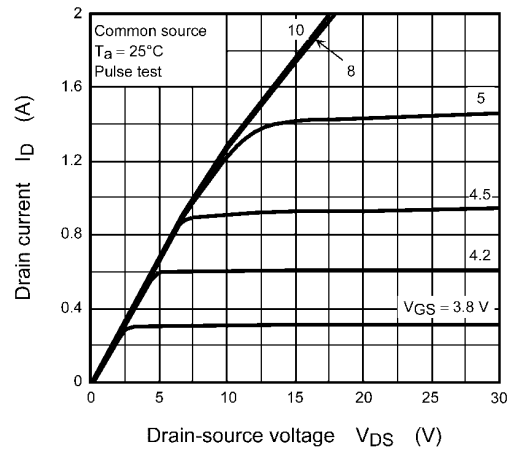


Fig. 8.2 $I_D - V_{DS}$

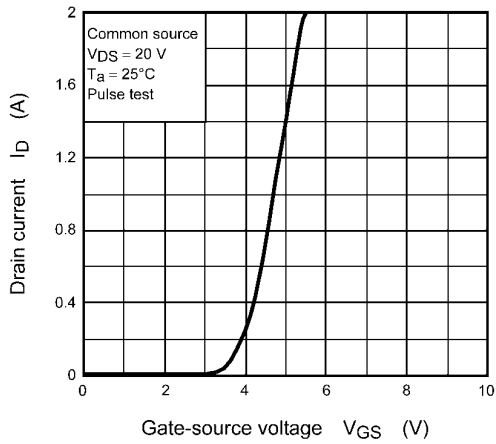


Fig. 8.3 $I_D - V_{GS}$

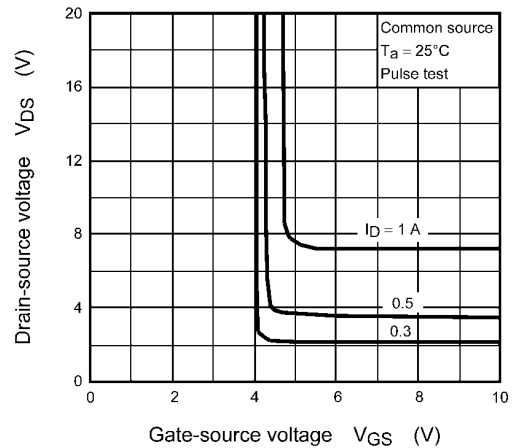


Fig. 8.4 $V_{DS} - V_{GS}$

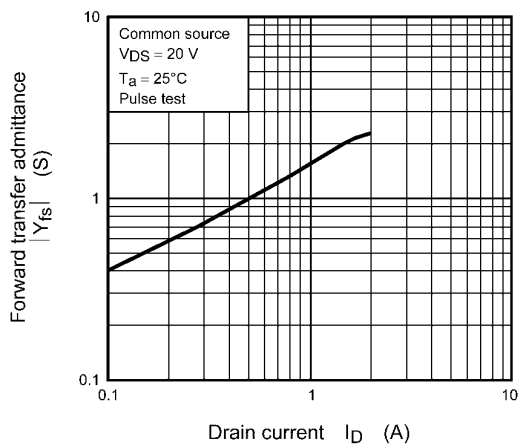


Fig. 8.5 $|Y_{fs}| - I_D$

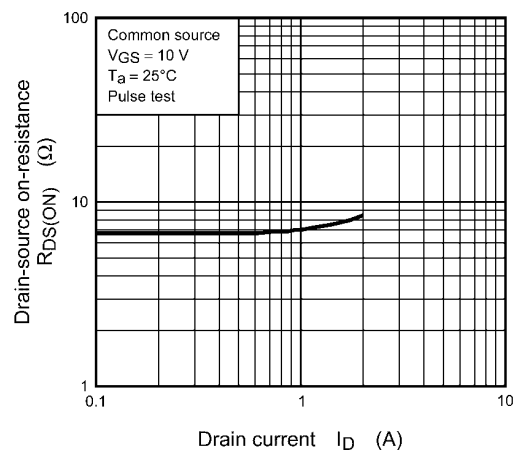


Fig. 8.6 $R_{DS(ON)} - I_D$

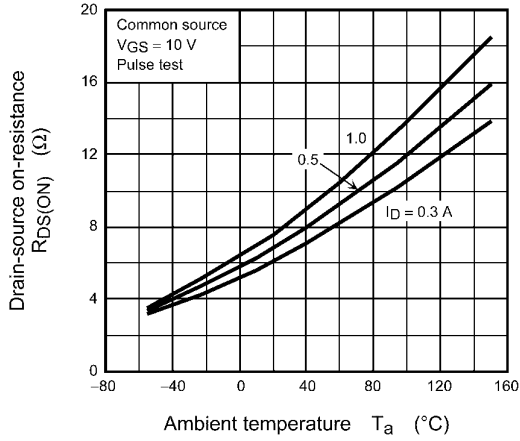


Fig. 8.7 $R_{DS(ON)} - T_a$

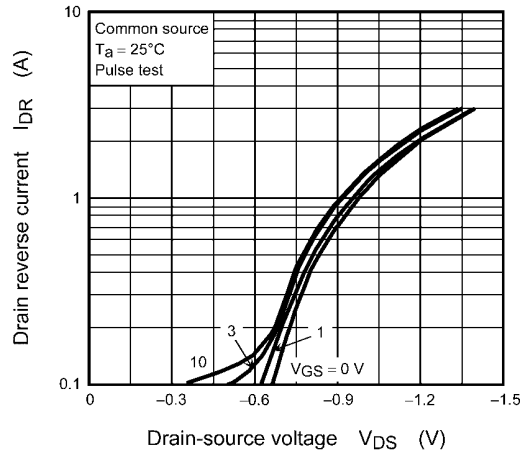


Fig. 8.8 $I_{DR} - V_{DS}$

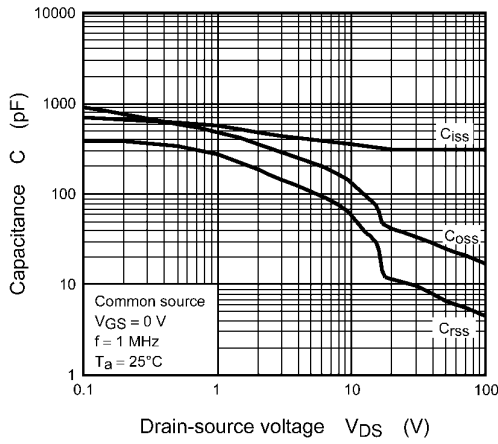


Fig. 8.9 C - V_{DS}

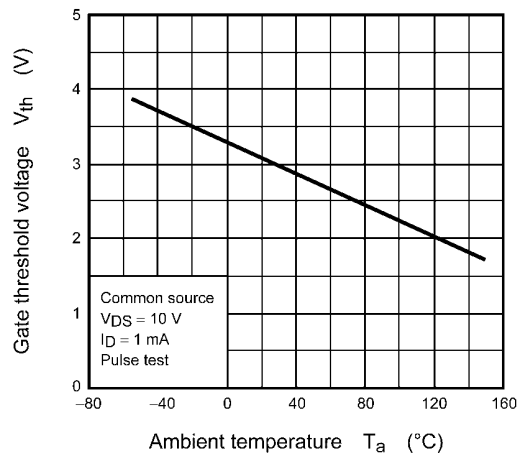
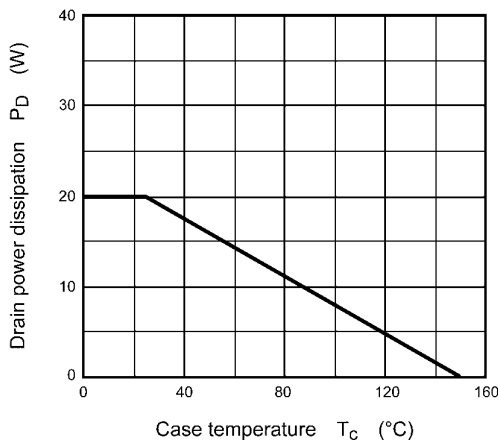


Fig. 8.10 $V_{th} - T_a$



**Fig. 8.11 $P_D - T_c$
(Guaranteed Maximum)**

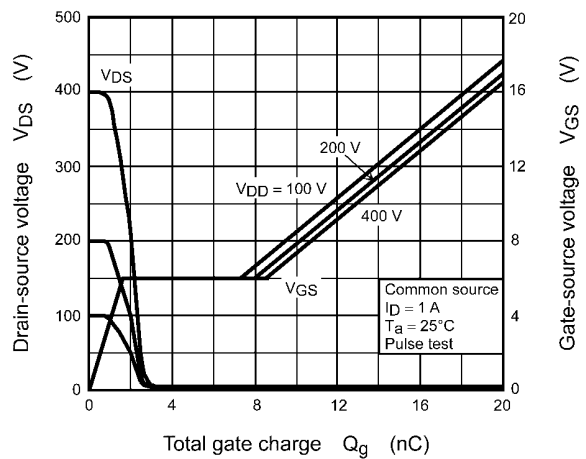


Fig. 8.12 Dynamic Input/Output Characteristics

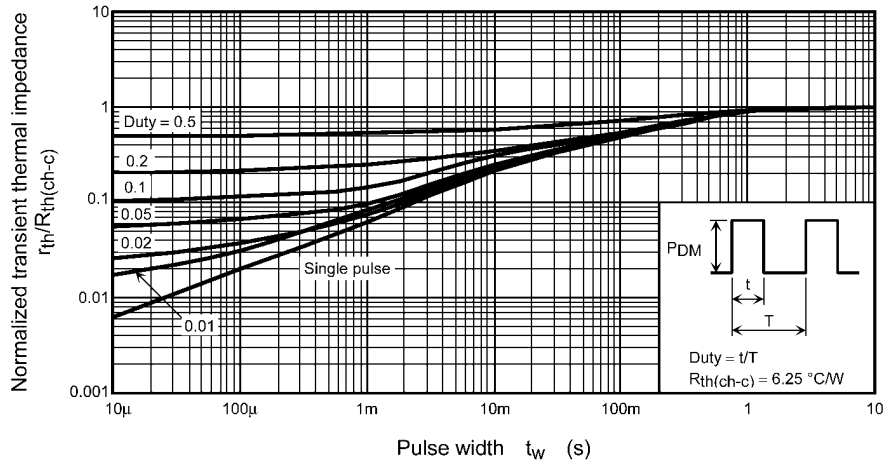


Fig. 8.13 $r_{th}/R_{th(ch-c)} - t_w$
(Guaranteed Maximum)

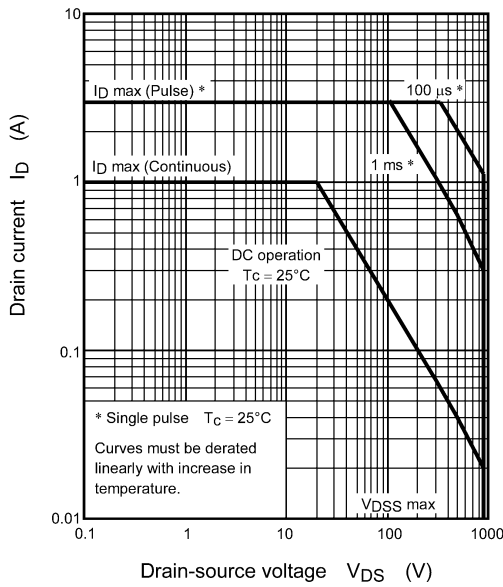


Fig. 8.14 Safe Operating Area
(Guaranteed Maximum)

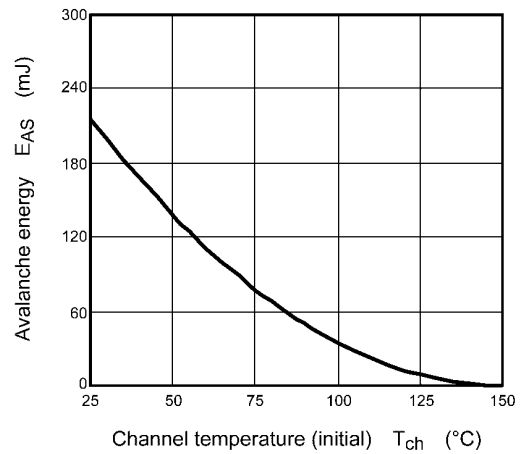


Fig. 8.15 $E_{AS} - T_{ch}$
(Guaranteed Maximum)

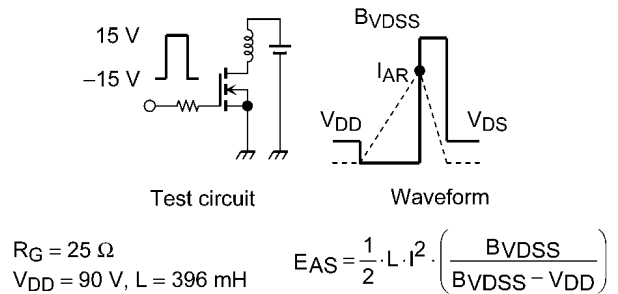
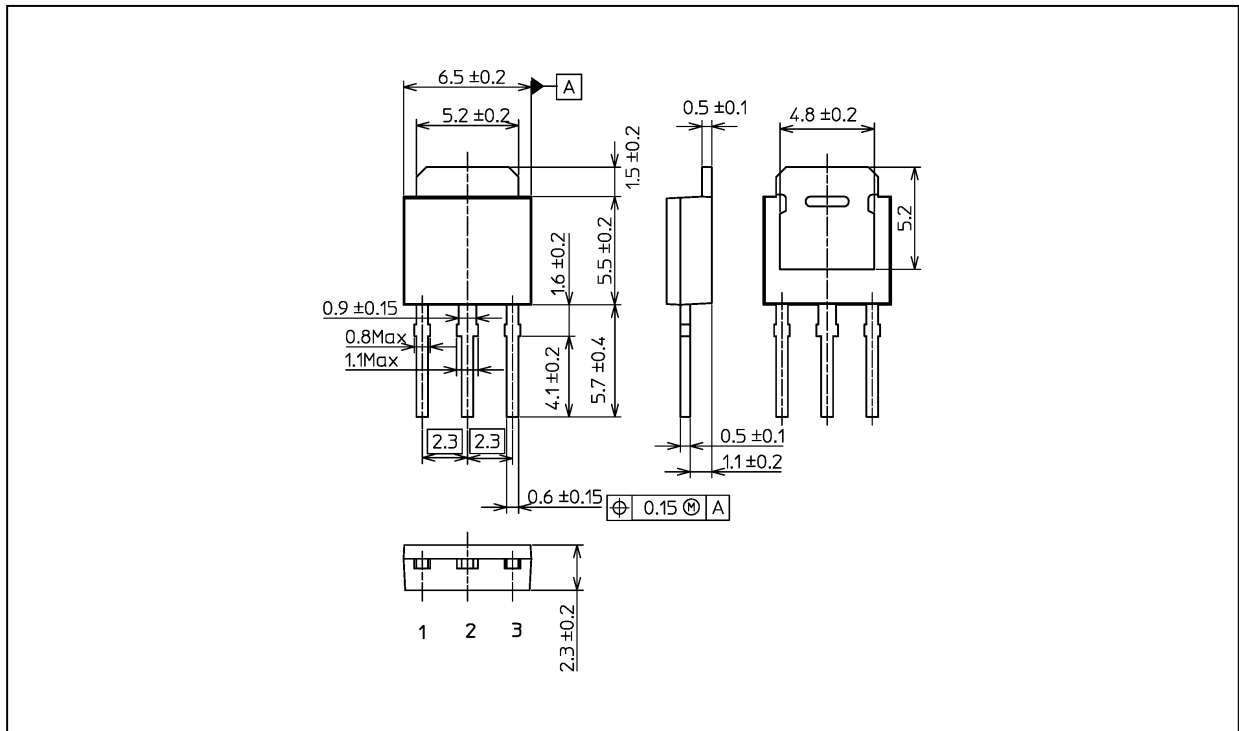


Fig. 8.16 Test Circuit/Waveform

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

Package Dimensions

Unit: mm



Weight: 0.36 g (typ.)

| Package Name(s) |
|------------------------|
| TOSHIBA: 2-7J2S |
| Nickname: New PW-Mold2 |

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