

# TK6A80E

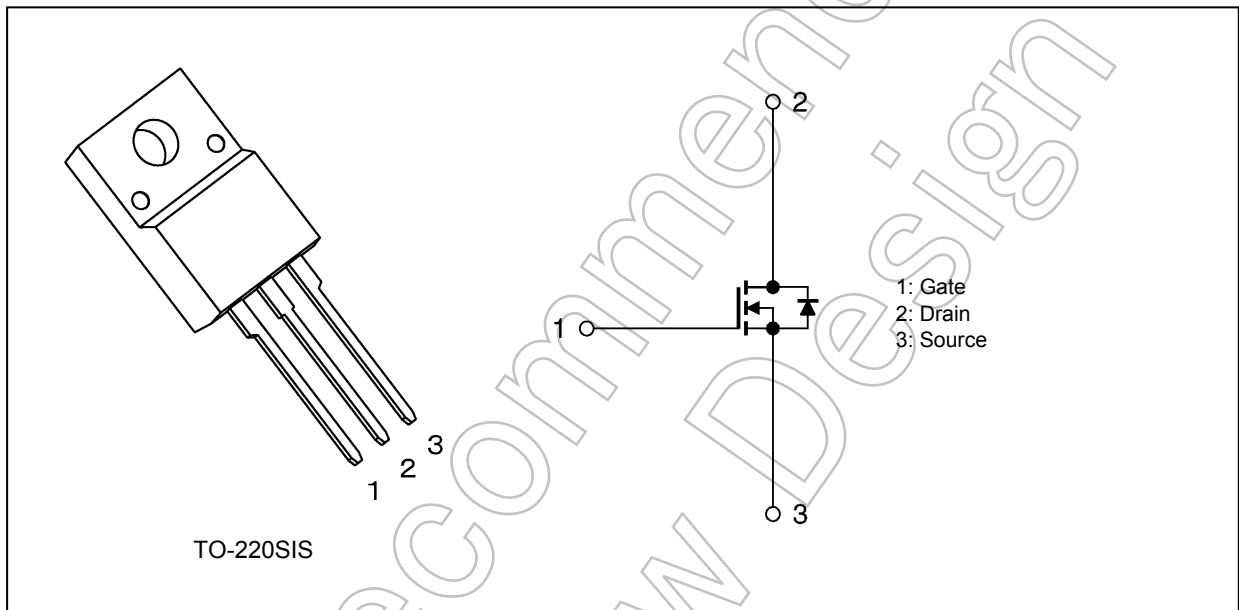
## 1. Applications

- Switching Voltage Regulators

## 2. Features

- (1) Low drain-source on-resistance:  $R_{DS(ON)} = 1.35 \Omega$  (typ.)
- (2) Low leakage current :  $I_{DSS} = 10 \mu\text{A}$  (max) ( $V_{DS} = 640 \text{ V}$ )
- (3) Enhancement mode:  $V_{th} = 2.5$  to  $4.0 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 0.6 \text{ mA}$ )

## 3. Packaging and Internal Circuit



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

| Characteristics                                | Symbol         | Rating     | Unit             |
|--|----------------|------------|------------------|
| Drain-source voltage                           | $V_{DSS}$      | 800        | V                |
| Gate-source voltage                            | $V_{GSS}$      | $\pm 30$   |                  |
| Drain current (DC) (Note 1)                    | $I_D$          | 6          | A                |
| Drain current (pulsed) (Note 1)                | $I_{DP}$       | 18         |                  |
| Power dissipation ( $T_c = 25^\circ\text{C}$ ) | $P_D$          | 45         | W                |
| Single-pulse avalanche energy (Note 2)         | $E_{AS}$       | 308        | mJ               |
| Avalanche current                              | $I_{AR}$       | 6          | A                |
| Reverse drain current (DC) (Note 1)            | $I_{DR}$       | 6          |                  |
| Reverse drain current (pulsed) (Note 1)        | $I_{DRP}$      | 18         |                  |
| Channel temperature                            | $T_{ch}$       | 150        | $^\circ\text{C}$ |
| Storage temperature                            | $T_{stg}$      | -55 to 150 |                  |
| Isolation voltage (RMS)                        | $V_{ISO(RMS)}$ | 2000       | V                |
| Mounting torque                                | TOR            | 0.6        | N · m            |

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).

#### 5. Thermal Characteristics

| Characteristics                       | Symbol         | Max  | Unit               |
|---------------------------------------|----------------|------|--------------------|
| Channel-to-case thermal resistance    | $R_{th(ch-c)}$ | 2.78 | $^\circ\text{C/W}$ |
| Channel-to-ambient thermal resistance | $R_{th(ch-a)}$ | 62.5 | $^\circ\text{C/W}$ |

Note 1: Ensure that the channel temperature does not exceed  $150\text{ }^\circ\text{C}$ .

Note 2:  $V_{DD} = 90\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 15.5\text{ mH}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = 6\text{ A}$

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

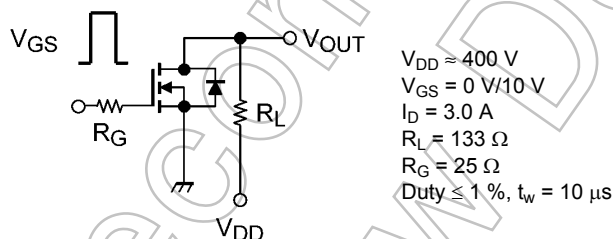
**6. Electrical Characteristics**

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

| Characteristics                | Symbol        | Test Condition                                  | Min | Typ. | Max     | Unit          |
|--------------------------------|---------------|---|-----|------|---------|---------------|
| Gate leakage current           | $I_{GSS}$     | $V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$ | —   | —    | $\pm 1$ | $\mu\text{A}$ |
| Drain cut-off current          | $I_{DSS}$     | $V_{DS} = 640\text{ V}, V_{GS} = 0\text{ V}$    | —   | —    | 10      |               |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$       | 800 | —    | —       | V             |
| Gate threshold voltage         | $V_{th}$      | $V_{DS} = 10\text{ V}, I_D = 0.6\text{ mA}$     | 2.5 | —    | 4.0     |               |
| Drain-source on-resistance     | $R_{DS(ON)}$  | $V_{GS} = 10\text{ V}, I_D = 3\text{ A}$        | —   | 1.35 | 1.7     | $\Omega$      |

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

| Characteristics                | Symbol     | Test Condition  | Min | Typ. | Max | Unit        |
|--------------------------------|------------|---|-----|------|-----|-------------|
| Input capacitance              | $C_{iss}$  | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | —   | 1350 | —   | $\text{pF}$ |
| Reverse transfer capacitance   | $C_{riss}$ |   | —   | 10   | —   |             |
| Output capacitance             | $C_{oss}$  |   | —   | 110  | —   |             |
| Gate resistance                | $r_g$      | $V_{DS} = \text{OPEN}, f = 1\text{ MHz}$                      | —   | 4.0  | —   | $\Omega$    |
| Switching time (rise time)     | $t_r$      | See Fig. 6.2.1.   | —   | 20   | —   | ns          |
| Switching time (turn-on time)  | $t_{on}$   |   | —   | 55   | —   |             |
| Switching time (fall time)     | $t_f$      |   | —   | 15   | —   |             |
| Switching time (turn-off time) | $t_{off}$  |   | —   | 85   | —   |             |
| MOSFET dv/dt ruggedness        | dv/dt      | $V_{DD} = 0\text{ to }400\text{ V}, I_D = 6\text{ A}$         | 20  | —    | —   | V/ns        |



**Fig. 6.2.1 Switching Time Test Circuit**

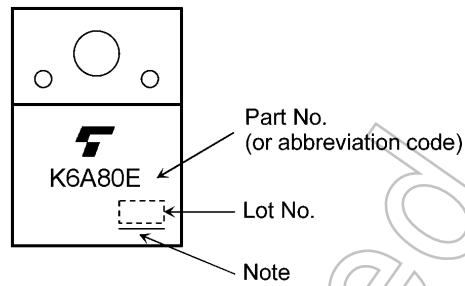
**6.3. Gate Charge Characteristics ( $T_a = 25\text{ }^\circ\text{C}$  unless otherwise specified)**

| Characteristics                                 | Symbol    | Test Condition  | Min | Typ. | Max | Unit |
|---|-----------|---|-----|------|-----|------|
| Total gate charge (gate-source plus gate-drain) | $Q_g$     | $V_{DD} \approx 400\text{ V}, V_{GS} = 10\text{ V}, I_D = 6\text{ A}$ | —   | 32   | —   | nC   |
| Gate-source charge 1                            | $Q_{gs1}$ |   | —   | 10   | —   |      |
| Gate-drain charge                               | $Q_{gd}$  |   | —   | 12   | —   |      |

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

| Characteristics               | Symbol    | Test Condition   | Min | Typ. | Max  | Unit          |
|-------------------------------|-----------|--|-----|------|------|---------------|
| Diode forward voltage         | $V_{DSF}$ | $I_{DR} = 6\text{ A}, V_{GS} = 0\text{ V}$   | —   | —    | -1.7 | V             |
| Reverse recovery time         | $t_{rr}$  | $I_{DR} = 6\text{ A}, V_{GS} = 0\text{ V}$<br>$-di_{DR}/dt = 100\text{ A}/\mu\text{s}$ | —   | 1100 | —    | ns            |
| Reverse recovery charge       | $Q_{rr}$  |  | —   | 8    | —    | $\mu\text{C}$ |
| Peak reverse recovery current | $I_{rr}$  |  | —   | 18   | —    | A             |

**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.

Not Recommended for New Design

8. Characteristics Curves (Note)

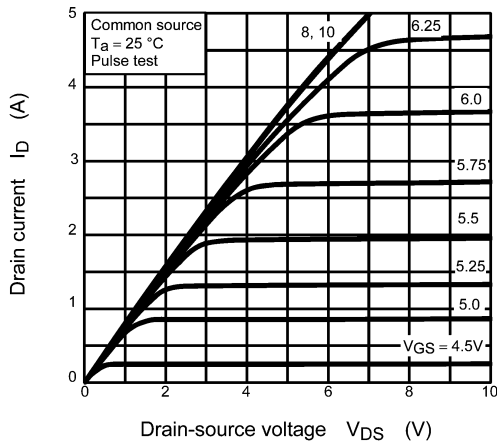


Fig. 8.1  $I_D - V_{DS}$

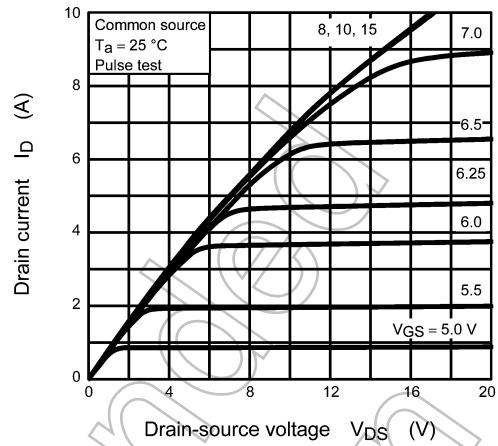


Fig. 8.2  $I_D - V_{DS}$

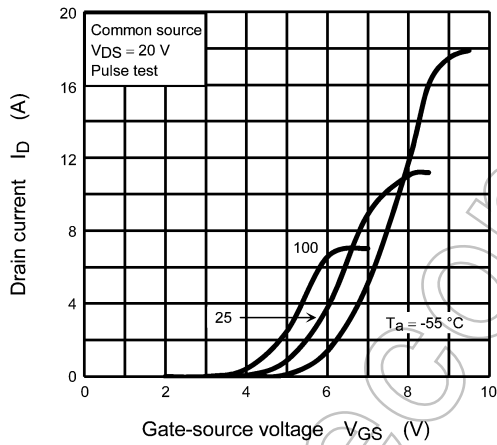


Fig. 8.3  $I_D - V_{GS}$

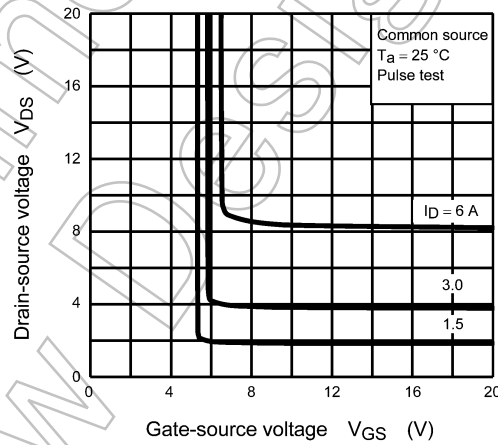


Fig. 8.4  $V_{DS} - V_{GS}$

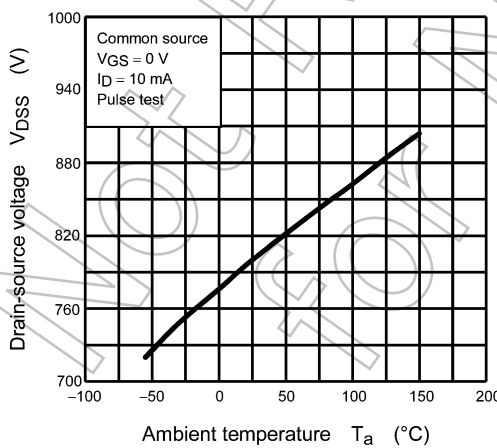


Fig. 8.5  $V_{DSS} - T_a$

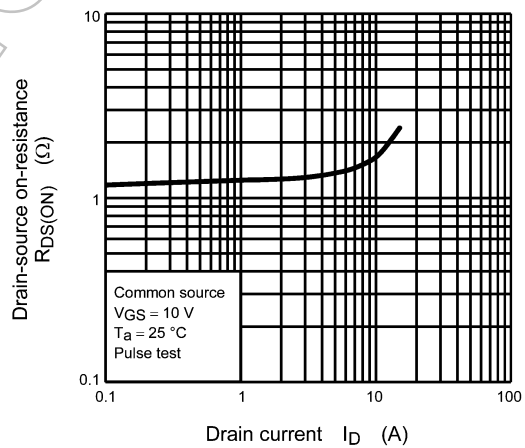


Fig. 8.6  $R_{DS(ON)} - I_D$

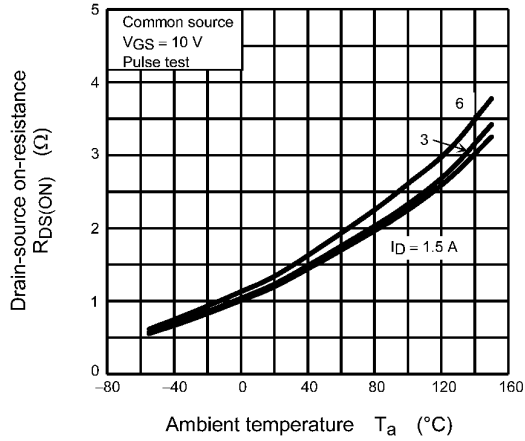


Fig. 8.7  $R_{DS(ON)} - T_a$

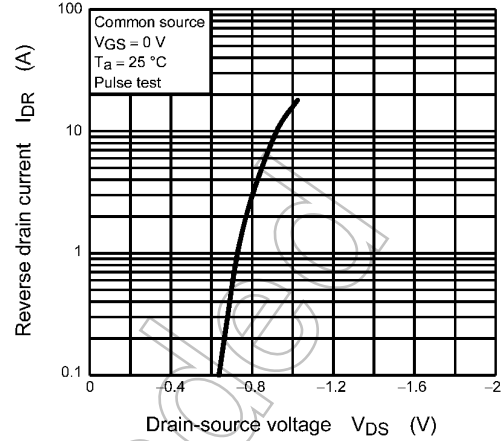


Fig. 8.8  $I_{DR} - V_{DS}$

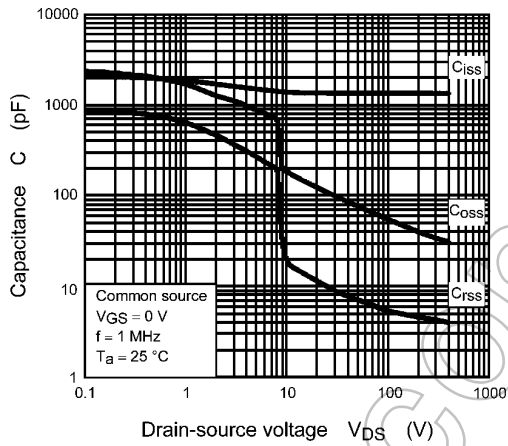


Fig. 8.9 C -  $V_{DS}$

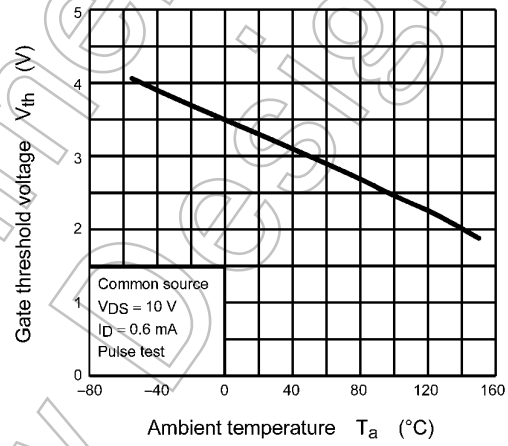


Fig. 8.10  $V_{th} - T_a$

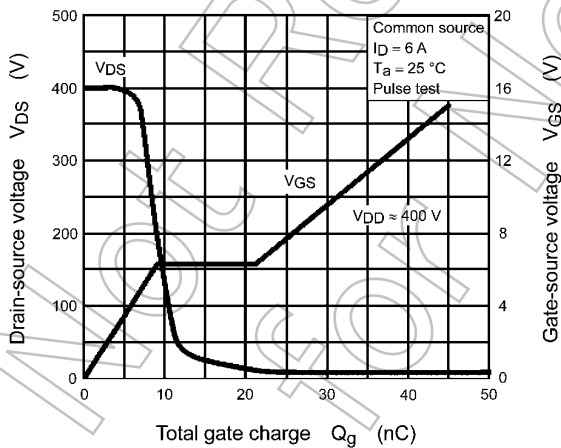


Fig. 8.11 Dynamic Input/Output Characteristics

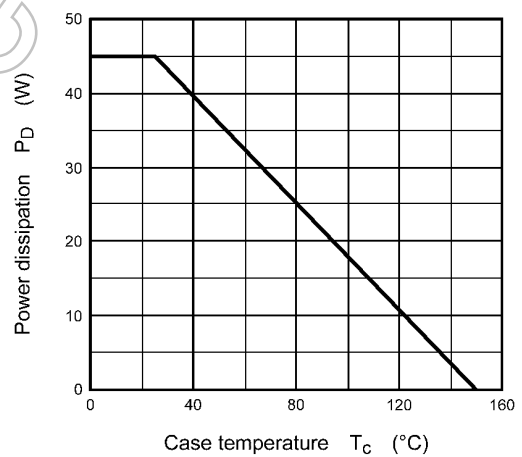
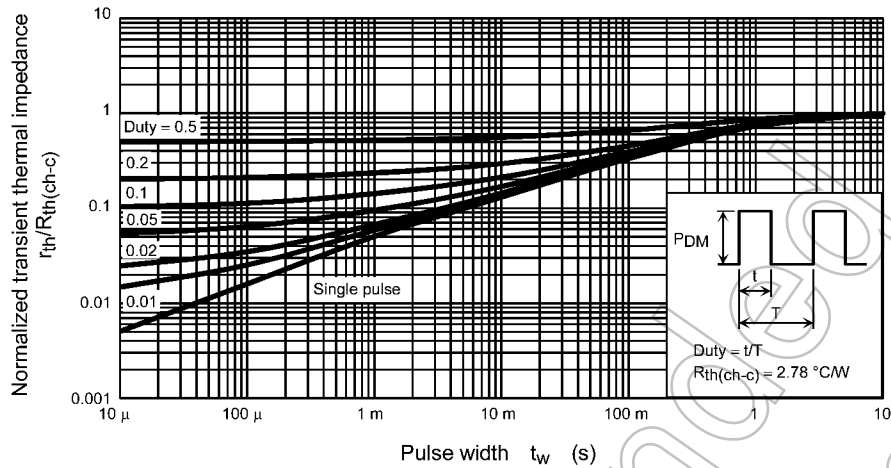
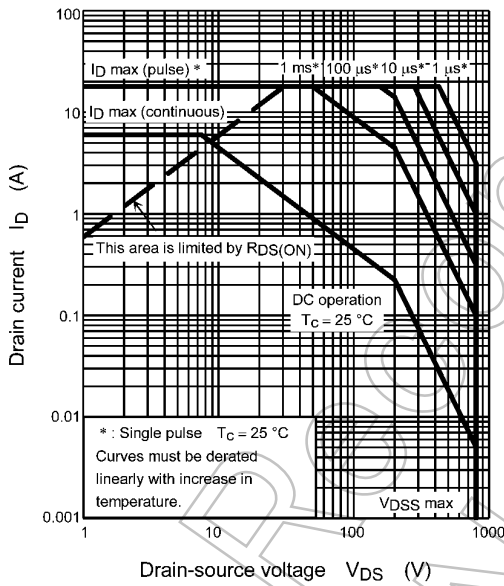


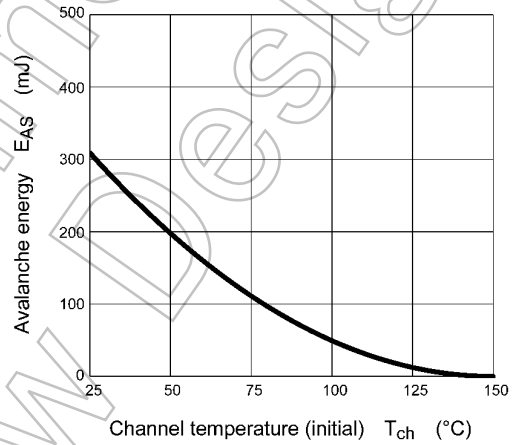
Fig. 8.12  $P_D - T_c$   
(Guaranteed Maximum)



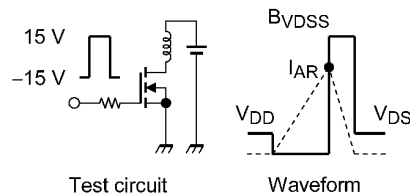
**Fig. 8.13  $r_{th} - t_w$**   
(Guaranteed Maximum)



**Fig. 8.14 Safe Operating Area**  
(Guaranteed Maximum)



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



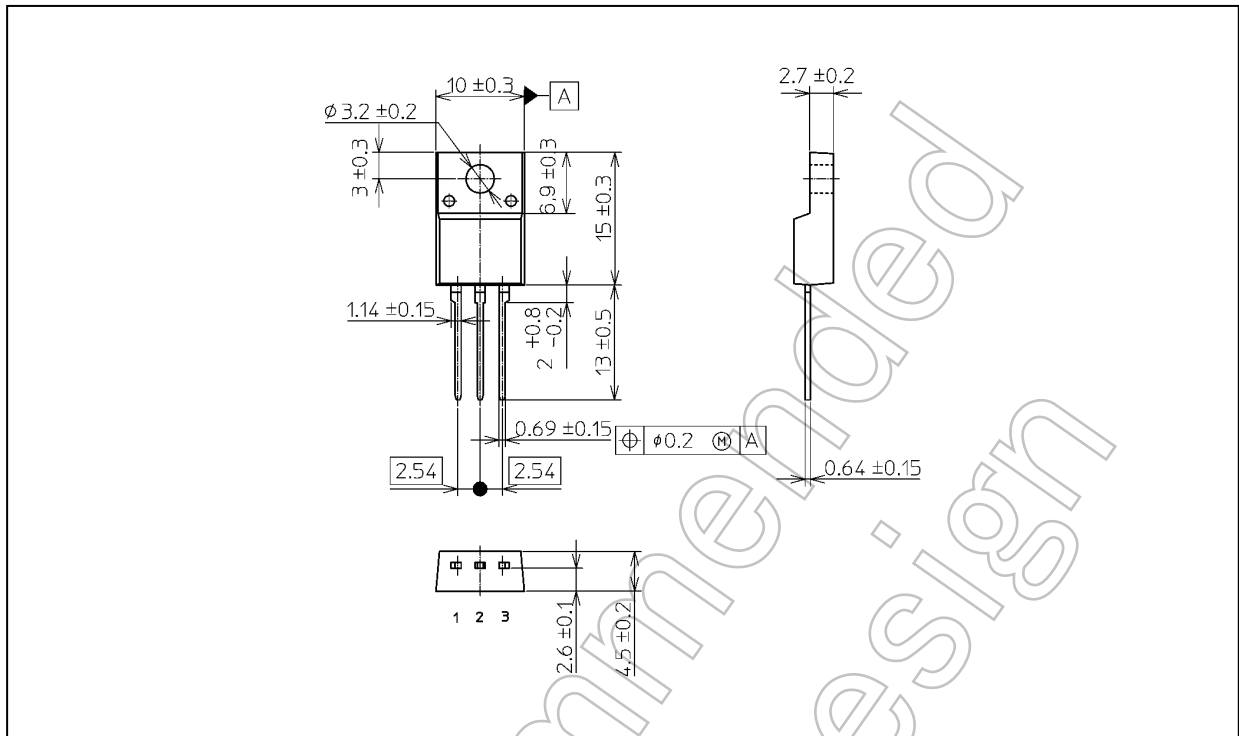
$$R_G = 25 \Omega, V_{DD} = 90 \text{ V} \quad E_{AS} = \frac{1}{2} \cdot L \cdot I_{AR}^2 \cdot \left[ \frac{B_{VDSS}}{B_{VDSS} - V_{DD}} \right]$$

**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: 1.7 g (typ.)

| Package Name(s)     |
|---------------------|
| JEITA: SC-67        |
| TOSHIBA: 2-10U1S    |
| Nickname: TO-220SIS |

Not Recommended for New Design

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