

# TK6A80E

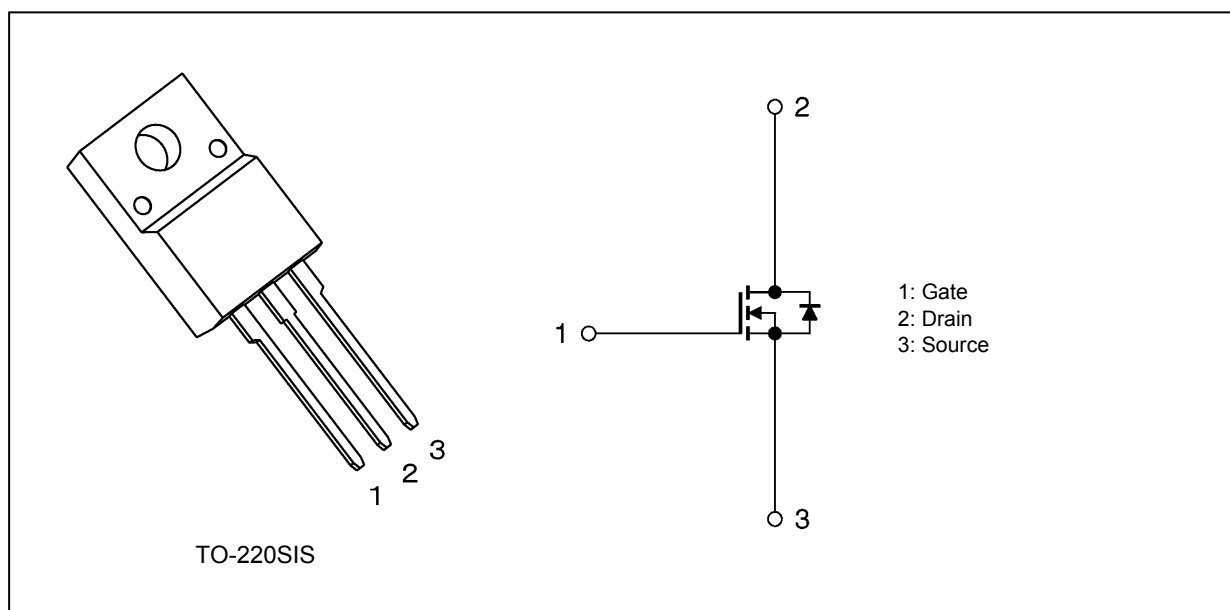
## 1. Applications

- Switching Voltage Regulators

## 2. Features

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

## 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),  $L = 15.5\text{ mH}$ ,  $R_G = 25\text{ }\Omega$ ,  $I_{AR} = 6\text{ A}$

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 | —   | pF       |
| Reverse transfer capacitance   | $C_{rss}$ |                                                                     | —   | 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     |

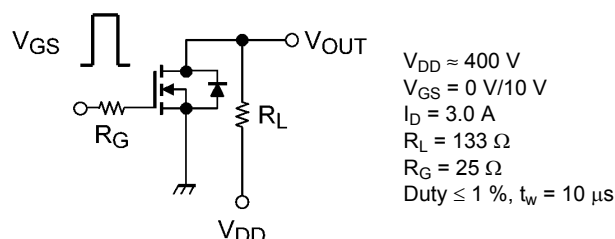


Fig. 6.2.1 Switching Time Test Circuit

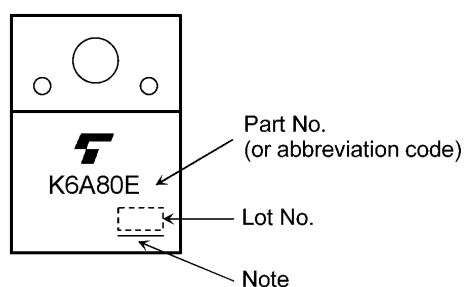
### 6.3. Gate Charge Characteristics ( $T_a = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

| 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.

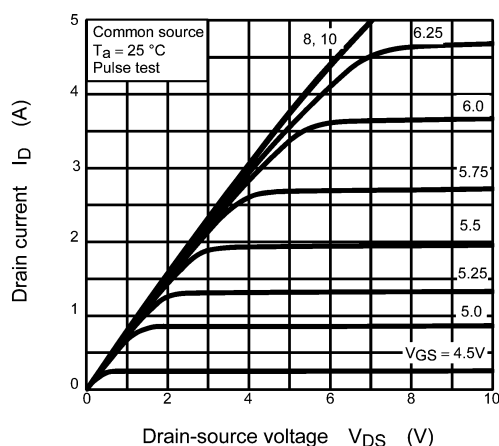
Not underlined: [[Pb]]/INCLUDES > MCV

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

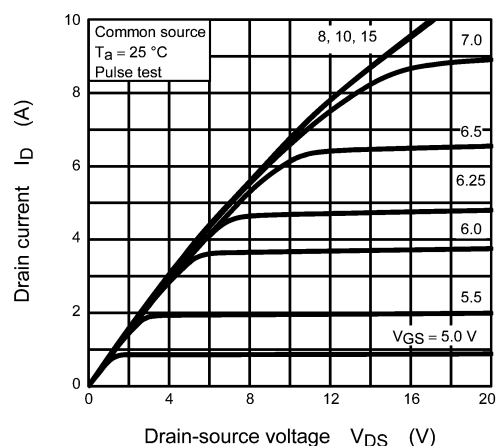
Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.

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.

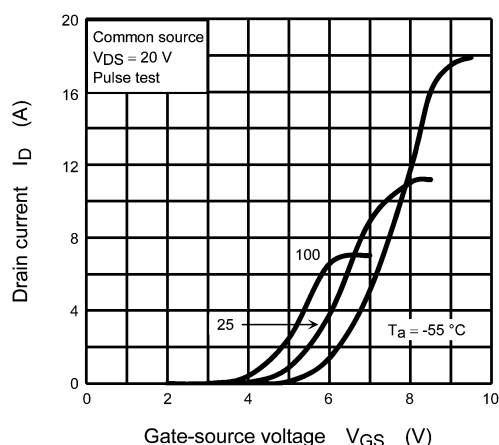
# 8. Characteristics Curves (Note)



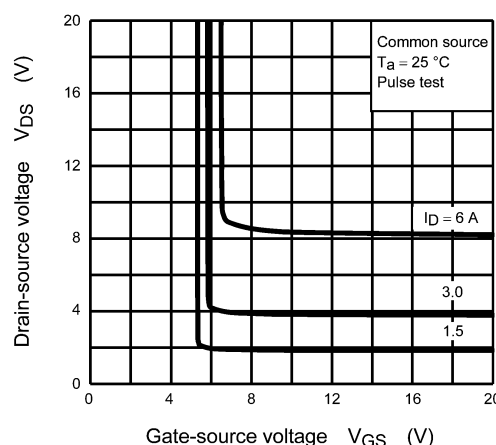
**Fig. 8.1  $I_D - V_{DS}$**



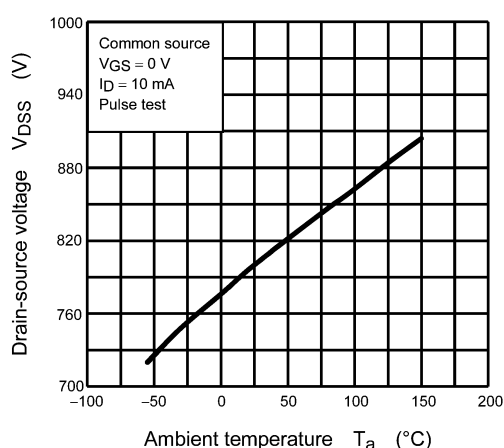
**Fig. 8.2  $I_D - V_{DS}$**



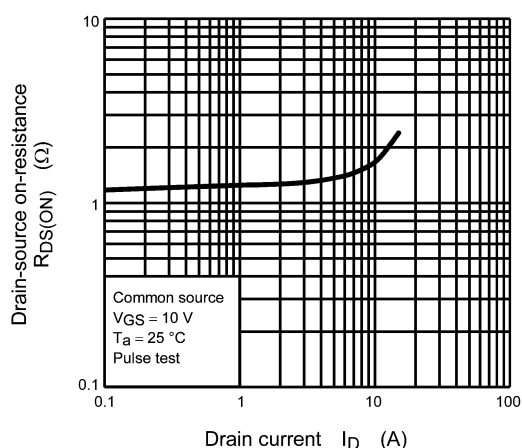
**Fig. 8.3  $I_D - V_{GS}$**



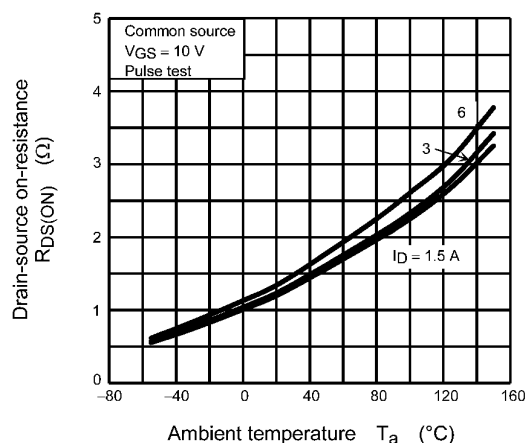
**Fig. 8.4  $V_{DS} - V_{GS}$**



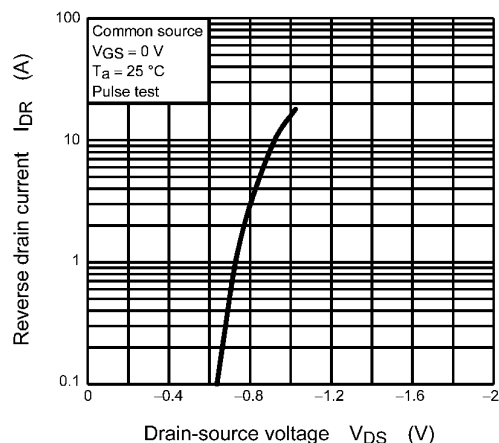
**Fig. 8.5  $V_{DS} - T_a$**



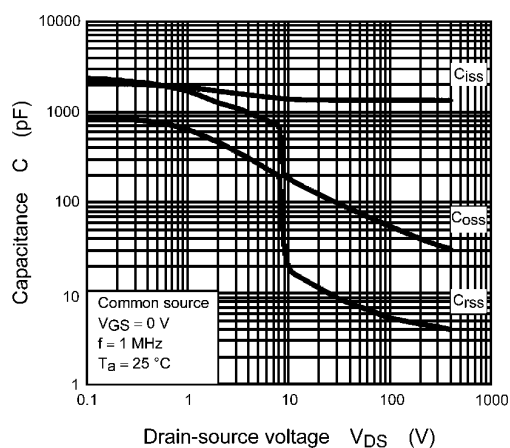
**Fig. 8.6  $R_{DS(ON)} - I_D$**



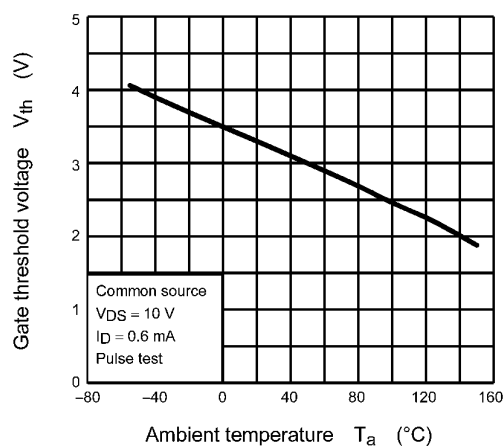
**Fig. 8.7  $R_{DS(ON)} - T_a$**



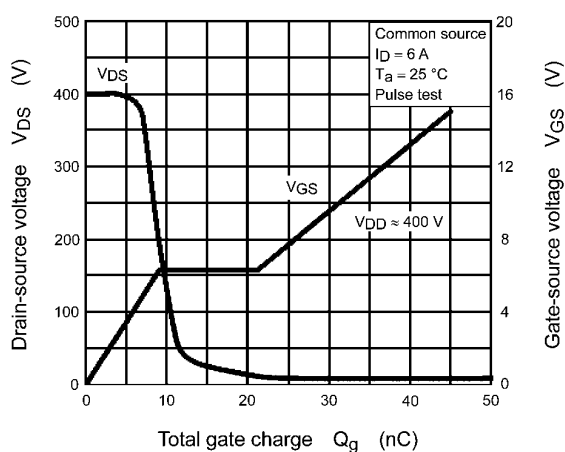
**Fig. 8.8  $I_{DR} - V_{DS}$**



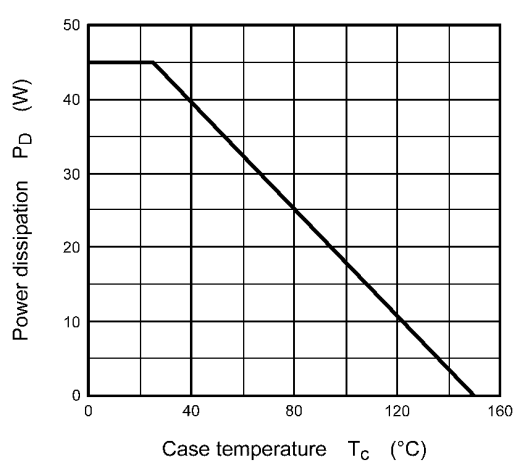
**Fig. 8.9  $C - V_{DS}$**



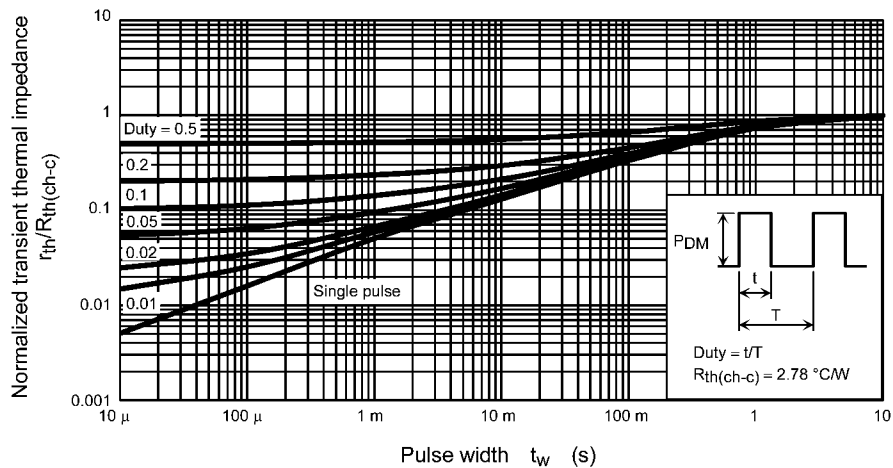
**Fig. 8.10  $V_{th} - T_a$**



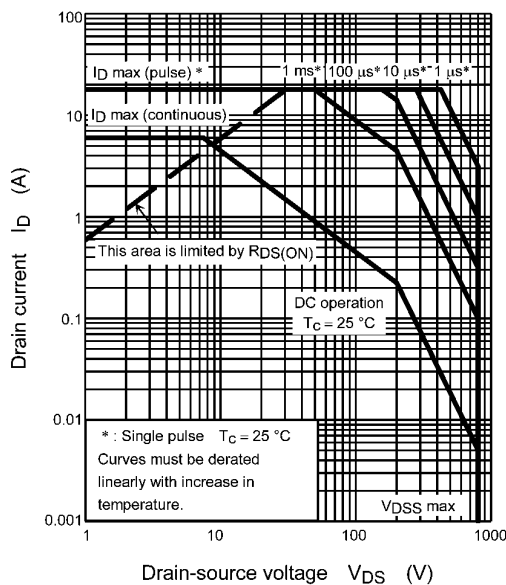
**Fig. 8.11 Dynamic Input/Output Characteristics**



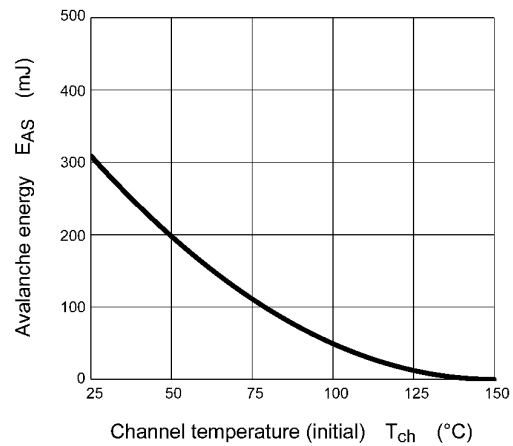
**Fig. 8.12  $P_D - T_c$   
(Guaranteed Maximum)**



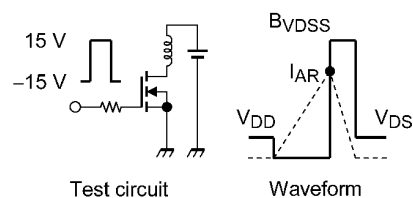
**Fig. 8.13  $r_{th} - t_w$**   
(Guaranteed Maximum)



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



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



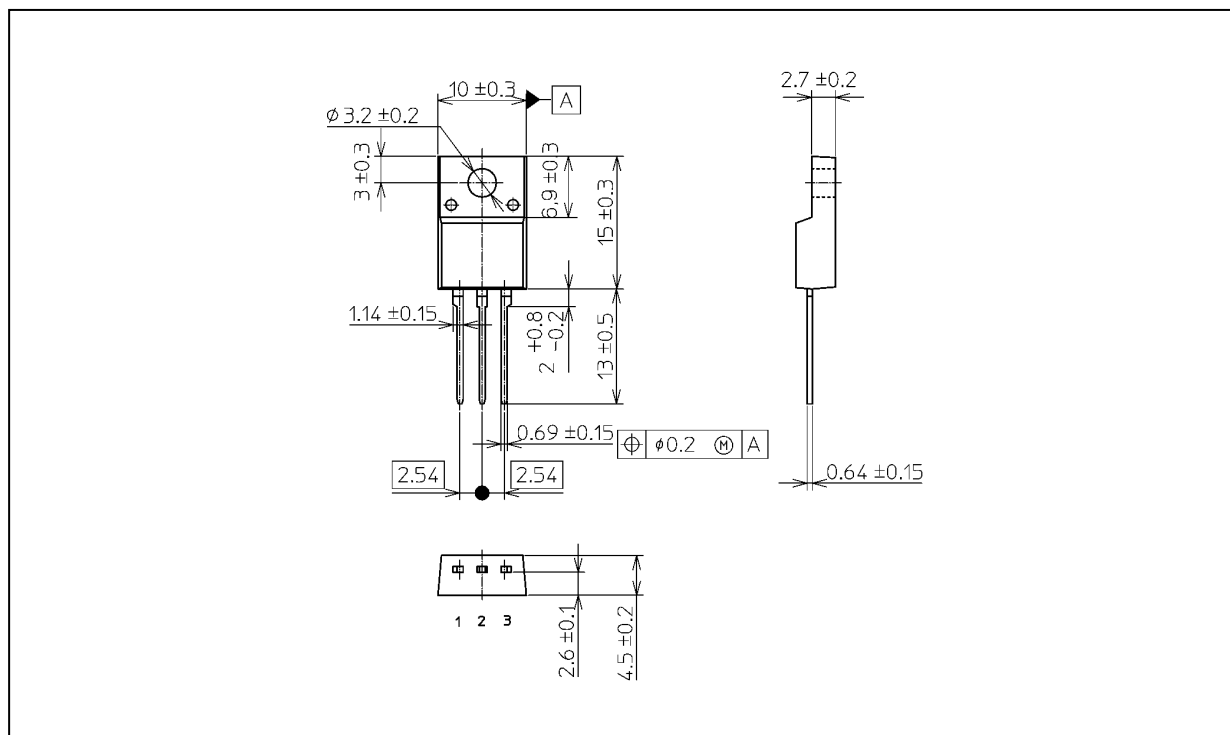
$$R_G = 25 \, \Omega, V_{DD} = 90 \, V \quad E_{AS} = \frac{1}{2} \cdot L \cdot I_{AR}^2 \cdot \left( \frac{B_{VDSS}}{B_{VDSS} - V_{DD}} \right)$$

**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 |



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