

# TPC8067-H

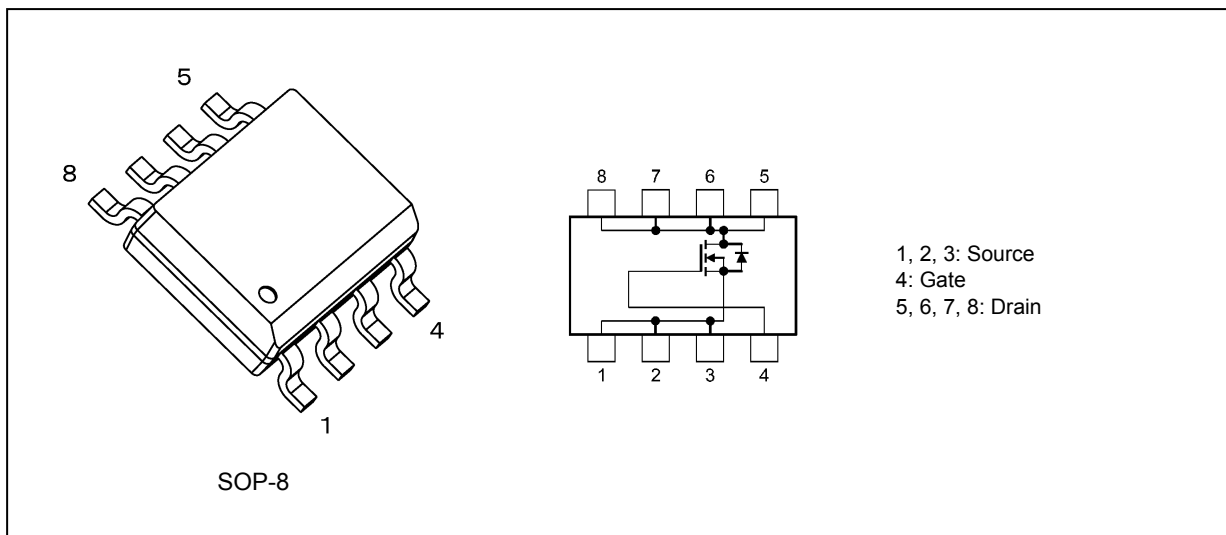
## 1. Applications

- High-Efficiency DC-DC Converters
- Notebook PCs
- Mobile Handsets

## 2. Features

- (1) Small, thin package
- (2) High-speed switching
- (3) Small gate charge:  $Q_{SW} = 1.9 \text{ nC (typ.)}$
- (4) Low drain-source on-resistance:  $R_{DS(ON)} = 26 \text{ m}\Omega \text{ (typ.)}$  ( $V_{GS} = 4.5 \text{ V}$ )
- (5) Low leakage current:  $I_{DSS} = 10 \text{ }\mu\text{A (max)}$  ( $V_{DS} = 30 \text{ V}$ )
- (6) Enhancement mode:  $V_{th} = 1.3 \text{ to } 2.3 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 0.1 \text{ mA}$ )

## 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                     | $V_{\text{DSS}}$ | 30         | V                |
| Gate-source voltage                      | $V_{\text{GSS}}$ | -20/+20    |                  |
| Drain current (DC) (Note 1)              | $I_{\text{D}}$   | 9          | A                |
| Drain current (pulsed) (Note 1)          | $I_{\text{DP}}$  | 36         |                  |
| Power dissipation ( $t = 10$ s) (Note 2) | $P_{\text{D}}$   | 1.9        | W                |
| Power dissipation ( $t = 10$ s) (Note 3) | $P_{\text{D}}$   | 1.0        | W                |
| Single-pulse avalanche energy (Note 4)   | $E_{\text{AS}}$  | 21         | mJ               |
| Avalanche current                        | $I_{\text{AR}}$  | 9          | A                |
| Channel temperature                      | $T_{\text{ch}}$  | 150        | $^\circ\text{C}$ |
| Storage temperature                      | $T_{\text{stg}}$ | -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.).

#### 5. Thermal Characteristics

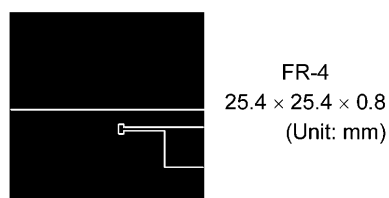
| Characteristics                                              | Symbol                | Max  | Unit               |
|--------------------------------------------------------------|-----------------------|------|--------------------|
| Channel-to-ambient thermal resistance ( $t = 10$ s) (Note 2) | $R_{\text{th(ch-a)}}$ | 65.7 | $^\circ\text{C/W}$ |
| Channel-to-ambient thermal resistance ( $t = 10$ s) (Note 3) | $R_{\text{th(ch-a)}}$ | 125  | $^\circ\text{C/W}$ |

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

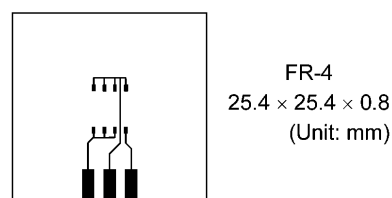
Note 2: Device mounted on a glass-epoxy board (a), Figure 5.1

Note 3: Device mounted on a glass-epoxy board (b), Figure 5.2

Note 4:  $V_{\text{DD}} = 24$  V,  $T_{\text{ch}} = 25^\circ\text{C}$  (initial),  $L = 0.2$  mH,  $R_{\text{G}} = 1.2$   $\Omega$ ,  $I_{\text{AR}} = 9$  A



**Fig. 5.1 Device Mounted on a Glass-Epoxy Board (a)**



**Fig. 5.2 Device Mounted on a Glass-Epoxy Board (b)**

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           | $I_{GSS}$     | $V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$ | —   | —    | $\pm 0.1$ | $\mu\text{A}$    |
| Drain cut-off current          | $I_{DSS}$     | $V_{DS} = 30\text{ V}$ , $V_{GS} = 0\text{ V}$     | —   | —    | 10        |                  |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $I_D = 10\text{ mA}$ , $V_{GS} = 0\text{ V}$       | 30  | —    | —         | V                |
|                                | $V_{(BR)DSX}$ | $I_D = 10\text{ mA}$ , $V_{GS} = -20\text{ V}$     | 15  | —    | —         |                  |
| Gate threshold voltage         | $V_{th}$      | $V_{DS} = 10\text{ V}$ , $I_D = 0.1\text{ mA}$     | 1.3 | —    | 2.3       |                  |
| Drain-source on-resistance     | $R_{DS(ON)}$  | $V_{GS} = 4.5\text{ V}$ , $I_D = 4.5\text{ A}$     | —   | 26   | 33        | $\text{m}\Omega$ |
|                                |               | $V_{GS} = 10\text{ V}$ , $I_D = 4.5\text{ A}$      | —   | 20   | 25        |                  |

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

| Characteristics                | Symbol    | Test Condition                                                      | Min | Typ. | Max | Unit        |
|--------------------------------|-----------|---------------------------------------------------------------------|-----|------|-----|-------------|
| Input capacitance              | $C_{iss}$ | $V_{DS} = 10\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$ | —   | 690  | —   | $\text{pF}$ |
| Reverse transfer capacitance   | $C_{rss}$ |                                                                     | —   | 28   | —   |             |
| Output capacitance             | $C_{oss}$ |                                                                     | —   | 120  | —   |             |
| Gate resistance                | $r_g$     | $V_{DS} = 10\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 5\text{ MHz}$ | —   | 3.4  | 5.1 | $\Omega$    |
| Switching time (rise time)     | $t_r$     | See Figure 6.2.1.                                                   | —   | 2.1  | —   | ns          |
| Switching time (turn-on time)  | $t_{on}$  |                                                                     | —   | 6.7  | —   |             |
| Switching time (fall time)     | $t_f$     |                                                                     | —   | 2.1  | —   |             |
| Switching time (turn-off time) | $t_{off}$ |                                                                     | —   | 15   | —   |             |

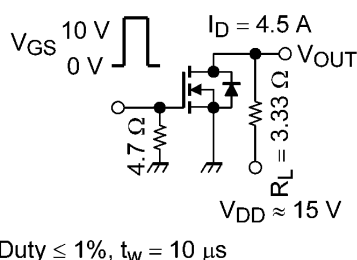


Fig. 6.2.1 Switching Time Test Circuit

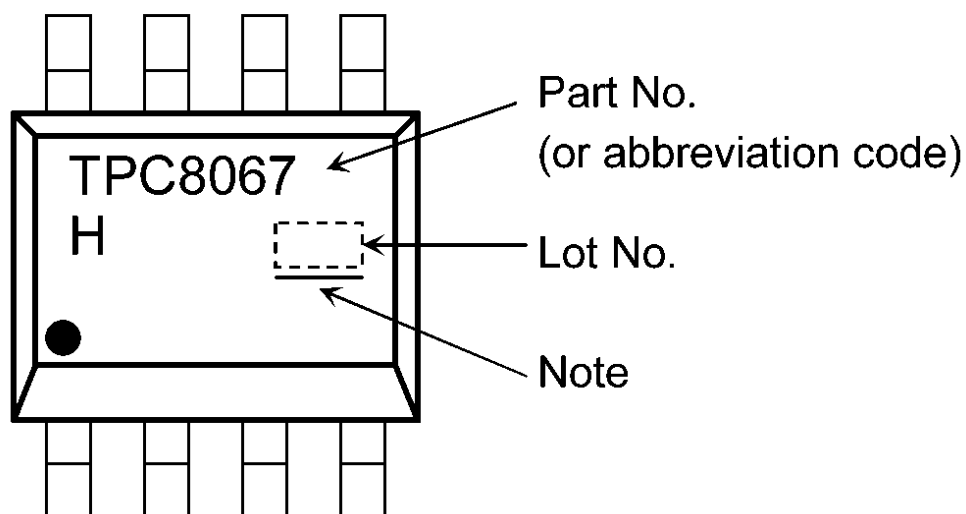
### 6.3. Gate Charge Characteristics ( $T_a = 25^\circ\text{C}$ unless otherwise specified)

| Characteristics                                 | Symbol    | Test Condition                                                             | Min | Typ. | Max | Unit |
|-------------------------------------------------|-----------|----------------------------------------------------------------------------|-----|------|-----|------|
| Total gate charge (gate-source plus gate-drain) | $Q_g$     | $V_{DD} \approx 24\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 9\text{ A}$ | —   | 9.5  | —   | nC   |
|                                                 |           | $V_{DD} \approx 24\text{ V}$ , $V_{GS} = 5\text{ V}$ , $I_D = 9\text{ A}$  | —   | 4.7  | —   |      |
| Gate-source charge 1                            | $Q_{gs1}$ | $V_{DD} \approx 24\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 9\text{ A}$ | —   | 2.2  | —   |      |
| Gate-drain charge                               | $Q_{gd}$  |                                                                            | —   | 0.9  | —   |      |
| Gate switch charge                              | $Q_{sw}$  |                                                                            | —   | 1.9  | —   |      |

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

| Characteristics                       | Symbol    | Test Condition                                | Min | Typ. | Max  | Unit |
|---------------------------------------|-----------|-----------------------------------------------|-----|------|------|------|
| Pulsed reverse drain current (Note 5) | $I_{DRP}$ | —                                             | —   | —    | 36   | A    |
| Diode forward voltage                 | $V_{DSF}$ | $I_{DR} = 9\text{ A}$ , $V_{GS} = 0\text{ V}$ | —   | —    | -1.2 | V    |

Note 5: Ensure that the channel temperature does not exceed  $150^\circ\text{C}$ .

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

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

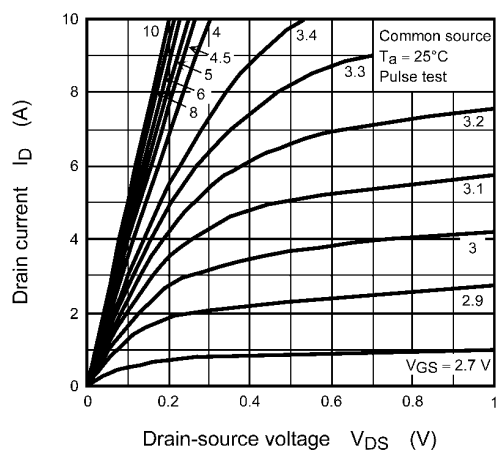
Not underlined: [[Pb]]/INCLUDES > MCV

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

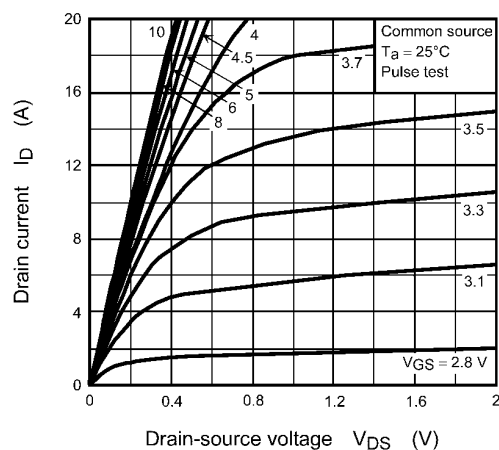
Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.

The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

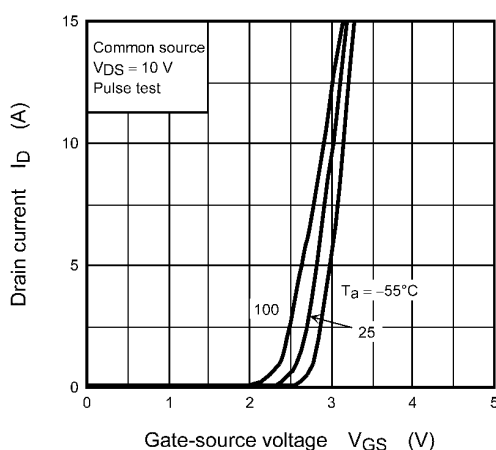
# 8. Characteristics Curves (Note)



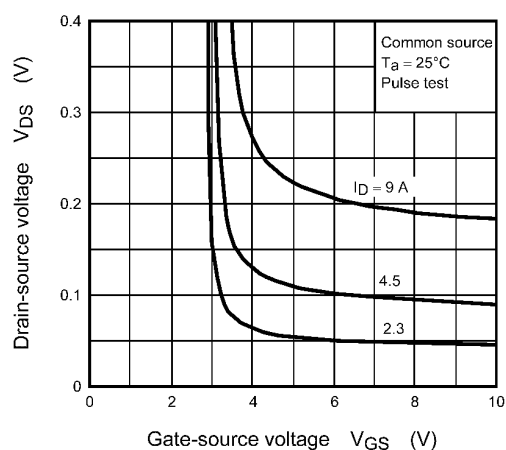
**Fig. 8.1  $I_D - V_{DS}$**



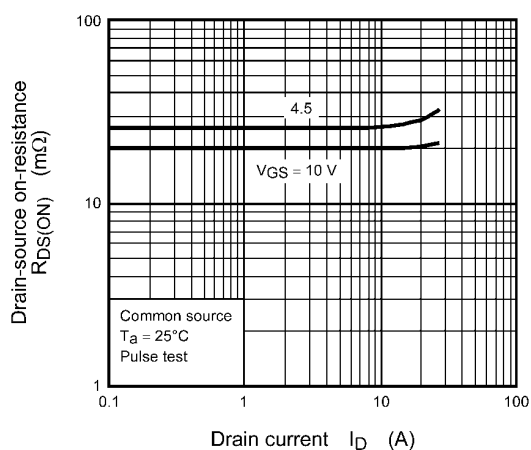
**Fig. 8.2  $I_D - V_{DS}$**



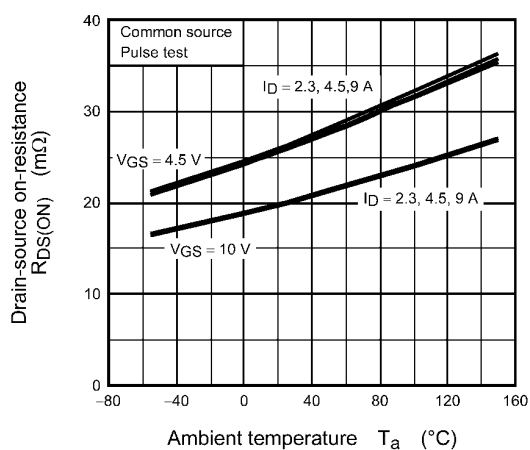
**Fig. 8.3  $I_D - V_{GS}$**



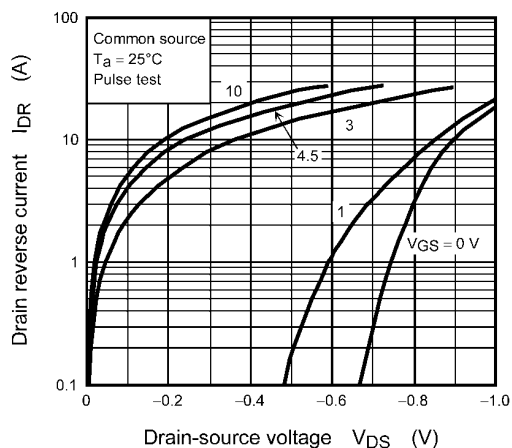
**Fig. 8.4  $V_{DS} - V_{GS}$**



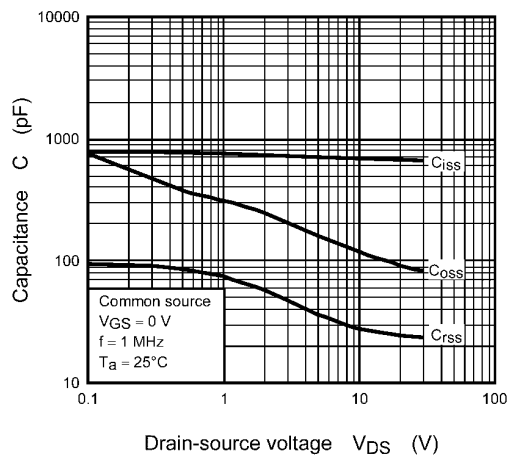
**Fig. 8.5  $R_{DS(ON)} - I_D$**



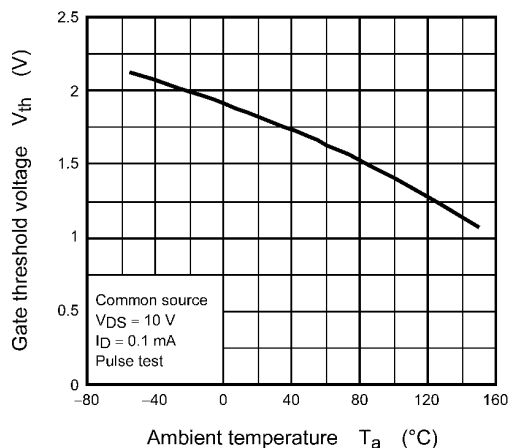
**Fig. 8.6  $R_{DS(ON)} - T_a$**



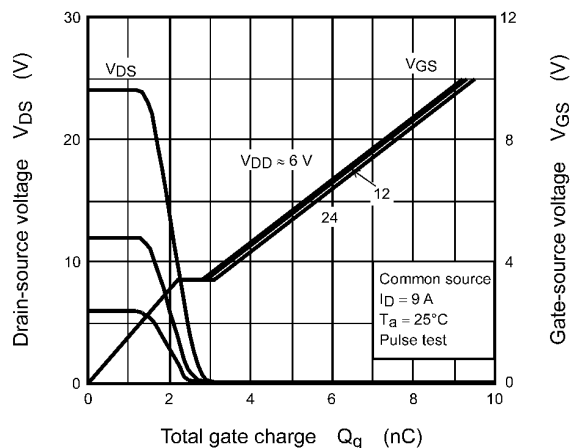
**Fig. 8.7  $I_{DR} - V_{DS}$**



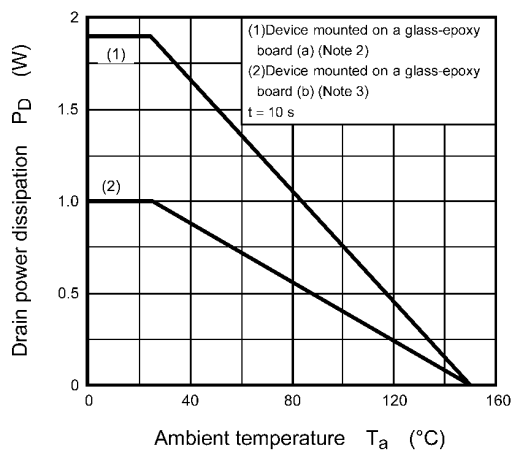
**Fig. 8.8 Capacitance -  $V_{DS}$**



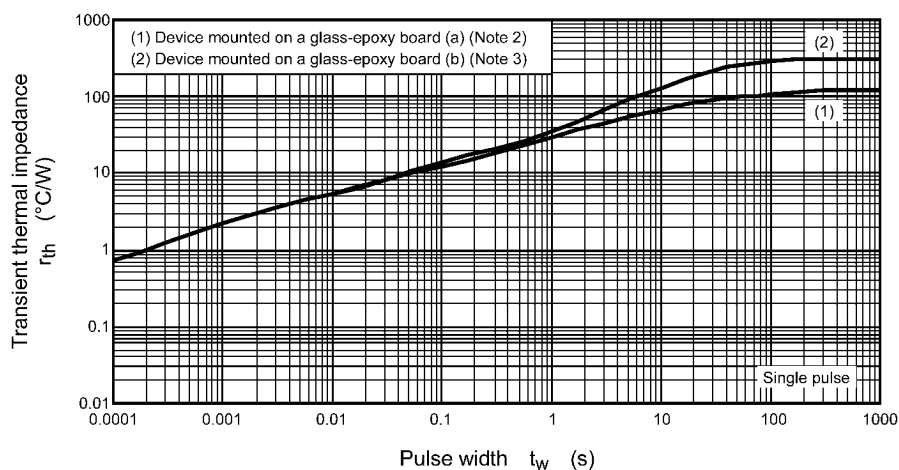
**Fig. 8.9  $V_{th} - T_a$**



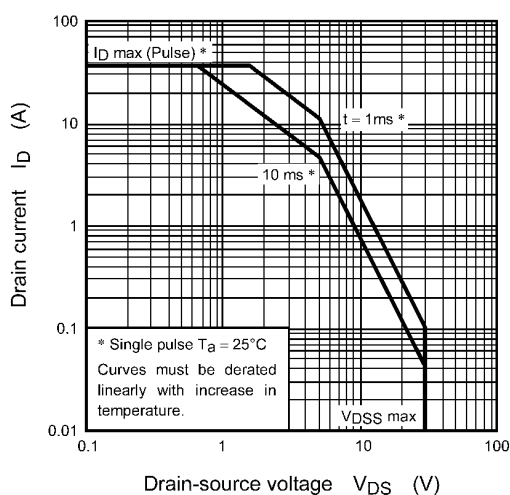
**Fig. 8.10 Dynamic Input/Output Characteristics**



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



**Fig. 8.12  $r_{th} - t_w$**   
(Guaranteed Maximum)

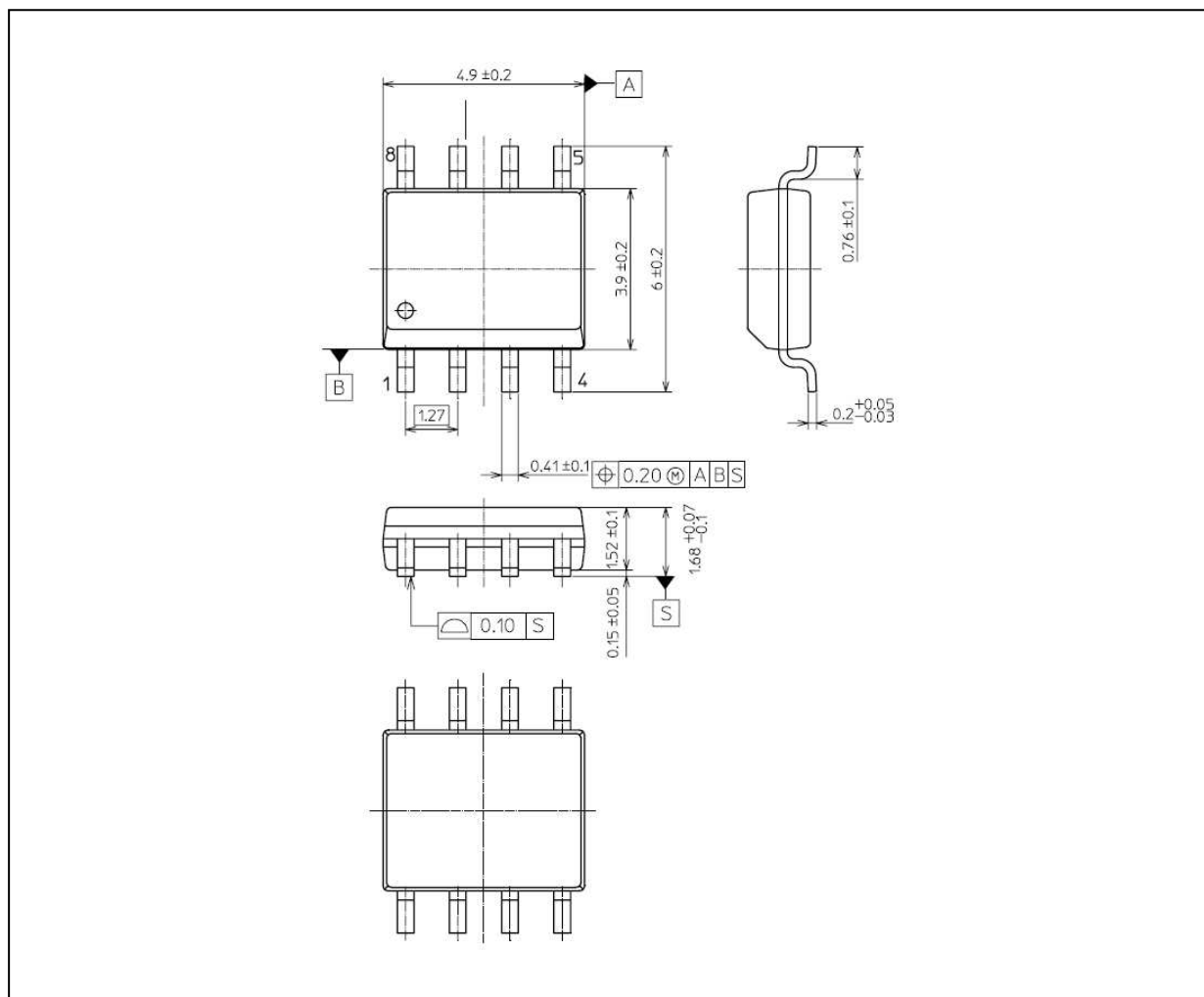


**Fig. 8.13 Safe Operating Area**  
(Guaranteed Maximum)

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

## Package Dimensions

Unit: mm



Weight: 0.085 g (typ.)

| Package Name(s) |
|-----------------|
| TOSHIBA: 2-5R1S |
| Nickname: SOP-8 |

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