

# TPC8092

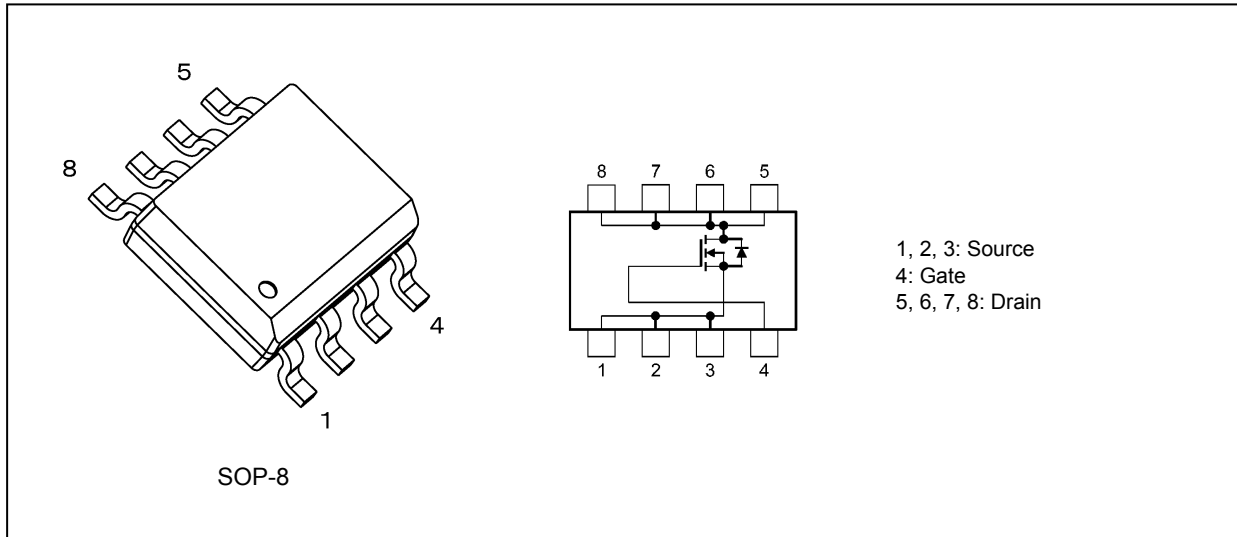
## 1. Applications

- Lithium-Ion Secondary Batteries
- Power Management Switches
- Notebook PCs

## 2. Features

- (1) Small footprint due to a small and thin package
- (2) Low drain-source on-resistance:  $R_{DS(ON)} = 7.6 \text{ m}\Omega$  (typ.) ( $V_{GS} = 10 \text{ V}$ )
- (3) Low leakage current:  $I_{DSS} = 10 \text{ }\mu\text{A}$  (max) ( $V_{DS} = 30 \text{ V}$ )
- (4) Enhancement mode:  $V_{th} = 1.3 \text{ to } 2.3 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 0.2 \text{ mA}$ )

## 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          | $V_{DSS}$                 | 30         | V                |
| Gate-source voltage           | $V_{GSS}$                 | $\pm 20$   |                  |
| Drain current (DC)            | (Note 1) $I_D$            | 15         | A                |
| Drain current (pulsed)        | (Note 1) $I_{DP}$         | 60         |                  |
| Power dissipation             | (t = 10 s) (Note 2) $P_D$ | 1.9        | W                |
| Power dissipation             | (t = 10 s) (Note 3) $P_D$ | 1.0        |                  |
| Single-pulse avalanche energy | (Note 4) $E_{AS}$         | 70         | mJ               |
| Avalanche current             | $I_{AR}$                  | 15         |                  |
| 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).

**5. Thermal Characteristics**

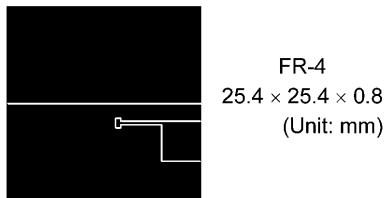
| Characteristics                       |            |          | Symbol         | Max  | Unit |
|---------------------------------------|------------|----------|----------------|------|------|
| Channel-to-ambient thermal resistance | (t = 10 s) | (Note 2) | $R_{th(ch-a)}$ | 65.7 | °C/W |
| Channel-to-ambient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

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

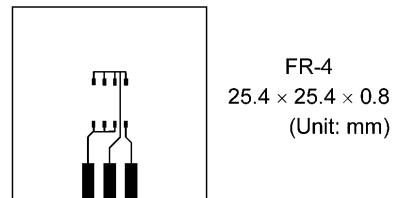
Note 2: Device mounted on a glass-epoxy board (a), Figure 5.1

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

Note 4:  $V_{DD} = 24\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 0.24\text{ mH}$ ,  $R_G = 1.2\ \Omega$ ,  $I_{AR} = 15\text{ A}$



**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.

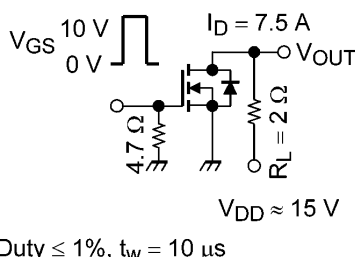
**6. Electrical Characteristics**

**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         | $V_{th}$      | $V_{DS} = 10\text{ V}, I_D = 0.2\text{ mA}$     | 1.3 | —    | 2.3       |                  |
| Drain-source on-resistance     | $R_{DS(ON)}$  | $V_{GS} = 4.5\text{ V}, I_D = 7.5\text{ A}$     | —   | 9.2  | 11.1      | $\text{m}\Omega$ |
|                                |               | $V_{GS} = 10\text{ V}, I_D = 7.5\text{ A}$      | —   | 7.6  | 9         |                  |

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

| Characteristics                | Symbol    | Test Condition  | Min | Typ. | Max | Unit        |
|--------------------------------|-----------|---|-----|------|-----|-------------|
| Input capacitance              | $C_{iss}$ | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | —   | 1800 | —   | $\text{pF}$ |
| Reverse transfer capacitance   | $C_{rss}$ |   | —   | 88   | —   |             |
| Output capacitance             | $C_{oss}$ |   | —   | 330  | —   |             |
| Switching time (rise time)     | $t_r$     | See Figure 6.2.1.   | —   | 2.8  | —   | ns          |
| Switching time (turn-on time)  | $t_{on}$  |   | —   | 9.6  | —   |             |
| Switching time (fall time)     | $t_f$     |   | —   | 8.3  | —   |             |
| Switching time (turn-off time) | $t_{off}$ |   | —   | 39   | —   |             |



**Fig. 6.2.1 Switching Time Test Circuit**

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

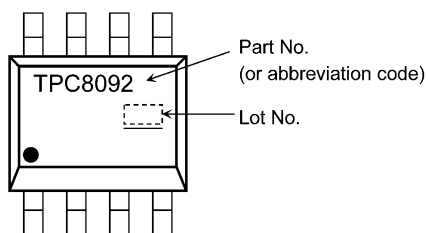
| Characteristics                                 | Symbol    | Test Condition  | Min | Typ. | Max | Unit |
|---|-----------|---|-----|------|-----|------|
| Total gate charge (gate-source plus gate-drain) | $Q_g$     | $V_{DD} \approx 24\text{ V}, V_{GS} = 10\text{ V}, I_D = 15\text{ A}$ | —   | 25   | —   | nC   |
| Gate-source charge 1                            | $Q_{gs1}$ |   | —   | 5.7  | —   |      |
| Gate-drain charge                               | $Q_{gd}$  |   | —   | 2.8  | —   |      |

**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 (pulsed) (Note 5) | $I_{DRP}$ | —   | —   | —    | 60   | A    |
| Diode forward voltage                   | $V_{DSF}$ | $I_{DR} = 15\text{ A}, V_{GS} = 0\text{ V}$ | —   | —    | -1.2 | V    |

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

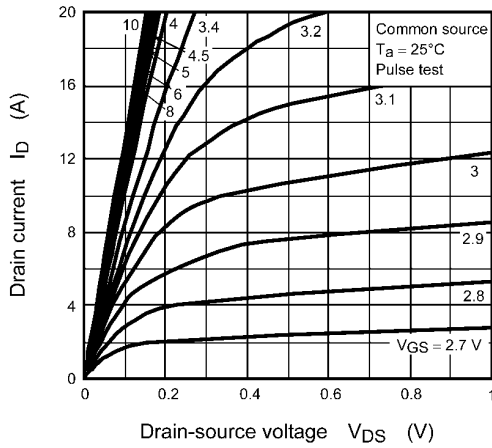
**7. Marking (Note)**



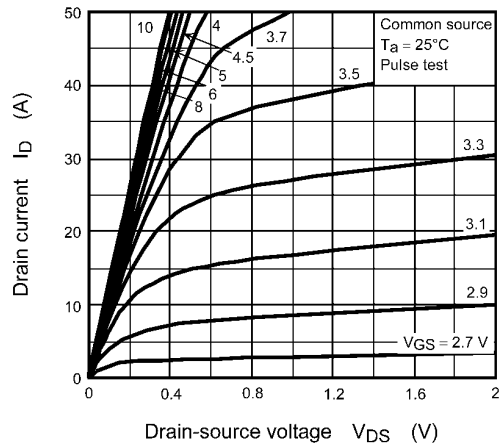
**Fig. 7.1 Marking**

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.

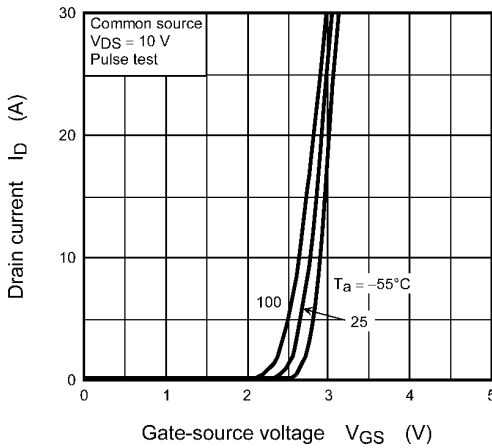
**8. Characteristics Curves (Note)**



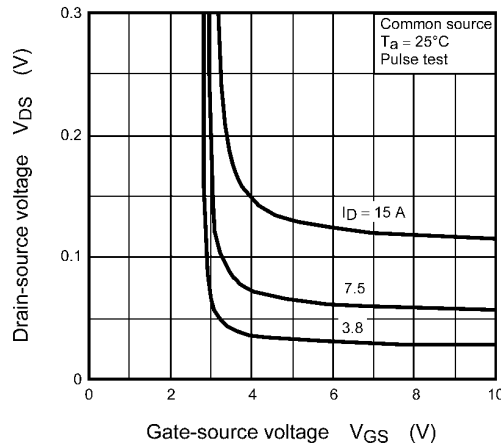
**Fig. 8.1  $I_D - V_{DS}$**



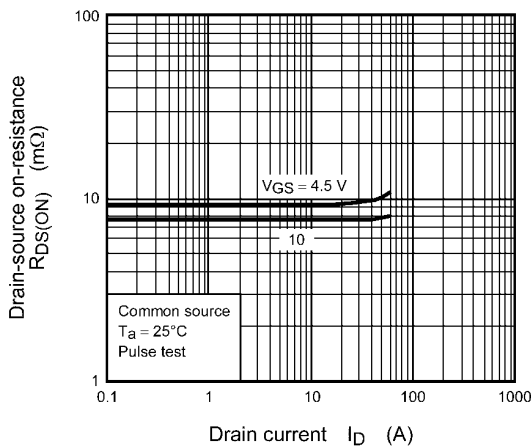
**Fig. 8.2  $I_D - V_{DS}$**



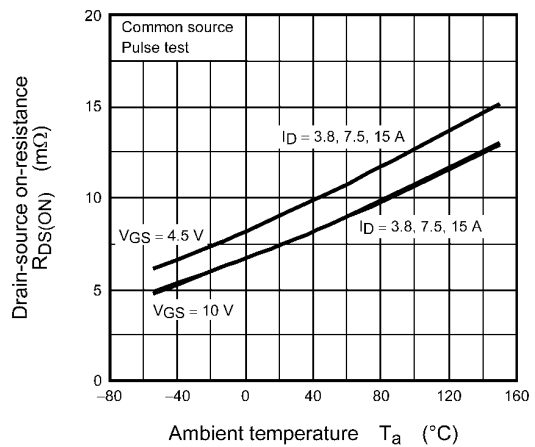
**Fig. 8.3  $I_D - V_{GS}$**



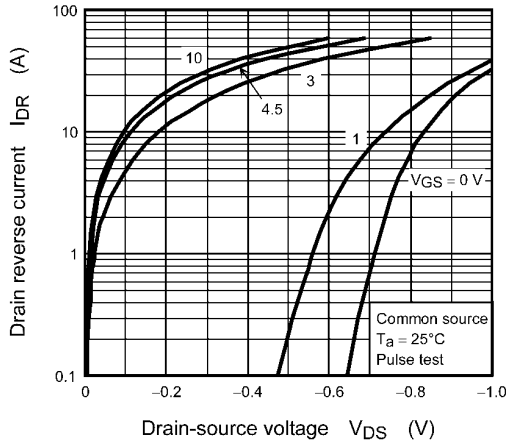
**Fig. 8.4  $V_{DS} - V_{GS}$**



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



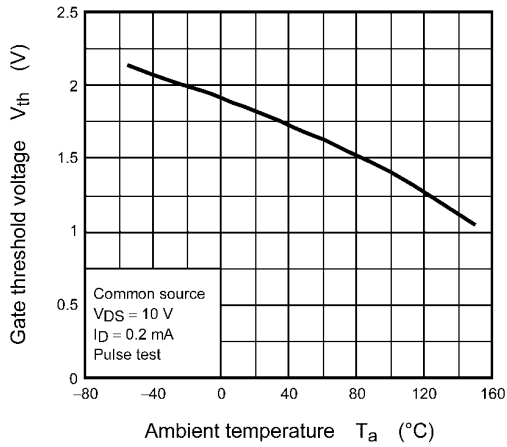
**Fig. 8.6  $R_{DS(ON)} - T_a$**



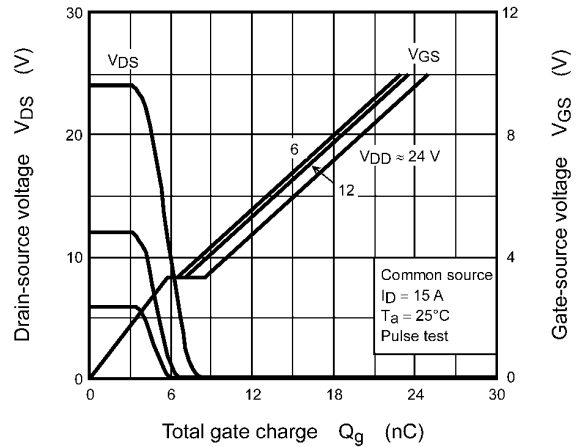
**Fig. 8.7  $I_{DR} - V_{DS}$**



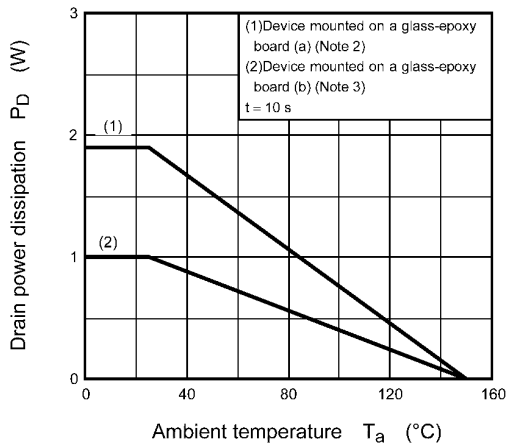
**Fig. 8.8 Capacitance -  $V_{DS}$**



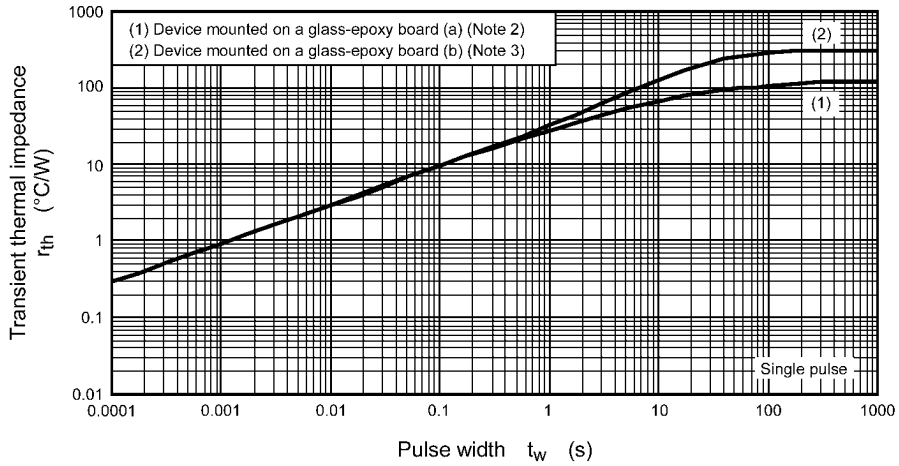
**Fig. 8.9  $V_{th} - T_a$**



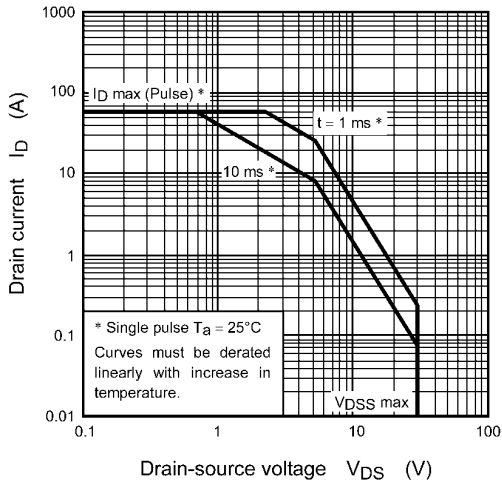
**Fig. 8.10 Dynamic Input/Output Characteristics**



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



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

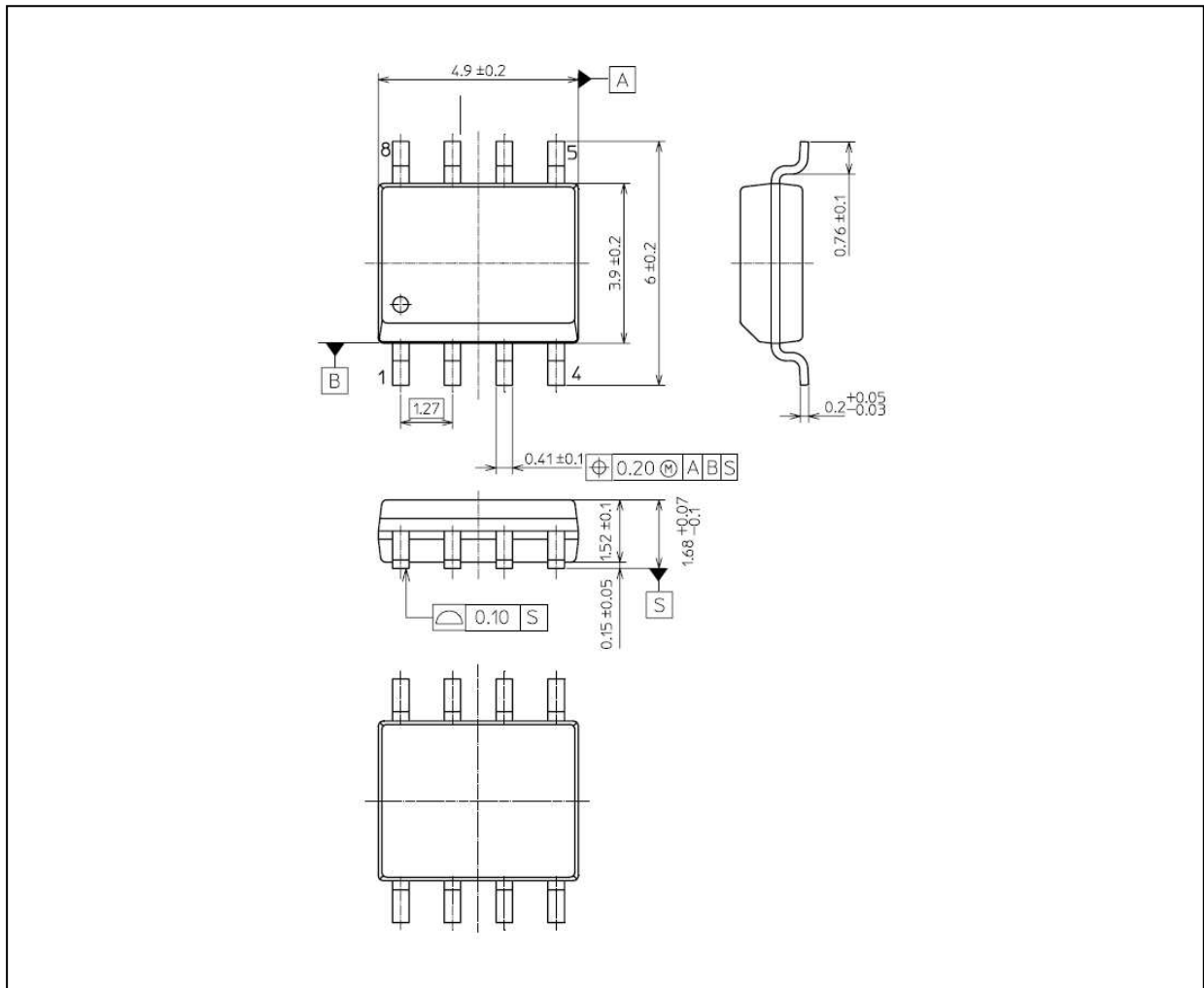


**Fig. 8.13 Safe Operating Area**  
**(Guaranteed Maximum)**

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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