

# TPCP8206

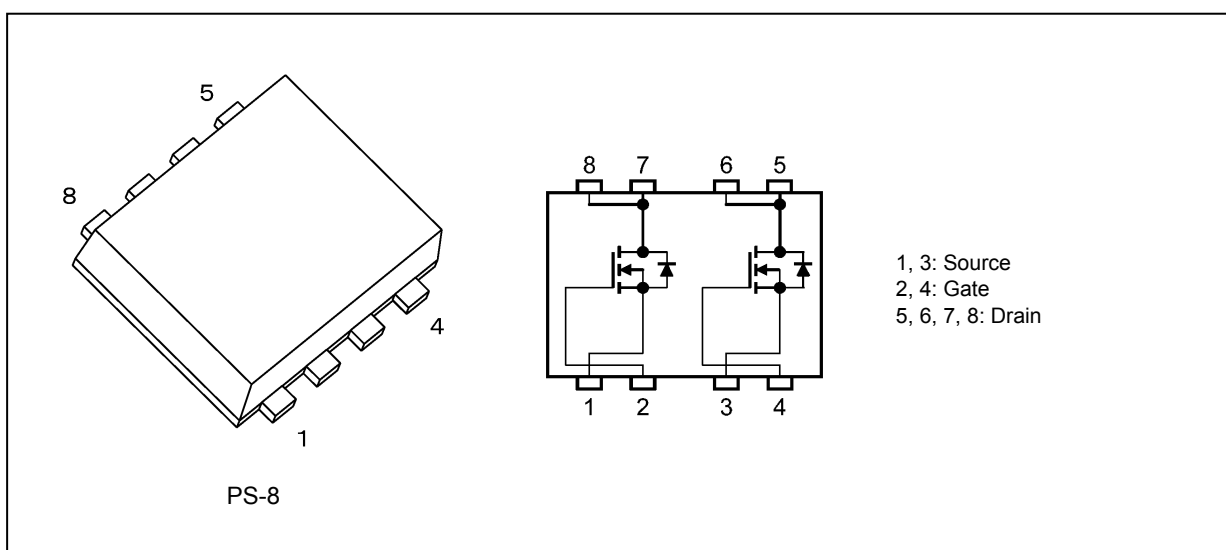
## 1. Applications

- Mobile Equipments

## 2. Features

- (1) Small footprint due to a small and thin package
- (2) Low drain-source on-resistance:  $R_{DS(ON)} = 19 \text{ m}\Omega$  (typ.) ( $V_{GS} = 4.5 \text{ V}$ )
- (3) Low leakage current:  $I_{DSS} = 10 \text{ }\mu\text{A}$  (max) ( $V_{DS} = 20 \text{ V}$ )
- (4) Enhancement mode:  $V_{th} = 0.5$  to  $1.2 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 0.2 \text{ mA}$ )

## 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                                                           | $V_{DS}$   | 20         | V                |
| Gate-source voltage                                                            | $V_{GS}$   | $\pm 12$   |                  |
| Drain current (DC) (Note 1)                                                    | $I_D$      | 6.0        | A                |
| Drain current (pulsed) (Note 1)                                                | $I_{DP}$   | 20         |                  |
| Power dissipation (single operation) (t = 5 s) (Note 2), (Note 4)              | $P_{D(1)}$ | 1.48       | W                |
| Power dissipation (per device for dual operation) (t = 5 s) (Note 2), (Note 5) | $P_{D(2)}$ | 1.23       |                  |
| Power dissipation (single operation) (t = 5 s) (Note 3), (Note 4)              | $P_{D(1)}$ | 0.58       |                  |
| Power dissipation (per device for dual operation) (t = 5 s) (Note 3), (Note 5) | $P_{D(2)}$ | 0.36       |                  |
| Single-pulse avalanche energy (Note 6)                                         | $E_{AS}$   | 23.4       | mJ               |
| Avalanche current                                                              | $I_{AR}$   | 6.0        | A                |
| 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 (single operation) (t = 5 s) (Note 2), (Note 4)              | $R_{th(ch-a)(1)}$ | 84.4  | °C/W |
| Channel-to-ambient thermal resistance (per device for dual operation) (t = 5 s) (Note 2), (Note 5) | $R_{th(ch-a)(2)}$ | 101.6 |      |
| Channel-to-ambient thermal resistance (single operation) (t = 5 s) (Note 3), (Note 4)              | $R_{th(ch-a)(1)}$ | 215.5 |      |
| Channel-to-ambient thermal resistance (per device for dual operation) (t = 5 s) (Note 3), (Note 5) | $R_{th(ch-a)(2)}$ | 347.2 |      |

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

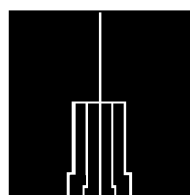
Note 2: Device mounted on a glass-epoxy board (a), Figure 5.1

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

Note 4: Power dissipation and thermal resistance values per device with the other device being off (During single operation, power is supplied to only one of the two devices.)

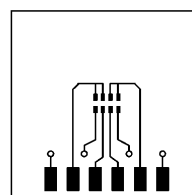
Note 5: Power dissipation and thermal resistance values per device for dual operation (During dual operation, power is evenly supplied to both devices.)

Note 6:  $V_{DD} = 16\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 0.5\text{ mH}$ ,  $R_G = 1\ \Omega$ ,  $I_{AR} = 6.0\text{ A}$



FR-4  
25.4 × 25.4 × 0.8  
(Unit: mm)

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



FR-4  
25.4 × 25.4 × 0.8  
(Unit: mm)

**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           | $I_{GSS}$     | $V_{GS} = \pm 12\text{ V}, V_{DS} = 0\text{ V}$ | —   | —    | $\pm 0.1$ | $\mu\text{A}$    |
| Drain cut-off current          | $I_{DSS}$     | $V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$     | —   | —    | 10        |                  |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$       | 20  | —    | —         | V                |
|                                | $V_{(BR)DSX}$ | $I_D = 10\text{ mA}, V_{GS} = -12\text{ V}$     | 8   | —    | —         |                  |
| Gate threshold voltage         | $V_{th}$      | $V_{DS} = 10\text{ V}, I_D = 0.2\text{ mA}$     | 0.5 | —    | 1.2       |                  |
| Drain-source on-resistance     | $R_{DS(ON)}$  | $V_{GS} = 2.5\text{ V}, I_D = 3.0\text{ A}$     | —   | 27   | 35        | $\text{m}\Omega$ |
|                                |               | $V_{GS} = 4.5\text{ V}, I_D = 3.0\text{ A}$     | —   | 19   | 24        |                  |

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

| Characteristics                | Symbol    | Test Condition                                                | Min | Typ. | Max | Unit        |
|--------------------------------|-----------|---------------------------------------------------------------|-----|------|-----|-------------|
| Input capacitance              | $C_{iss}$ | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | —   | 630  | —   | $\text{pF}$ |
| Reverse transfer capacitance   | $C_{rss}$ |                                                               | —   | 47   | —   |             |
| Output capacitance             | $C_{oss}$ |                                                               | —   | 144  | —   |             |
| Switching time (rise time)     | $t_r$     | See Figure 6.2.1.                                             | —   | 4.6  | —   | $\text{ns}$ |
| Switching time (turn-on time)  | $t_{on}$  |                                                               | —   | 11.8 | —   |             |
| Switching time (fall time)     | $t_f$     |                                                               | —   | 5.9  | —   |             |
| Switching time (turn-off time) | $t_{off}$ |                                                               | —   | 23.3 | —   |             |

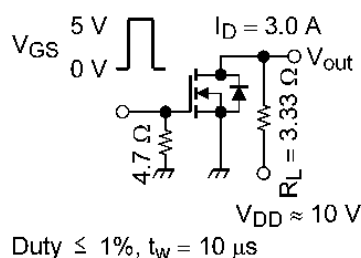


Fig. 6.2.1 Switching Time Test Circuit

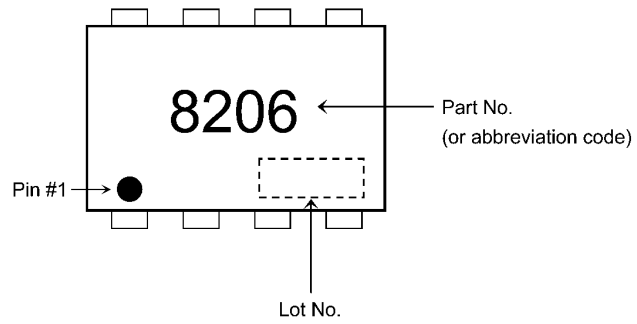
### 6.3. Gate Charge Characteristics ( $T_a = 25^\circ\text{C}$ unless otherwise specified)

| Characteristics                                 | Symbol    | Test Condition                                                        | Min | Typ. | Max | Unit        |
|-------------------------------------------------|-----------|-----------------------------------------------------------------------|-----|------|-----|-------------|
| Total gate charge (gate-source plus gate-drain) | $Q_g$     | $V_{DD} \approx 16\text{ V}, V_{GS} = 5\text{ V}, I_D = 6.0\text{ A}$ | —   | 5.8  | —   | $\text{nC}$ |
| Gate-source charge 1                            | $Q_{gs1}$ |                                                                       | —   | 1.3  | —   |             |
| Gate-drain charge                               | $Q_{gd}$  |                                                                       | —   | 1.1  | —   |             |

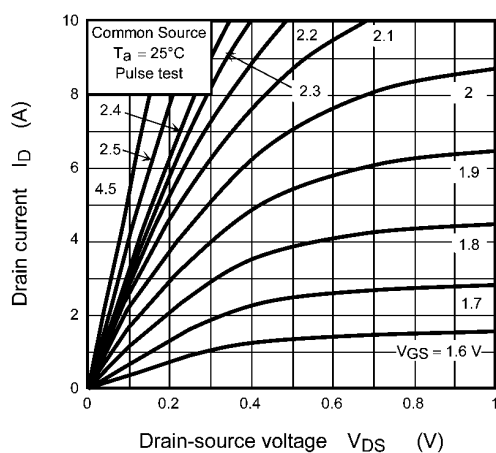
### 6.4. Source-Drain Characteristics ( $T_a = 25^\circ\text{C}$ unless otherwise specified)

| Characteristics                         | Symbol    | Test Condition                               | Min | Typ. | Max  | Unit |
|-----------------------------------------|-----------|----------------------------------------------|-----|------|------|------|
| Reverse drain current (pulsed) (Note 7) | $I_{DRP}$ | —                                            | —   | —    | 20   | A    |
| Diode forward voltage                   | $V_{DSF}$ | $I_{DR} = 6.0\text{ A}, V_{GS} = 0\text{ V}$ | —   | —    | -1.2 | V    |

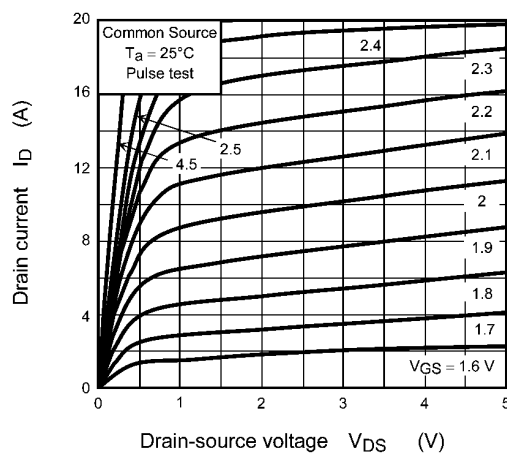
Note 7: Ensure that the channel temperature does not exceed  $150^\circ\text{C}$ .

**7. Marking****Fig. 7.1 Marking**

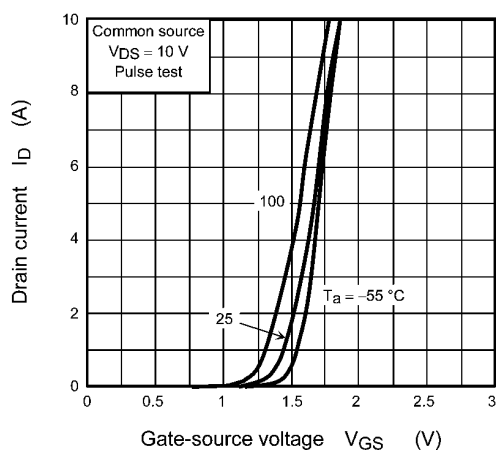
# 8. Characteristics Curves (Note)



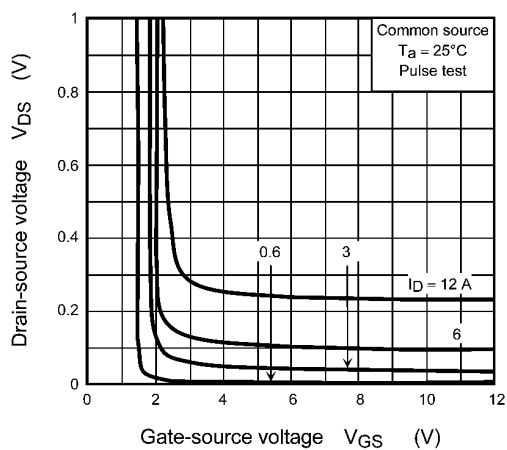
**Fig. 8.1**  $I_D - V_{DS}$



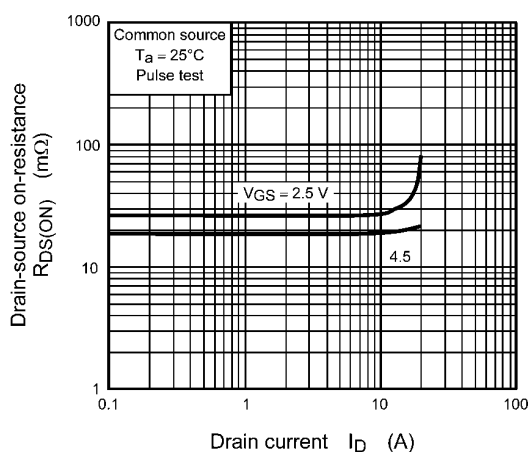
**Fig. 8.2**  $I_D - V_{DS}$



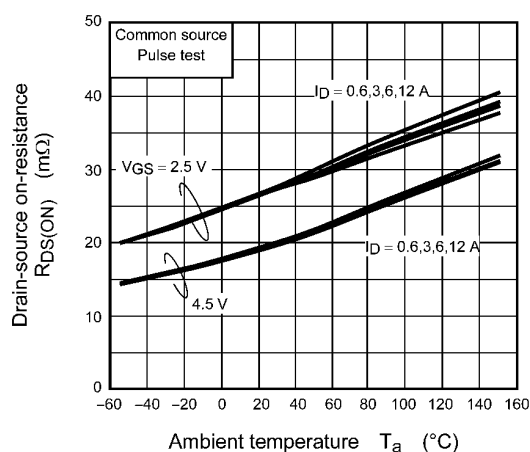
**Fig. 8.3**  $I_D - V_{GS}$



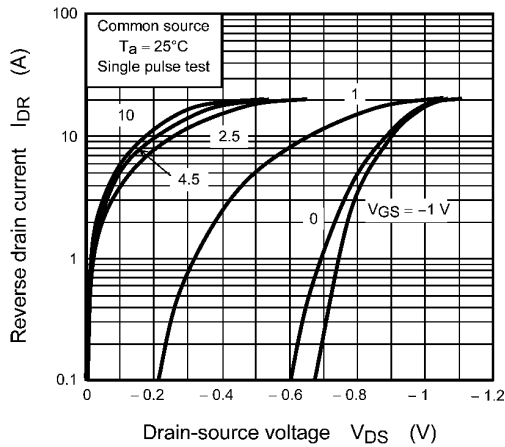
**Fig. 8.4**  $V_{DS} - V_{GS}$



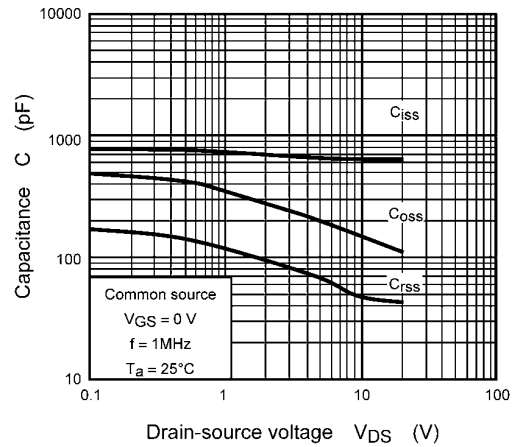
**Fig. 8.5**  $R_{DS(ON)} - I_D$



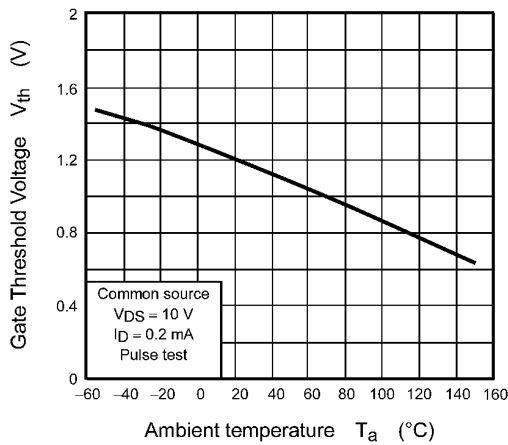
**Fig. 8.6**  $R_{DS(ON)} - T_a$



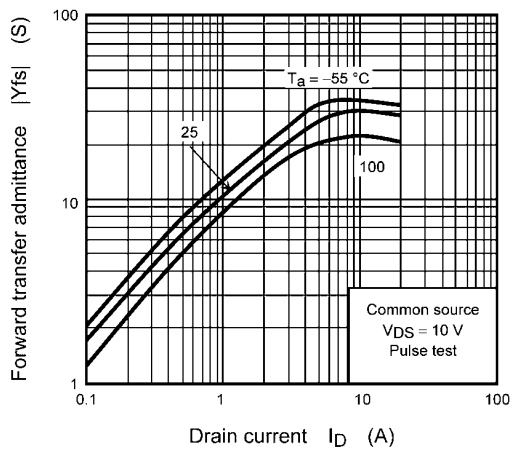
**Fig. 8.7  $I_{DR} - V_{DS}$**



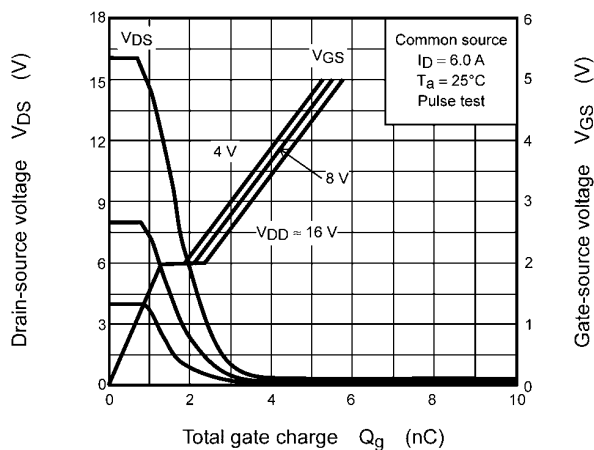
**Fig. 8.8 Capacitance -  $V_{DS}$**



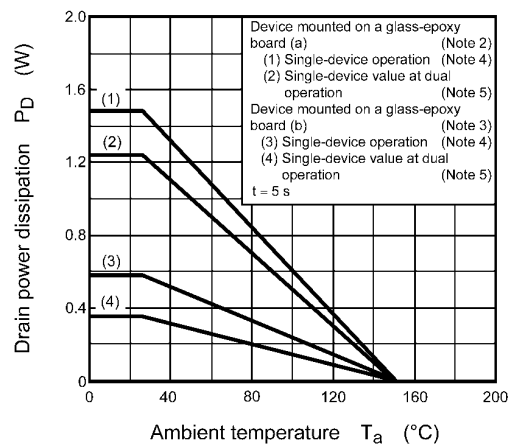
**Fig. 8.9  $V_{th} - T_a$**



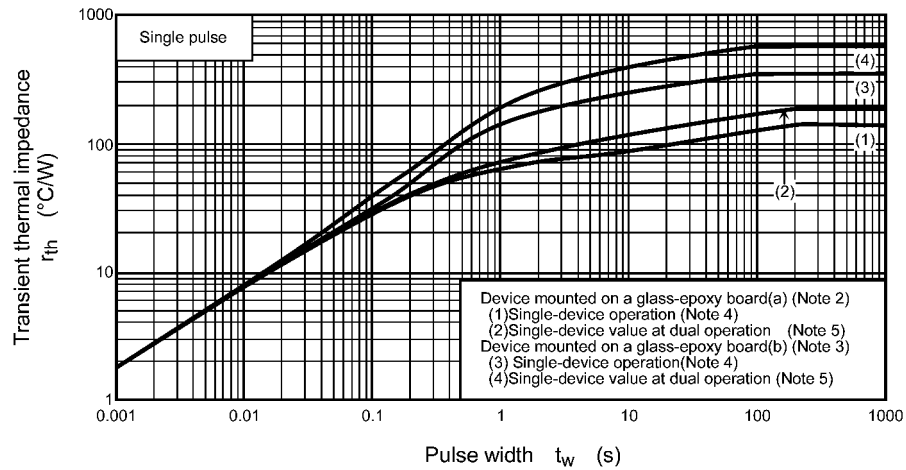
**Fig. 8.10  $|Y_{fs}| - I_D$**



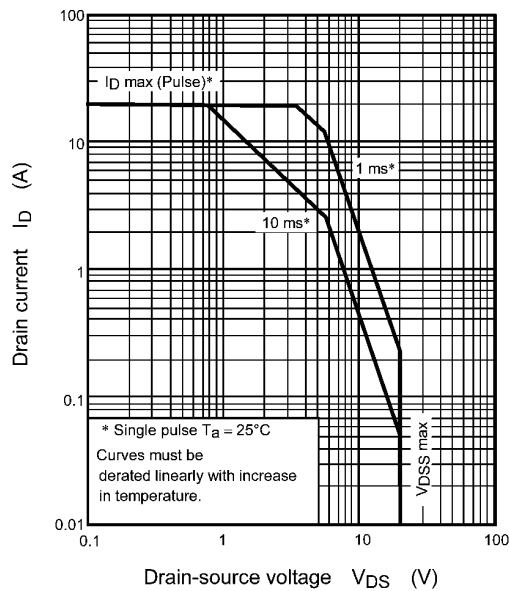
**Fig. 8.11 Dynamic Input/Output Characteristics**



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



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

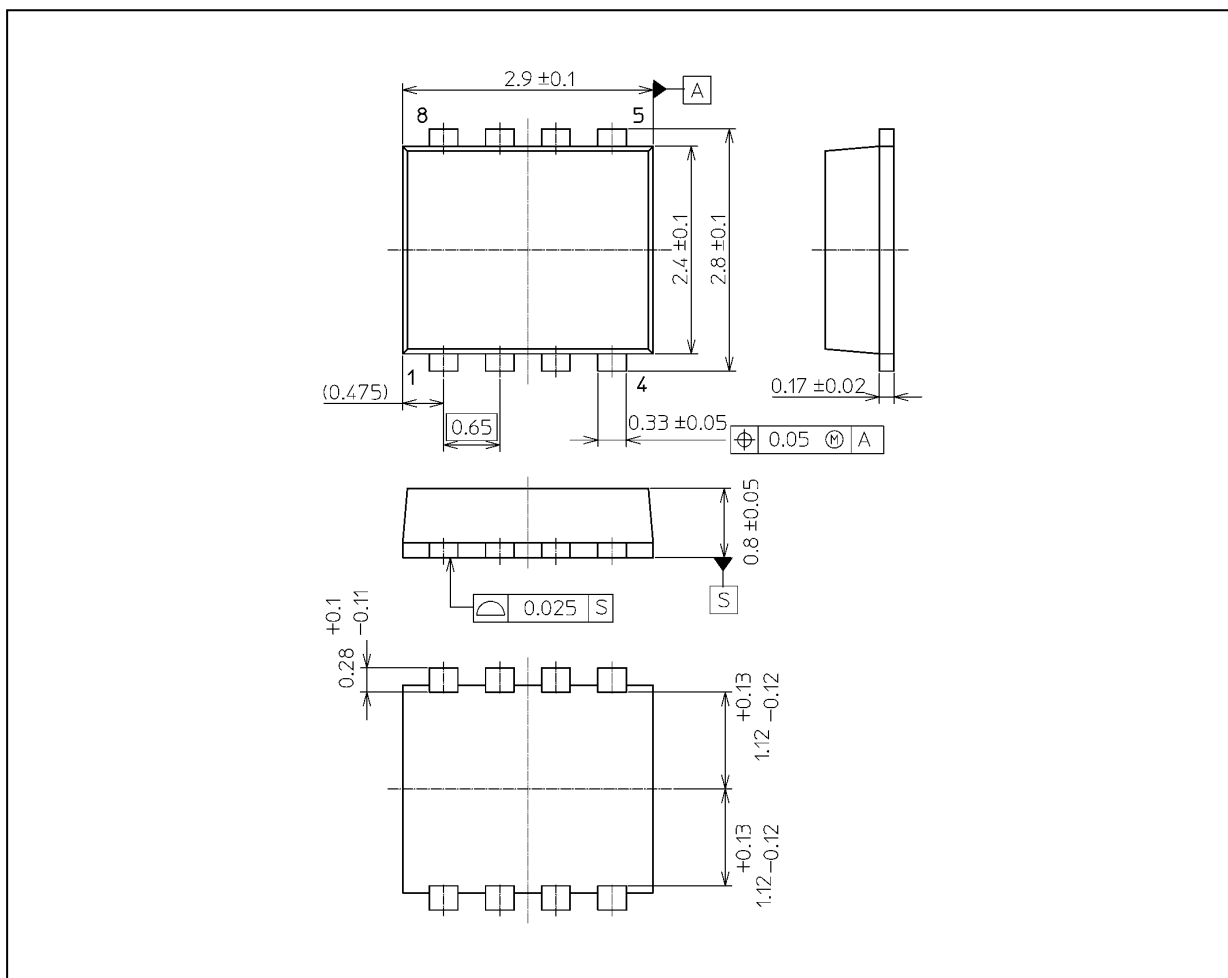


**Fig. 8.14 Safe Operating Area**  
(Guaranteed Maximum)

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

## Package Dimensions

Unit: mm



Weight: 0.017 g (typ.)

| Package Name(s) |
|-----------------|
| TOSHIBA: 2-3V1S |
| Nickname: PS-8  |

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