

# TPCP8009

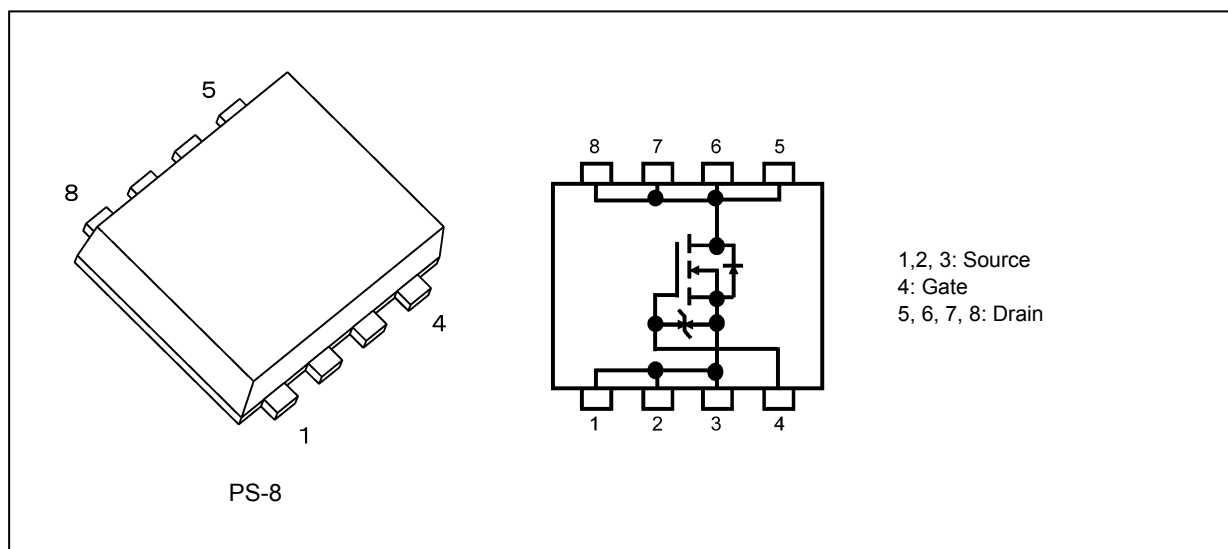
## 1. Applications

- Motor Drivers
- Mobile Equipment

## 2. Features

- (1) Small, thin package
- (2) Small gate charge :  $Q_{SW} = 9.6 \text{ nC (typ.)}$
- (3) Low drain-source on-resistance:  $R_{DS(ON)} = 9.5 \text{ m}\Omega \text{ (typ.)}$  ( $V_{GS} = 10 \text{ V}$ )
- (4) Low leakage current:  $I_{DSS} = 10 \text{ }\mu\text{A (max)}$  ( $V_{DS} = 40 \text{ V}$ )
- (5) Enhancement mode:  $V_{th} = 2 \text{ to } 3 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

## 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	$V_{DSS}$	40	V
Gate-source voltage	$V_{GSS}$	$\pm 20$	
Drain current (DC)	$I_D$	10	A
Drain current (pulsed)	$I_{DP}$	40	
Power dissipation	$P_D$	2.01	W
Power dissipation	$P_D$	1.01	W
Single-pulse avalanche energy	$E_{AS}$	116.5	mJ
Avalanche current	$I_{AR}$	10	A
Channel temperature	$T_{ch}$	175	$^\circ\text{C}$
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 = 5 s)	(Note 2)	$R_{th(ch-a)}$	74.4	°C/W
Channel-to-ambient thermal resistance	(t = 5 s)	(Note 3)	$R_{th(ch-a)}$	148.8	°C/W

Note 1: Ensure that the channel temperature does not exceed 175°C.

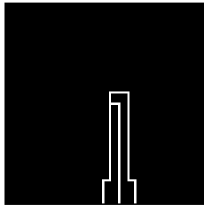
Note 2: Device mounted on a glass-epoxy board (a), Figure 5.1

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

Note 4:  $V_{DD} = 25\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 1.21\text{ mH}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = 10\text{ A}$

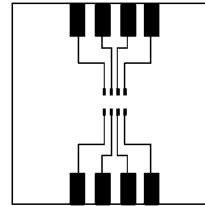
Note 5: Merely Channel temperature is guaranteed 175°C.

Storage temperature range is guaranteed as usual (-55 to 150°C).



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.

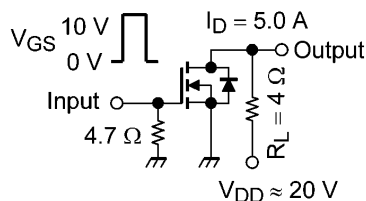
**6. Electrical Characteristics**

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current	$I_{GSS}$	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cut-off current	$I_{DSS}$	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$	—	—	10	
Drain-source breakdown voltage	$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	40	—	—	V
Drain-source breakdown voltage	$V_{(BR)DSX}$	$I_D = 10\text{ mA}, V_{GS} = -20\text{ V}$	20	—	—	
Gate threshold voltage	$V_{th}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	2	2.5	3	
Drain-source on-resistance	$R_{DS(ON)}$	$V_{GS} = 6\text{ V}, I_D = 5\text{ A}$	—	12.2	19.5	$\text{m}\Omega$
		$V_{GS} = 10\text{ V}, I_D = 5\text{ A}$	—	9.5	11.9	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input capacitance	$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	1250	—	$\text{pF}$
Reverse transfer capacitance	$C_{rss}$		—	165	—	
Output capacitance	$C_{oss}$		—	265	—	
Switching time (rise time)	$t_r$	See Figure 6.2.1	—	17	—	$\text{ns}$
Switching time (turn-on time)	$t_{on}$		—	30	—	
Switching time (fall time)	$t_f$		—	4.0	—	
Switching time (turn-off time)	$t_{off}$		—	23	—	



Duty  $\leq 1\%$ ,  $t_w = 10\ \mu\text{s}$

**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)	$Q_g$	$V_{DD} \approx 32\text{ V}, V_{GS} = 10\text{ V}, I_D = 10\text{ A}$	—	25.1	—	$\text{nC}$
Gate-source charge 1	$Q_{gs1}$		—	4.2	—	
Gate switch charge	$Q_{SW}$		—	9.6	—	
Gate-drain charge	$Q_{gd}$		—	8.1	—	

**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 6)	$I_{DRP}$	—	—	—	40	A
Diode forward voltage	$V_{DSF}$	$I_{DR} = 10\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.2	V

Note 6: Ensure that the channel temperature does not exceed  $175^\circ\text{C}$ .

7. Marking

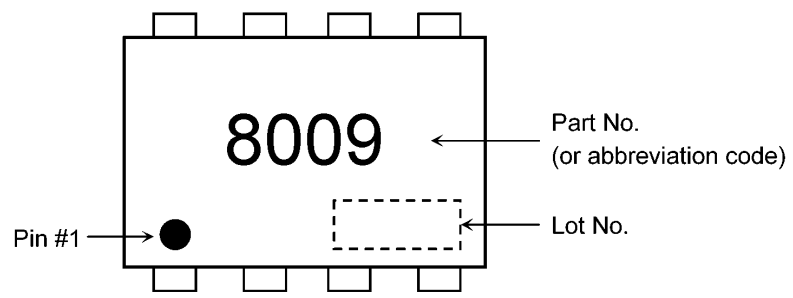
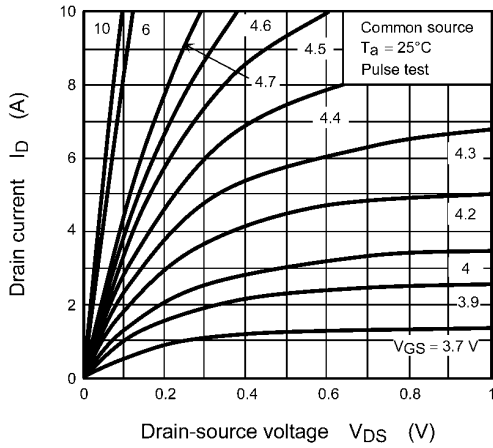
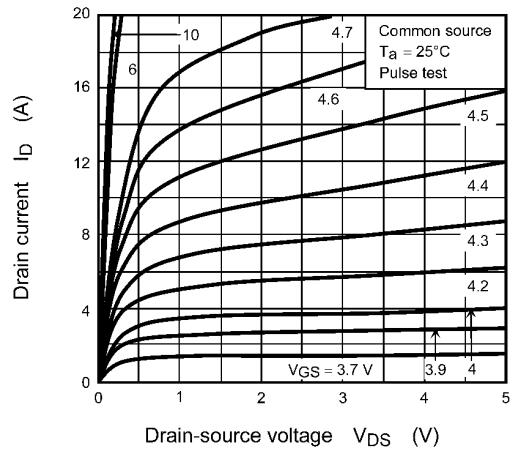


Fig. 7.1 Marking

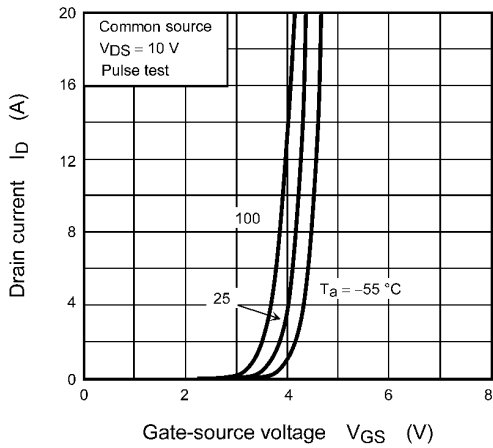
**8. Characteristics Curves (Note)**



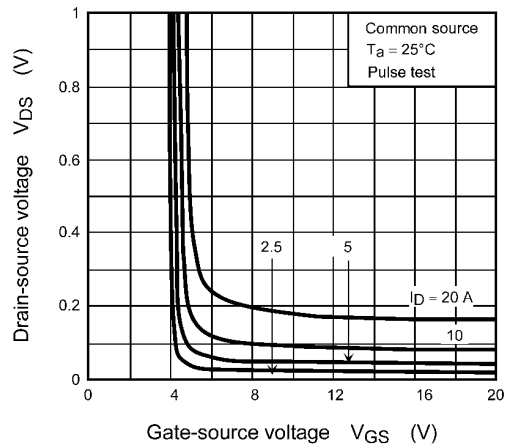
**Fig. 8.1  $I_D - V_{DS}$**



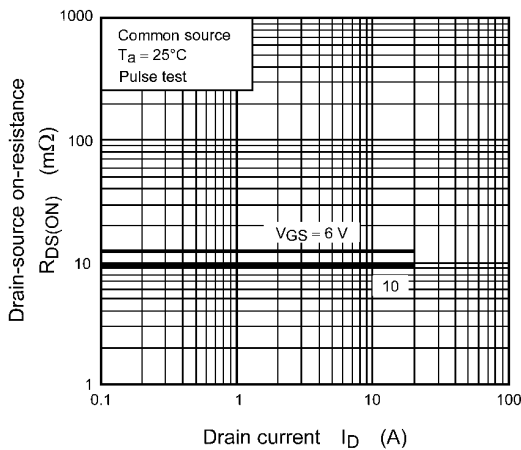
**Fig. 8.2  $I_D - V_{DS}$**



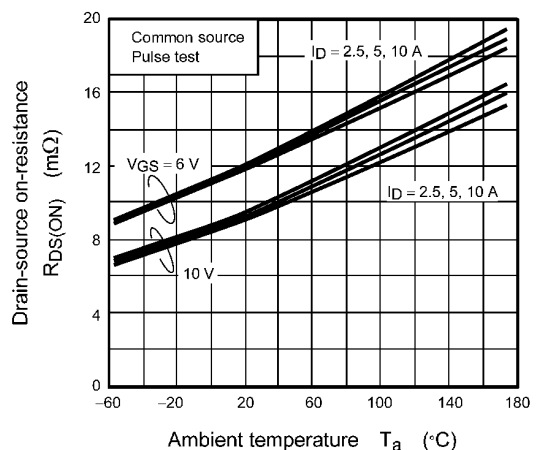
**Fig. 8.3  $I_D - V_{GS}$**



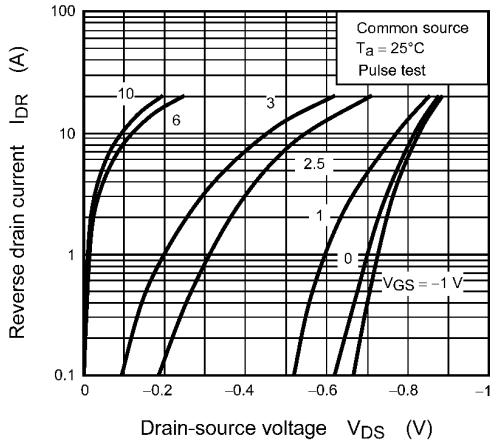
**Fig. 8.4  $V_{DS} - V_{GS}$**



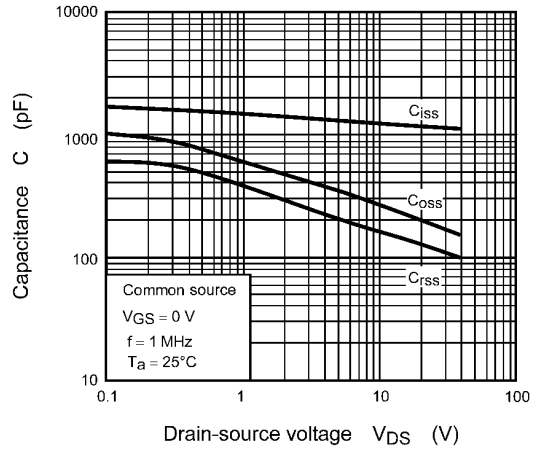
**Fig. 8.5  $R_{DS(ON)} - I_D$**



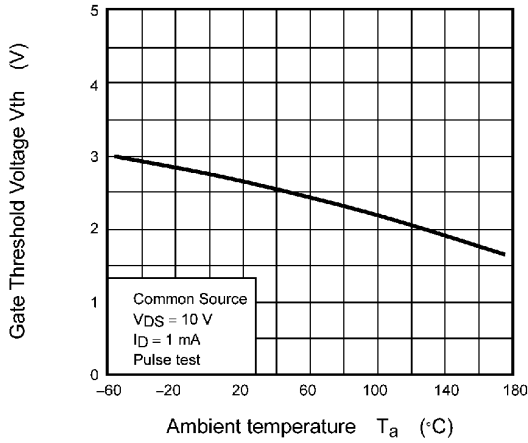
**Fig. 8.6  $R_{DS(ON)} - T_a$  (Note 7)**



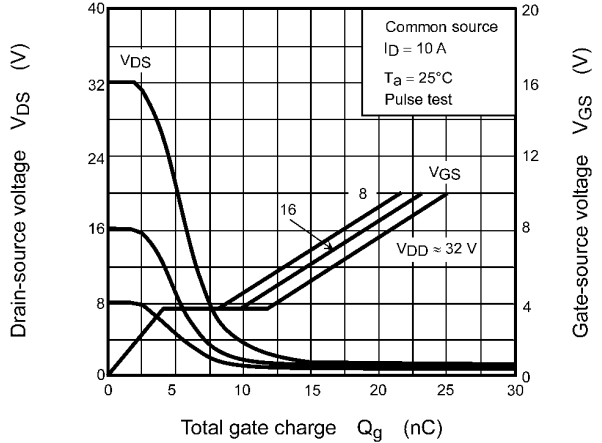
**Fig. 8.7  $I_{DR} - V_{DS}$**



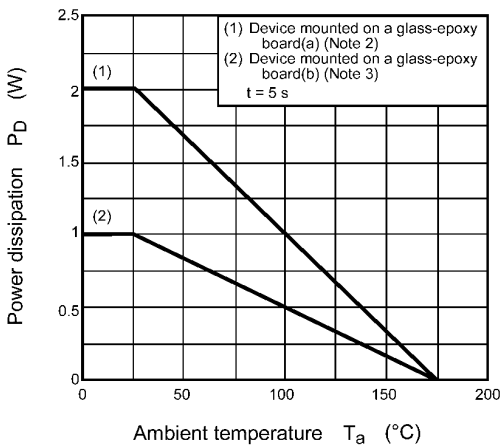
**Fig. 8.8 Capacitance -  $V_{DS}$**



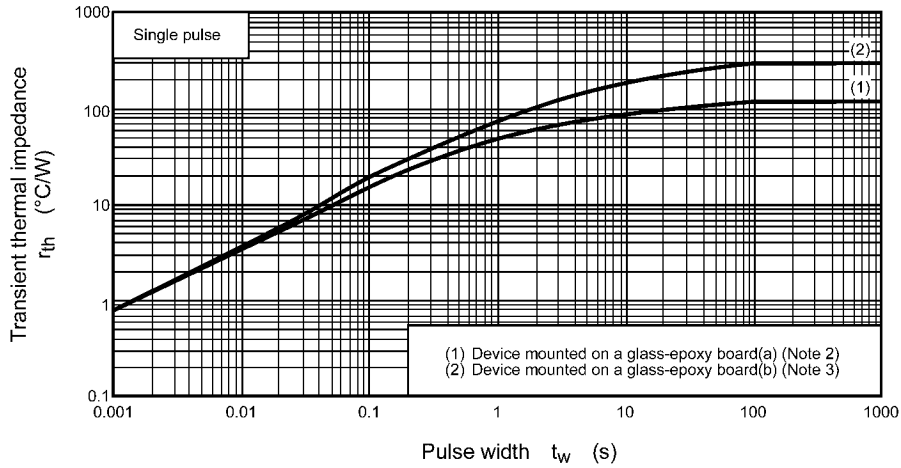
**Fig. 8.9  $V_{th} - T_a$  (Note 7)**



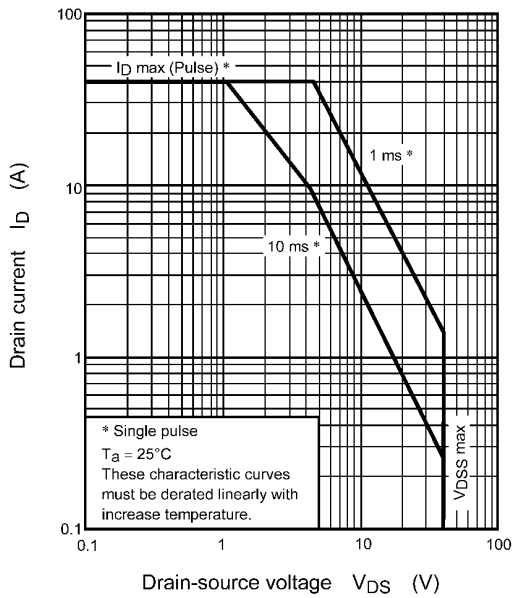
**Fig. 8.10 Dynamic Input/Output Characteristics**



**Fig. 8.11  $P_D - T_a$  (Note 7)  
(Guaranteed Maximum)**



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



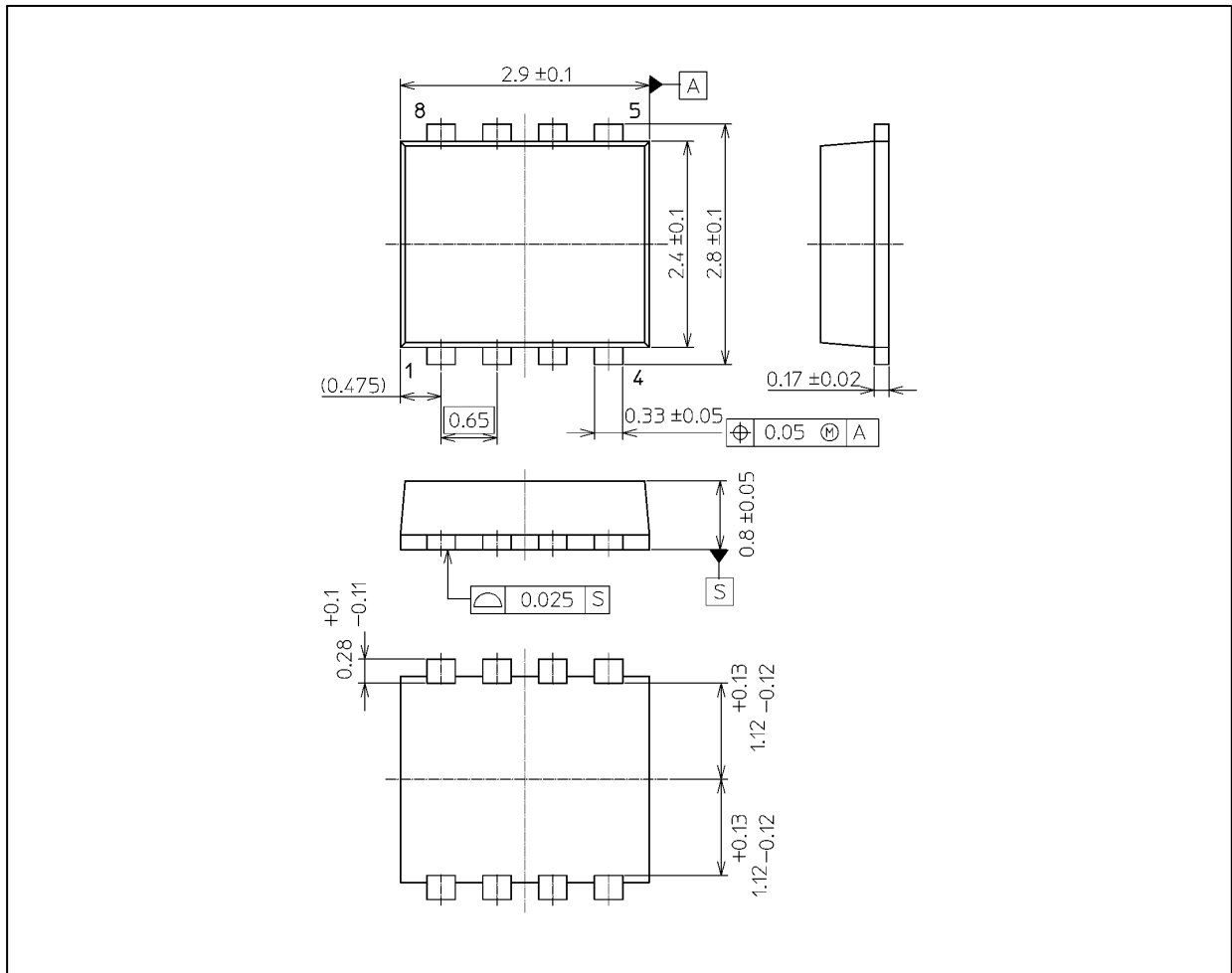
**Fig. 8.13 Safe Operating Area**  
**(Guaranteed Maximum)**

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

Note 7: Although several performance curves are shown up to a  $T_a = 175^{\circ}\text{C}$ , the device is not guaranteed at storage temperatures up to  $175^{\circ}\text{C}$ . The storage temperature ( $T_{stg}$ ) range is rated at  $-55^{\circ}\text{C}$  to  $150^{\circ}\text{C}$ .

**Package Dimensions**

Unit: mm



Weight: 0.017 g (typ.)

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

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