

# TPCP8110

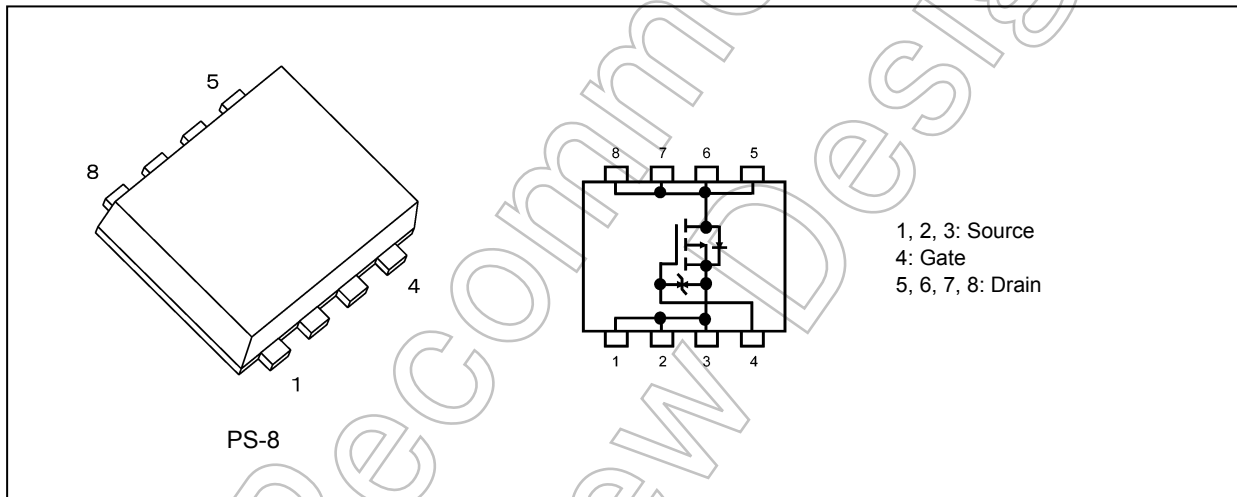
## 1. Applications

- Motor Drivers
- Mobile Equipment

## 2. Features

- (1) AEC-Q101 qualified
- (2) Small, thin package
- (3) Small gate charge:  $Q_{SW} = 14 \text{ nC (typ.)}$
- (4) Low drain-source on-resistance:  $R_{DS(ON)} = 30.4 \text{ m}\Omega \text{ (typ.) (} V_{GS} = -10 \text{ V)}$
- (5) Low leakage current:  $I_{DSS} = -10 \text{ }\mu\text{A (max) (} V_{DS} = -60 \text{ V)}$
- (6) 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



Start of commercial production

2013-01

**4. Absolute Maximum Ratings (Note) ( $T_a = 25^\circ\text{C}$  unless otherwise specified)**

Characteristics	Symbol	Rating	Unit
Drain-source voltage	$V_{DSS}$	-60	V
Gate-source voltage	$V_{GSS}$	-20/+10	
Drain current (DC) (Note 1)	$I_D$	-5	A
Drain current (pulsed) (Note 1)	$I_{DP}$	-20	
Power dissipation ( $t = 5\text{ s}$ ) (Note 2)	$P_D$	2.01	W
Power dissipation ( $t = 5\text{ s}$ ) (Note 3)	$P_D$	1	W
Single-pulse avalanche energy (Note 4)	$E_{AS}$	101.4	mJ
Avalanche current	$I_{AR}$	-5	A
Channel temperature (Note 5)	$T_{ch}$	175	$^\circ\text{C}$
Storage temperature (Note 5)	$T_{stg}$	-55 to 175	

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 ( $t \geq 5\text{ s}$ ) (Note 2)	$R_{th(ch-a)}$	74.6	$^\circ\text{C/W}$
Channel-to-ambient thermal resistance ( $t = 5\text{ s}$ ) (Note 3)	$R_{th(ch-a)}$	150	

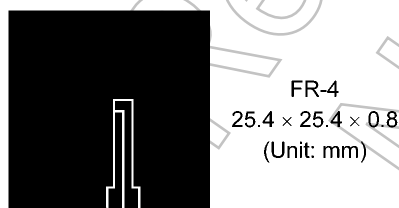
Note 1: Ensure that the channel temperature does not exceed  $175^\circ\text{C}$ .

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

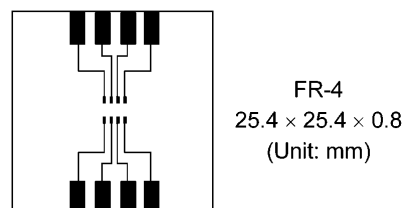
Note 3: Device mounted on a glass-epoxy board (b), Figure 5.2

Note 4:  $V_{DD} = -25\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 5.512\text{ mH}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = -5\text{ A}$

Note 5: The definitions of the absolute maximum channel and storage temperatures are qualified per AEC-Q101.



**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**

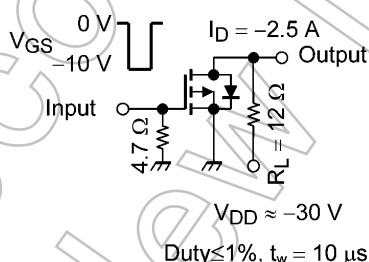
**6.1. Static Characteristics ( $T_a = 25^\circ\text{C}$  unless otherwise specified)**

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current	$I_{GSS}$	$V_{GS} = -16/+10\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cut-off current	$I_{DSS}$	$V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}$	—	—	-10	
Drain-source breakdown voltage	$V_{(BR)DSS}$	$I_D = -10\text{ mA}, V_{GS} = 0\text{ V}$	-60	—	—	V
Drain-source breakdown voltage (Note 6)	$V_{(BR)DSX}$	$I_D = -10\text{ mA}, V_{GS} = 10\text{ V}$	-50	—	—	
Gate threshold voltage	$V_{th}$	$V_{DS} = -10\text{ V}, I_D = -1\text{ mA}$	-2	-2.5	-3	
Drain-source on-resistance	$R_{DS(ON)}$	$V_{GS} = -6\text{ V}, I_D = -2.5\text{ A}$	—	33.3	53.2	$\text{m}\Omega$
		$V_{GS} = -10\text{ V}, I_D = -2.5\text{ A}$	—	30.4	39.5	

Note 6: If a reverse bias is applied between gate and source, this device enters  $V_{(BR)DSX}$  mode. Note that the drain-source breakdown voltage is lowered in this mode.

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input capacitance	$C_{iss}$	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	2075	—	pF
Reverse transfer capacitance	$C_{rss}$		—	150	—	
Output capacitance	$C_{oss}$		—	205	—	
Switching time (rise time)	$t_r$	See Figure 6.2.1.	—	9	—	ns
Switching time (turn-on time)	$t_{on}$		—	26	—	
Switching time (fall time)	$t_f$		—	27	—	
Switching time (turn-off time)	$t_{off}$		—	143	—	



**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)	$Q_g$	$V_{DD} \approx -48\text{ V}, V_{GS} = -10\text{ V}, I_D = -5\text{ A}$	—	45	—	nC
Gate-source charge 1	$Q_{gs1}$		—	6	—	
Gate-drain charge	$Q_{gd}$		—	13	—	
Gate switch charge	$Q_{sw}$		—	14	—	

**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	$V_{DSF}$	$I_{DR} = -5\text{ A}, V_{GS} = 0\text{ V}$	—	—	1.2	V

Note 7: Ensure that the channel temperature does not exceed  $175^\circ\text{C}$ .

7. Marking

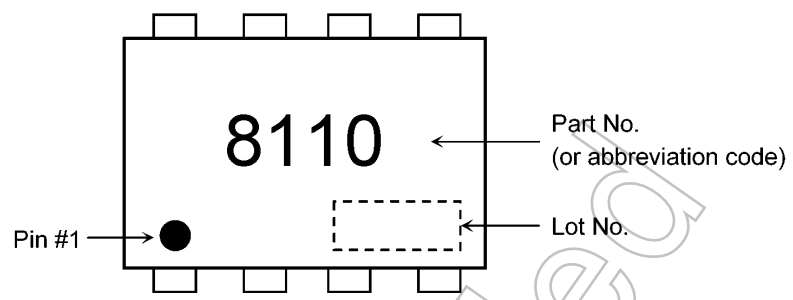
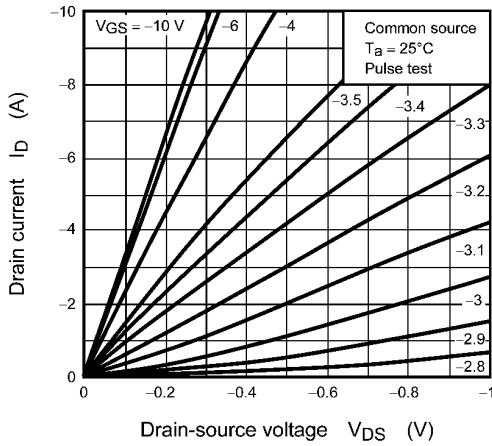


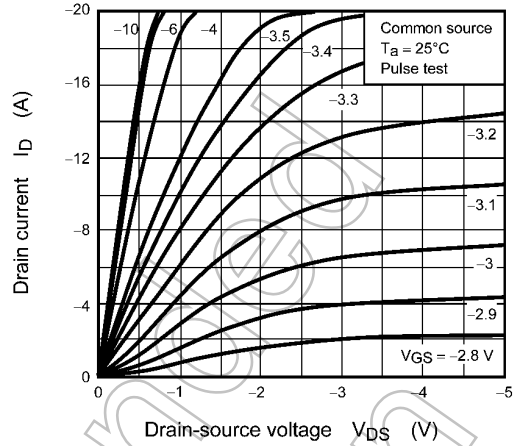
Fig. 7.1 Marking

Not Recommended for New Design

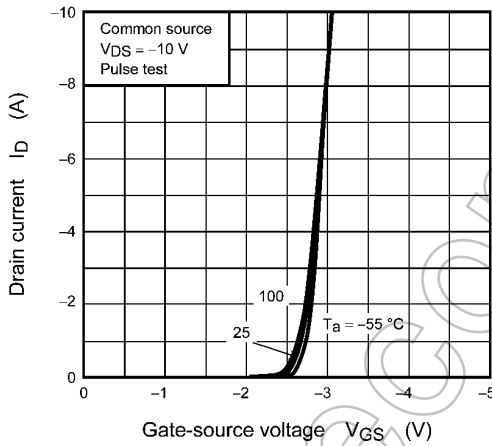
**8. Characteristics Curves (Note)**



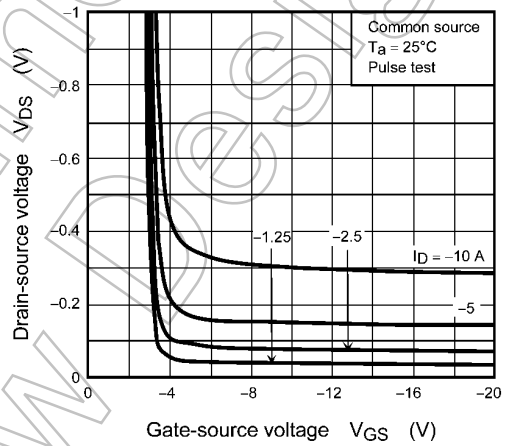
**Fig. 8.1  $I_D - V_{DS}$**



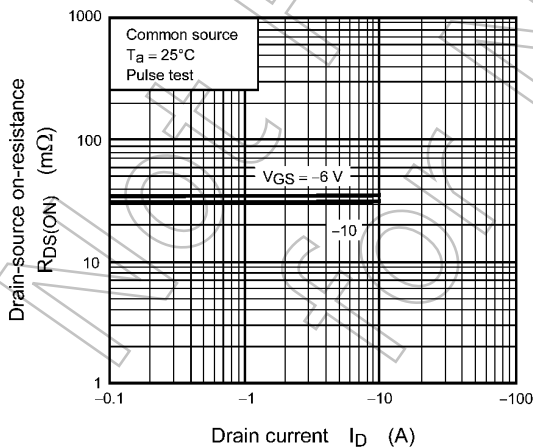
**Fig. 8.2  $I_D - V_{DS}$**



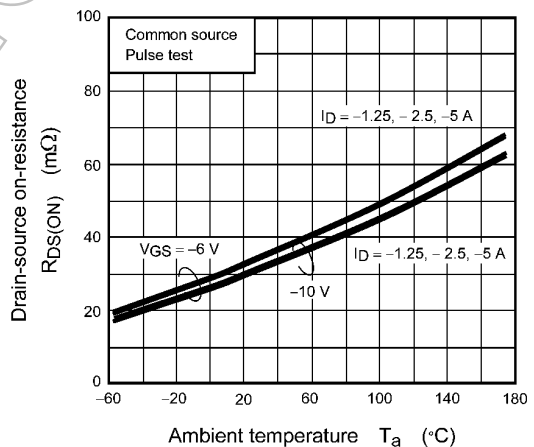
**Fig. 8.3  $I_D - V_{GS}$**



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



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



**Fig. 8.6  $R_{DS(ON)} - T_a$  (Note 8)**

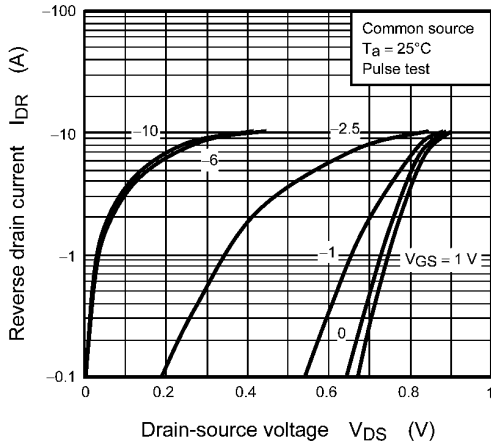


Fig. 8.7  $I_{DR} - V_{DS}$

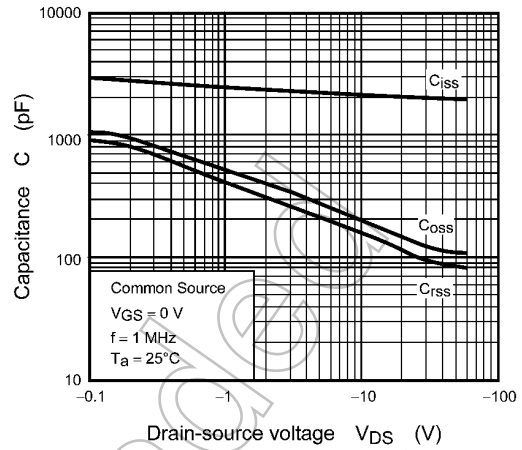


Fig. 8.8 Capacitance -  $V_{DS}$

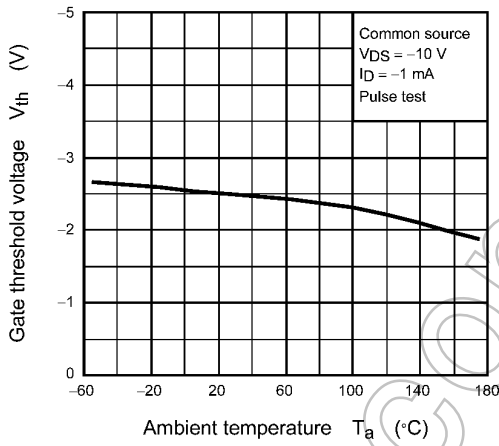


Fig. 8.9  $V_{th} - T_a$  (Note 8)

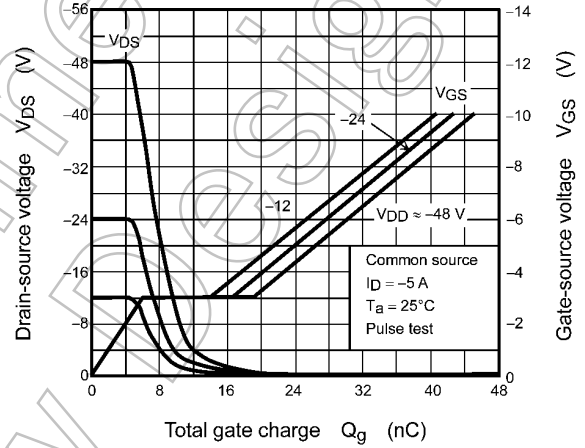


Fig. 8.10 Dynamic Input/Output Characteristics

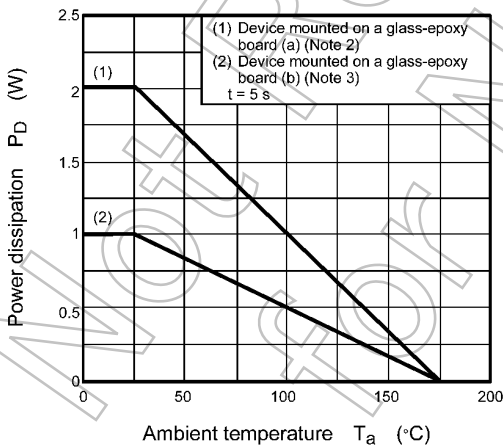
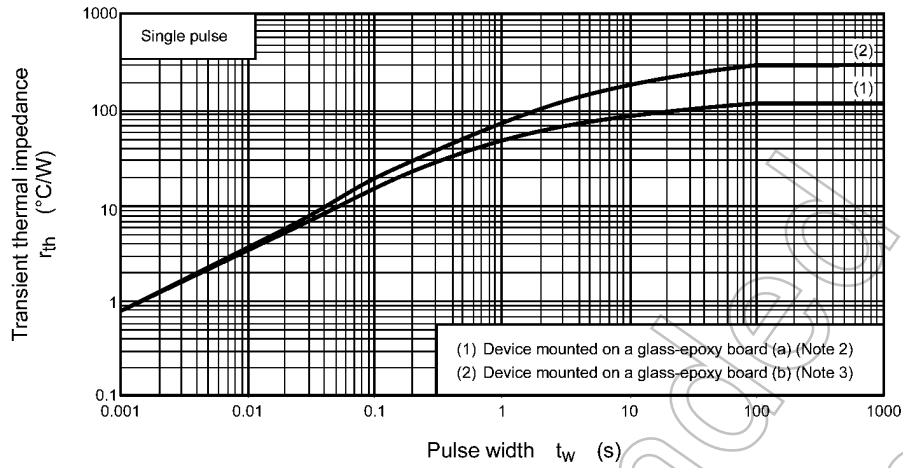
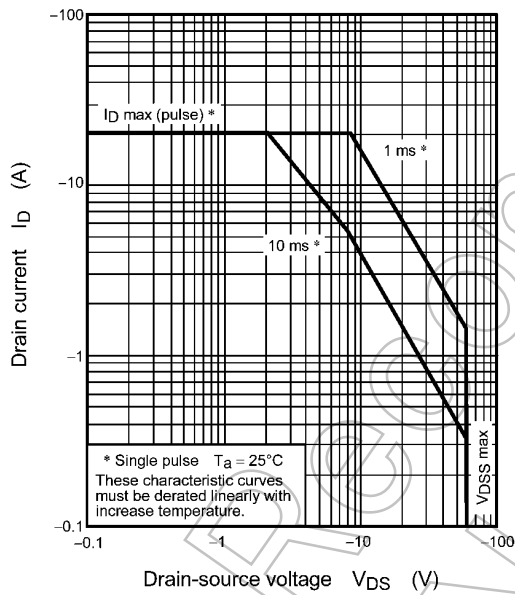


Fig. 8.11  $P_D - T_a$   
 (Guaranteed Maximum) (Note 8)



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



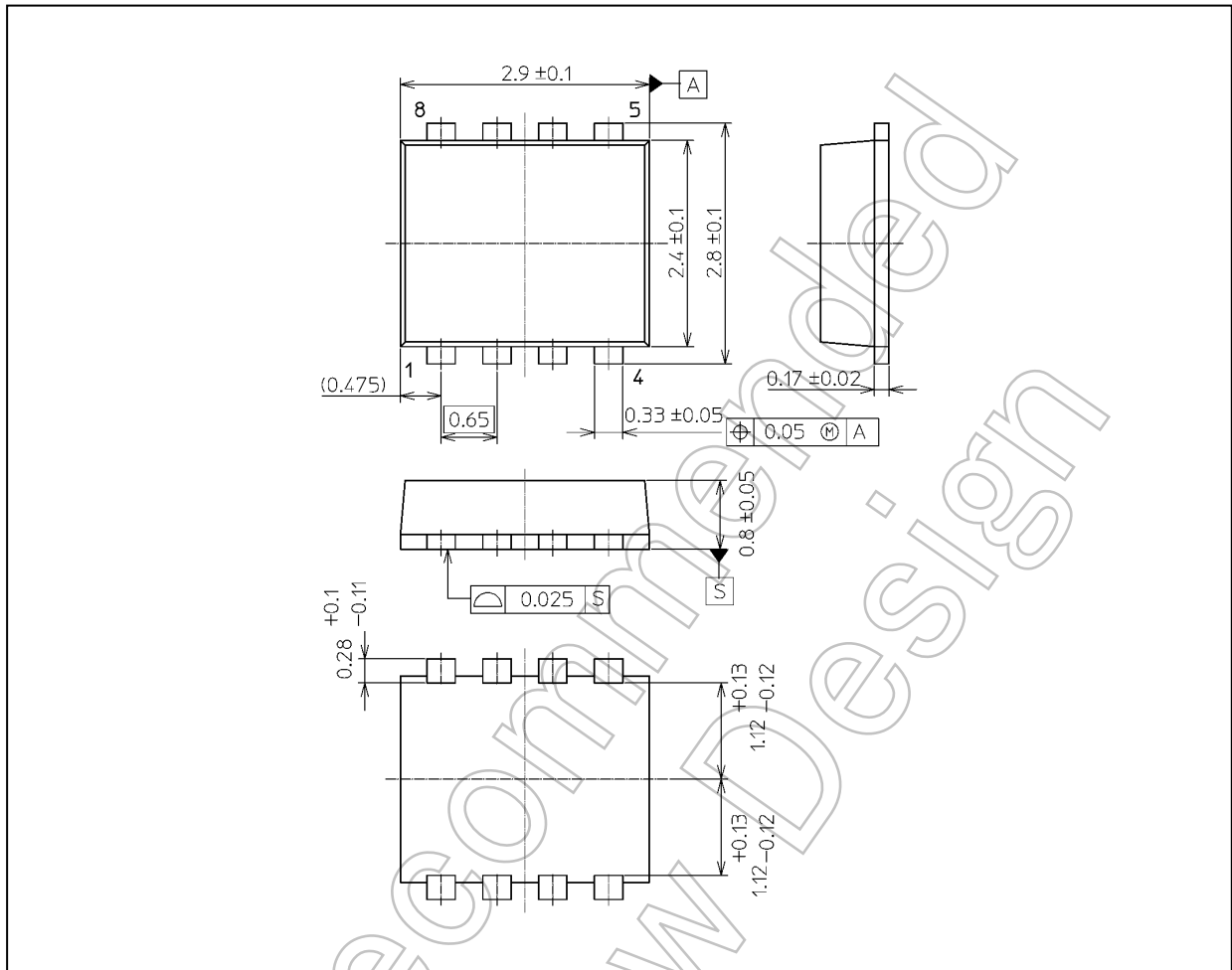
**Fig. 8.13 Safe Operating Area**  
**(Guaranteed Maximum)**

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

Note 8: The definitions of the absolute maximum channel and storage temperatures are qualified per AEC-Q101.

**Package Dimensions**

Unit: mm



Weight: 0.017 g (typ.)

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



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