

TPCP8109

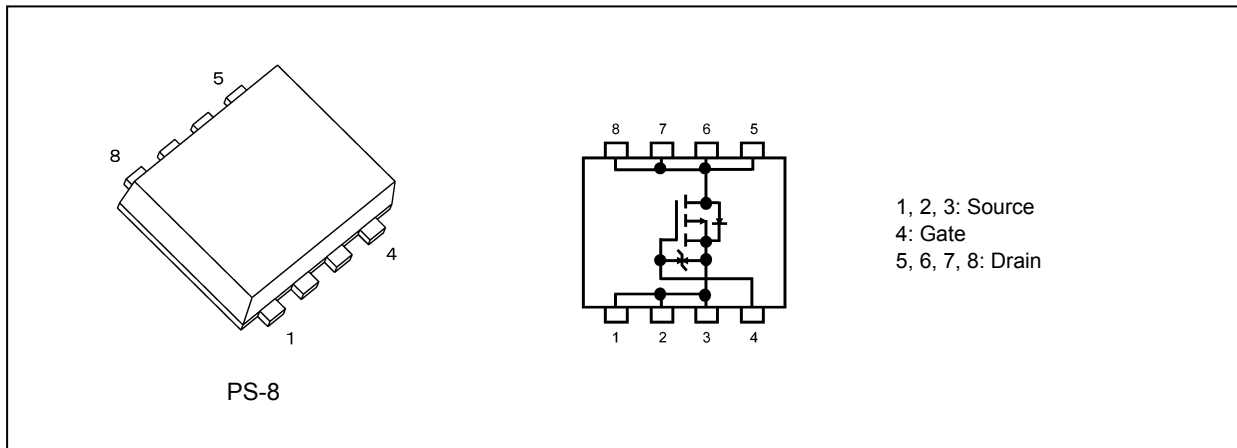
1. Applications

- Motor Drivers
- Mobile Equipment

2. Features

- (1) AEC-Q101 qualified
- (2) Small, thin package
- (3) Small gate charge: $Q_{SW} = 5.8 \text{ nC (typ.)}$
- (4) Low drain-source on-resistance: $R_{DS(ON)} = 40.3 \text{ m}\Omega \text{ (typ.)}$ ($V_{GS} = -10 \text{ V}$)
- (5) Low leakage current: $I_{DSS} = -10 \text{ }\mu\text{A (max)}$ ($V_{DS} = -40 \text{ V}$)
- (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

2012-10

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

Characteristics	Symbol	Rating	Unit
Drain-source voltage	V_{DSS}	-40	V
Gate-source voltage	V_{GSS}	-20/+10	
Drain current (DC) (Note 1)	I_D	-4.5	A
Drain current (pulsed) (Note 1)	I_{DP}	-18	
Power dissipation ($t = 5\text{ s}$) (Note 2)	P_D	1.96	W
Power dissipation ($t = 5\text{ s}$) (Note 3)	P_D	0.94	
Single-pulse avalanche energy (Note 4)	E_{AS}	46.2	mJ
Avalanche current	I_{AR}	-4.5	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 ($t = 5\text{ s}$) (Note 2)	$R_{th(ch-a)}$	76.5	$^\circ\text{C/W}$
Channel-to-ambient thermal resistance ($t = 5\text{ s}$) (Note 3)		159.5	

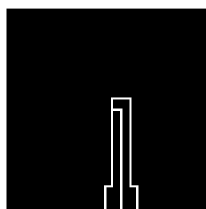
Note 1: Ensure that the channel temperature does not exceed $175\text{ }^\circ\text{C}$.

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

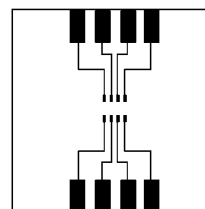
Note 4: $V_{DD} = -25\text{ V}$, $T_{ch} = 25\text{ }^\circ\text{C}$ (initial), $L = 2.369\text{ mH}$, $R_G = 25\text{ }\Omega$, $I_{AR} = -4.5\text{ A}$

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



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 ($T_a = 25\text{ }^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current	I_{GSS}	$V_{GS} = -16/+10\text{ V}, V_{DS} = 0\text{ V}$	—	—	± 10	μA
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 (Note 6)	$V_{(BR)DSX}$	$I_D = -10\text{ mA}, V_{GS} = 10\text{ V}$	-30	—	—	
Gate threshold voltage	V_{th}	$V_{DS} = -10\text{ V}, I_D = -1\text{ mA}$	-2	-2.5	-3	
Drain-source on-resistance	$R_{DS(ON)}$	$V_{GS} = -6\text{ V}, I_D = -2.25\text{ A}$	—	48	76.8	$\text{m}\Omega$
		$V_{GS} = -10\text{ V}, I_D = -2.25\text{ A}$	—	40.3	52.3	

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 ($T_a = 25\text{ }^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input capacitance	C_{iss}	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	810	—	pF
Reverse transfer capacitance	C_{rss}		—	85	—	
Output capacitance	C_{oss}		—	130	—	
Switching time (rise time)	t_r	See Figure 6.2.1.	—	8	—	ns
Switching time (turn-on time)	t_{on}		—	25	—	
Switching time (fall time)	t_f		—	33	—	
Switching time (turn-off time)	t_{off}		—	126	—	

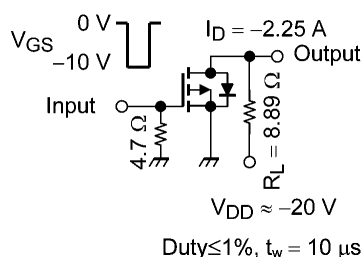


Fig. 6.2.1 Switching Time Test Circuit

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Total gate charge (gate-source plus gate-drain)	Q_g	$V_{DD} \approx -32\text{ V}, V_{GS} = -10\text{ V}, I_D = -4.5\text{ A}$	—	18.0	—	nC
Gate-source charge 1	Q_{gs1}		—	3.0	—	
Gate-drain charge	Q_{gd}		—	4.6	—	
Gate switch charge	Q_{SW}		—	5.8	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Reverse drain current (pulsed) (Note 7)	I_{DRP}	—	—	—	-18	A
Diode forward voltage	V_{DSF}	$I_{DR} = -4.5\text{ A}, V_{GS} = 0\text{ V}$	—	—	1.2	V

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

7. Marking

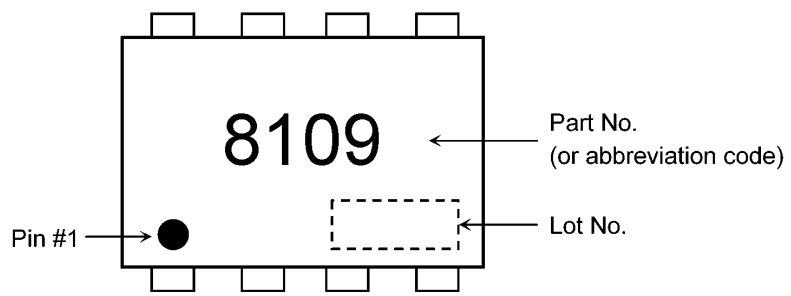


Fig. 7.1 Marking

8. Characteristics Curves (Note)

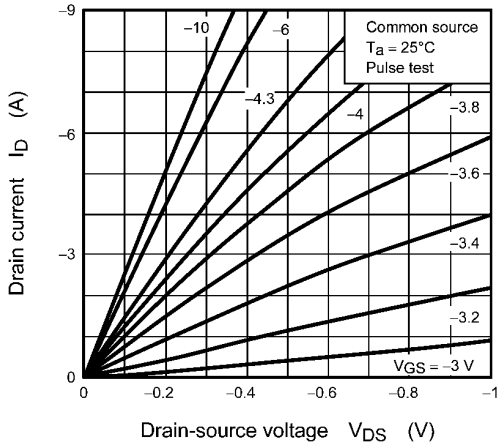


Fig. 8.1 $I_D - V_{DS}$

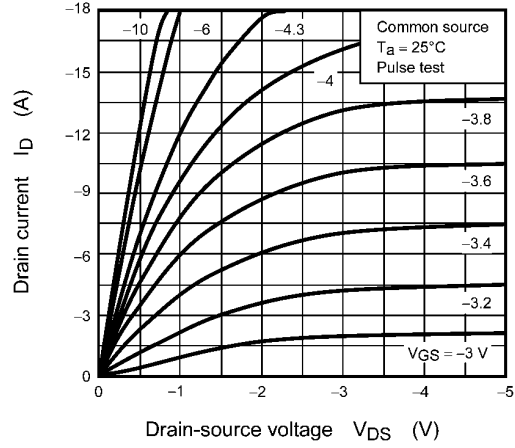


Fig. 8.2 $I_D - V_{DS}$

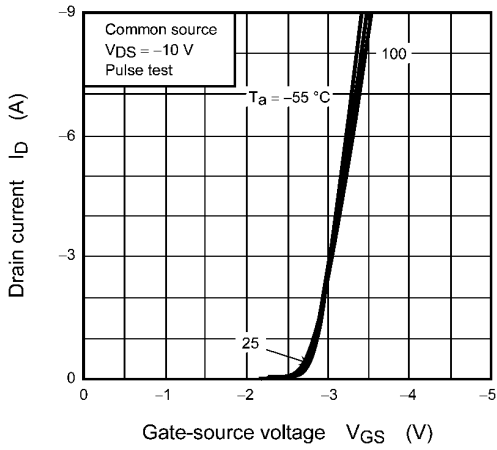


Fig. 8.3 $I_D - V_{GS}$

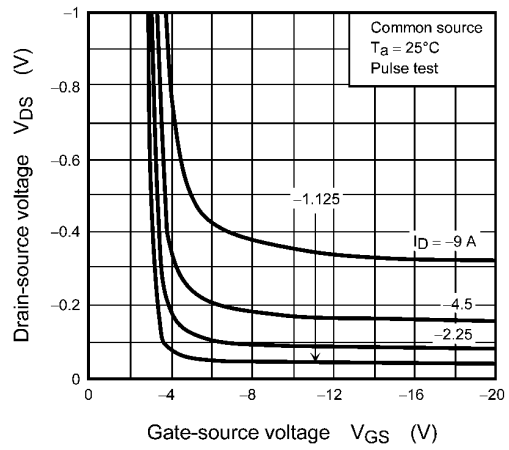


Fig. 8.4 $V_{DS} - V_{GS}$

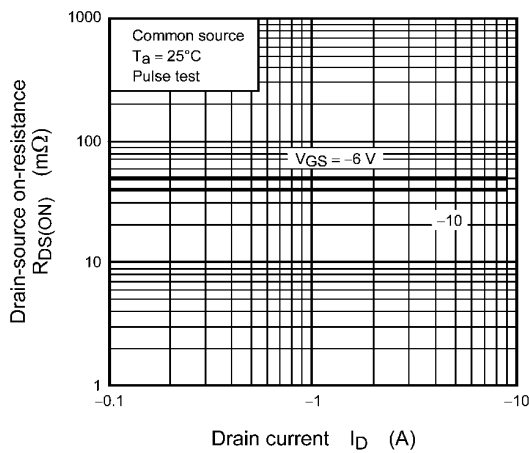


Fig. 8.5 $R_{DS(ON)} - I_D$

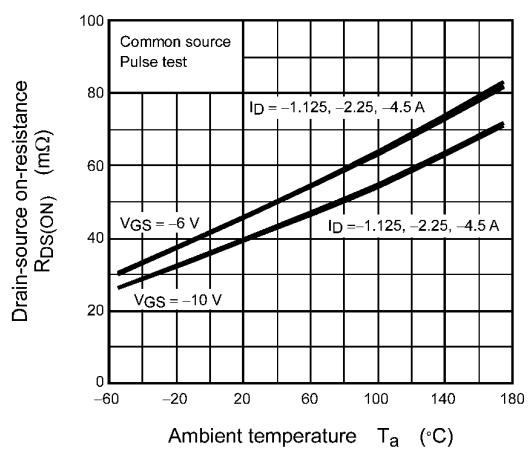


Fig. 8.6 $R_{DS(ON)} - T_a$ (Note 8)

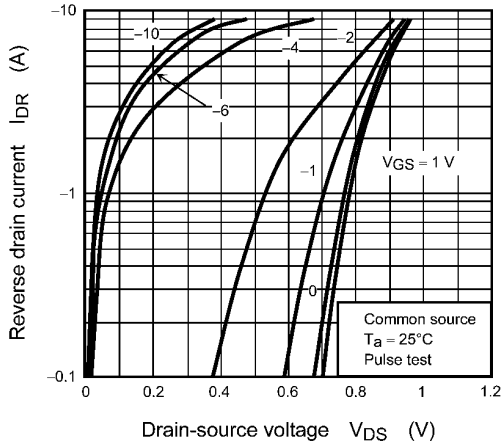


Fig. 8.7 $I_{DR} - V_{DS}$

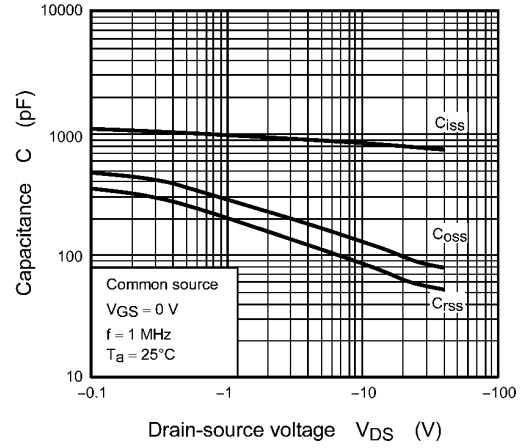


Fig. 8.8 Capacitance - V_{DS}

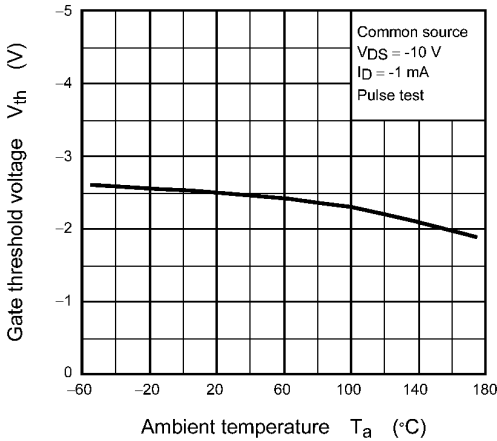


Fig. 8.9 $V_{th} - T_a$ (Note 8)

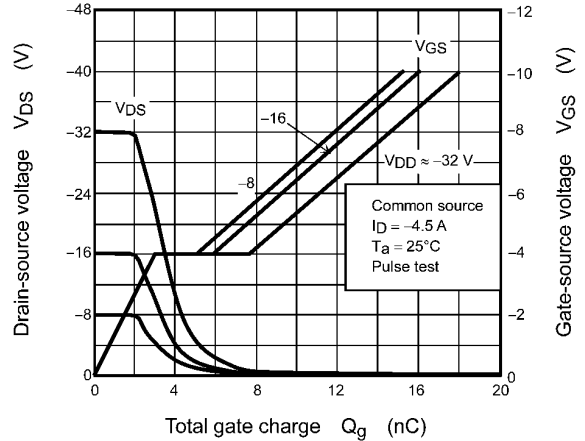
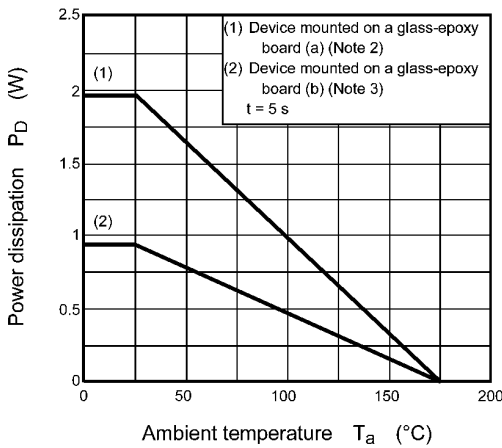


Fig. 8.10 Dynamic Input/Output Characteristics



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

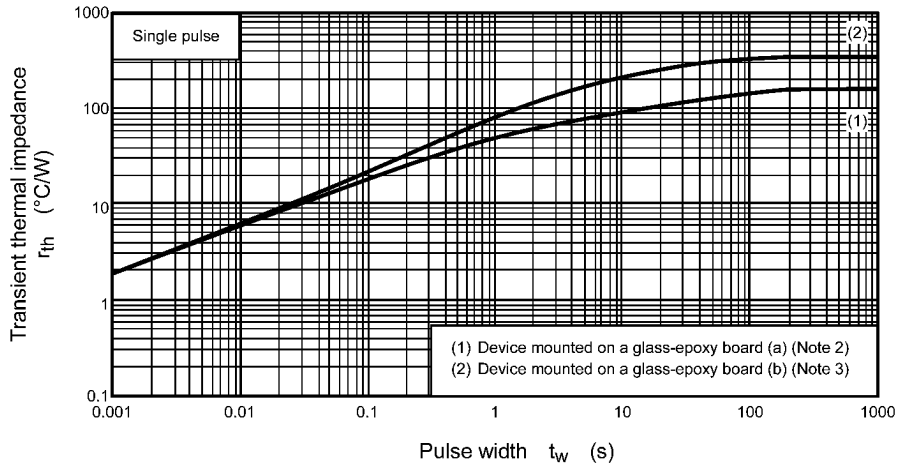


Fig. 8.12 $r_{th} - t_w$
(Guaranteed Maximum)

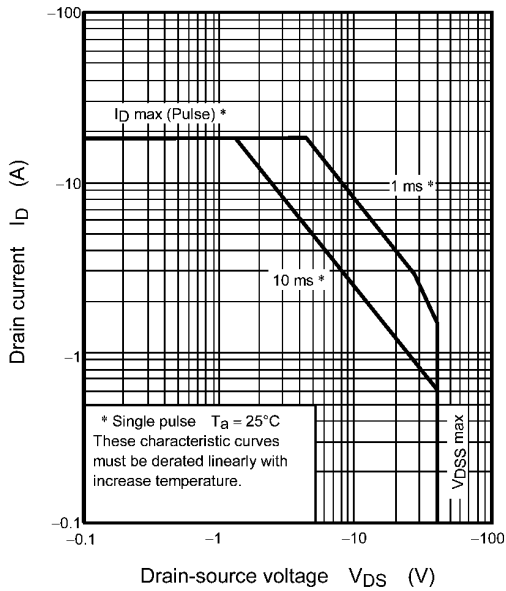


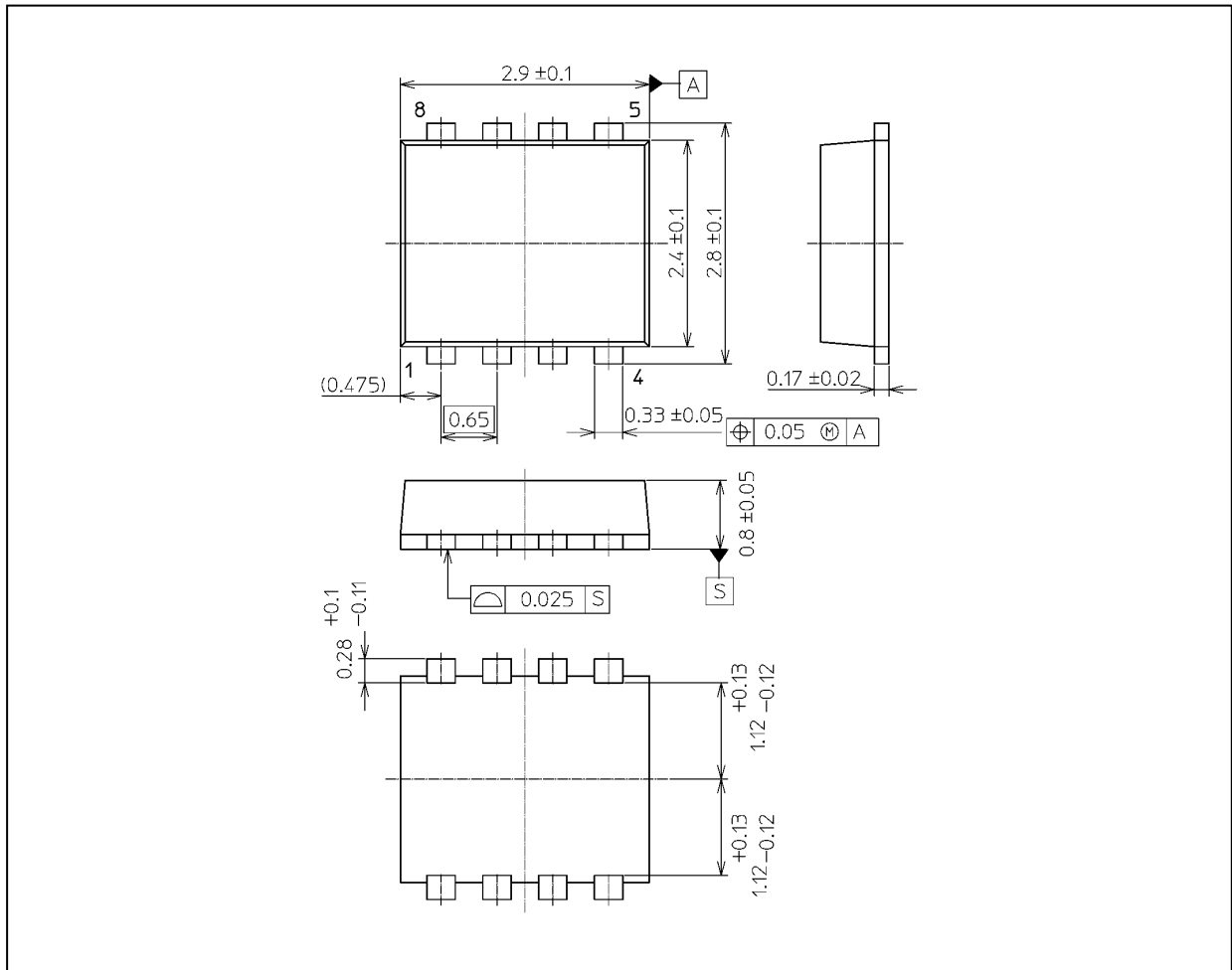
Fig. 8.13 Safe Operating Area
(Guaranteed Maximum)

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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