

TPCP8107

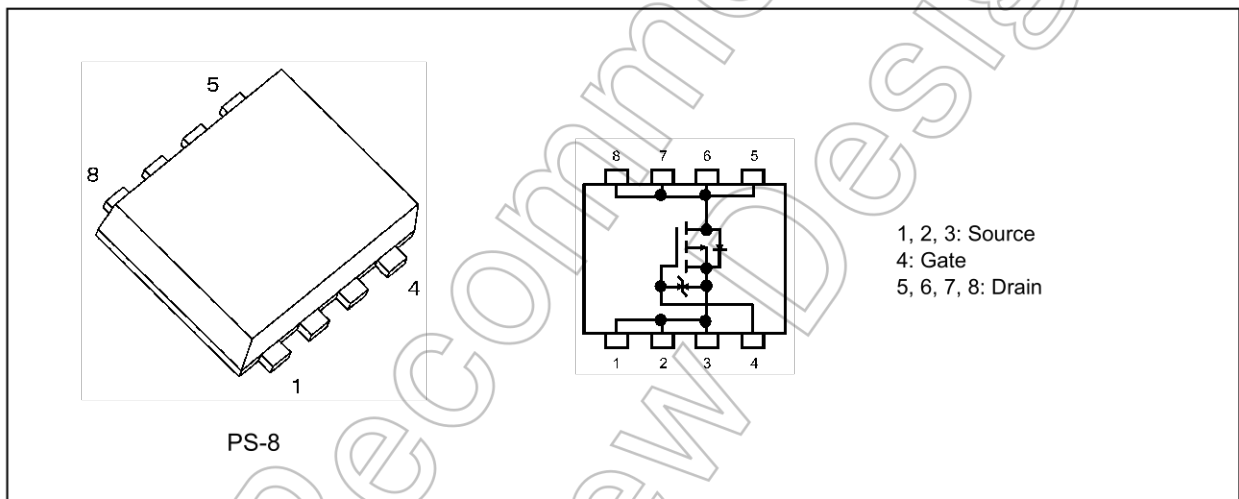
1. Applications

- Motor Drivers
- Mobile Equipment

2. Features

- (1) AEC-Q101 qualified
- (2) Small, thin package
- (3) Small gate charge: $Q_{SW} = 14.0 \text{ nC (typ.)}$
- (4) Low drain-source on-resistance: $R_{DS(ON)} = 13.9 \text{ m}\Omega \text{ (typ.) (} V_{GS} = -10 \text{ V)}$
- (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

2013-03

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} | -20/+10 | |
| Drain current (DC) (Note 1) | I_D | -8 | A |
| Drain current (pulsed) (Note 1) | I_{DP} | -32 | |
| 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} | 145.8 | mJ |
| Avalanche current | I_{AR} | -8 | 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) | | 150 | |

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), $L = 2.366\text{ mH}$, $R_G = 25\ \Omega$, $I_{AR} = -8\text{ A}$

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

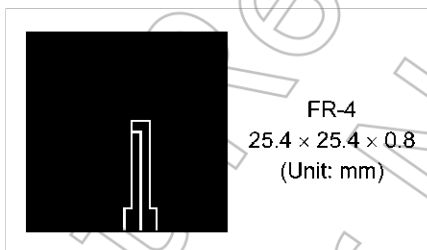


Fig. 5.1 Device Mounted on a Glass-Epoxy Board (a)

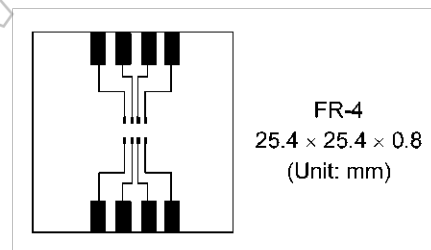


Fig. 5.2 Device Mounted on a Glass-Epoxy Board (b)

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} | $V_{GS} = -16/+10\text{ V}, V_{DS} = 0\text{ V}$ | — | — | ± 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 | $R_{DS(ON)}$ | $V_{GS} = -6\text{ V}, I_D = -4\text{ A}$ | — | 16.8 | 26.8 | $\text{m}\Omega$ |
| | | $V_{GS} = -10\text{ V}, I_D = -4\text{ A}$ | — | 13.9 | 18 | |

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} | $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | — | 2160 | — | pF |
| Reverse transfer capacitance | C_{rss} | | — | 238 | — | |
| Output capacitance | C_{oss} | | — | 292 | — | |
| Switching time (rise time) | t_r | See Figure 6.2.1. | — | 11 | — | ns |
| Switching time (turn-on time) | t_{on} | | — | 29 | — | |
| Switching time (fall time) | t_f | | — | 35 | — | |
| Switching time (turn-off time) | t_{off} | | — | 150 | — | |

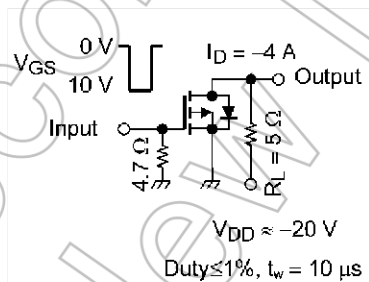


Fig. 6.2.1 Switching Time Test Circuit

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 | $V_{DD} \approx -32\text{ V}, V_{GS} = -10\text{ V}, I_D = -8\text{ A}$ | — | 44.6 | — | nC |
| Gate-source charge 1 | Q_{gs1} | | — | 5.7 | — | |
| Gate-drain charge | Q_{gd} | | — | 13.1 | — | |
| Gate switch charge | Q_{sw} | | — | 14.0 | — | |

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} | — | — | — | -32 | A |
| Diode forward voltage | V_{DSF} | $I_{DR} = -8\text{ A}, V_{GS} = 0\text{ V}$ | — | — | 1.2 | V |

Note 7: Ensure that the channel temperature does not exceed 175°C .

7. Marking

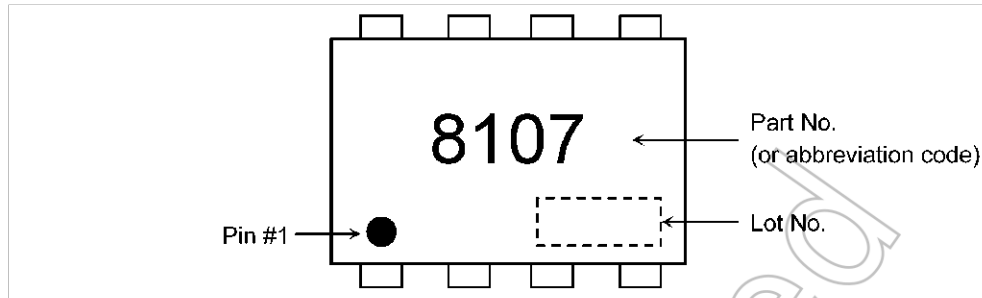


Fig. 7.1 Marking

Not Recommended
for New Design

8. Characteristics Curves (Note)

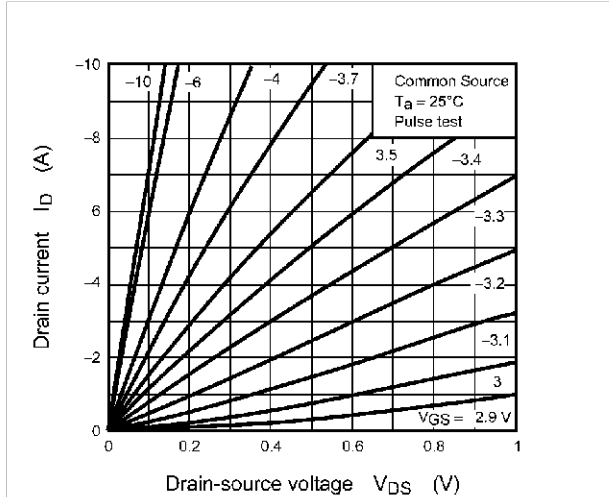


Fig. 8.1 $I_D - V_{DS}$

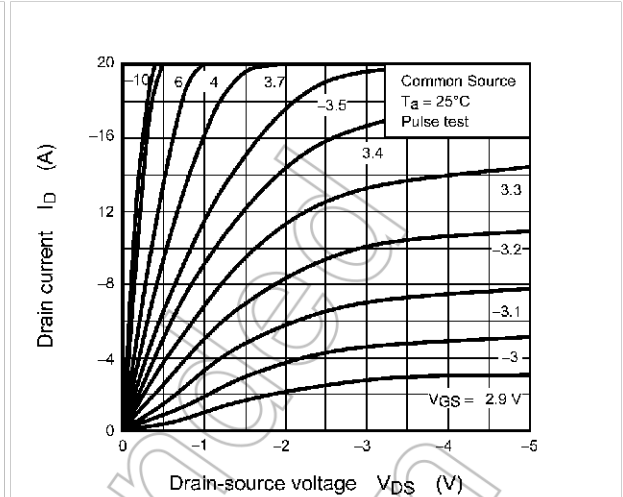


Fig. 8.2 $I_D - V_{DS}$

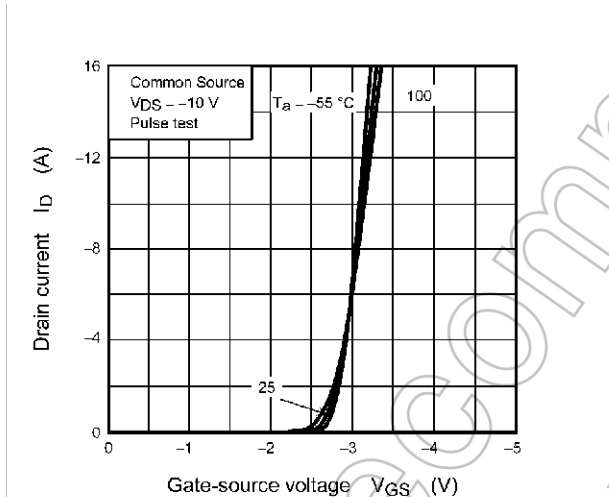


Fig. 8.3 $I_D - V_{GS}$

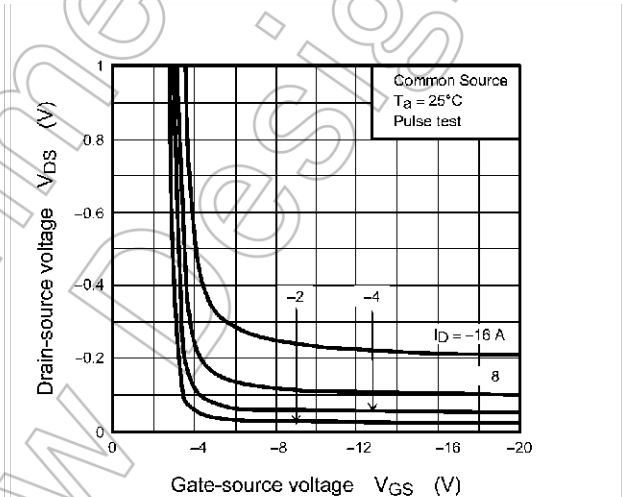


Fig. 8.4 $V_{DS} - V_{GS}$

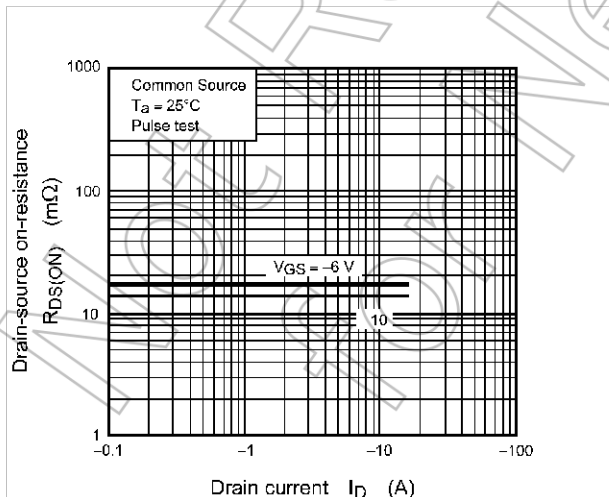


Fig. 8.5 $R_{DS(ON)} - I_D$

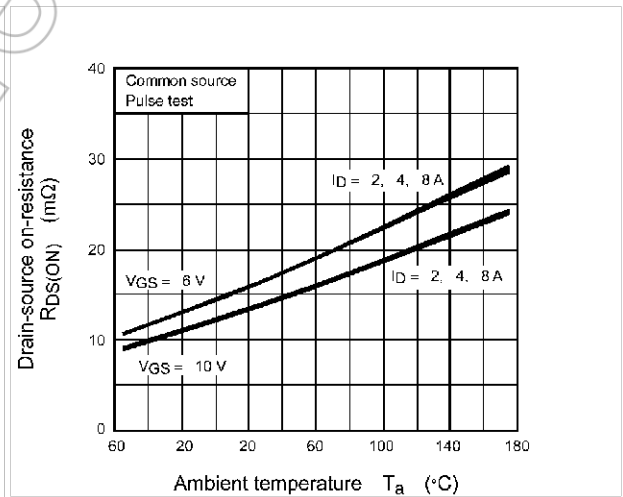


Fig. 8.6 $R_{DS(ON)} - T_a$ (Note 8)

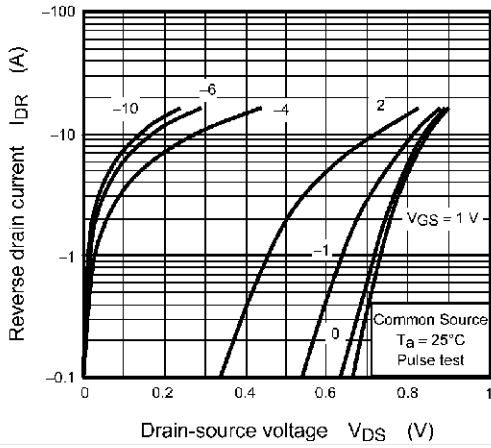


Fig. 8.7 $I_{DR} - V_{DS}$

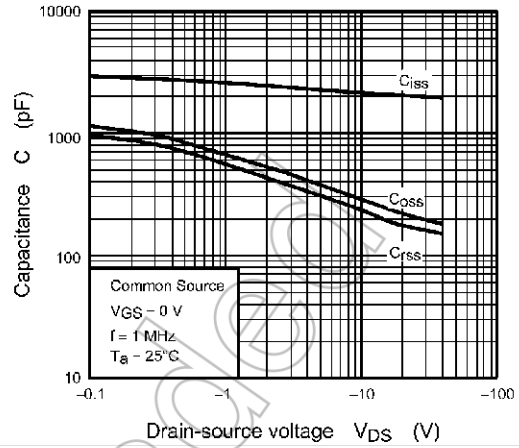


Fig. 8.8 Capacitance - V_{DS}

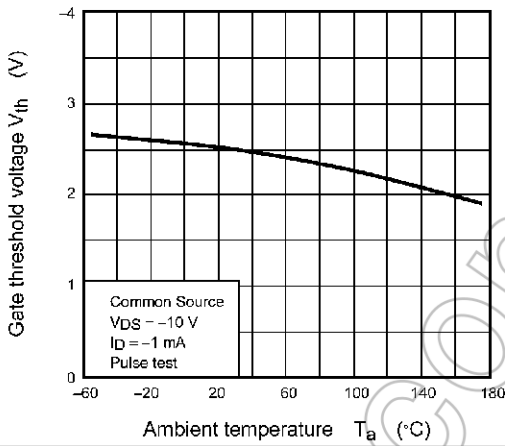


Fig. 8.9 $V_{th} - T_a$ (Note 8)

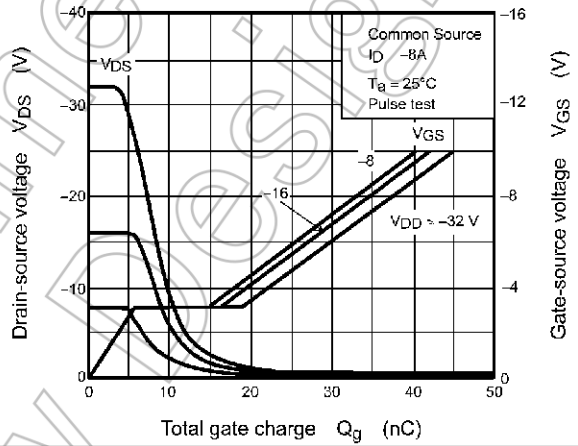
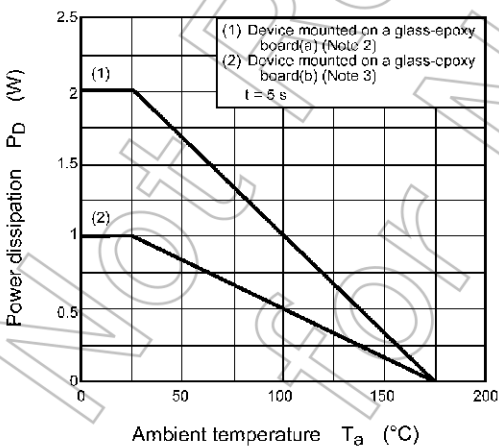


Fig. 8.10 Dynamic Input/Output Characteristics



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

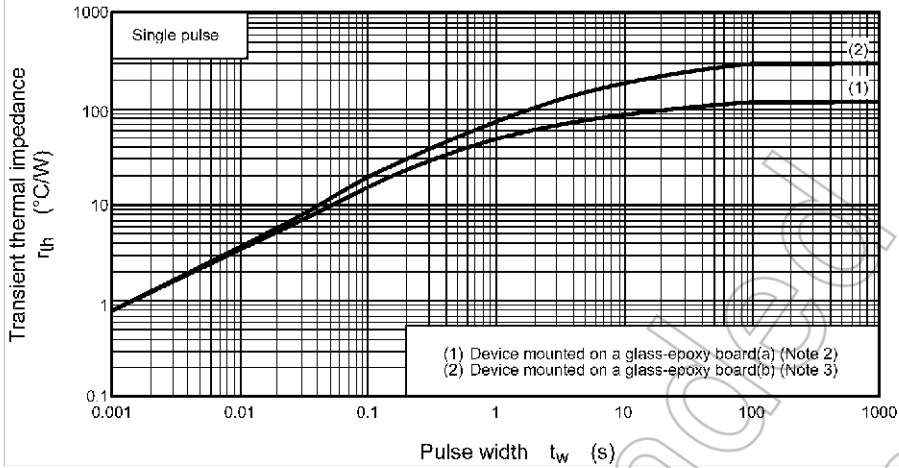


Fig. 8.12 $r_{th} - t_w$
(Guaranteed Maximum)

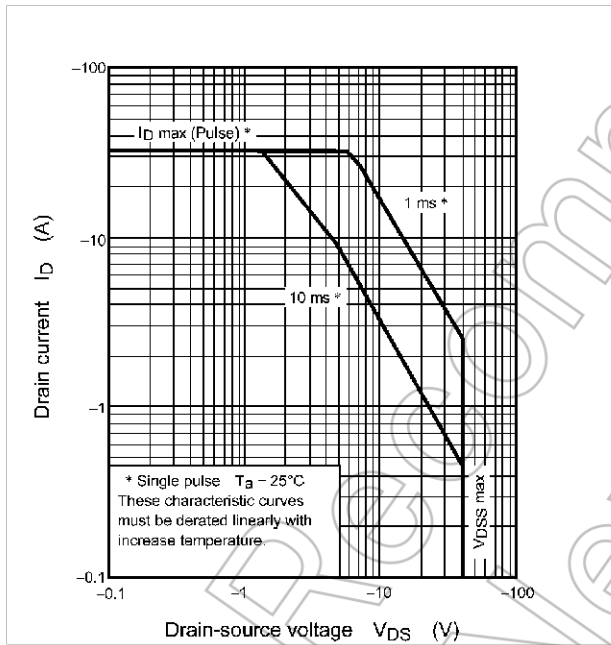


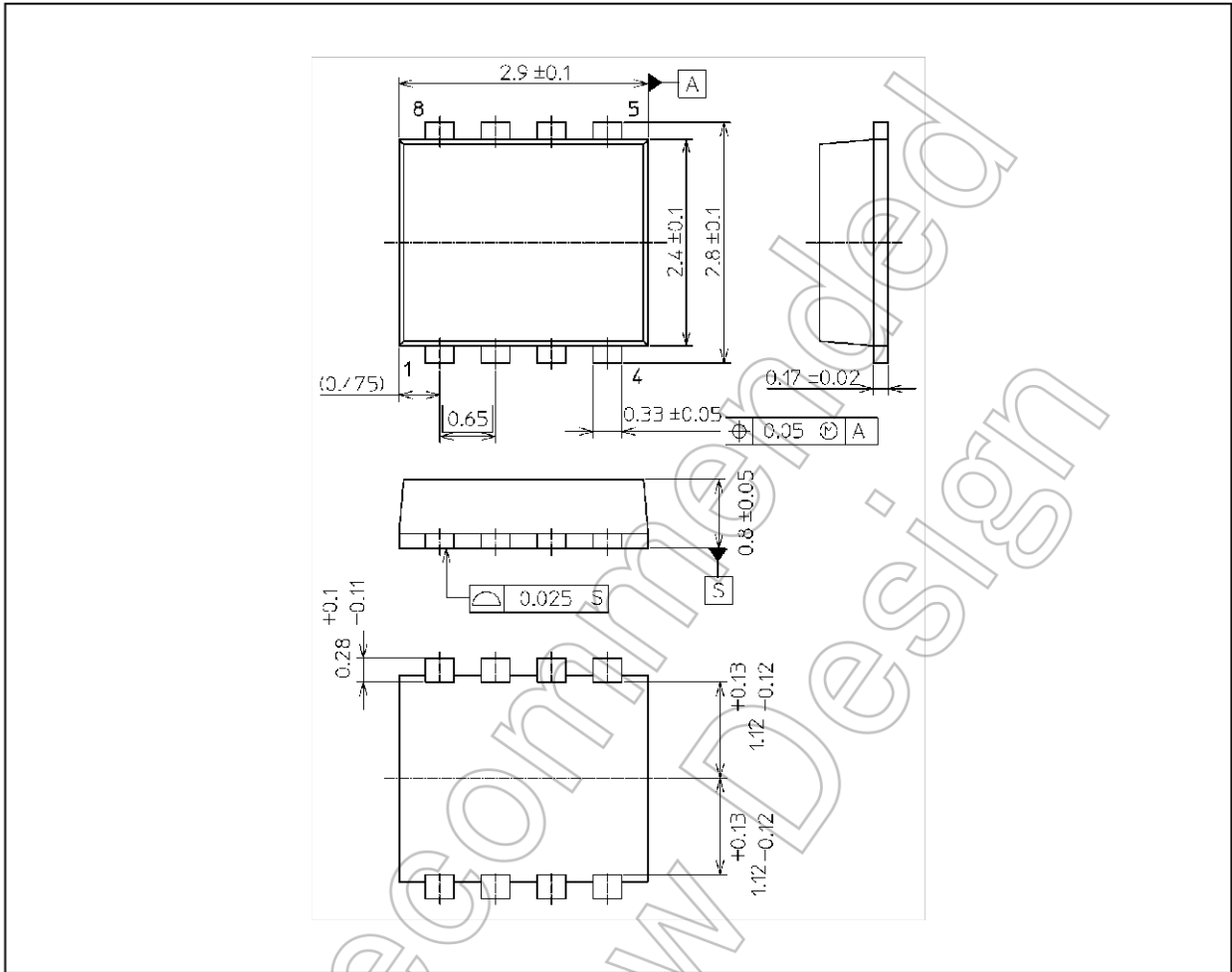
Fig. 8.13 Safe Operating Area
(Guaranteed Maximum)

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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