MOSFETs Silicon N-channel MOS (U-MOSⅣ)

TPCP8011

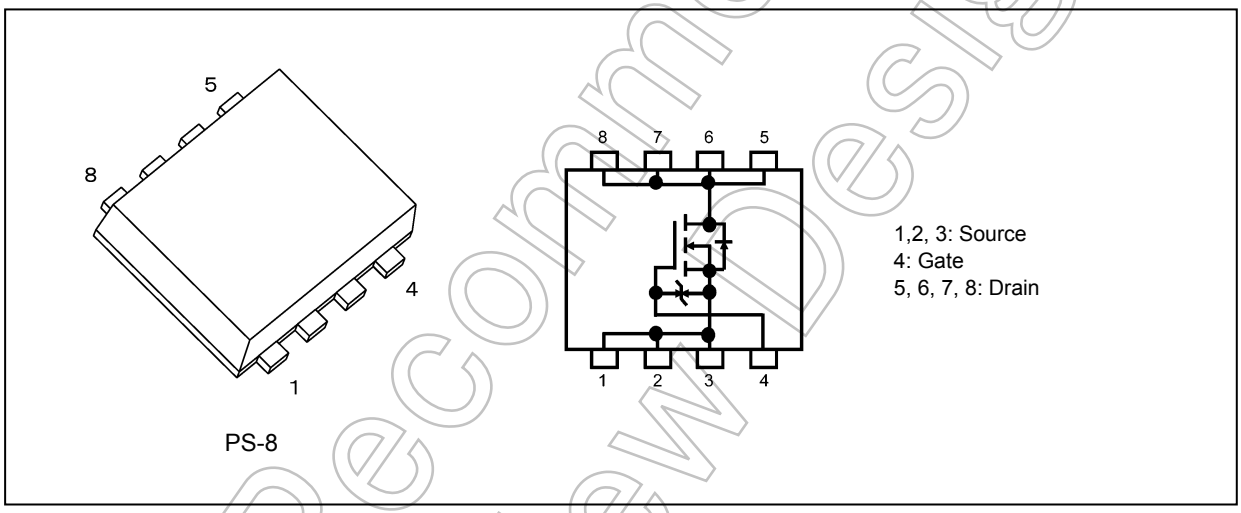
1. Applications

- Motor Drivers
- Mobile Equipment

2. Features

(1) AEC-Q101 qualified
(2) Small, thin package
(3) Small gate charge : Q_{SW} = 4.7 nC (typ.)
(4) Low drain-source on-resistance: $R_{DS(ON)}$ = 25.5 mΩ (typ.) (V_{GS} = 10 V)
(5) Low leakage current: I_{DSS} = 10 μA (max) (V_{DS} = 40 V)
(6) Enhancement mode: V_{th} = 2 to 3 V (V_{DS} = 10 V, I_D = 1 mA)

3. Packaging and Internal Circuit



Start of commercial production
2012-12

4. Absolute Maximum Ratings (Note) (T_a = 25°C unless otherwise specified)

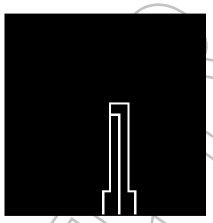
Characteristics			Symbol	Rating	Unit
Drain-source voltage			V_{DSS}	40	V
Gate-source voltage			V_{GSS}	±20	
Drain current (DC)		(Note 1)	I_D	5	A
Drain current (pulsed)		(Note 1)	I_{DP}	20	
Power dissipation	(t = 5 s)	(Note 2)	P_D	1.96	W
Power dissipation	(t = 5 s)	(Note 3)	P_D	0.94	W
Single-pulse avalanche energy		(Note 4)	E_{AS}	33.2	mJ
Avalanche current			I_{AR}	5	A
Channel temperature		(Note 5)	T_{ch}	175	°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

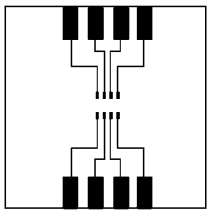
Characteristics			Symbol	Max	Unit
Channel-to-ambient thermal resistance	(t = 5 s)	(Note 2)	$R_{th(ch-a)}$	76.5	°C/W
Channel-to-ambient thermal resistance	(t = 5 s)	(Note 3)	$R_{th(ch-a)}$	159.5	°C/W

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 V, T_{ch} = 25°C (initial), L = 1.379 mH, R_G = 1 Ω, I_{AR} = 5 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.

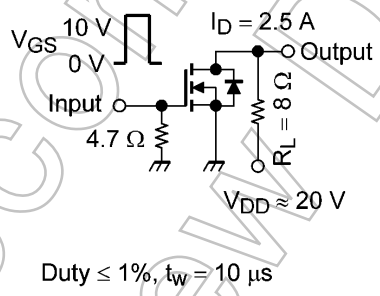
6. Electrical Characteristics

6.1. Static Characteristics (T_a = 25°C unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current	I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0 V	—	—	±10	μA
Drain cut-off current	I_{DSS}	V_{DS} = 40 V, V_{GS} = 0 V	—	—	10	
Drain-source breakdown voltage	$V_{(BR)DSS}$	I_D = 10 mA, V_{GS} = 0 V	40	—	—	V
Drain-source breakdown voltage	$V_{(BR)DSX}$	I_D = 10 mA, V_{GS} = -20 V	20	—	—	
Gate threshold voltage	V_{th}	V_{DS} = 10 V, I_D = 1 mA	2	2.5	3	
Drain-source on-resistance	$R_{DS(ON)}$	V_{GS} = 6 V, I_D = 2.5 A	—	32	51.2	mΩ
		V_{GS} = 10 V, I_D = 2.5 A	—	25.5	31.8	

6.2. Dynamic Characteristics (T_a = 25°C unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input capacitance	C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	505	—	pF
Reverse transfer capacitance	C_{rss}		—	66	—	
Output capacitance	C_{oss}		—	115	—	
Switching time (rise time)	t_r	See Figure 6.2.1	—	5.37	—	ns
Switching time (turn-on time)	t_{on}		—	12	—	
Switching time (fall time)	t_f		—	4.34	—	
Switching time (turn-off time)	t_{off}		—	17.4	—	



Duty ≤ 1%, t_w = 10 μs

Fig. 6.2.1 Switching Time Test Circuit

6.3. Gate Charge Characteristics (T_a = 25°C unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Total gate charge (gate-source plus gate-drain)	Q_g	V_{DD} ≈ 32 V, V_{GS} = 10 V, I_D = 5 A	—	11.8	—	nC
Gate-source charge 1	Q_{gs1}		—	2.1	—	
Gate-drain charge	Q_{gd}		—	3.9	—	
Gate switch charge	Q_{SW}		—	4.7	—	

6.4. Source-Drain Characteristics (T_a = 25°C unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Reverse drain current (pulsed) (Note 6)	I_{DRP}	—	—	—	20	A
Diode forward voltage	V_{DSF}	I_{DR} = 5 A, V_{GS} = 0 V	—	—	-1.2	V

Note 6: Ensure that the channel temperature does not exceed 175°C.

7. Marking

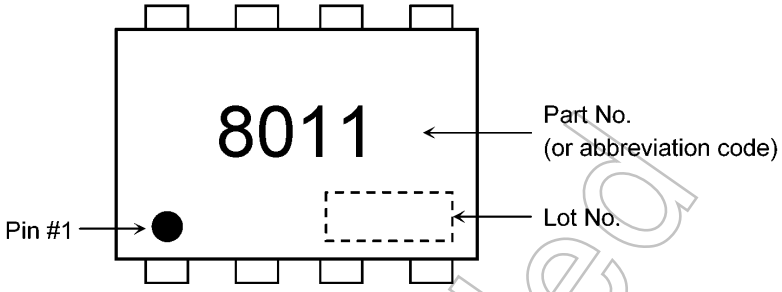


Fig. 7.1 Marking

8. Characteristics Curves (Note)

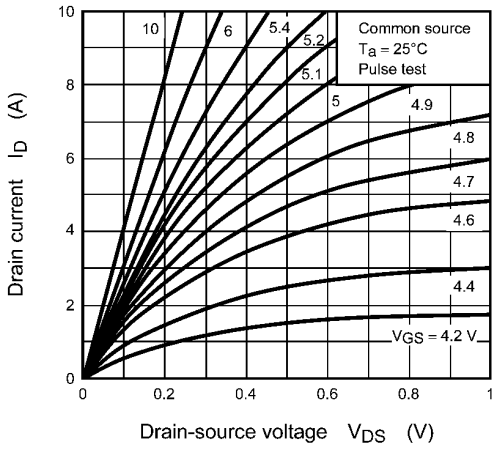


Fig. 8.1 I_D - V_{DS}

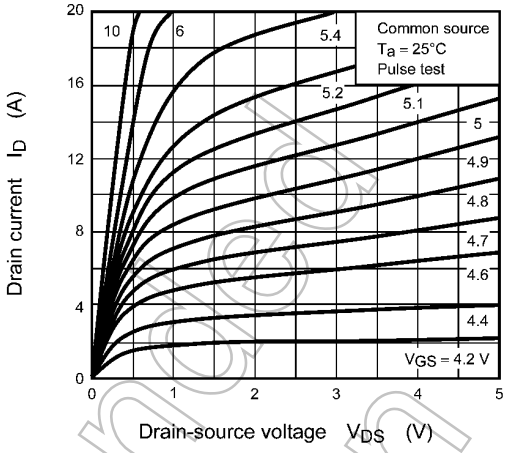


Fig. 8.2 I_D - V_{DS}

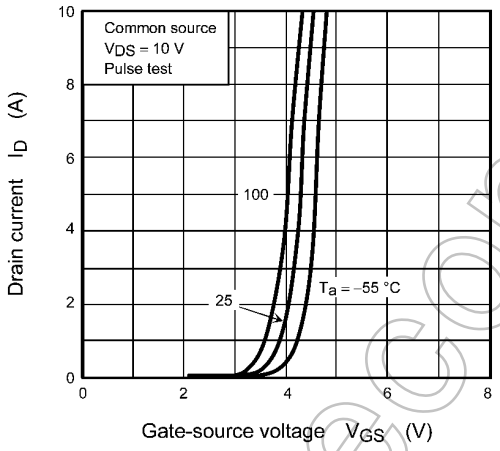


Fig. 8.3 I_D - V_{GS}

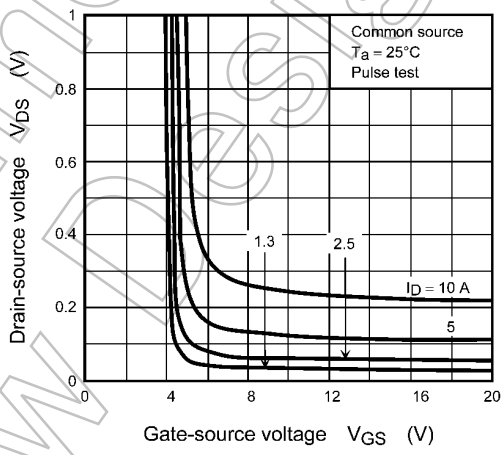


Fig. 8.4 V_{DS} - V_{GS}

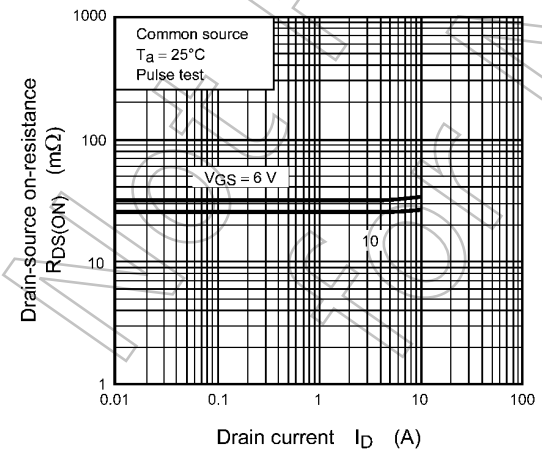


Fig. 8.5 $R_{DS(ON)}$ - I_D

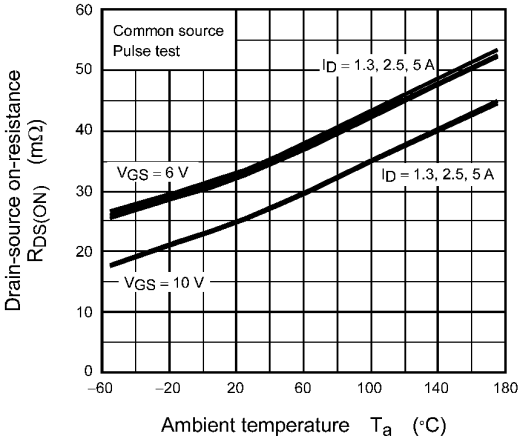


Fig. 8.6 $R_{DS(ON)}$ - T_a (Note 7)

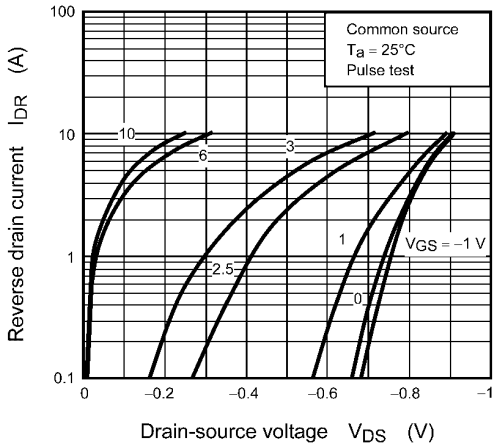


Fig. 8.7 I_{DR} - V_{DS}

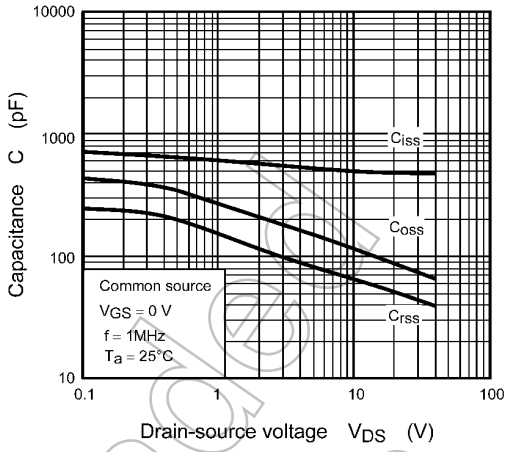


Fig. 8.8 Capacitance - V_{DS}

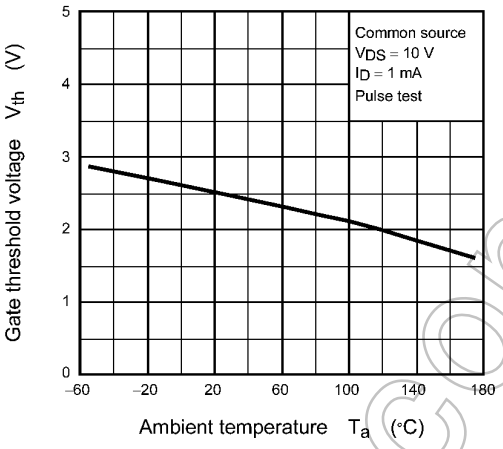


Fig. 8.9 V_{th} - T_a (Note 7)

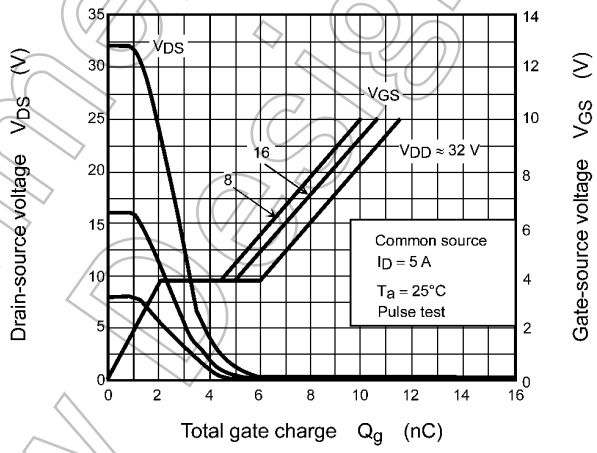


Fig. 8.10 Dynamic Input/Output Characteristics

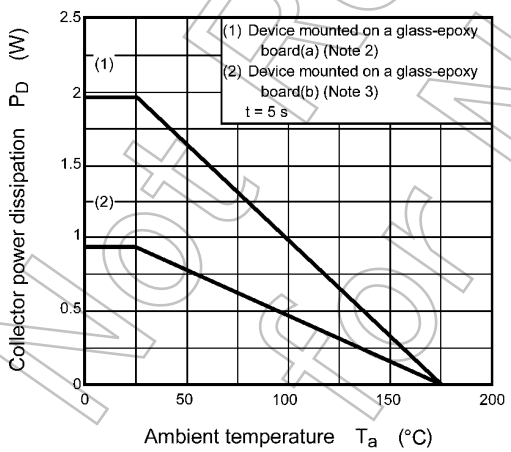


Fig. 8.11 P_D - T_a (Note 7)
(Guaranteed Maximum)

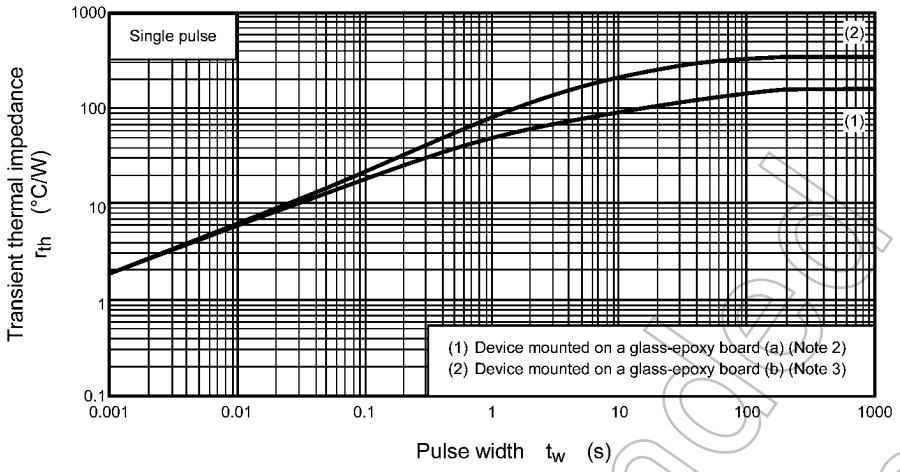


Fig. 8.12 r_{th} - t_w (Guaranteed Maximum)

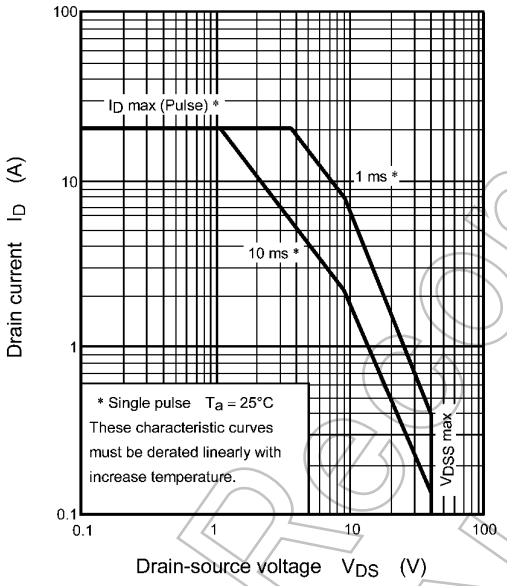


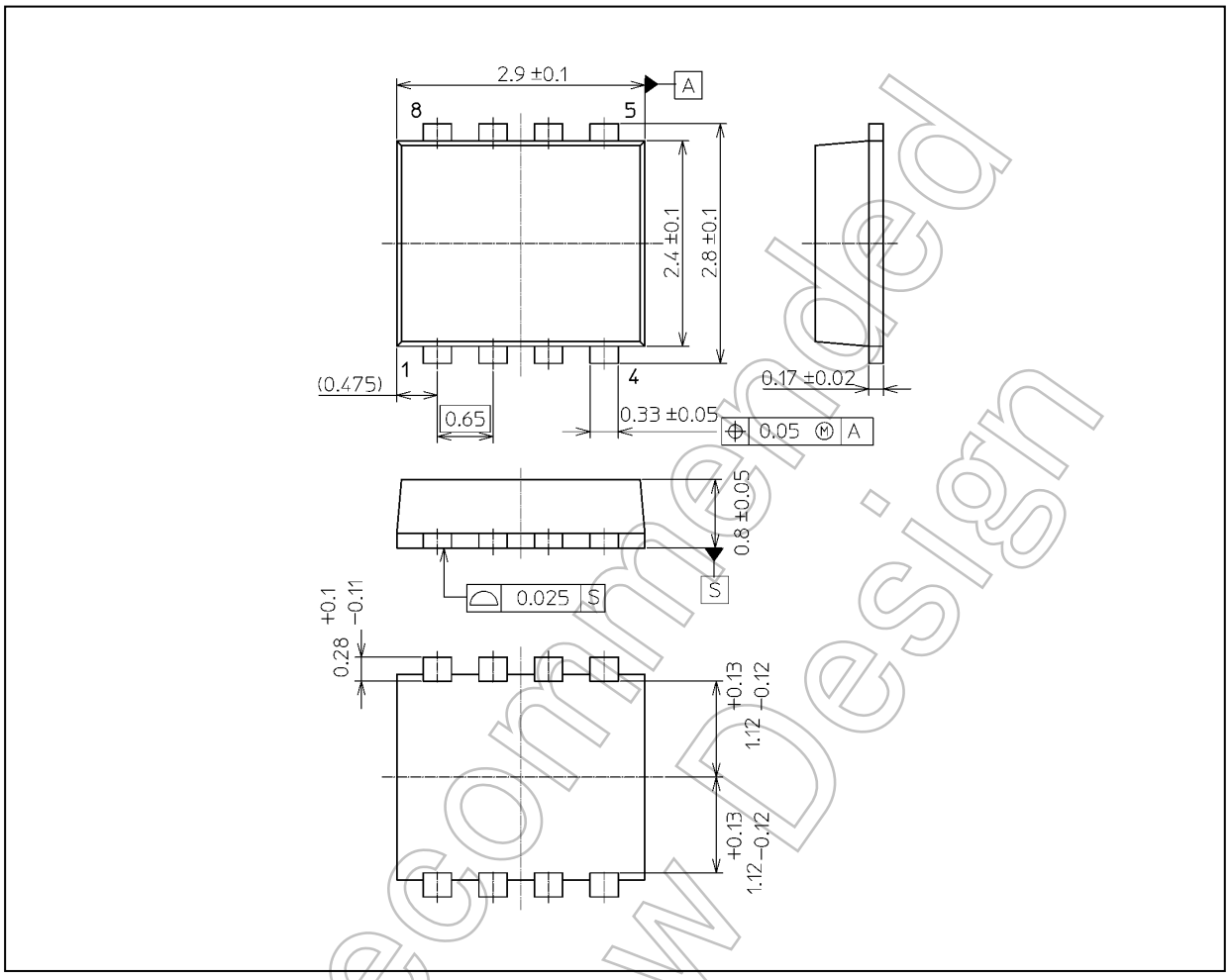
Fig. 8.13 Safe Operating Area (Guaranteed Maximum)

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

Note 7: 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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