

TPW2R508NH

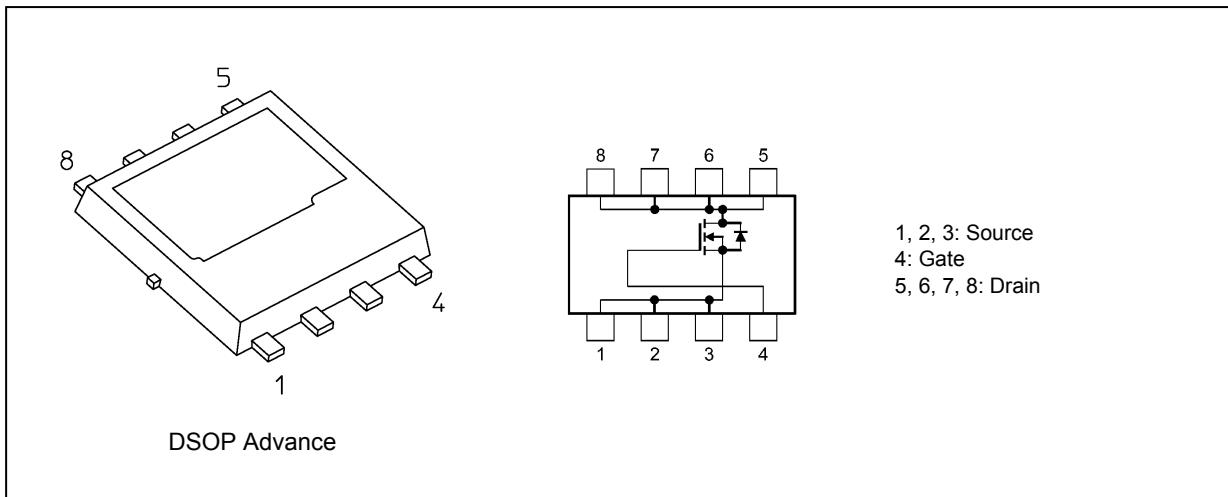
1. Applications

- High-Efficiency DC-DC Converters
- Switching Voltage Regulators

2. Features

- (1) High-speed switching
- (2) Small gate charge: $Q_{SW} = 28 \text{ nC}$ (typ.)
- (3) Low drain-source on-resistance: $R_{DS(ON)} = 2.0 \text{ m}\Omega$ (typ.) ($V_{GS} = 10 \text{ V}$)
- (4) Low leakage current: $I_{DSS} = 10 \text{ }\mu\text{A}$ (max) ($V_{DS} = 75 \text{ V}$)
- (5) Enhancement mode: $V_{th} = 2.0 \text{ to } 4.0 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 1.0 \text{ mA}$)

3. Packaging and Internal Circuit



Start of commercial production
2015-12

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

Characteristics	Symbol	Rating	Unit
Drain-source voltage	V_{DSS}	75	V
Gate-source voltage	V_{GSS}	± 20	
Drain current (DC) (T _c = 25 °C) (Bottom drain)	I_D	150	A
Drain current (DC) (Silicon limit)	I_D	170	
Drain current (pulsed) (t = 100 μs)	I_{DP}	500	
Power dissipation (T _c = 25 °C) (Bottom drain)	P_D	142	W
Power dissipation	P_D	2.5	
Power dissipation	P_D	0.8	
Single-pulse avalanche energy	E_{AS}	131	mJ
Single-pulse avalanche current	I_{AS}	120	A
Channel temperature	T_{ch}	150	°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-case thermal resistance (T _c = 25 °C)	$R_{th(ch-c)}$	0.88	°C/W
Channel-to-case thermal resistance (Top source (T _c = 25 °C)	$R_{th(ch-c)}$	0.93	
Channel-to-ambient thermal resistance (T _a = 25 °C)	$R_{th(ch-a)}$	50	
Channel-to-ambient thermal resistance (T _a = 25 °C)	$R_{th(ch-a)}$	156	

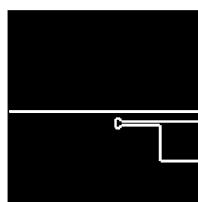
Note 1: Ensure that the channel temperature does not exceed 150 °C.

Note 2: Limited 150 A by package limit.

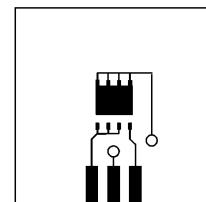
Note 3: Device mounted on a glass-epoxy board (a), Figure 5.1

Note 4: Device mounted on a glass-epoxy board (b), Figure 5.2

Note 5: $V_{DD} = 60$ V, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 7 \mu\text{H}$, $I_{AS} = 120$ A



FR-4
25.4 x 25.4 x 1.6
(Unit: mm)
2 oz copper



FR-4
25.4 x 25.4 x 1.6
(Unit: mm)
2 oz copper

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}	$V_{GS} = \pm 20\text{ V}$, $V_{DS} = 0\text{ V}$	—	—	± 0.1	μA
Drain cut-off current	I_{DSS}	$V_{DS} = 75\text{ V}$, $V_{GS} = 0\text{ V}$	—	—	10	
Drain-source breakdown voltage	$V_{(BR)DSS}$	$I_D = 10\text{ mA}$, $V_{GS} = 0\text{ V}$	75	—	—	V
	$V_{(BR)DSX}$	$I_D = 10\text{ mA}$, $V_{GS} = -20\text{ V}$	55	—	—	
Gate threshold voltage	V_{th}	$V_{DS} = 10\text{ V}$, $I_D = 1.0\text{ mA}$	2.0	—	4.0	
Drain-source on-resistance	$R_{DS(ON)}$	$V_{GS} = 10\text{ V}$, $I_D = 50\text{ A}$	—	2.0	2.5	$\text{m}\Omega$

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}	$V_{DS} = 37.5\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$	—	4600	6000	pF
Reverse transfer capacitance	C_{rss}		—	50	95	
Output capacitance	C_{oss}		—	1100	—	
Gate resistance	r_g	See Fig. 6.2.1	—	1.0	1.5	Ω
Switching time (rise time)	t_r		—	11	—	ns
Switching time (turn-on time)	t_{on}		—	30	—	
Switching time (fall time)	t_f		—	15	—	
Switching time (turn-off time)	t_{off}		—	56	—	

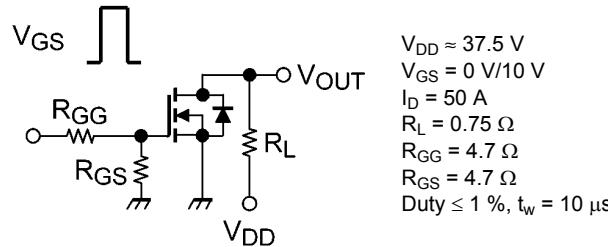


Fig. 6.2.1 Switching Time Test Circuit

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	$V_{DD} \approx 37.5\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 50\text{ A}$	—	72	—	nC
Gate-source charge 1	Q_{gs1}		—	24	—	
Gate-drain charge	Q_{gd}		—	18	—	
Gate switch charge	Q_{SW}		—	28	—	

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}	—	—	—	500	A
Diode forward voltage	V_{DSF}	$I_{DR} = 150\text{ A}$, $V_{GS} = 0\text{ V}$	—	—	-1.2	V
Reverse recovery time	t_{rr}	$V_R = 37.5\text{ V}$, $I_{DR} = 37.5\text{ A}$, $V_{GS} = 0\text{ V}$, $-dI_{DR}/dt = 100\text{ A}/\mu\text{s}$	—	51	—	ns
Reverse recovery charge	Q_{rr}	—	—	62	—	nC

Note 6: Ensure that the channel temperature does not exceed 150°C .

7. Marking

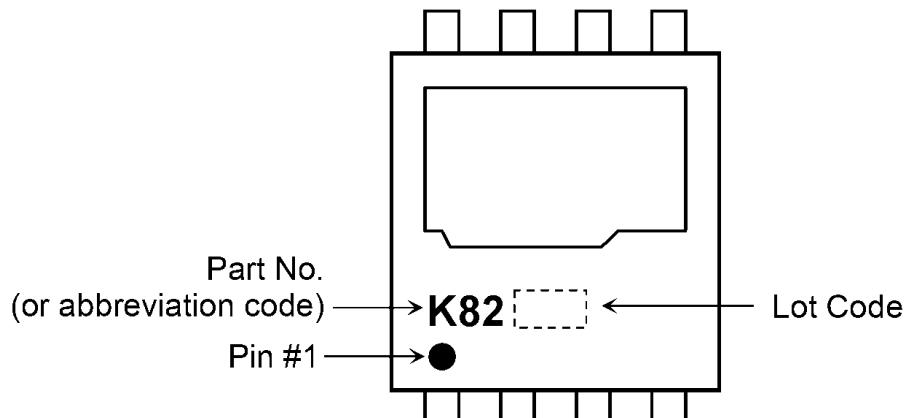


Fig. 7.1 Marking

8. Characteristics Curves (Note)

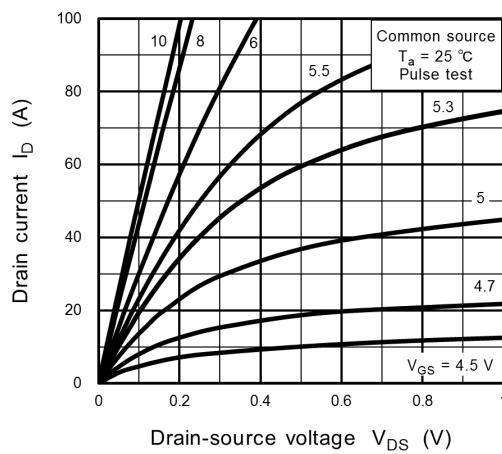


Fig. 8.1 I_D - V_{DS}

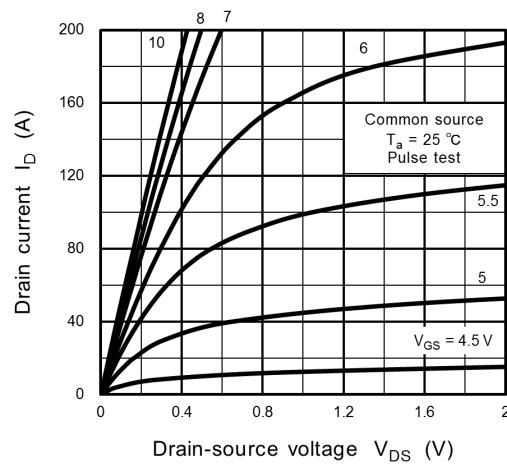


Fig. 8.2 I_D - V_{DS}

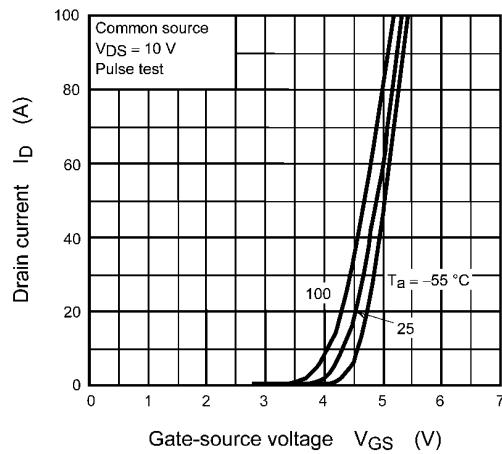


Fig. 8.3 I_D - V_{GS}

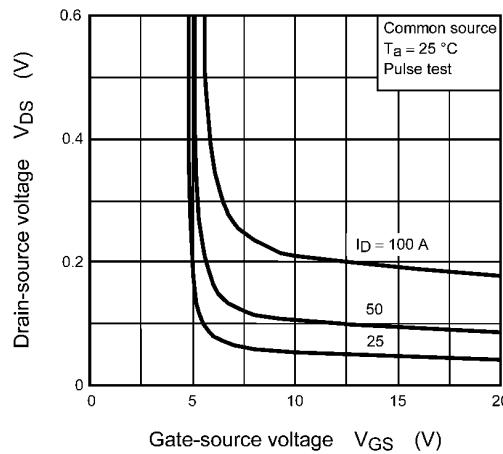


Fig. 8.4 V_{DS} - V_{GS}

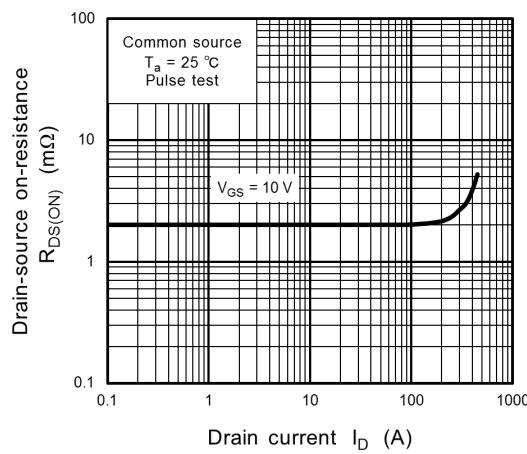


Fig. 8.5 $R_{DS(\text{ON})}$ - I_D

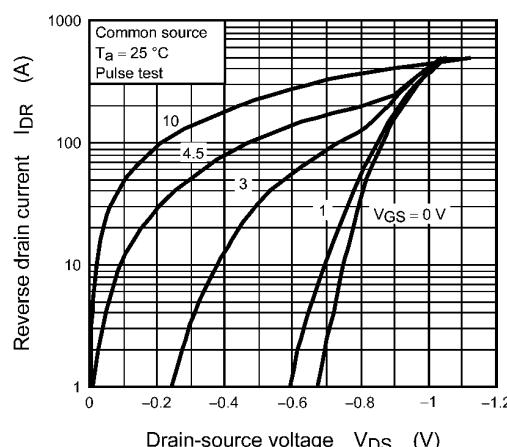


Fig. 8.6 I_{DR} - V_{DS}

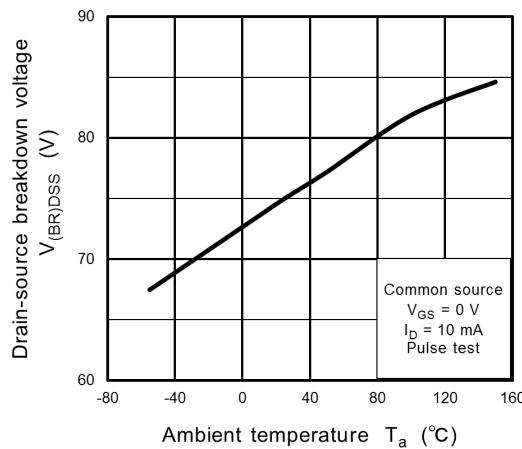


Fig. 8.7 $V_{(BR)DSS}$ - T_a

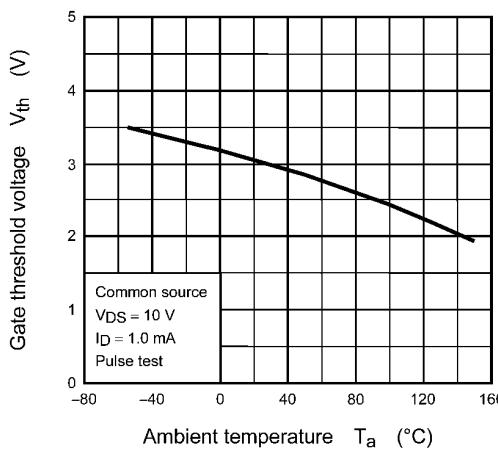


Fig. 8.8 V_{th} - T_a

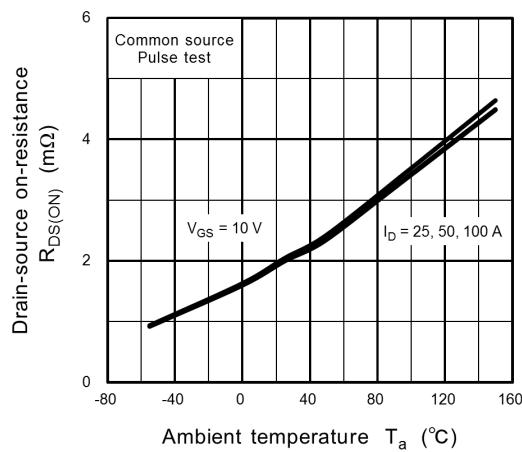


Fig. 8.9 $R_{DS(ON)}$ - T_a

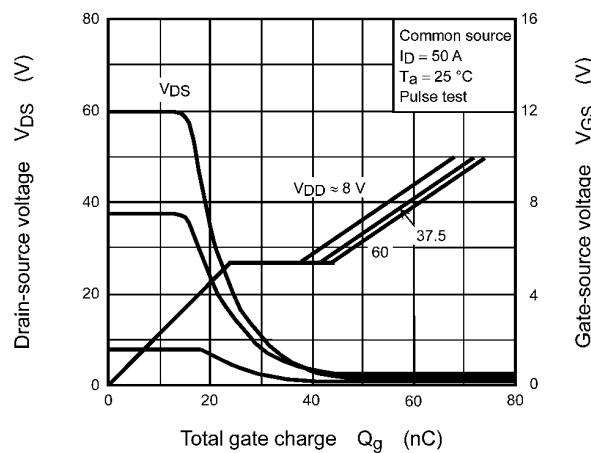


Fig. 8.10 Dynamic Input/Output Characteristics

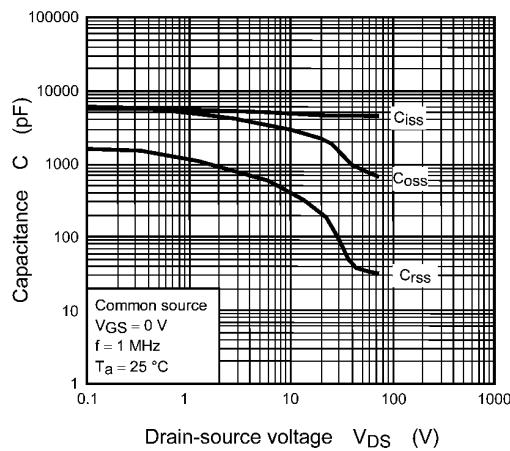
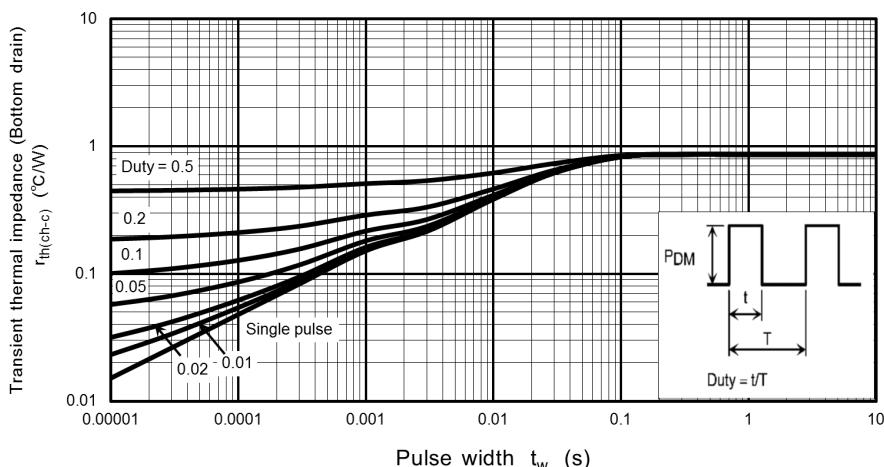
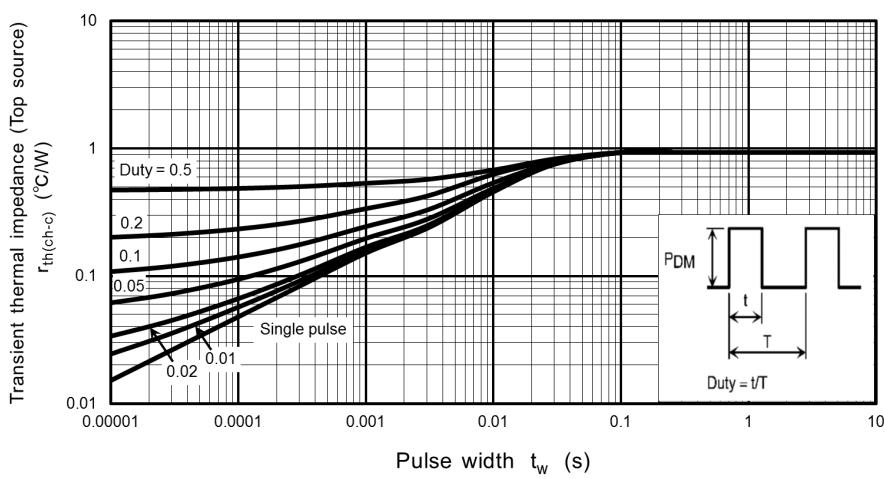


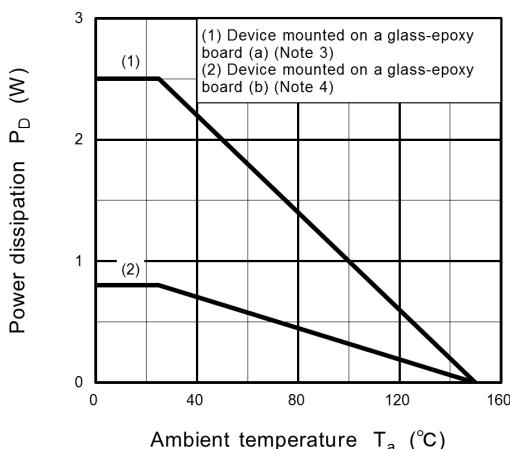
Fig. 8.11 Capacitance - V_{DS}



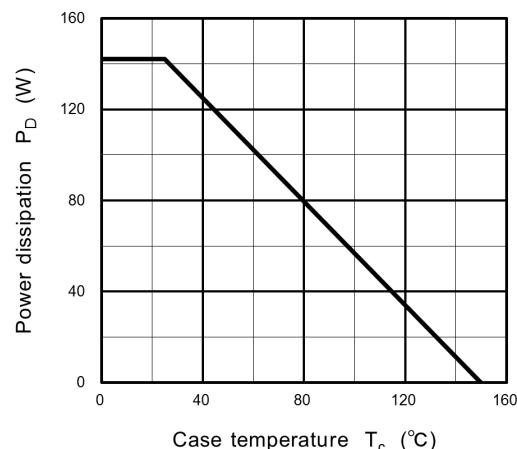
**Fig. 8.12 $r_{th} - t_w$ (Bottom drain)
(Guaranteed Maximum)**



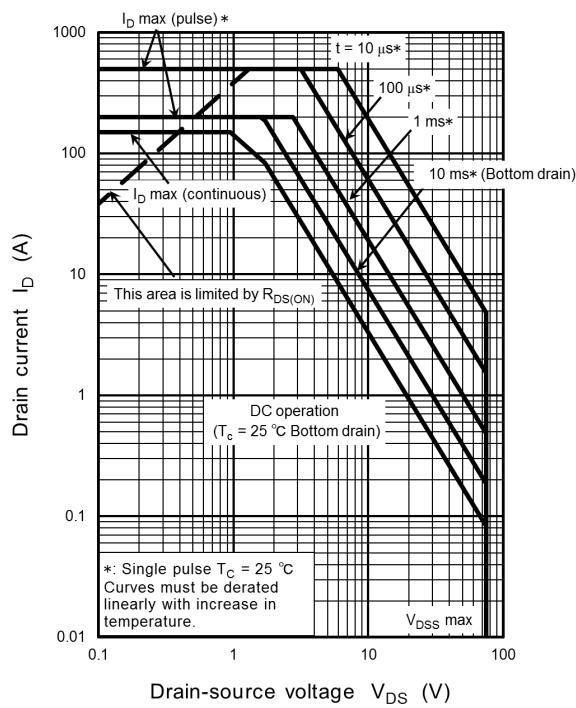
**Fig. 8.13 $r_{th} - t_w$ (Top source)
(Guaranteed Maximum)**



**Fig. 8.14 $P_D - T_a$
(Guaranteed Maximum)**



**Fig. 8.15 $P_D - T_c$ (Bottom drain)
(Guaranteed Maximum)**

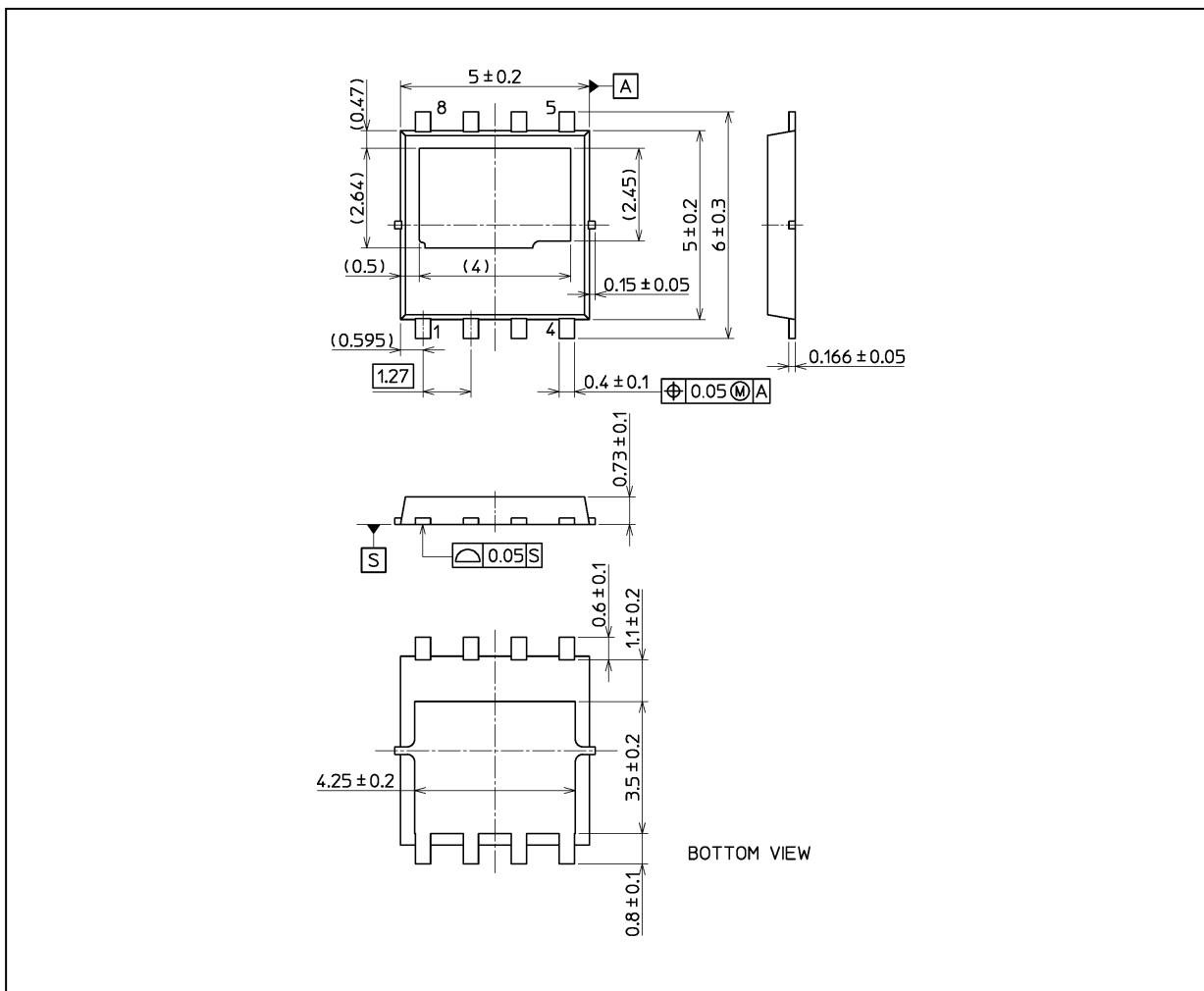


**Fig. 8.16 Safe Operating Area
(Guaranteed Maximum)**

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

Package Dimensions

Unit: mm



Weight: 0.104 g (typ.)

Package Name(s)
TOSHIBA: 2-5S1A
Nickname: DSOP Advance

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