MOSFETs Silicon N-channel MOS (U-MOSⅨ-H)

TPHR7904PB

1. Applications

- Automotive
- Motor Drivers
- Switching Voltage Regulators

2. Features

(1) AEC-Q101 qualified

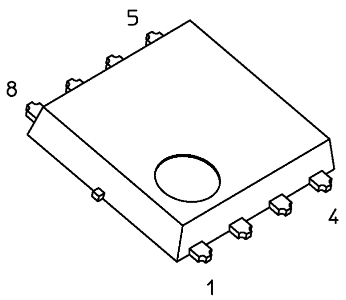
(2) Small, thin package

(3) Low drain-source on-resistance: $R_{DS(ON)}$ = 0.65 mΩ (typ.) (V_{GS} = 10 V)

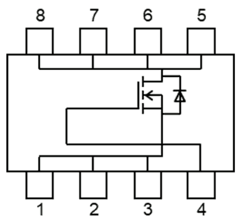
(4) Low leakage current: I_{DSS} = 10 μA (max) (V_{DS} = 40 V)

(5) Enhancement mode: V_{th} = 2.0 to 3.0 V (V_{DS} = 10 V, I_D = 1.0 mA)

3. Packaging and Internal Circuit



SOP Advance(WF)



1, 2, 3: Source
4: Gate
5, 6, 7, 8: Drain

Start of commercial production
2018-03

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

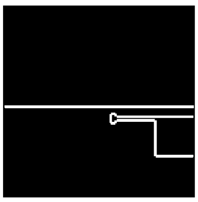
Characteristics			Symbol	Rating	Unit
Drain-source voltage			V_{DSS}	40	V
Gate-source voltage			V_{GSS}	±20	
Drain current (DC)		(Note 1)	I_D	150	A
Drain current (pulsed)		(Note 1)	I_{DP}	450	
Power dissipation	(T_c = 25 °C)		P_D	170	W
Power dissipation	(t = 10 s)	(Note 2)		3.0	
Power dissipation	(t = 10 s)	(Note 3)		0.96	
Single-pulse avalanche energy		(Note 4)	E_{AS}	287	mJ
Single-pulse avalanche current			I_{AS}	150	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

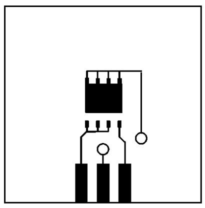
Characteristics			Symbol	Max	Unit
Channel-to-case thermal impedance	(T_c = 25 °C)		$z_{th(ch-c)}$	0.88	°C/W
Channel-to-ambient thermal impedance	(t = 10 s)	(Note 2)	$z_{th(ch-a)}$	50	
Channel-to-ambient thermal impedance	(t = 10 s)	(Note 3)	$z_{th(ch-a)}$	156	

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} = 32 V, T_{ch} = 25 °C (initial), L = 9.8 μH, R_G = 25 Ω, I_{AS} = 150 A
Note 5: The definitions of the absolute maximum channel and storage temperatures are qualified per AEC-Q101.



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

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



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

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} = ±20 V, V_{DS} = 0 V	—	—	±1	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
	$V_{(BR)DSX}$	I_D = 10 mA, V_{GS} = -20 V	20	—	—	
Gate threshold voltage	V_{th}	V_{DS} = 10 V, I_D = 1.0 mA	2.0	—	3.0	
Drain-source on-resistance	$R_{DS(ON)}$	V_{GS} = 6 V, I_D = 75 A	—	0.85	1.3	mΩ
		V_{GS} = 10 V, I_D = 75 A	—	0.65	0.79	

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 = 300 kHz	—	6650	—	pF
Reverse transfer capacitance	C_{rss}		—	490	—	
Output capacitance	C_{oss}		—	4300	—	
Gate resistance	r_g		—	4.1	—	Ω
Switching time (rise time)	t_r	See Fig. 6.2.1	—	10	—	ns
Switching time (turn-on time)	t_{on}		—	23	—	
Switching time (fall time)	t_f		—	35	—	
Switching time (turn-off time)	t_{off}		—	115	—	

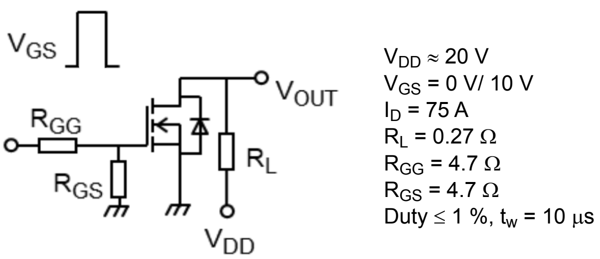


Fig. 6.2.1 Switching Time Test Circuit

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 = 150 A	—	85	—	nC
Gate-source charge 1	Q_{gs1}		—	28	—	
Gate-drain charge	Q_{gd}		—	14	—	

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}	—	—	—	450	A
Diode forward voltage	V_{DSF}	I_{DR} = 150 A, V_{GS} = 0 V	—	—	-1.2	V

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

7. Marking

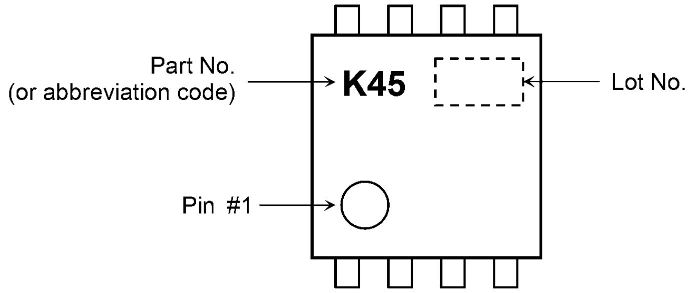


Fig. 7.1 Marking

8. Characteristics Curves (Note)

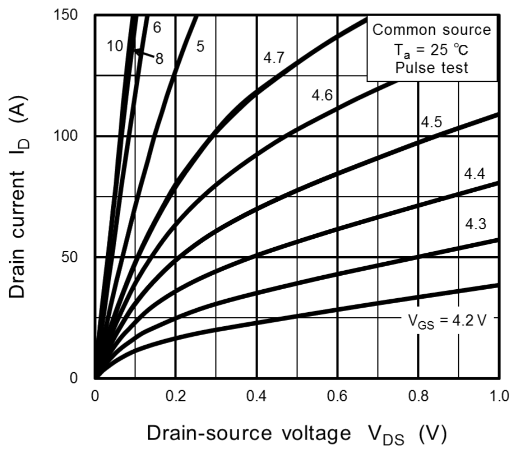


Fig. 8.1 I_D - V_{DS}

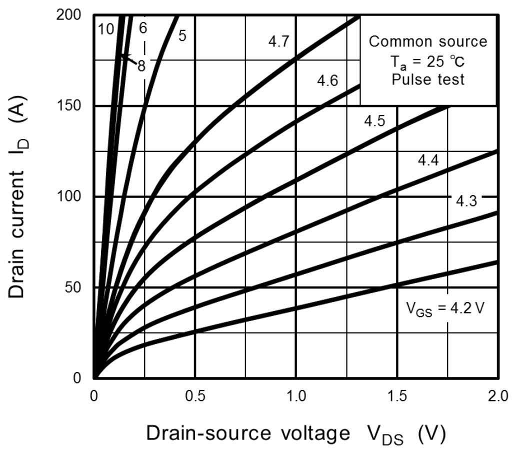


Fig. 8.2 I_D - V_{DS}

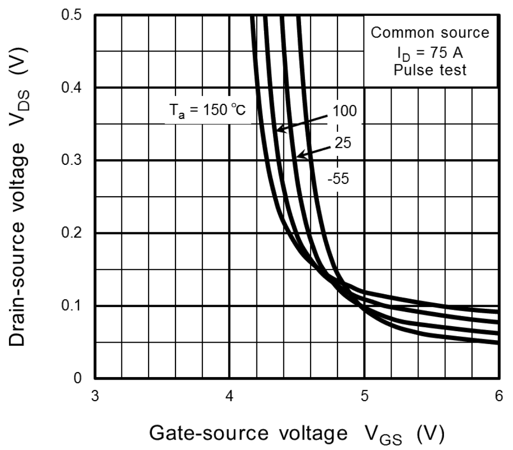


Fig. 8.3 V_{DS} - V_{GS}

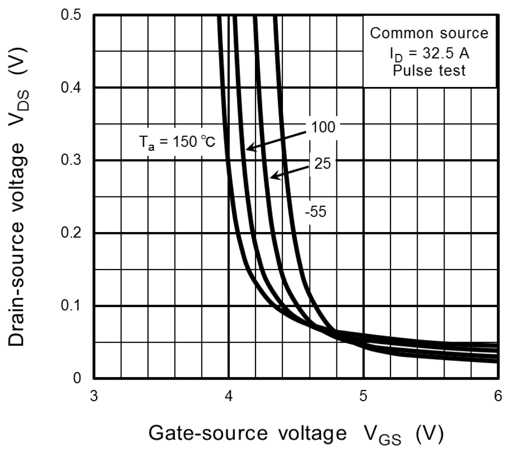


Fig. 8.4 V_{DS} - V_{GS}

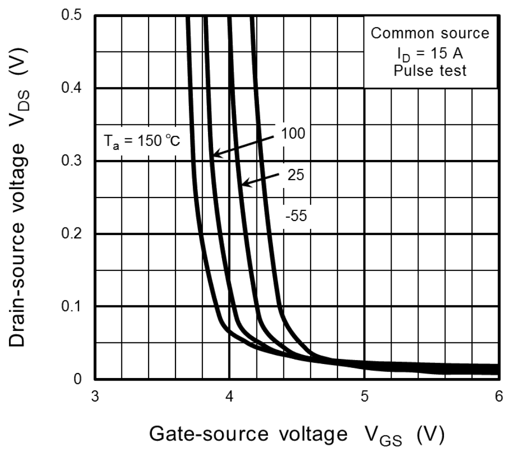


Fig. 8.5 V_{DS} - V_{GS}

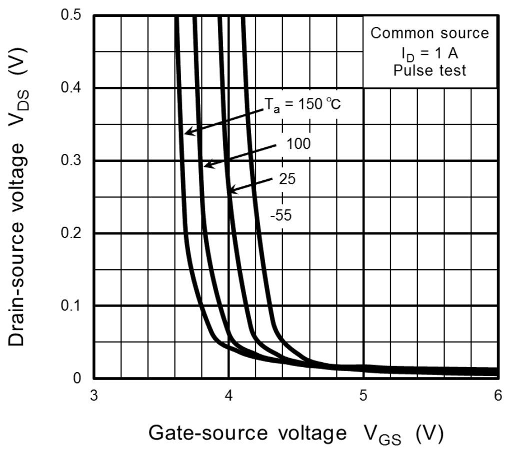


Fig. 8.6 V_{DS} - V_{GS}

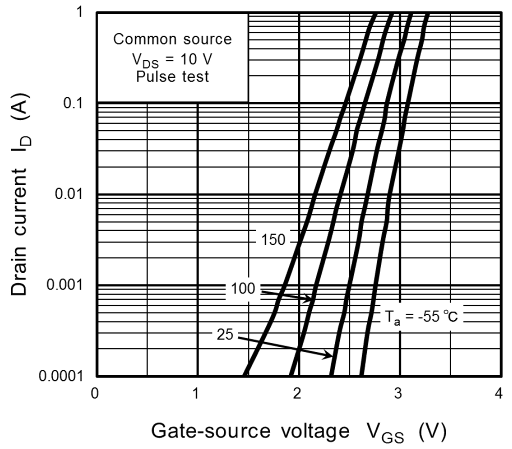


Fig. 8.7 I_D - V_{GS}

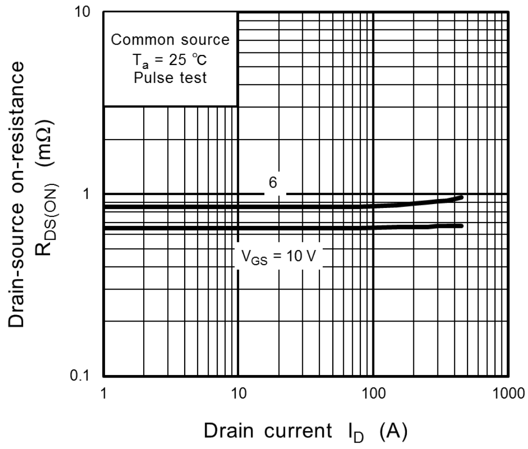


Fig. 8.8 $R_{DS(ON)}$ - I_D

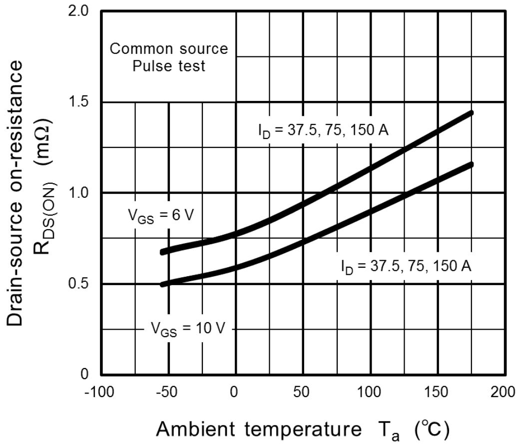


Fig. 8.9 $R_{DS(ON)}$ - T_a

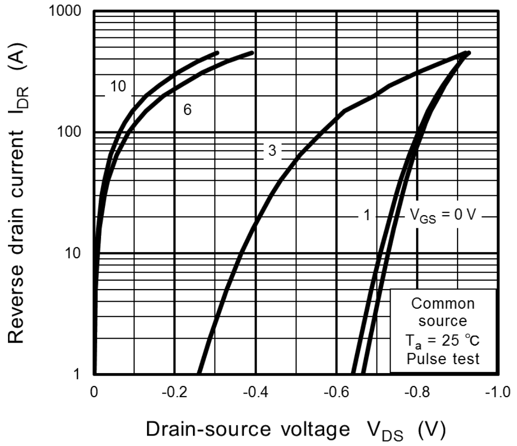


Fig. 8.10 I_{DR} - V_{DS}

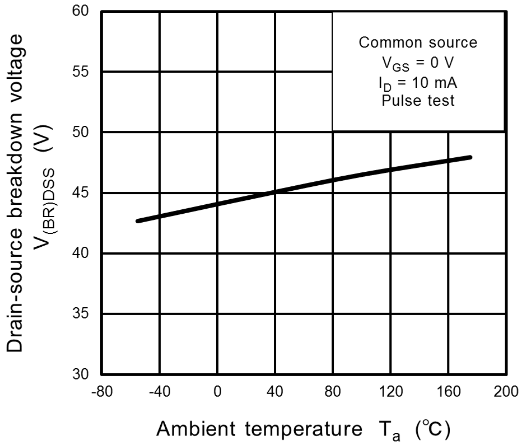


Fig. 8.11 $V_{(BR)DSS}$ - T_a

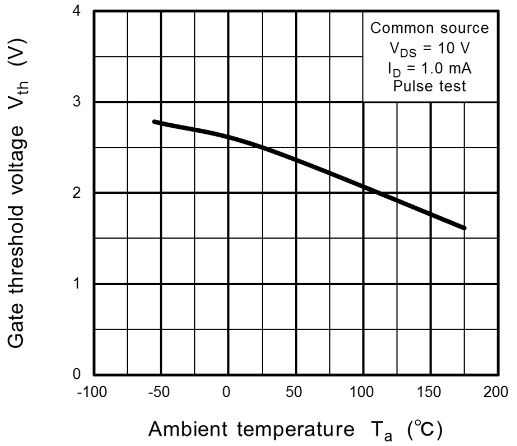


Fig. 8.12 V_{th} - T_a

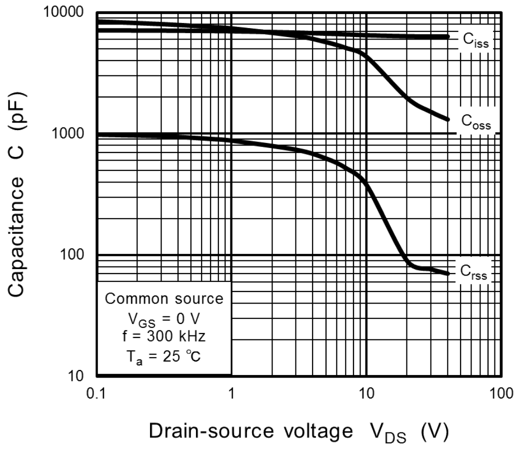


Fig. 8.13 Capacitance - V_{DS}

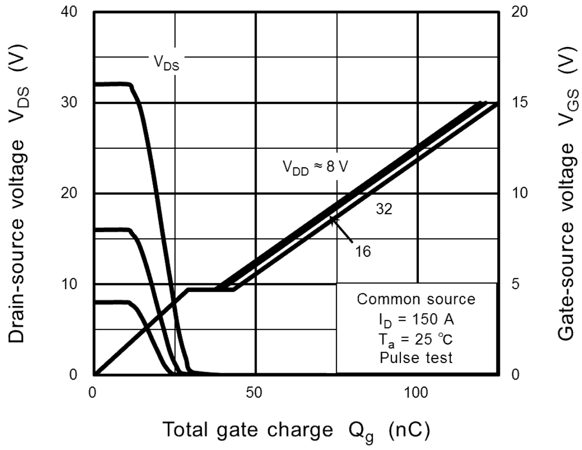


Fig. 8.14 Dynamic Input/Output Characteristics

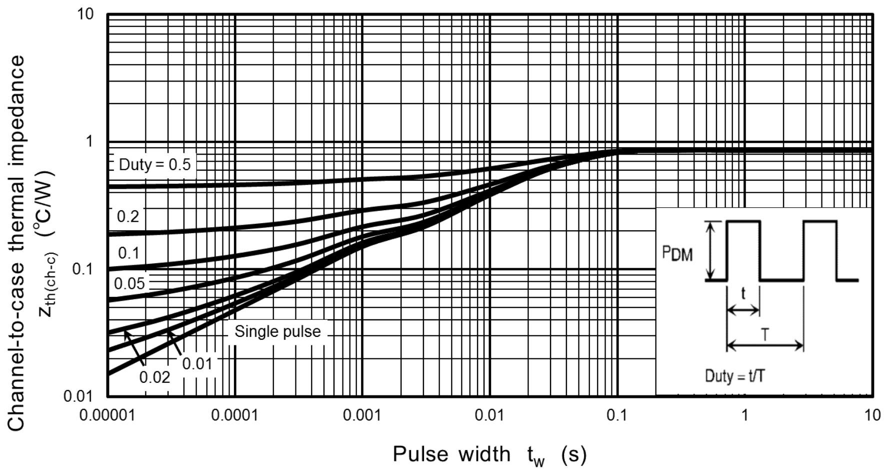


Fig. 8.15 $z_{th(ch-c)}$ - t_w
(Guaranteed Maximum)

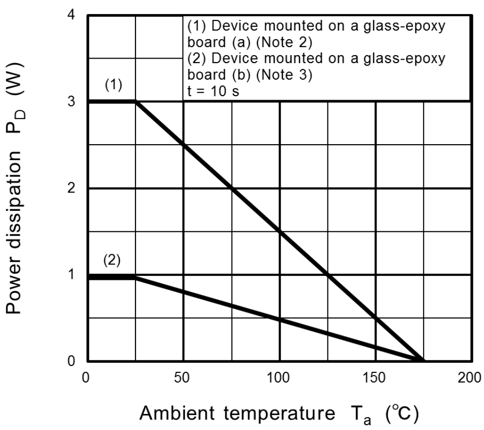


Fig. 8.16 P_D - T_a
(Guaranteed Maximum)

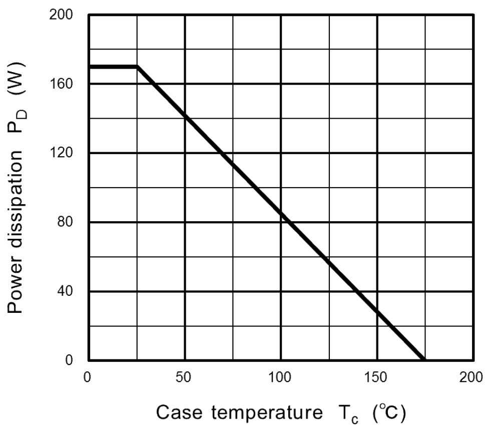


Fig. 8.17 P_D - T_c
(Guaranteed Maximum)

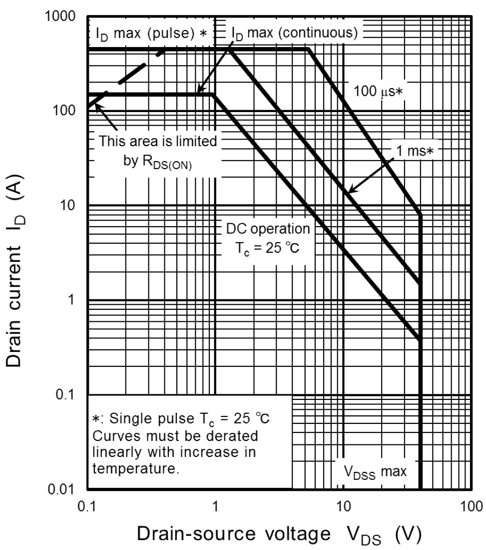
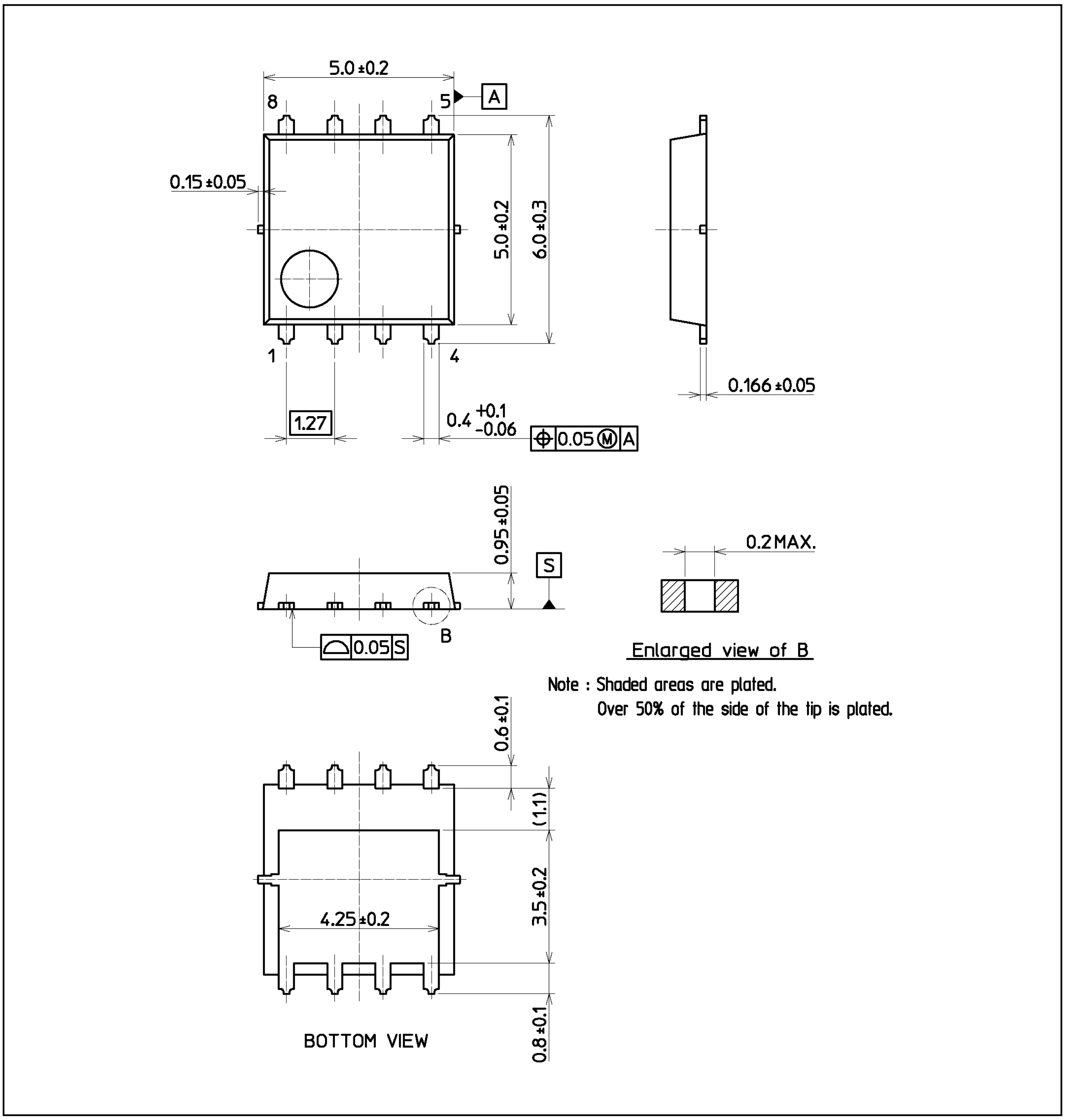


Fig. 8.18 Safe Operating Area
(Guaranteed Maximum)

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

Package Dimensions

Unit: mm



Weight: 0.083 g (typ.)

Package Name(s)
TOSHIBA: 2-5Q4A
Nickname: SOP Advance(WF)

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