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

TPW2900ENH

1. Applications

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

2. Features

(1) High-speed switching

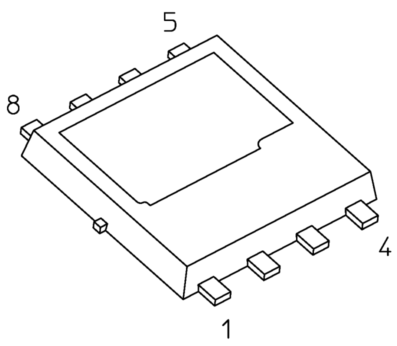
(2) Small gate charge: Q_{SW} = 8.2 nC (typ.)

(3) Low drain-source on-resistance: $R_{DS(ON)}$ = 24 mΩ (typ.) (V_{GS} = 10 V)

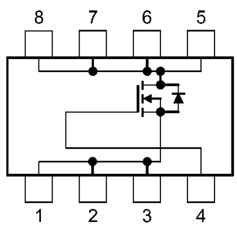
(4) Low leakage current: I_{DSS} = 10 μA (max) (V_{DS} = 200 V)

(5) Enhancement mode: V_{th} = 2.0 to 4.0 V (V_{DS} = 10 V, I_D = 1.0 mA)

3. Packaging and Internal Circuit



DSOP Advance



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

Start of commercial production
2015-08

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

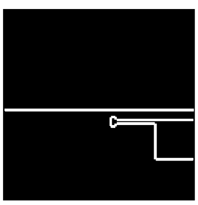
Characteristics	Symbol	Rating	Unit
Drain-source voltage	V_{DSS}	200	V
Gate-source voltage	V_{GSS}	±20	
Drain current (DC) (T_c = 25 °C) (Bottom drain) (Note 1)	I_D	33	A
Drain current (DC) (Silicon limit) (Note 1), (Note 2)	I_D	36	
Drain current (pulsed) (t = 100 μs) (Note 1)	I_{DP}	150	
Power dissipation (T_c = 25 °C) (Bottom drain)	P_D	142	W
Power dissipation (Note 3)	P_D	2.5	
Power dissipation (Note 4)	P_D	0.8	
Single-pulse avalanche energy (Note 5)	E_{AS}	176	mJ
Single-pulse avalanche current (Note 5)	I_{AS}	33	A
Channel temperature	T_{ch}	150	°C
Storage temperature	T_{stg}	-55 to 150	°C

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

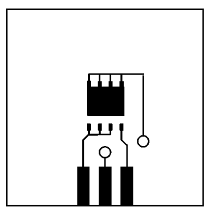
Characteristics	Symbol	Max	Unit
Channel-to-case thermal resistance Bottom drain (T_c = 25 °C)	$R_{th(ch-c)}$	0.88	°C/W
Channel-to-case thermal resistance Top source (T_c = 25 °C)	$R_{th(ch-c)}$	0.93	°C/W
Channel-to-ambient thermal resistance (T_a = 25 °C) (Note 3)	$R_{th(ch-a)}$	50	°C/W
Channel-to-ambient thermal resistance (T_a = 25 °C) (Note 4)	$R_{th(ch-a)}$	156	°C/W

Note 1: Ensure that the channel temperature does not exceed 150 °C.
Note 2: Limited by silicon chip capability.
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 °C (initial), L = 250 μH, I_{AS} = 33 A



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.

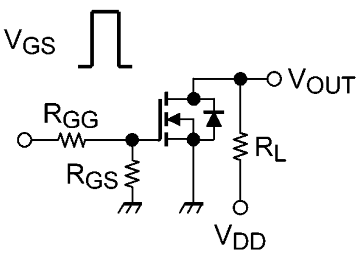
6. Electrical Characteristics

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	—	—	±0.1	μA
Drain cut-off current	I_{DSS}	V_{DS} = 200 V, V_{GS} = 0 V	—	—	10	
Drain-source breakdown voltage	$V_{(BR)DSS}$	I_D = 10 mA, V_{GS} = 0 V	200	—	—	V
	$V_{(BR)DSX}$	I_D = 10 mA, V_{GS} = -20 V	140	—	—	
Gate threshold voltage	V_{th}	V_{DS} = 10 V, I_D = 1.0 mA	2.0	—	4.0	
Drain-source on-resistance	$R_{DS(ON)}$	V_{GS} = 10 V, I_D = 16.5 A	—	24	29	mΩ

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} = 100 V, V_{GS} = 0 V, f = 1 MHz	—	1700	2200	pF
Reverse transfer capacitance	C_{rss}		—	7.0	50	
Output capacitance	C_{oss}		—	180	—	
Gate resistance	r_g	—	—	4.0	6.0	Ω
Switching time (rise time)	t_r	See Fig. 6.2.1	—	8.0	—	ns
Switching time (turn-on time)	t_{on}		—	20	—	
Switching time (fall time)	t_f		—	12	—	
Switching time (turn-off time)	t_{off}		—	36	—	



V_{DD} ≈ 100 V
V_{GS} = 0 V/10 V
I_D = 16.5 A
R_L = 6.06 Ω
R_{GG} = 4.7 Ω
R_{GS} = 4.7 Ω
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} ≈ 100 V, V_{GS} = 10 V, I_D = 33 A	—	22	—	nC
Gate-source charge 1	Q_{gs1}		—	9.0	—	nC
Gate-drain charge	Q_{gd}		—	4.4	—	
Gate switch charge	Q_{SW}		—	8.2	—	

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}	—	—	—	150	A
Diode forward voltage	V_{DSF}	I_{DR} = 33 A, V_{GS} = 0 V	—	—	-1.2	V
Reverse recovery time	t_{rr}	V_{DD} = 100 V, I_{DR} = 8.3 A, V_{GS} = 0 V, $-dI_{DR}/dt$ = 100 A/μs	—	93	—	ns
Reverse recovery charge	Q_{rr}		—	300	—	nC

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

7. Marking

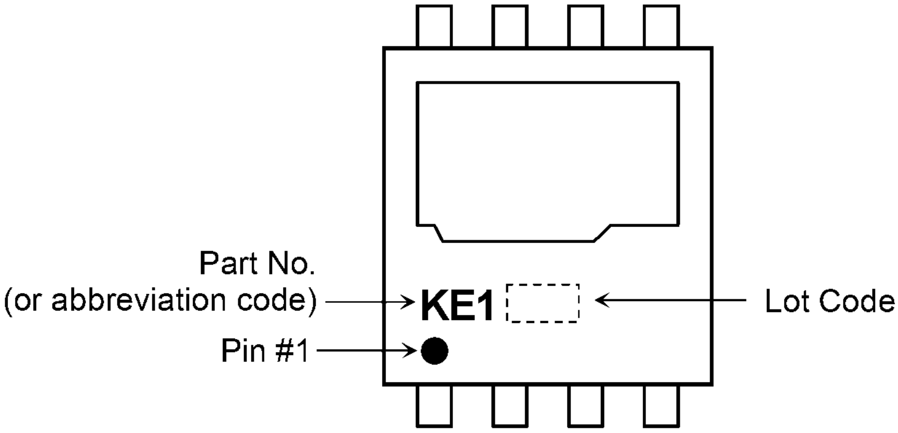


Fig. 7.1 Marking

8. Characteristics Curves (Note)

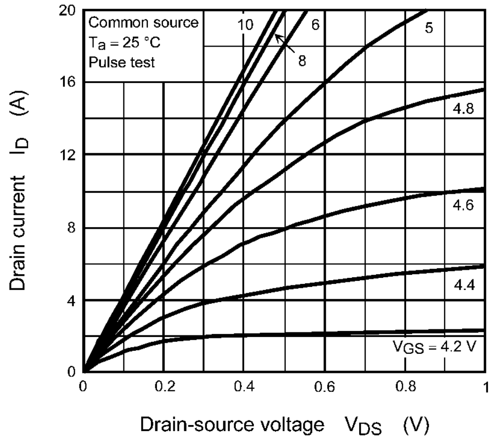


Fig. 8.1 I_D - V_{DS}

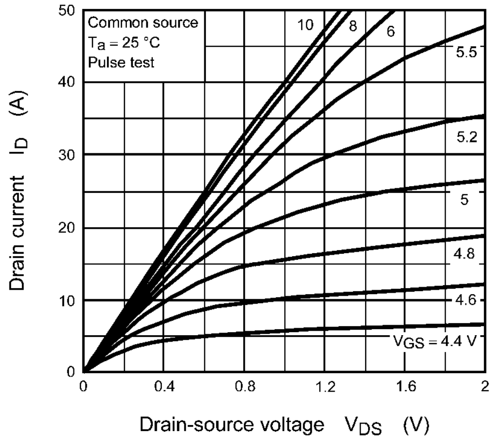


Fig. 8.2 I_D - V_{DS}

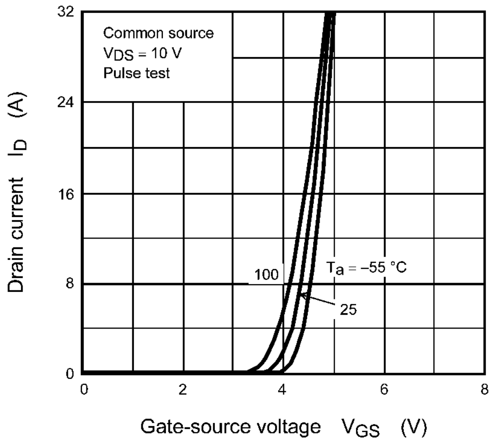


Fig. 8.3 I_D - V_{GS}

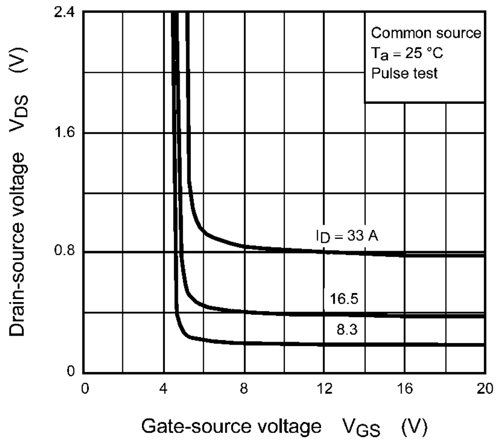


Fig. 8.4 V_{DS} - V_{GS}

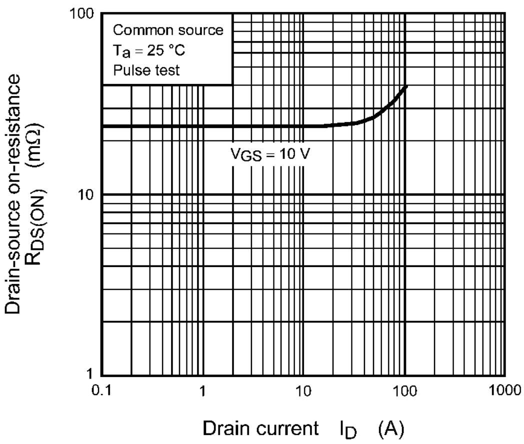


Fig. 8.5 $R_{DS(ON)}$ - I_D

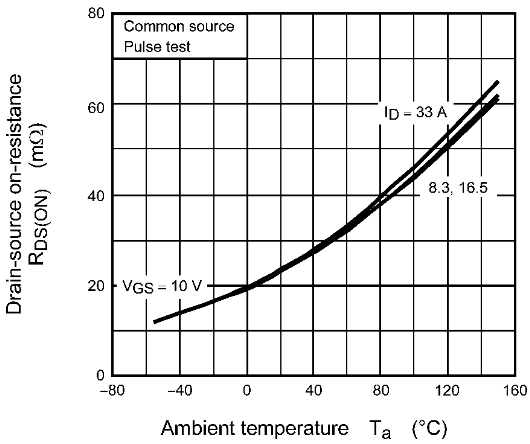


Fig. 8.6 $R_{DS(ON)}$ - T_a

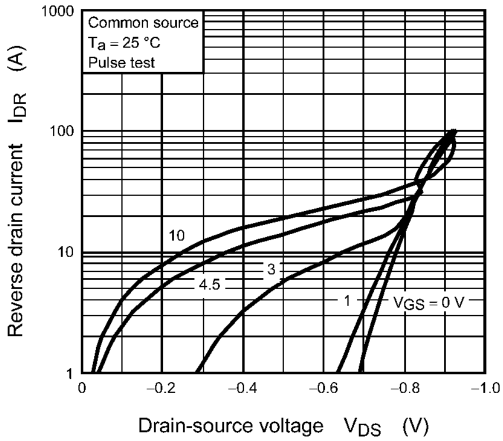


Fig. 8.7 I_{DR} - V_{DS}

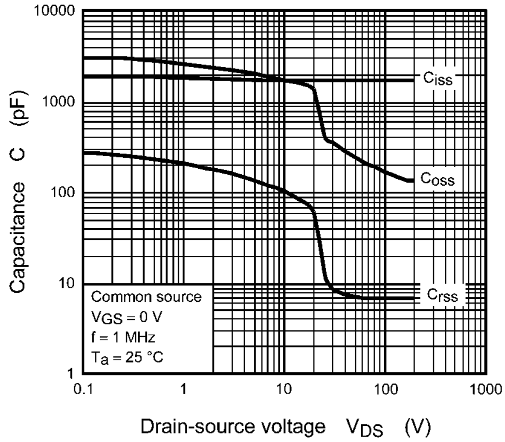


Fig. 8.8 Capacitance - V_{DS}

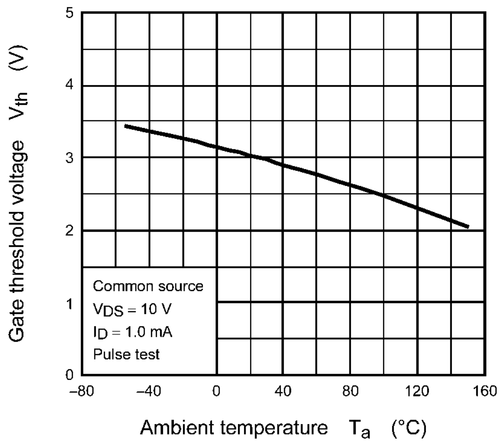


Fig. 8.9 V_{th} - T_a

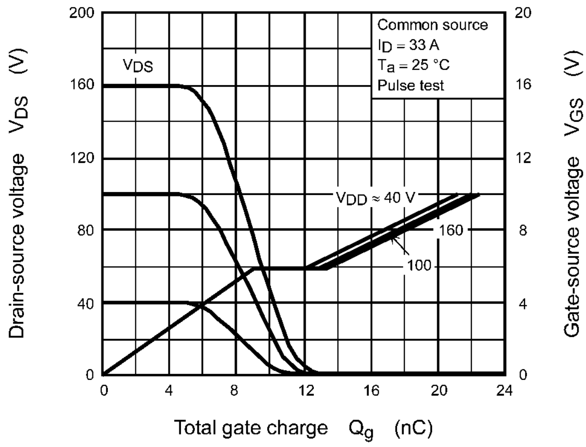


Fig. 8.10 Dynamic Input/Output Characteristics

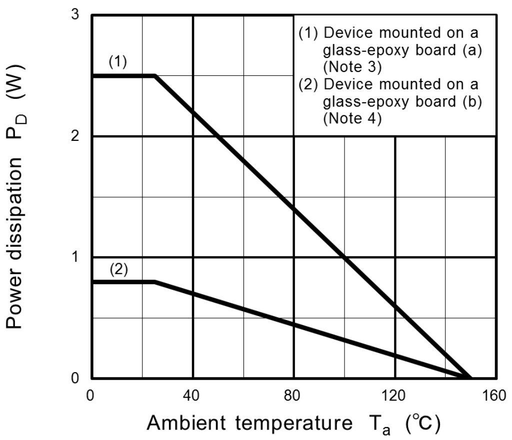


Fig. 8.11 P_D - T_a
(Guaranteed Maximum)

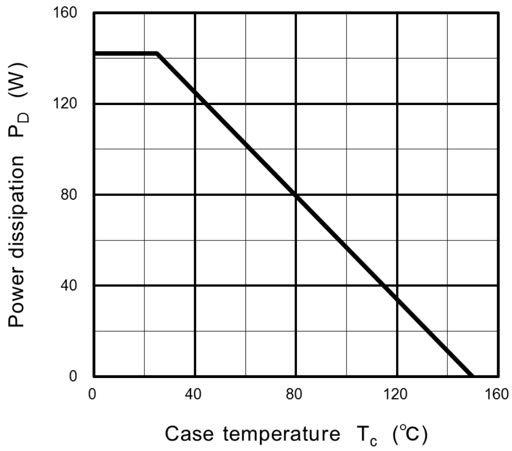


Fig. 8.12 P_D - T_c (Bottom drain)
(Guaranteed Maximum)

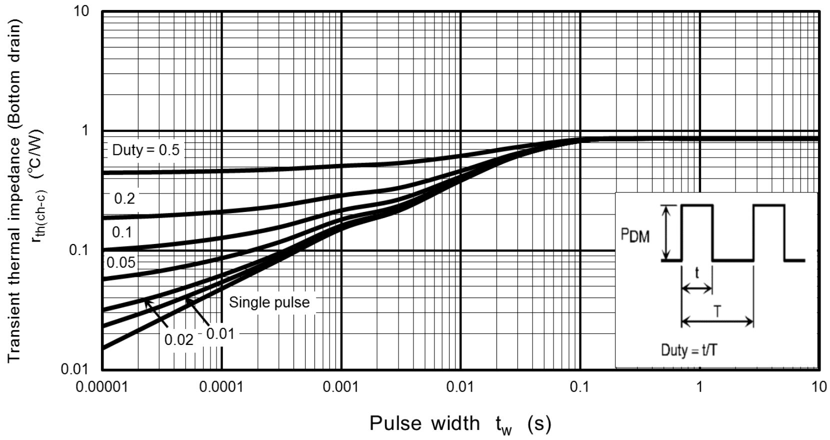


Fig. 8.13 r_{th} - t_w (Bottom drain)
(Guaranteed Maximum)

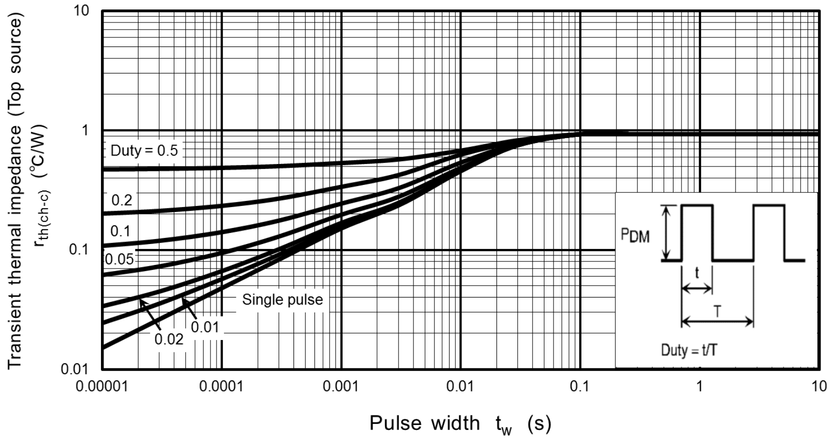


Fig. 8.14 r_{th} - t_w (Top source)
(Guaranteed Maximum)

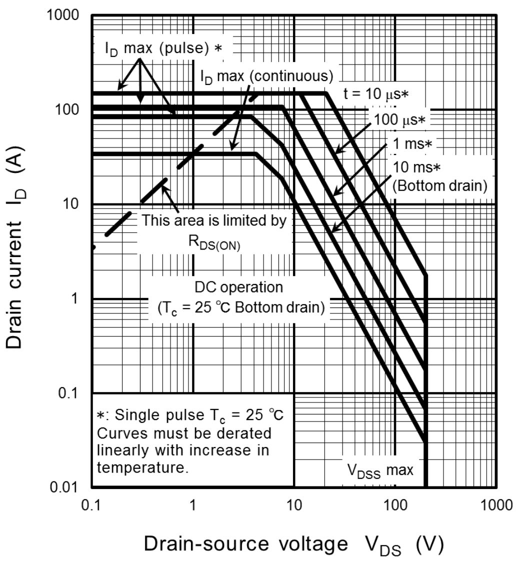
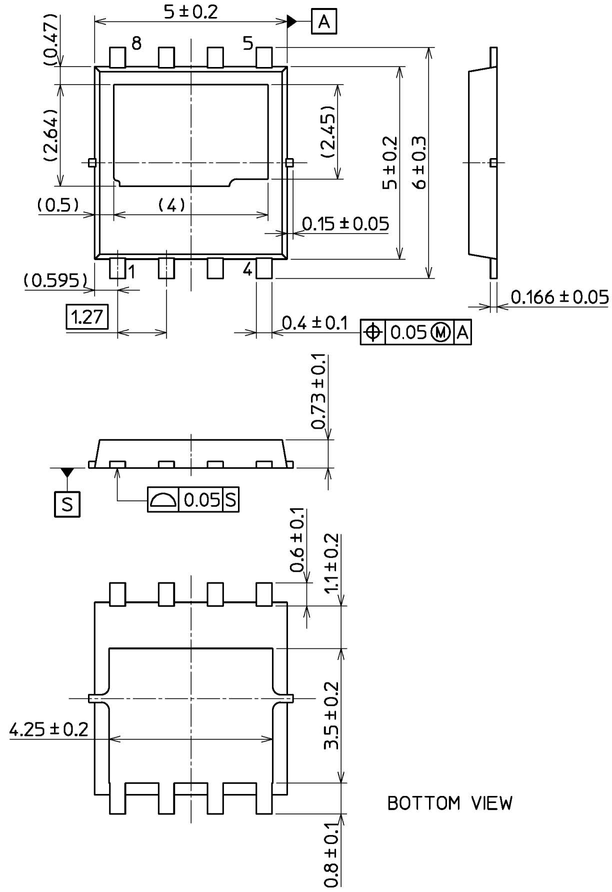


Fig. 8.15 Safe Operating Area
(Guaranteed Maximum)

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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