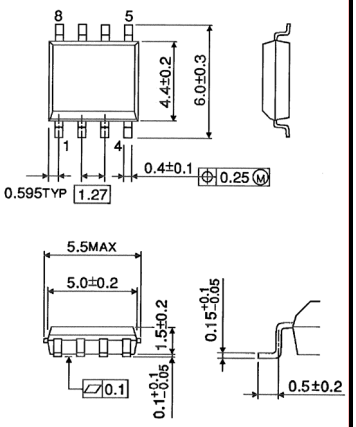
T OSHIBA Field Effect Transistor with Built-in Schottky Barrier Diode
Silicon N-Channel MOS Type (Ultra-High-Speed U-MOS Ⅲ)

TPC8A02-H

High-Efficiency DC/DC Converter Applications
Notebook PC Applications
Portable-Equipment Applications

- Built-in schottky barrier diode
  Low forward voltage: V_{DSF} = 0.6V(Max.)
- High-speed switching.
- Small gate charge.: Q_{SW} = 11 nC(Typ.)
- Low drain-source ON-resistance: $R_{DS\ (ON)}$ = 4.3 mΩ (typ.)
- High forward transfer admittance: $|Y_{fs}|$ = 40 S (typ.)
- Low leakage current: I_{DSS} = 100 μA (max) (V_{DS} = 30 V)
- Enhancement mode: V_{th} = 1.1 to 2.3 V (V_{DS} = 10 V, I_D = 1 mA)

Unit: mm



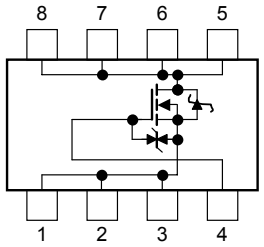
1,2,3	SOURCE, ANODE
4	GATE
5,6,7,8	DRAIN, CATHODE
JEDEC	—
JEITA	—
TOSHIBA	2-6J1B

Weight: 0.085 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	30	V
Drain-gate voltage (R_{GS} = 20 kΩ)		V_{DGR}	30	V
Gate-source voltage		V_{GSS}	±20	V
Drain current	DC (Note 1)	I_D	16	A
	Pulse (Note 1)	I_{DP}	48	
Drain power dissipation (t = 10 s) (Note 2a)		P_D	1.9	W
Drain power dissipation (t = 10 s) (Note 2b)		P_D	1.0	W
Single-pulse avalanche energy (Note 3)		E_{AS}	166	mJ
Avalanche current		I_{AR}	16	A
Repetitive avalanche energy (Note 2a) (Note 4)		E_{AR}	0.11	mJ
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55 to 150	°C

Circuit Configuration



Note: For Notes 1 to 5, refer to the next page.

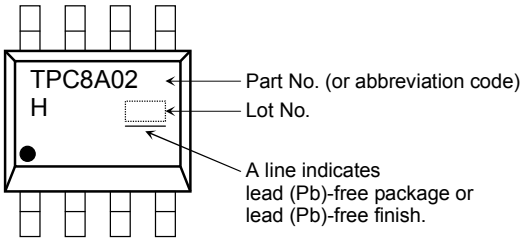
Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within 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).

This transistor is an electrostatic-sensitive device. Handle with care. Schottky barrier diodes have large-reverse-current-leakage characteristic compared to other rectifier products. This current leakage combined with improper operating temperature or voltage may cause thermal runaway. Please take forward and reverse loss into consideration during design.

Thermal Characteristics

Characteristic	Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 10 s) (Note 2a)	$R_{th\ (ch\text{-}a)}$	65.8	°C/W
Thermal resistance, channel to ambient (t = 10 s) (Note 2b)	$R_{th\ (ch\text{-}a)}$	125	°C/W

Marking (Note 5)



Note 1: The channel temperature should not exceed 150°C during use.

Note 2:

(a) Device mounted on a glass-epoxy board (a) (b) Device mounted on a glass-epoxy board (b)

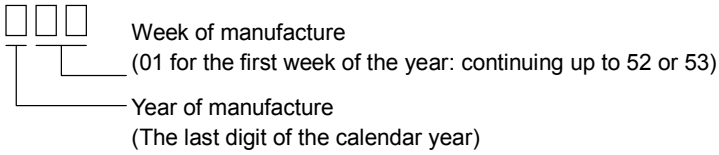
(a) (b)

Note 3: V_{DD} = 24 V, T_{ch} = 25°C (initial), L = 0.5 mH, R_G = 25Ω, I_{AR} = 16 A

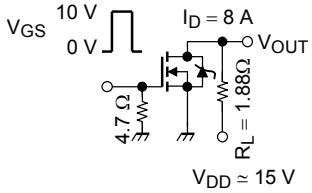
Note 4: Repetitive rating: pulse width limited by maximum channel temperature

Note 5: • on the lower left of the marking indicates Pin 1.

* Weekly code: (Three digits)



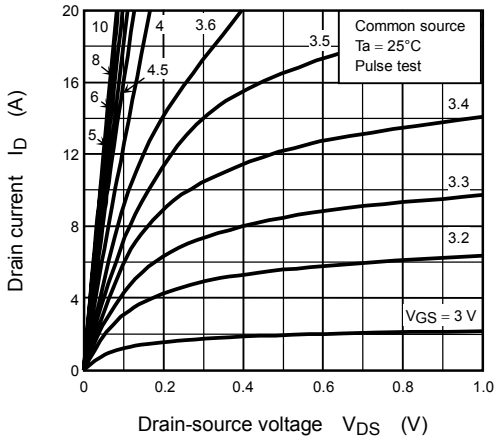
Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0 V	—	—	±10	μA
Drain cutoff current		I_{DSS}	V_{DS} = 30 V, V_{GS} = 0 V	—	—	100	μA
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 10 mA, V_{GS} = 0 V	30	—	—	V
		$V_{(BR)\ DSX}$	I_D = 10 mA, V_{GS} = −20 V	15	—	—	
Gate threshold voltage		V_{th}	V_{DS} = 10 V, I_D = 1 mA	1.1	—	2.3	V
Drain-source ON-resistance		$R_{DS\ (ON)}$	V_{GS} = 4.5 V, I_D = 8 A	—	6.2	8.5	mΩ
			V_{GS} = 10 V, I_D = 8 A	—	4.3	5.6	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 10 V, I_D = 8 A	20	40	—	S
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	1970	—	pF
Reverse transfer capacitance		C_{rss}		—	240	—	
Output capacitance		C_{oss}		—	950	—	
Switching time	Rise time	t_r	 Duty ≦ 1%, t_w = 10 μs	—	6	—	ns
	Turn-on time	t_{on}		—	14	—	
	Fall time	t_f		—	12	—	
	Turn-off time	t_{off}		—	26	—	
Total gate charge (gate-source plus gate-drain)		Q_g	V_{DD} ≃ 24 V, V_{GS} = 10 V, I_D = 16 A	—	34	—	nC
			V_{DD} ≃ 24 V, V_{GS} = 5 V, I_D = 16 A	—	19	—	
Gate-source charge 1		Q_{gs1}	V_{DD} ≃ 24 V, V_{GS} = 10 V, I_D = 16 A	—	6	—	
Gate-drain (“Miller”) charge		Q_{gd}		—	8.4	—	
Gate switch charge		Q_{sw}		—	11	—	

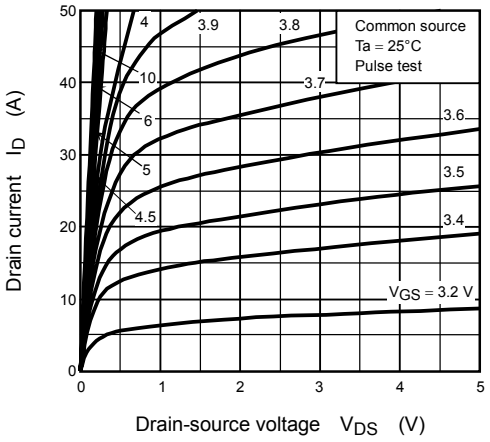
Source-Drain Ratings and Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Peak forward current	Pulse (Note 1)	I_{FP}	—	—	—	48	A
Forward voltage (diode)		V_{DSF}	I_{DR} = 1.0 A, V_{GS} = 0 V	—	-0.45	−0.6	V
			I_{DR} = 16 A, V_{GS} = 0 V	—	—	−1.2	

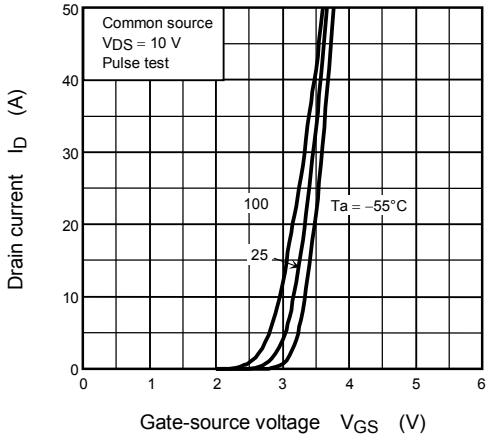
$I_D - V_{DS}$



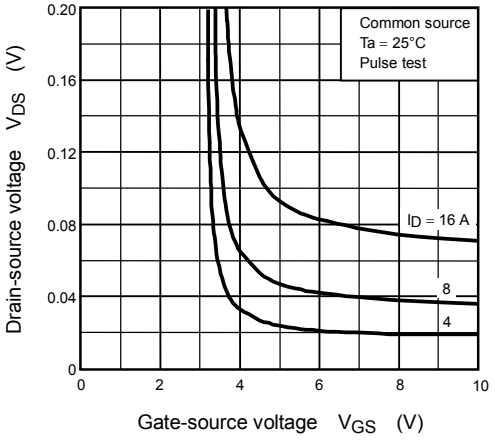
$I_D - V_{DS}$



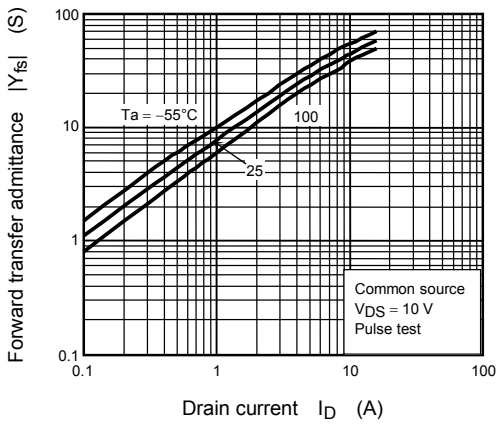
$I_D - V_{GS}$



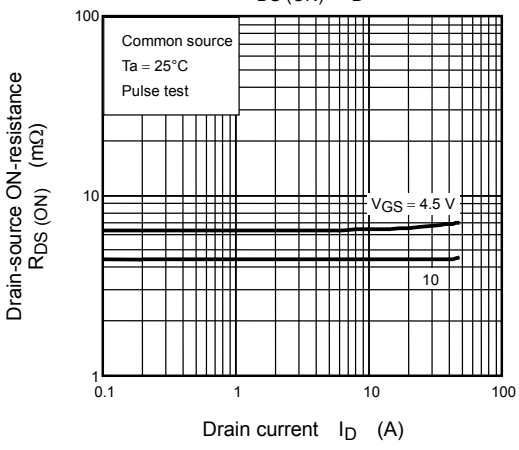
$V_{DS} - V_{GS}$



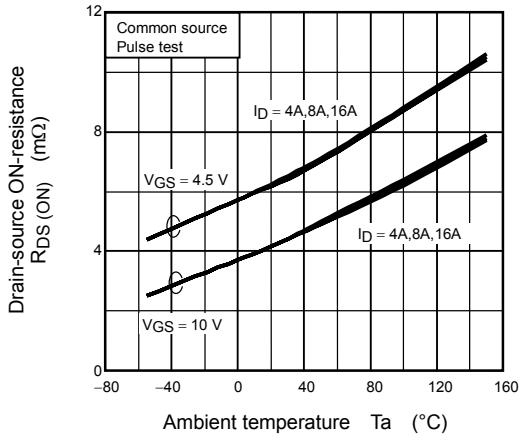
$|Y_{fs}| - I_D$



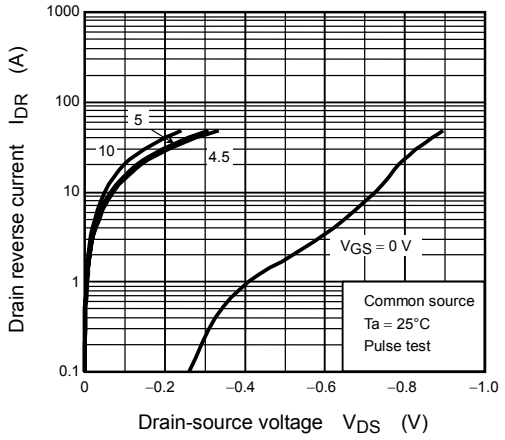
$R_{DS\ (ON)} - I_D$



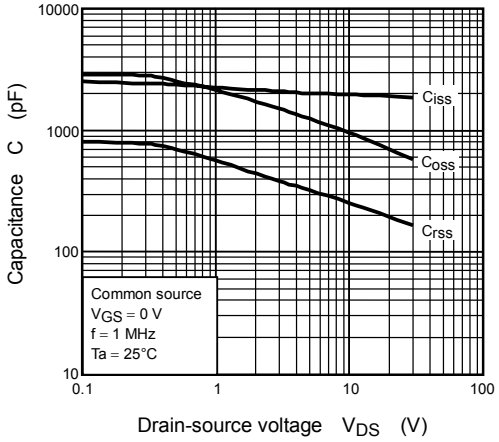
$R_{DS\ (ON)}$ – Ta



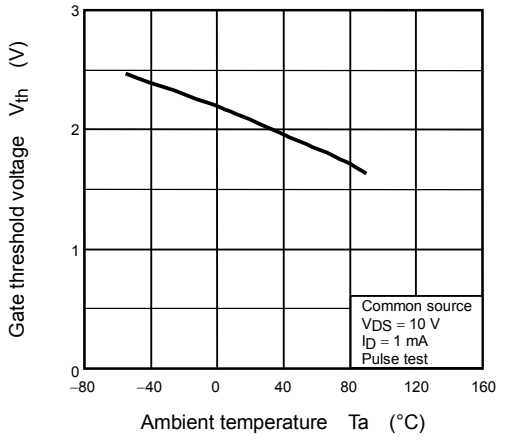
I_{DR} – V_{DS}



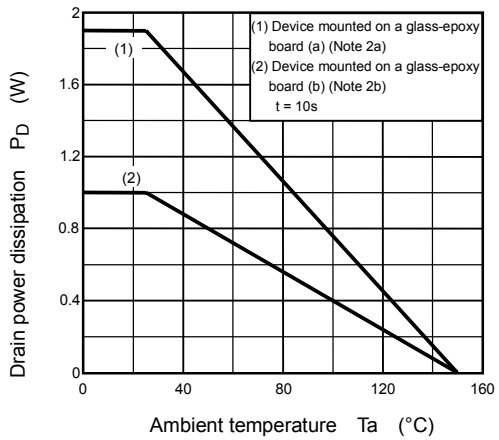
Capacitance – V_{DS}



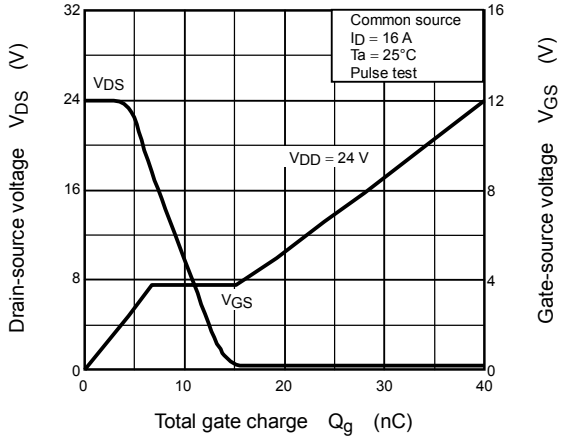
V_{th} – Ta



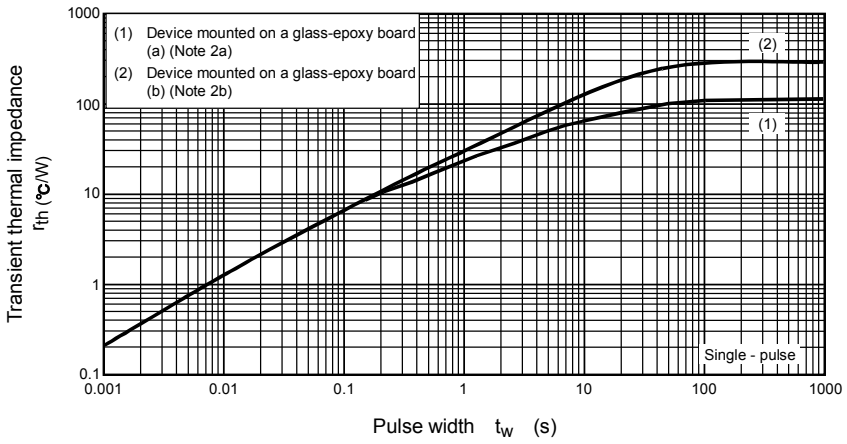
P_D – Ta



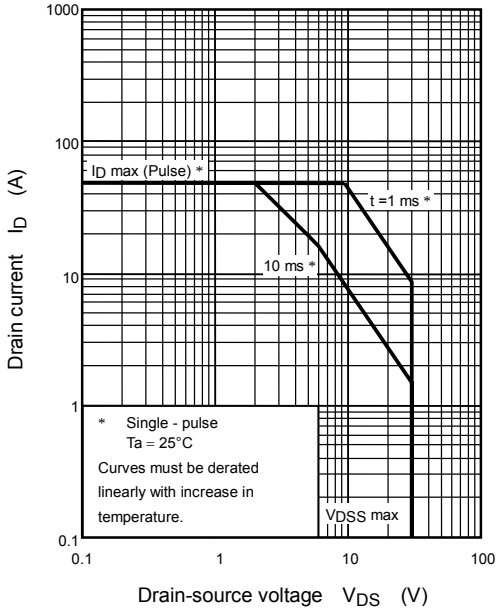
Dynamic input/output characteristics



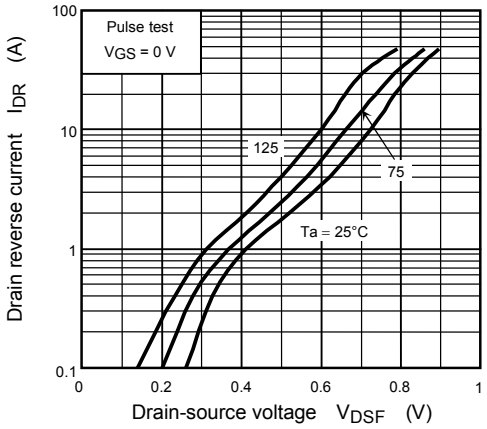
$r_{th} - t_w$



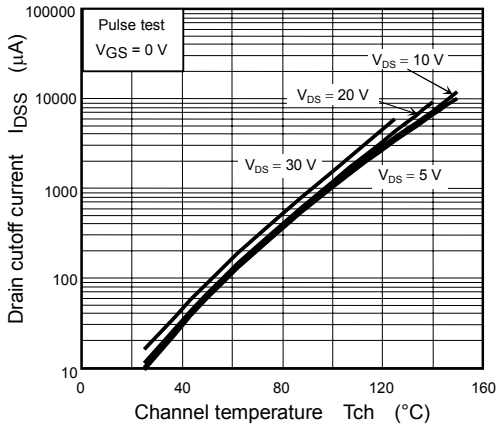
Safe operating area



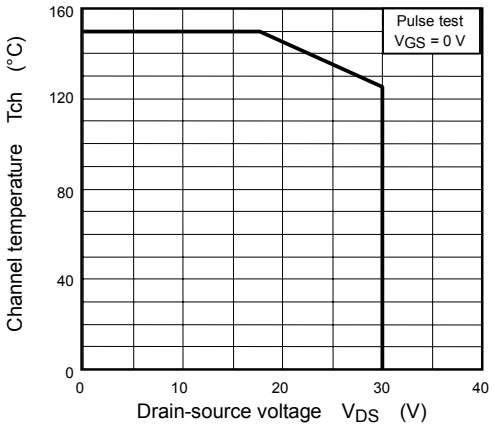
I_{DR} – V_{DSF}



I_{DSS} – Tch (typ.)



Tch – V_{DS}



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