TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (Ultra-High-Speed U-MOSIII)

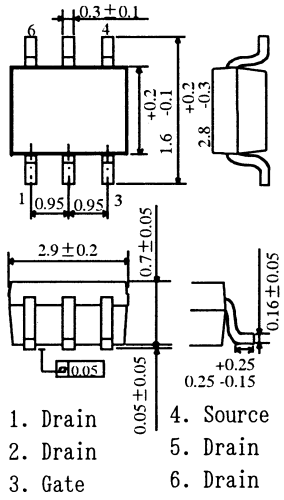
TPC6006-H

Notebook PC Applications

Portable Equipment Applications

- Small footprint due to small and thin package
- High-speed switching
- Small gate charge: Qsw = 2.4 nC (typ.)
- Low drain-source ON-resistance: $R_{DS\ (ON)}$ = 59 mΩ (typ.)
- High forward transfer admittance: $|Y_{fs}|$ = 7 S (typ.)
- Low leakage current: I_{DSS} = 10 μA (max) (V_{DS} = 40 V)
- Enhancement mode: V_{th} = 1.1 to 2.3 V (V_{DS} = 10 V, I_D = 1 mA)

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	2-3T1A

Weight: 0.011 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	40	V
Drain-gate voltage (R_{GS} = 20 kΩ)		V_{DGR}	40	V
Gate-source voltage		V_{GSS}	±20	V
Drain current	DC (Note 1)	I_D	3.9	A
	Pulse (Note 1)	I_{DP}	15.6	
Drain power dissipation (t = 5 s) (Note 2a)		P_D	2.2	W
Drain power dissipation (t = 5 s) (Note 2b)		P_D	0.7	W
Single pulse avalanche energy (Note 3)		E_{AS}	7	mJ
Avalanche current		I_{AR}	3.9	A
Repetitive avalanche energy (Note 4)		E_{AR}	0.22	mJ
Channel temperature		T_{ch}	150	°C
Storage temperature range		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).

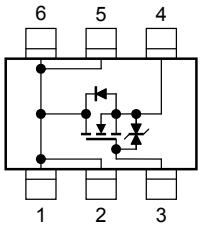
Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 5 s) (Note 2a)	$R_{th\ (ch-a)}$	56.8	°C/W
Thermal resistance, channel to ambient (t = 5 s) (Note 2b)	$R_{th\ (ch-a)}$	178.5	°C/W

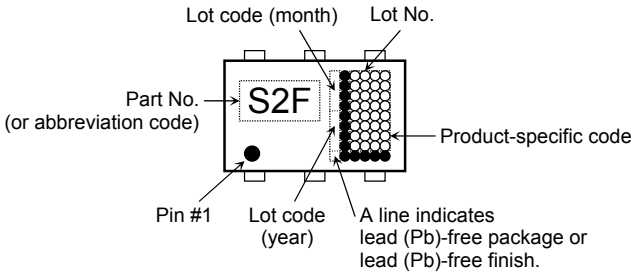
Note: (Note 1), (Note 2), (Note 3), (Note 4) and (Note 5): See the next page.

This transistor is an electrostatic-sensitive device. Handle with care.

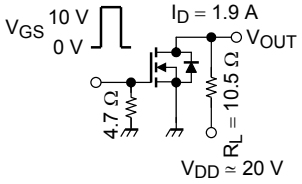
Circuit Configuration



Marking (Note 5)



Electrical Characteristics (Ta = 25°C)

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	μA
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	25	—	—	
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 = 1.9 A	—	78	100	mΩ
			V_{GS} = 10 V, I_D = 1.9 A	—	59	75	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 10 V, I_D = 1.9 A	3.5	7	—	S
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	251	—	pF
Reverse transfer capacitance		C_{rss}		—	18	—	
Output capacitance		C_{oss}		—	73	—	
Switching time	Rise time	t_r		—	4	—	ns
	Turn-ON time	t_{on}		—	9	—	
	Fall time	t_f		—	3	—	
	Turn-OFF time	t_{off}		—	18	—	
Total gate charge (gate-source plus gate-drain)		Q_g	V_{DD} ≃ 32 V, V_{GS} = 10 V, I_D = 3.9 A	—	4.4	—	nC
			V_{DD} ≃ 32 V, V_{GS} = 5 V, I_D = 3.9 A	—	2.4	—	
Gate-source charge 1		Q_{gs1}	V_{DD} ≃ 32 V, V_{GS} = 10 V, I_D = 3.9 A	—	1.0	—	
Gate-drain (“Miller”) charge		Q_{gd}		—	0.8	—	
Gate switch charge		Q_{SW}		—	1.3	—	

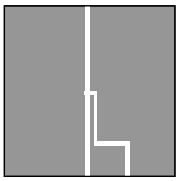
Duty ≦ 1%, t_w = 10 μs

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Pulse drain reverse current (Note 1)	I_{DRP}	—	—	—	15.6	A
Forward voltage (Diode)	V_{DSF}	I_{DR} = 3.9 A, V_{GS} = 0 V	—	—	−1.2	V

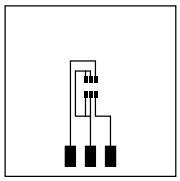
Note 1: Ensure that the channel temperature does not exceed 150°C.

Note 2: (a) Device mounted on a glass-epoxy board (a) (b) Device mounted on a glass-epoxy board (b)



FR-4
25.4 × 25.4 × 0.8
Unit: (mm)

(a)



FR-4
25.4 × 25.4 × 0.8
Unit: (mm)

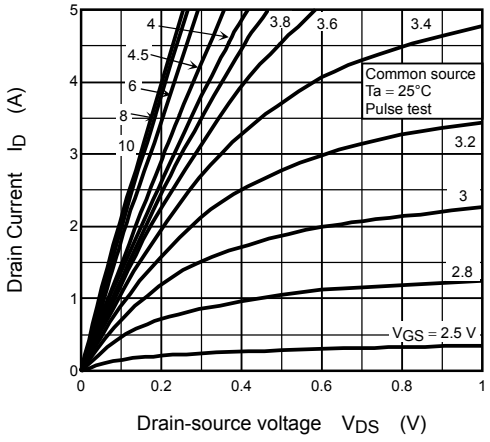
(b)

Note 3: V_{DD} = 24 V, T_{ch} = 25°C (initial), L = 0.5 mH, R_G = 25 Ω, I_{AR} = 3.9 A

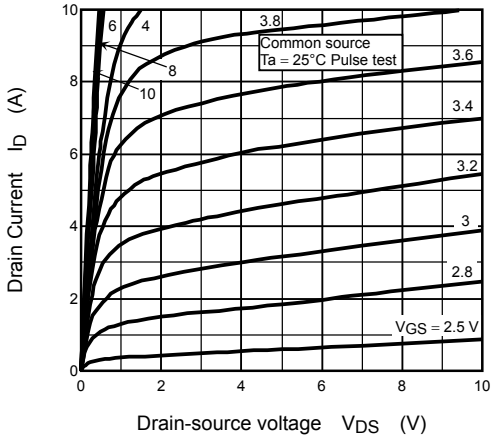
Note 4: Repetitive rating: pulse width limited by maximum channel temperature

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

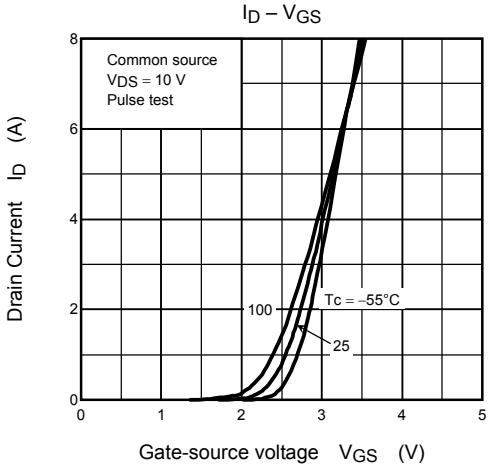
$I_D - V_{DS}$



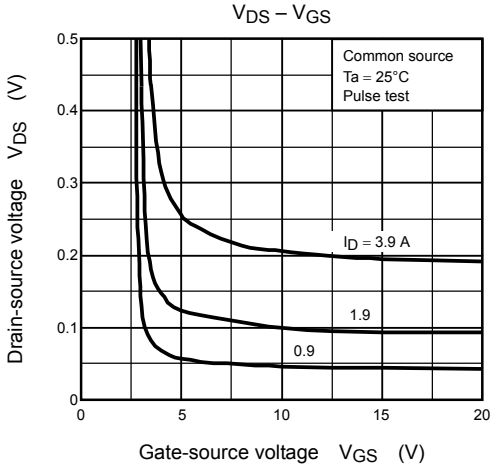
$I_D - V_{DS}$



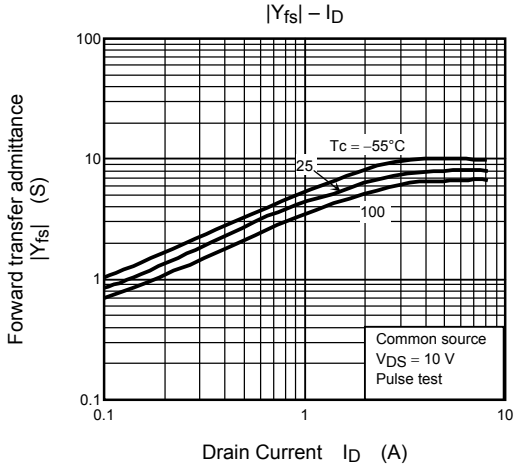
$I_D - V_{GS}$



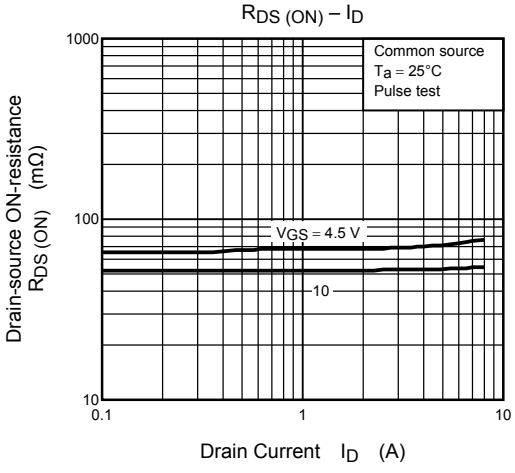
$V_{DS} - V_{GS}$



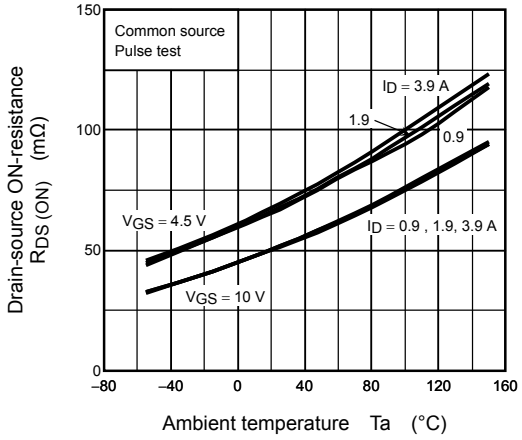
$|Y_{fs}| - I_D$



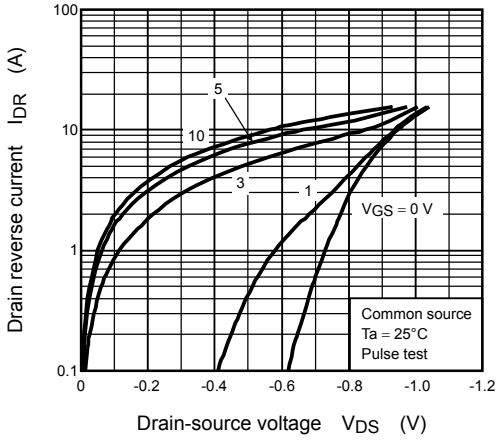
$R_{DS\ (ON)} - I_D$



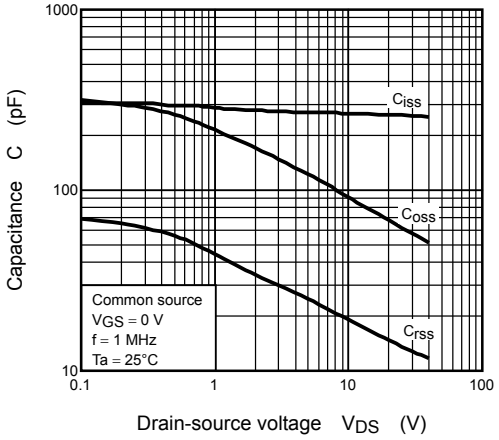
$R_{DS\ (ON)}$ – Ta



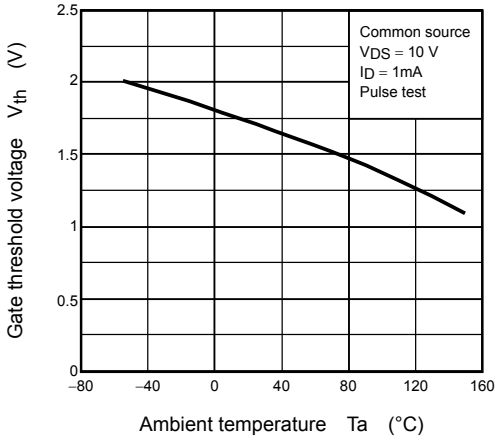
I_{DR} – V_{DS}



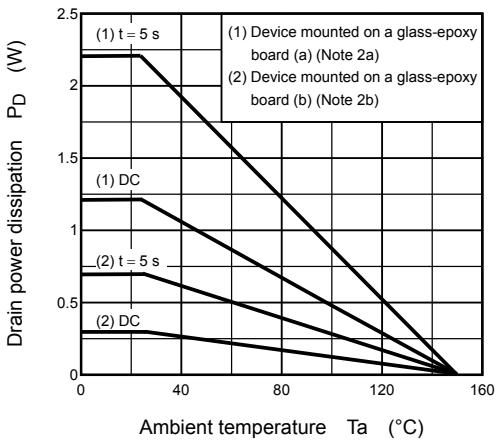
Capacitance – V_{DS}



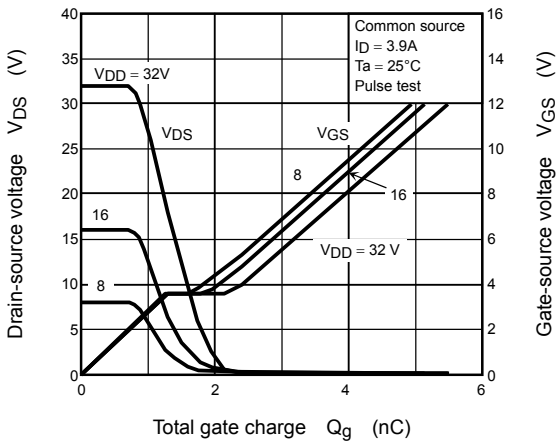
V_{th} – Ta

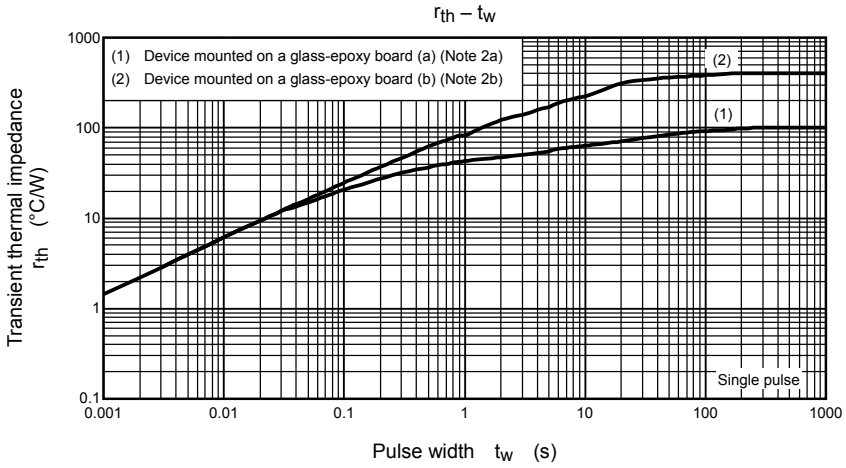


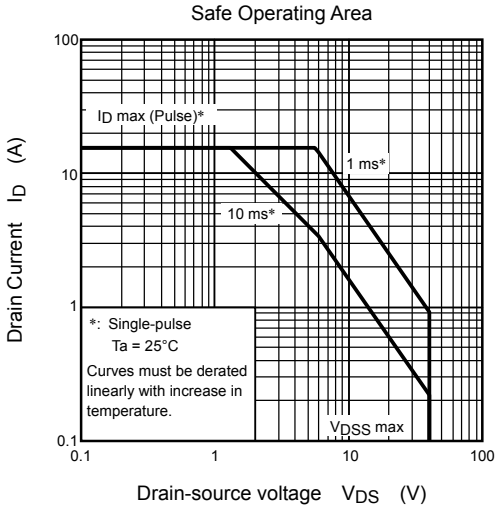
P_D – Ta



Dynamic input/output characteristics







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