

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:  $Q_{sw} = 2.4 \text{ nC}$  (typ.)
- Low drain-source ON-resistance:  $R_{DS(ON)} = 59 \text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 7 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 10 \text{ }\mu\text{A}$  (max) ( $V_{DS} = 40 \text{ V}$ )
- Enhancement mode:  $V_{th} = 1.1 \text{ to } 2.3 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

### Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Characteristics		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	40	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )		$V_{DGR}$	40	V
Gate-source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	3.9	A
	Pulse (Note 1)	$I_{DP}$	15.6	
Drain power dissipation	( $t = 5 \text{ s}$ ) (Note 2a)	$P_D$	2.2	W
Drain power dissipation	( $t = 5 \text{ s}$ ) (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	$^\circ\text{C}$
Storage temperature range		$T_{stg}$	-55 to 150	$^\circ\text{C}$

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.).

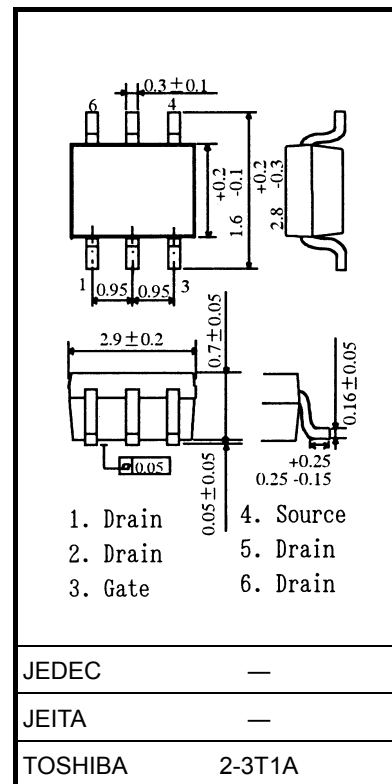
### Thermal Characteristics

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

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

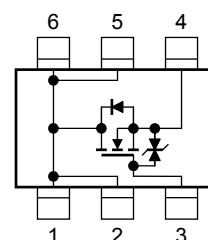
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm

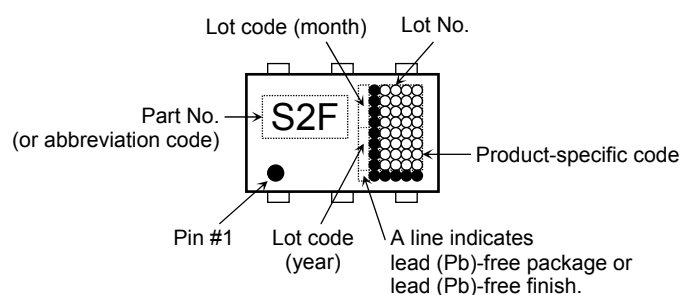


Weight: 0.011 g (typ.)

### Circuit Configuration



## Marking (Note 5)



## Electrical Characteristics (Ta = 25°C)

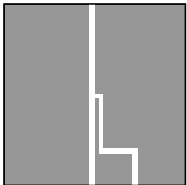
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I <sub>GSS</sub>	V <sub>GS</sub> = ±16 V, V <sub>DS</sub> = 0 V	—	—	±10	μA
Drain cut-OFF current		I <sub>DSS</sub>	V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 0 V	—	—	10	μA
Drain-source breakdown voltage	V (BR) DSS	I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 0 V	40	—	—	V	
	V (BR) DSX	I <sub>D</sub> = 10 mA, V <sub>GS</sub> = −20 V	25	—	—		
Gate threshold voltage		V <sub>th</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA	1.1	—	2.3	V
Drain-source ON resistance	R <sub>DS (ON)</sub>	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 1.9 A	—	78	100	mΩ	
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 1.9 A	—	59	75		
Forward transfer admittance		Y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1.9 A	3.5	7	—	S
Input capacitance		C <sub>iss</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1 MHz	—	251	—	pF
Reverse transfer capacitance		C <sub>rss</sub>		—	18	—	
Output capacitance		C <sub>oss</sub>		—	73	—	
Switching time	Rise time	t <sub>r</sub>	<p>V<sub>GS</sub> 10 V 0 V</p> <p>I<sub>D</sub> = 1.9 A</p> <p>V<sub>OUT</sub></p> <p>4.7 Ω</p> <p>10.5 Ω</p> <p>V<sub>DD</sub> ≈ 20 V</p> <p>Duty ≤ 1%, t<sub>W</sub> = 10 μs</p>	—	4	—	ns
	Turn-ON time	t <sub>on</sub>		—	9	—	
	Fall time	t <sub>f</sub>		—	3	—	
	Turn-OFF time	t <sub>off</sub>		—	18	—	
Total gate charge (gate-source plus gate-drain)		Q <sub>g</sub>	V <sub>DD</sub> ≈ 32 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 3.9 A	—	4.4	—	nC
			V <sub>DD</sub> ≈ 32 V, V <sub>GS</sub> = 5 V, I <sub>D</sub> = 3.9 A	—	2.4	—	
Gate-source charge 1		Q <sub>gs1</sub>	V <sub>DD</sub> ≈ 32 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 3.9 A	—	1.0	—	
Gate-drain (“Miller”) charge		Q <sub>gd</sub>		—	0.8	—	
Gate switch charge		Q <sub>SW</sub>		—	1.3	—	

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)	$V_{DSF}$	$I_{DR} = 3.9\text{ A}$ , $V_{GS} = 0\text{ V}$	—	—	-1.2	V

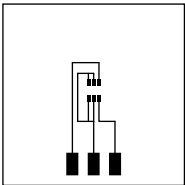
Note 1: Ensure that the channel temperature does not exceed 150°C.

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)



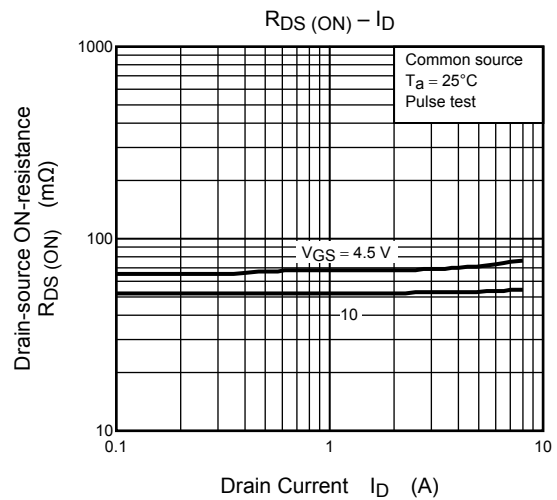
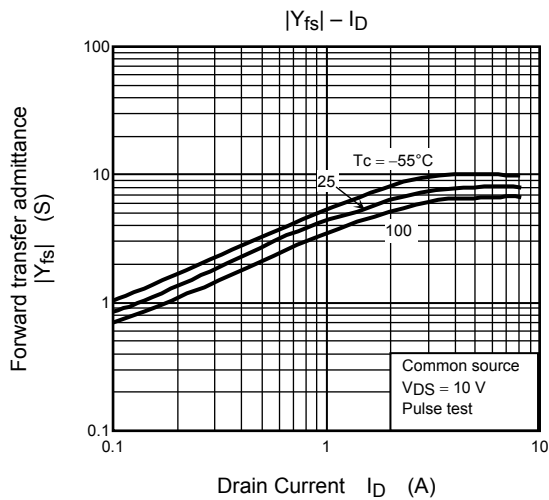
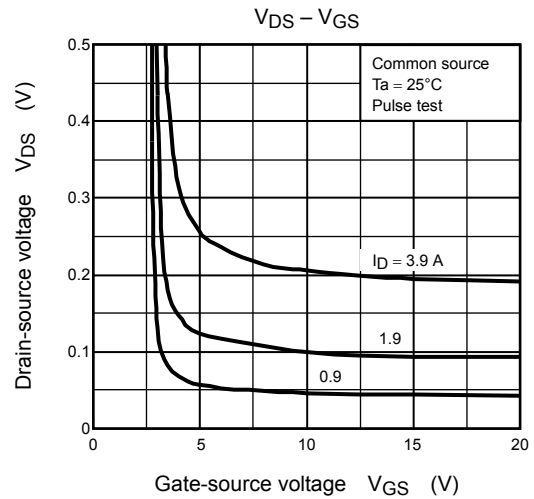
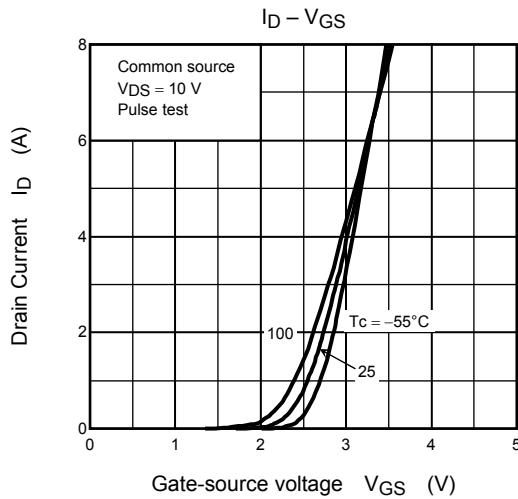
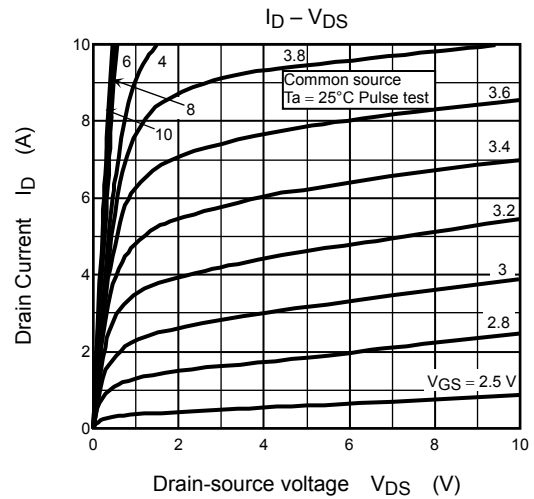
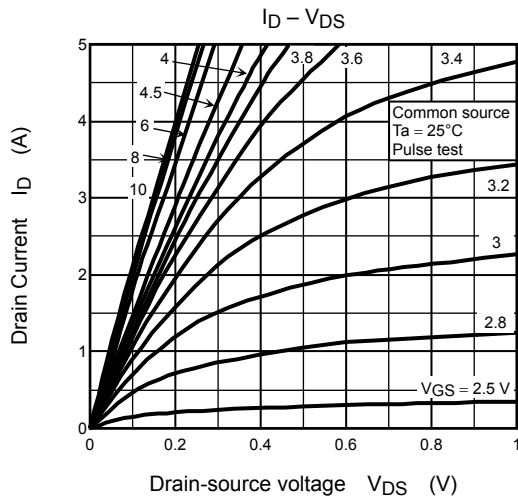
FR-4  
25.4 × 25.4 × 0.8  
Unit: (mm)

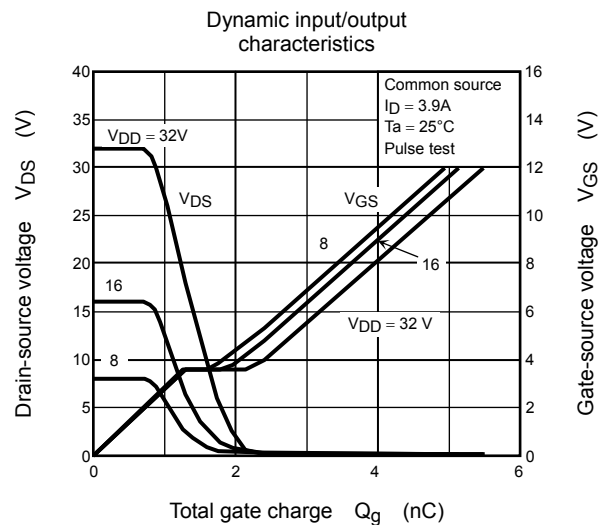
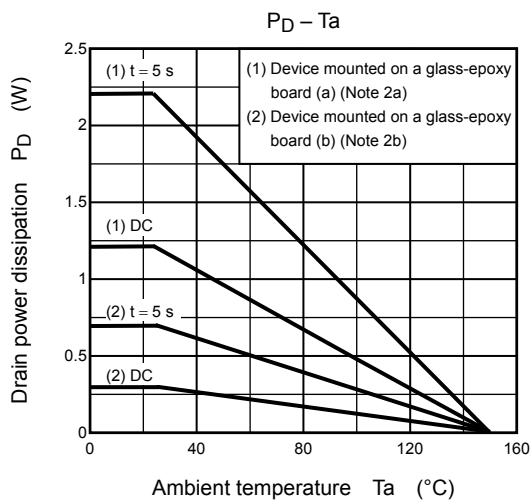
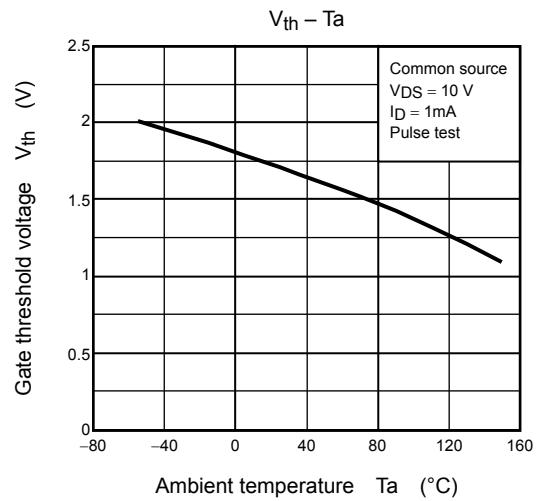
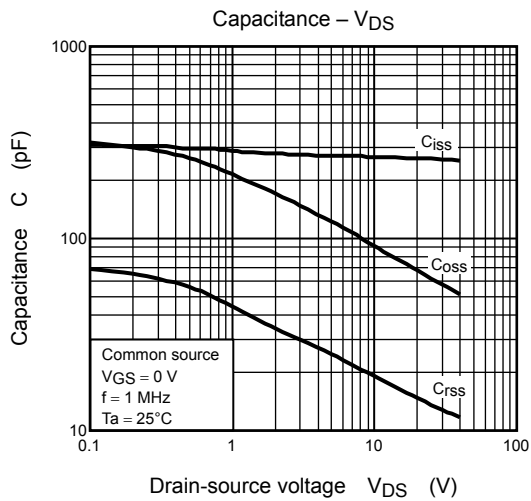
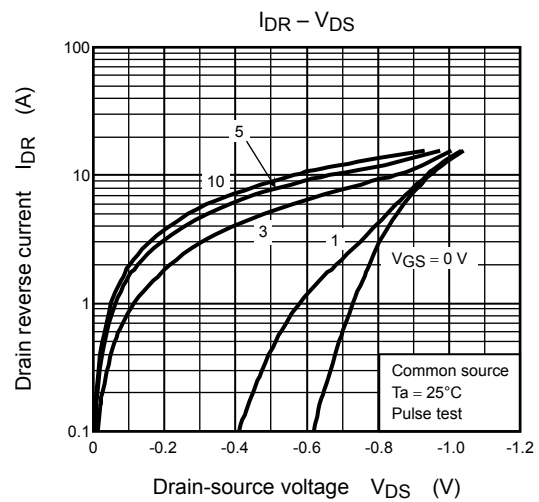
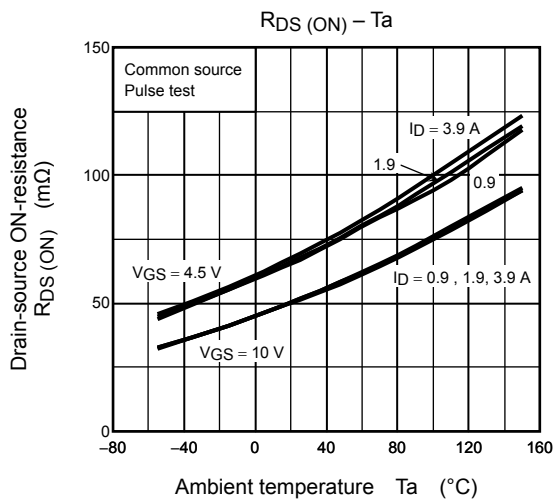
(b)

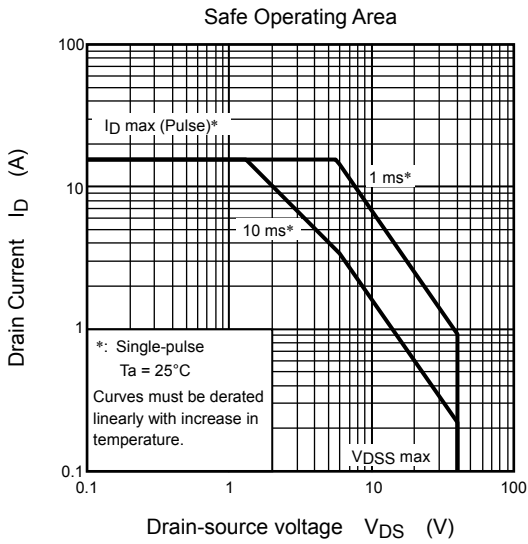
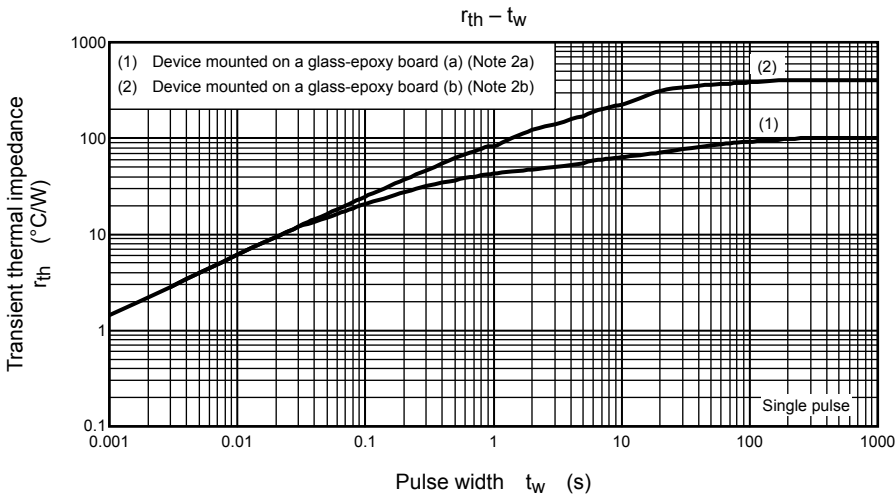
Note 3:  $V_{DD} = 24\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 0.5\text{ mH}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = 3.9\text{ A}$

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

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







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20070701-EN

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