

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: $R_{DS(ON)} = 59 \text{ m}\Omega \text{ (typ.)}$
- 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 (Ta = 25°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}	± 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).

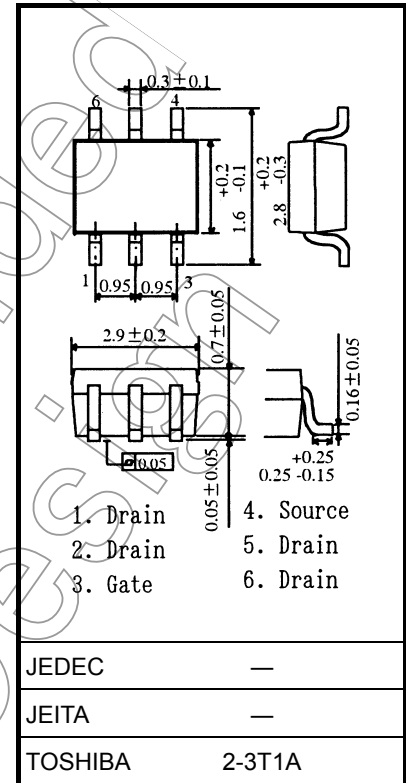
Thermal Characteristics

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.

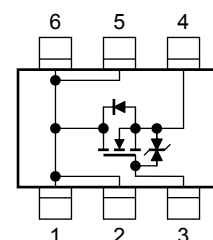
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm

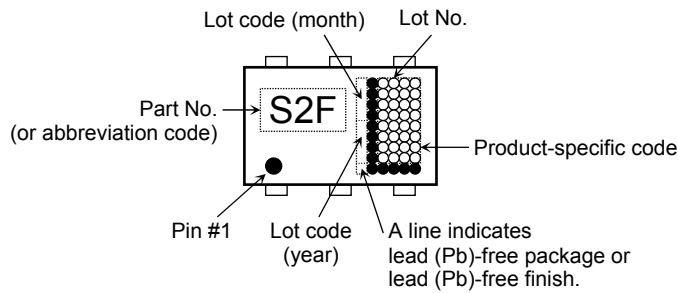


Weight: 0.011 g (typ.)

Circuit Configuration



Marking (Note 5)



Electrical Characteristics (Ta = 25°C)

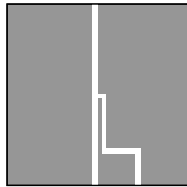
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	± 10	μA
Drain cut-OFF current		I_{DSS}	$V_{DS} = 40 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	10	μA
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$	40	—	—	V
		$V_{(BR)DSX}$	$I_D = 10 \text{ mA}, V_{GS} = -20 \text{ V}$	25	—	—	
Gate threshold voltage		V_{th}	$V_{DS} = 10 \text{ V}, I_D = 1 \text{ mA}$	1.1	—	2.3	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = 4.5 \text{ V}, I_D = 1.9 \text{ A}$	—	78	100	m Ω
			$V_{GS} = 10 \text{ V}, I_D = 1.9 \text{ A}$	—	59	75	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10 \text{ V}, I_D = 1.9 \text{ A}$	3.5	7	—	S
Input capacitance		C_{iss}	$V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	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}		Duty $\leq 1\%$, $t_w = 10 \mu\text{s}$	—	18	
Total gate charge (gate-source plus gate-drain)		Q_g	$V_{DD} \approx 32 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 3.9 \text{ A}$	—	4.4	—	nC
			$V_{DD} \approx 32 \text{ V}, V_{GS} = 5 \text{ V}, I_D = 3.9 \text{ A}$	—	2.4	—	
Gate-source charge 1		Q_{gs1}	$V_{DD} \approx 32 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 3.9 \text{ A}$	—	1.0	—	
Gate-drain ("Miller") charge		Q_{gd}		—	0.8	—	
Gate switch charge		Q_{sw}		—	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

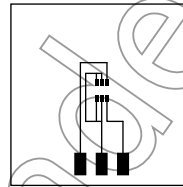
Note 1: Ensure that the channel temperature does not exceed 150°C.

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



(a)

FR-4
25.4 × 25.4 × 0.8
Unit: (mm)



(b)

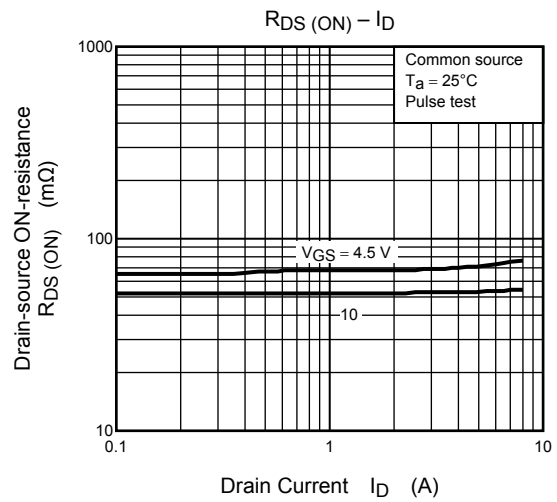
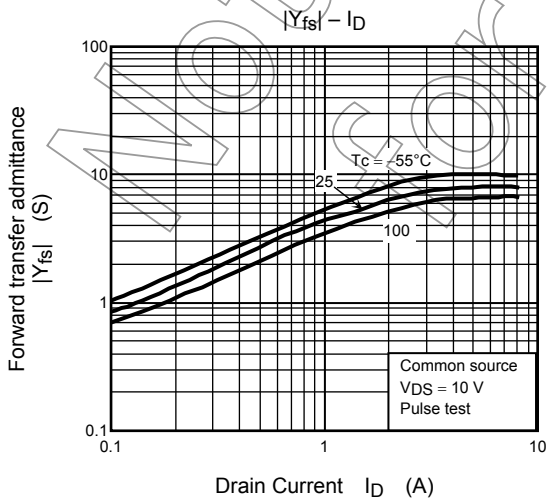
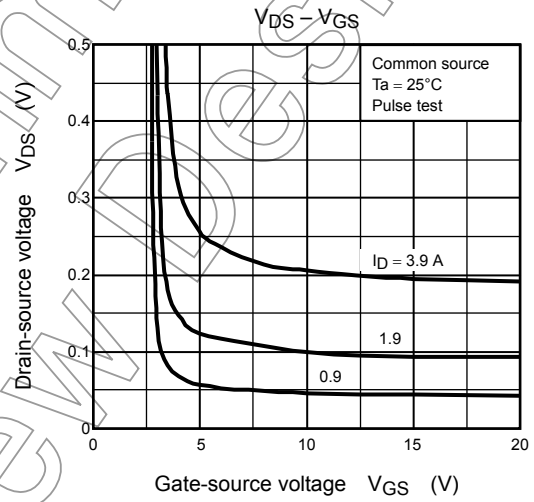
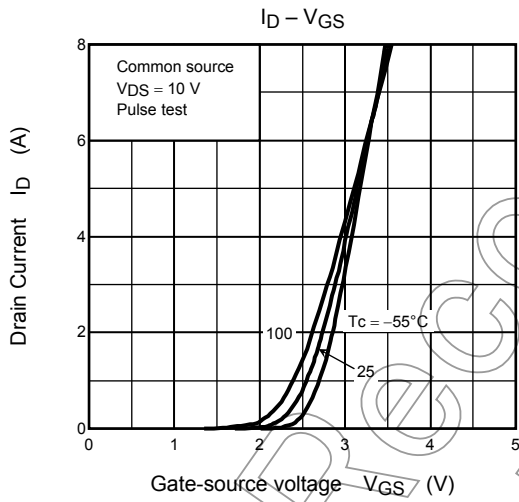
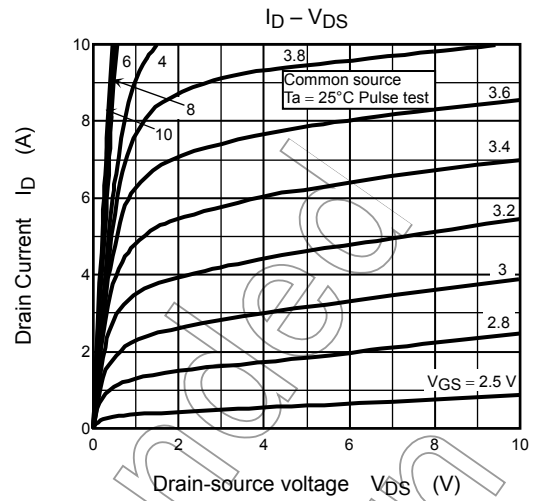
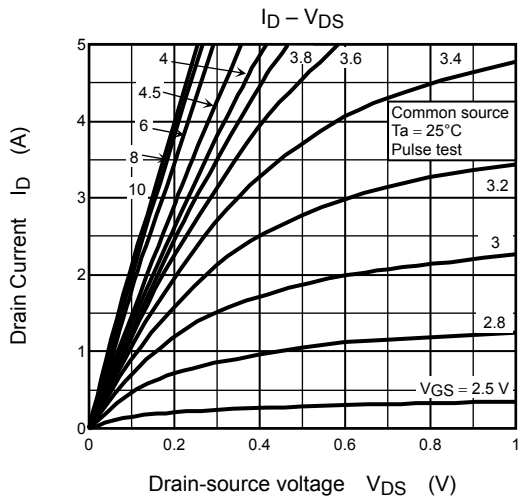
FR-4
25.4 × 25.4 × 0.8
Unit: (mm)

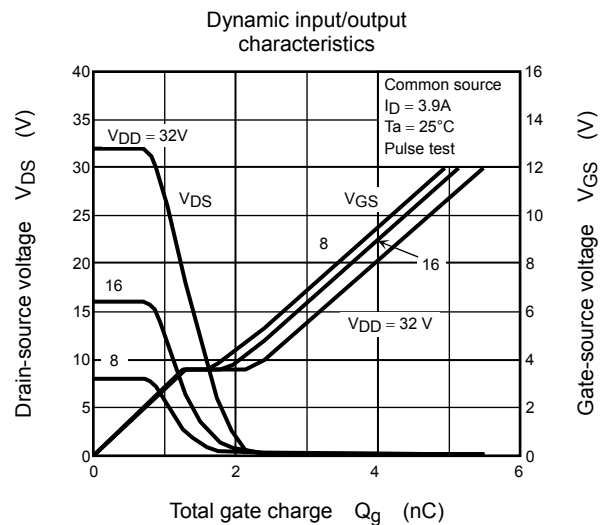
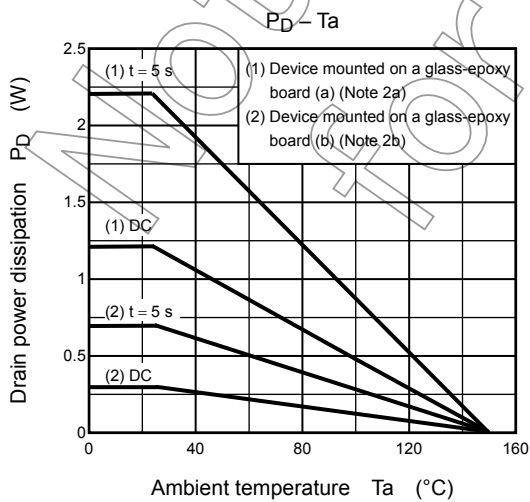
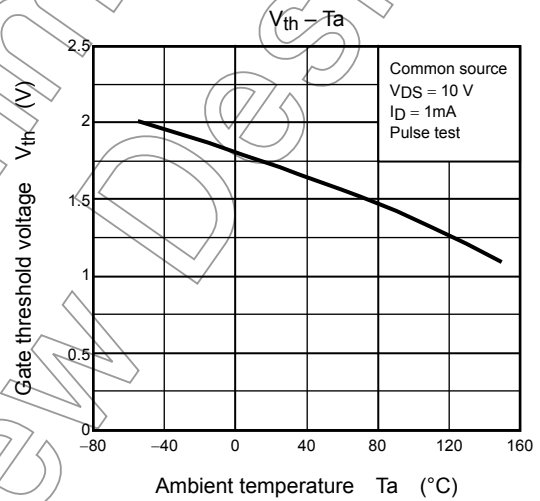
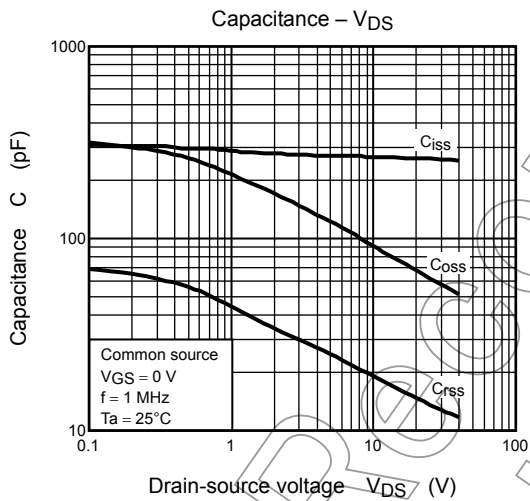
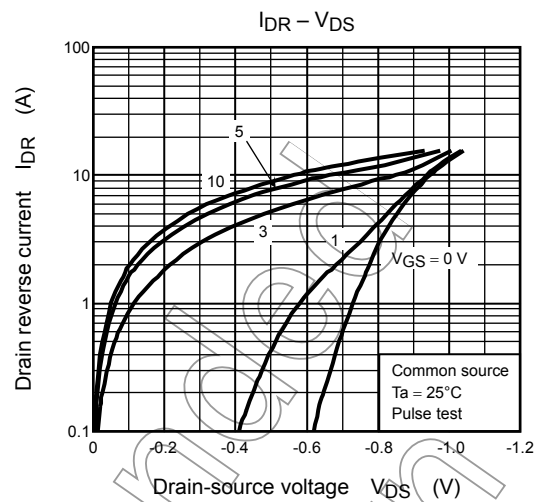
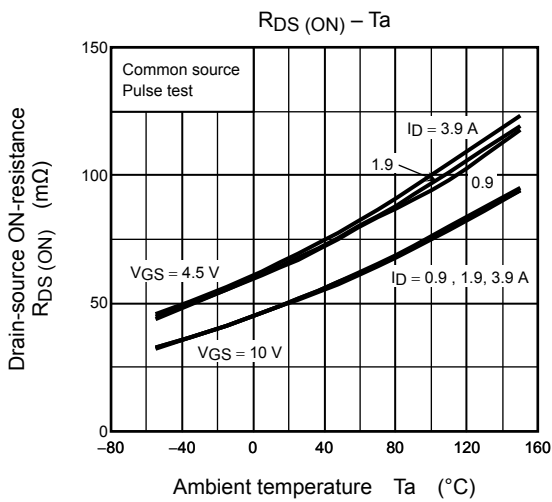
Note 3: $V_{DD} = 24 \text{ V}, T_{ch} = 25^\circ\text{C}$ (initial), $L = 0.5 \text{ mH}, R_G = 25 \Omega, I_{AR} = 3.9 \text{ A}$

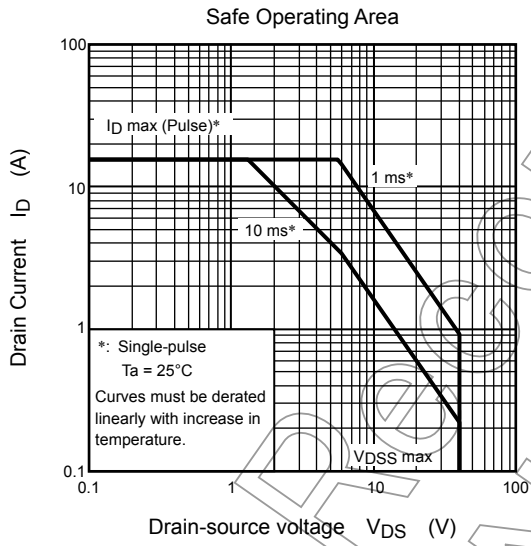
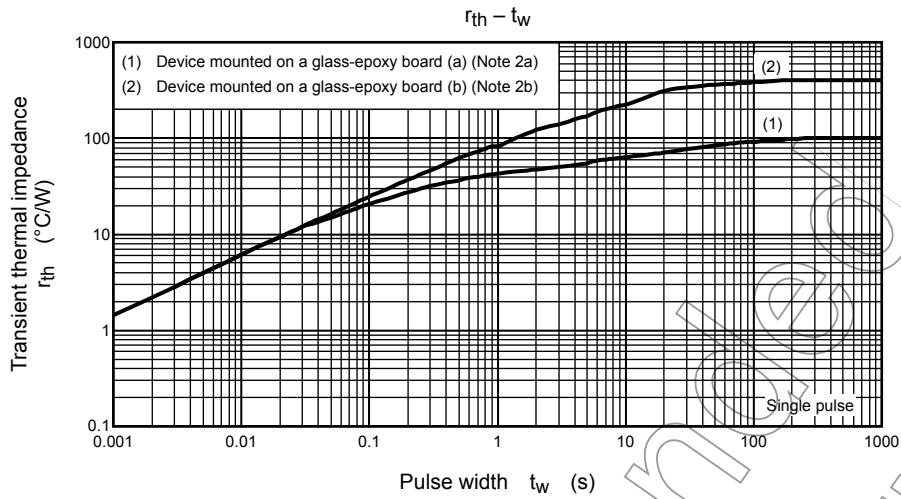
Note 4: Repetitive rating: pulse width limited by maximum channel temperature

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

Not Recommended for New Design







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