

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

TPC6004

Notebook PC Applications

Portable Equipment Applications

- Low drain-source ON resistance: $R_{DS(ON)} = 19 \text{ m}\Omega$ (typ.)
- High forward transfer admittance: $|Y_{fs}| = 11 \text{ S}$ (typ.)
- Low leakage current: $I_{DSS} = 10 \text{ }\mu\text{A}$ (max) ($V_{DS} = 20 \text{ V}$)
- Enhancement mode: $V_{th} = 0.5 \text{ to } 1.2 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 200 \text{ }\mu\text{A}$)

Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	20	V
Drain-gate voltage ($R_{GS} = 20\text{ k}\Omega$)		V_{DGR}	20	V
Gate-source voltage		V_{GSS}	± 12	V
Drain current	DC (Note 1)	I_D	6	A
	Pulse (Note 1)	I_{DP}	24	
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}	5.8	mJ
Avalanche current		I_{AR}	3	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).

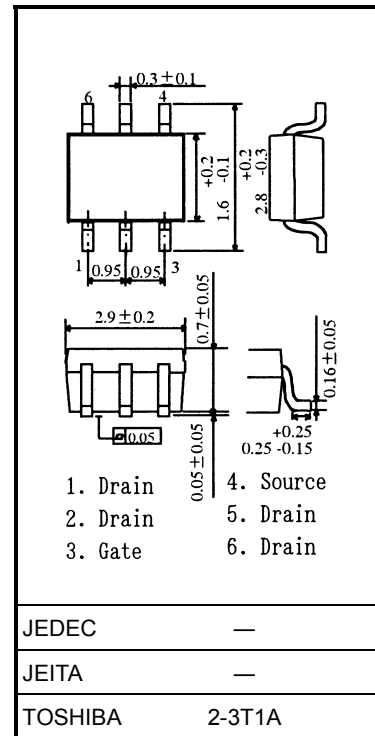
Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 5 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.

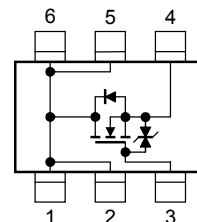
This transistor is an electrostatic-sensitive device. Please handle with caution.

Unit: mm

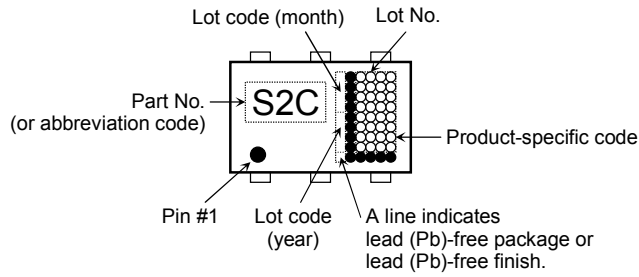


Weight: 0.011 g (typ.)

Circuit Configuration



Marking (Note 5)



Electrical Characteristics (Ta = 25°C)

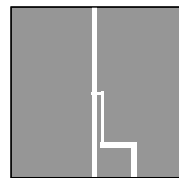
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm 10 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	± 10	μA
Drain cut-OFF current		I_{DSS}	$V_{DS} = 20 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	10	μA
Drain-source breakdown voltage		$V_{(BR) DSS}$	$I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$	20	—	—	V
		$V_{(BR) DSX}$	$I_D = 10 \text{ mA}, V_{GS} = -12 \text{ V}$	8	—	—	
Gate threshold voltage		V_{th}	$V_{DS} = 10 \text{ V}, I_D = 200 \mu\text{A}$	0.5	—	1.2	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = 2.0 \text{ V}, I_D = 3 \text{ A}$	—	30	37	$\text{m}\Omega$
			$V_{GS} = 2.5 \text{ V}, I_D = 3 \text{ A}$	—	25	32	
			$V_{GS} = 4.5 \text{ V}, I_D = 3 \text{ A}$	—	19	24	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10 \text{ V}, I_D = 3 \text{ A}$	5.5	11	—	S
Input capacitance		C_{iss}	$V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	1400	—	pF
Reverse transfer capacitance		C_{rss}		—	165	—	
Output capacitance		C_{oss}		—	180	—	
Switching time	Rise time	t_r	<p>$V_{GS} = 5 \text{ V}, 0 \text{ V}$ $I_D = 3 \text{ A}$ $V_{DS} = V_{OUT}$</p> <p>$R_G = 4.7 \Omega$ $R_L = 3.3 \Omega$ $V_{DD} \approx 10 \text{ V}$</p> <p>Duty $\leq 1\%$, $t_W = 10 \mu\text{s}$</p>	—	5	—	ns
	Turn-ON time	t_{on}		—	10	—	
	Fall time	t_f		—	14	—	
	Turn-OFF time	t_{off}		—	60	—	
Total gate charge (gate-source plus gate-drain)		Q_g	$V_{DD} \approx 16 \text{ V}, V_{GS} = 5 \text{ V}, I_D = 6 \text{ A}$	—	17	—	nC
Gate-source charge		Q_{gs}		—	13	—	
Gate-drain ("miller") charge		Q_{gd}		—	4	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Pulse drain reverse current (Note 1)	I_{DRP}	—	—	—	24	A
Forward voltage (Diode)	V_{DSF}	$I_{DR} = 6\text{ A}$, $V_{GS} = 0\text{ V}$	—	—	-1.2	V

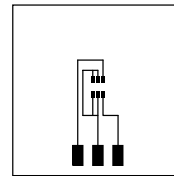
Note 1: Ensure that the channel temperature does not exceed 150°C.

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)



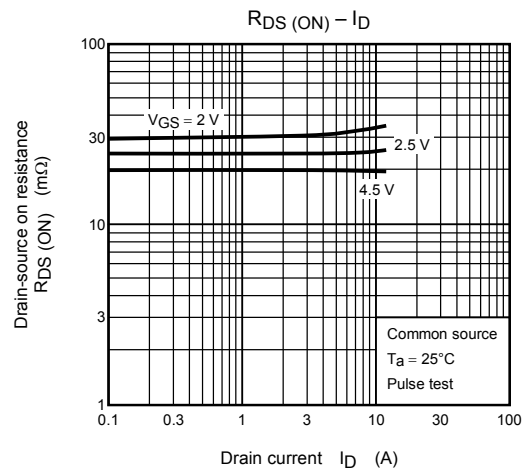
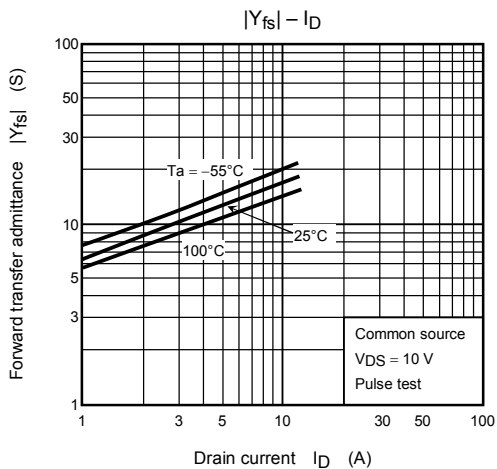
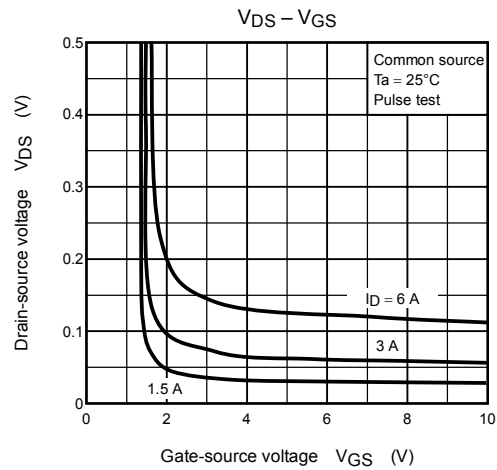
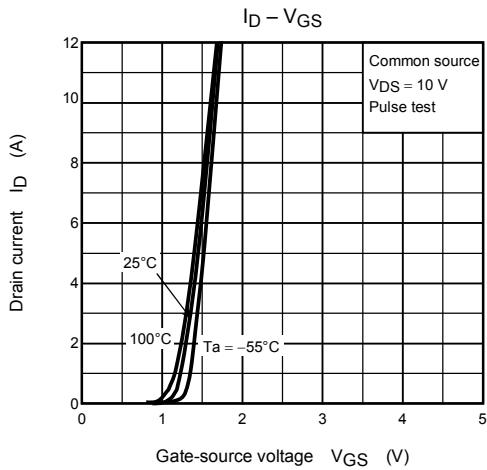
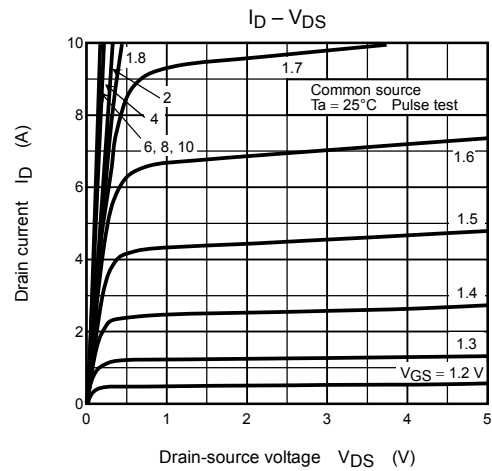
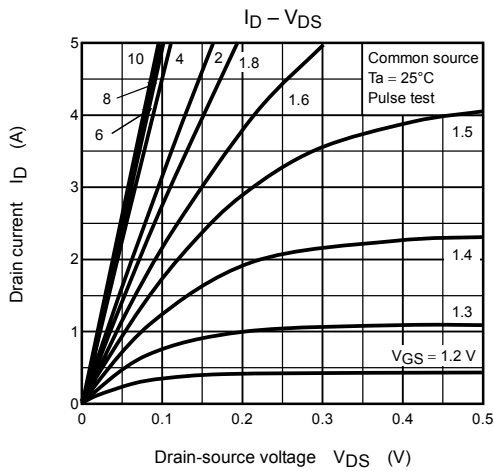
(b)

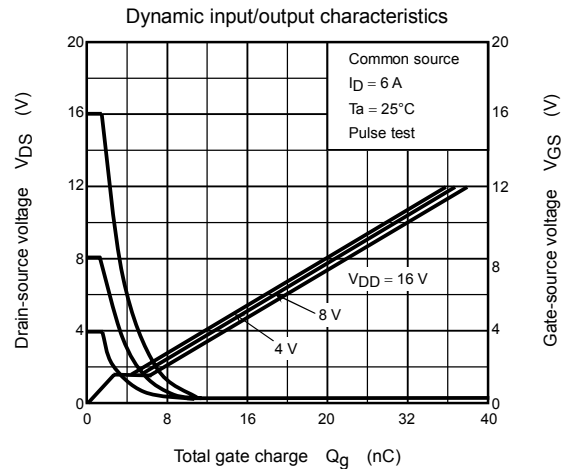
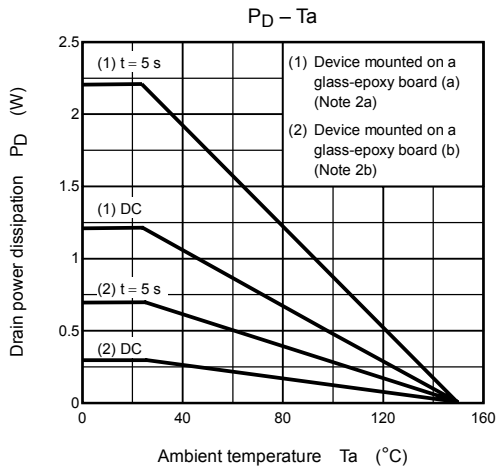
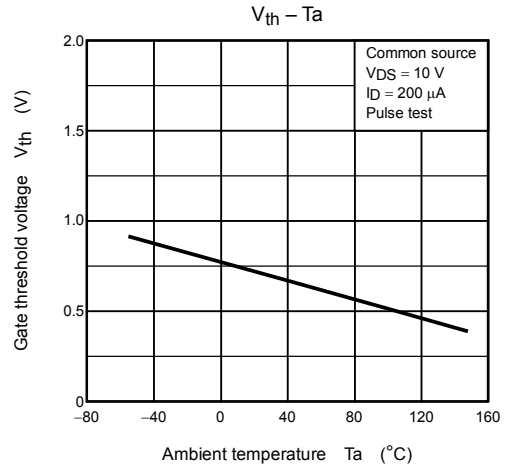
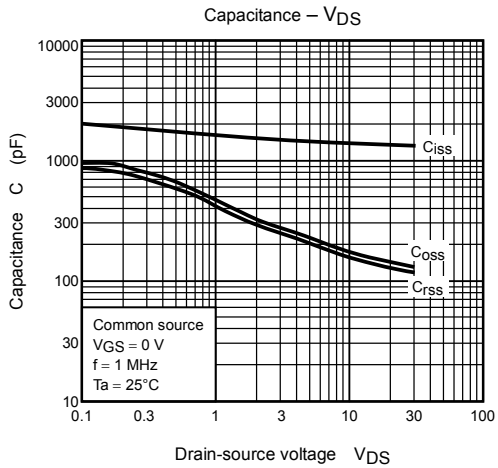
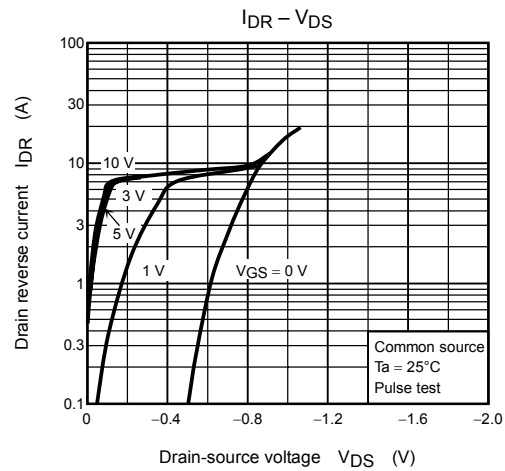
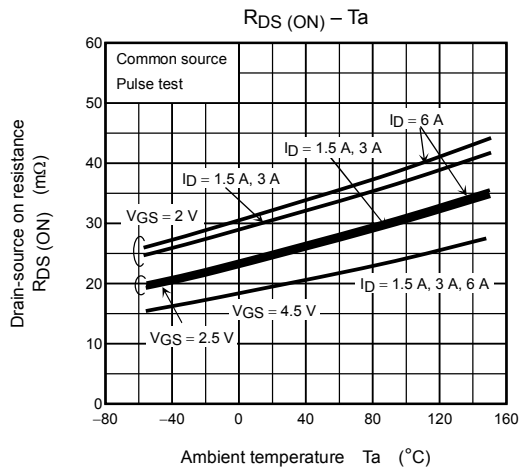
FR-4
25.4 × 25.4 × 0.8
Unit: (mm)

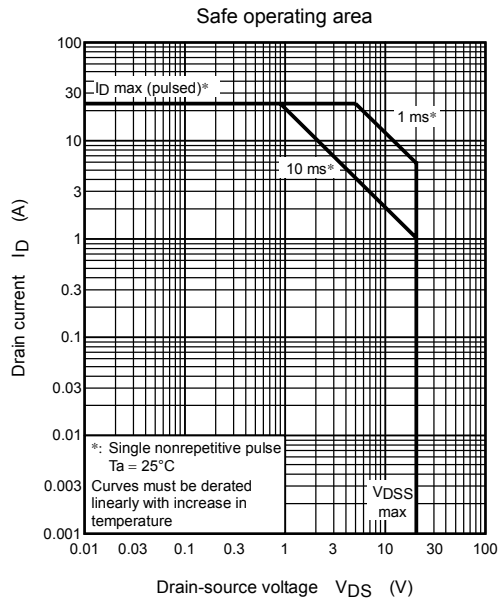
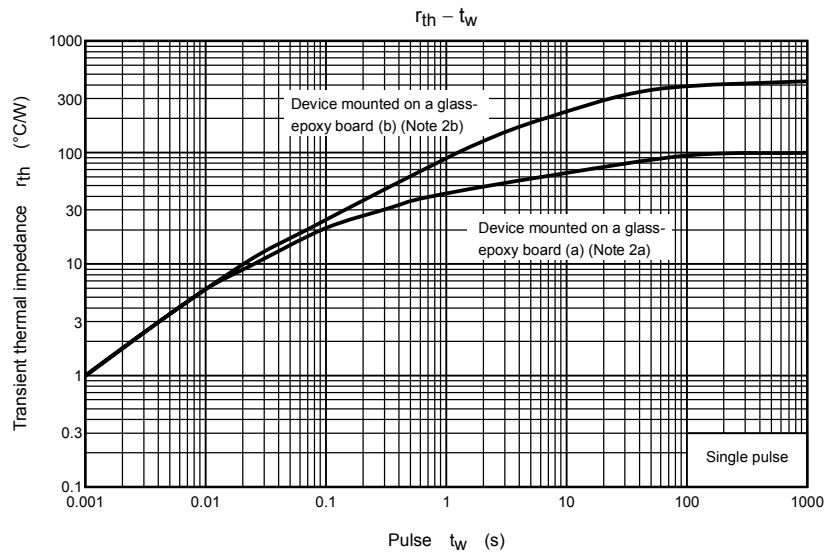
Note 3: $V_{DD} = 16\text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 0.5\text{ mH}$, $R_G = 25\ \Omega$, $I_{AR} = 3.0\text{ A}$

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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