

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:  $V_{th} = 0.5 \text{ to } 1.2 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 200 \text{ }\mu\text{A}$ )

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

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		$V_{GSS}$	$\pm 12$	V
Drain current	DC (Note 1)	$I_D$	6	A
	Pulse (Note 1)	$I_{DP}$	24	
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)		$E_{AS}$	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	$^\circ\text{C}$

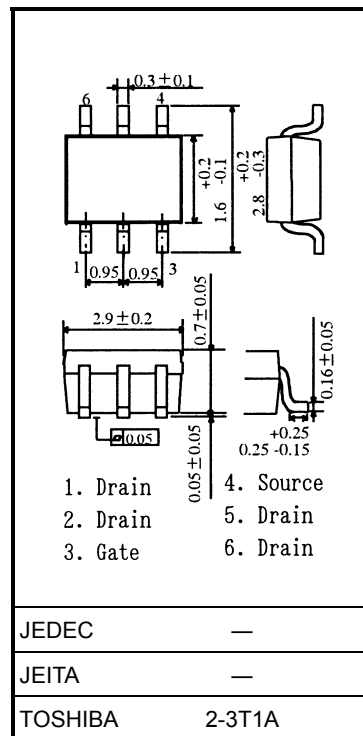
## Thermal Characteristics

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.

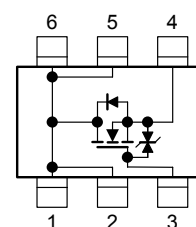
This transistor is an electrostatic-sensitive device. Please handle with caution.

Unit: mm

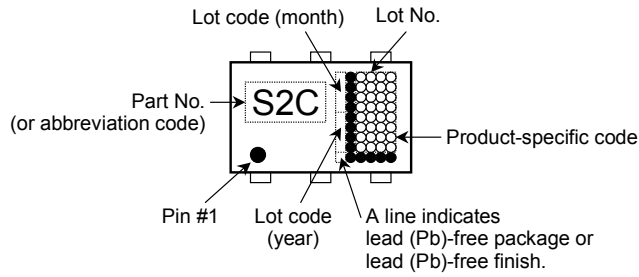


Weight: 0.011 g (typ.)

## Circuit Configuration



## Marking (Note 5)



## Electrical Characteristics (Ta = 25°C)

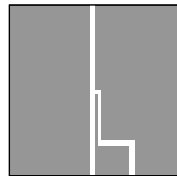
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 10 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cut-OFF current		$I_{DSS}$	$V_{DS} = 20 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	10	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR) DSS}$	$I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$	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><math>V_{GS} = 5 \text{ V}, 0 \text{ V}</math></p> <p><math>I_D = 3 \text{ A}</math></p> <p><math>V_{OUT}</math></p> <p><math>4.7 \Omega</math></p> <p><math>R_L = 3.3 \Omega</math></p> <p><math>V_{DD} \approx 10 \text{ V}</math></p> <p>Duty <math>\leq 1\%</math>, <math>t_W = 10 \mu\text{s}</math></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

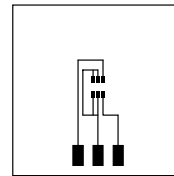
Note 1: Ensure that the channel temperature does not exceed 150°C.

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)



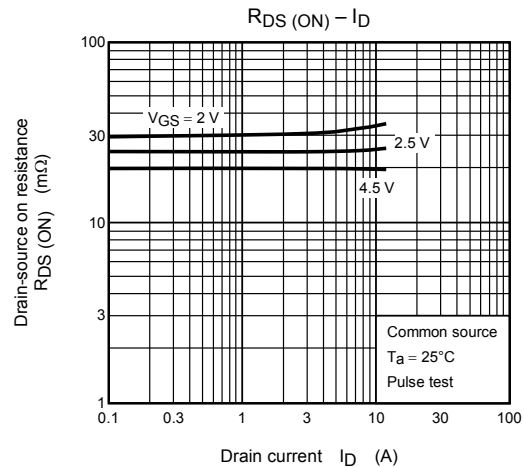
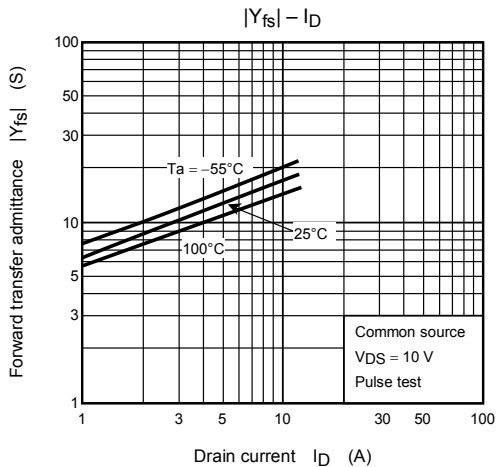
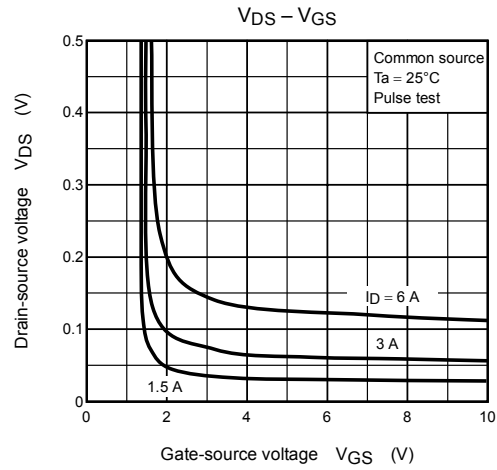
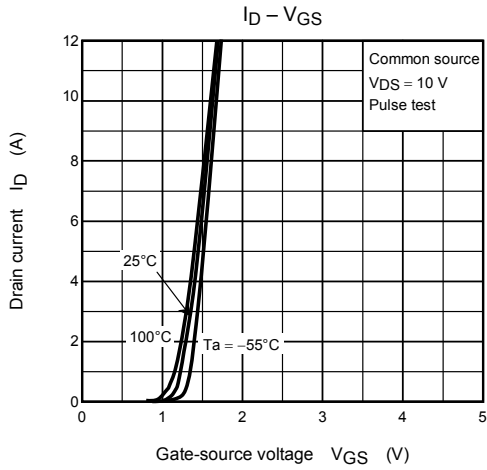
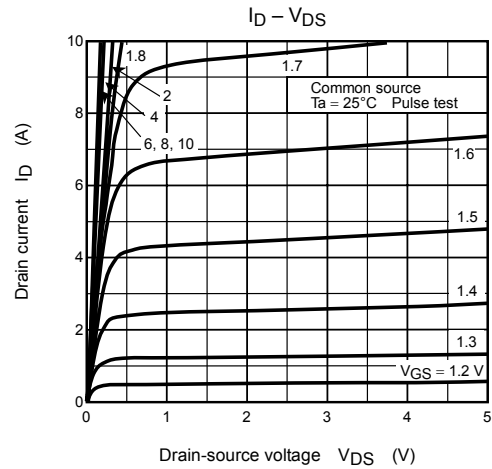
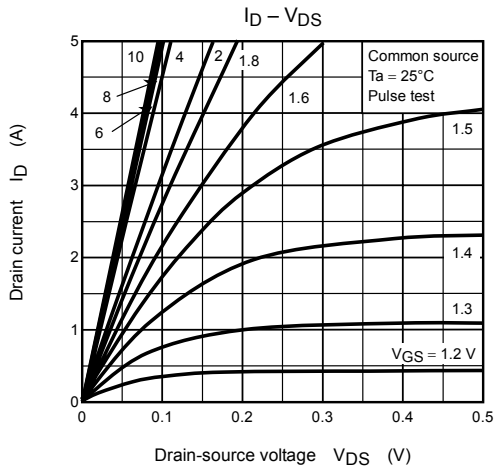
(b)

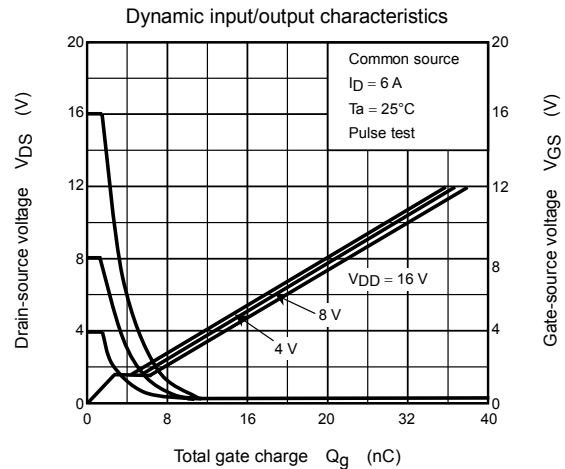
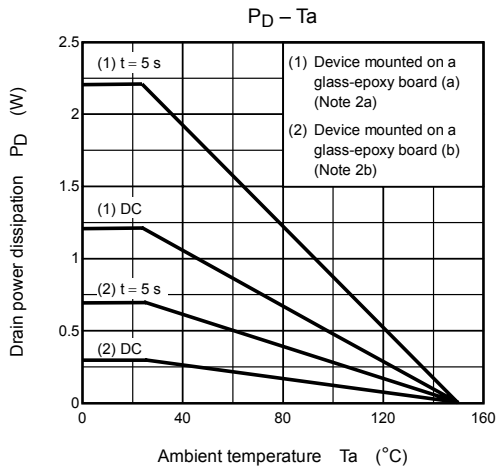
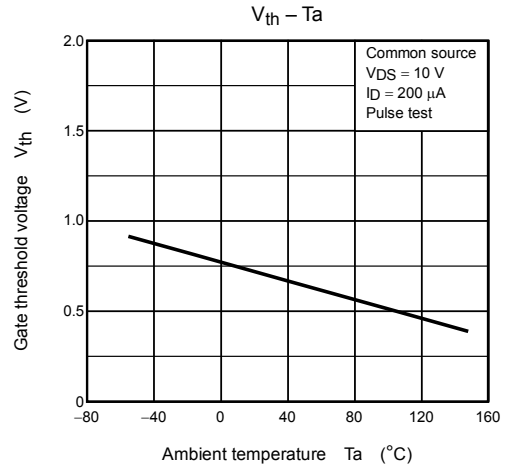
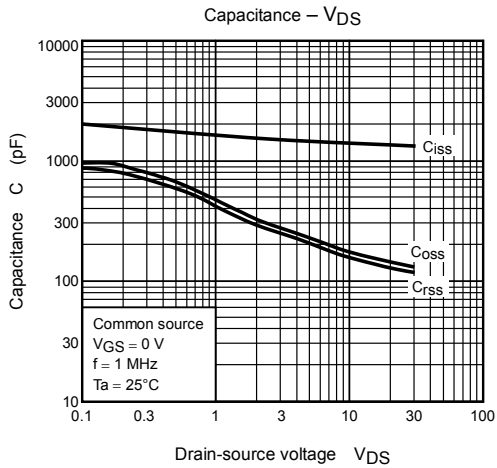
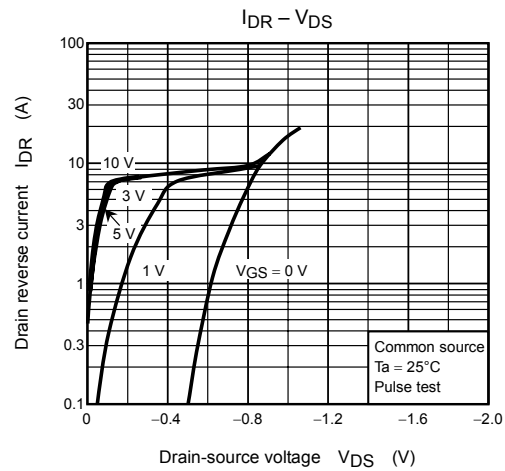
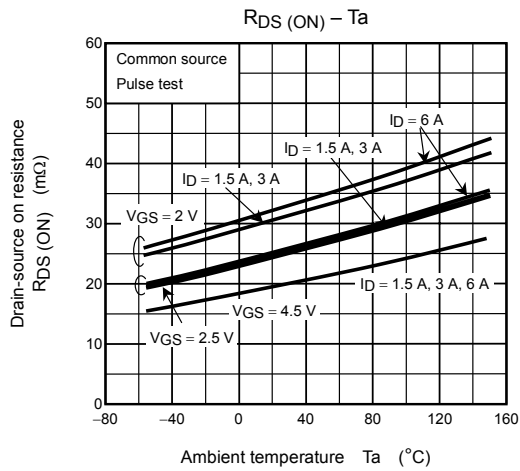
FR-4  
25.4 × 25.4 × 0.8  
Unit: (mm)

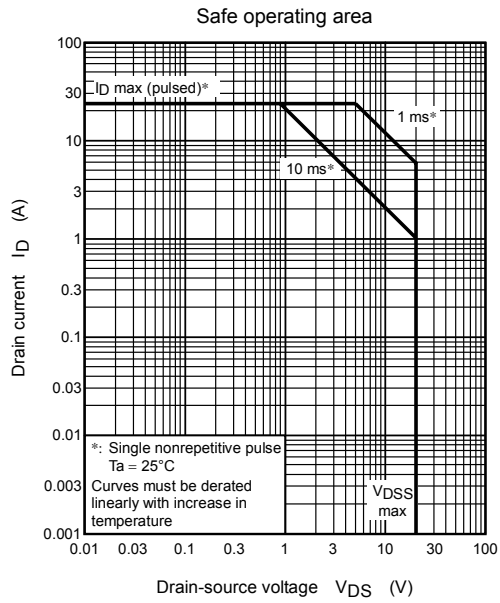
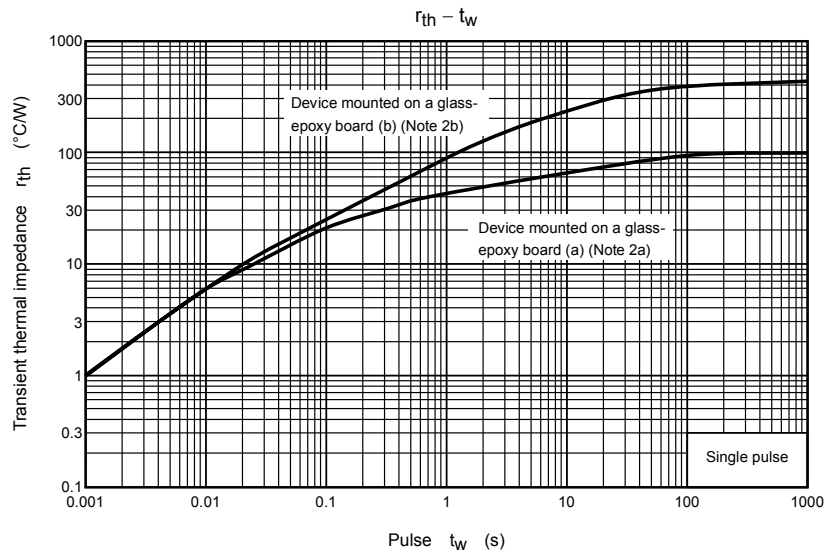
Note 3:  $V_{DD} = 16\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 0.5\text{ mH}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = 3.0\text{ A}$

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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