

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

# TPC6104

Notebook PC Applications  
 Portable Equipment Applications

- Low drain-source ON resistance:  $R_{DS(ON)} = 33 \text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 12 \text{ S}$  (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		$V_{GSS}$	$\pm 8$	V
Drain current	DC (Note 1)	$I_D$	-5.5	A
	Pulse (Note 1)	$I_{DP}$	-22	
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)		$E_{AS}$	4.9	mJ
Avalanche current		$I_{AR}$	-2.75	A
Repetitive avalanche energy (Note 4)		$E_{AR}$	0.22	mJ
Channel temperature		$T_{ch}$	150	°C
Storage temperature range		$T_{stg}$	-55~150	°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).

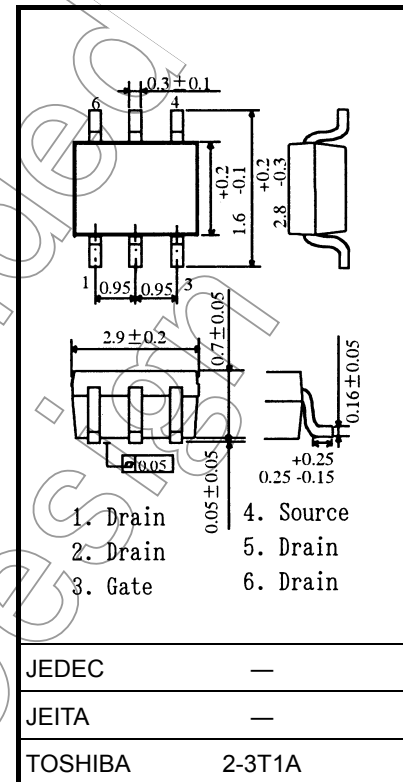
## Thermal Characteristics

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) and (Note 4): See the third page.

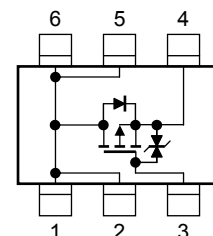
This transistor is an electrostatic-sensitive device. Please handle with caution.

Unit: mm



Weight: 0.011 g (typ.)

## Circuit Configuration



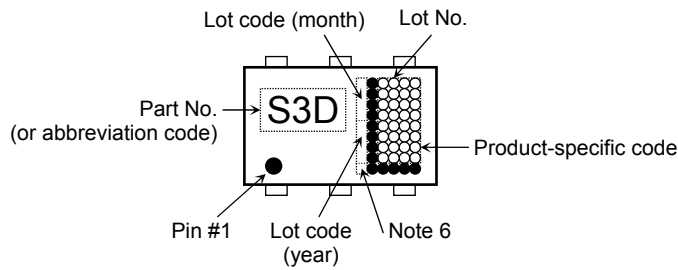
## Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 8 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
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
		$V_{(BR)DSX}$	$I_D = -10 \text{ mA}, V_{GS} = 8 \text{ V}$	-12	—	—	
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		$R_{DS(ON)}$	$V_{GS} = -1.8 \text{ V}, I_D = -1.4 \text{ A}$	—	78	120	m $\Omega$
		$R_{DS(ON)}$	$V_{GS} = -2.5 \text{ V}, I_D = -2.8 \text{ A}$	—	49	60	
		$R_{DS(ON)}$	$V_{GS} = -4.5 \text{ V}, I_D = -2.8 \text{ A}$	—	33	40	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = -10 \text{ V}, I_D = -2.8 \text{ A}$	6	12	—	S
Input capacitance		$C_{iss}$	$V_{DS} = -10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	1430	—	pF
Reverse transfer capacitance		$C_{rss}$		—	200	—	
Output capacitance		$C_{oss}$		—	240	—	
Switching time	Rise time	$t_r$		—	8.5	—	ns
	Turn-on time	$t_{on}$		—	15	—	
	Fall time	$t_f$		—	20	—	
	Turn-off time	$t_{off}$		Duty $\leq 1\%$ , $t_w = 10 \mu\text{s}$	—	66	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx -16 \text{ V}, V_{GS} = -5 \text{ V}, I_D = -5.5 \text{ A}$	—	19	—	nC
Gate-source charge		$Q_{gs}$		—	14	—	
Gate-drain ("miller") charge		$Q_{gd}$		—	5	—	

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

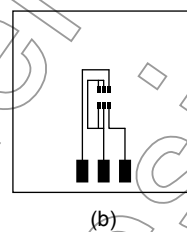
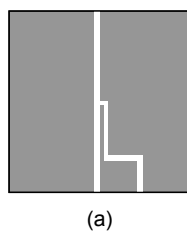
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	$I_{DRP}$	—	—	—	-22	A
Forward voltage (diode)		$V_{DSF}$	$I_{DR} = -5.5 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	1.2	V

## Marking (Note 5)



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

Note 2: (a) Device mounted on a glass-epoxy board (a) (t = 5 s)  
 (b) Device mounted on a glass-epoxy board (b) (t = 5 s)



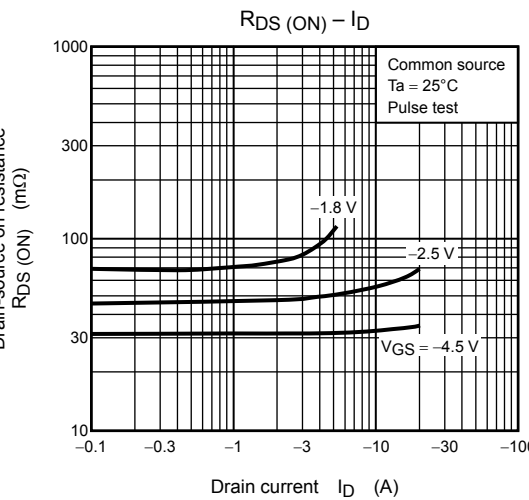
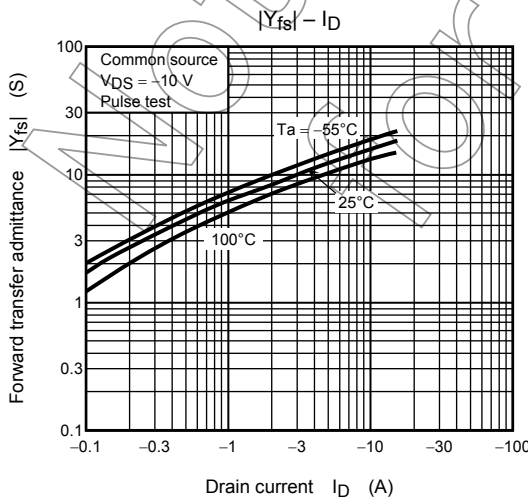
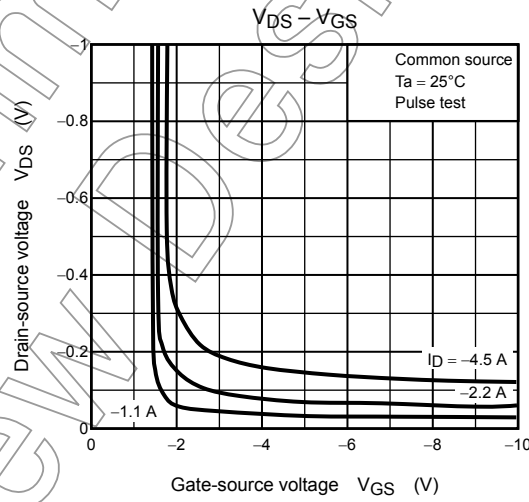
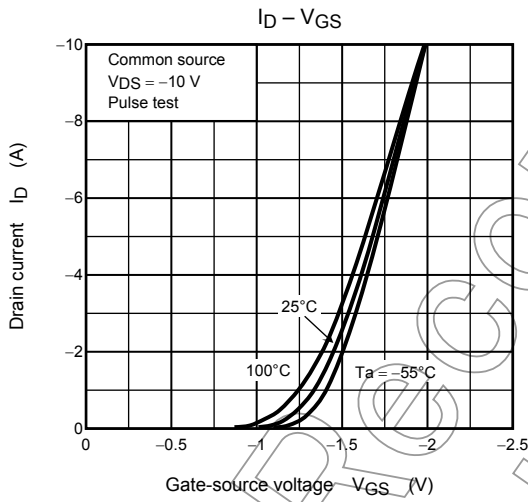
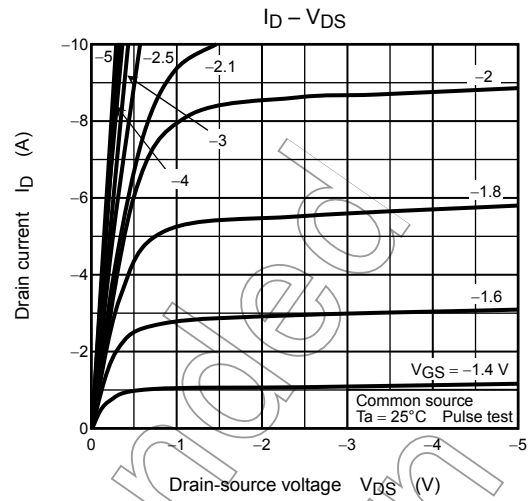
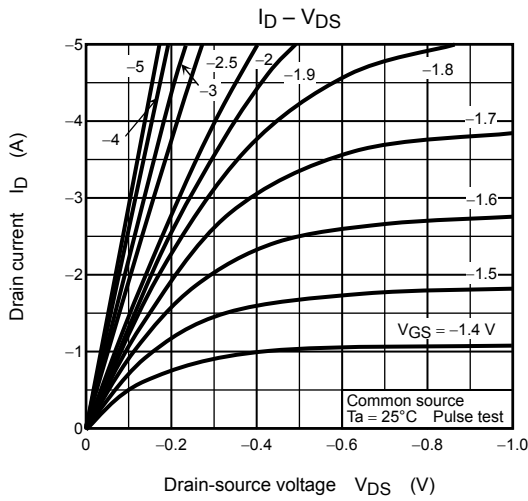
Note 3:  $VDD = 16\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 0.5\text{ mH}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = 2.75\text{ A}$

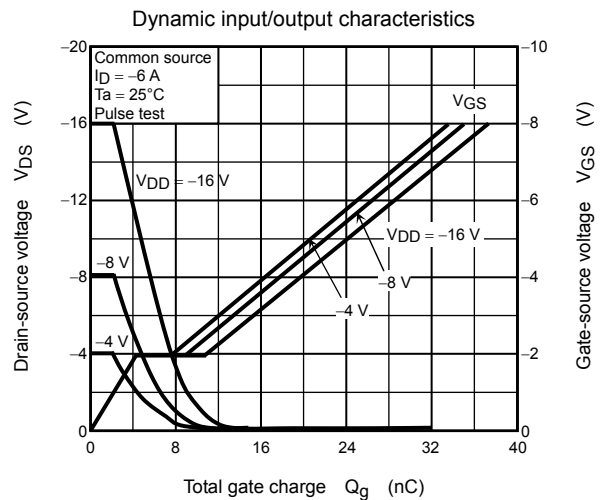
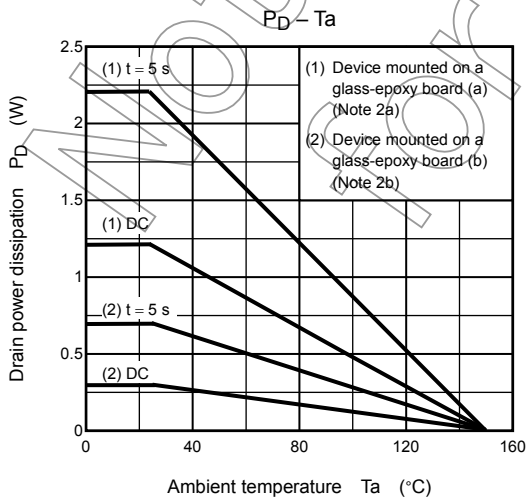
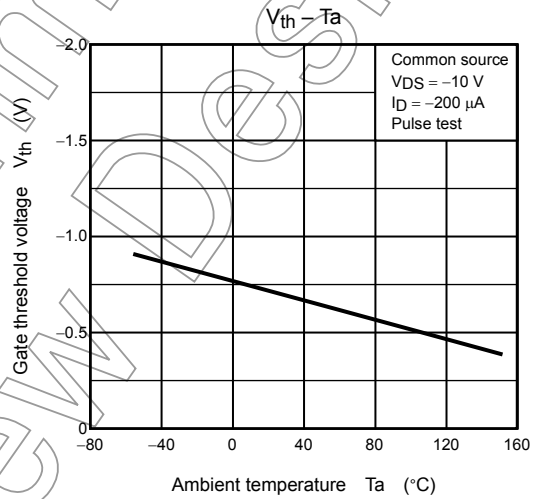
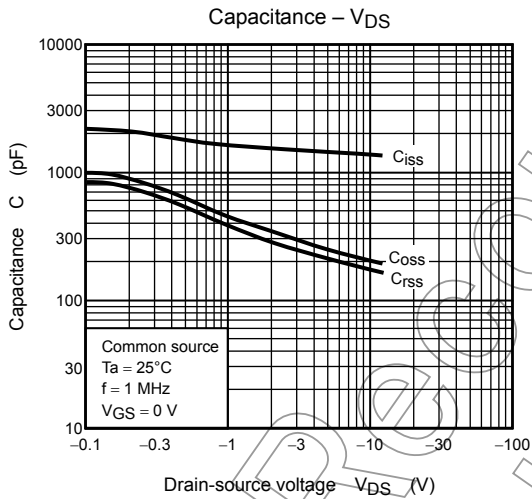
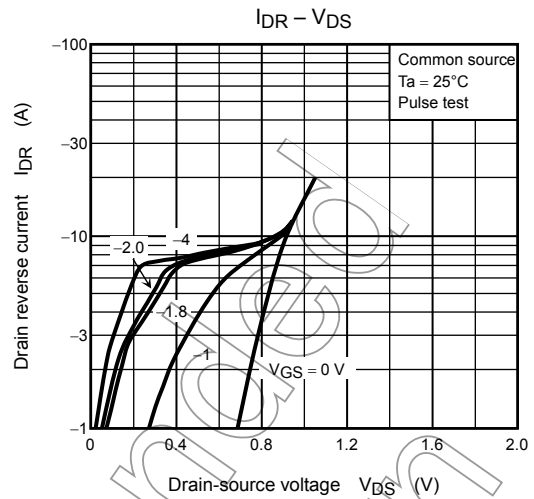
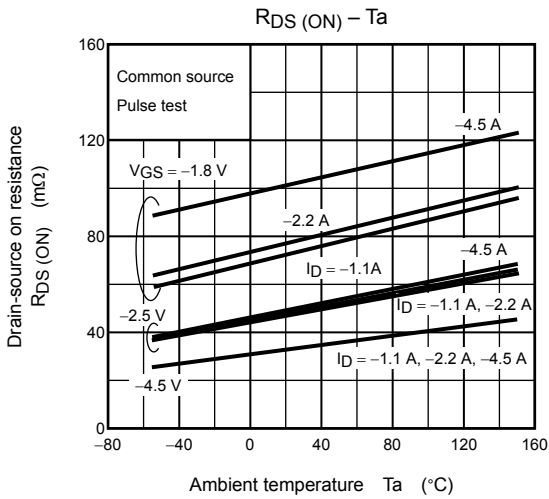
Note 4: Repetitive rating: pulse width limited by maximum channel temperature

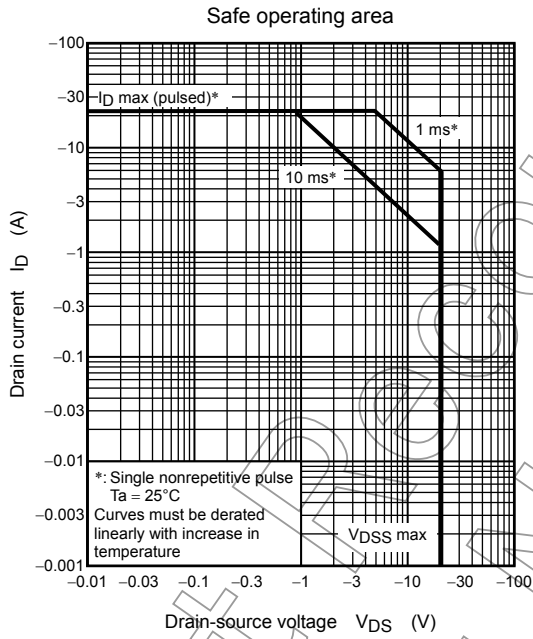
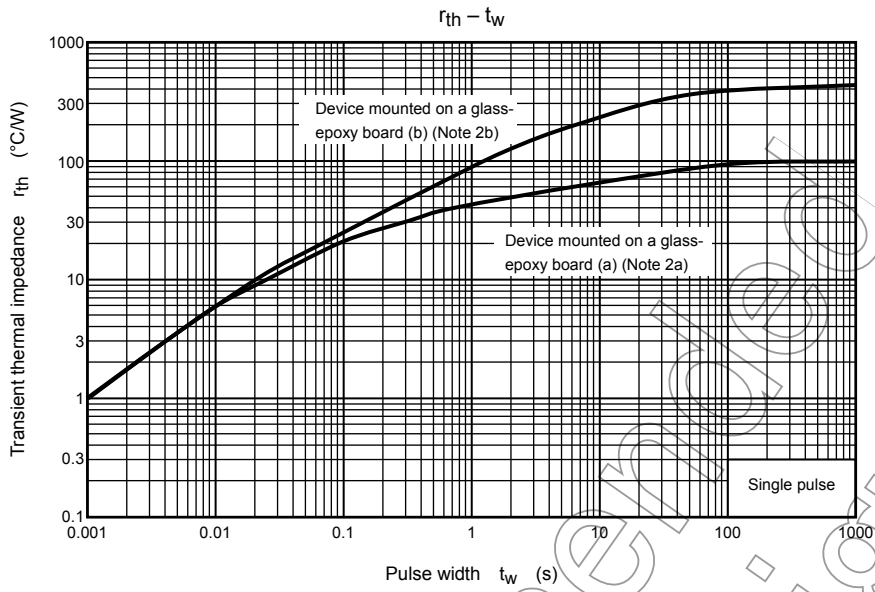
Note 5: • on lower left of the marking indicates Pin 1.

Note 6: A dot marking for identifying the indication of product Labels.  
 Without a dot: [[Pb]]/INCLUDES > MCV  
 With a dot: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.







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