

# TPC6110

## Power Management Switch Applications

- Small footprint due to small and thin package
- Low drain-source ON resistance:  $R_{DS(ON)} = 43 \text{ m}\Omega$  (typ.)
- Low leakage current:  $I_{DSS} = -10 \text{ }\mu\text{A}$  (max) ( $V_{DS} = -30 \text{ V}$ )
- Enhancement mode:  $V_{th} = -0.8$  to  $-2.0 \text{ V}$   
( $V_{DS} = -10 \text{ V}$ ,  $I_D = -0.1 \text{ mA}$ )

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

Characteristics		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	-30	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )		$V_{DGR}$	-30	V
Gate-source voltage		$V_{GSS}$	-25/+20	V
Drain current	DC (Note 1)	$I_D$	-4.5	A
	Pulse (Note 1)	$I_{DP}$	-18	
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)		$E_{AS}$	3.4	mJ
Avalanche current		$I_{AR}$	-2.3	A
Repetitive avalanche energy (Note 4)		$E_{AR}$	0.025	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).

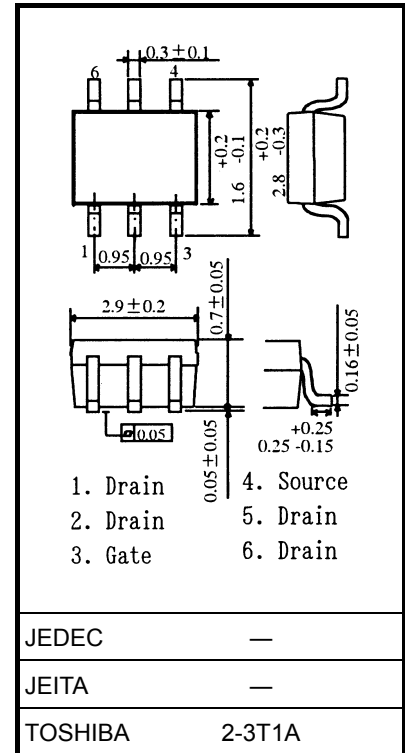
## Thermal Characteristics

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

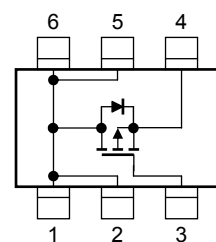
This transistor is an electrostatic-sensitive device. Please handle with caution.

Unit: mm



Weight: 0.011 g (typ.)

## Circuit Configuration



Start of commercial production  
2009-08

## Electrical Characteristics (Ta = 25°C)

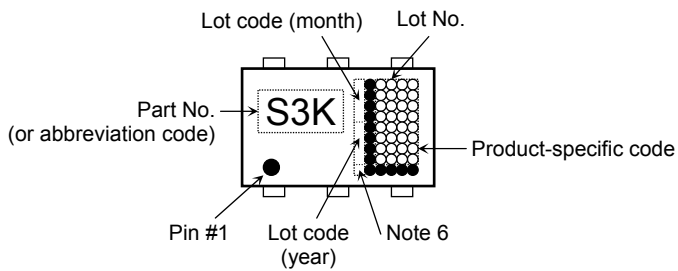
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	$\pm 100$	nA
Drain cut-off current		$I_{DSS}$	$V_{DS} = -30 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	-10	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = -10 \text{ mA}, V_{GS} = 0 \text{ V}$	-30	—	—	V
		$V_{(BR)DSX}$	$I_D = -10 \text{ mA}, V_{GS} = 10 \text{ V}$ (Note 7)	-21	—	—	
Gate threshold voltage		$V_{th}$	$V_{DS} = -10 \text{ V}, I_D = -0.1 \text{ mA}$	-0.8	—	-2.0	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = -4.5 \text{ V}, I_D = -2.2 \text{ A}$	—	59	77	m $\Omega$
			$V_{GS} = -10 \text{ V}, I_D = -2.2 \text{ A}$	—	43	56	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = -10 \text{ V}, I_D = -2.2 \text{ A}$	4.2	8.4	—	S
Input capacitance		$C_{iss}$	$V_{DS} = -10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	510	—	pF
Reverse transfer capacitance		$C_{rss}$		—	85	—	
Output capacitance		$C_{oss}$		—	110	—	
Switching time	Rise time	$t_r$	<p><math>V_{GS} = 0 \text{ V}</math> <math>V_{GS} = -10 \text{ V}</math> <math>I_D = -2.2 \text{ A}</math> <math>V_{OUT}</math> <math>4.7 \Omega</math> <math>R_L = 6.8 \Omega</math> <math>V_{DD} \approx -15 \text{ V}</math> Duty <math>\leq 1\%</math>, <math>t_w = 10 \mu\text{s}</math></p>	—	6	—	ns
	Turn-on time	$t_{on}$		—	12	—	
	Fall time	$t_f$		—	21	—	
	Turn-off time	$t_{off}$		—	70	—	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx -24 \text{ V}, V_{GS} = -10 \text{ V}, I_D = -4.5 \text{ A}$	—	14	—	nC
Gate-source charge 1		$Q_{gs1}$		—	1.6	—	
Gate-drain ("miller") charge		$Q_{gd}$		—	3.8	—	

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

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	$I_{DRP}$	—	—	—	-18	A
Forward voltage (diode)		$V_{DSF}$	$I_{DR} = -4.5 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	1.2	V

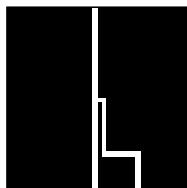
Note 7: VDSX mode (the application of a plus voltage between gate and source) may cause decrease in maximum rating of drain-source voltage.

## Marking (Note 5)



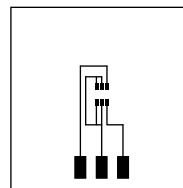
Note 1: Ensure that the channel temperature does not exceed 150°C.

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)



(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),  $L = 0.5\text{ mH}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = -2.3\text{ A}$

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

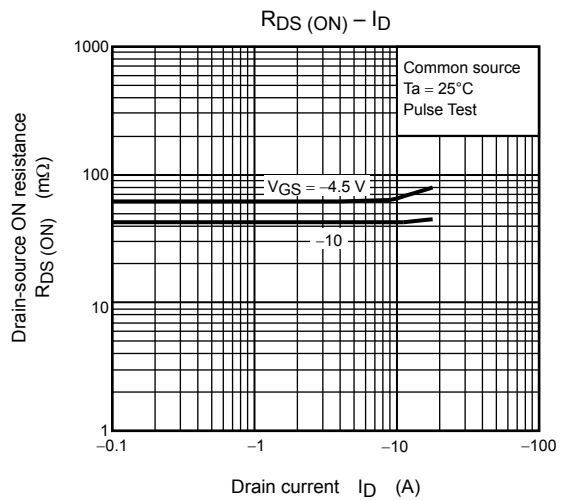
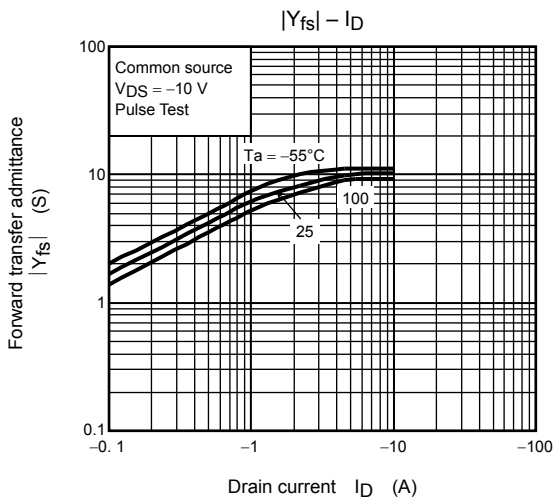
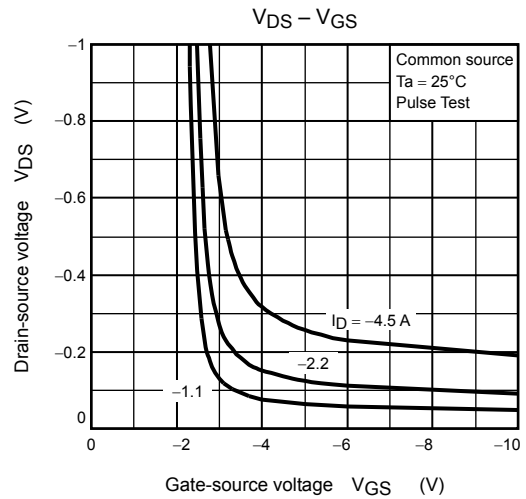
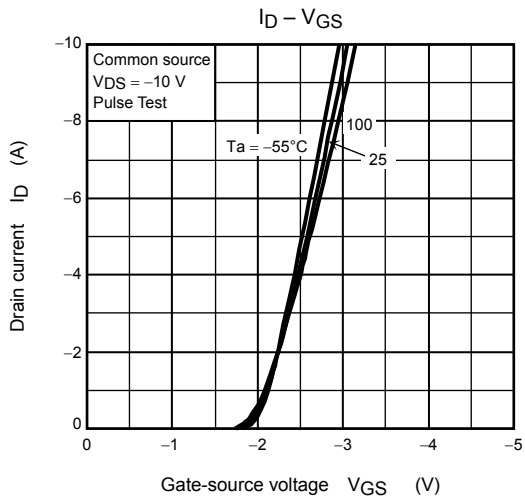
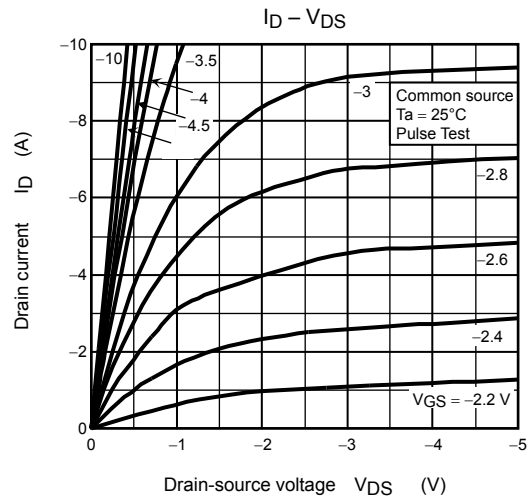
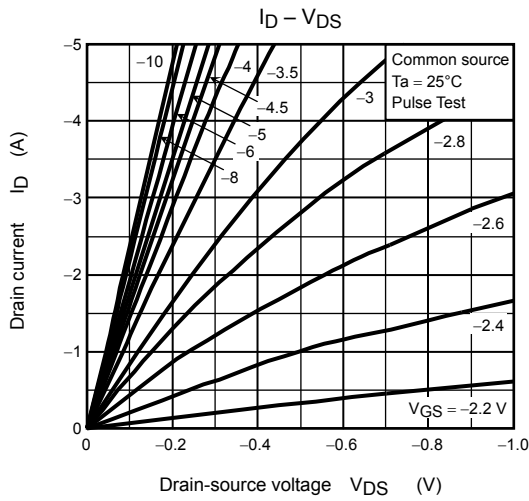
Note 5: • on lower left of the marking indicates Pin 1.

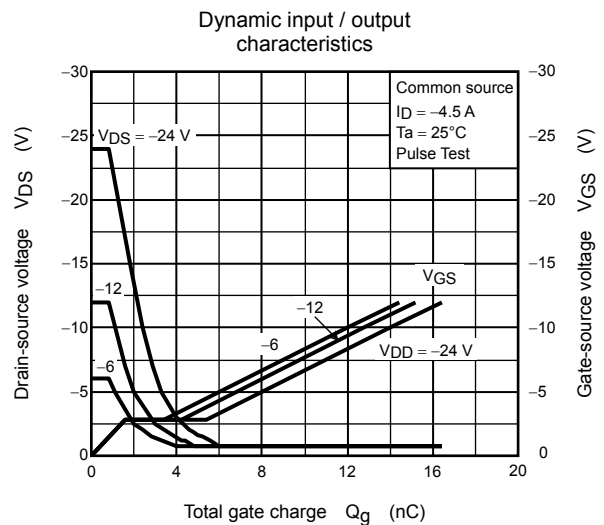
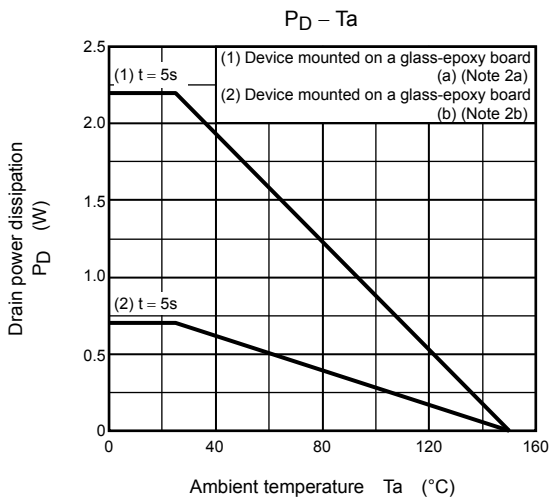
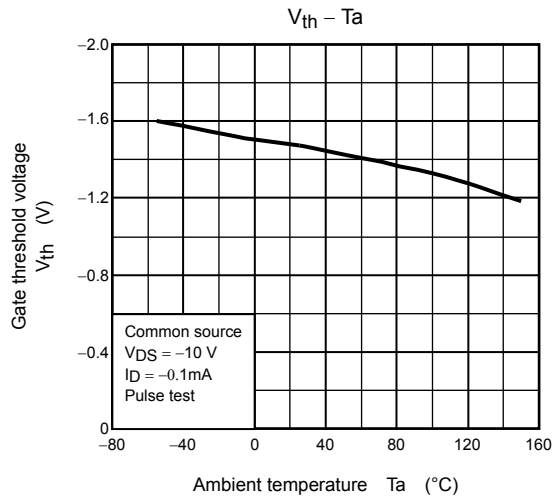
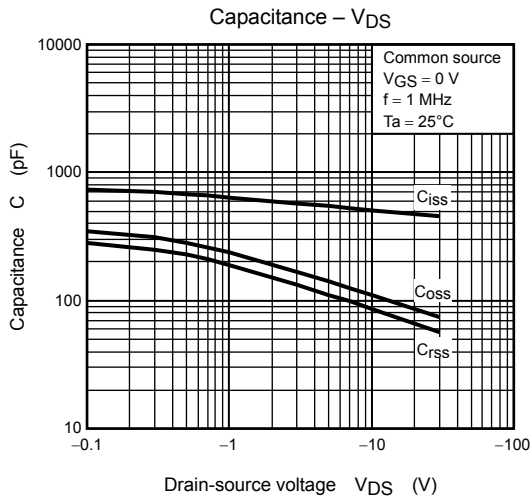
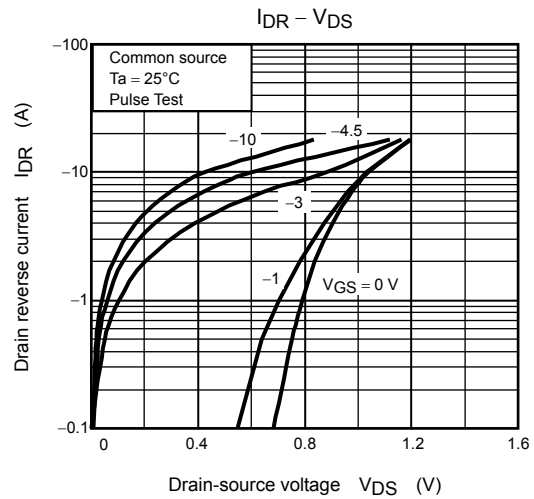
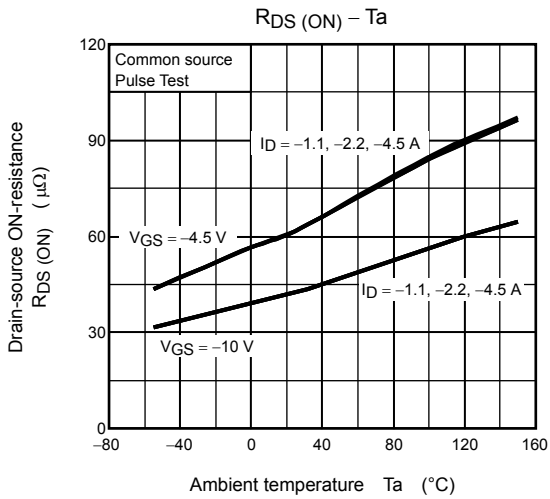
Note 6: A dot marking for identifying the indication of product Labels.

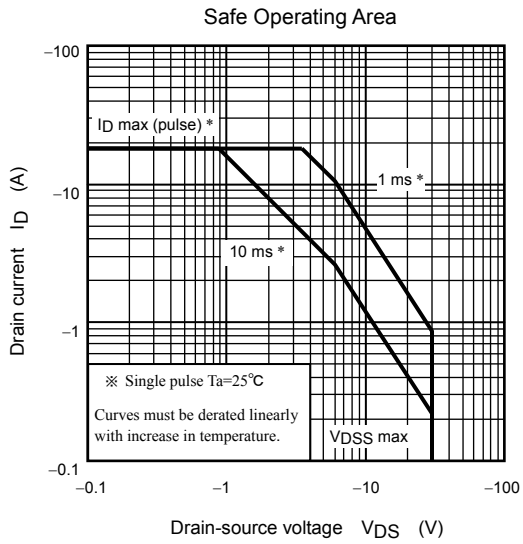
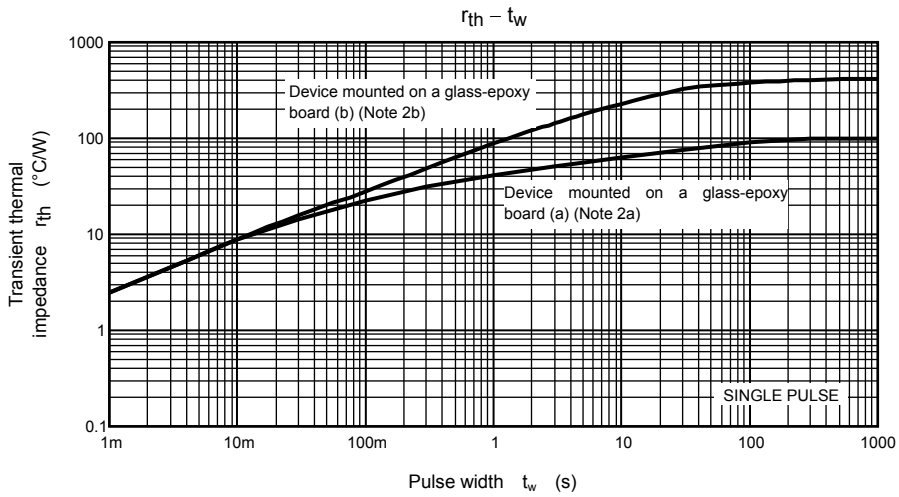
Without a dot: [[Pb]]/INCLUDES > MCV

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 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.







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