

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

# TPC8123

Lithium Ion Battery Applications  
Power Management Switch Applications

- Small footprint due to small and thin package
- Low drain-source ON-resistance:  $R_{DS(ON)} = 7.0 \text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 36 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = -10 \text{ }\mu\text{A}$  (max) ( $V_{DS} = -30 \text{ V}$ )
- Enhancement mode:  $V_{th} = -0.8$  to  $-2.0 \text{ V}$  ( $V_{DS} = -10 \text{ V}$ ,  $I_D = -0.5 \text{ mA}$ )

## Absolute Maximum Ratings (Ta = 25°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)	$I_D$	-11	A
	Pulse (Note 1)	$I_{DP}$	-44	
Drain power dissipation ( $t = 10 \text{ s}$ ) (Note 2a)		$P_D$	1.9	W
Drain power dissipation ( $t = 10 \text{ s}$ ) (Note 2b)		$P_D$	1.0	W
Single pulse avalanche energy (Note 3)		$E_{AS}$	79	mJ
Avalanche current (Note 1)		$I_{AR}$	-11	A
Repetitive avalanche energy (Note 2a) (Note 4)		$E_{AR}$	0.04	mJ
Channel temperature		$T_{ch}$	150	°C
Storage temperature range		$T_{stg}$	-55 to 150	°C

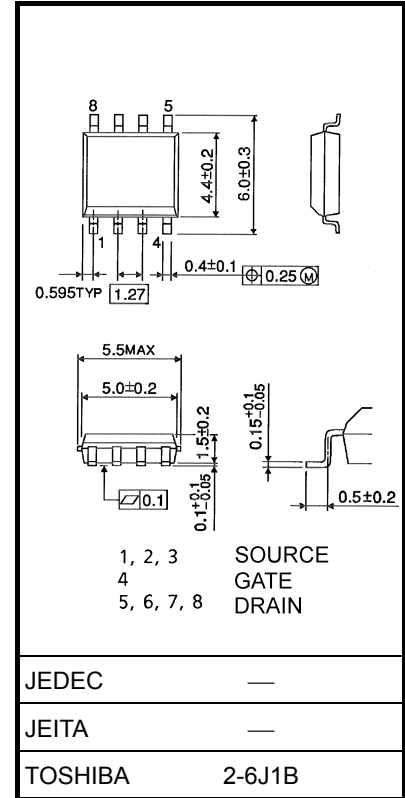
Note 1, Note 2, Note 3 and Note 4: See the next page.

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).

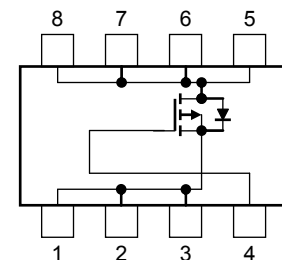
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 0.080 g (typ.)

## Circuit Configuration

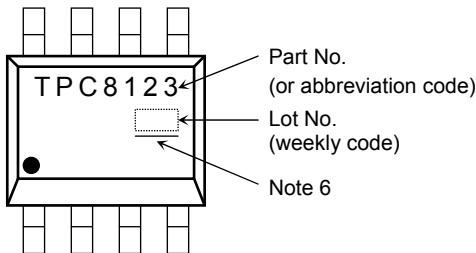


Start of commercial production  
2009-03

## Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 10 s) (Note 2a)	R <sub>th (ch-a)</sub>	65.8	°C/W
Thermal resistance, channel to ambient (t = 10 s) (Note 2b)	R <sub>th (ch-a)</sub>	125	°C/W

## Marking (Note 5)

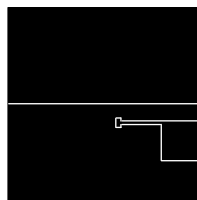


Note 6: A line under a Lot No. identifies the indication of product Labels [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is 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.

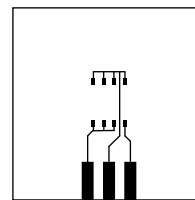
Note 1: Ensure that the channel temperature does not exceed 150°C.

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<sub>DD</sub> = -24 V, T<sub>ch</sub> = 25 °C (initial), L = 500 μH, R<sub>G</sub> = 25 Ω, I<sub>AR</sub> = -11 A

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

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

※ Weekly code: (Three digits)



Week of manufacture

(01 for the first week of a year: sequential number up to 52 or 53)



Year of manufacture

(The last digit of a year)

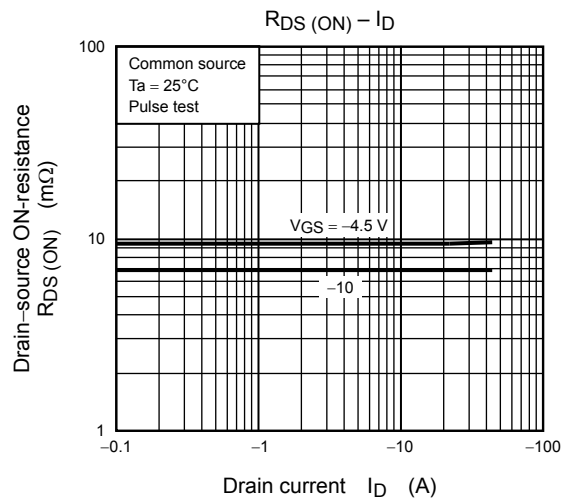
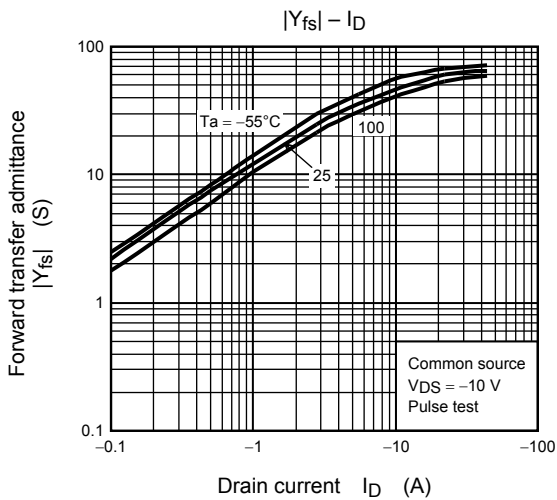
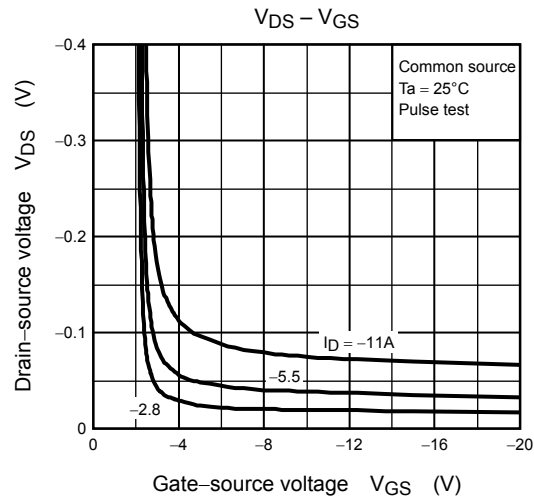
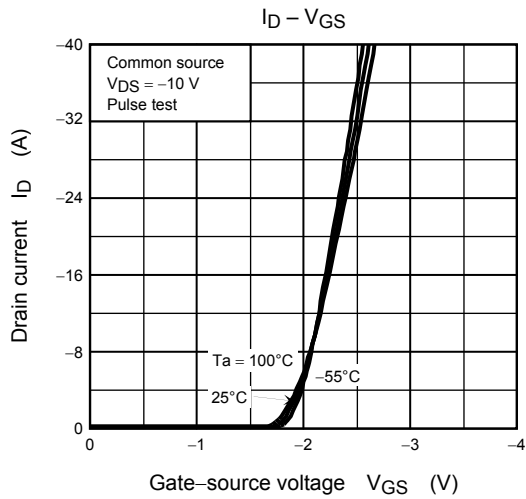
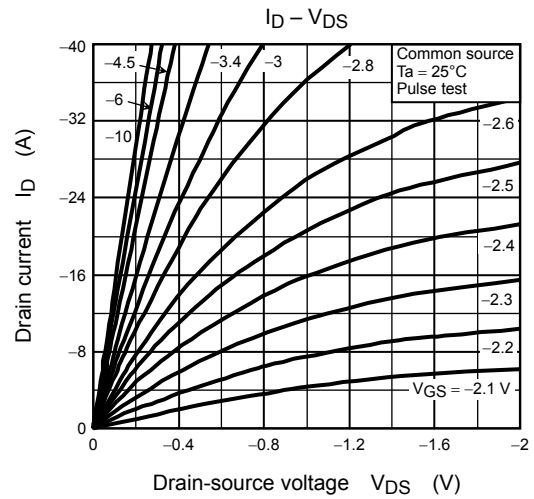
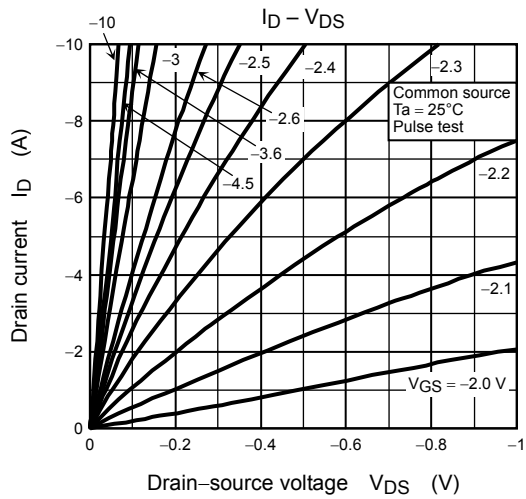
## Electrical Characteristics (Ta = 25°C)

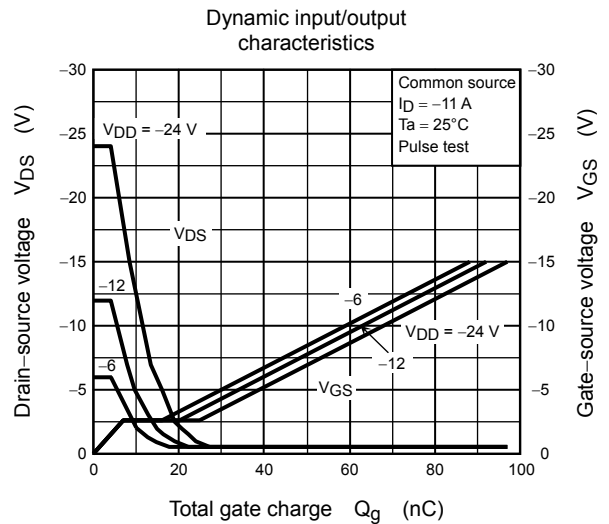
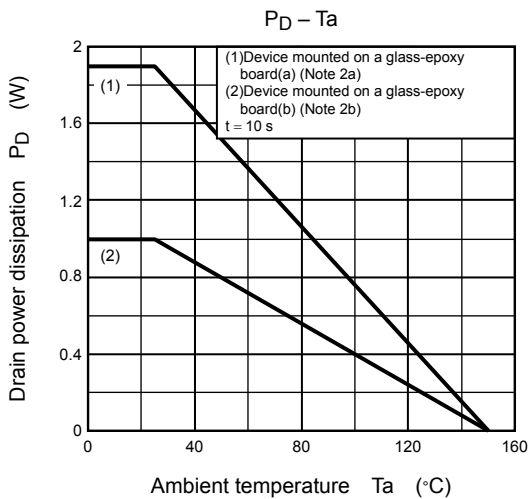
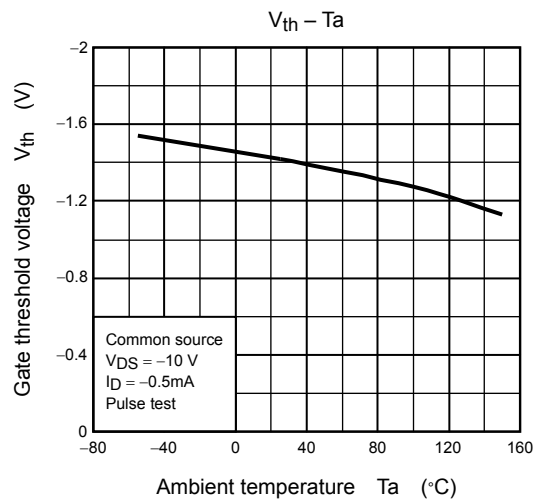
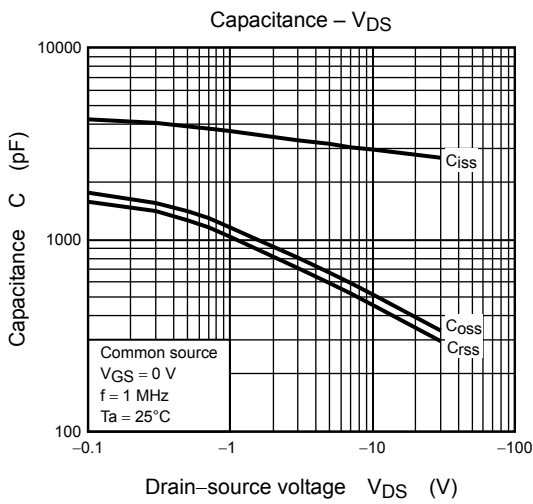
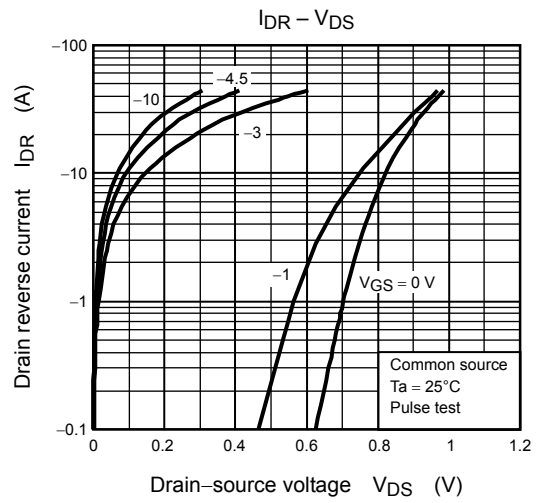
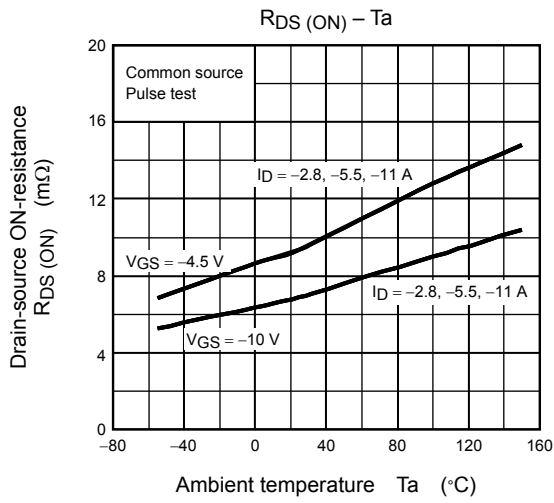
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 100$	nA
Drain cut-OFF current		$I_{DSS}$	$V_{DS} = -30\text{ V}, V_{GS} = 0\text{ V}$	—	—	-10	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = -10\text{ mA}, V_{GS} = 0\text{ V}$	-30	—	—	V
		$V_{(BR)DSX}$	$I_D = -10\text{ mA}, V_{GS} = 10\text{ V}$ (Note 7)	-21	—	—	
Gate threshold voltage		$V_{th}$	$V_{DS} = -10\text{ V}, I_D = -0.5\text{ mA}$	-0.8	—	-2.0	V
Drain-source ON-resistance		$R_{DS(ON)}$	$V_{GS} = -4.5\text{ V}, I_D = -5.5\text{ A}$	—	9.5	12.5	m $\Omega$
			$V_{GS} = -10\text{ V}, I_D = -5.5\text{ A}$	—	7.0	9.0	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = -10\text{ V}, I_D = -5.5\text{ A}$	18	36	—	S
Input capacitance		$C_{iss}$	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	2940	—	pF
Reverse transfer capacitance		$C_{rss}$		—	460	—	
Output capacitance		$C_{oss}$		—	520	—	
Switching time	Rise time	$t_r$	<p><math>V_{GS}</math> 0 V, -10 V  <math>I_D = -5.5\text{ A}</math>  <math>R_L = 2.7\ \Omega</math>  <math>V_{DD} \approx -15\text{ V}</math>  Duty <math>\leq 1\%</math>, <math>t_w = 10\ \mu\text{s}</math></p>	—	10	—	ns
	Turn-ON time	$t_{on}$		—	18	—	
	Fall time	$t_f$		—	80	—	
	Turn-OFF time	$t_{off}$		—	250	—	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx -24\text{ V}, V_{GS} = -10\text{ V}, I_D = -11\text{ A}$	—	68	—	nC
Gate-source charge 1		$Q_{gs1}$		—	7	—	
Gate-drain ("miller") charge		$Q_{gd}$		—	18	—	

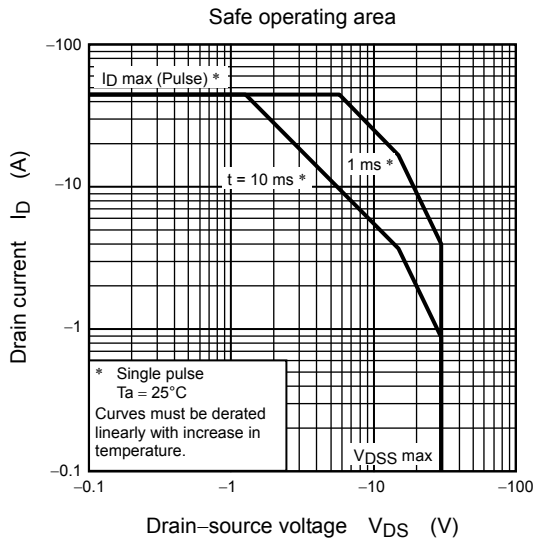
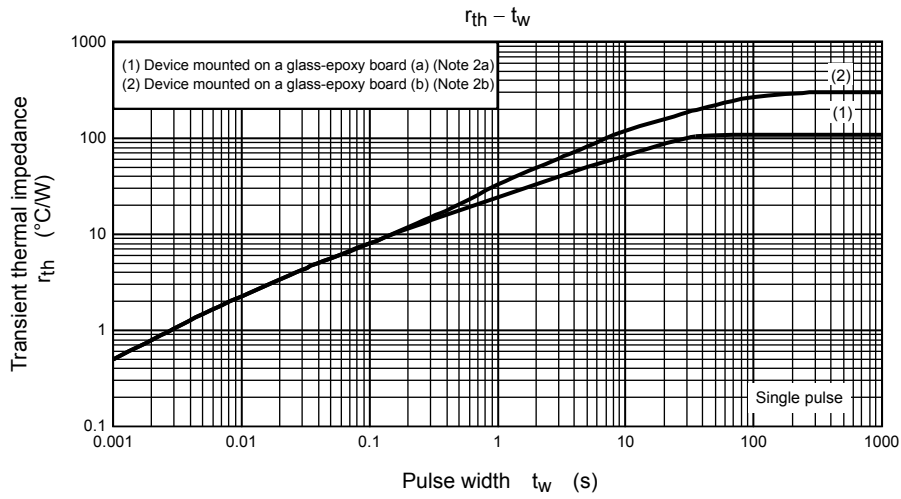
## Source-Drain Ratings and Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	$I_{DRP}$	—	—	—	-44	A
Forward voltage (diode)		$V_{DSF}$	$I_{DR} = -11\text{ A}, V_{GS} = 0\text{ V}$	—	—	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.







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