

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

TPC6113

Lithium Ion Battery Applications

Power Management Switch Applications

- Small footprint due to small and thin package
- Low drain-source ON-resistance: $R_{DS(ON)} = 38 \text{ m}\Omega$ (typ.)
($V_{GS} = -4.5\text{V}$)
- Low leakage current: $I_{DSS} = -10 \text{ }\mu\text{A}$ (max) ($V_{DS} = -20 \text{ V}$)
- Enhancement mode: $V_{th} = -0.5 \text{ to } -1.2 \text{ V}$
($V_{DS} = -10 \text{ V}$, $I_D = -0.2 \text{ mA}$)

Absolute 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}	± 12	V
Drain current	DC (Note 1)	I_D	-5	A
	Pulse (Note 1)	I_{DP}	-20	
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}	1.6	mJ
Avalanche current		I_{AR}	-2.5	A
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.).

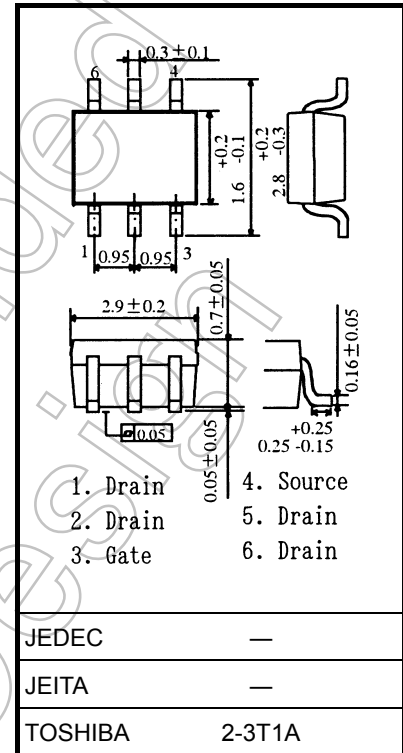
Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to ambient ($t = 5 \text{ s}$) (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) : See other pages.

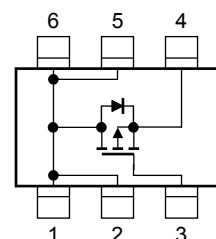
This transistor is an electrostatic-sensitive device. Please handle with caution.

Unit: mm



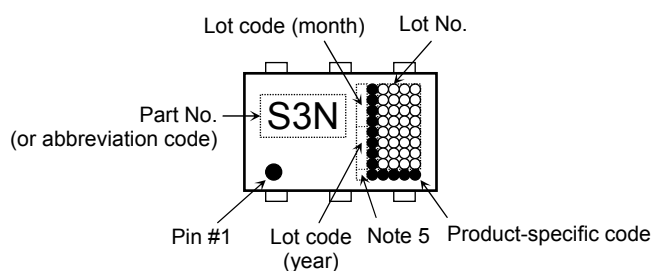
Weight: 0.011 g (typ.)

Circuit Configuration



Start of commercial production
2009-11

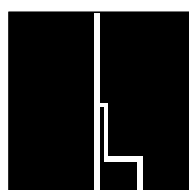
Marking (Note 4)



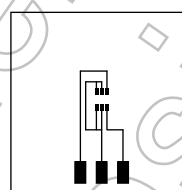
Note 1: Ensure that the channel temperature does not exceed 150°C.

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)



(b)

Note 3: $V_{DD} = -16$ V, $T_{ch} = 25^{\circ}\text{C}$ (initial), $L = 0.2$ mH, $R_G = 25\ \Omega$, $I_{AR} = -2.5$ A

Note 4: • on lower left of the marking indicates Pin 1.

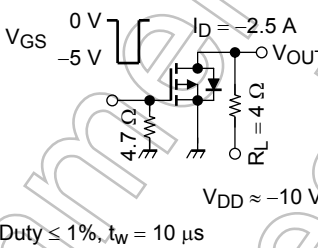
Note 5: A line under a Lot No. identifies the indication of product Labels.

Not underlined: $[[Pb]]/INCLUDES > MCV$

Underlined: $[[G]]/RoHS\ COMPATIBLE$ 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.

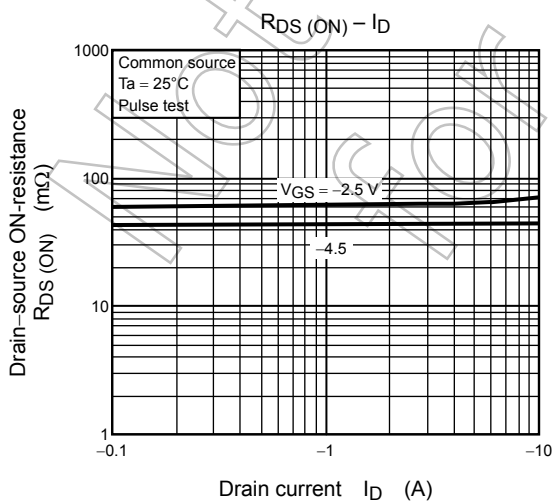
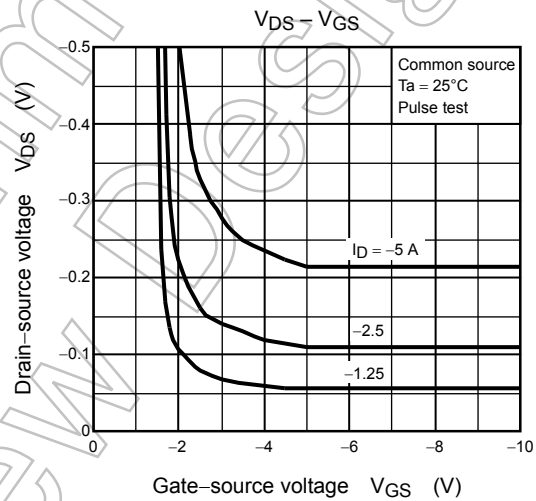
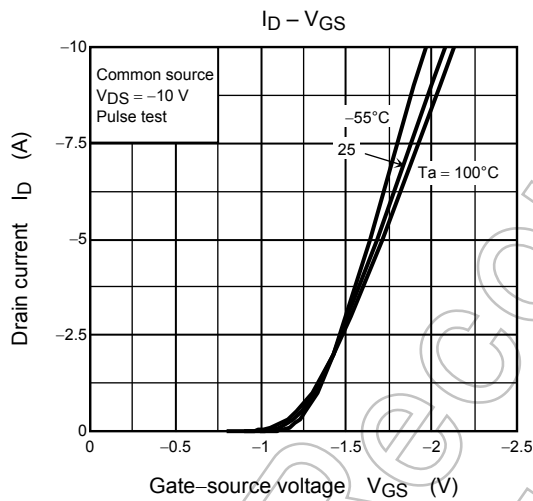
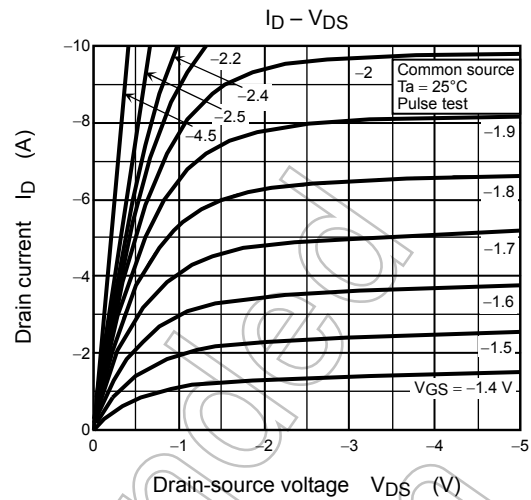
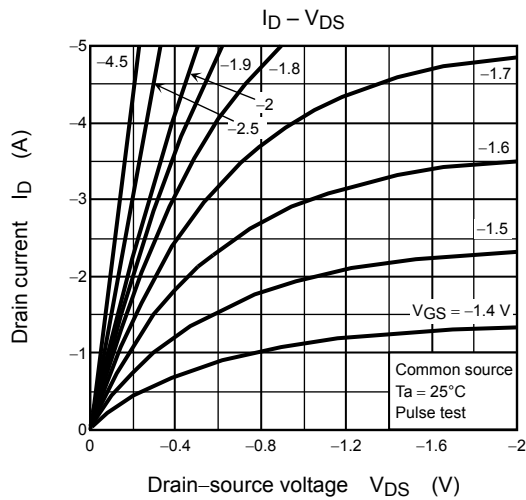
Electrical Characteristics (Ta = 25°C)

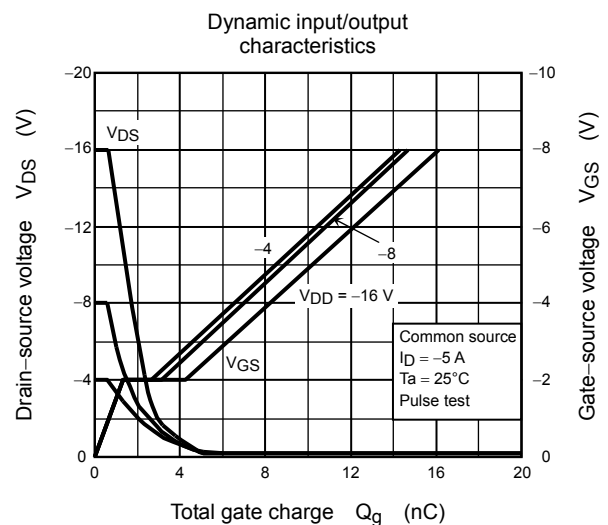
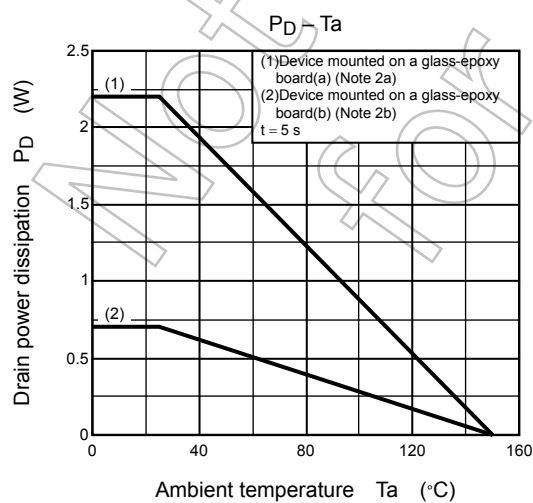
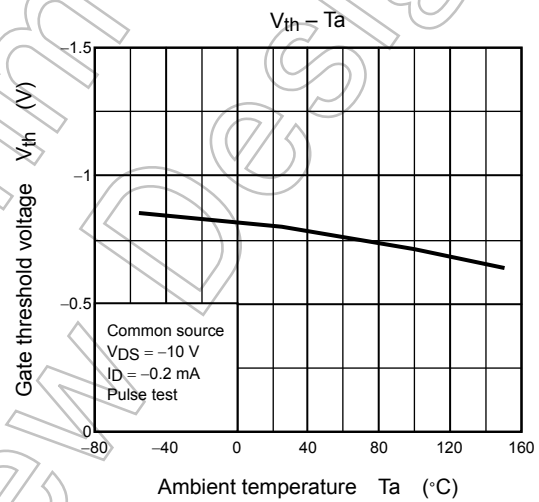
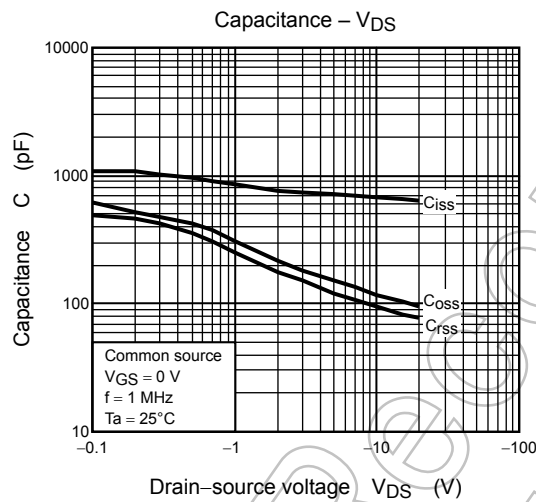
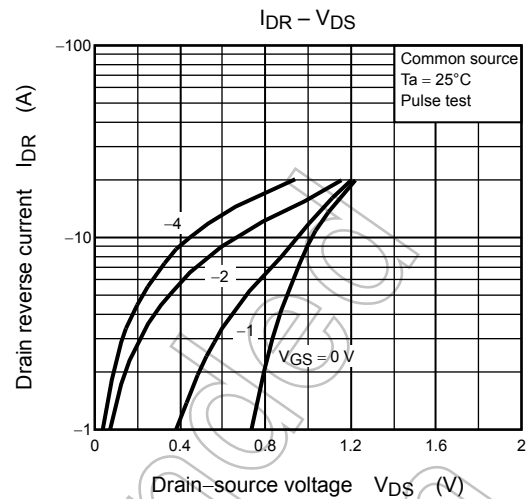
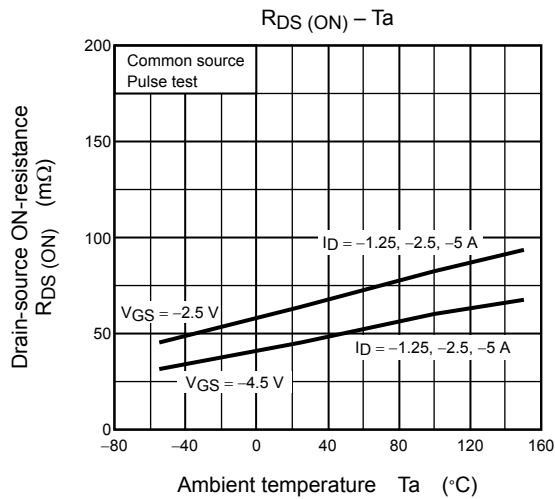
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm 12 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	± 100	nA
Drain cut-off current		I_{DSS}	$V_{DS} = -20 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	-10	μA
Drain-source breakdown voltage	$V_{(BR) DSS}$		$I_D = -10 \text{ mA}, V_{GS} = 0 \text{ V}$	-20	—	—	V
	$V_{(BR) DSX}$		$I_D = -10 \text{ mA}, V_{GS} = 8 \text{ V}$ (Note 6)	-12	—	—	
Gate threshold voltage		V_{th}	$V_{DS} = -10 \text{ V}, I_D = -0.2 \text{ mA}$	-0.5	—	-1.2	V
Drain-source ON-resistance	$R_{DS(ON)}$		$V_{GS} = -2.5 \text{ V}, I_D = -2.5 \text{ A}$	—	56	85	$\text{m}\Omega$
	$R_{DS(ON)}$		$V_{GS} = -4.5 \text{ V}, I_D = -2.5 \text{ A}$	—	38	55	
Input capacitance		C_{iss}	$V_{DS} = -10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	690	—	pF
Reverse transfer capacitance		C_{rss}		—	93	—	
Output capacitance		C_{oss}		—	117	—	
Switching time	Rise time	t_r	 V_{GS} 0 V, -5 V, $I_D = -2.5 \text{ A}$, $V_{DD} \approx -10 \text{ V}$, $R_L = 4 \Omega$, $Duty \leq 1\%, t_w = 10 \mu\text{s}$	—	6	—	ns
	Turn-on time	t_{on}		—	13	—	
	Fall time	t_f		—	25	—	
	Turn-off time	t_{off}		—	81	—	
Total gate charge (gate-source plus gate-drain)		Q_g	$V_{DD} \approx -16 \text{ V}, V_{GS} = -5 \text{ V}, I_D = -5 \text{ A}$	—	10	—	nC
Gate-source charge 1		Q_{gs1}		—	1.3	—	
Gate-drain ("miller") charge		Q_{gd}		—	2.8	—	

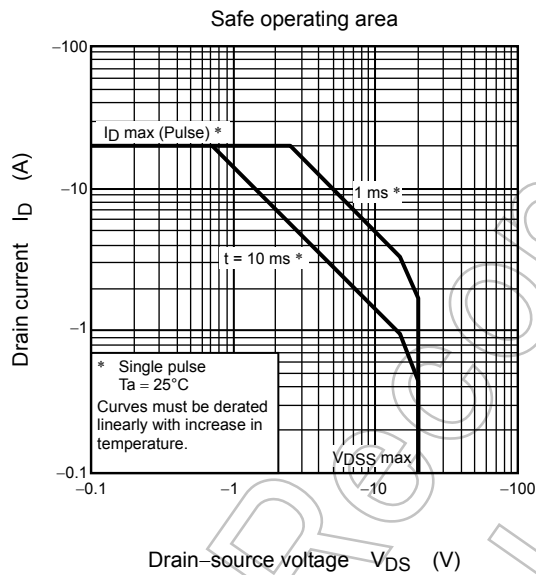
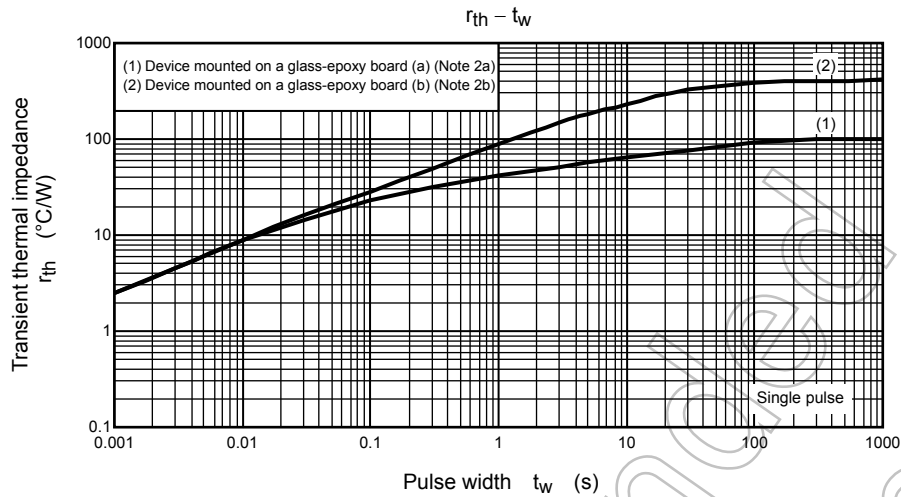
Source-Drain Ratings and Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	-20	A
Forward voltage (diode)		V_{DSF}	$I_{DR} = -5 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	1.2	V

Note 6: 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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