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

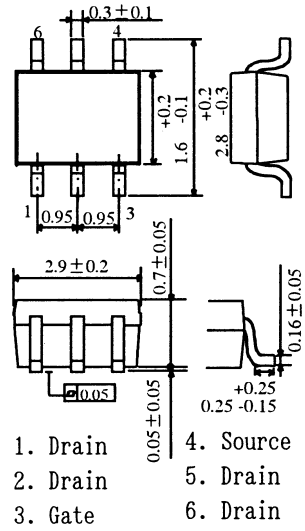
TPC6113

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 mΩ (typ.)
  (V_{GS} = −4.5V)
- Low leakage current: I_{DSS} = −10 μA (max) (V_{DS} = −20 V)
- Enhancement mode: V_{th} = −0.5 to −1.2 V
  (V_{DS} = −10 V, I_D = −0.2 mA)

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	2-3T1A

Weight: 0.011 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	−20	V
Drain-gate voltage (R_{GS} = 20 kΩ)		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 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}	1.6	mJ
Avalanche current		I_{AR}	−2.5	A
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55 to 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).

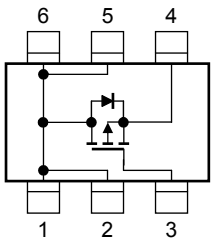
Thermal Characteristics

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) : See other pages.

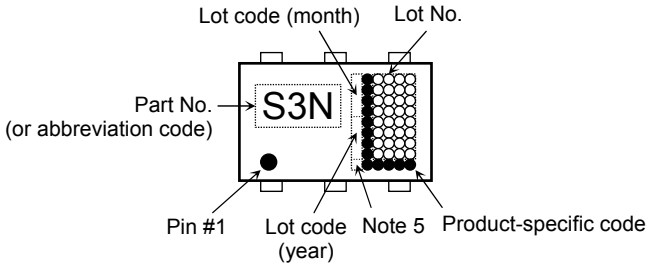
This transistor is an electrostatic-sensitive device. Please handle with caution.

Circuit Configuration



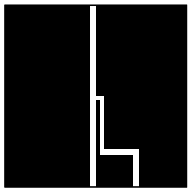
Start of commercial production
2009-11

Marking (Note 4)



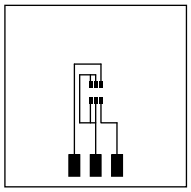
Note 1: Ensure that the channel temperature does not exceed 150°C.

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)



FR-4
25.4 × 25.4 × 0.8
(Unit: mm)

(a)



FR-4
25.4 × 25.4 × 0.8
(Unit: mm)

(b)

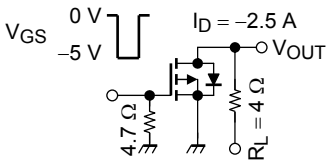
Note 3: V_{DD} = −16 V, T_{ch} = 25°C (initial), L = 0.2 mH, R_G = 25 Ω, I_{AR} = −2.5 A

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)

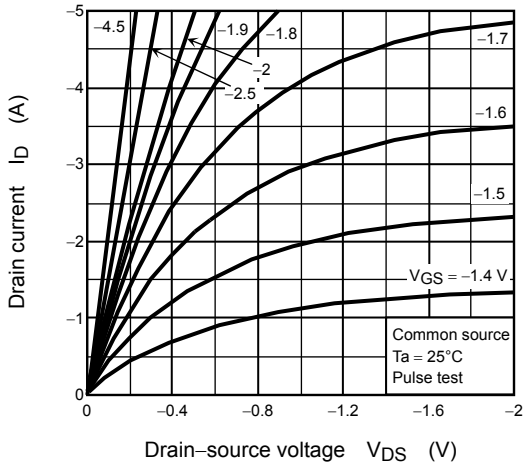
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±12 V, V_{DS} = 0 V	—	—	±100	nA
Drain cut-off current		I_{DSS}	V_{DS} = −20 V, V_{GS} = 0 V	—	—	−10	μA
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	I_D = −10 mA, V_{GS} = 0 V	−20	—	—	V
		$V_{(BR)\ DSX}$	I_D = −10 mA, V_{GS} = 8 V (Note 6)	−12	—	—	
Gate threshold voltage		V_{th}	V_{DS} = −10 V, I_D = −0.2 mA	−0.5	—	−1.2	V
Drain-source ON-resistance		$R_{DS\ (ON)}$	V_{GS} = −2.5 V, I_D = −2.5 A	—	56	85	mΩ
		$R_{DS\ (ON)}$	V_{GS} = −4.5 V, I_D = −2.5 A	—	38	55	
Input capacitance		C_{iss}	V_{DS} = −10 V, V_{GS} = 0 V, f = 1 MHz	—	690	—	pF
Reverse transfer capacitance		C_{rss}		—	93	—	
Output capacitance		C_{oss}		—	117	—	
Switching time	Rise time	t_r	 Duty ≤ 1%, t_w = 10 μs	—	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} ≈ −16 V, V_{GS} = −5 V, I_D = −5 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)

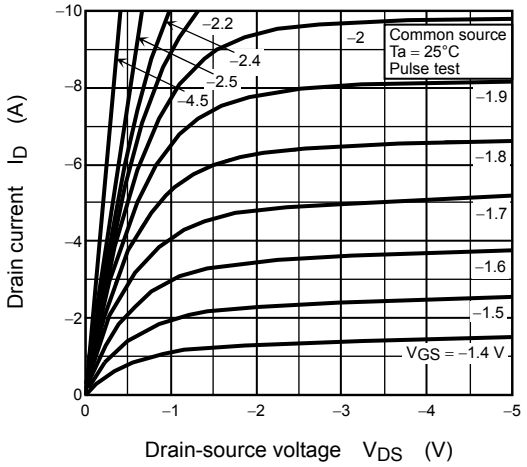
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	−20	A
Forward voltage (diode)		V_{DSF}	I_{DR} = −5 A, V_{GS} = 0 V	—	—	1.2	V

Note 6: VDSX mode (the application of a plus voltage between gate and source) may cause decrease in maximum rating of drain-source voltage.

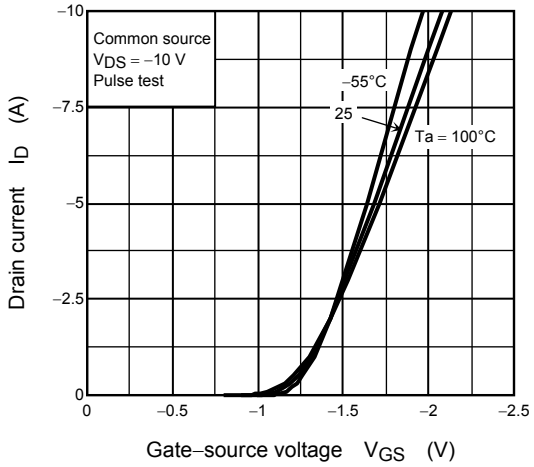
$I_D - V_{DS}$



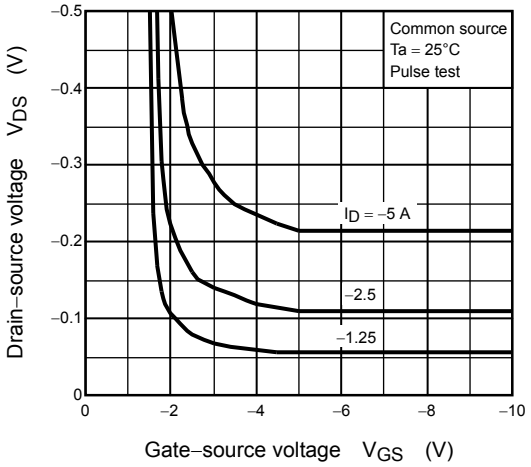
$I_D - V_{DS}$



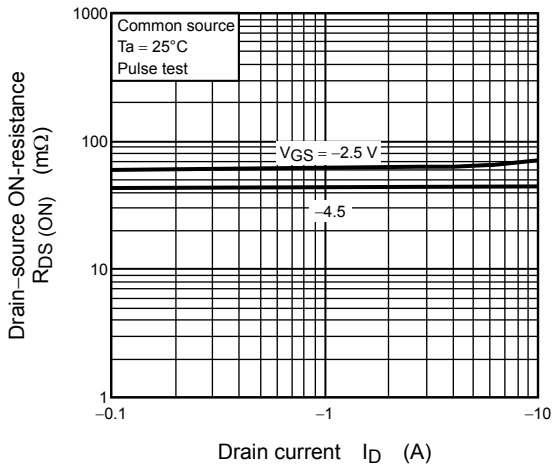
$I_D - V_{GS}$



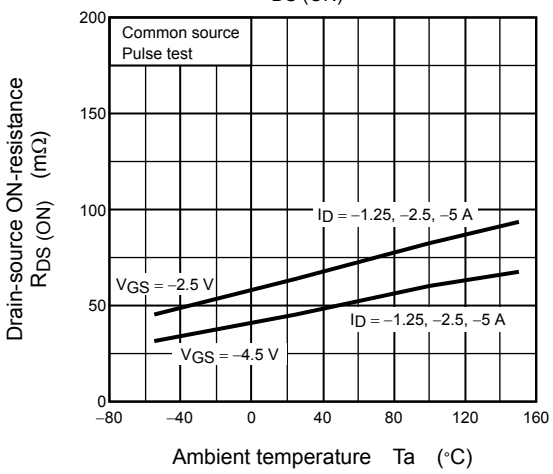
$V_{DS} - V_{GS}$



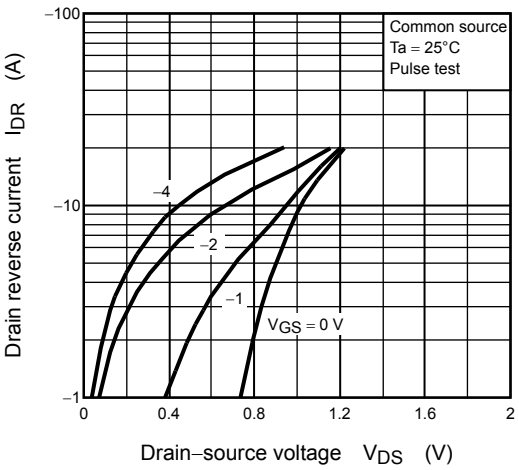
$R_{DS\ (ON)} - I_D$



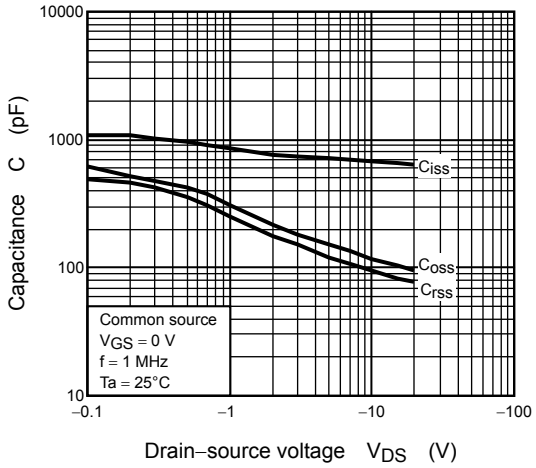
$R_{DS\ (ON)}$ – Ta



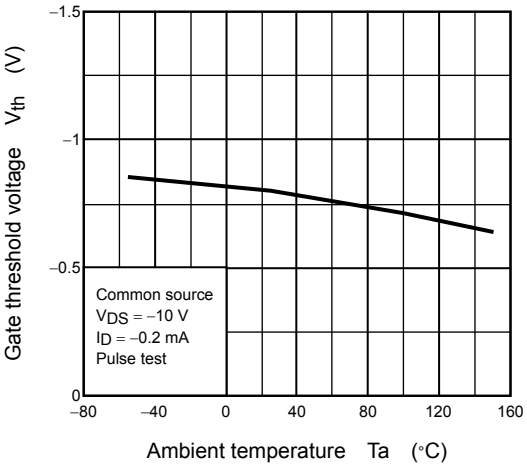
I_{DR} – V_{DS}



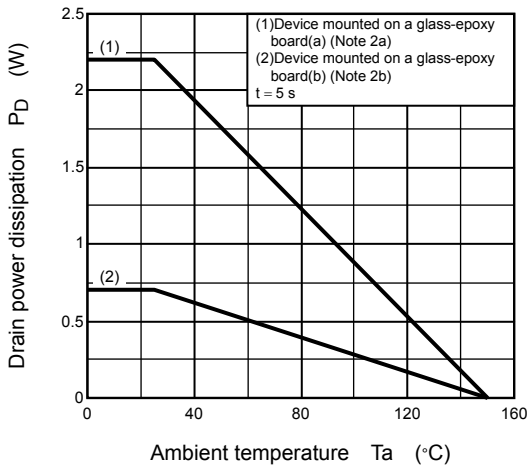
Capacitance – V_{DS}



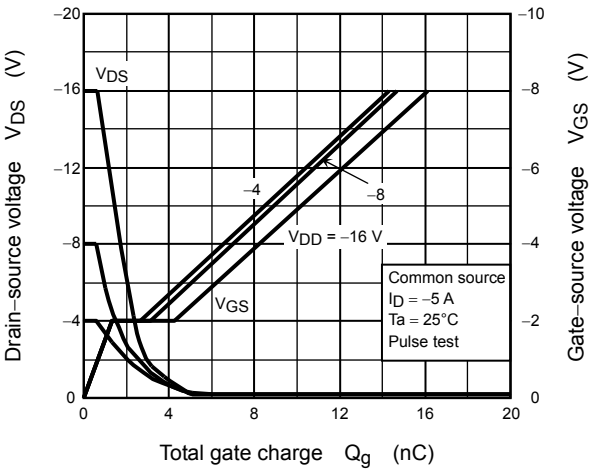
V_{th} – Ta



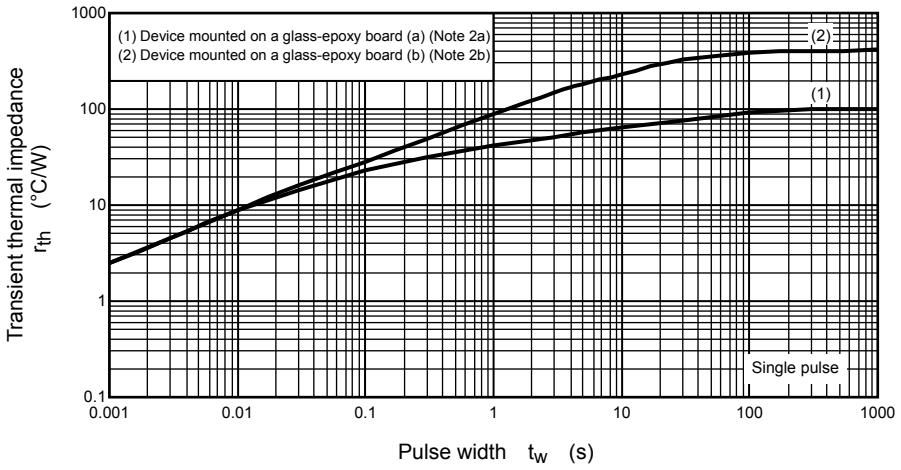
P_D – Ta



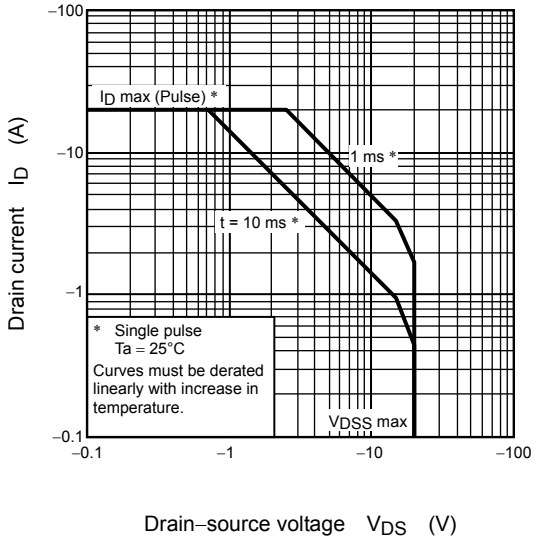
Dynamic input/output characteristics



$r_{th} - t_w$



Safe operating area



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