

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

TPC6109-H

High-Efficiency DC-DC Converter Applications

- Small footprint due to small and thin package
- Low drain-source ON-resistance: $R_{DS(ON)} = 44 \text{ m}\Omega$ (typ.)
($V_{DS} = -10 \text{ V}$)
- High forward transfer admittance: $|Y_{fs}| = 8.0 \text{ S}$ (typ.)
- Low leakage current: $I_{DSS} = -10 \mu\text{A}$ (max) ($V_{DS} = -30 \text{ V}$)
- Enhancement mode: $V_{th} = -0.8$ to -2.0 V ($V_{DS} = -10 \text{ V}$, $I_D = -1 \text{ mA}$)

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}	± 20	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	
Single-pulse avalanche energy (Note 3)		E_{AS}	16.3	mJ
Avalanche current		I_{AR}	-5	A
Repetitive avalanche energy (Note 4)		E_{AR}	0.055	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.).

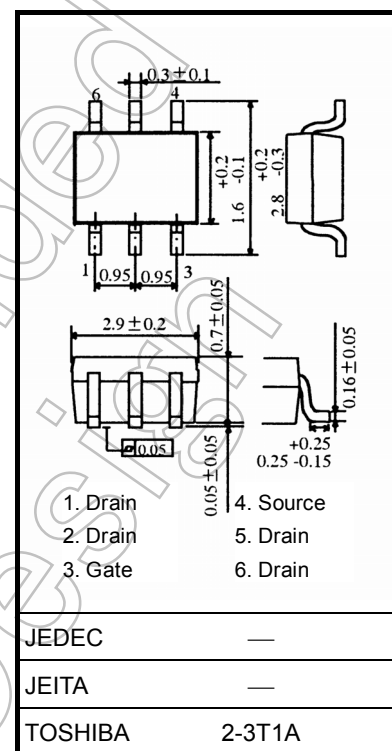
Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to ambient ($t = 5 \text{ s}$) (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: For Notes 1 to 5, see page 3.

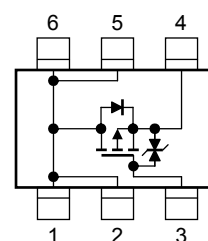
Caution: This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm

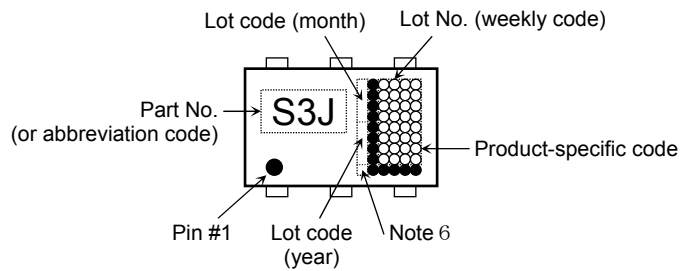


Weight: 0.011 g (typ.)

Circuit Configuration



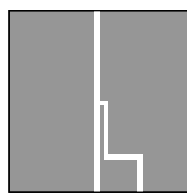
Marking (Note 5)



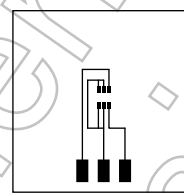
Note 1: Ensure that the channel temperature does not exceed 150°C.

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)



(b)

Note 3: $V_{DD} = -24 \text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 500 \mu\text{H}$, $R_G = 25 \Omega$, $I_{AR} = -5 \text{ A}$

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

Note 5: ● to the lower left of the Part No. marking indicates Pin 1.

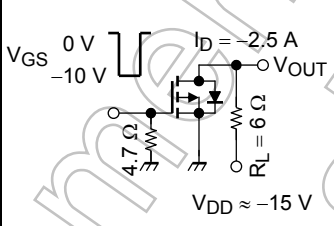
Note 6: A dot marking identifies the indication of product Labels.

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

With a dot: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

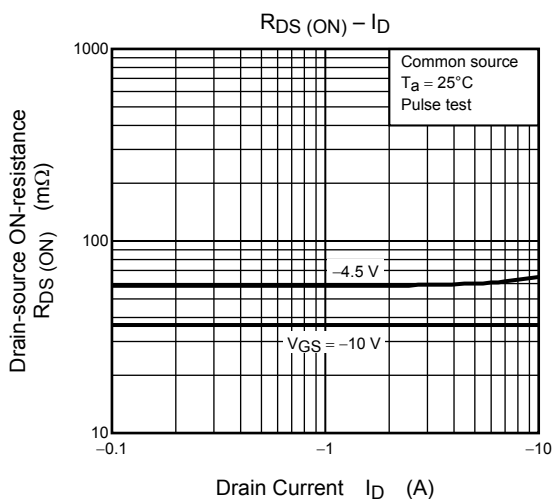
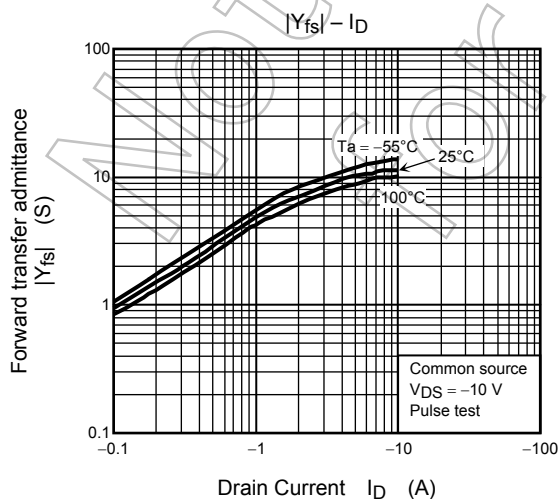
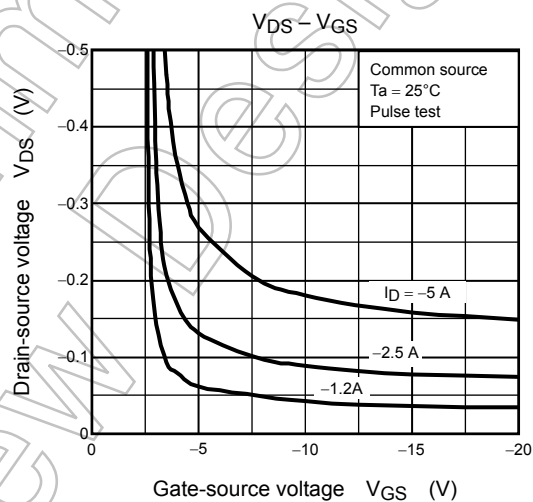
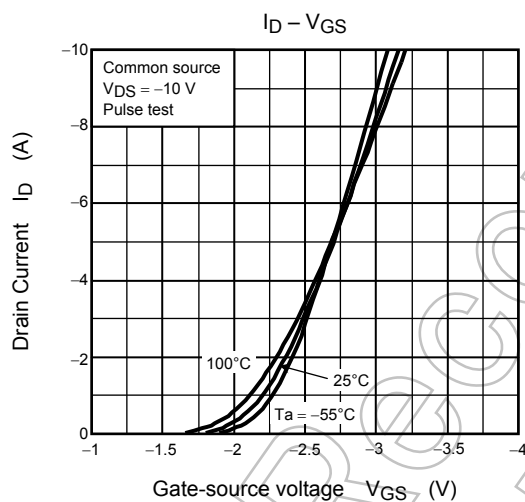
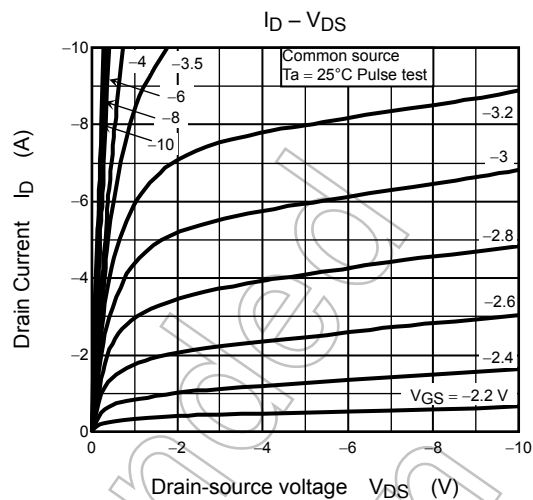
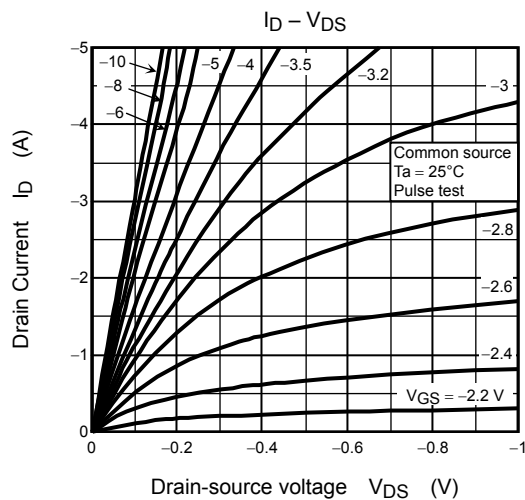
Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical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

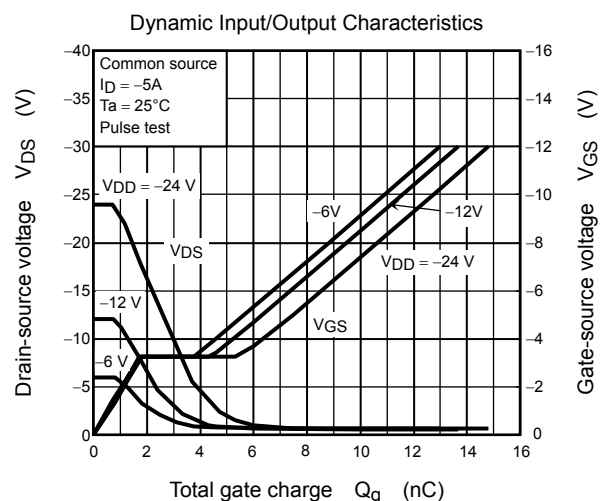
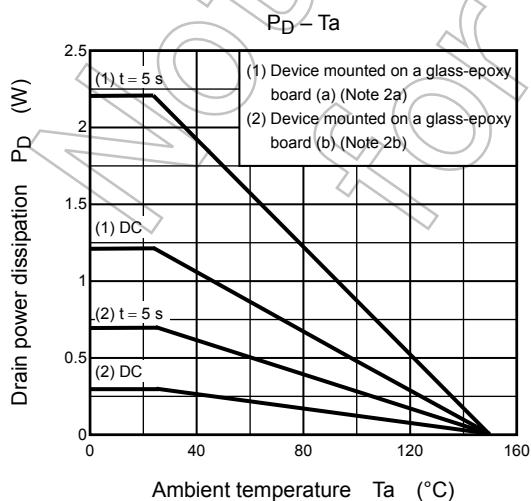
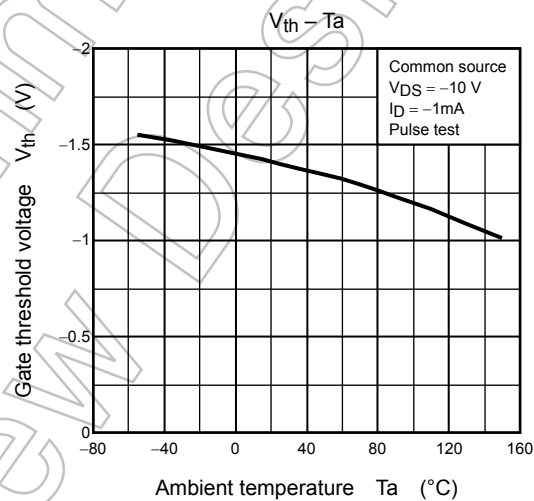
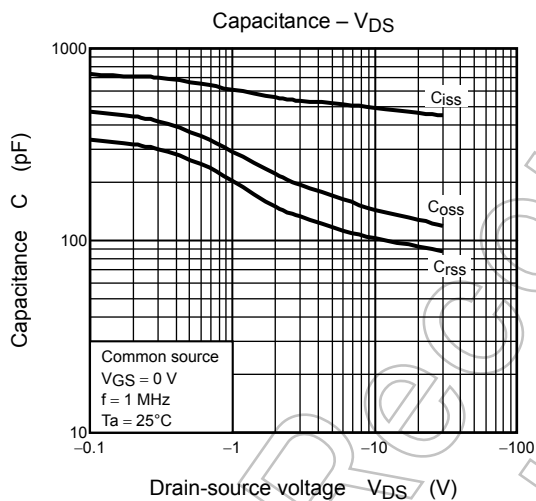
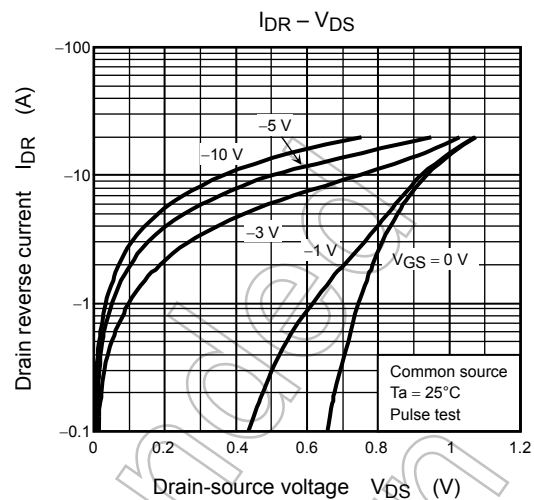
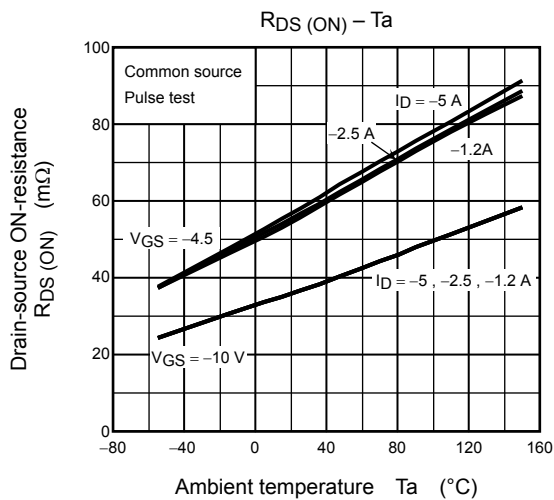
Electrical Characteristics (Ta = 25°C)

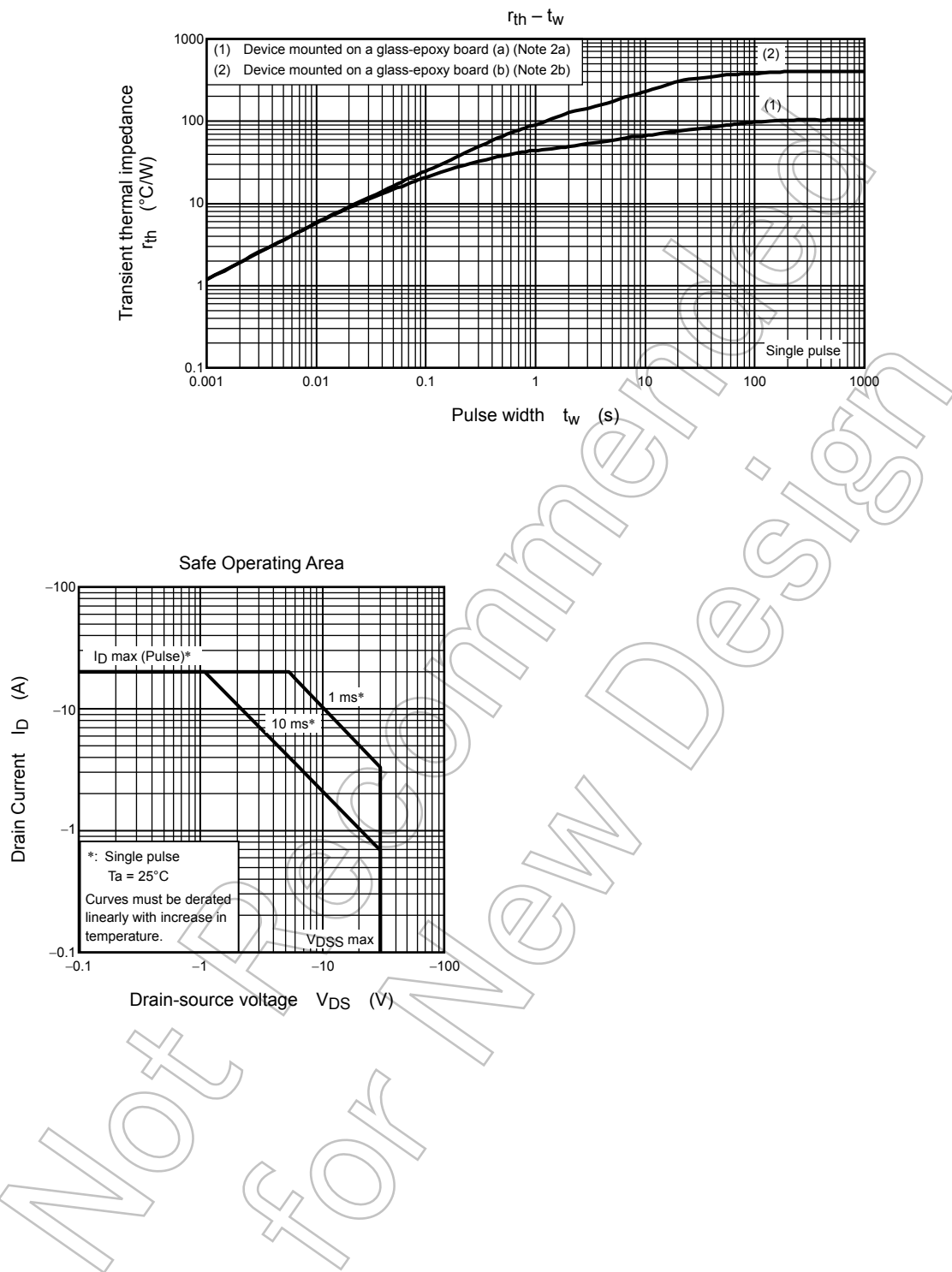
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I _{GSS}	V _{GS} = ±16 V, V _{DS} = 0 V	—	—	±10	μA
Drain cut-off current		I _{DSS}	V _{DS} = -30 V, V _{GS} = 0 V	—	—	-10	μA
Drain-source breakdown voltage		V (BR) DSS	I _D = -10 mA, V _{GS} = 0 V	-30	—	—	V
		V (BR) DSX	I _D = -10 mA, V _{GS} = 20 V	-15	—	—	
Gate threshold voltage		V _{th}	V _{DS} = -10 V, I _D = - 1 mA	-0.8	—	-2.0	V
Drain-source ON resistance		R _{DS (ON)}	V _{GS} = -4.5 V, I _D = -2.5 A	—	64	83	mΩ
		R _{DS (ON)}	V _{GS} = -10 V, I _D = -2.5 A	—	44	59	
Forward transfer admittance		Y _{fs}	V _{DS} = -10 V, I _D = -2.5 A	4.0	8.0	—	S
Input capacitance		C _{iss}	V _{DS} = -10 V, V _{GS} = 0 V, f = 1 MHz	—	490	—	pF
Reverse transfer capacitance		C _{rss}		—	105	—	
Output capacitance		C _{oss}		—	150	—	
Switching time	Rise time	t _r	 V_{GS} 0 V -10 V I_D = -2.5 A V_{OUT} 4.7 Ω 6 Ω V_{DD} ≈ -15 V Duty ≤ 1%, t_w = 10 μs	—	5.1	—	ns
	Turn-on time	t _{on}		—	10.7	—	
	Fall time	t _f		—	8.0	—	
	Turn-off time	t _{off}		—	33.5	—	
Total gate charge (gate-source plus gate-drain)		Q _g	V _{DD} ≈ -24 V, V _{GS} = -10 V, I _D = -5 A	—	12.3	—	nC
			V _{DD} ≈ -24 V, V _{GS} = -5 V, I _D = -5 A	—	7.2	—	
Gate-source charge1		Q _{gs1}	V _{DD} ≈ -24 V, V _{GS} = -10 V, I _D = -5 A	—	1.7	—	
Gate-drain (“Miller”) charge		Q _{gd}		—	3.6	—	
Gate switch charge		Q _{SW}		—	4.8	—	

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

Characteristic		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







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