

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: $V_{th} = -0.8 \text{ to } -2.0 \text{ V}$ ($V_{DS} = -10 \text{ V}$, $I_D = -1 \text{ mA}$)

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
	Pulse (Note 1)	I_{DP}	-20
Drain power dissipation ($t = 5 \text{ s}$)	(Note 2a)	P_D	2.2
	(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).

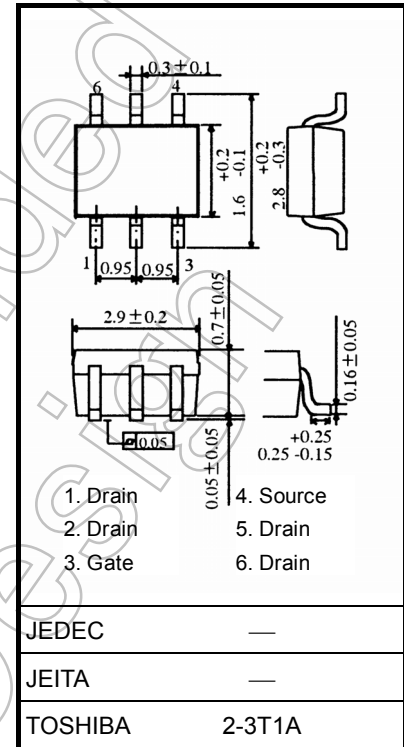
Thermal Characteristics

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.

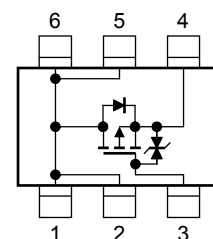
Caution: This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm

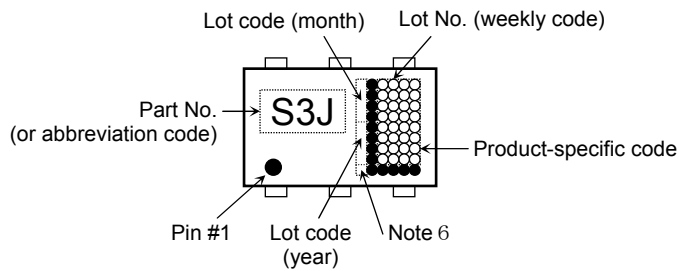


Weight: 0.011 g (typ.)

Circuit Configuration



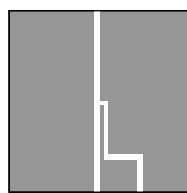
Marking (Note 5)



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

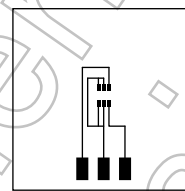
Note 2: (a) Device mounted on a glass-epoxy board (a) ($t = 5$ s)

(b) Device mounted on a glass-epoxy board (b) ($t = 5$ s)



(a)

FR-4
25.4 × 25.4 × 0.8
(Unit: mm)



(b)

FR-4
25.4 × 25.4 × 0.8
(Unit: mm)

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

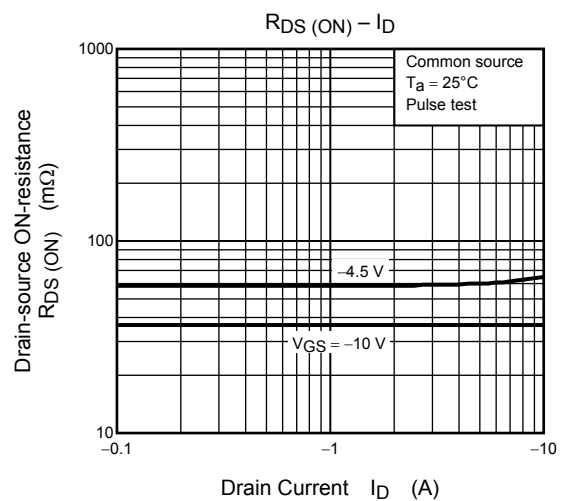
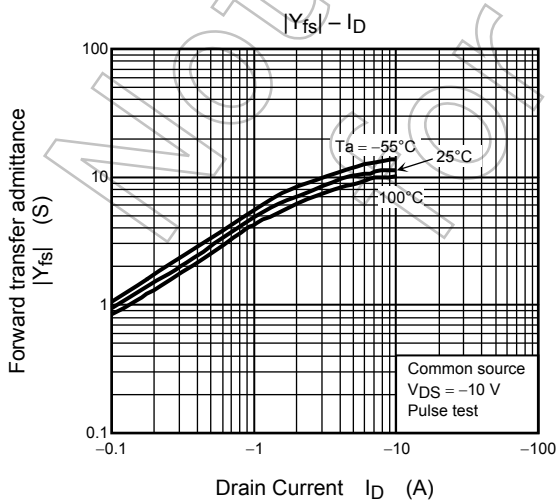
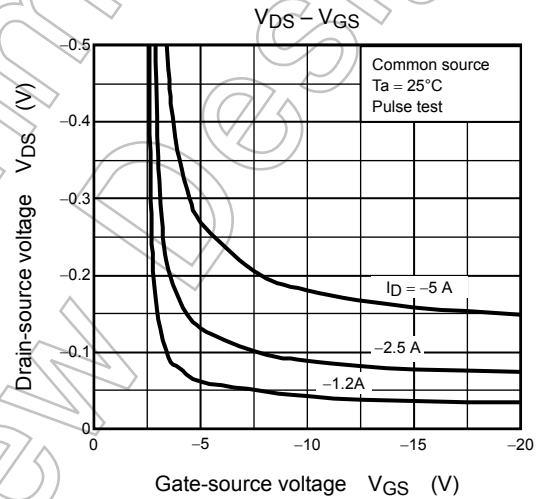
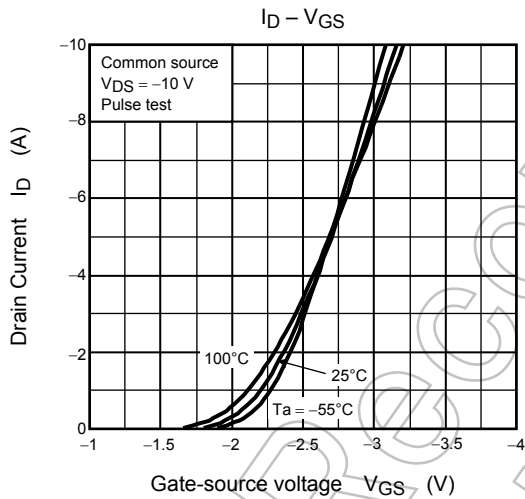
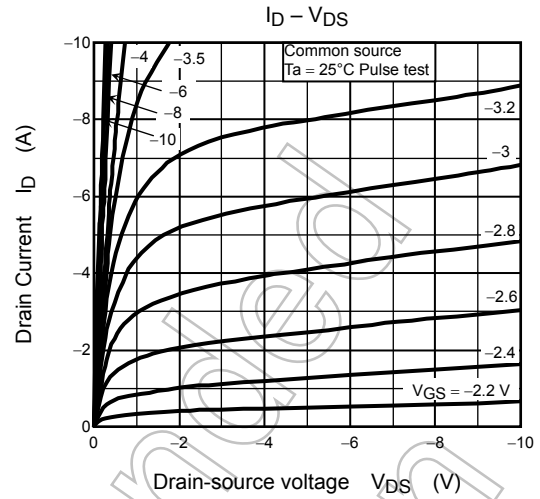
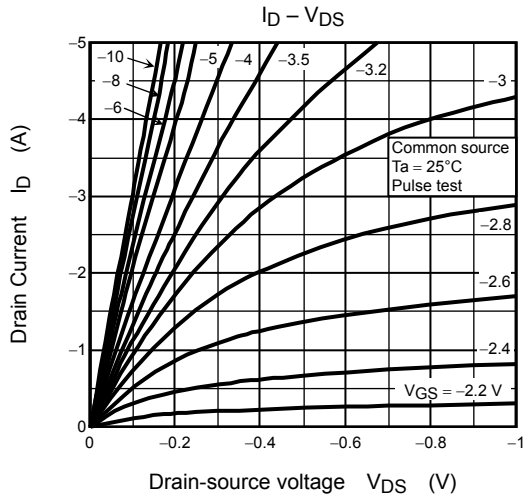
Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical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

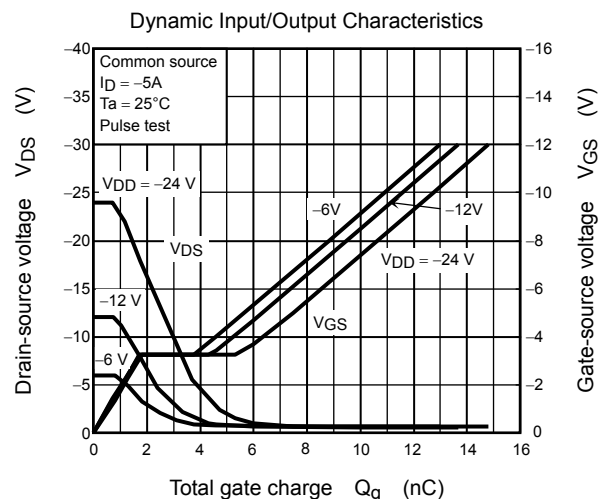
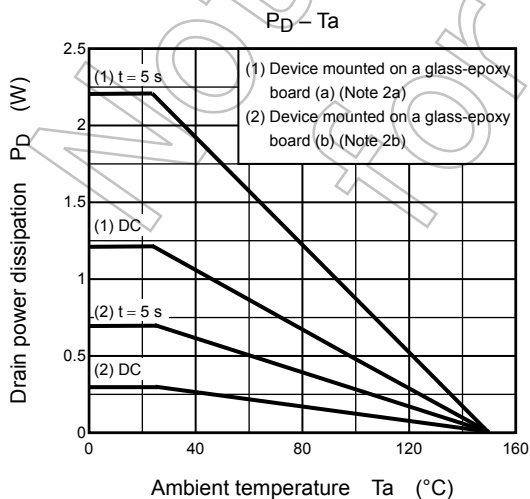
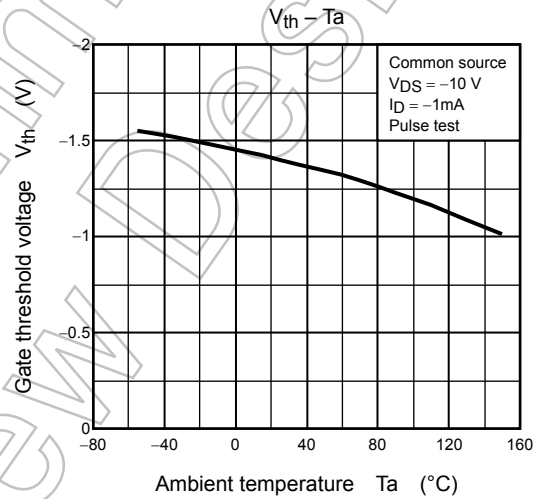
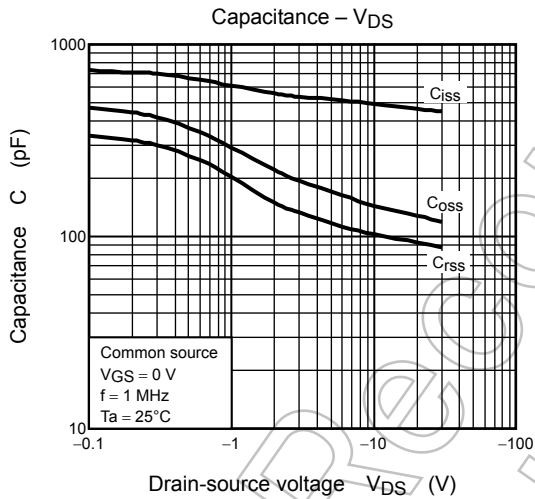
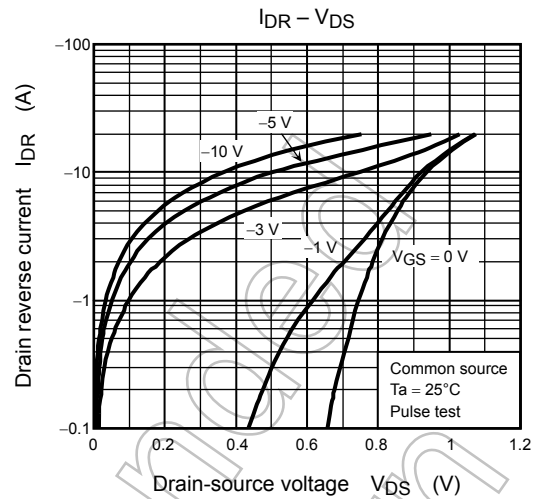
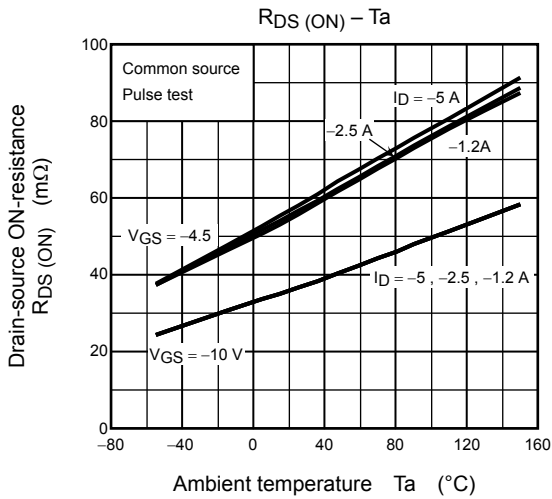
Electrical Characteristics (Ta = 25°C)

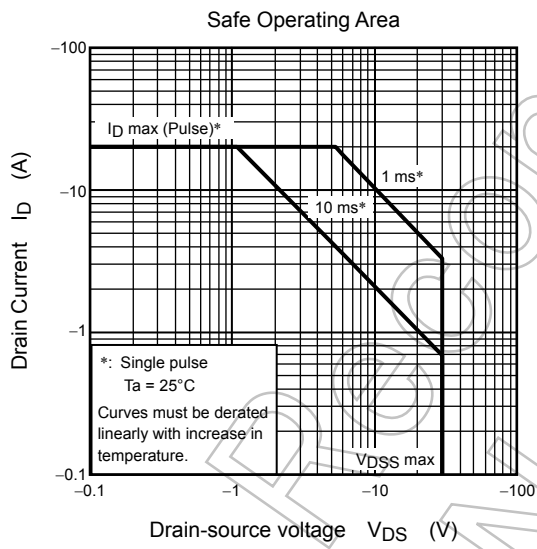
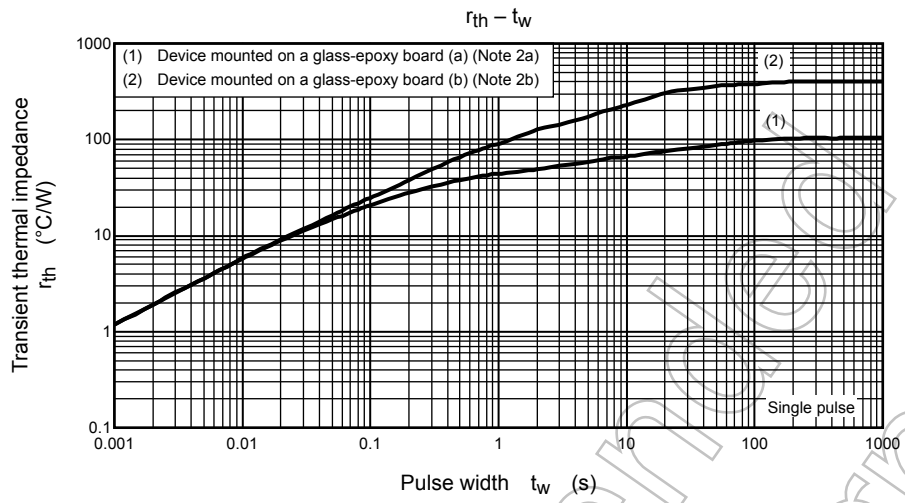
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	± 10	μA
Drain cut-off current		I_{DSS}	$V_{DS} = -30\text{ V}, V_{GS} = 0\text{ V}$	—	—	-10	μA
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = -10\text{ mA}, V_{GS} = 0\text{ V}$	-30	—	—	V
		$V_{(BR)DSX}$	$I_D = -10\text{ mA}, V_{GS} = 20\text{ V}$	-15	—	—	
Gate threshold voltage		V_{th}	$V_{DS} = -10\text{ V}, I_D = -1\text{ mA}$	-0.8	—	-2.0	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = -4.5\text{ V}, I_D = -2.5\text{ A}$	—	64	83	$\text{m}\Omega$
		$R_{DS(ON)}$	$V_{GS} = -10\text{ V}, I_D = -2.5\text{ A}$	—	44	59	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = -10\text{ V}, I_D = -2.5\text{ A}$	4.0	8.0	—	S
Input capacitance		C_{iss}	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	490	—	pF
Reverse transfer capacitance		C_{rss}		—	105	—	
Output capacitance		C_{oss}		—	150	—	
Switching time	Rise time	t_r		—	5.1	—	ns
	Turn-on time	t_{on}		—	10.7	—	
	Fall time	t_f		—	8.0	—	
	Turn-off time	t_{off}		Duty $\leq 1\%$, $t_w = 10\ \mu\text{s}$	—	33.5	
Total gate charge (gate-source plus gate-drain)		Q_g	$V_{DD} \approx -24\text{ V}, V_{GS} = -10\text{ V}, I_D = -5\text{ A}$	—	12.3	—	nC
			$V_{DD} \approx -24\text{ V}, V_{GS} = -5\text{ V}, I_D = -5\text{ A}$	—	7.2	—	
Gate-source charge1		Q_{gs1}	$V_{DD} \approx -24\text{ V}, V_{GS} = -10\text{ V}, I_D = -5\text{ A}$	—	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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