

# 2SJ610

Switching Regulator, DC/DC Converter and Motor Drive Applications

- Low drain-source ON-resistance:  $R_{DS(ON)} = 1.85 \Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 18 S$  (typ.)
- Low leakage current:  $I_{DSS} = -100 \mu A$  ( $V_{DS} = -250 V$ )
- Enhancement mode:  $V_{th} = -1.5$  to  $-3.5 V$  ( $V_{DS} = 10 V, I_D = 1 mA$ )

## Absolute Maximum Ratings ( $T_a = 25^\circ C$ )

Characteristic		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	-250	V
Drain-gate voltage ( $R_{GS} = 20 k\Omega$ )		$V_{DGR}$	-250	V
Gate-source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	-2.0	A
	Pulse ( $t = 1 ms$ ) (Note 1)	$I_{DP}$	-4.0	
Drain power dissipation		$P_D$	20	W
Single-pulse avalanche energy (Note 2)		$E_{AS}$	180	mJ
Avalanche current		$I_{AR}$	-2.0	A
Repetitive avalanche energy (Note 3)		$E_{AR}$	2.0	mJ
Channel temperature		$T_{ch}$	150	$^\circ C$
Storage temperature range		$T_{stg}$	-55 to 150	$^\circ C$

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

Characteristic	Symbol	Max	Unit
Thermal resistance, channel to case	$R_{th(ch-c)}$	6.25	$^\circ C/W$
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	125	$^\circ C/W$

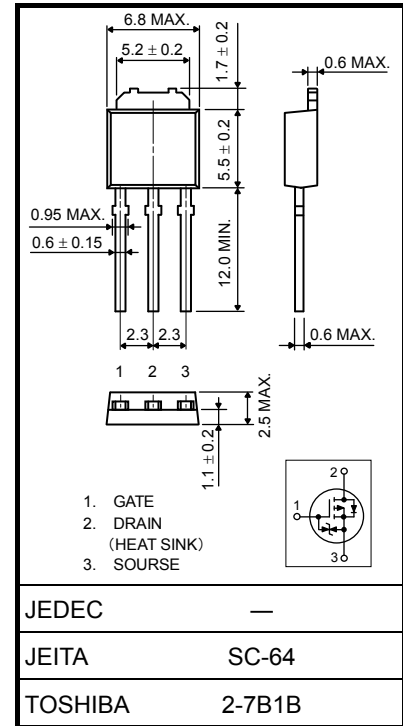
Note 1: Ensure that the channel temperature does not exceed  $150^\circ C$ .

Note 2:  $V_{DD} = -50 V, T_{ch} = 25^\circ C$  (initial),  $L = 75 mH, I_{AR} = -2.0 A, R_G = 25 \Omega$

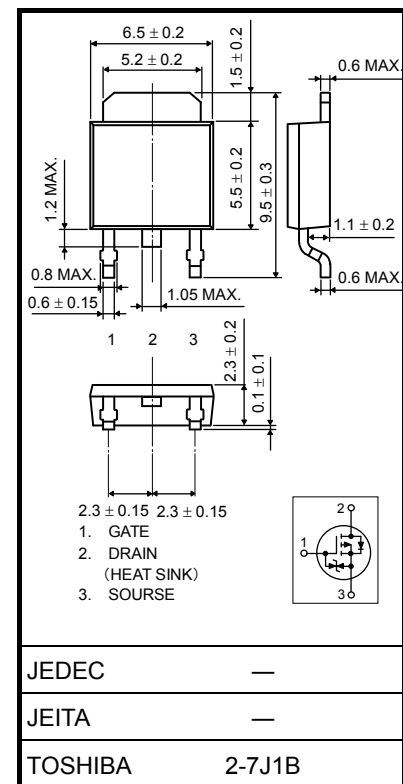
Note 3: Repetitive rating: pulse width limited by maximum channel temperature

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

Unit: mm



Weight: 0.36 g (typ.)



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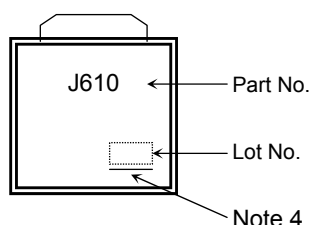
## Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cutoff current		$I_{DSS}$	$V_{DS} = -250 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	-100	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = -10 \text{ mA}, V_{GS} = 0 \text{ V}$	-250	—	—	V
Gate threshold voltage		$V_{th}$	$V_{DS} = -10 \text{ V}, I_D = -1 \text{ mA}$	-1.5	—	-3.5	V
Drain-source ON-resistance		$R_{DS(ON)}$	$V_{GS} = -10 \text{ V}, I_D = -1.0 \text{ A}$	—	1.85	2.55	$\Omega$
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = -10 \text{ V}, I_D = -1.0 \text{ A}$	0.5	1.8	—	S
Input capacitance		$C_{iss}$	$V_{DS} = -10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	381	—	pF
Reverse transfer capacitance		$C_{rss}$		—	52	—	
Output capacitance		$C_{oss}$		—	157	—	
Switching time	Rise time	$t_r$	<p><math>I_D = 1.0 \text{ A}</math> <math>R_L = 100 \Omega</math> <math>V_{DD} \approx 100 \text{ V}</math> Duty <math>\leq 1\%</math>, <math>t_w = 10 \mu\text{s}</math></p>	—	5	—	ns
	Turn-on time	$t_{on}$		—	20	—	
	Fall time	$t_f$		—	6	—	
	Turn-off time	$t_{off}$		—	36	—	
Total gate charge		$Q_g$	$V_{DD} \approx -200 \text{ V}, V_{GS} = -10 \text{ V}, I_D = -2.0 \text{ A}$	—	24	—	nC
Gate-source charge		$Q_{gs}$		—	11	—	
Gate-drain charge		$Q_{gd}$		—	13	—	

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

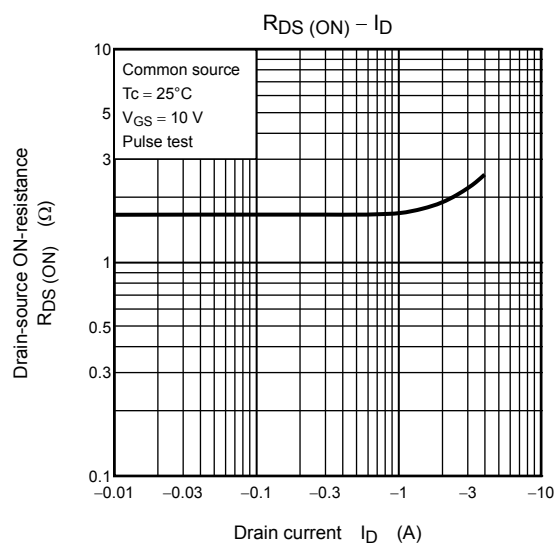
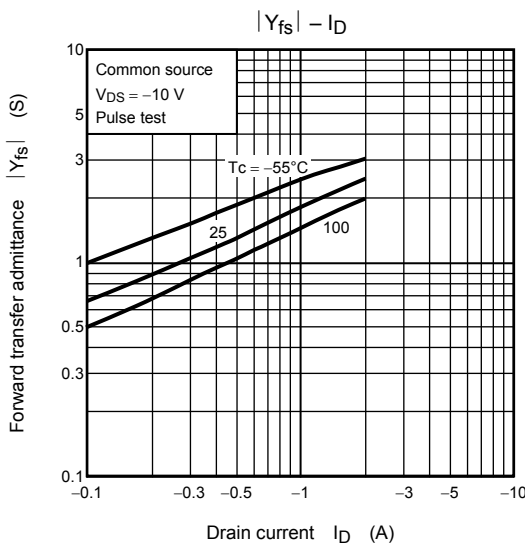
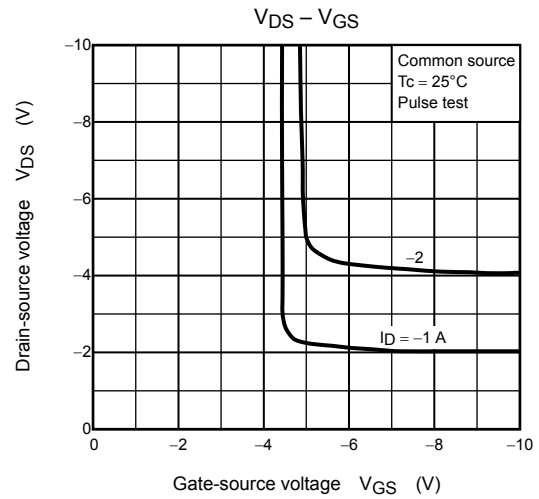
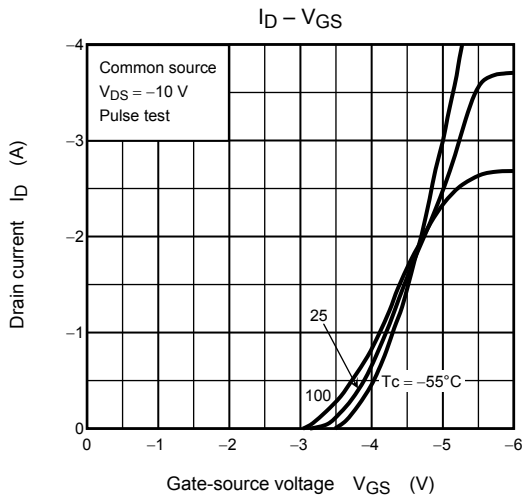
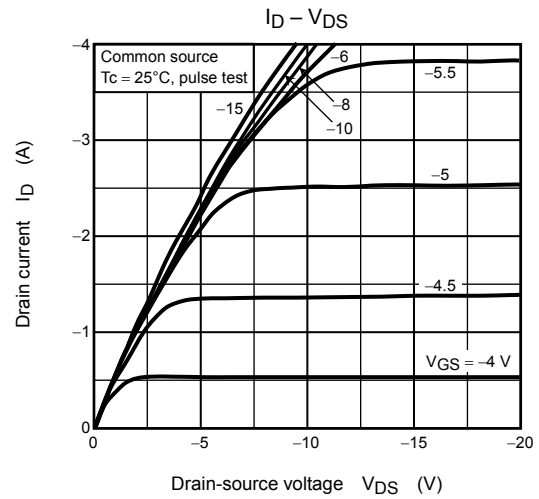
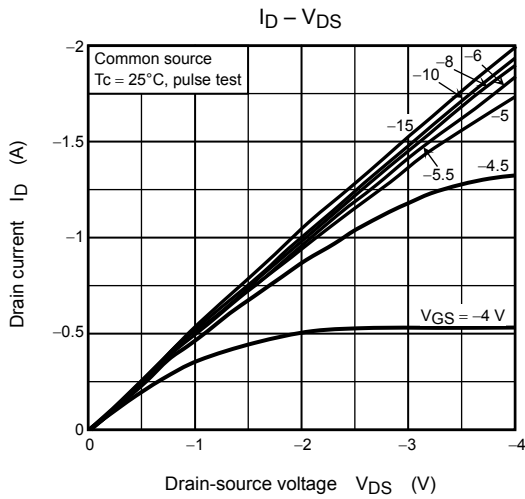
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	$I_{DR}$	—	—	—	-2.0	A
Pulse drain reverse current (Note 1)	$I_{DRP}$	—	—	—	-4.0	A
Forward voltage (diode)	$V_{DSF}$	$I_{DR} = -2.0 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	2.0	V
Reverse recovery time	$t_{rr}$	$I_{DR} = -2.0 \text{ A}, V_{GS} = 0 \text{ V},$	—	120	—	ns
Reverse recovery charge	$Q_{rr}$	$dI_{DR}/dt = 100 \text{ A}/\mu\text{s}$	—	540	—	nC

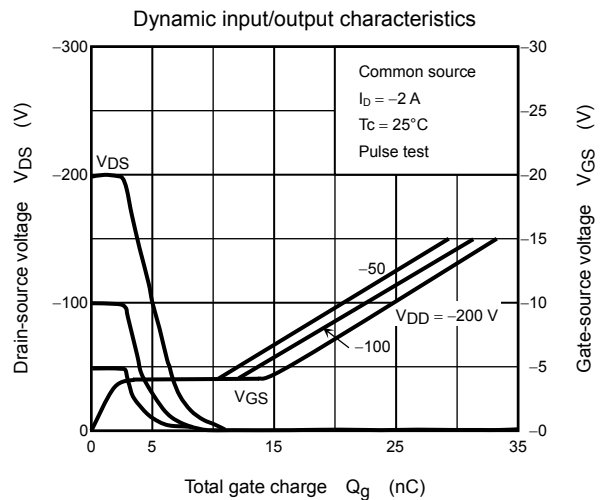
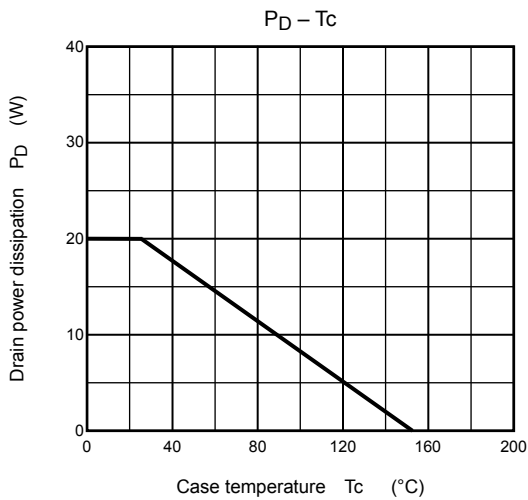
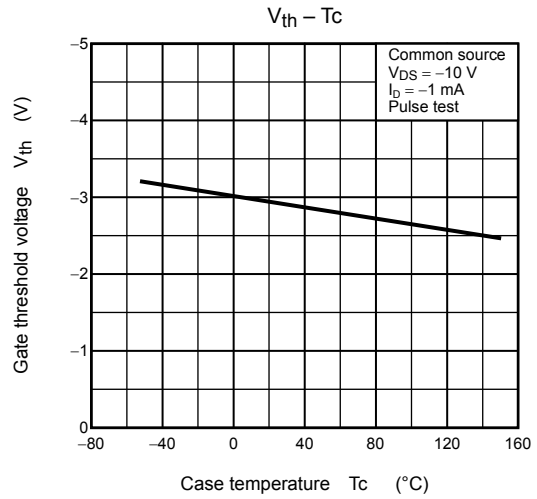
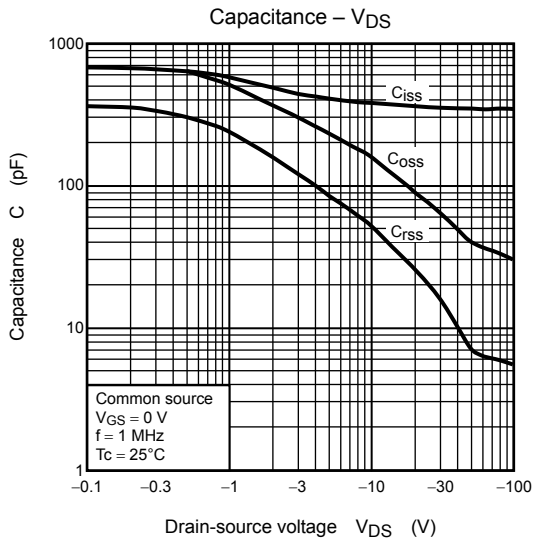
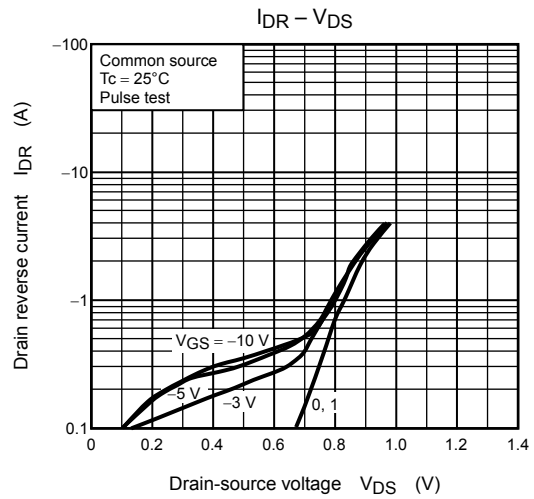
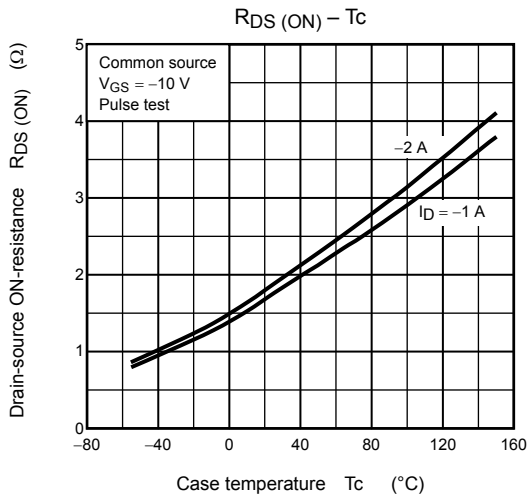
## Marking

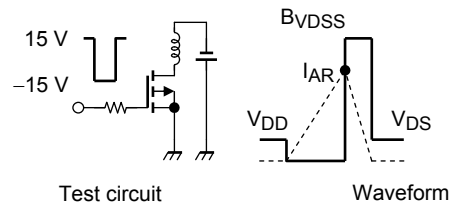
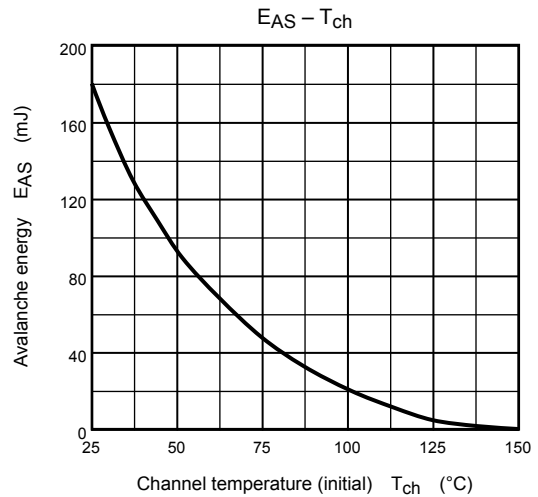
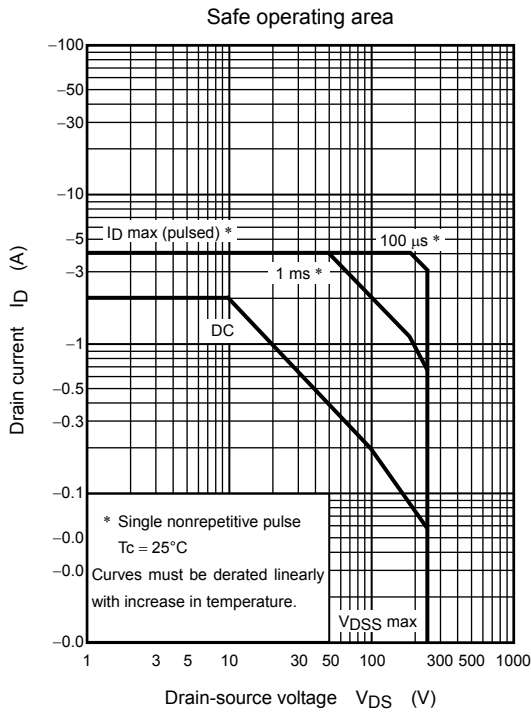
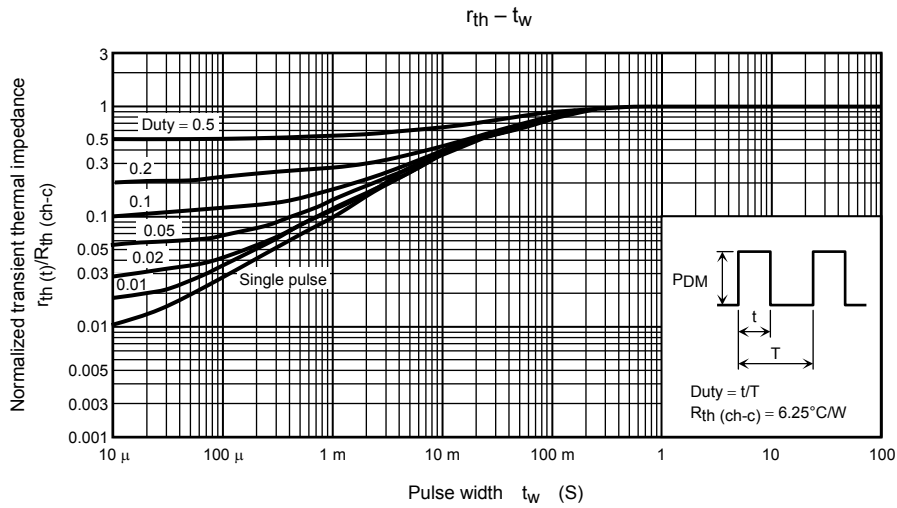


Note 4 : A line under a Lot No. identifies the indication of product Labels [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

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







$$R_G = 25 \Omega$$

$$V_{DD} = -50 V, L = 75 mH$$

$$E_{AS} = \frac{1}{2} \cdot L \cdot I_{AR}^2 \cdot \left( \frac{BVDSS}{BVDSS - V_{DD}} \right)$$

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