

## DC-DC Converter, Relay Drive and Motor Drive Applications

- 4-V gate drive
- Low drain-source ON resistance :  $R_{DS(ON)} = 29 \text{ m}\Omega$  (typ.)
- High forward transfer admittance :  $|Y_{fs}| = 23 \text{ S}$  (typ.)
- Low leakage current :  $I_{DSS} = -100 \text{ }\mu\text{A}$  (max) ( $V_{DS} = -60 \text{ V}$ )
- Enhancement mode :  $V_{th} = -0.8 \sim -2.0 \text{ V}$  ( $V_{DS} = -10 \text{ V}$ ,  $I_D = -1 \text{ mA}$ )

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

Characteristics	Symbol	Rating	Unit
Drain-source voltage	$V_{DSS}$	-60	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )	$V_{DGR}$	-60	V
Gate-source voltage	$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	A
	Pulse (Note 1)	$I_{DP}$	A
Drain power dissipation ( $T_c = 25^\circ\text{C}$ )	$P_D$	45	W
Single pulse avalanche energy (Note 2)	$E_{AS}$	936	mJ
Avalanche current	$I_{AR}$	-30	A
Repetitive avalanche energy (Note 3)	$E_{AR}$	4.5	mJ
Channel temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage temperature range	$T_{stg}$	-55~150	$^\circ\text{C}$

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 case	$R_{th(ch-c)}$	2.78	$^\circ\text{C/W}$
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	62.5	$^\circ\text{C/W}$

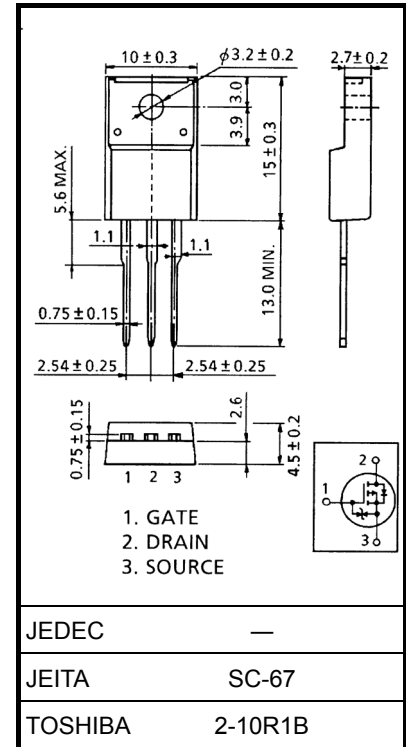
Note 1: Ensure that the channel temperature does not exceed  $150^\circ\text{C}$ .

Note 2:  $V_{DD} = -50 \text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 747 \text{ }\mu\text{H}$ ,  $R_G = 25 \text{ }\Omega$ ,  $I_{AR} = -30 \text{ A}$

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

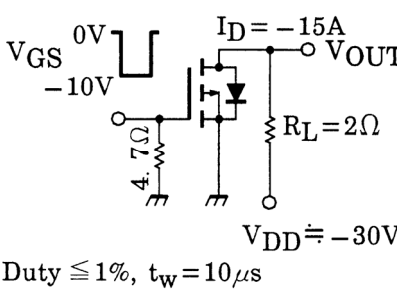
This transistor is an electrostatic-sensitive device. Please handle with caution.

Unit: mm



Weight: 1.9 g (typ.)

## Electrical Characteristics (Ta = 25°C)

Characteristics		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 cut-off current		$I_{DSS}$	$V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}$	—	—	-100	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR) DSS}$	$I_D = -10\text{ mA}, V_{GS} = 0\text{ V}$	-60	—	—	V
Gate threshold voltage		$V_{th}$	$V_{DS} = -10\text{ V}, I_D = -1\text{ mA}$	-0.8	—	-2.0	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = -4\text{ V}, I_D = -15\text{ A}$	—	46	60	m $\Omega$
			$V_{GS} = -10\text{ V}, I_D = -15\text{ A}$	—	29	38	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = -10\text{ V}, I_D = -15\text{ A}$	14	23	—	S
Input capacitance		$C_{iss}$	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	3300	—	pF
Reverse transfer capacitance		$C_{rss}$		—	460	—	
Output capacitance		$C_{oss}$		—	1450	—	
Switching time	Rise time	$t_r$	 <p><math>V_{GS} = 0\text{ V}, -10\text{ V}</math>  <math>I_D = -15\text{ A}</math>  <math>R_L = 2\Omega</math>  <math>V_{DD} \approx -30\text{ V}</math>  Duty <math>\leq 1\%</math>, <math>t_w = 10\mu\text{s}</math></p>	—	20	—	ns
	Turn-on time	$t_{on}$		—	25	—	
	Fall time	$t_f$		—	35	—	
	Turn-off time	$t_{off}$		—	130	—	
Total gate charge (Gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx -48\text{ V}, V_{GS} = -10\text{ V}, I_D = -30\text{ A}$	—	110	—	nC
Gate-source charge		$Q_{gs}$		—	75	—	
Gate-drain ("miller") charge		$Q_{gd}$		—	35	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	$I_{DR}$	—	—	—	30	A
Pulse drain reverse current (Note 1)	$I_{DRP}$	—	—	—	120	A
Forward voltage (diode)	$V_{DSF}$	$I_{DR} = -30\text{ A}, V_{GS} = 0\text{ V}$	—	—	1.7	V
Reverse recovery time	$t_{rr}$	$I_{DR} = -30\text{ A}, V_{GS} = 0\text{ V}$	—	100	—	ns
Reverse recovery charge	$Q_{rr}$	$dI_{DR} / dt = 50\text{ A} / \mu\text{s}$	—	0.16	—	$\mu\text{C}$

## Marking

