

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (L²-π-MOSV)

2SK2311

Chopper Regulator, DC-DC Converter and Switching Regulator Applications

- 4-V gate drive
- Low drain-source ON resistance : $R_{DS(ON)} = 36 \text{ m}\Omega$ (typ.)
- High forward transfer admittance : $|Y_{fs}| = 16 \text{ S}$ (typ.)
- Low leakage current : $I_{DSS} = 100 \text{ }\mu\text{A}$ (max) ($V_{DS} = 60 \text{ V}$)
- Enhancement mode : $V_{th} = 0.8 \text{ to } 2.0 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 1 \text{ mA}$)

Absolute Maximum Ratings (Ta = 25°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}	± 20	V
Drain current	DC (Note 1)	I_D	25 A
	Pulse (Note 1)	I_{DP}	100 A
Drain power dissipation ($T_c = 25^\circ\text{C}$)	P_D	40	W
Single pulse avalanche energy (Note 2)	E_{AS}	156	mJ
Avalanche current	I_{AR}	25	A
Repetitive avalanche energy (Note 3)	E_{AR}	3.5	mJ
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 case	$R_{th(ch-c)}$	3.125	°C / W
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	83.3	°C / W

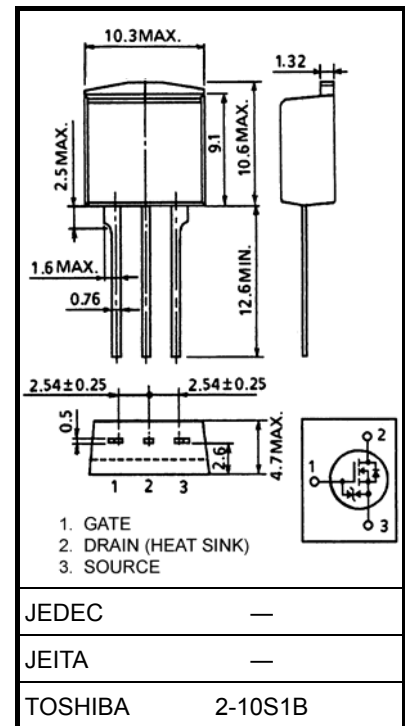
Note 1: Ensure that the channel temperature does not exceed 150°C.

Note 2: $V_{DD} = 25 \text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 339 \text{ }\mu\text{H}$, $R_G = 25 \text{ }\Omega$, $I_{AR} = 25 \text{ A}$

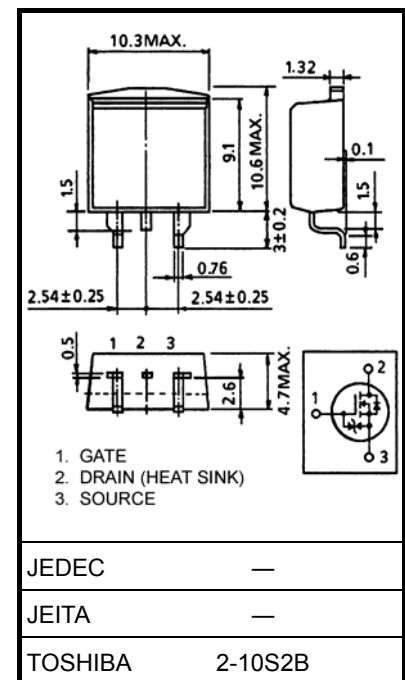
Note 3: Repetitive rating: pulse width limited by maximum channel temperature

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

Unit: mm



Weight: 1.5 g (typ.)



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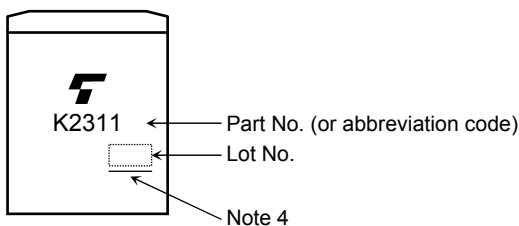
Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	± 10	μA
Drain cut-off current		I_{DSS}	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$	—	—	100	μA
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		$R_{DS(ON)}$	$V_{GS} = 4\text{ V}, I_D = 12\text{ A}$	—	57	80	m Ω
			$V_{GS} = 10\text{ V}, I_D = 12\text{ A}$	—	36	46	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 12\text{ A}$	10	16	—	S
Input capacitance		C_{iss}	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	1000	—	pF
Reverse transfer capacitance		C_{rss}		—	200	—	
Output capacitance		C_{oss}		—	550	—	
Switching time	Rise time	t_r	<p>$I_D = 12\text{ A}$ $V_{GS} = 10\text{ V}, 0\text{ V}$ $R_L = 2.5\ \Omega$ $V_{DD} = 30\text{ V}$ $50\ \Omega$ V_{OUT} $Duty \leq 1\%, t_w = 10\ \mu\text{s}$</p>	—	20	—	ns
	Turn-on time	t_{on}		—	30	—	
	Fall time	t_f		—	55	—	
	Turn-off time	t_{off}		—	130	—	
Total gate charge (Gate-source plus gate-drain)		Q_g	$V_{DD} \approx 48\text{ V}, V_{GS} = 10\text{ V}, I_D = 25\text{ A}$	—	38	—	nC
Gate-source charge		Q_{gs}		—	25	—	
Gate-drain ("miller") charge		Q_{gd}		—	13	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	I_{DR}	—	—	—	25	A
Pulse drain reverse current (Note 1)	I_{DRP}	—	—	—	100	A
Forward voltage (diode)	V_{DSF}	$I_{DR} = 25\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.8	V
Reverse recovery time	t_{rr}	$I_{DR} = 25\text{ A}, V_{GS} = 0\text{ V}$	—	50	—	ns
Reverse recovery charge	Q_{rr}	$dI_{DR} / dt = 50\text{ A} / \mu\text{s}$	—	35	—	μC

Marking

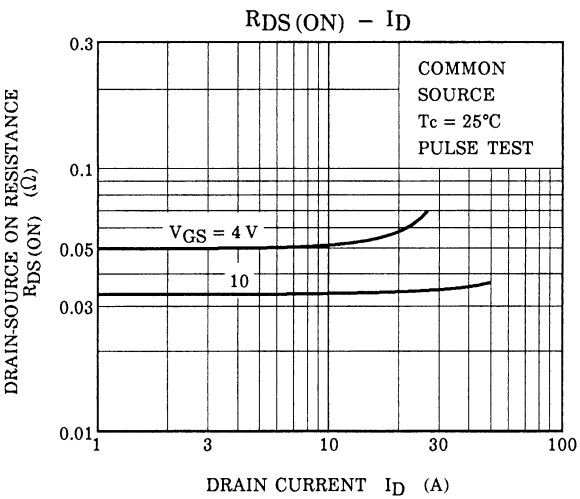
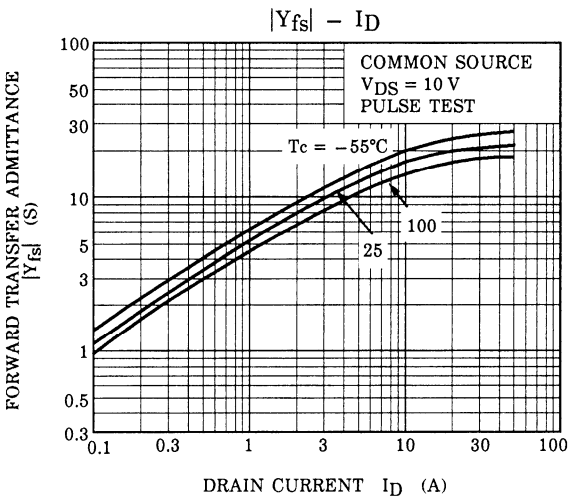
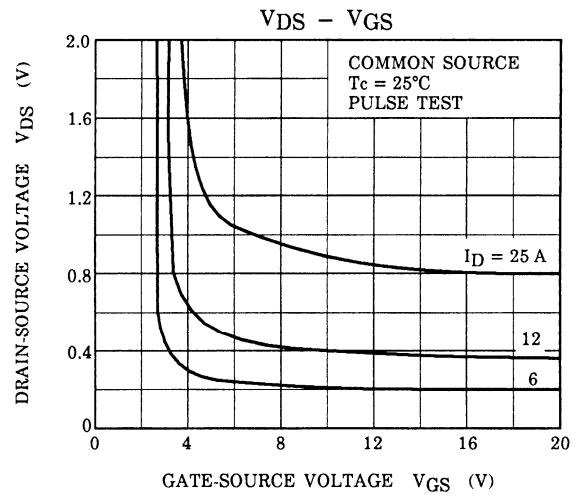
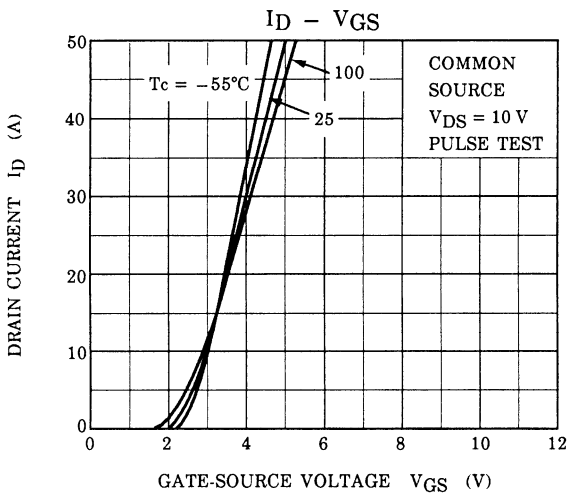
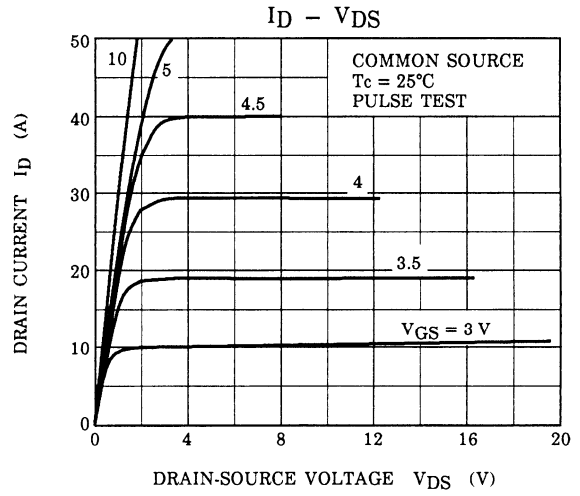
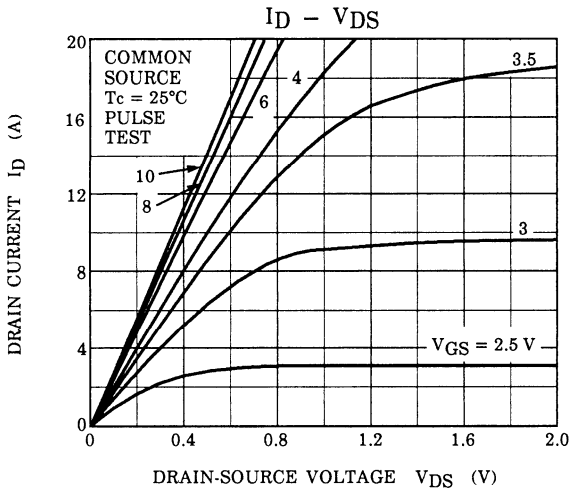


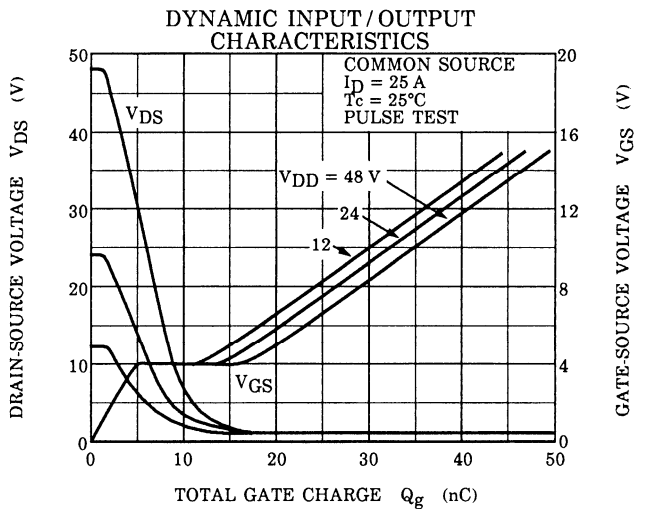
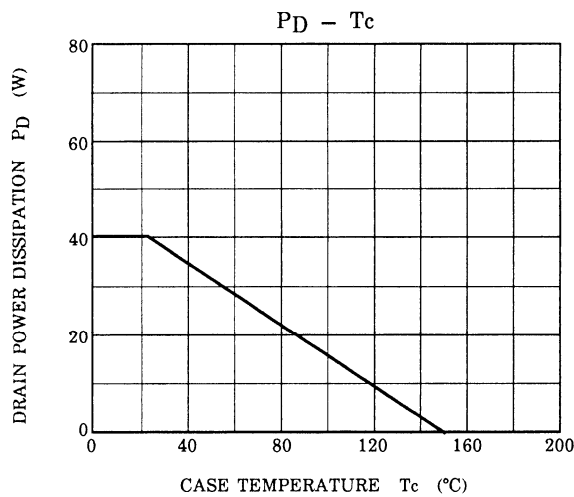
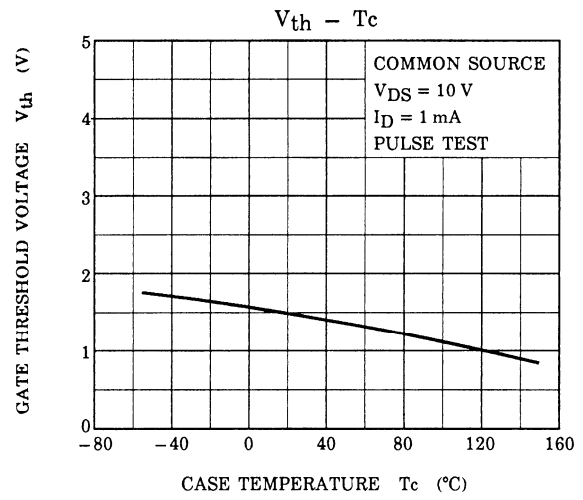
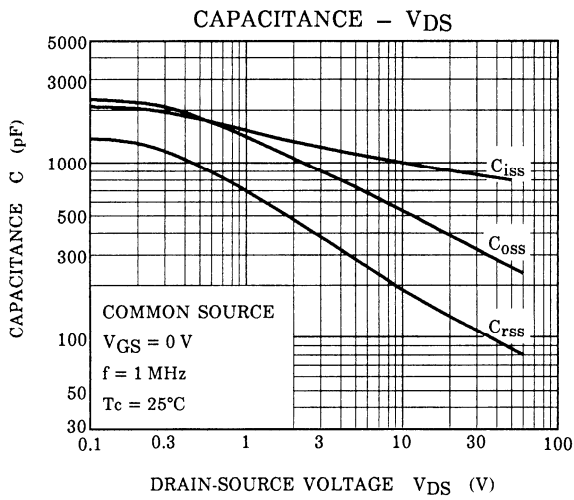
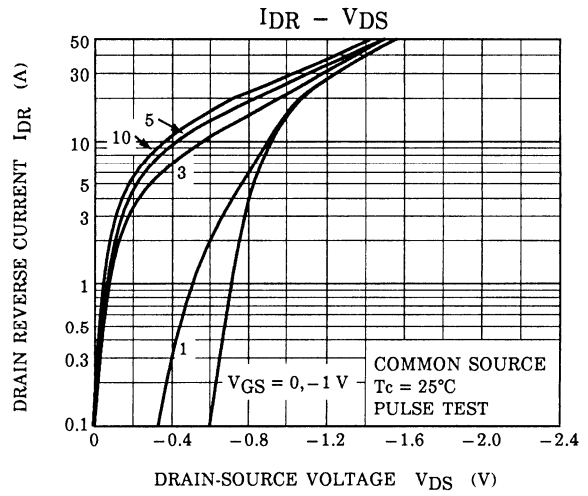
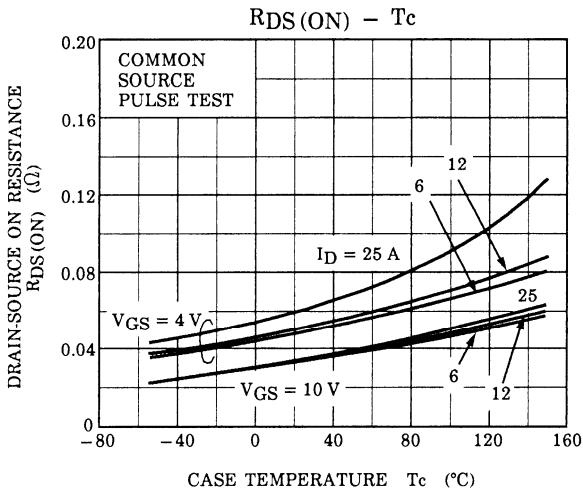
Note 4: A line under a Lot No. identifies the indication of product Labels.

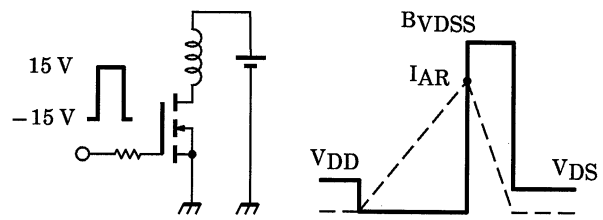
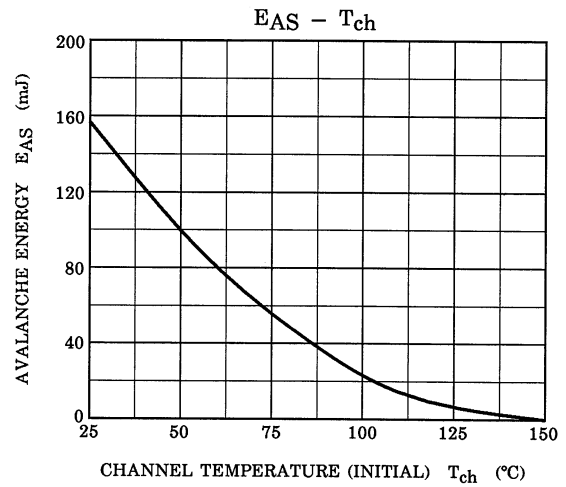
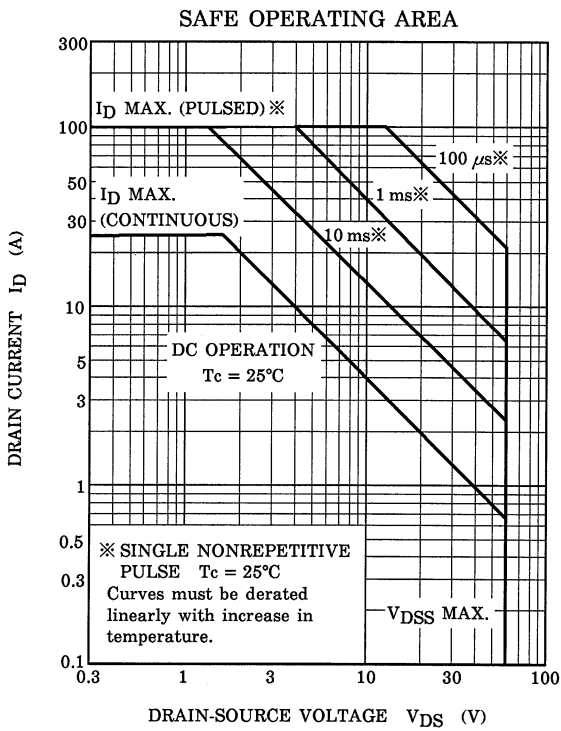
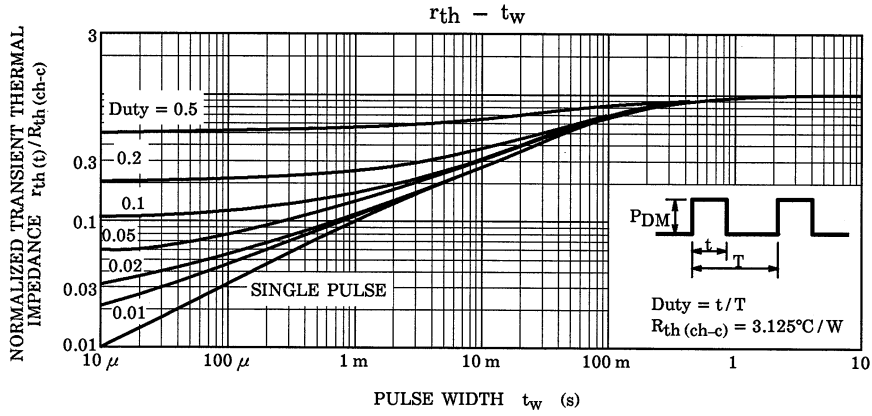
Not underlined: $[[Pb]]/INCLUDES > MCV$

Underlined: $[[G]]/RoHS COMPATIBLE$ or $[[G]]/RoHS [[Pb]]$

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TEST CIRCUIT

$R_G = 25 \Omega$
 $V_{DD} = 25 \text{ V}, L = 339 \mu\text{H}$

WAVE FORM

$$E_{AS} = \frac{1}{2} \cdot L \cdot I^2 \cdot \left(\frac{B_{VDSS}}{B_{VDSS} - V_{DD}} \right)$$

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