

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

2SK3131

Chopper Regulator DC-DC Converter and Motor Drive Applications

- Fast reverse recovery time : $t_{rr} = 105 \text{ ns (typ.)}$
- Built-in high-speed free-wheeling diode
- Low drain-source ON resistance : $R_{DS(ON)} = 0.085 \Omega \text{ (typ.)}$
- High forward transfer admittance : $|Y_{fs}| = 35 \text{ S (typ.)}$
- Low leakage current : $I_{DSS} = 100 \mu\text{A (max)}$ ($V_{DS} = 500 \text{ V}$)
- Enhancement mode : $V_{th} = 2.4 \text{ to } 3.4 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 1 \text{ mA}$)

Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	500	V
Drain-gate voltage ($R_{GS} = 20\text{ k}\Omega$)		V_{DGR}	500	V
Gate-source voltage		V_{GSS}	± 30	V
DC Drain current	DC (Note 1)	I_D	50	A
	Pulse (Note 1)	I_{DP}	200	A
Drain power dissipation ($T_c = 25^\circ\text{C}$)		P_D	250	W
Single pulse avalanche energy (Note 2)		E_{AS}	525	mJ
Avalanche current		I_{AR}	50	A
Repetitive avalanche energy (Note 3)		E_{AR}	25	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

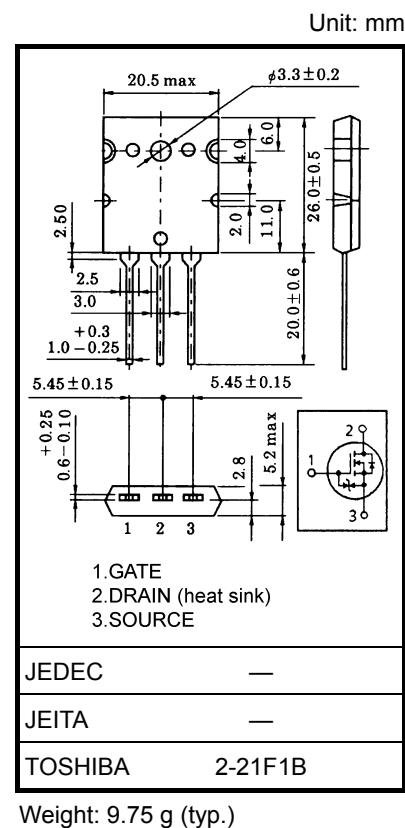
Characteristics	Symbol	Max	Unit
Thermal resistance, channel to case	$R_{th(ch-c)}$	0.5	°C / W
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	35.7	°C / W

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

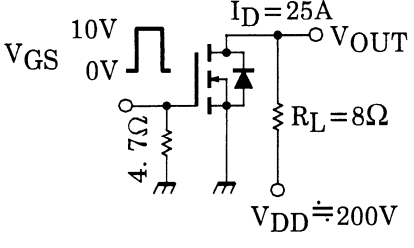
Note 2: $V_{DD} = 90 \text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 357 \text{ }\mu\text{H}$, $R_G = 25 \text{ }\Omega$, $I_{AB} = 50 \text{ A}$

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

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



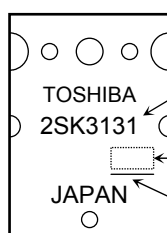
Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm 25 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	± 10	μA
Gate-source breakdown voltage		$V_{(BR)GSS}$	$I_G = \pm 100 \mu\text{A}, V_{DS} = 0 \text{ V}$	± 30	—	—	V
Drain cut-off current		I_{DSS}	$V_{DS} = 500 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	100	μA
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$	500	—	—	V
Gate threshold voltage		V_{th}	$V_{DS} = 10 \text{ V}, I_D = 1 \text{ mA}$	2.4	—	3.4	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = 10 \text{ V}, I_D = 25 \text{ A}$	—	0.085	0.11	Ω
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10 \text{ V}, I_D = 25 \text{ A}$	15	35	—	S
Input capacitance		C_{iss}	$V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	11000	—	pF
Reverse transfer capacitance		C_{rss}		—	2100	—	
Output capacitance		C_{oss}		—	4200	—	
Switching time	Rise time	t_r		—	105	—	ns
	Turn-on time	t_{on}		—	160	—	
	Fall time	t_f		—	65	—	
	Turn-off time	t_{off}		—	245	—	
Total gate charge (Gate-source plus gate-drain)		Q_g	$V_{DD} \approx 400 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 50 \text{ A}$	—	280	—	nC
Gate-source charge		Q_{gs}		—	150	—	
Gate-drain ("miller") charge		Q_{gd}		—	130	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	I_{DR}	—	—	—	50	A
Pulse drain reverse current (Note 1)	I_{DRP}	—	—	—	200	A
Forward voltage (diode)	V_{DSF}	$V_{DR} = 25 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	-1.7	V
Reverse recovery time	t_{rr}	$I_{DR} = 50 \text{ A}, V_{GS} = 0 \text{ V}$	—	105	—	ns
Reverse recovery charge	Q_{rr}	$dI_{DR} / dt = 100 \text{ A} / \mu\text{s}$	—	380	—	nC

Marking



Part No. (or abbreviation code)

Lot No.

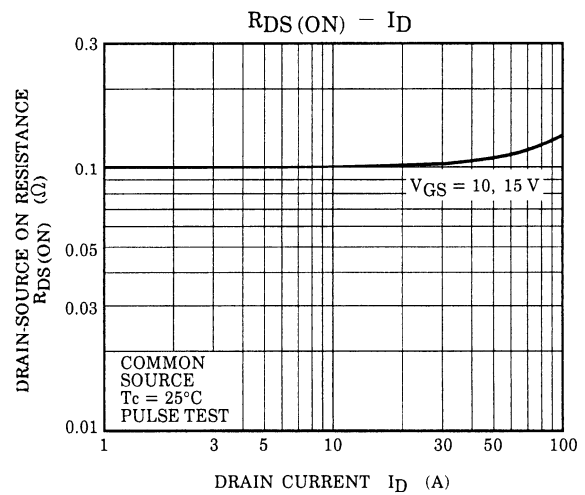
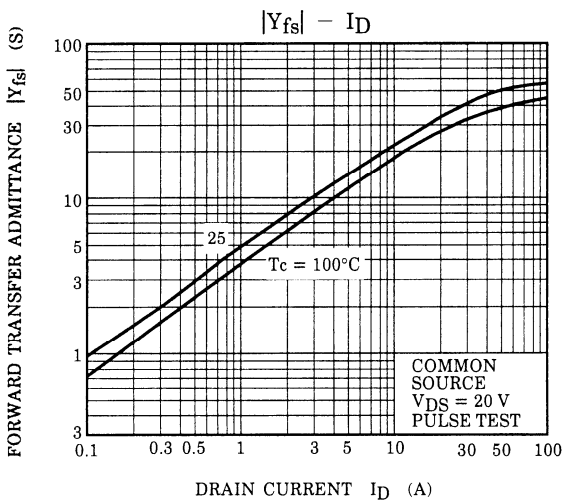
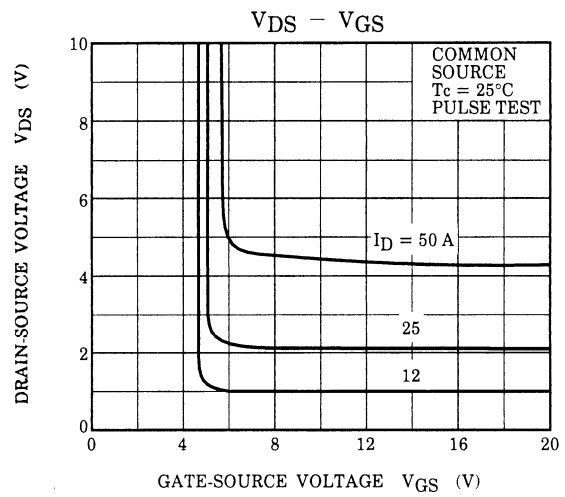
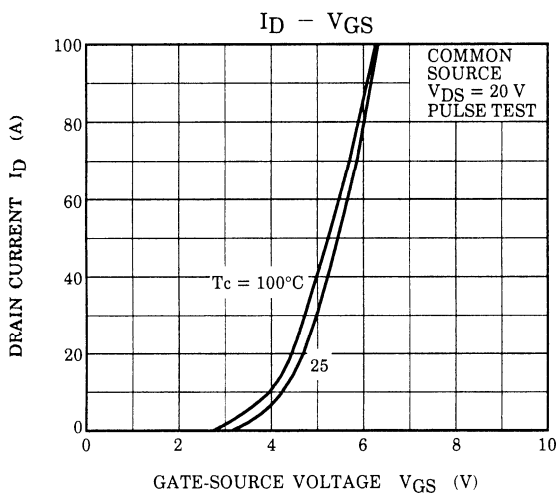
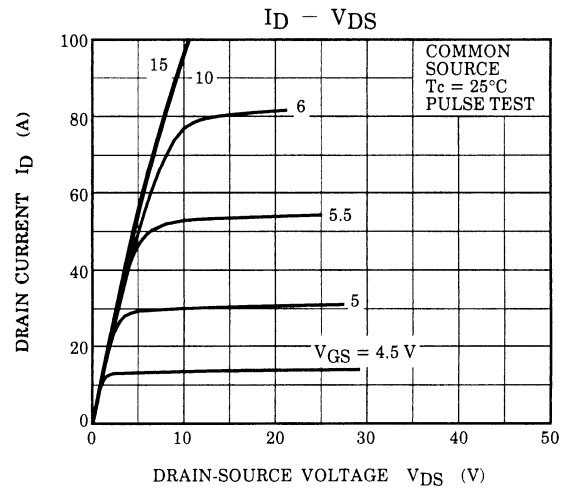
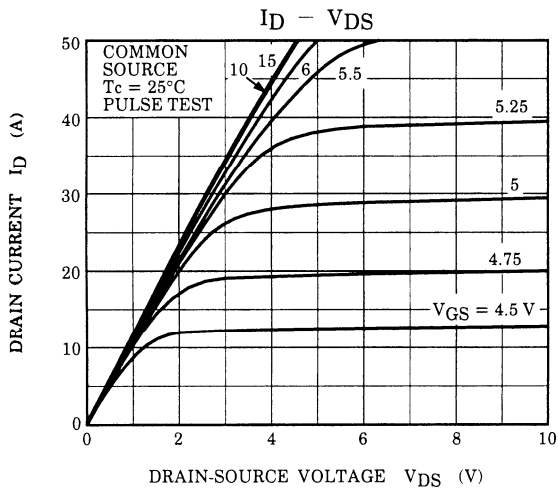
Note 4

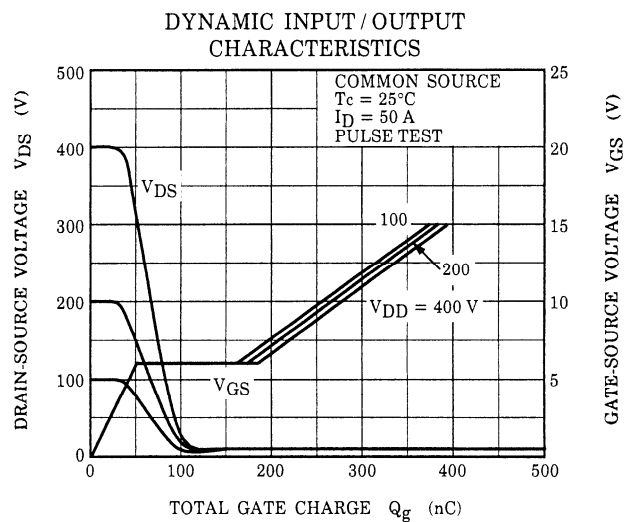
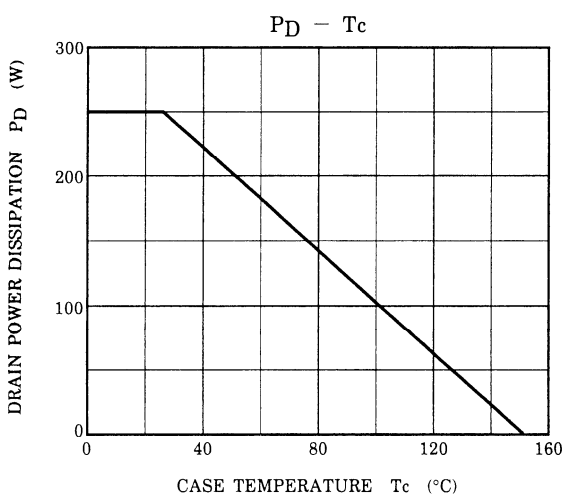
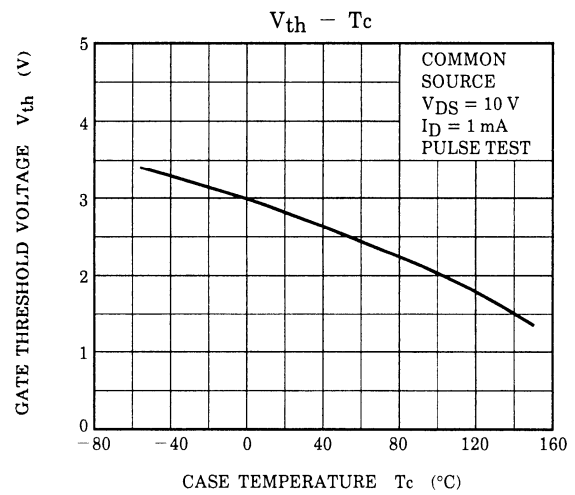
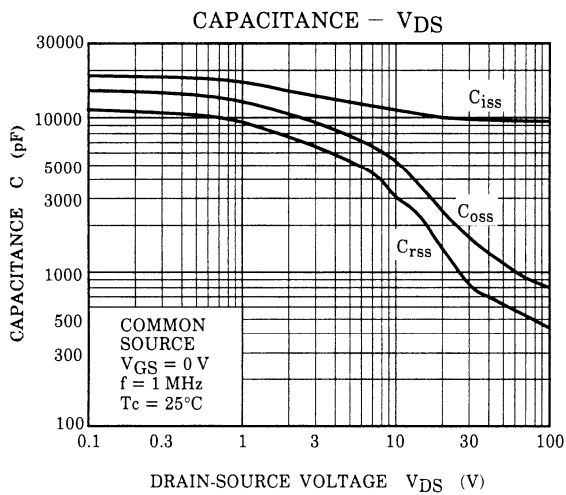
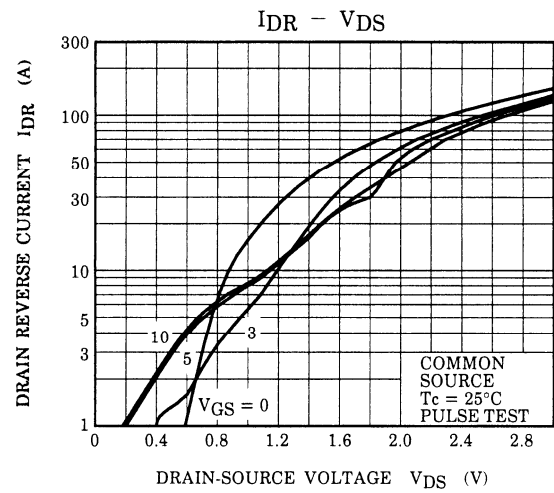
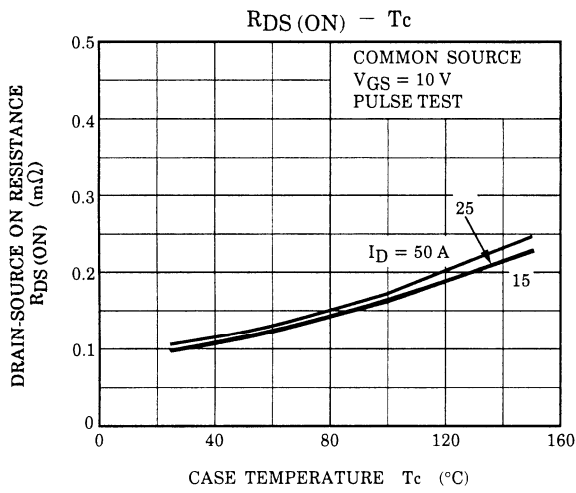
Note 4: A line under a Lot No. identifies the indication of product Labels.

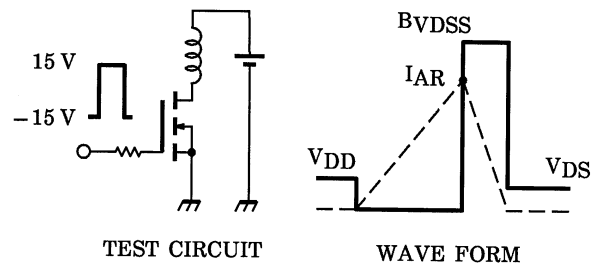
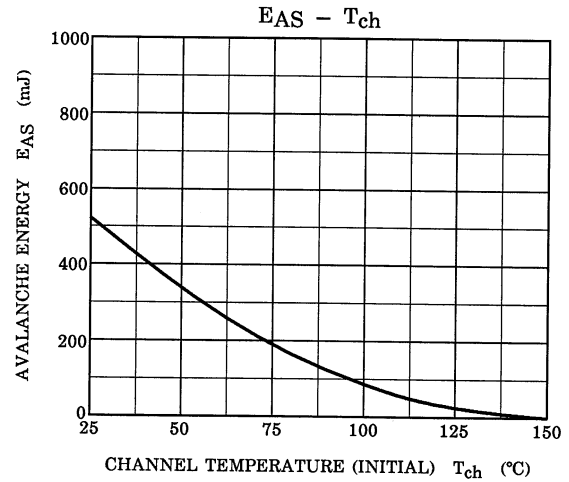
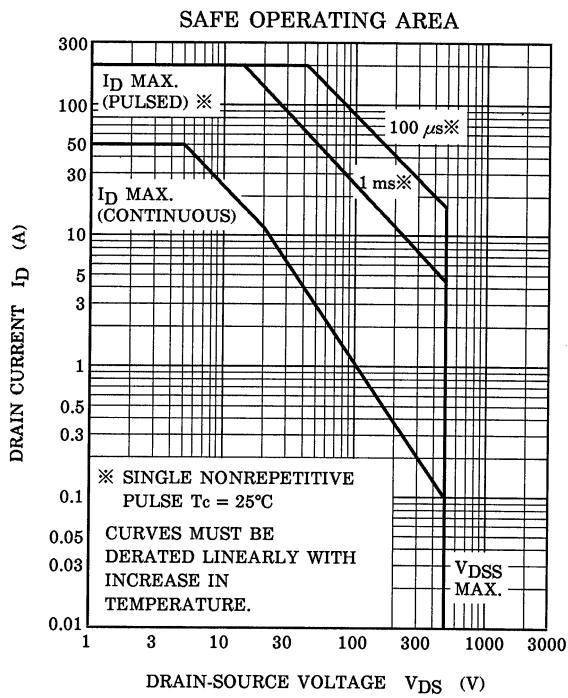
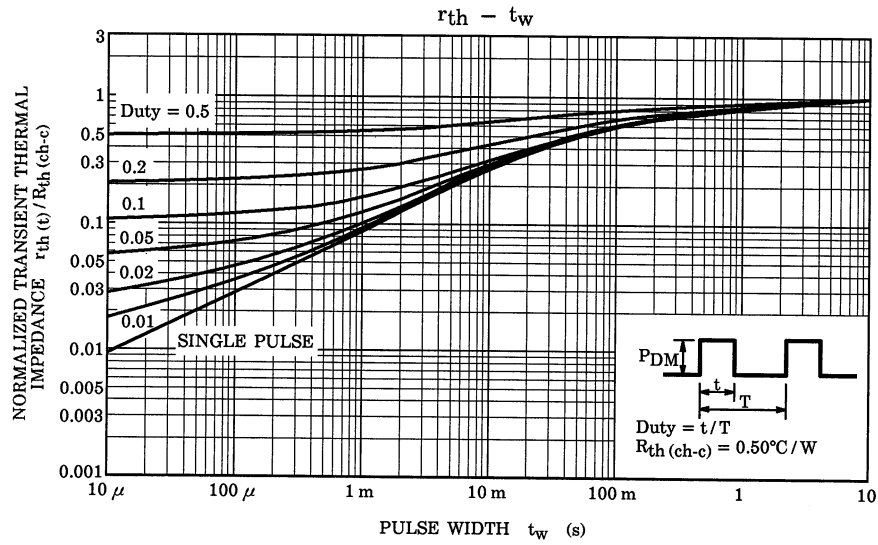
Not underlined: $[[Pb]]/INCLUDES > MCV$

Underlined: $[[G]]/RoHS \text{ COMPATIBLE}$ or $[[G]]/RoHS [[Pb]]$

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$$R_G = 25 \, \Omega$$

$$V_{DD} = 90 \, \text{V}, L = 357 \, \mu\text{H}$$

$$EAS = \frac{1}{2} \cdot L \cdot I^2 \cdot \left(\frac{BVDSS}{BVDSS - V_{DD}} \right)$$

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