

TOSHIBA FIELD EFFECT TRANSISTOR SILICON N CHANNEL MOS TYPE (π -MOSV)

2SK3131

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS

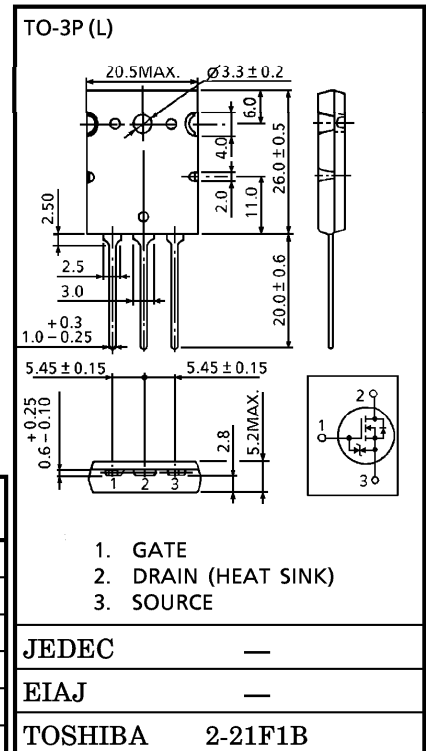
INDUSTRIAL APPLICATIONS

Unit in mm

- 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 : $V_{th} = 2.4 \sim 3.4 \text{ V (}V_{DS} = 10 \text{ V, }I_D = 1 \text{ mA)}$

MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

CHARACTERISTIC	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	I_D	50
	Pulse	I_{DP}	200
Drain Power Dissipation ($T_c = 25^\circ\text{C}$)	P_D	250	W
Single Pulse Avalanche Energy**	E_{AS}	525	mJ
Avalanche Current	I_{AR}	50	A
Repetitive Avalanche Energy*	E_{AR}	25	mJ
Channel Temperature	T_{ch}	150	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	$-55 \sim 150$	$^\circ\text{C}$



THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Channel to Case	$R_{th(ch-c)}$	0.5	$^\circ\text{C/W}$
Thermal Resistance, Channel to Ambient	$R_{th(ch-a)}$	35.7	$^\circ\text{C/W}$

Note ;

- * Repetitive rating ; Pulse Width Limited by Max. junction temperature.
- ** $V_{DD} = 90 \text{ V, } T_{ch} = 25^\circ\text{C (initial), } L = 357 \mu\text{H, } R_G = 25 \Omega, I_{AR} = 50 \text{ A}$

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

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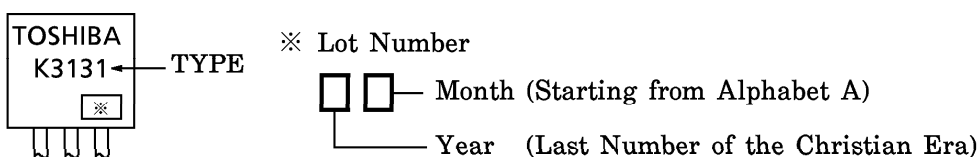
ELECTRICAL CHARACTERISTICS (Ta = 25°C)

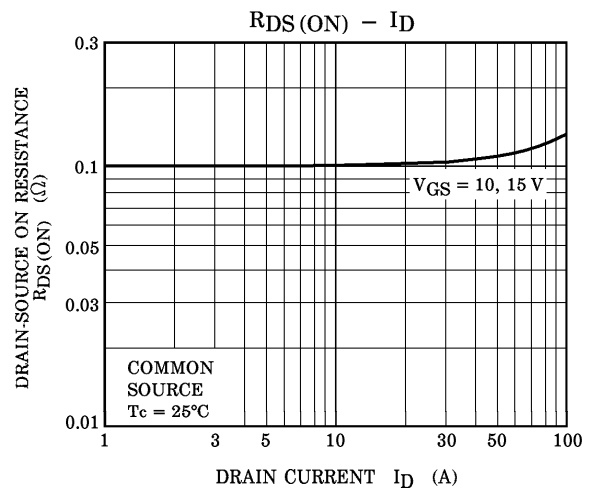
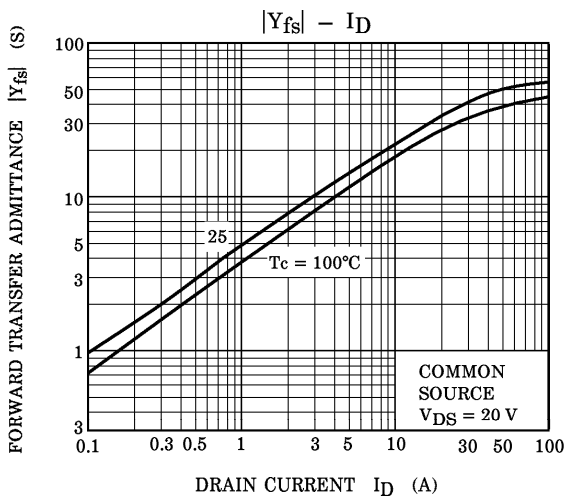
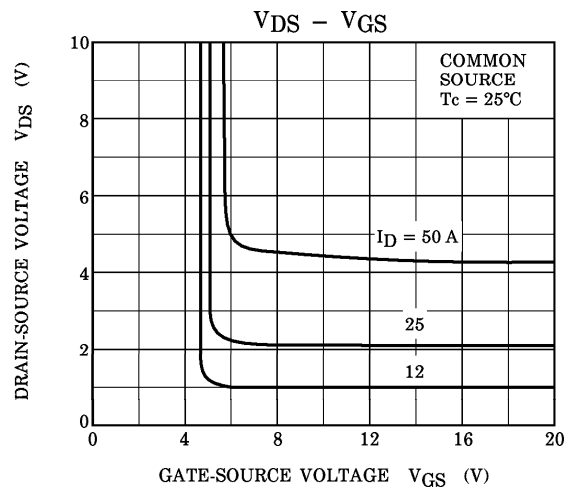
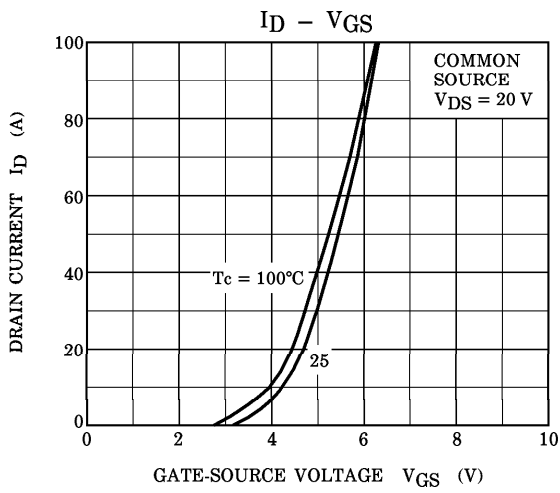
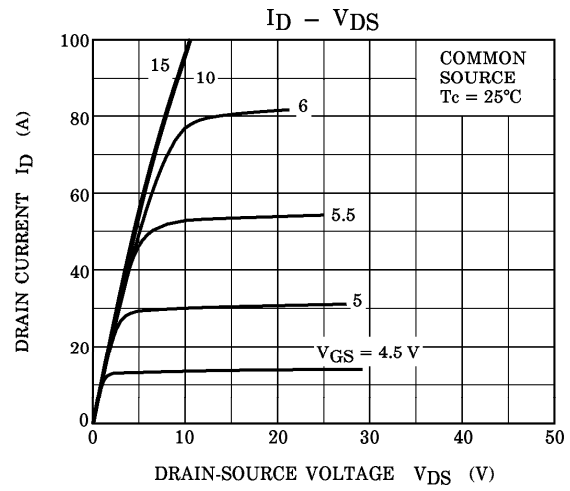
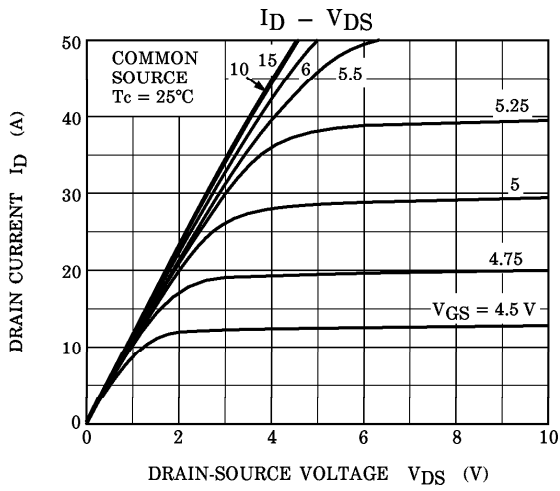
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	$V_{GS} = \pm 25\text{ V}, V_{DS} = 0\text{ V}$	—	—	± 10	μA
Gate-Source Breakdown Voltage		$V_{(BR)GSS}$	$I_G = \pm 100\ \mu\text{A}, V_{DS} = 0\text{ V}$	± 30	—	—	V
Drain Cut-off Current		I_{DSS}	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$	—	—	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}		$V_{IN} : t_r, t_f < 5\text{ ns},$ $Duty \leq 1\%, t_w = 10\ \mu\text{s}$	—	245	
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	$V_{DD} \doteq 400\text{ V}, V_{GS} = 10\text{ V},$ $I_D = 50\text{ A}$	—	280	—	nC
Gate-Source Charge		Q_{gs}		—	150	—	
Gate-Drain (“Miller”) Charge		Q_{gd}		—	130	—	

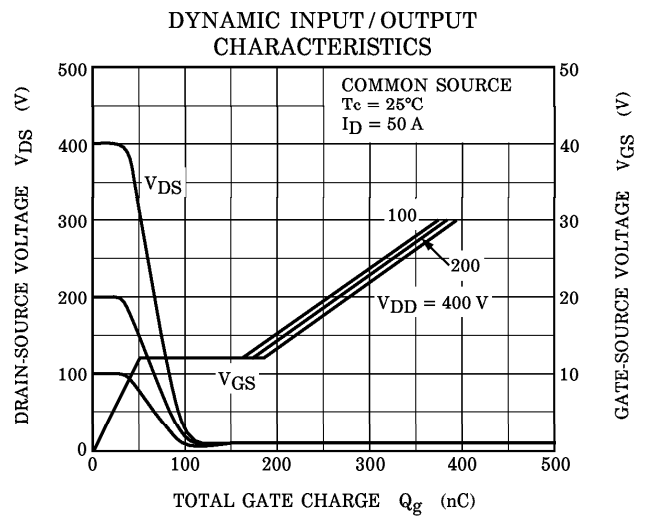
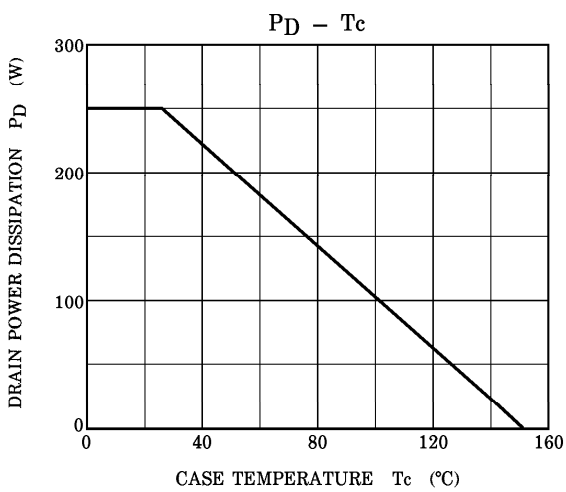
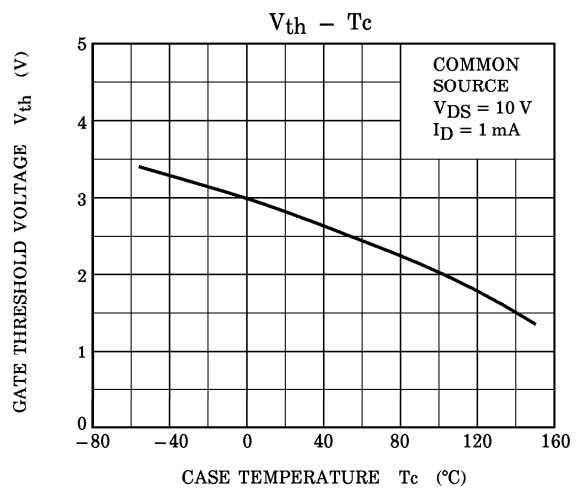
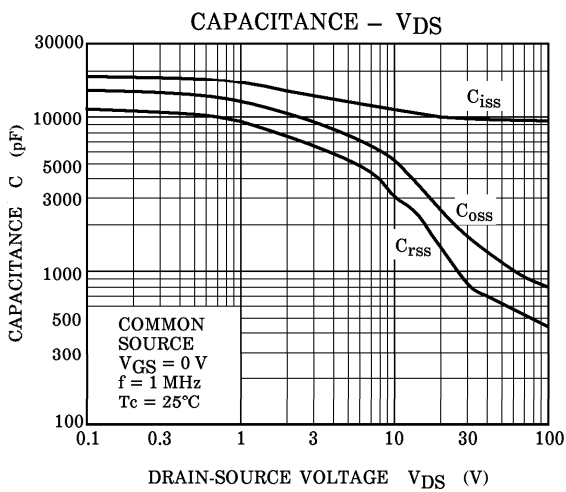
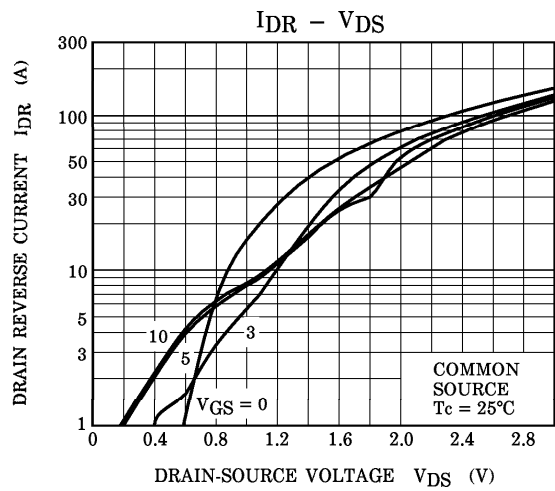
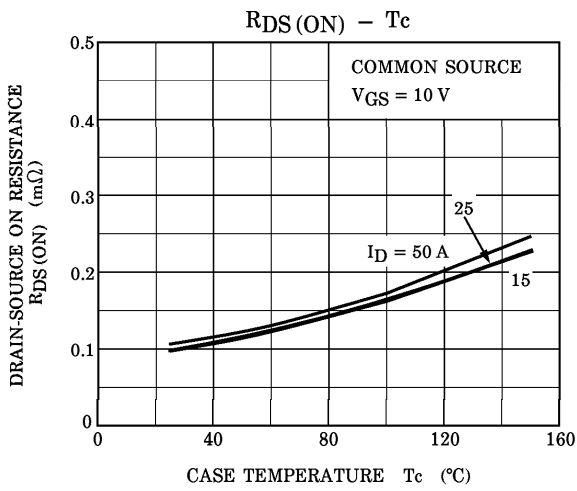
SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta = 25°C)

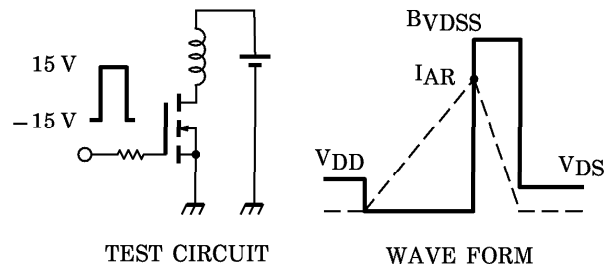
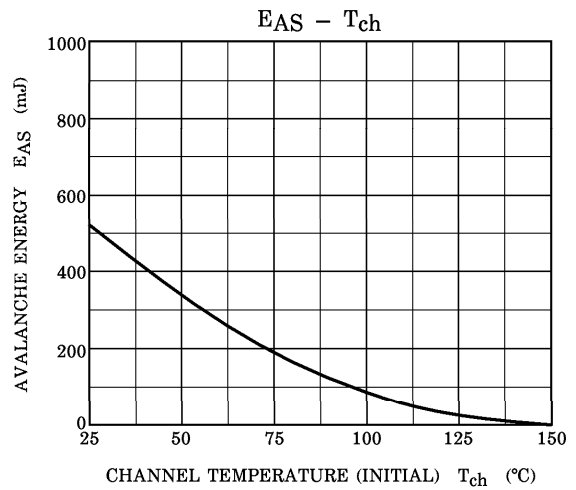
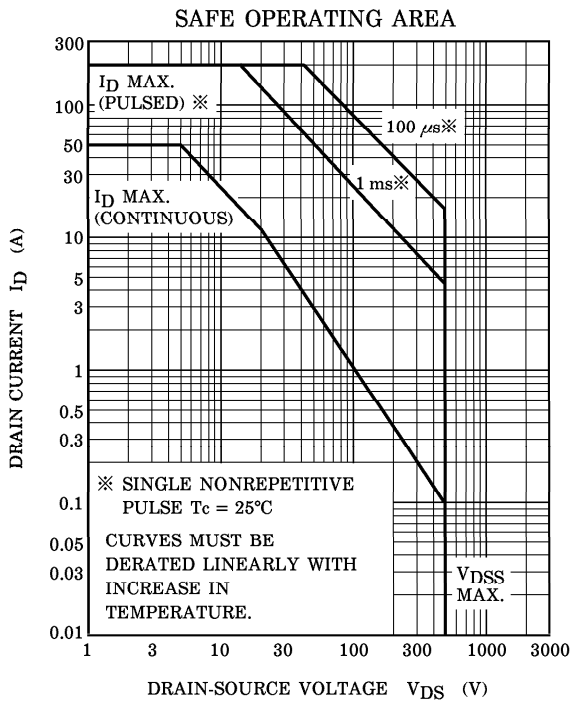
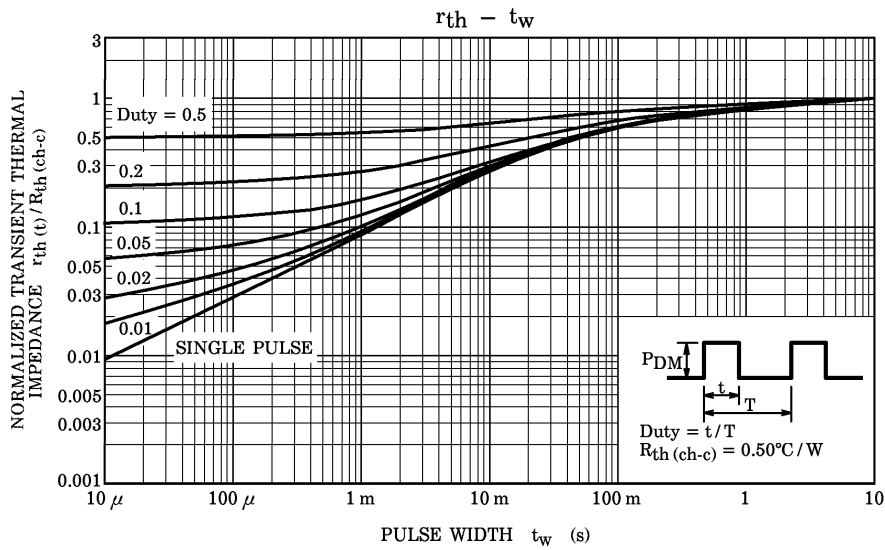
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Drain Reverse Current	I_{DR}	—	—	—	50	A
Pulse Drain Reverse Current	I_{DRP}	—	—	—	200	A
Diode Forward Voltage	V_{DSF}	$I_{DR} = 25\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.7	V
Reverse Recovery Time	t_{rr}	$I_{DR} = 50\text{ A}, V_{GS} = 0\text{ V}$	—	105	—	ns
Reverse Recovery Charge	Q_{rr}	$dI_{DR}/dt = 100\text{ A}/\mu\text{s}$	—	380	—	nC

MARKING









Peak $I_{AR} = 50 A$, $R_G = 25 \Omega$
 $V_{DD} = 90 V$, $L = 357 \mu H$

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