

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type ( $L^2$ -π-MOSV)

# 2SK2201

Chopper Regulator, DC-DC Converter and Motor Drive Applications

- 4 V gate drive
- Low drain-source ON resistance :  $R_{DS(ON)} = 0.28 \Omega$  (typ.)
- High forward transfer admittance :  $|Y_{fs}| = 3.5 S$  (typ.)
- Low leakage current :  $I_{DSS} = 100 \mu A$  (max) ( $V_{DS} = 100 V$ )
- Enhancement-mode :  $V_{th} = 0.8 \sim 2.0 V$  ( $V_{DS} = 10 V, I_D = 1 mA$ )

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

Characteristics	Symbol	Rating	Unit
Drain-source voltage	$V_{DSS}$	100	V
Drain-gate voltage ( $R_{GS} = 20 k\Omega$ )	$V_{DGR}$	100	V
Gate-source voltage	$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	3 A
	Pulse (Note 1)	$I_{DP}$	12 A
Drain power dissipation ( $T_c = 25^\circ C$ )	$P_D$	20	W
Single pulse avalanche energy (Note 2)	$E_{AS}$	140	mJ
Avalanche current	$I_{AR}$	3	A
Repetitive avalanche energy (Note 3)	$E_{AR}$	2	mJ
Channel temperature	$T_{ch}$	150	$^\circ C$
Storage temperature range	$T_{stg}$	-55~150	$^\circ C$

## Thermal Characteristics

Characteristics	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	$^\circ C / W$

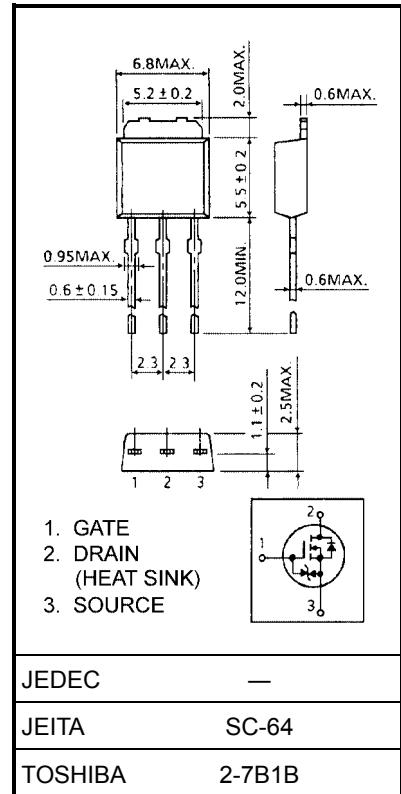
Note 1: Please use devices on condition that the channel temperature is below  $150^\circ C$ .

Note 2:  $V_{DD} = 50 V, T_{ch} = 25^\circ C$  (initial),  $L = 25 mH, R_G = 25 \Omega, I_{AR} = 3 A$

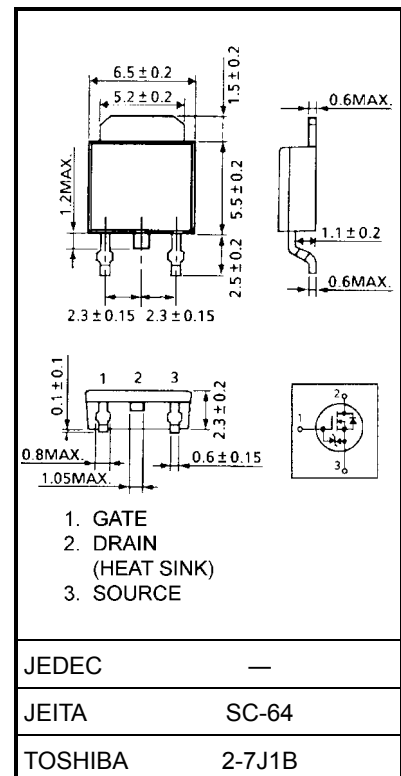
Note 3: Repetitive rating: Pulse width limited by maximum channel temperature

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

Unit: mm



Weight: 0.36 g (typ.)



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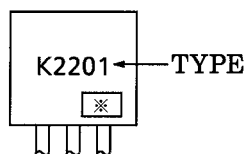
## Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cut-off current		$I_{DSS}$	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$	—	—	100	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	100	—	—	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		$R_{DS(ON)}$	$V_{GS} = 4\text{ V}, I_D = 2\text{ A}$	—	0.36	0.45	$\Omega$
			$V_{GS} = 10\text{ V}, I_D = 2\text{ A}$	—	0.28	0.35	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 2\text{ A}$	1.5	3.5	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	280	—	pF
Reverse transfer capacitance		$C_{rss}$		—	50	—	
Output capacitance		$C_{oss}$		—	105	—	
Switching time	Rise time	$t_r$	<p><math>I_D = 2\text{ A}</math> <math>V_{GS} = 10\text{ V}</math> <math>V_{DS} = 10\text{ V}</math> <math>R_L = 25\ \Omega</math> <math>V_{DD} \approx 50\text{ V}</math> Duty <math>\leq 1\%</math>, <math>t_w = 10\ \mu\text{s}</math></p>	—	20	—	ns
	Turn-on time	$t_{on}$		—	50	—	
	Fall time	$t_f$		—	40	—	
	Turn-off time	$t_{off}$		—	170	—	
Total gate charge (Gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx 80\text{ V}, V_{GS} = 10\text{ V}, I_D = 3\text{ A}$	—	13.5	—	nC
Gate-source charge		$Q_{gs}$		—	8.5	—	
Gate-drain ("miller") charge		$Q_{gd}$		—	5	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	$I_{DR}$	—	—	—	3	A
Pulse drain reverse current (Note 1)	$I_{DRP}$	—	—	—	12	A
Forward voltage (diode)	$V_{DSF}$	$I_{DR} = 3\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.5	V
Reverse recovery time	$t_{rr}$	$I_{DR} = 3\text{ A}, V_{GS} = 0\text{ V}, dI_{DR} / dt = 50\text{ A} / \mu\text{s}$	—	100	—	ns
Reverse recovery charge	$Q_{rr}$		—	0.2	—	$\mu\text{C}$

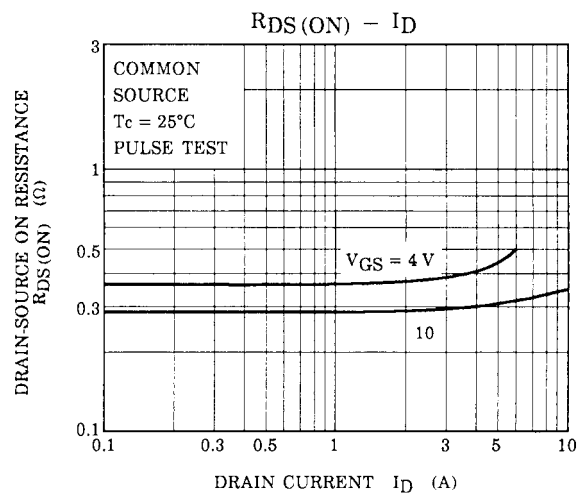
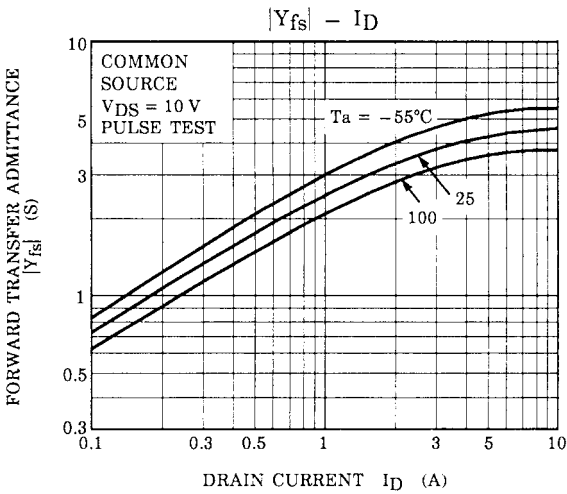
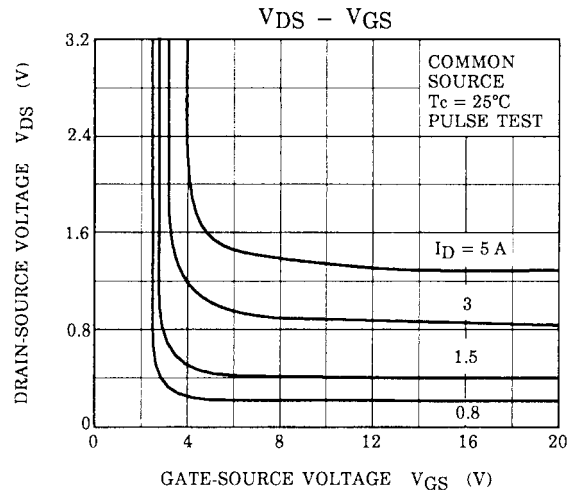
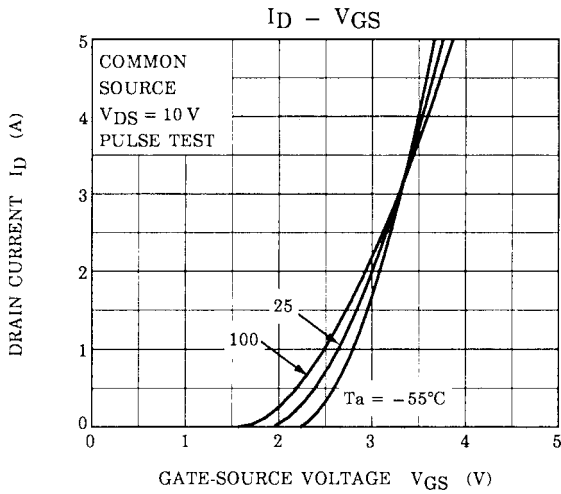
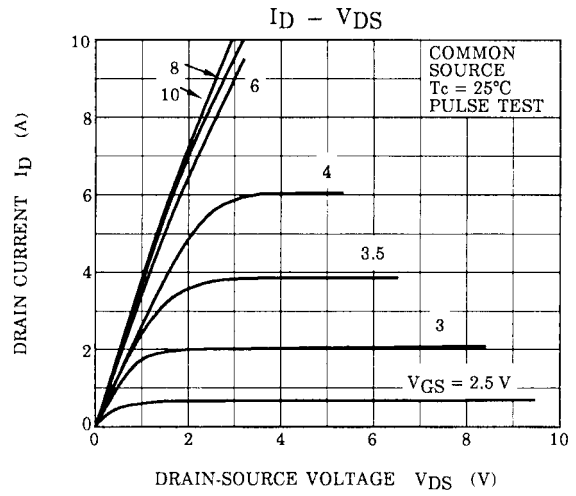
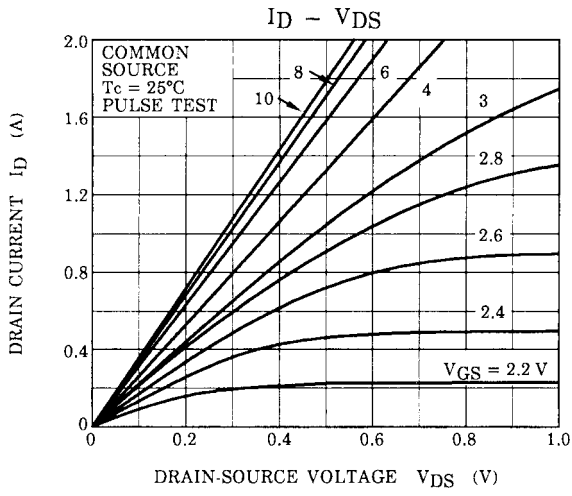
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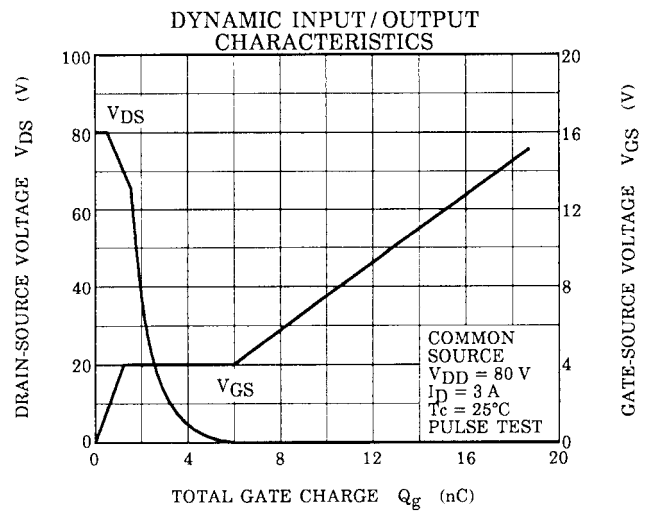
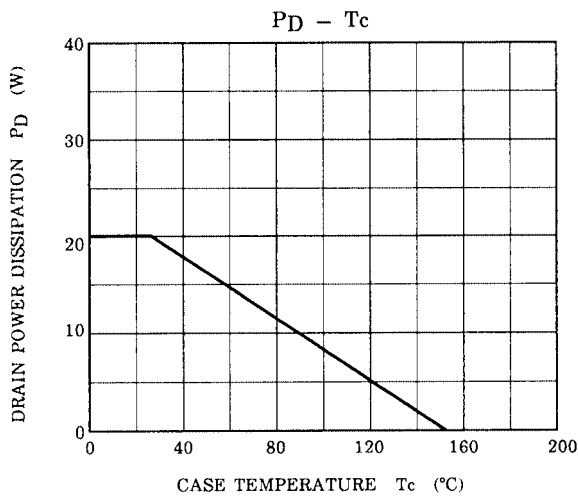
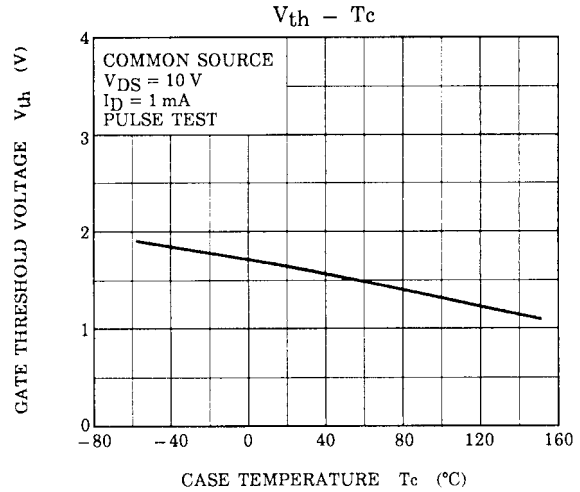
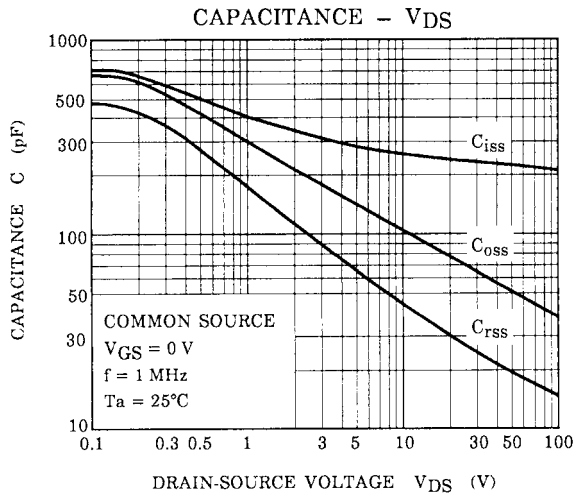
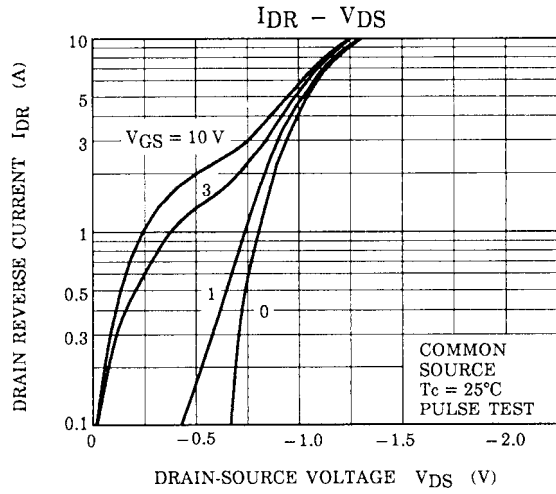
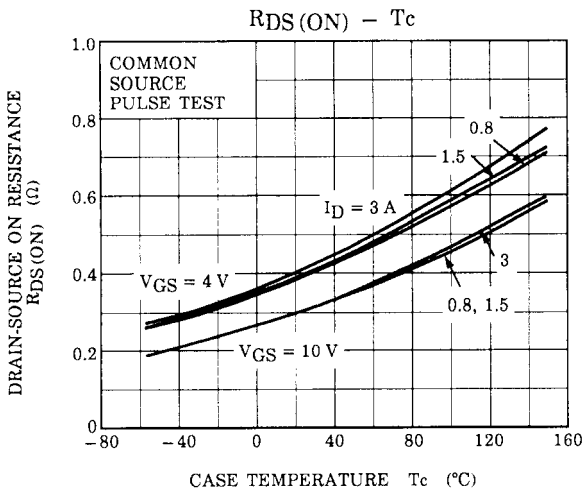


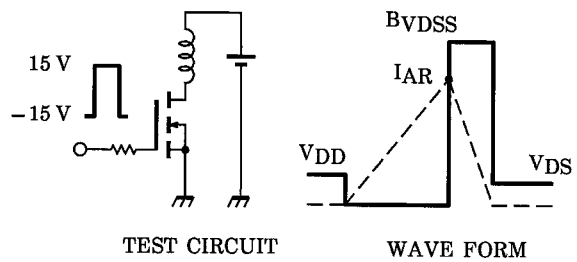
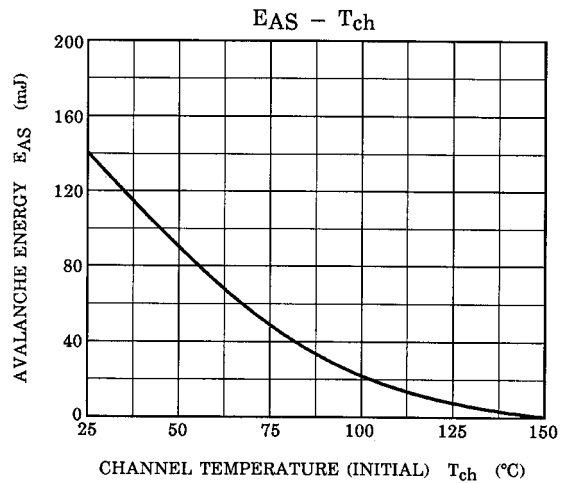
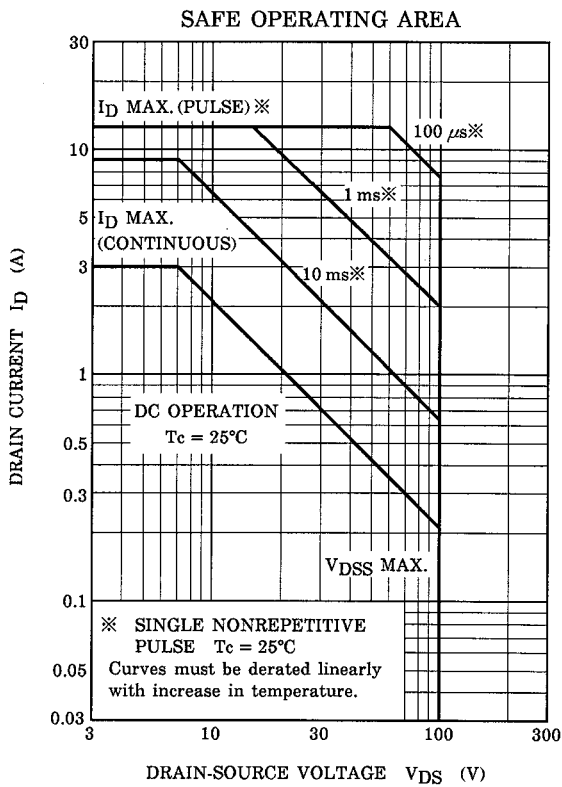
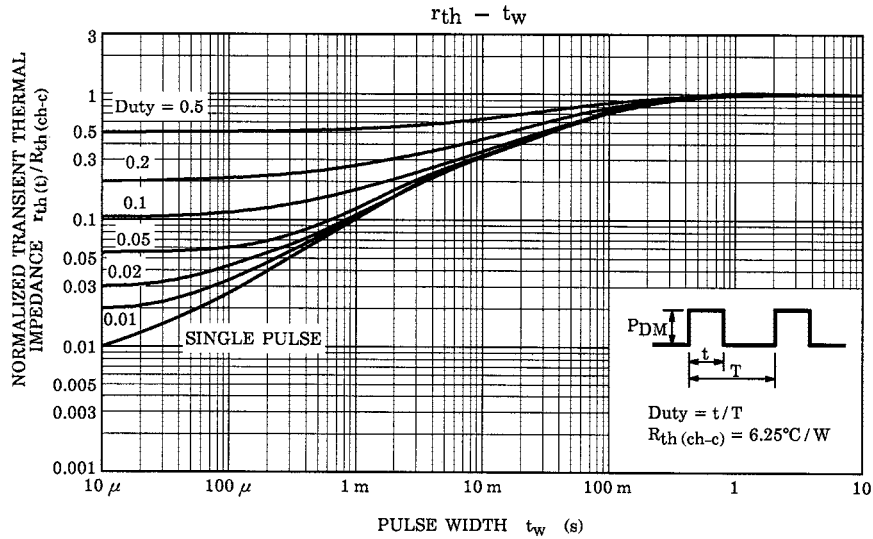
※ Lot Number

□ □ — Month (Starting from Alphabet A)

□ — Year (Last Number of the Christian Era)







$R_G = 25 \Omega$   
 $V_{DD} = 25 \text{ V}, L = 25 \text{ mH}$

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

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