

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type ( $\pi$ -MOSV)

## 2SK3313

Chopper Regulator, DC-DC Converter Applications  
Motor Drive Applications

- Fast reverse recovery time :  $t_{rr} = 90 \text{ ns (typ.)}$
- Built-in high-speed free-wheeling diode
- Low drain-source ON resistance :  $R_{DS(ON)} = 0.5 \Omega \text{ (typ.)}$
- High forward transfer admittance :  $|Y_{fs}| = 8.5 \text{ S (typ.)}$
- Low leakage current :  $I_{DSS} = 100 \mu\text{A (max)}$  ( $V_{DS} = 500 \text{ V}$ )
- Enhancement-mode :  $V_{th} = 2.0\sim 4.0 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

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

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	$V_{GSS}$	$\pm 30$	V
Drain current	DC (Note 1)	$I_D$	12 A
	Pulse (Note 1)	$I_{DP}$	48 A
Drain power dissipation ( $T_c = 25^\circ\text{C}$ )	$P_D$	40	W
Single pulse avalanche energy (Note 2)	$E_{AS}$	324	mJ
Avalanche current	$I_{AR}$	12	A
Repetitive avalanche energy (Note 3)	$E_{AR}$	4.0	mJ
Channel temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage temperature range	$T_{stg}$	-55~150	$^\circ\text{C}$

### Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to case	$R_{th(ch-c)}$	3.125	$^\circ\text{C/W}$
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	62.5	$^\circ\text{C/W}$

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

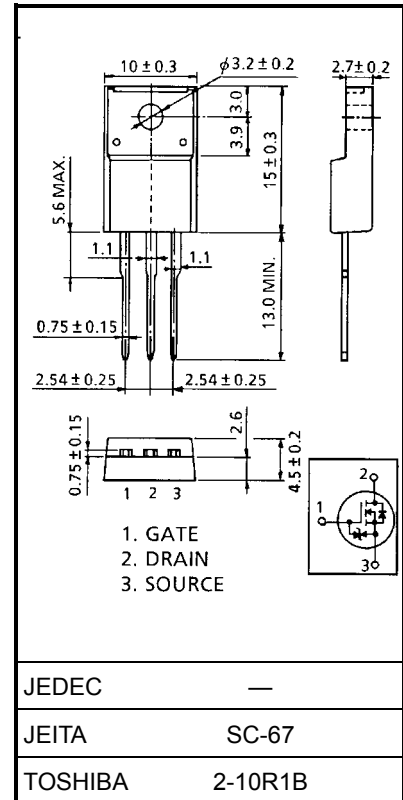
Note 2:  $V_{DD} = 90 \text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 3.83 \text{ mH}$ ,  $R_G = 25 \Omega$ ,  $I_{AR} = 12 \text{ A}$

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.)

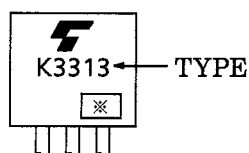
## Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 25\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Gate-source breakdown voltage		$V_{(BR)GSS}$	$I_G = \pm 100\ \mu\text{A}, V_{DS} = 0\text{ V}$	$\pm 30$	—	—	V
Drain cut-off current		$I_{DSS}$	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$	—	—	100	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	500	—	—	V
Gate threshold voltage		$V_{th}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	2.0	—	4.0	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 6\text{ A}$	—	0.5	0.62	$\Omega$
Forward transfer admittance		$ Y_{fs} $	$V_{GS} = 10\text{ V}, I_D = 6\text{ A}$	3.0	8.5	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	2040	—	pF
Reverse transfer capacitance		$C_{rss}$		—	210	—	
Output capacitance		$C_{oss}$		—	630	—	
Switching time	Rise time	$t_r$		—	22	—	ns
	Turn-on time	$t_{on}$		—	58	—	
	Fall time	$t_f$		—	36	—	
	Turn-off time	$t_{off}$		—	180	—	
Total gate charge (Gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx 400\text{ V}, V_{GS} = 10\text{ V}, I_D = 12\text{ A}$	—	45	—	nC
Gate-source charge		$Q_{gs}$		—	25	—	
Gate-drain ("miller") charge		$Q_{gd}$		—	20	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	$I_{DR}$	—	—	—	12	A
Pulse drain reverse current (Note 1)	$I_{DRP}$	—	—	—	48	A
Forward voltage (diode)	$V_{DSF}$	$I_{DR} = 12\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.7	V
Reverse recovery time	$t_{rr}$	$I_{DR} = 12\text{ A}, V_{GS} = 0\text{ V}$	—	90	160	ns
Reverse recovery charge	$Q_{rr}$	$dI_{DR} / dt = 100\text{ A} / \mu\text{s}$	—	0.25	—	$\mu\text{C}$

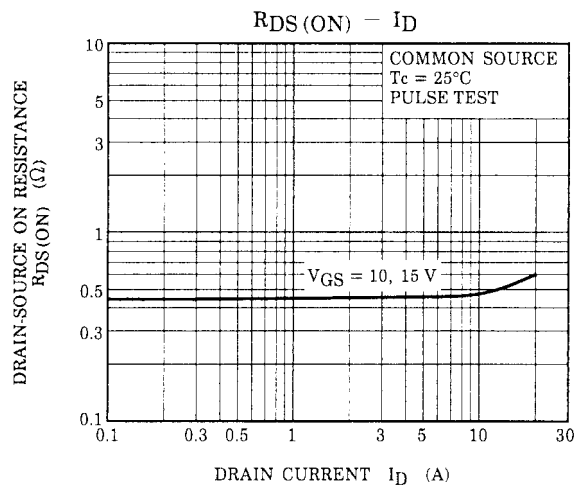
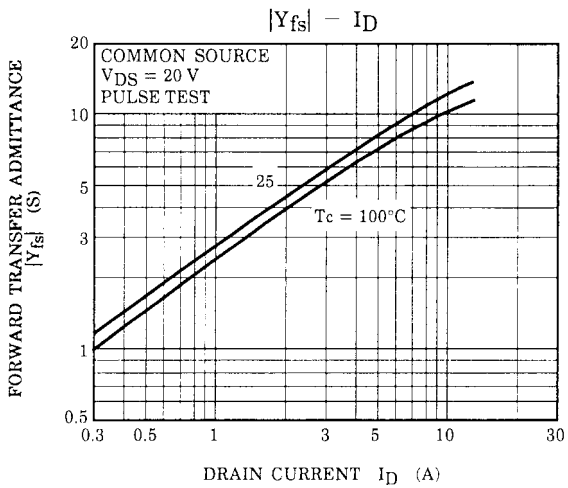
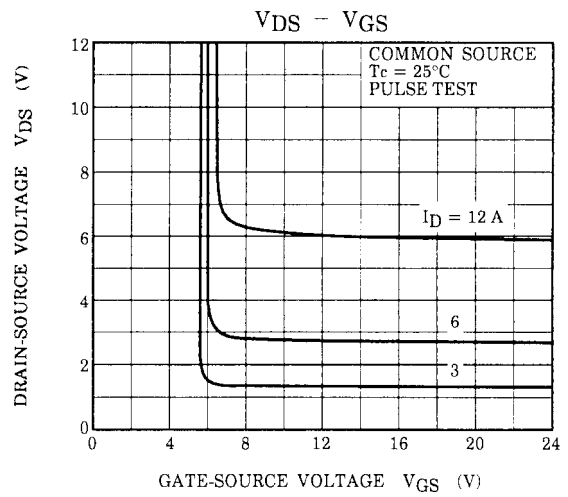
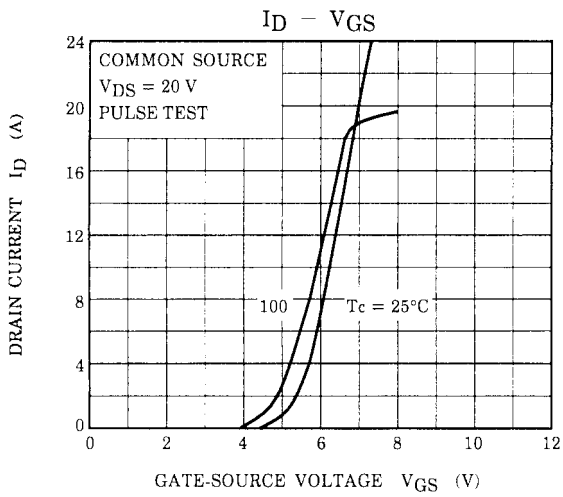
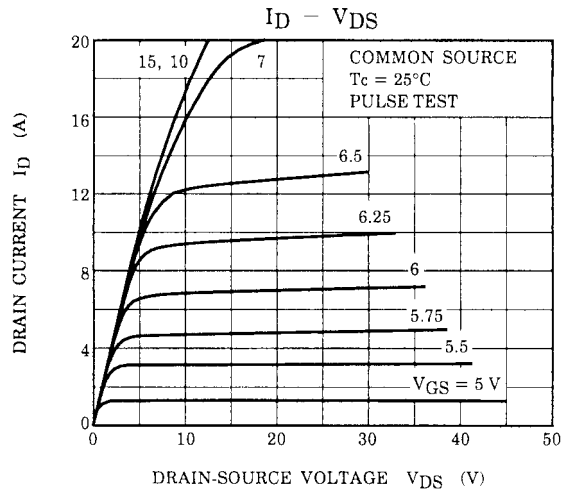
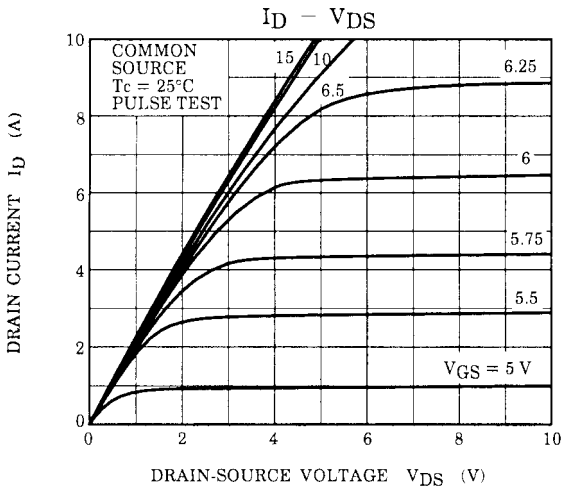
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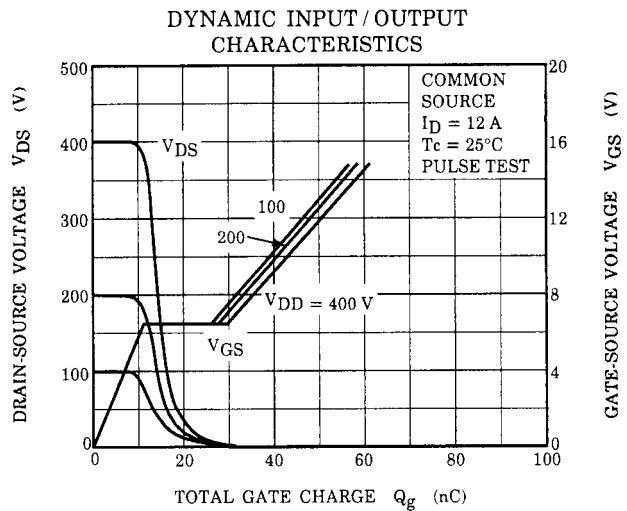
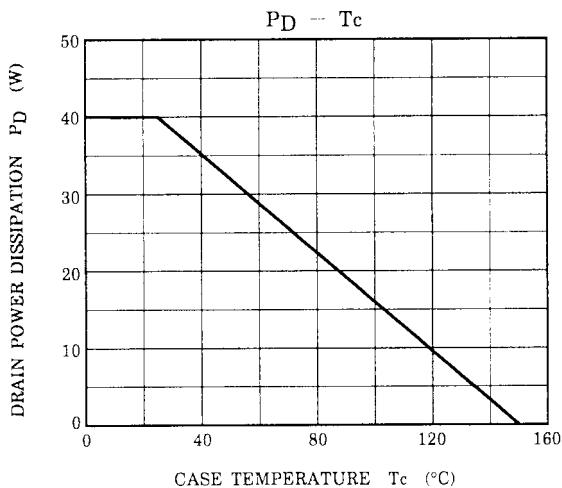
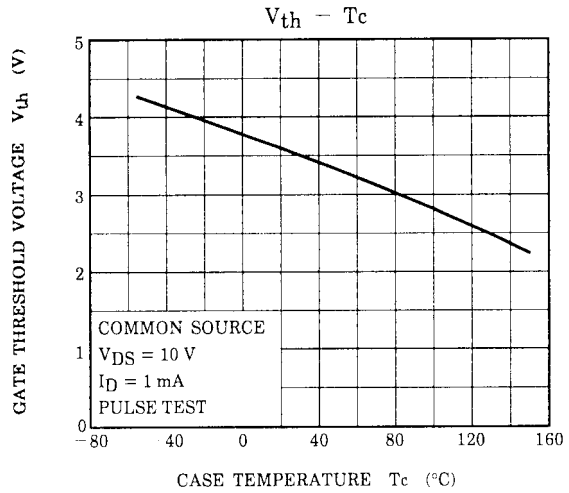
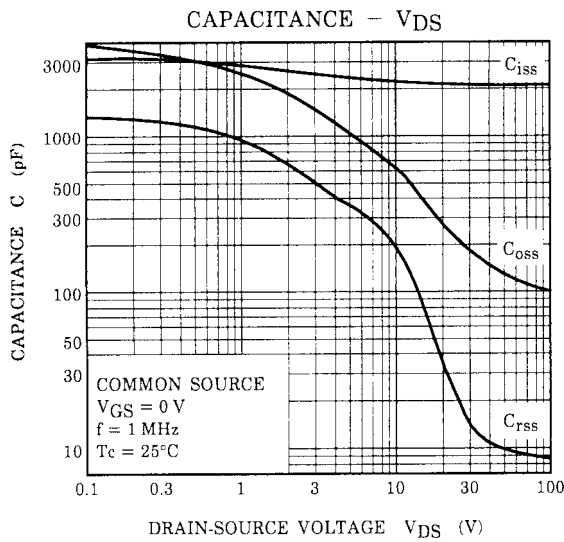
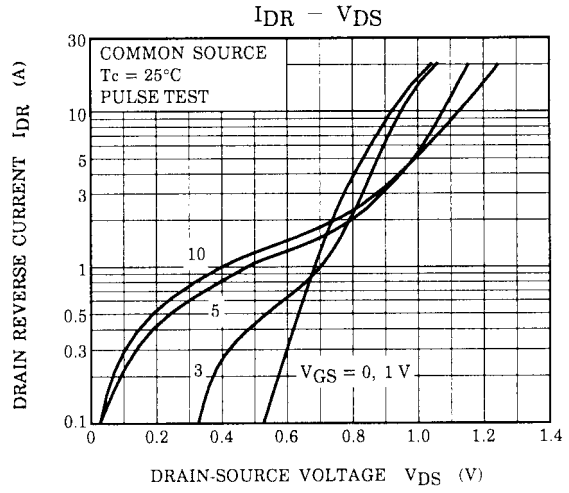
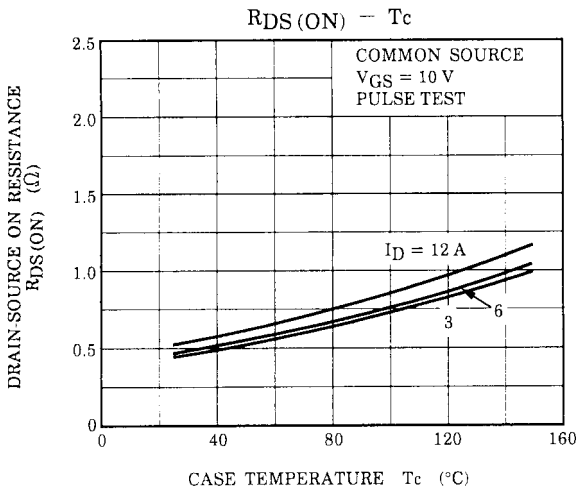


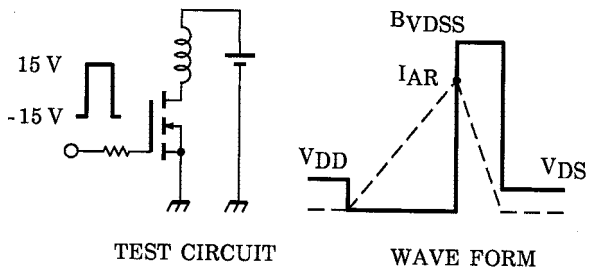
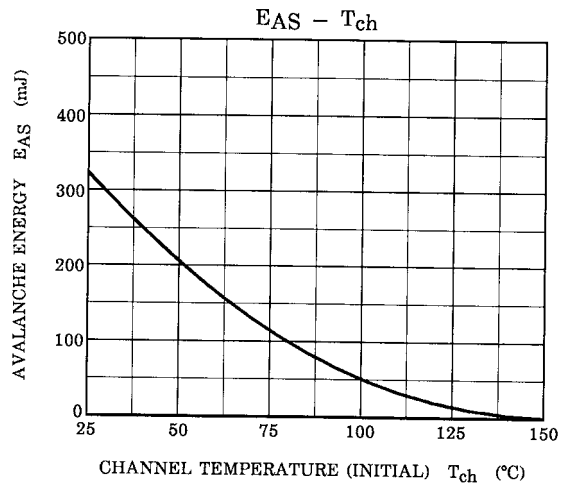
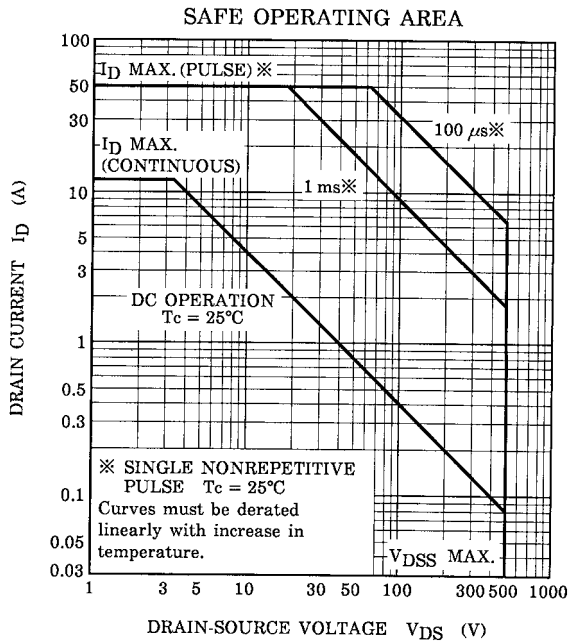
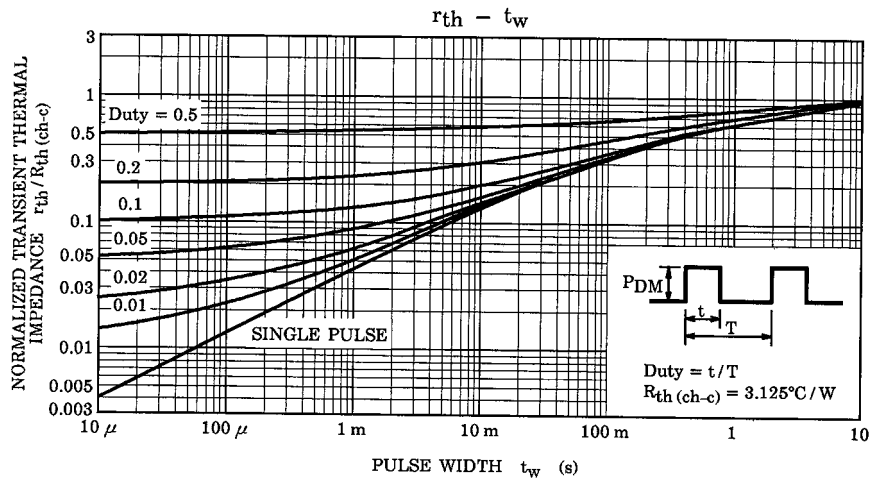
※ Lot Number

□ □ — Month (Starting from Alphabet A)

— Year (Last Number of the Christian Era)







$$R_G = 25 \Omega$$

$$V_{DD} = 90 \text{ V}, L = 3.83 \text{ mH}$$

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

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