

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

# 2SK4113

## Switching Regulator Applications

- Low drain-source ON resistance:  $R_{DS(ON)} = 2.0$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 4.5$  S (typ.)
- Low leakage current:  $I_{DSS} = 100$   $\mu$ A ( $V_{DS} = 720$  V)
- Enhancement mode:  $V_{th} = 2.0\sim 4.0$  V ( $V_{DS} = 10$  V,  $I_D = 1$  mA)

## Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Drain-source voltage	$V_{DSS}$	900	V
Drain-gate voltage ( $R_{GS} = 20$ k $\Omega$ )	$V_{DGR}$	900	V
Gate-source voltage	$V_{GSS}$	$\pm 30$	V
Drain current	DC (Note 1)	$I_D$	5
	Pulse (t = 1 ms) (Note 1)	$I_{DP}$	15
Drain power dissipation ( $T_c = 25^\circ\text{C}$ )	$P_D$	45	W
Single pulse avalanche energy (Note 2)	$E_{AS}$	595	mJ
Avalanche current	$I_{AR}$	5	A
Repetitive avalanche energy (Note 3)	$E_{AR}$	4.5	mJ
Channel temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage temperature range	$T_{stg}$	-55~150	$^\circ\text{C}$

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	$R_{th(ch-c)}$	2.78	$^\circ\text{C/W}$
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	62.5	$^\circ\text{C/W}$

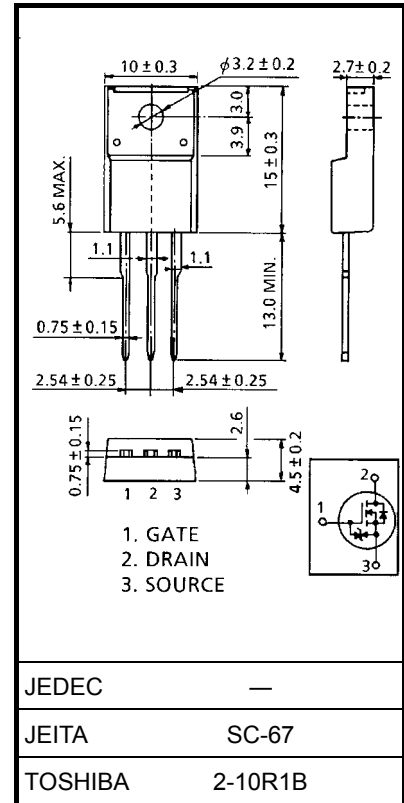
Note 1: Ensure that the channel temperature does not exceed 150 .

Note 2:  $V_{DD} = 90$  V,  $T_{ch} = 25^\circ\text{C}$ (Initial),  $L = 43.6$  mH,  $I_{AR} = 5.0$  A,  $R_G = 25$   $\Omega$

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.)

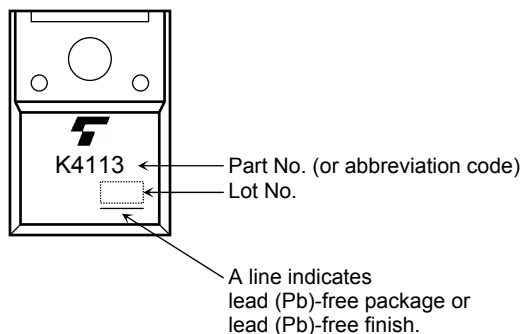
## Electrical Characteristics (Ta = 25°C)

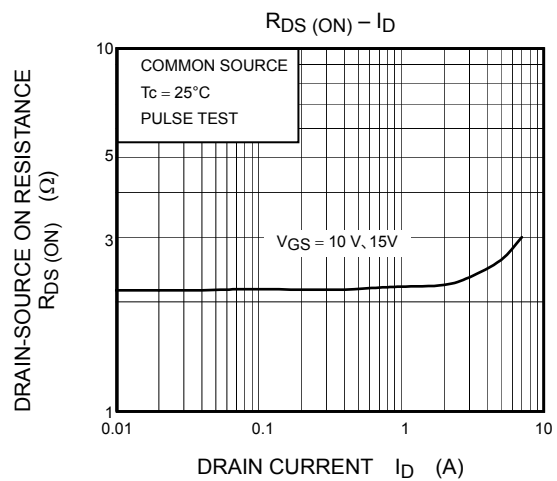
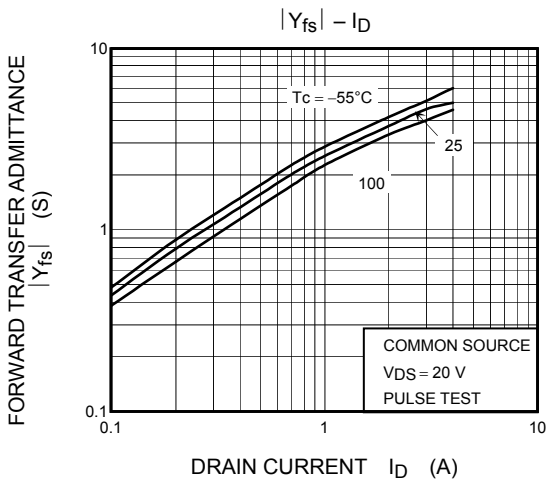
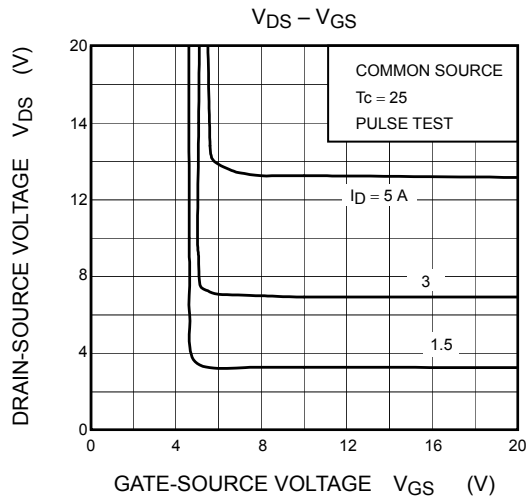
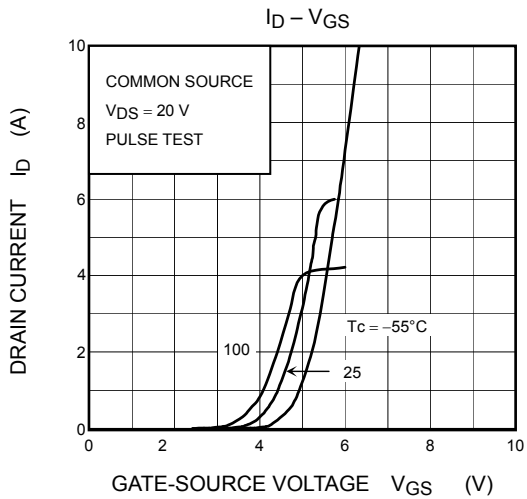
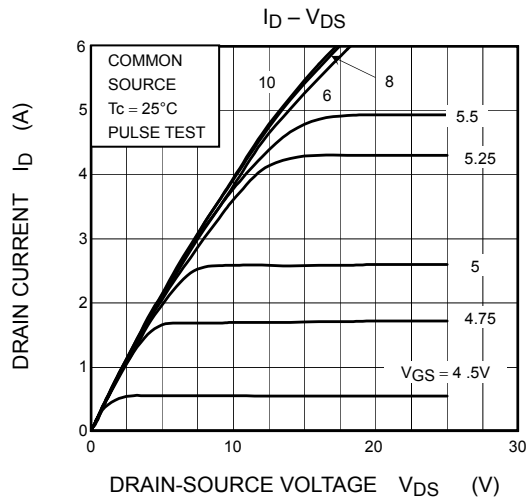
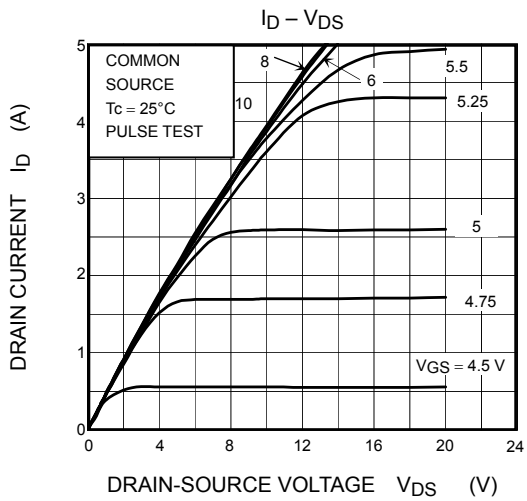
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 25 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Gate-source breakdown voltage		$V_{(BR)GSS}$	$I_G = \pm 10 \mu\text{A}, V_{DS} = 0 \text{ V}$	$\pm 30$	—	—	V
Drain cut-off current		$I_{DSS}$	$V_{DS} = 720 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	100	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$	900	—	—	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		$R_{DS(ON)}$	$V_{GS} = 10 \text{ V}, I_D = 3 \text{ A}$	—	2.0	2.5	$\Omega$
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 20 \text{ V}, I_D = 3 \text{ A}$	2.0	4.5	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	1150	—	pF
Reverse transfer capacitance		$C_{rss}$		—	20	—	
Output capacitance		$C_{oss}$		—	100	—	
Switching time	Rise time	$t_r$		—	30	—	ns
	Turn-on time	$t_{on}$		—	70	—	
	Fall time	$t_f$		—	60	—	
	Turn-off time	$t_{off}$		Duty $\leq 1\%$ , $t_w = 10 \mu\text{s}$		—	
Total gate charge		$Q_g$	$V_{DD} \approx 400 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 5 \text{ A}$	—	28	—	nC
Gate-source charge		$Q_{gs}$		—	17	—	
Gate-drain charge		$Q_{gd}$		—	11	—	

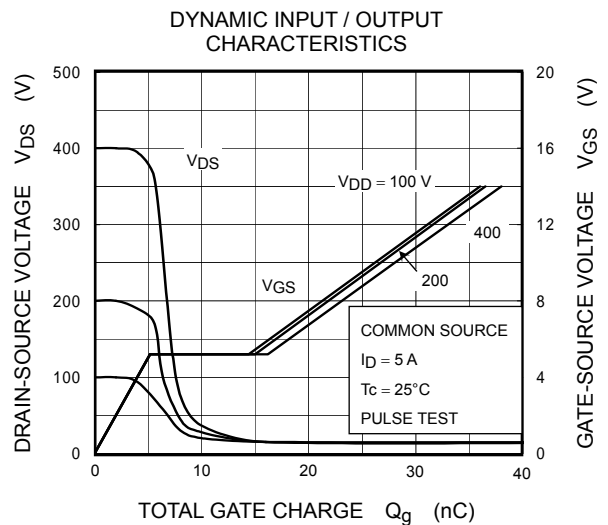
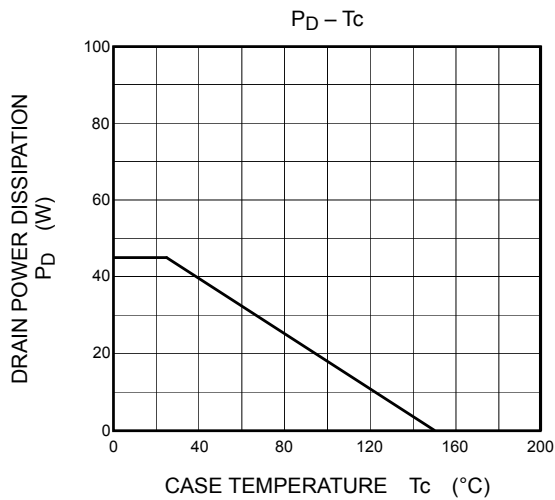
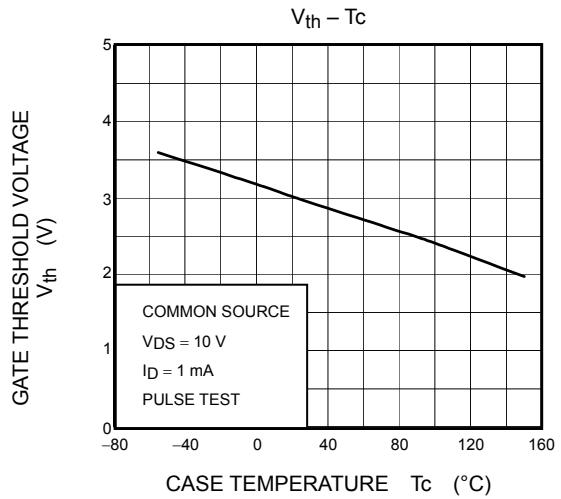
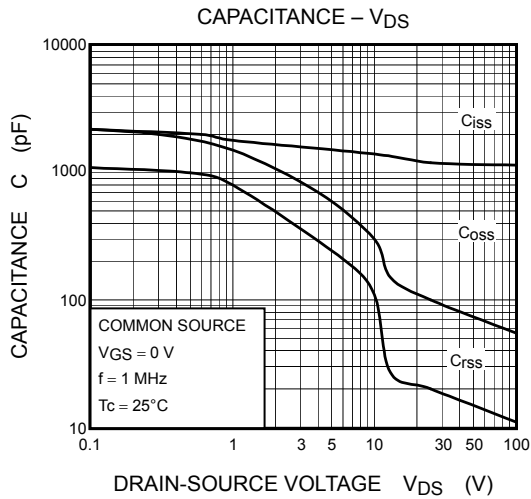
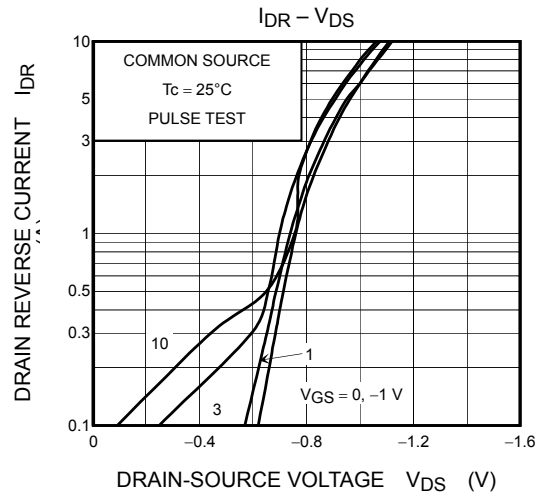
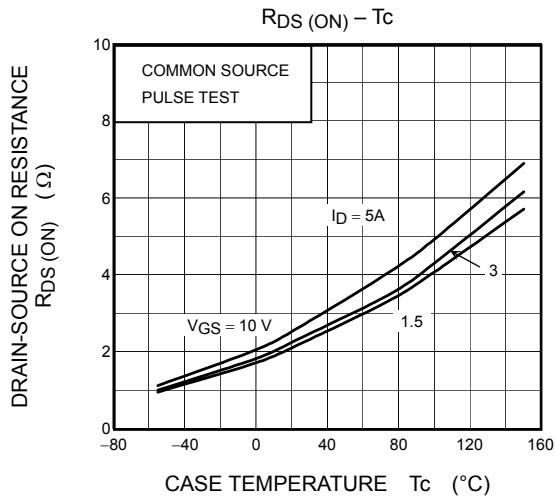
## Source-Drain Ratings and Characteristics (Ta = 25°C)

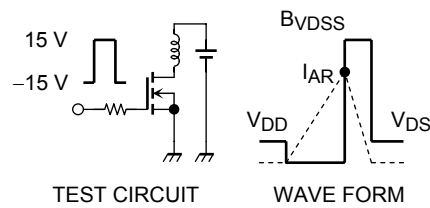
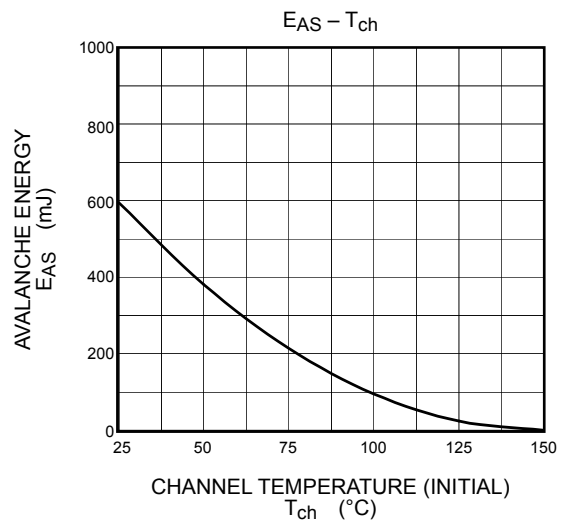
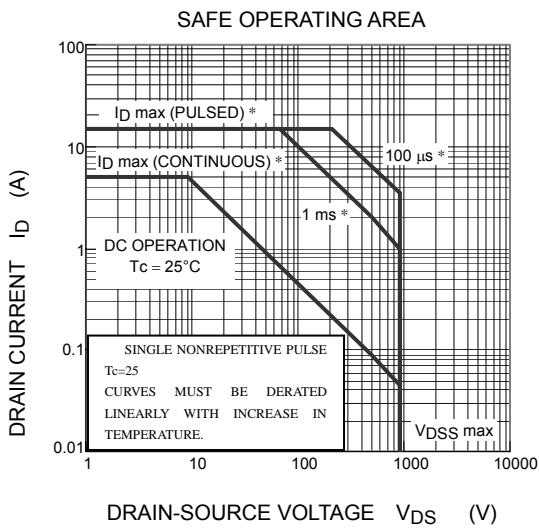
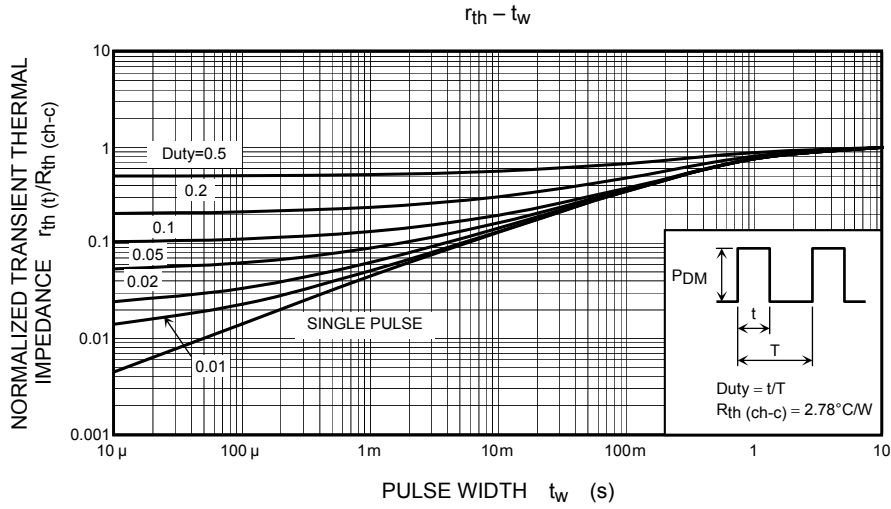
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)		$I_{DR}$	—	—	—	5	A
Pulse drain reverse current (Note 1)		$I_{DRP}$	—	—	—	15	A
Forward voltage (diode)		$V_{DSF}$	$I_{DR} = 5 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	-1.7	V
Reverse recovery time		$t_{rr}$	$I_{DR} = 5 \text{ A}, V_{GS} = 0 \text{ V},$	—	900	—	ns
Reverse recovery charge		$Q_{rr}$	$dI_{DR}/dt = 100 \text{ A}/\mu\text{s}$	—	5.4	—	$\mu\text{C}$

## Marking









$R_G = 25 \Omega$   
 $V_{DD} = 90 \text{ V}, L = 43.6 \text{ mH}$

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

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