

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

## 2SK3544

### Switching Regulator Applications

- Low drain-source ON-resistance:  $R_{DS(ON)} = 0.29 \Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 5.8 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 100 \mu\text{A}$  (max) ( $V_{DSS} = 450 \text{ V}$ )
- Enhancement mode:  $V_{th} = 3.0$  to  $5.0 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

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

Characteristic		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	450	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )		$V_{DGR}$	450	V
Gate-source voltage		$V_{GSS}$	$\pm 30$	V
Drain current	DC (Note 1)	$I_D$	13	A
	Pulse (Note 1)	$I_{DP}$	52	
Drain power dissipation ( $T_c = 25^\circ\text{C}$ )		$P_D$	100	W
Single-pulse avalanche energy (Note 2)		$E_{AS}$	350	mJ
Avalanche current		$I_{AR}$	13	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 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

Characteristic	Symbol	Max	Unit
Thermal resistance, channel to case	$R_{th(ch-c)}$	1.25	$^\circ\text{C/W}$

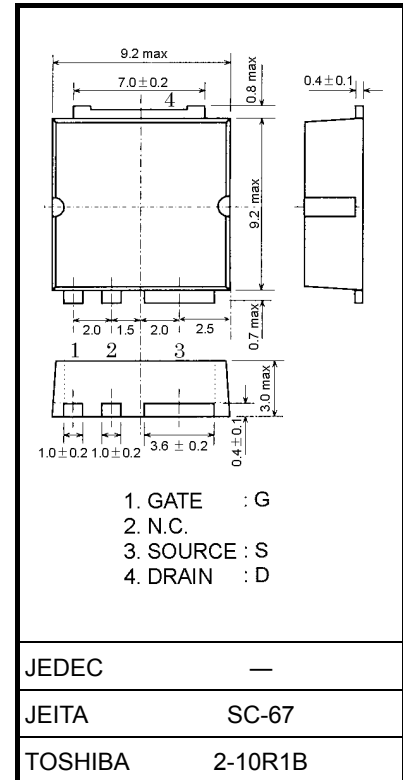
Note 1: Ensure that the channel temperature does not exceed  $150^\circ\text{C}$ .

Note 2:  $V_{DD} = 90 \text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 3.46 \text{ mH}$ ,  $R_G = 25 \Omega$ ,  $I_{AR} = 13 \text{ A}$

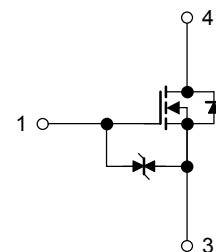
Note 3: Repetitive rating; pulse width limited by maximum channel temperature

This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 0.74 g (typ.)



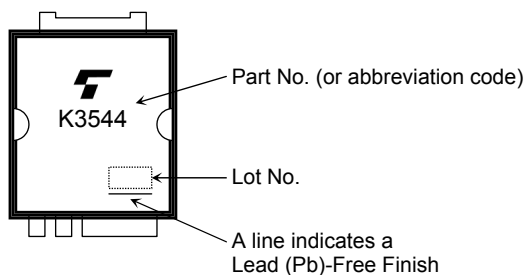
## Electrical Characteristics (Ta = 25°C)

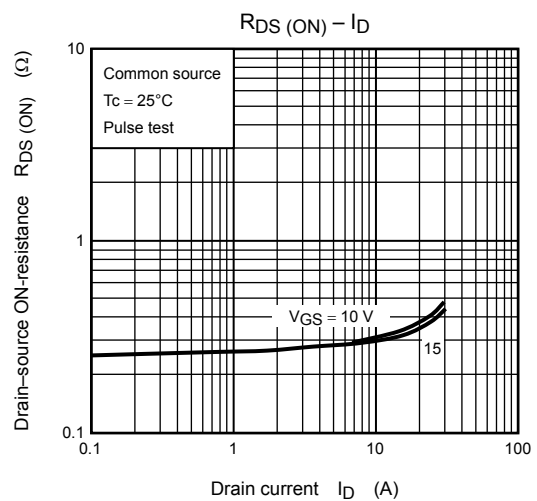
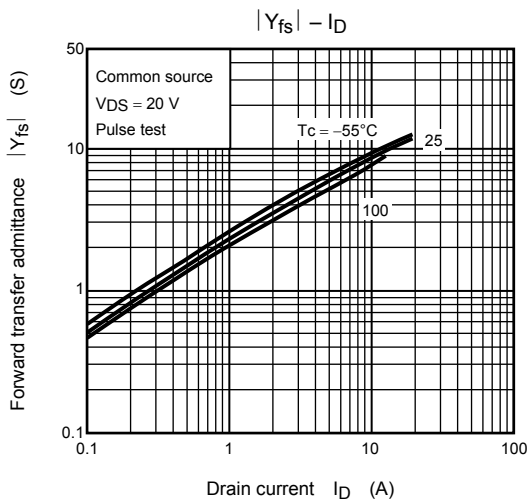
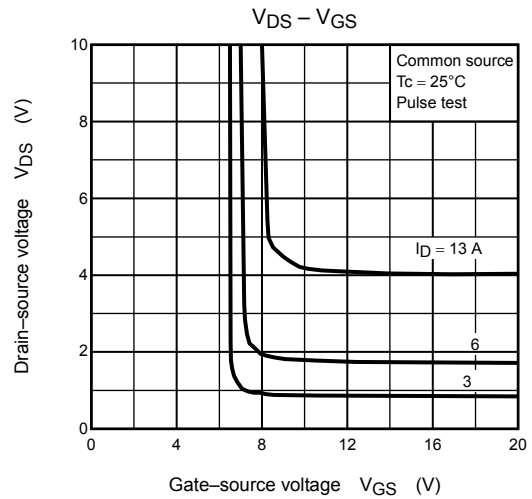
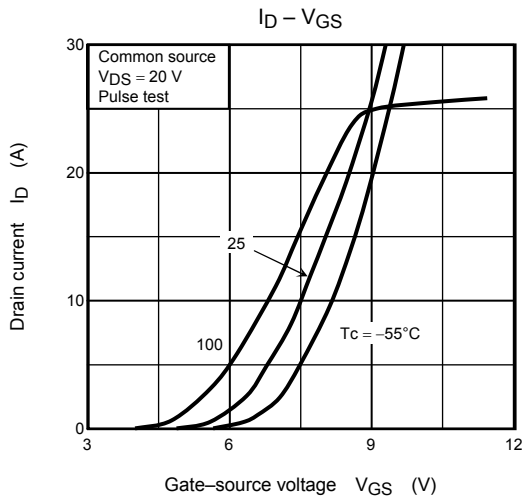
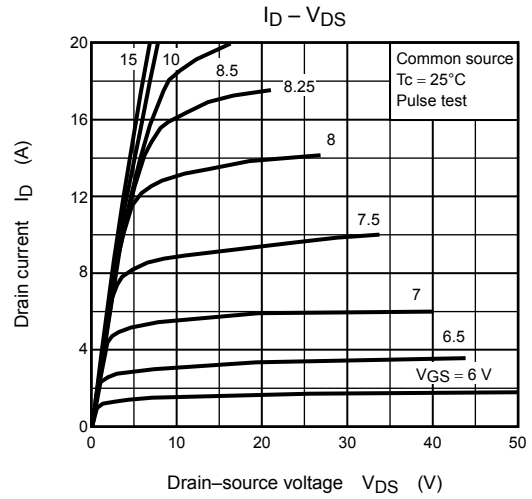
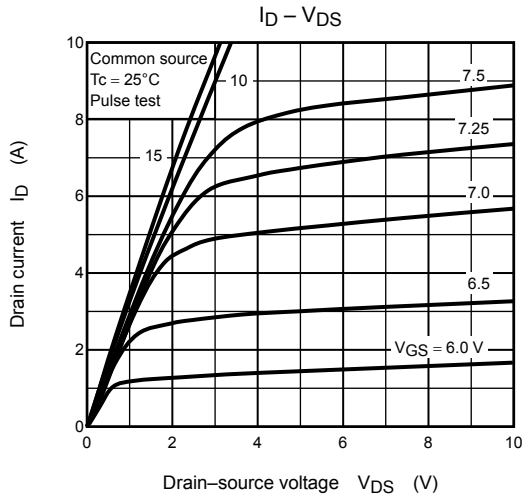
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 25 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Gate–source breakdown voltage		$V_{(BR)GSS}$	$I_G = \pm 10 \mu\text{A}, V_{DS} = 0 \text{ V}$	$\pm 30$	—	—	V
Drain cutoff current		$I_{DSS}$	$V_{DS} = 450 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	100	$\mu\text{A}$
Drain–source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$	450	—	—	V
Gate threshold voltage		$V_{th}$	$V_{DS} = 10 \text{ V}, I_D = 1 \text{ mA}$	3.0	—	5.0	V
Drain–source ON-resistance		$R_{DS(ON)}$	$V_{GS} = 10 \text{ V}, I_D = 6 \text{ A}$	—	0.29	0.4	$\Omega$
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10 \text{ V}, I_D = 6 \text{ A}$	3.0	5.8	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	1600	—	pF
Reverse transfer capacitance		$C_{rss}$		—	17	—	
Output capacitance		$C_{oss}$		—	220	—	
Switching time	Rise time	$t_r$		—	28	—	ns
	Turn-on time	$t_{on}$		—	45	—	
	Fall time	$t_f$		—	10	—	
	Turn-off time	$t_{off}$		Duty $\leq 1\%$ , $t_w = 10 \mu\text{s}$	—	56	
Total gate charge		$Q_g$	$V_{DD} \approx 360 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 13 \text{ A}$	—	34	—	nC
Gate–source charge		$Q_{gs}$		—	19	—	
Gate–drain charge		$Q_{gd}$		—	15	—	

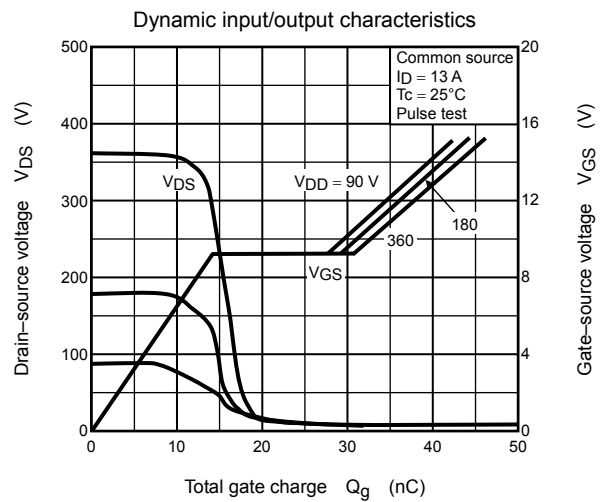
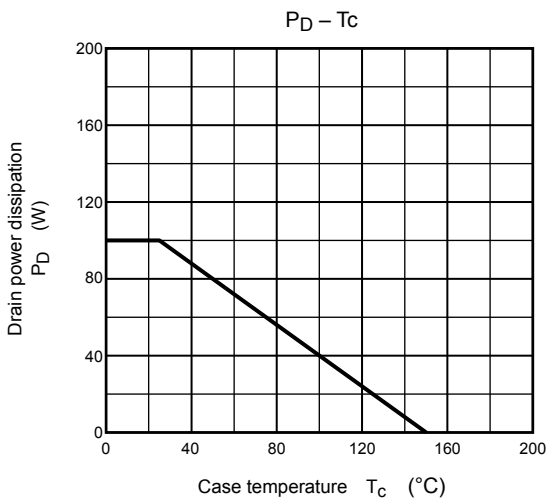
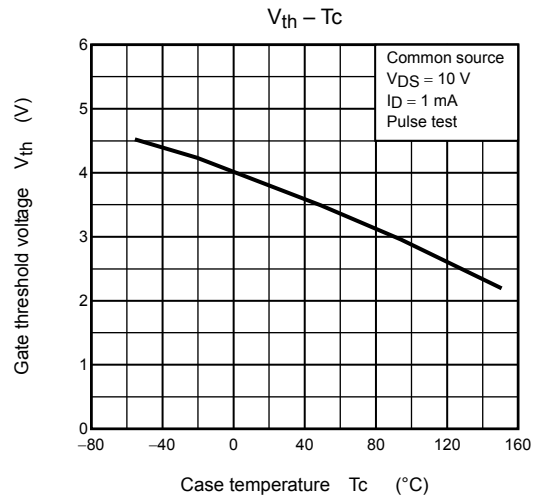
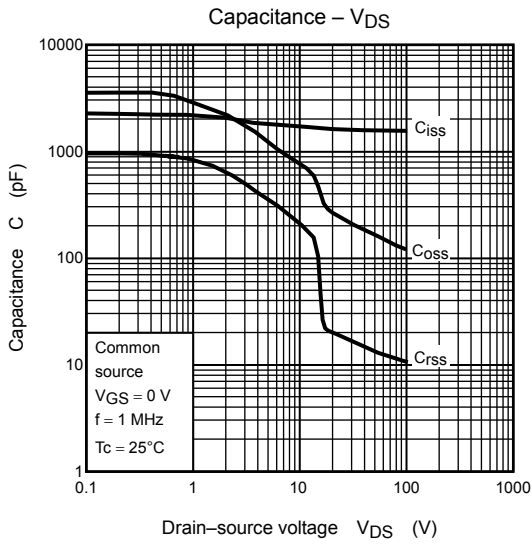
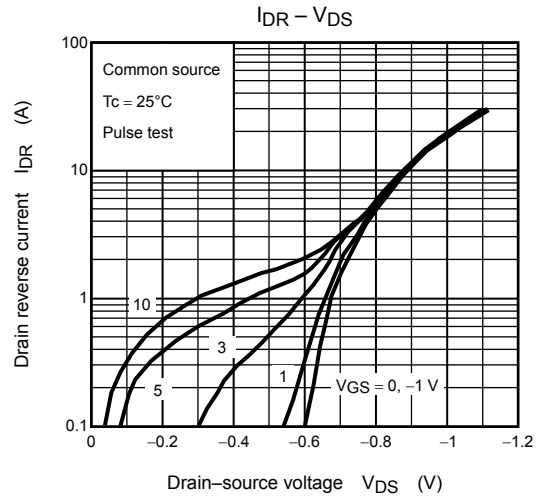
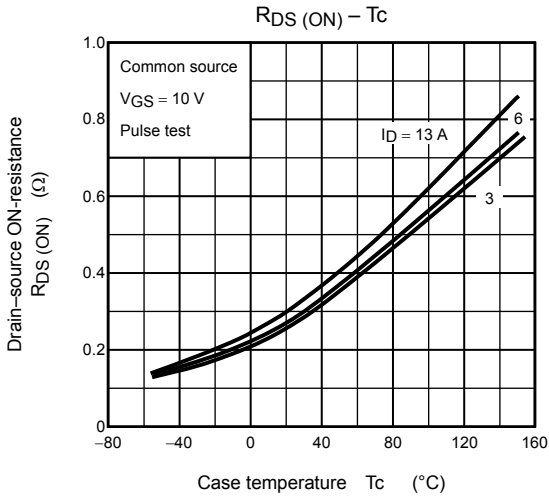
## Source–Drain Ratings and Characteristics (Ta = 25°C)

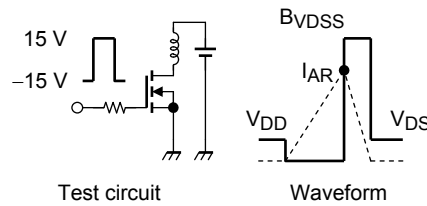
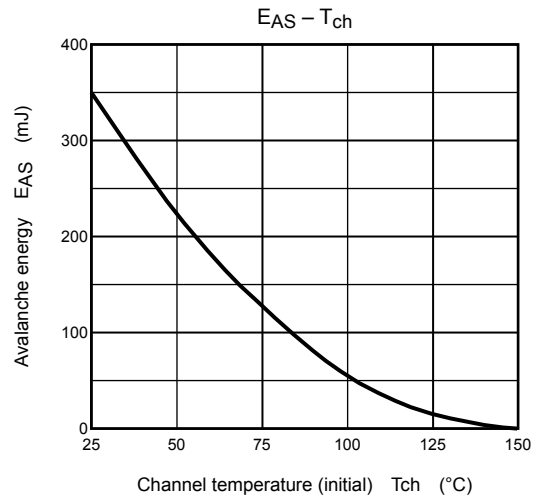
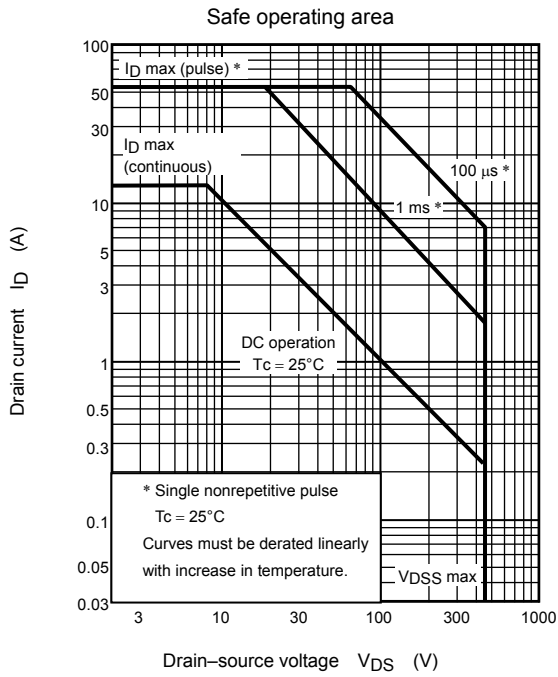
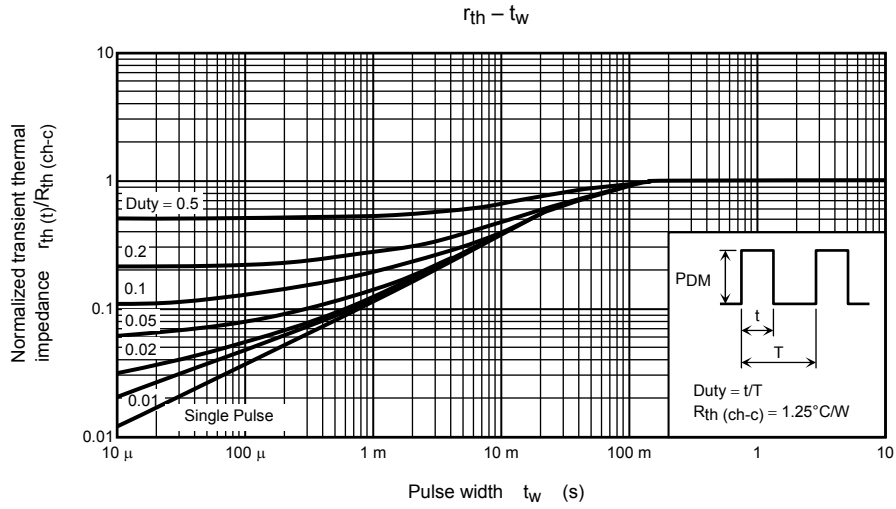
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	$I_{DR}$	—	—	—	13	A
Pulse drain reverse current (Note 1)	$I_{DRP}$	—	—	—	52	A
Forward voltage (diode)	$V_{DSF}$	$I_{DR} = 13 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	-1.7	V
Reverse recovery time	$t_{rr}$	$I_{DR} = 13 \text{ A}, V_{GS} = 0 \text{ V},$	—	300	—	ns
Reverse recovery charge	$Q_{rr}$	$dI_{DR}/dt = 100 \text{ A}/\mu\text{s}$	—	3.4	—	$\mu\text{C}$

## Marking









$R_G = 25 \Omega$   
 $V_{DD} = 90 V, L = 3.46 mH$

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

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20070701-EN GENERAL

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