

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

## 2SK3844

Switching Regulator, DC-DC Converter Applications  
Motor Drive Applications

Unit: mm

- Low drain-source ON resistance:  $R_{DS(ON)} = 4.1 \text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 63 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 100 \text{ }\mu\text{A}$  (max) ( $V_{DS} = 60 \text{ V}$ )
- Enhancement mode:  $V_{th} = 2.0$  to  $4.0 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

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

Characteristics		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	60	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )		$V_{DGR}$	60	V
Gate-source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	45	A
	Pulse (Note 1)	$I_{DP}$	180	
Drain power dissipation ( $T_c = 25^\circ\text{C}$ )		$P_D$	45	W
Single pulse avalanche energy (Note 2)		$E_{AS}$	527	mJ
Avalanche current		$I_{AR}$	45	A
Repetitive avalanche energy (Note 3)		$E_{AR}$	4.0	mJ
Channel temperature		$T_{ch}$	150	$^\circ\text{C}$
Storage temperature range		$T_{stg}$	$-55 \sim 150$	$^\circ\text{C}$

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

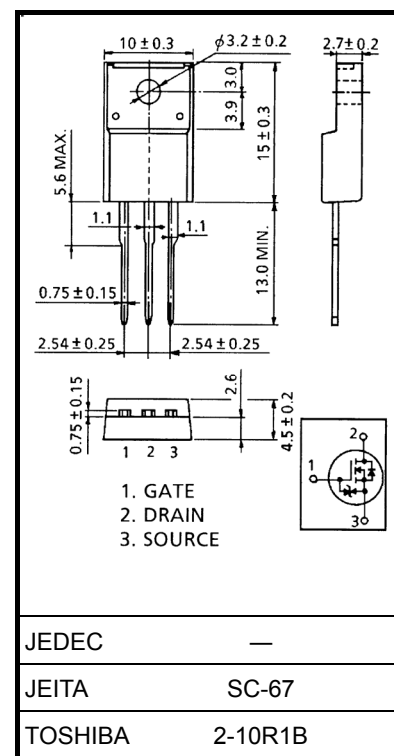
Characteristics	Symbol	Max	Unit
Thermal resistance, channel to case	$R_{th(ch-c)}$	2.78	$^\circ\text{C/W}$
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	62.5	$^\circ\text{C/W}$

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

Note 2:  $V_{DD} = 25 \text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 353 \text{ }\mu\text{H}$ ,  $I_{AR} = 45 \text{ A}$ ,  $R_G = 25 \text{ }\Omega$

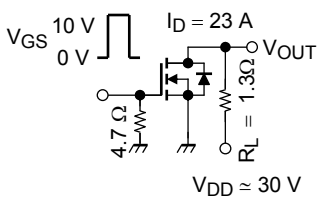
Note 3: Repetitive rating: pulse width limited by maximum channel temperature

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



Weight: 1.9 g (typ.)

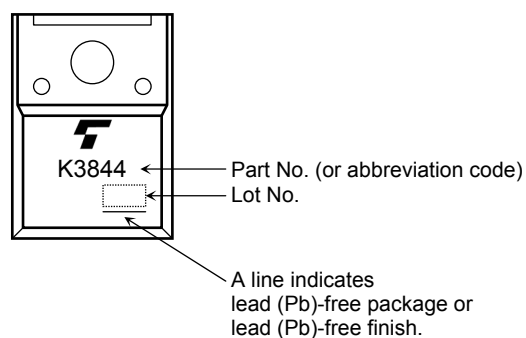
## Electrical Characteristics (Ta = 25°C)

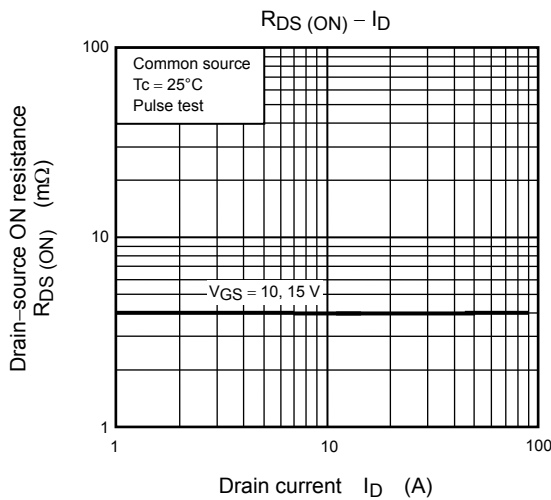
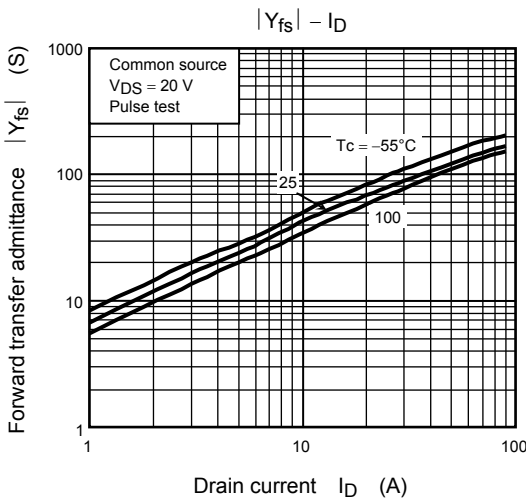
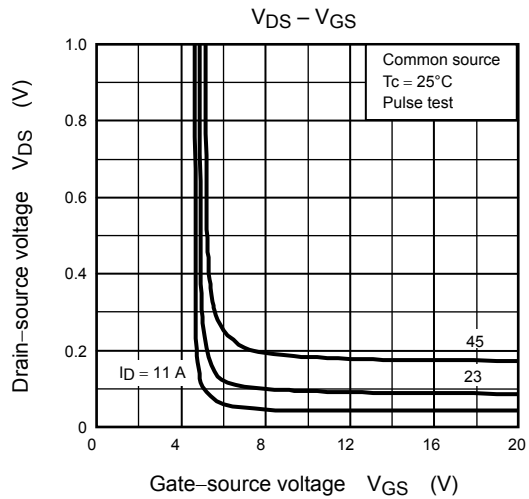
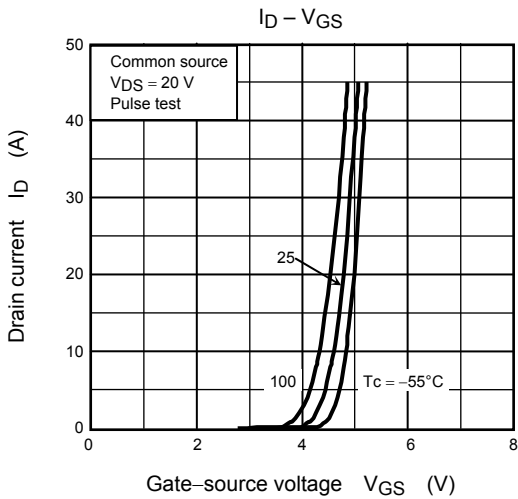
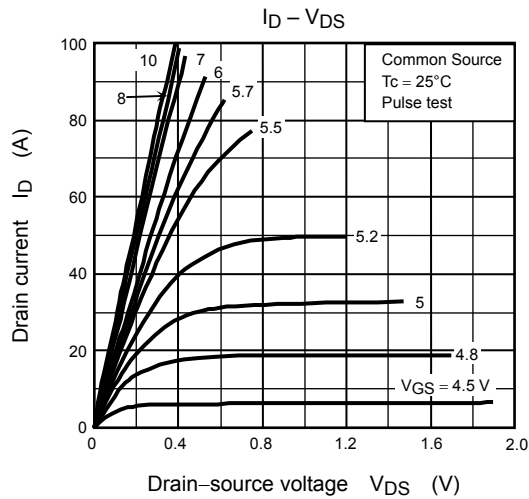
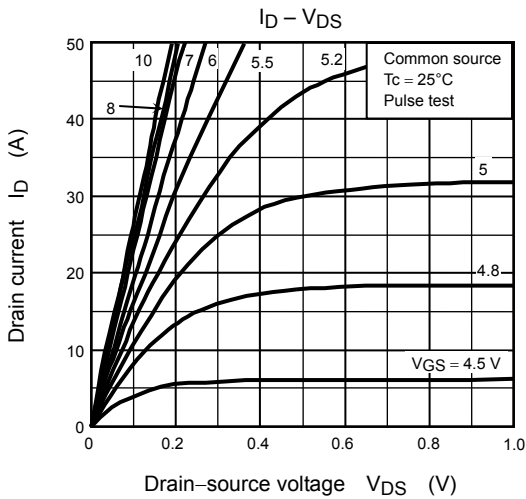
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cut-off current		$I_{DSS}$	$V_{DS} = 60 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	100	$\mu\text{A}$
Drain-source breakdown voltage	$V_{(BR) DSS}$		$I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$	60	—	—	V
	$V_{(BR) DSX}$		$I_D = 10 \text{ mA}, V_{GS} = -20 \text{ V}$	35	—	—	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		$R_{DS(ON)}$	$V_{GS} = 10 \text{ V}, I_D = 23 \text{ A}$	—	4.1	5.8	$\text{m}\Omega$
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10 \text{ V}, I_D = 23 \text{ A}$	32	63	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	12400	—	pF
Reverse transfer capacitance		$C_{rss}$		—	700	—	
Output capacitance		$C_{oss}$		—	1100	—	
Switching time	Rise time	$t_r$	 <p><math>V_{GS} = 10 \text{ V}, 0 \text{ V}</math>  <math>I_D = 23 \text{ A}</math>  <math>R_L = 1.3 \Omega</math>  <math>V_{DD} \approx 30 \text{ V}</math>  Duty <math>\leq 1\%</math>, <math>t_w = 10 \mu\text{s}</math></p>	—	18	—	ns
	Turn-on time	$t_{on}$		—	45	—	
	Fall time	$t_f$		—	35	—	
	Turn-off time	$t_{off}$		—	200	—	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx 48 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 45 \text{ A}$	—	196	—	nC
Gate-source charge		$Q_{gs}$		—	148	—	
Gate-drain ("miller") charge		$Q_{gd}$		—	48	—	

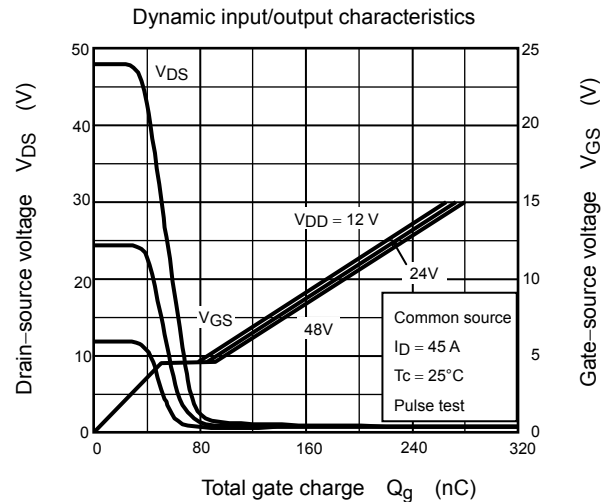
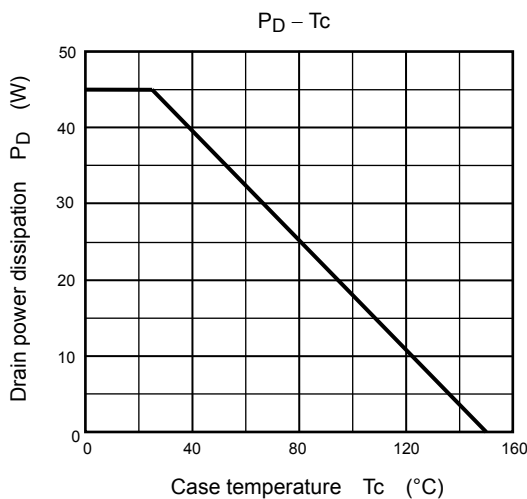
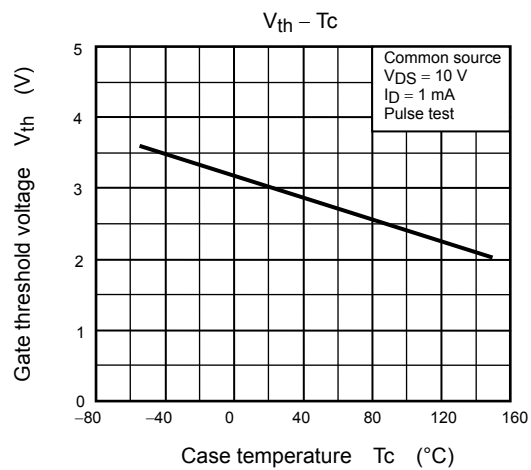
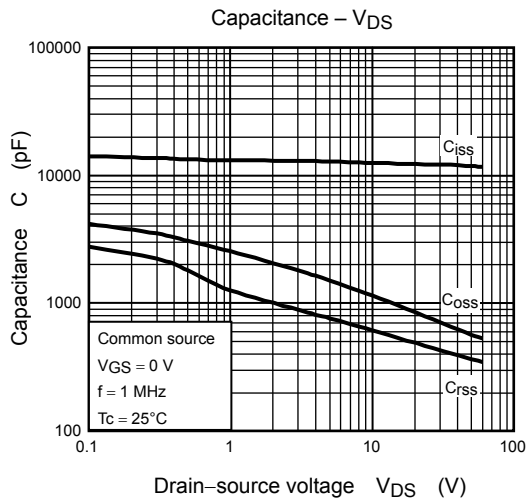
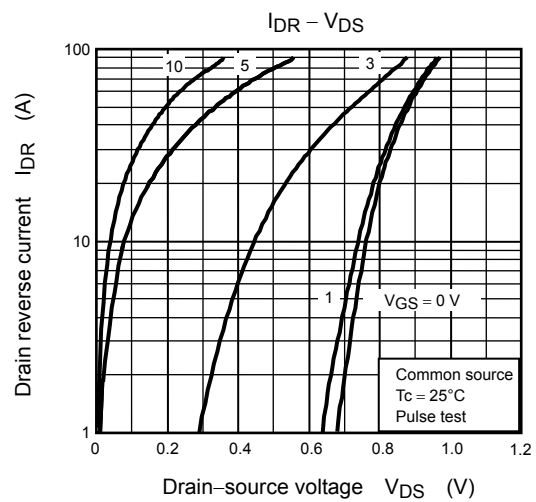
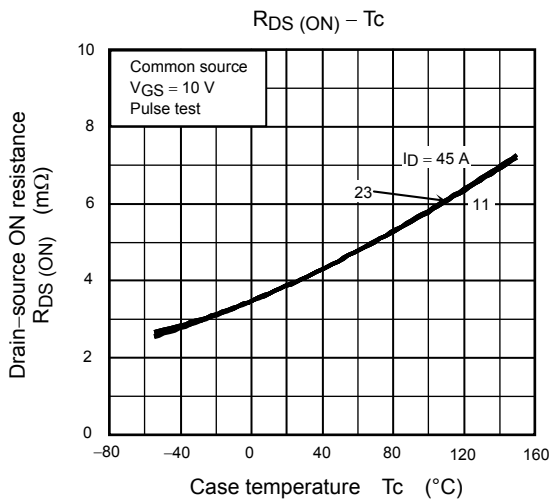
## Source-Drain Ratings and Characteristics (Ta = 25°C)

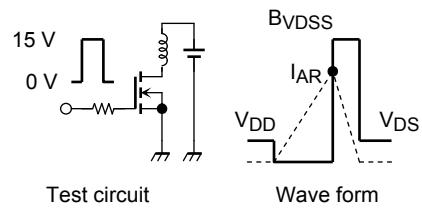
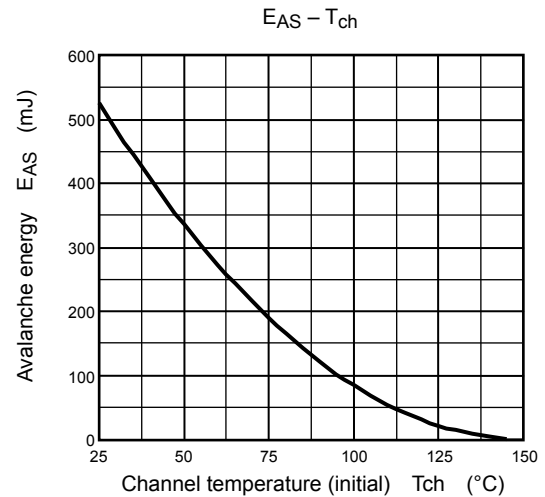
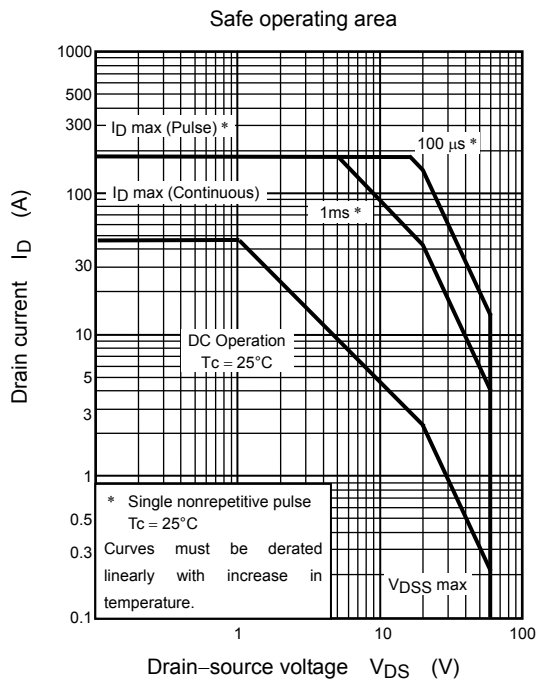
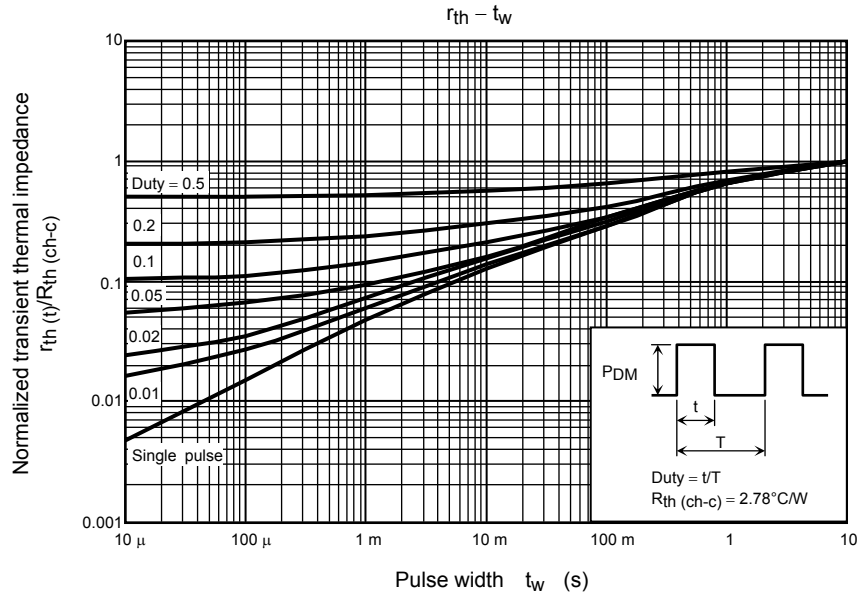
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	$I_{DR1}$	—	—	—	45	A
Pulse drain reverse current (Note 1)	$I_{DRP}$	—	—	—	180	A
Forward voltage (diode)	$V_{DSF}$	$I_{DR} = 45 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	-1.5	V
Reverse recovery time	$t_{rr}$	$I_{DR} = 45 \text{ A}, V_{GS} = 0 \text{ V},$ $dI_{DR}/dt = 50 \text{ A}/\mu\text{s}$	—	67	—	ns
Reverse recovery charge	$Q_{rr}$		—	70	—	nC

## Marking









$$R_G = 25 \, \Omega$$

$$V_{DD} = 25 \, \text{V}, L = 353 \, \mu\text{H}$$

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

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