

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

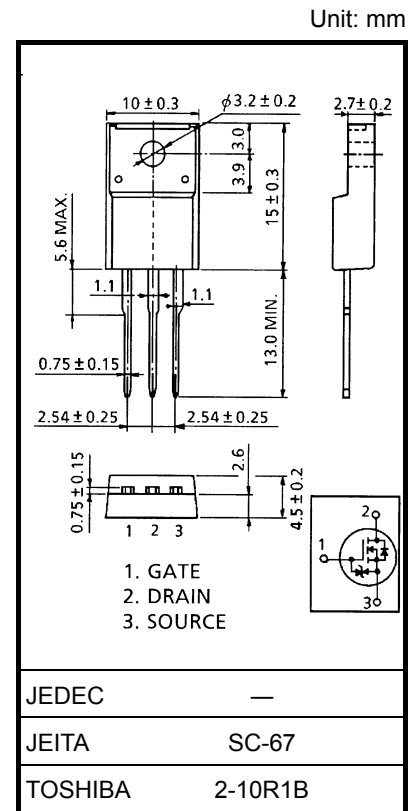
# 2SK3846

Switching Regulator, DC/DC Converter and Motor Drive Applications

- Low drain-source ON resistance :  $R_{DS(ON)} = 12 \text{ m}\Omega$  (typ.)
- High forward transfer admittance :  $|Y_{fs}| = 33 \text{ S}$  (typ.)
- Low leakage current :  $I_{DSS} = 100 \text{ }\mu\text{A}$  (max) ( $V_{DS} = 40 \text{ V}$ )
- Enhancement mode :  $V_{th} = 1.5\sim 2.5 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

## Maximum Ratings (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Drain-source voltage	$V_{DSS}$	40	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )	$V_{DGR}$	40	V
Gate-source voltage	$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	26 A
	Pulse (Note 1)	$I_{DP}$	78 A
Drain power dissipation ( $T_c = 25^\circ\text{C}$ )	$P_D$	25	W
Single-pulse avalanche energy (Note 2)	$E_{AS}$	63	mJ
Avalanche current	$I_{AR}$	26	A
Repetitive avalanche energy (Note 3)	$E_{AR}$	2.5	mJ
Channel temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage temperature range	$T_{stg}$	-55~150	$^\circ\text{C}$



Weight: 1.9 g (typ.)

## Thermal Characteristics

Characteristic	Symbol	Max	Unit
Thermal resistance, channel to case	$R_{th(ch-c)}$	5.0	$^\circ\text{C/W}$
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°C.

Note 2:  $V_{DD} = 25 \text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 97 \text{ }\mu\text{H}$ ,  $I_{AR} = 26 \text{ A}$ ,  $R_G = 25 \text{ }\Omega$

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

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

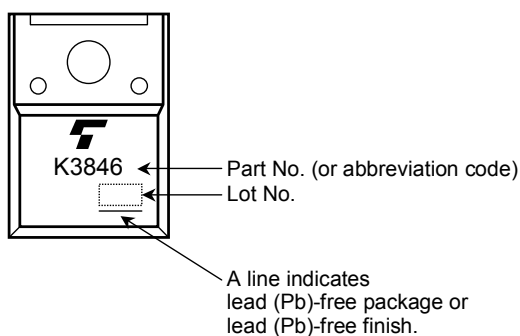
## Electrical Characteristics (Ta = 25°C)

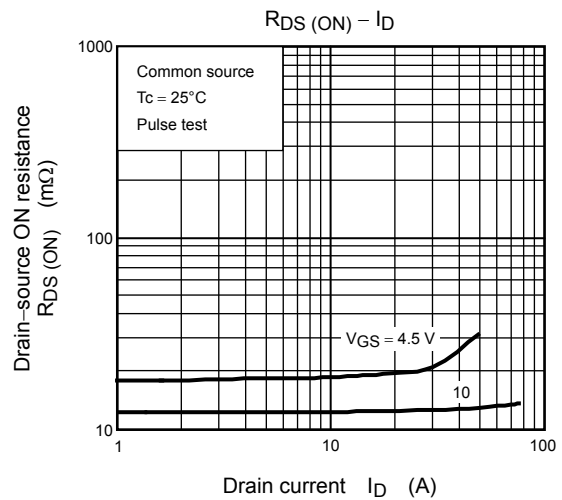
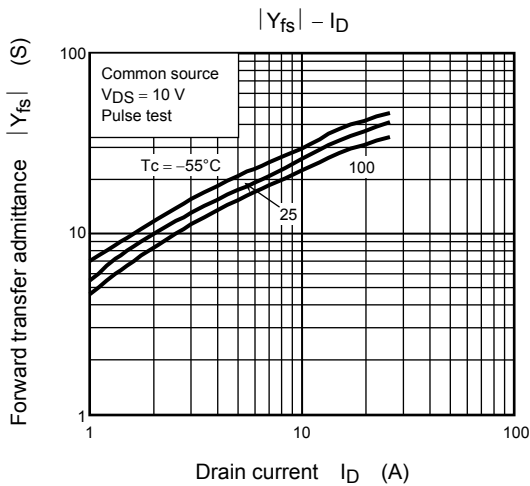
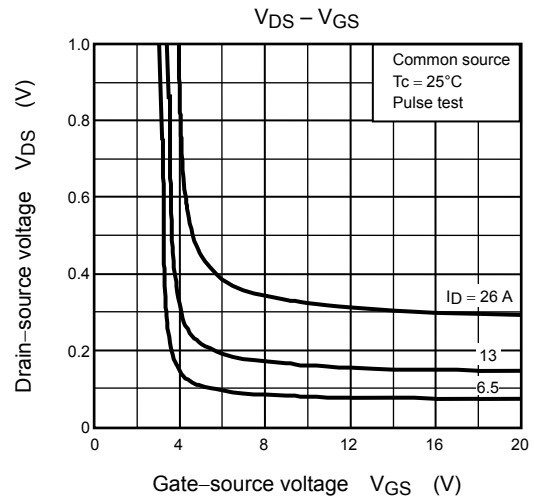
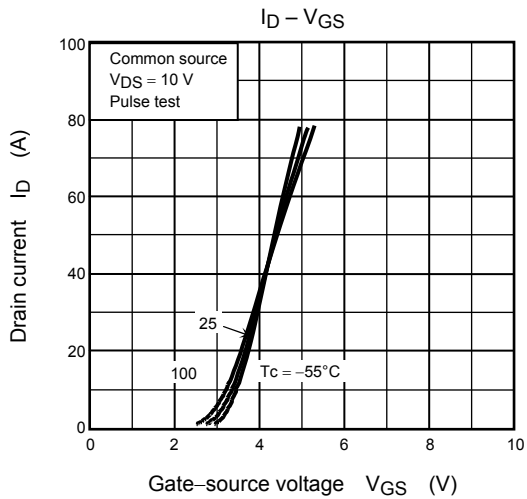
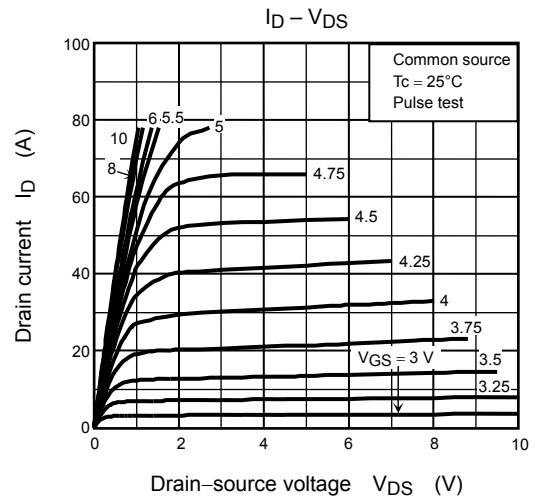
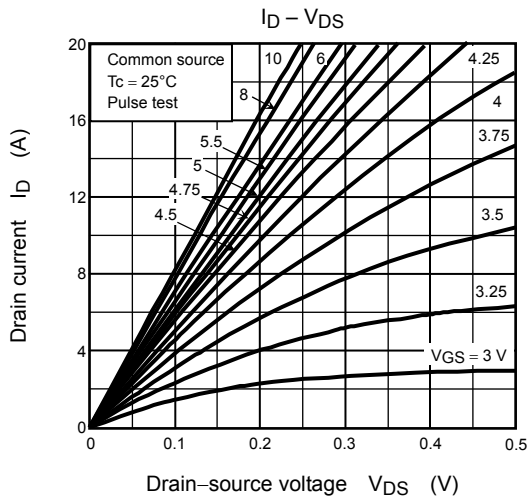
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cutoff current		$I_{DSS}$	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$	—	—	100	$\mu\text{A}$
Drain–source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	40	—	—	V
		$V_{(BR)DSX}$	$I_D = 10\text{ mA}, V_{GS} = -20\text{ V}$	15	—	—	
Gate threshold voltage		$V_{th}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	1.5	—	2.5	V
Drain–source ON resistance		$R_{DS(ON)}$	$V_{GS} = 4.5\text{ V}, I_D = 13\text{ A}$	—	19	26	m $\Omega$
			$V_{GS} = 10\text{ V}, I_D = 13\text{ A}$	—	12	16	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 13\text{ A}$	16	33	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	1980	—	pF
Reverse transfer capacitance		$C_{rss}$		—	210	—	
Output capacitance		$C_{oss}$		—	300	—	
Switching time	Rise time	$t_r$		—	7	—	ns
	Turn-on time	$t_{on}$		—	22	—	
	Fall time	$t_f$		—	10	—	
	Turn-off time	$t_{off}$		Duty $\leq 1\%$ , $t_w = 10\text{ }\mu\text{s}$	—	60	
Total gate charge (gate–source plus gate–drain)		$Q_g$	$V_{DD} \approx 32\text{ V}, V_{GS} = 10\text{ V}, I_D = 26\text{ A}$	—	40	—	nC
Gate–source charge		$Q_{gs}$		—	28	—	
Gate–drain (“Miller”) Charge		$Q_{gd}$		—	12	—	

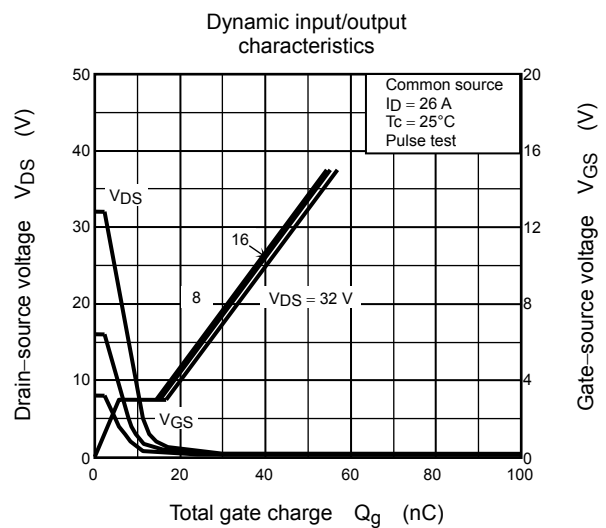
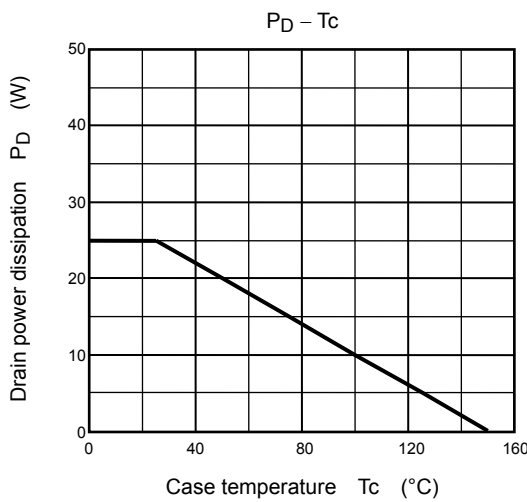
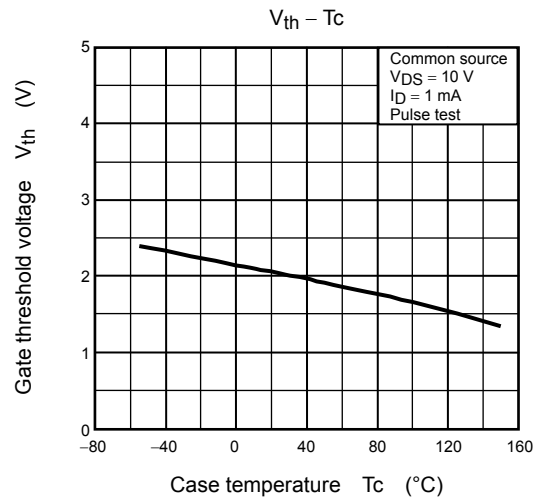
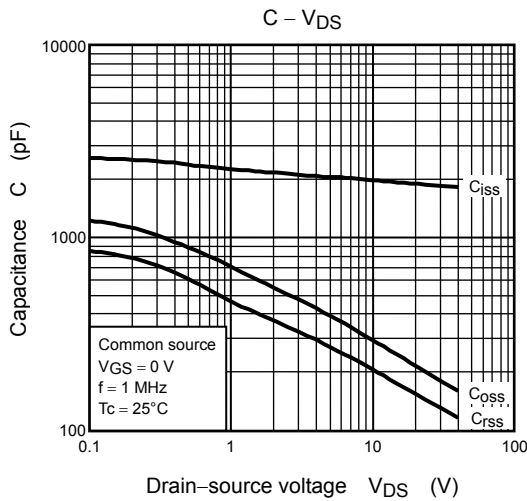
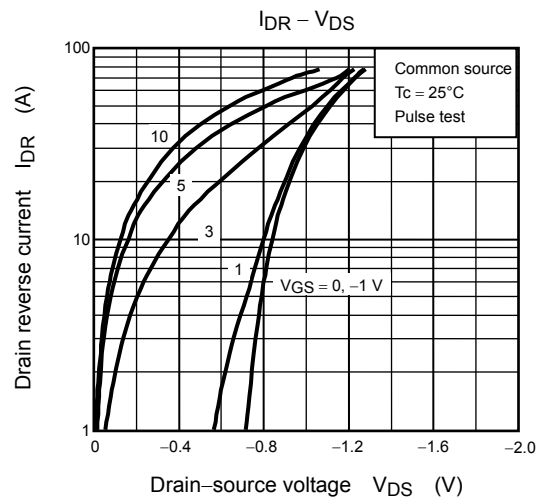
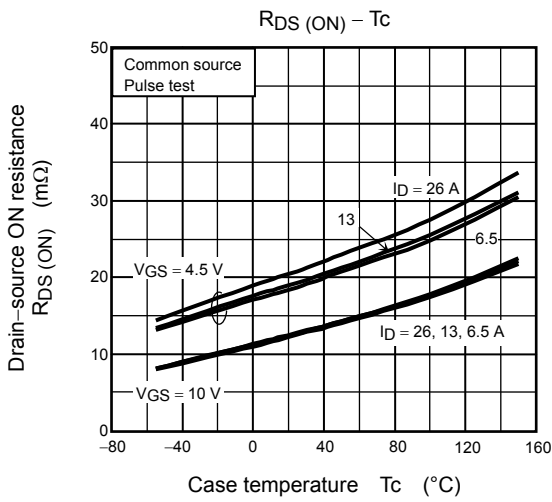
## Source–Drain Ratings and Characteristics (Ta = 25°C)

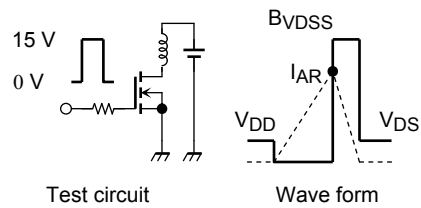
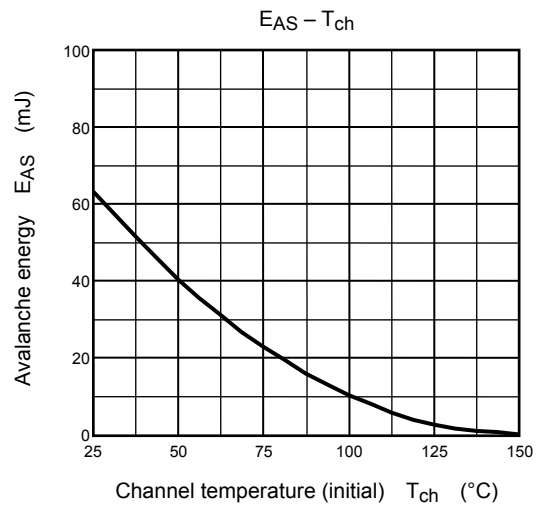
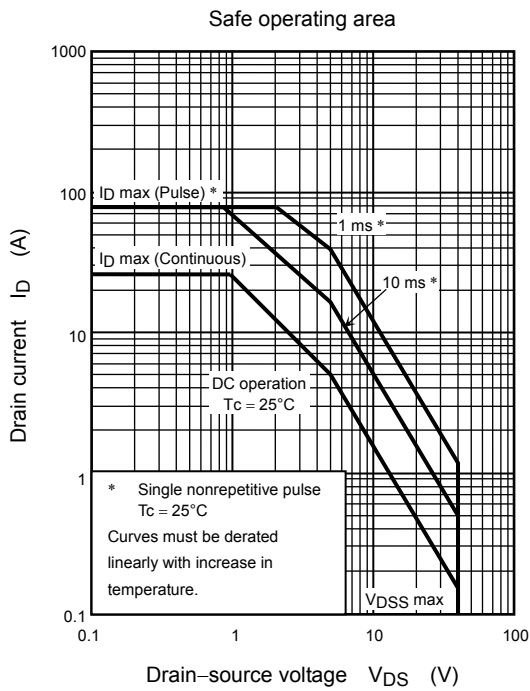
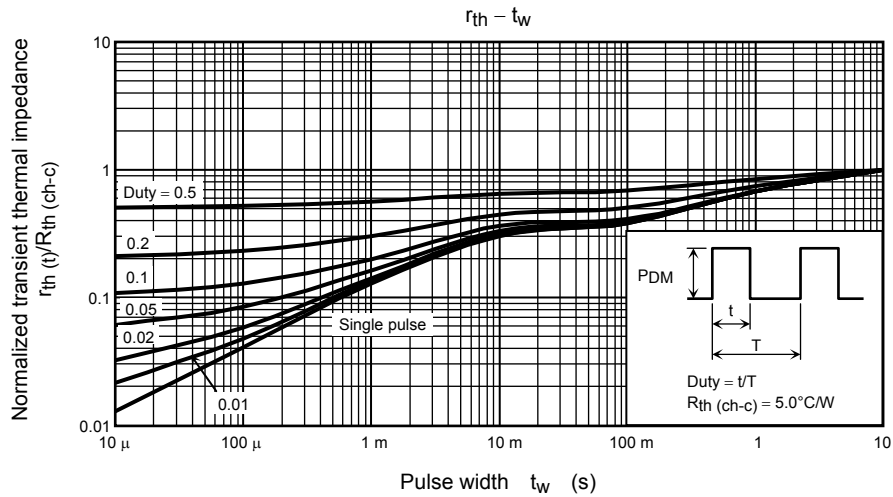
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	$I_{DR}$	—	—	—	26	A
Pulse drain reverse current (Note 1)	$I_{DRP}$	—	—	—	78	A
Forward voltage (diode)	$V_{DSF}$	$I_{DR} = 26\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.5	V
Reverse recovery time	$t_{rr}$	$I_{DR} = 26\text{ A}, V_{GS} = 0\text{ V}$	—	40	—	ns
Reverse recovery charge	$Q_{rr}$	$dI_{DR} / dt = 50\text{ A} / \mu\text{s}$	—	24	—	nC

## Marking









$R_G = 25 \Omega$   
 $V_{DD} = 25 V, L = 48 \mu H$

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

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