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

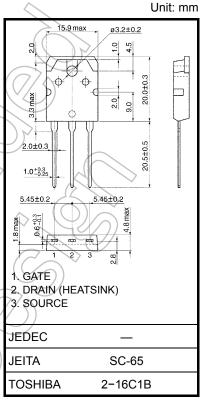
# 2SK3878

## **Switching Regulator Applications**

- Low drain-source ON-resistance:  $R_{DS(ON)} = 1.0 \Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fS}| = 7.0 \text{ S (typ.)}$
- Low leakage current: I<sub>DSS</sub> = 100 μA (max) (V<sub>DS</sub> = 720 V)
- Enhancement model:  $V_{th}$  = 2.0 to 4.0 V ( $V_{DS}$  = 10 V,  $I_D$  = 1 mA)

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

Characteristic			Symbol	Rating	Unit	
Drain-source voltage			$V_{DSS}$	900	(W)	
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )			$V_{DGR}$	900	V	
Gate-source voltage			$V_{GSS}$	±30	V	
Drain current	DC	(Note 1)	ΙD	9	Α	
	Pulse	(Note 1)	I <sub>DP</sub>	27	Α	
Drain power dissipation (Tc = 25°C)			PD	150	W	
Single pulse avalanche energy (Note 2)			EAS	778	mJ	
Avalanche current			I <sub>AR</sub>	)) 9	Α	
Repetitive avalanche energy (Note 3)			EAR	15	mJ	
Channel temperature			T <sub>ch</sub>	150	∫/°¢	
Storage temperature range			Tstg	-55 to 150	(Je)	



Weight: 4.6 g (typ.)

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

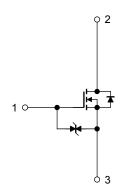
Characteristic	Symbol	Max	Unit
Thermal resistance, channel to case	Rth (ch-c)	0.833	°C/W
Thermal resistance, channel to ambient	R <sub>th (ch-a)</sub>	50	°C/W

Note 1: Ensure that the channel temperature does not exceed 150°C during use of the device.

Note 2:  $V_{DD} = 90 \text{ V}$ ,  $T_{ch} = 25^{\circ}\text{C}$ , L = 17.6 mH,  $R_G = 25 \Omega$ ,  $I_{AR} = 9 \text{ A}$ 

Note 3: Repetitive rating: pulse width limited by max junction temperature

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



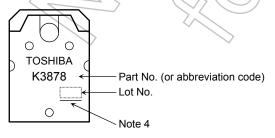
### **Electrical Characteristics (Ta = 25°C)**

Char	acteristic	Symbol	Test Condition	Min	Тур.	Max	Unit		
Gate leakage curi	ate leakage current I <sub>GSS</sub>		$V_{GS} = \pm 30 \text{ V}, V_{DS} = 0 \text{ V}$	_	_	±10	μА		
Gate-source brea	kdown voltage	V (BR) GSS	$I_G=\pm 10~\mu A,~V_{DS}=0~V$	±30	_	_	V		
Drain cutoff curre	nt	I <sub>DSS</sub>	V <sub>DS</sub> = 720 V, V <sub>GS</sub> = 0 V	/_	_	100	μА		
Drain-source brea	akdown voltage	V (BR) DSS	$I_D = 10$ mA, $V_{GS} = 0$ V	900	/	_	V		
Gate threshold voltage		V <sub>th</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA	2.0	) /_	4.0	V		
Drain-source ON resistance		R <sub>DS (ON)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 4 A		1.0	1.3	Ω		
Forward transfer admittance		Y <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 4 A	3.5	7.0	_	S		
Input capacitance		C <sub>iss</sub>		\	2200				
Reverse transfer	capacitance	C <sub>rss</sub>	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	_	45	_	pF		
Output capacitance		Coss		_	190	_			
Switching time	Rise time	t <sub>r</sub>	V <sub>GS</sub> D=4A	- (	25	7			
	Turn-on time	t <sub>on</sub>	0 V		65	) —			
	Fall time	t <sub>f</sub>	$\begin{array}{c c} G & \\ \downarrow \\ \uparrow \\ \uparrow$	<del>7</del> (5)	20	_	ns		
	Turn-off time	t <sub>off</sub>	Duty $\leq$ 1%, t <sub>W</sub> = 10 μs	) –	120	_			
Total gate charge (gate-source plus gate-drain)		Qg			60		_		
Gate-source charge		Qgs	$V_{DD} \approx 400 \text{ V}, V_{GS} = 10 \text{ V}, I_{D} = 9 \text{ A}$		34		nC		
Gate-drain ("Miller") charge		Qgd		_	26				

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

Characteristic	Symbol	Test Condition	Min	Тур.	Max	Unit
Continuous drain reverse current (Note 1)	I <sub>DR</sub>	_	_	_	9	Α
Pulse drain reverse current (Note 1)	IDRP		_	_	27	Α
Forward voltage (diode)	V <sub>DSF</sub>	I <sub>DR</sub> = 9 A, V <sub>GS</sub> = 0 V	_	_	-1.7	V
Reverse recovery time	∕> t <sub>rr</sub>	I <sub>DR</sub> = 9 A, V <sub>GS</sub> = 0 V,	_	1.4	_	μS
Reverse recovery charge	Q <sub>rr</sub>	dl <sub>DR</sub> /dt = 100 A/μs	_	16	_	μС

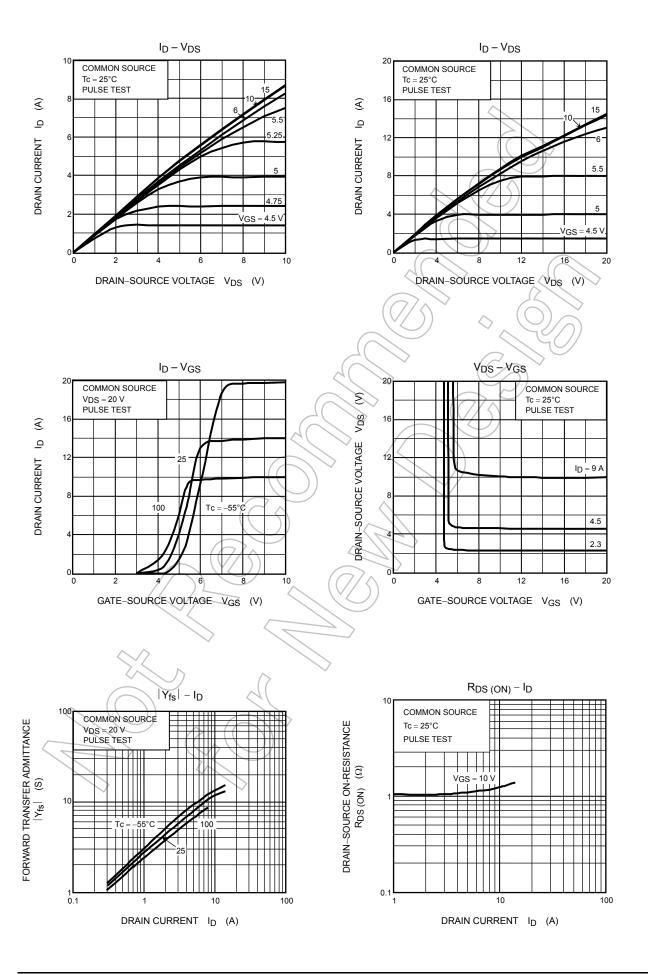
## Marking

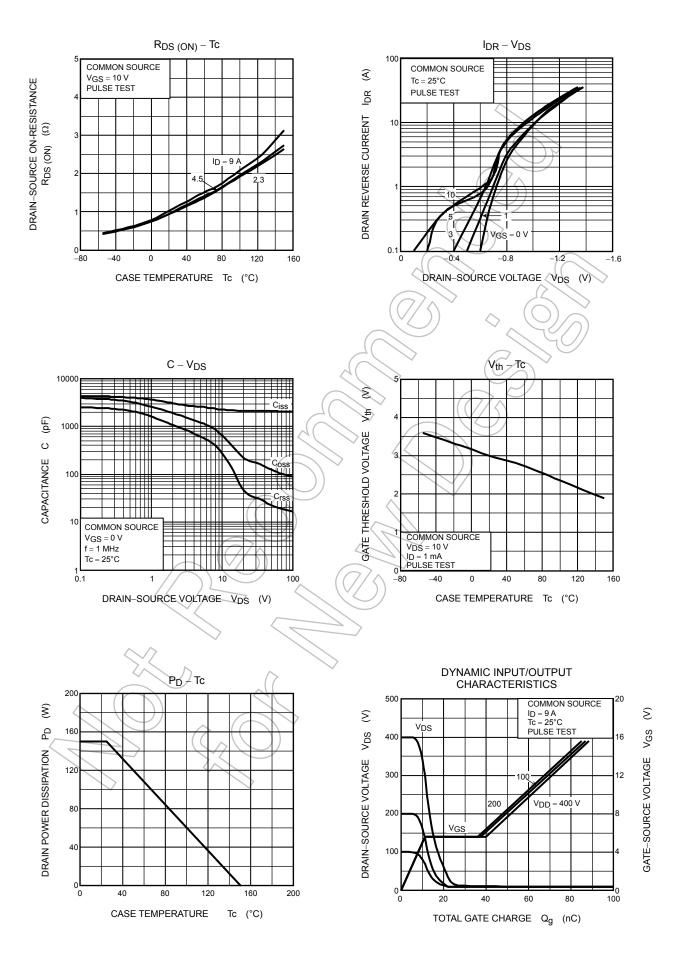


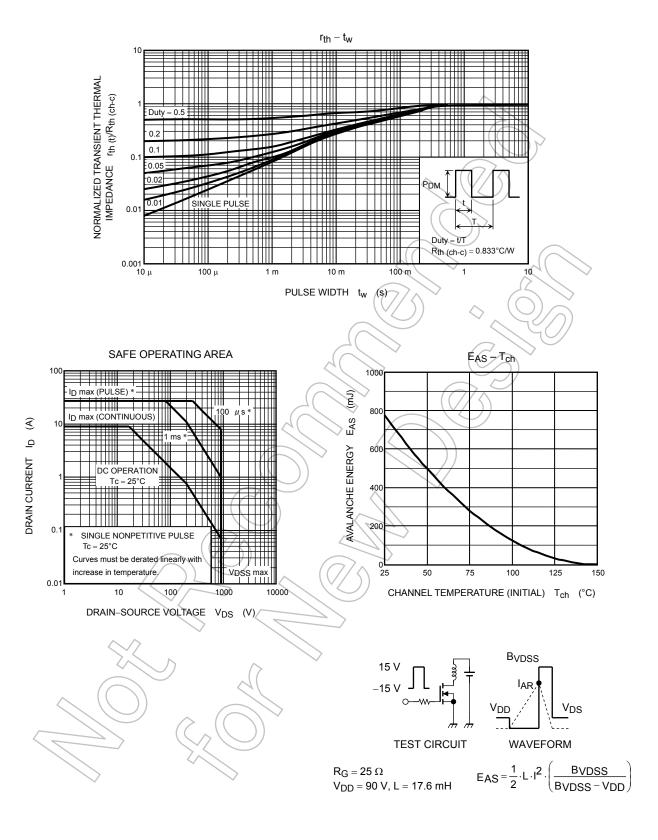
Note 4: A line under a Lot No. identifies the indication of product Labels.

Not underlined: [[Pb]]/INCLUDES > MCV Underlined: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

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