

# 2SK4003

## Chopper Regulator, DC-DC Converter and Motor Drive Applications

- Low drain-source ON-resistance:  $R_{DS(ON)} = 1.7 \Omega$  (typ.)
- Low leakage current:  $I_{DSS} = 100 \mu A$  (max) ( $V_{DS} = 600 V$ )
- Enhancement mode:  $V_{th} = 2.0$  to  $4.0 V$  ( $V_{DS} = 10 V, I_D = 1 mA$ )

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

Characteristic		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	600	V
Drain-gate voltage ( $R_{GS} = 20 k\Omega$ )		$V_{DGR}$	600	V
Gate-source voltage		$V_{GSS}$	$\pm 30$	V
Drain current	DC (Note 1)	$I_D$	3	A
	Pulse (Note 1)	$I_{DP}$	12	A
Drain power dissipation ( $T_c = 25^\circ C$ )		$P_D$	20	W
Single-pulse avalanche energy (Note 2)		$E_{AS}$	168	mJ
Avalanche current		$I_{AR}$	3	A
Repetitive avalanche energy (Note 3)		$E_{AR}$	2	mJ
Channel temperature		$T_{ch}$	150	$^\circ C$
Storage temperature range		$T_{stg}$	-55 to 150	$^\circ C$

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 ambient	$R_{th(ch-a)}$	125	$^\circ C / W$

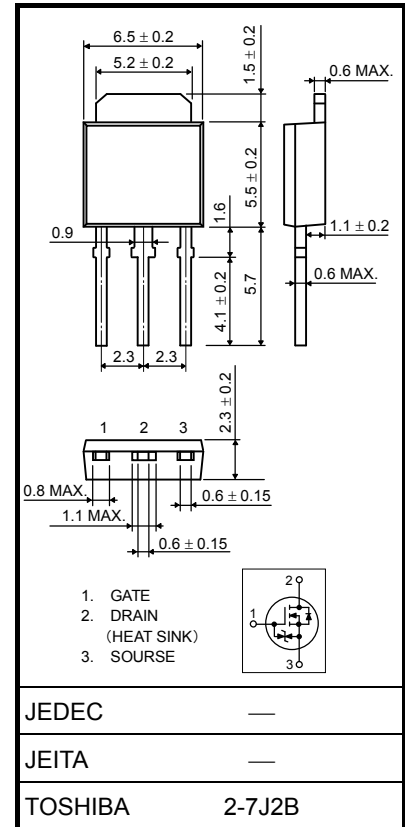
Note 1: Ensure that the channel temperature does not exceed  $150^\circ C$ .

Note 2:  $V_{DD} = 90 V, T_{ch} = 25^\circ C$  (initial),  $L = 8.2 mH, R_G = 25 \Omega, I_{AR} = 6 A$

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

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

Unit: mm



Weight: 0.36 g (typ.)

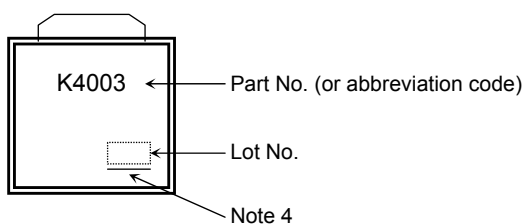
## Electrical Characteristics (Ta = 25°C)

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		$I_{DSS}$	$V_{DS} = 600 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	100	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$	600	—	—	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		$R_{DS(ON)}$	$V_{GS} = 10 \text{ V}, I_D = 1.5 \text{ A}$	—	1.7	2.2	$\Omega$
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10 \text{ V}, I_D = 1.5 \text{ A}$	0.5	2.0	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	600	—	pF
Reverse transfer capacitance		$C_{rss}$		—	7	—	
Output capacitance		$C_{oss}$		—	60	—	
Switching time	Rise time	$t_r$	<p>Duty <math>\leq 1\%</math>, <math>t_w = 10 \mu\text{s}</math></p>	—	16	—	ns
	Turn-on time	$t_{on}$		—	40	—	
	Fall time	$t_f$		—	18	—	
	Turn-off time	$t_{off}$		—	80	—	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx 400 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 3 \text{ A}$	—	15	—	nC
Gate-source charge		$Q_{gs}$		—	9	—	
Gate-drain ("Miller") charge		$Q_{gd}$		—	6	—	

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

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	$I_{DR}$	—	—	—	3	A
Pulse drain reverse current (Note 1)	$I_{DRP}$	—	—	—	12	A
Forward voltage (diode)	$V_{DSF}$	$I_{DR} = 3 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	-1.7	V
Reverse recovery time	$t_{rr}$	$I_{DR} = 3 \text{ A}, V_{GS} = 0 \text{ V}$	—	800	—	ns
Reverse recovery charge	$Q_{rr}$	$dI_{DR} / dt = 100 \text{ A} / \mu\text{s}$	—	5	—	$\mu\text{C}$

## Marking



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

[[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

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