

# 2SK2964

Chopper Regulators, DC-DC Converters and Motor Drive Applications

- 4-V gate drive
- Low drain-source ON-resistance:  $R_{DS(ON)} = 0.13 \Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 2.5 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 100 \mu\text{A}$  (max) ( $V_{DS} = 30 \text{ V}$ )
- Enhancement mode:  $V_{th} = 0.8 \text{ to } 2.0 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

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

Characteristics		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	30	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )		$V_{DGR}$	30	V
Gate-source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	2	A
	Pulse (Note 1)	$I_{DP}$	6	A
Drain power dissipation		$P_D$	0.5	W
Drain power dissipation (Note 2)		$P_D$	1.5	W
Single pulse avalanche energy (Note 3)		$E_{AS}$	56	mJ
Avalanche current		$I_{AR}$	2	A
Repetitive avalanche energy (Note 4)		$E_{AR}$	0.05	mJ
Channel temperature		$T_{ch}$	150	°C
Storage temperature range		$T_{stg}$	-55 to 150	°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 ambient	$R_{th(ch-a)}$	250	°C / W

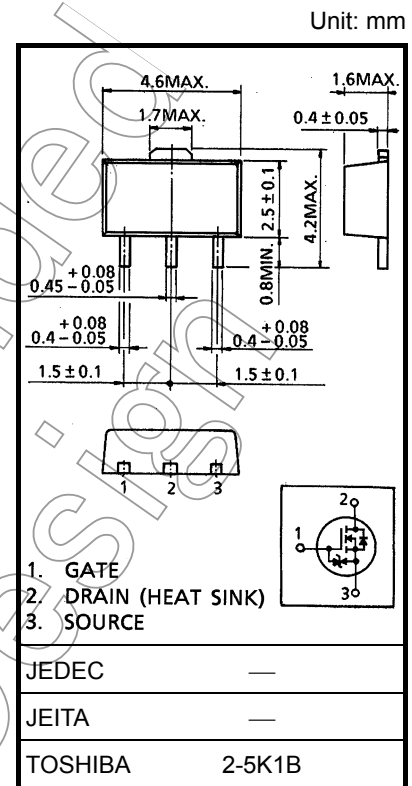
Note 1: Ensure that the channel temperature does not exceed 150°C.

Note 2: Mounted on a ceramic substrate (25.4 mm × 25.4 mm × 0.8 mm)

Note 3:  $V_{DD} = 25 \text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 10 \text{ mH}$ ,  $R_G = 25 \Omega$ ,  $I_{AR} = 2 \text{ A}$

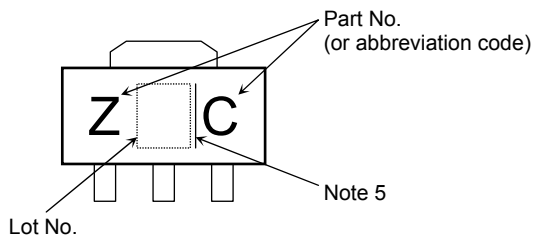
Note 4: Repetitive rating: pulse width limited by maximum channel temperature

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



Weight: 0.05 g (typ.)

## Marking



Note 5: A line to the right of a Lot No. identifies the indication of product Labels.

Without a line: [[Pb]]/INCLUDES > MCV

With a line: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

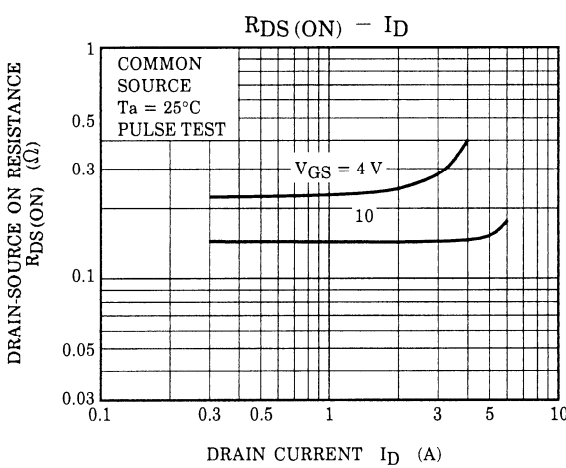
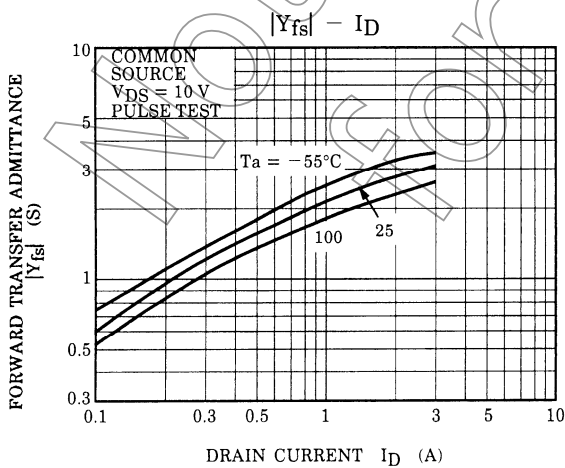
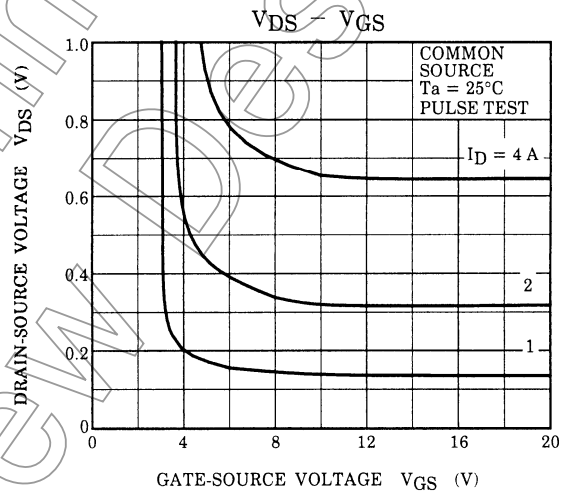
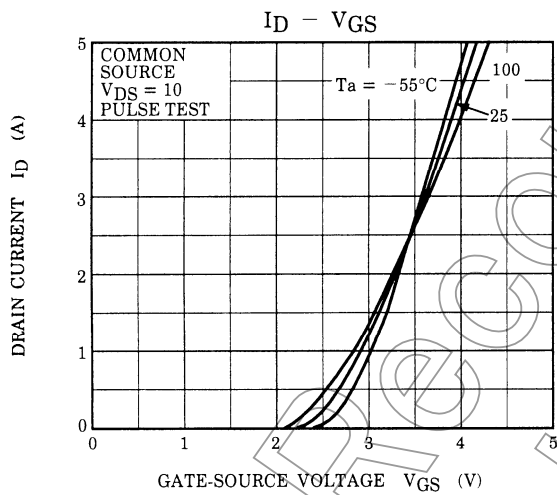
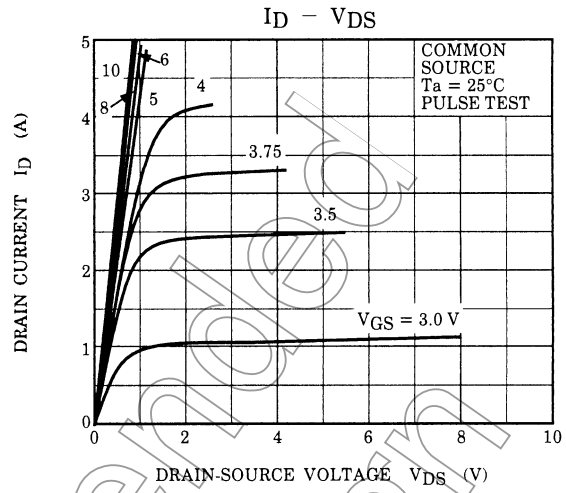
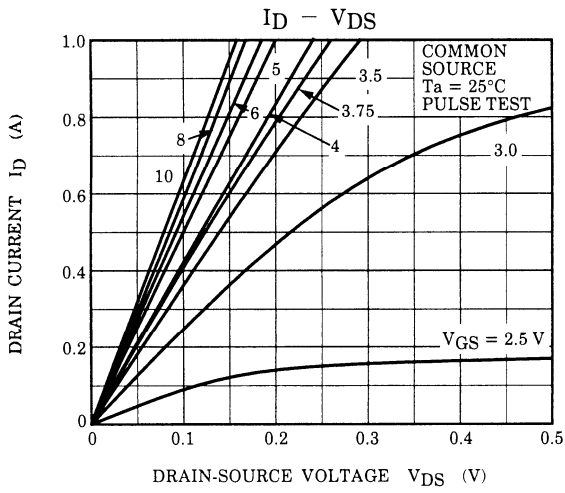
Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical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

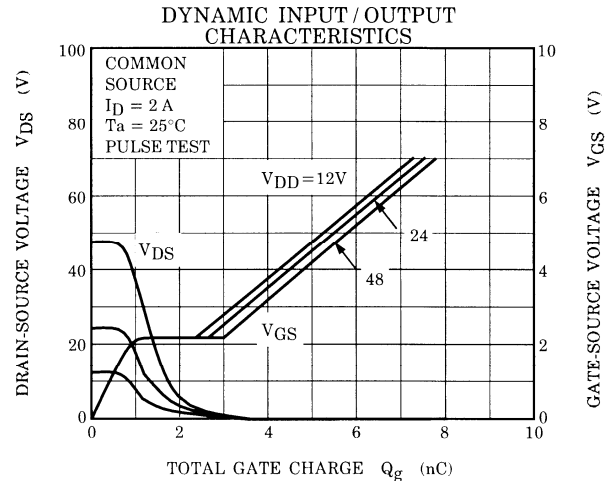
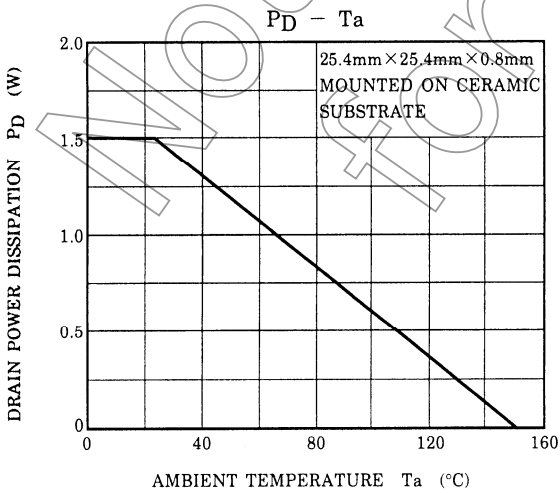
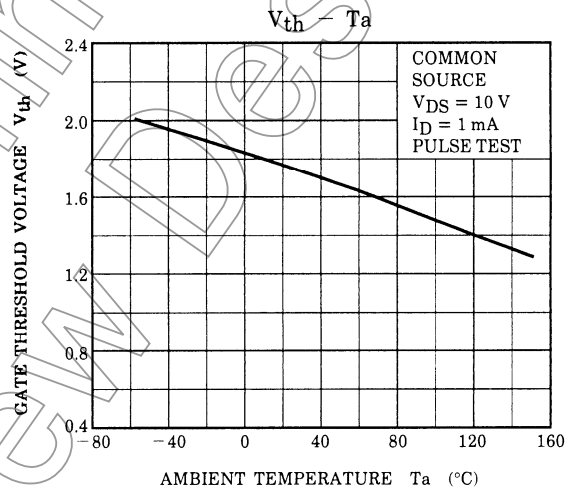
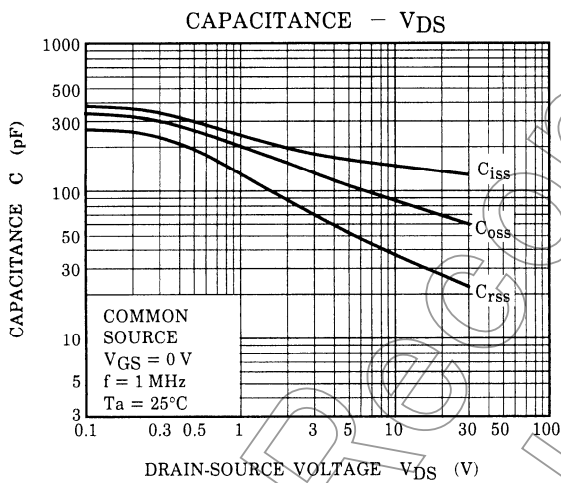
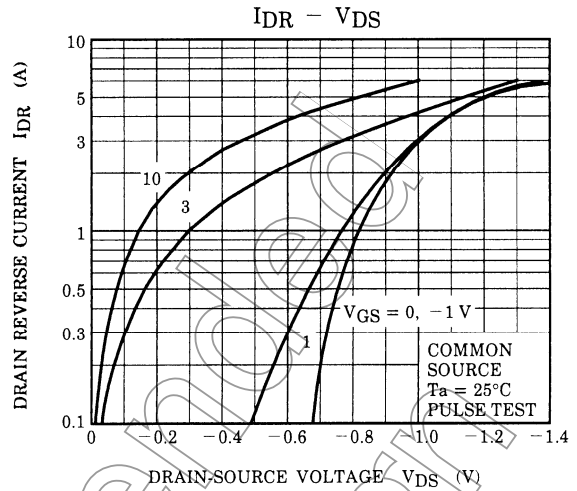
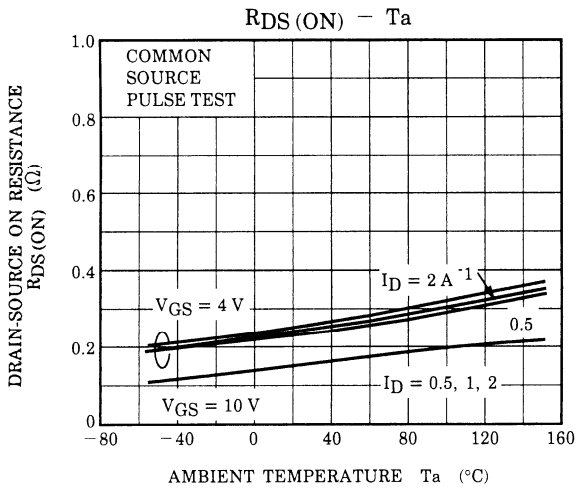
## Electrical Characteristics (Ta = 25°C)

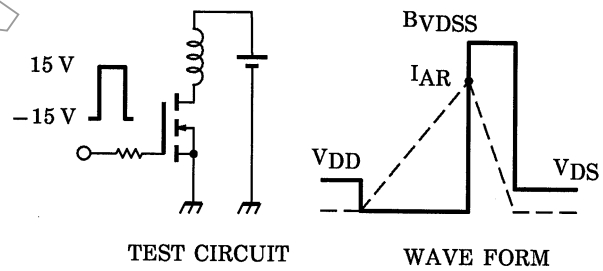
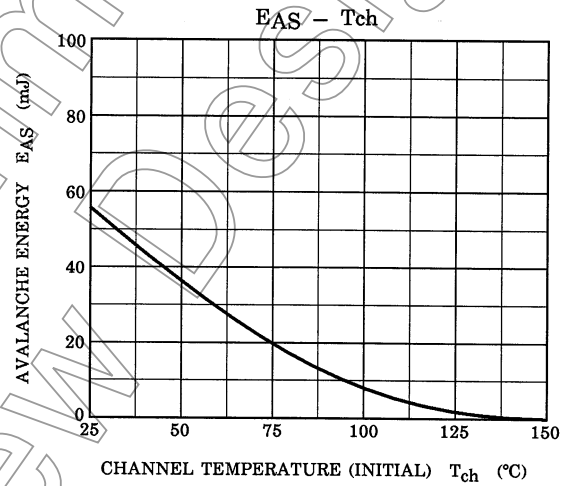
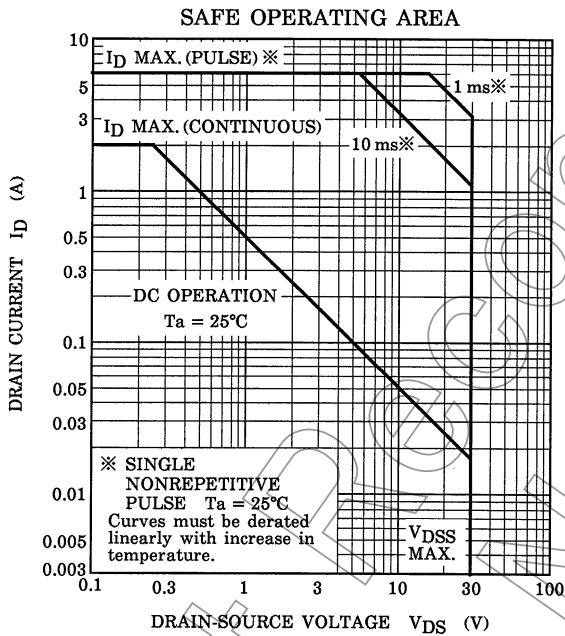
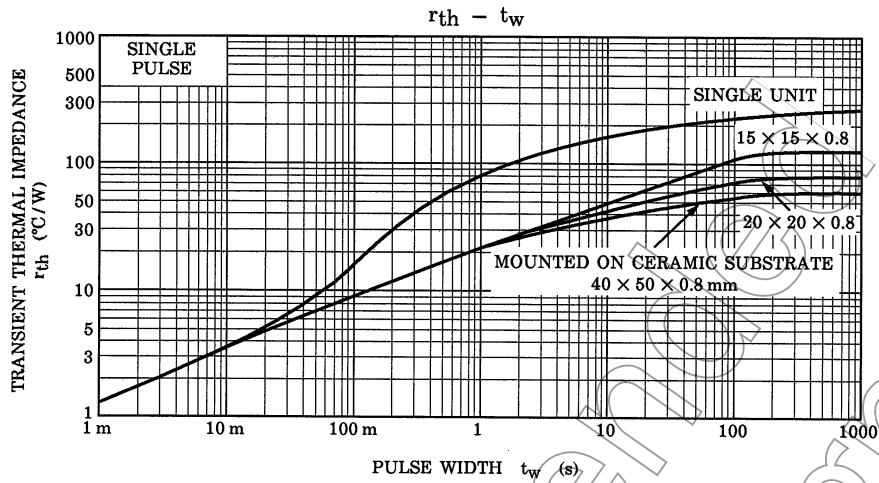
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cut-off current		$I_{DSS}$	$V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	100	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$	30	—	—	V
Gate threshold voltage		$V_{th}$	$V_{DS} = 10 \text{ V}, I_D = 1 \text{ mA}$	0.8	—	2.0	V
Drain-source ON-resistance		$R_{DS(ON)}$	$V_{GS} = 4 \text{ V}, I_D = 1 \text{ A}$	—	0.18	0.25	$\Omega$
			$V_{GS} = 10 \text{ V}, I_D = 1 \text{ A}$	—	0.13	0.18	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10 \text{ V}, I_D = 1 \text{ A}$	1.2	2.5	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	140	—	pF
Reverse transfer capacitance		$C_{rss}$		—	30	—	
Output capacitance		$C_{oss}$		—	80	—	
Switching time	Rise time	$t_r$		—	10	—	ns
	Turn-on time	$t_{on}$		—	15	—	
	Fall time	$t_f$		—	85	—	
	Turn-off time	$t_{off}$		Duty $\leq 1\%$ , $t_w = 10 \mu\text{s}$	—	195	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx 24 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 2 \text{ A}$	—	5.8	—	nC
Gate-source charge		$Q_{gs}$		—	4.3	—	
Gate-drain ("miller") Charge		$Q_{gd}$		—	1.5	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	$I_{DR}$	—	—	—	2	A
Pulse drain reverse current (Note 1)	$I_{DRP}$	—	—	—	6	A
Forward voltage (diode)	$V_{DSF}$	$I_{DR} = 2 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	-1.5	V
Reverse recovery time	$t_{rr}$	$I_{DR} = 2 \text{ A}, V_{GS} = 0 \text{ V}, dI_{DR}/dt = 50 \text{ A}/\mu\text{s}$	—	50	—	ns
Reverse recovery charge	$Q_{rr}$		—	20	—	nC







$R_G = 25 \Omega$   
 $V_{DD} = 25 \text{ V}, L = 10 \text{ mH}$

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

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