

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

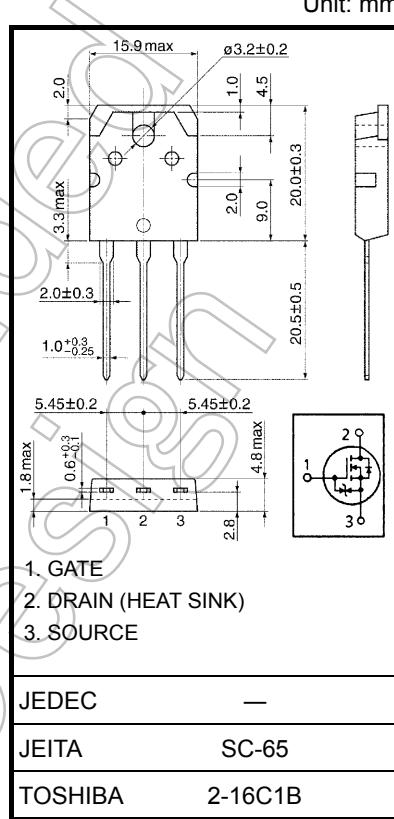
## 2SK2699

Chopper Regulator, DC-DC Converter and Motor Drive Applications

- Low drain-source ON resistance :  $R_{DS(ON)} = 0.5 \Omega$  (typ.)
- High forward transfer admittance :  $|Y_{fs}| = 11 S$  (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 ( $T_a = 25^\circ C$ )

Characteristics	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)	$I_D$	A
	Pulse (Note 1)	$I_{DP}$	A
Drain power dissipation ( $T_c = 25^\circ C$ )	$P_D$	150	W
Single pulse avalanche energy (Note 2)	$E_{AS}$	605	mJ
Avalanche current	$I_{AR}$	12	A
Repetitive avalanche energy (Note 3)	$E_{AR}$	15	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

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to case	$R_{th}(ch-c)$	0.833	$^\circ C / W$
Thermal resistance, channel to ambient	$R_{th}(ch-a)$	50	$^\circ C / W$

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),  $L = 7.35 mH$ ,  $R_G = 25 \Omega$ ,  $I_{AR} = 12 A$

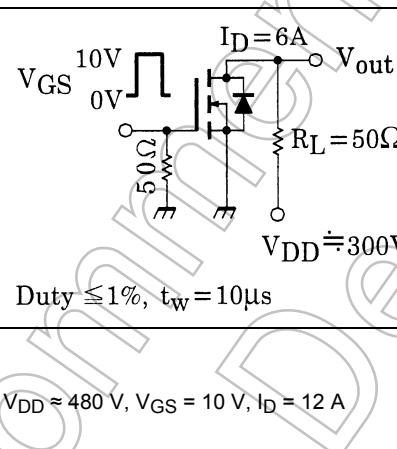
Note 3: Repetitive rating: pulse width limited by maximum channel temperature

This transistor is an electrostatic-sensitive device.

Please handle with caution.

Start of commercial production  
1996-02

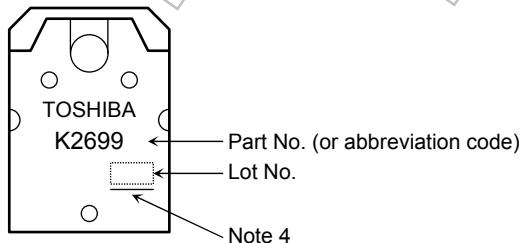
Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )

Characteristics	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	$V_{(\text{BR})\text{GSS}}$	$I_G = \pm 10\text{ }\mu\text{A}$ , $V_{DS} = 0\text{ V}$	$\pm 30$	—	—	$\text{V}$
Drain cut-off current	$I_{DSS}$	$V_{DS} = 600\text{ V}$ , $V_{GS} = 0\text{ V}$	—	—	100	$\mu\text{A}$
Drain-source breakdown voltage	$V_{(\text{BR})\text{DSS}}$	$I_D = 10\text{ mA}$ , $V_{GS} = 0\text{ V}$	600	—	—	$\text{V}$
Gate threshold voltage	$V_{th}$	$V_{DS} = 10\text{ V}$ , $I_D = 1\text{ mA}$	2.0	—	4.0	$\text{V}$
Drain-source ON resistance	$R_{DS(\text{ON})}$	$V_{GS} = 10\text{ V}$ , $I_D = 6\text{ A}$	—	0.5	0.65	$\Omega$
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = 10\text{ V}$ , $I_D = 6\text{ A}$	6.0	11.0	—	$\text{S}$
Input capacitance	$C_{iss}$	$V_{DS} = 10\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$	—	2600	—	$\text{pF}$
Reverse transfer capacitance	$C_{rss}$		—	270	—	
Output capacitance	$C_{oss}$		—	820	—	
Switching time	Rise time	$t_r$		—	45	—
	Turn-on time	$t_{on}$		—	75	—
	Fall time	$t_f$		—	65	—
	Turn-off time	$t_{off}$		—	270	—
Total gate charge (gate-source plus gate-drain)	$Q_g$	$V_{DD} \approx 480\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 12\text{ A}$	—	58	—	$\text{nC}$
Gate-source charge	$Q_{gs}$		—	37	—	
Gate-drain ("miller") Charge	$Q_{gd}$		—	21	—	

Source-Drain Diode Ratings and Characteristics ( $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	$I_{DR}$	—	—	—	12	$\text{A}$
Pulse drain reverse current (Note 1)	$I_{DRP}$	—	—	—	48	$\text{A}$
Forward voltage (diode)	$V_{DSF}$	$I_{DR} = 12\text{ A}$ , $V_{GS} = 0\text{ V}$	—	—	-1.7	$\text{V}$
Reverse recovery time	$t_{rr}$	$I_{DR} = 12\text{ A}$ , $V_{GS} = 0\text{ V}$ $dI_{DR} / dt = 100\text{ A} / \mu\text{s}$	—	460	—	ns
Reverse recovery charge	$Q_{rr}$		—	4.8	—	$\mu\text{C}$

## Marking

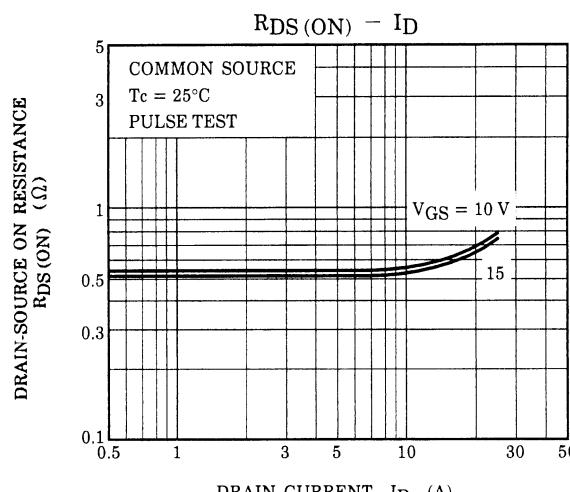
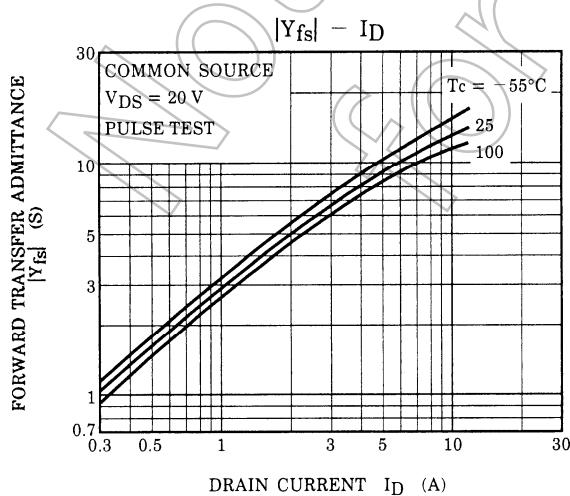
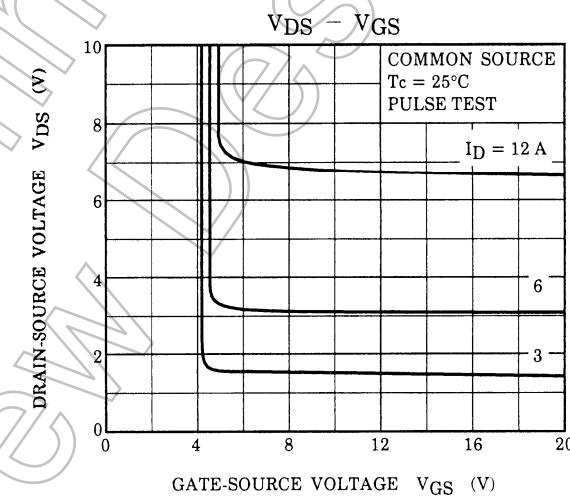
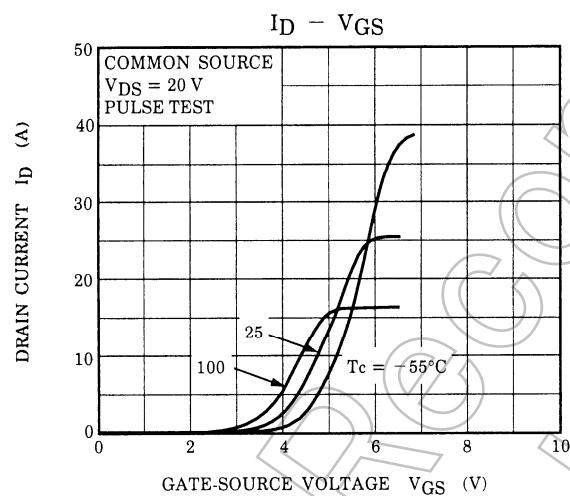
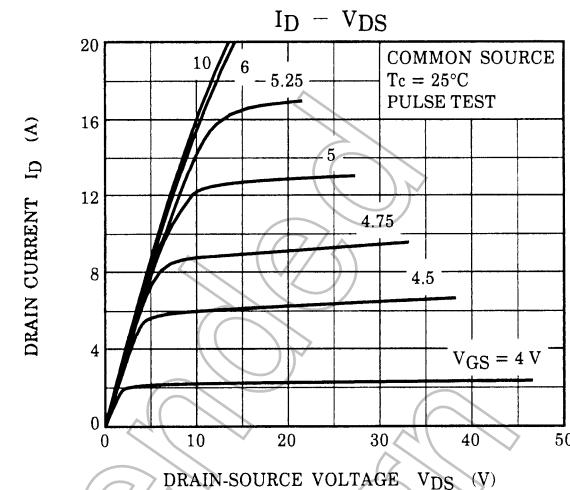
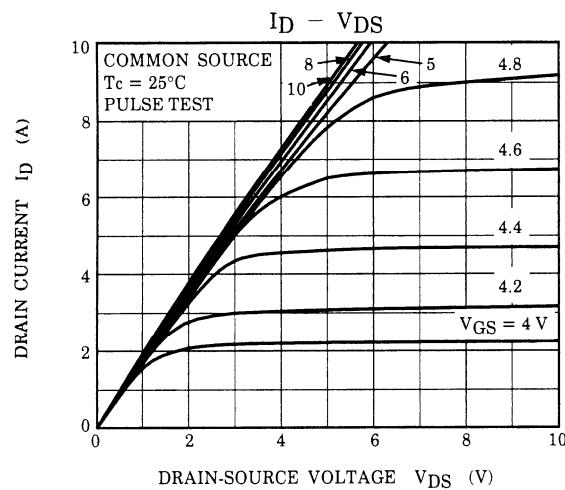


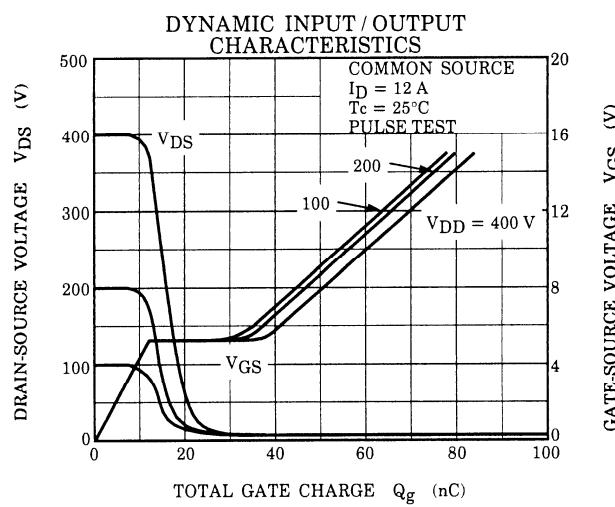
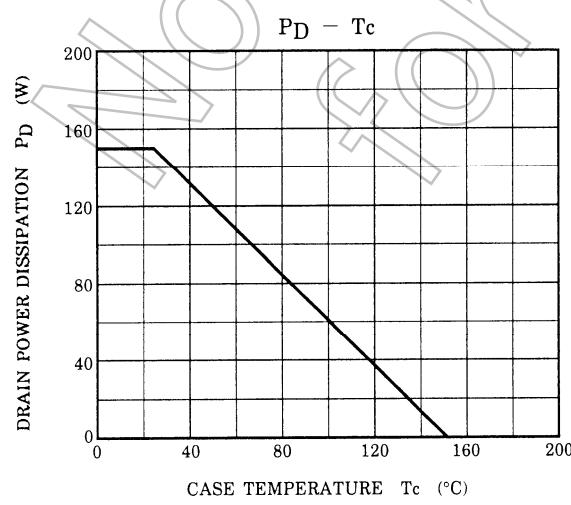
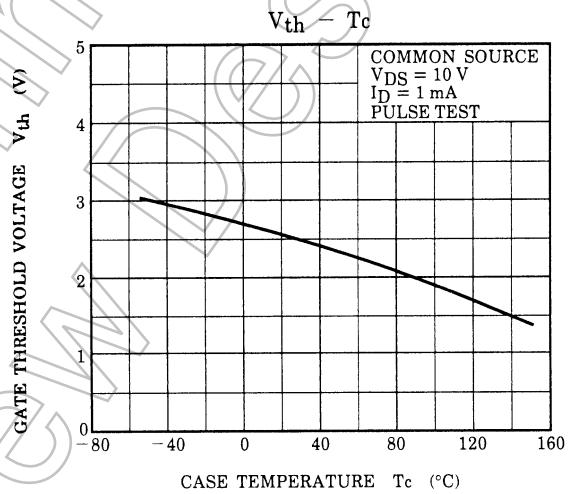
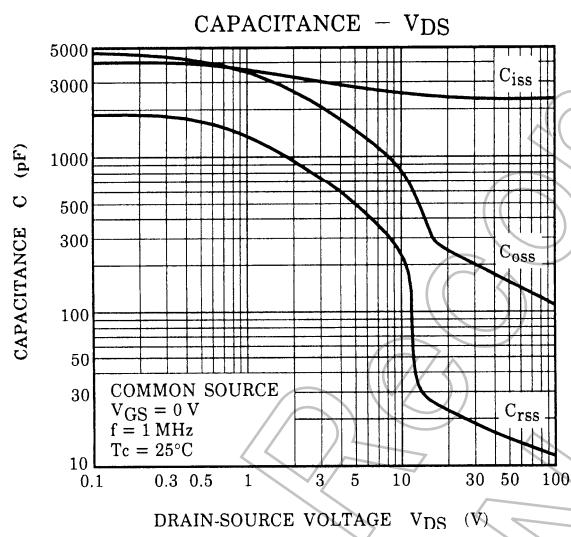
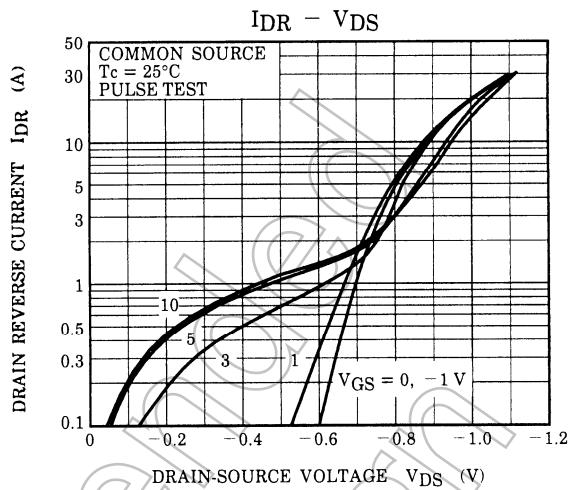
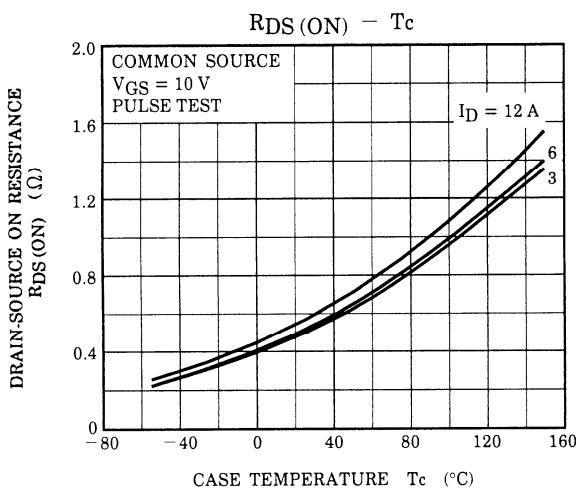
Note 4: A line under a Lot No. identifies the indication of product Labels.

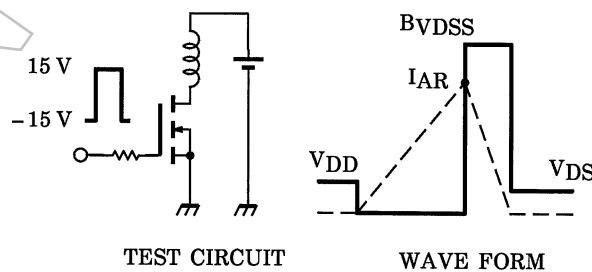
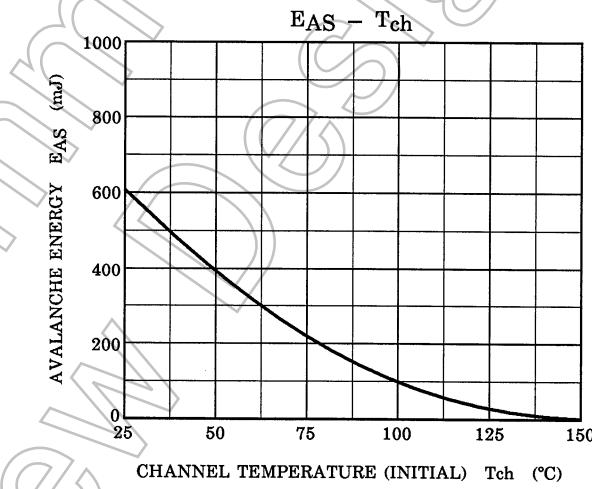
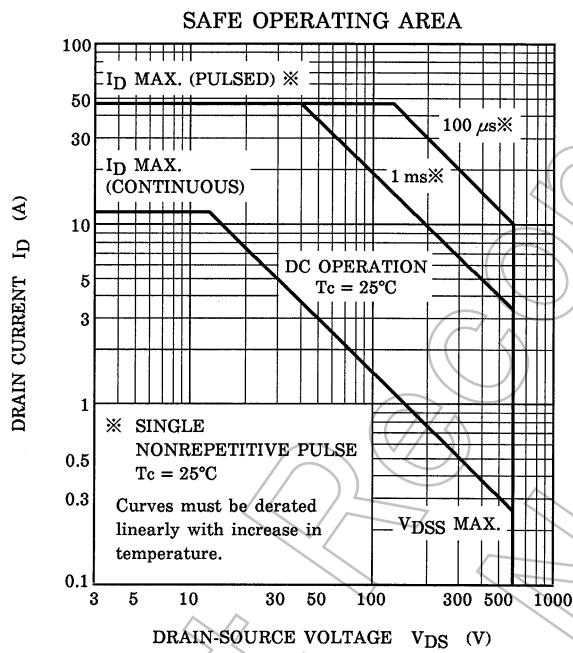
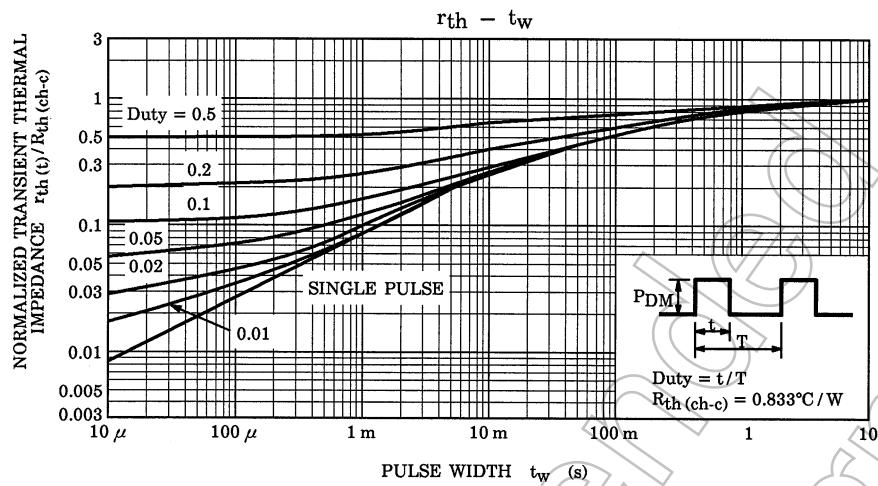
Not underlined: [[Pb]]/INCLUDES > MCV

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

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$$RG = 25 \Omega$$

$$VDD = 90 \text{ V}, L = 7.35 \text{ mH}$$

$$EAS = \frac{1}{2} \cdot L \cdot I^2 \cdot \left( \frac{BVDSS}{BVDSS - VDD} \right)$$

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