

# TK70D06J1

## Switching Regulator Application

- High-Speed switching
- Small gate charge:  $Q_g = 87\text{nC}$  (typ.)
- Low drain-source ON resistance:  $R_{DS(ON)} = 5.1\text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 80\text{S}$
- Low leakage current:  $I_{DSS} = 10\text{ }\mu\text{A}$  (max) ( $V_{DS} = 60\text{ V}$ )
- Enhancement-mode:  $V_{th} = 1.1\sim 2.3\text{ V}$  ( $V_{DS} = 10\text{ V}$ ,  $I_D = 1\text{ mA}$ )

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

Characteristics		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	60	V
Drain-gate voltage ( $R_{GS} = 20\text{ k}\Omega$ )		$V_{DGR}$	60	V
Gate-source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	70	A
	Pulse (Note 1)	$I_{DP}$	280	
Drain power dissipation ( $T_c = 25^\circ\text{C}$ )		$P_D$	140	W
Single pulse avalanche energy (Note 2)		$E_{AS}$	751	mJ
Avalanche current		$I_{AR}$	70	A
Repetitive avalanche energy (Note 3)		$E_{AR}$	10.3	mJ
Channel temperature		$T_{ch}$	150	$^\circ\text{C}$
Storage temperature range		$T_{stg}$	$-55\sim 150$	$^\circ\text{C}$

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	$R_{th(ch-c)}$	0.89	$^\circ\text{C/W}$
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	83.3	$^\circ\text{C/W}$

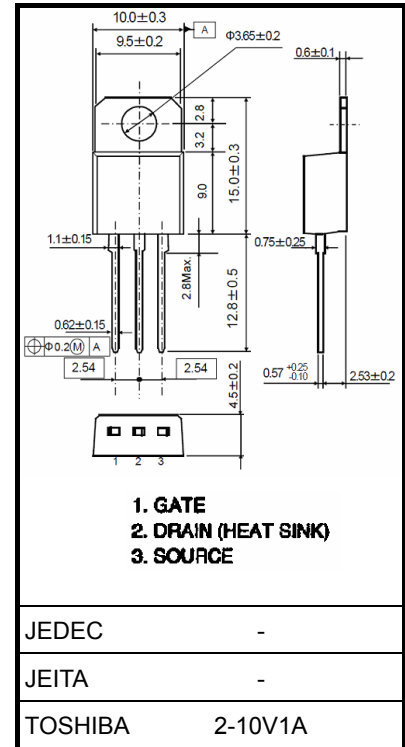
Note 1: Ensure that the channel & lead temperature does not exceed  $150^\circ\text{C}$ .

Note 2:  $V_{DD} = 25\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$ ,  $L = 200\text{ }\mu\text{H}$ ,  $I_{AR} = 70\text{ A}$ ,  $R_G = 1\text{ }\Omega$

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

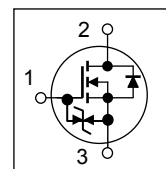
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 1.35 g (typ.)

## Internal Connection



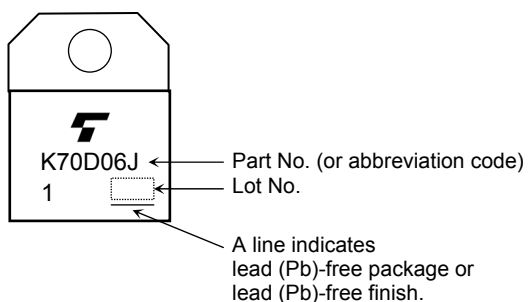
## Electrical Characteristics (Ta = 25°C)

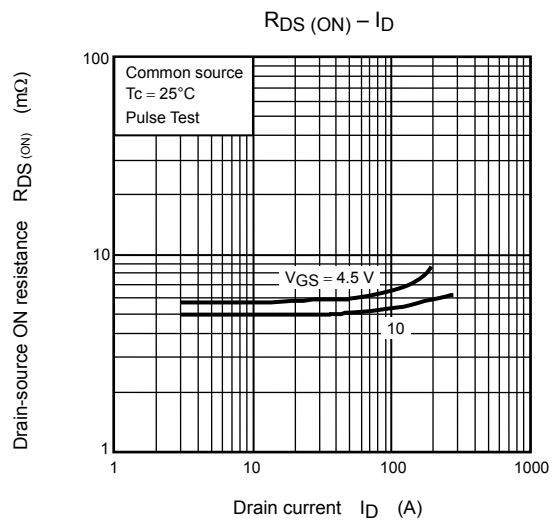
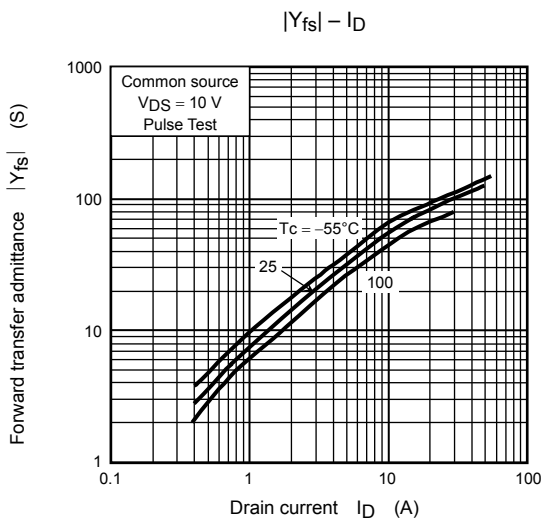
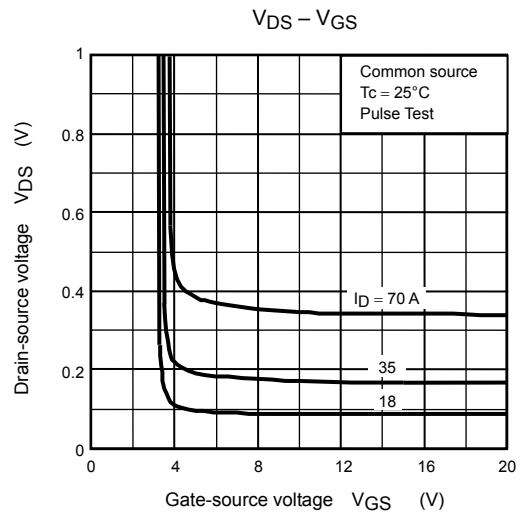
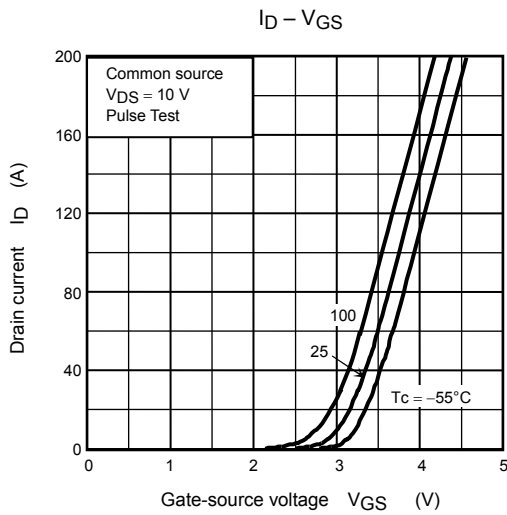
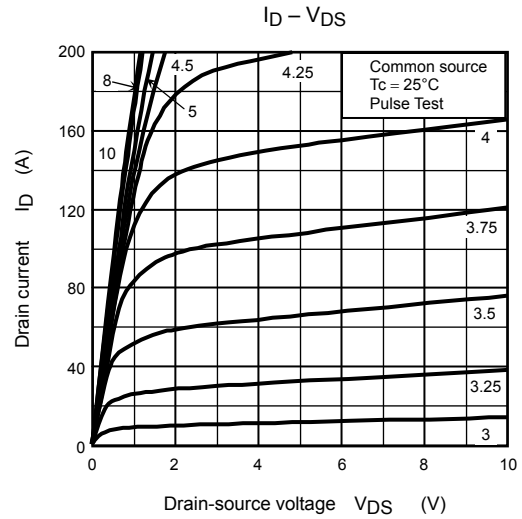
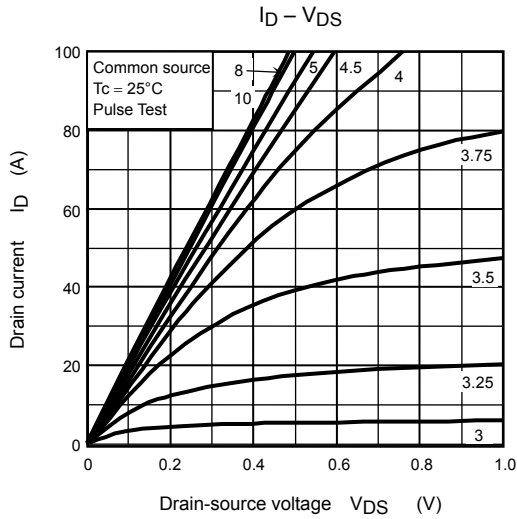
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cut-OFF current		$I_{DSS}$	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$	—	—	10	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	60	—	—	V
		$V_{(BR)DSX}$	$I_D = 10\text{ mA}, V_{GS} = -20\text{ V}$	45	—	—	
Gate threshold voltage		$V_{th}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	1.1	—	2.3	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = 4.5\text{ V}, I_D = 35\text{ A}$	—	5.8	7.6	m $\Omega$
			$V_{GS} = 10\text{ V}, I_D = 35\text{ A}$	—	5.1	6.4	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 35\text{ A}$	40	80	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	5450	—	pF
Reverse transfer capacitance		$C_{rss}$		—	320	—	
Output capacitance		$C_{oss}$		—	1420	—	
Switching time	Rise time	$t_r$	<p>Duty <math>\leq 1\%</math>, <math>t_w = 10\ \mu\text{s}</math></p>	—	9	—	ns
	Turn-ON time	$t_{on}$		—	24	—	
	Fall time	$t_f$		—	21	—	
	Turn-OFF time	$t_{off}$		—	106	—	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx 48\text{ V}, V_{GS} = 5\text{ V}, I_D = 70\text{ A}$	—	47	—	nC
Gate-source charge 1			$Q_{gs1}$	$V_{DD} \approx 48\text{ V}, V_{GS} = 10\text{ V}, I_D = 70\text{ A}$	—	87	
Gate-drain ("miller") charge		$Q_{gd}$	$V_{DD} \approx 48\text{ V}, V_{GS} = 10\text{ V}, I_D = 70\text{ A}$	—	16	—	
Gate switch charge		$Q_{sw}$	$V_{DD} \approx 48\text{ V}, V_{GS} = 10\text{ V}, I_D = 70\text{ A}$	—	19	—	
Gate switch charge		$Q_{sw}$	$V_{DD} \approx 48\text{ V}, V_{GS} = 10\text{ V}, I_D = 70\text{ A}$	—	30	—	

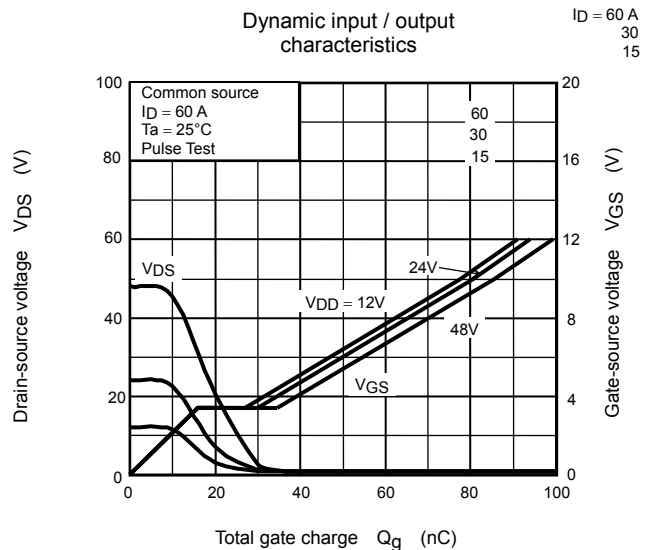
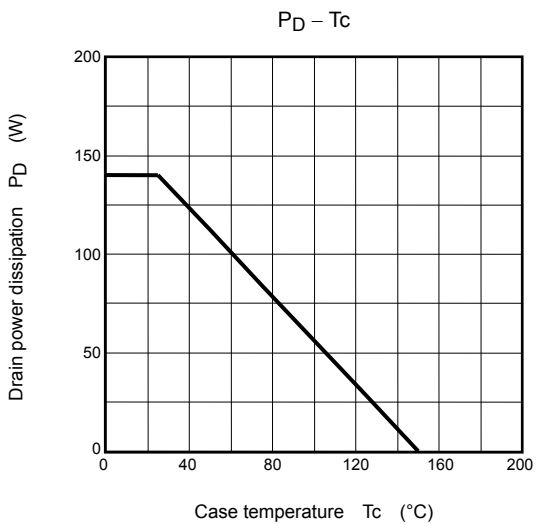
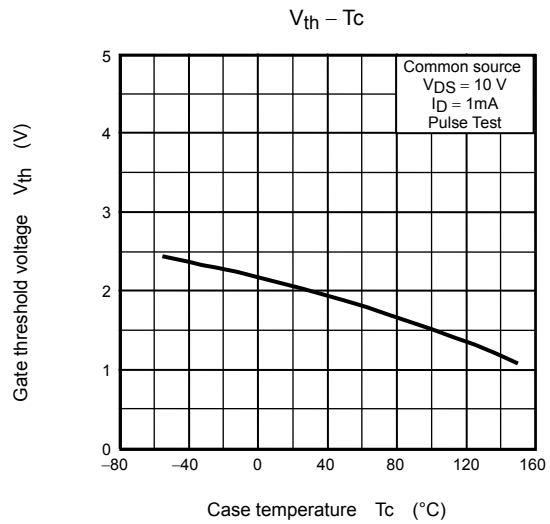
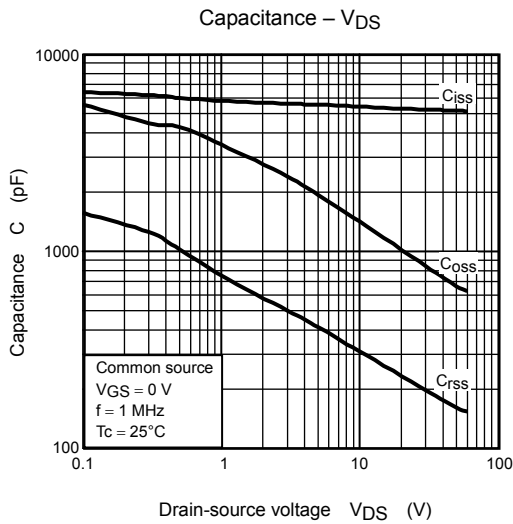
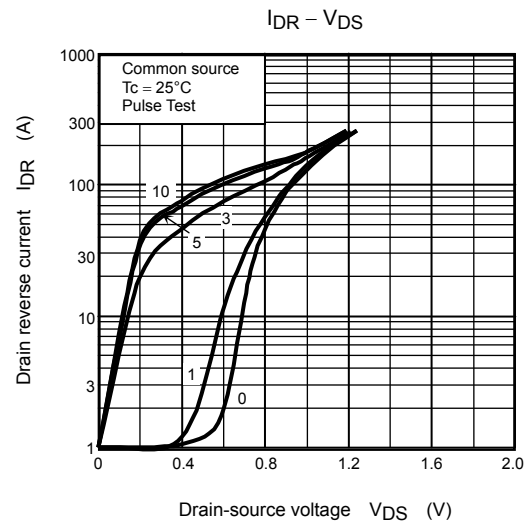
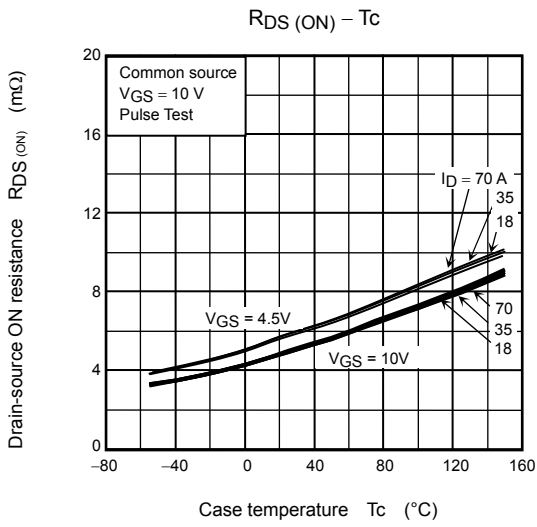
## Source-Drain Ratings and Characteristics (Ta = 25°C)

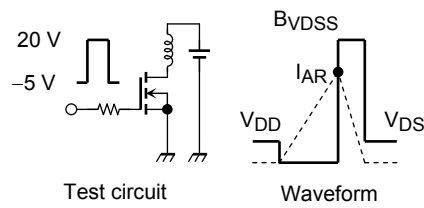
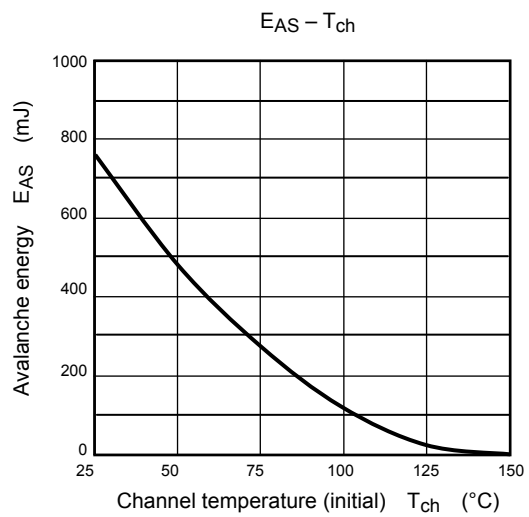
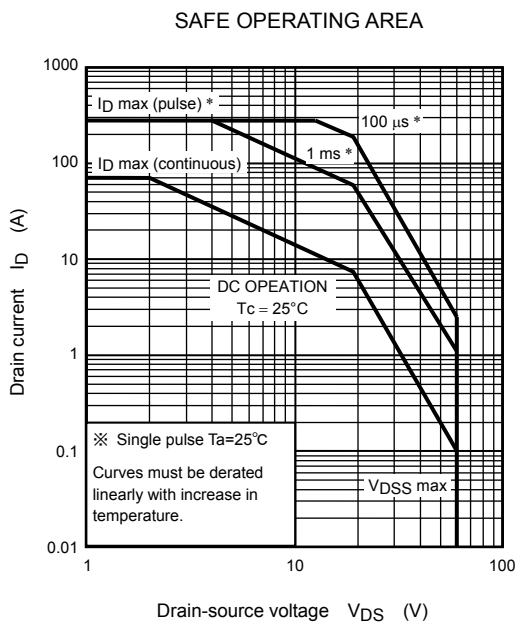
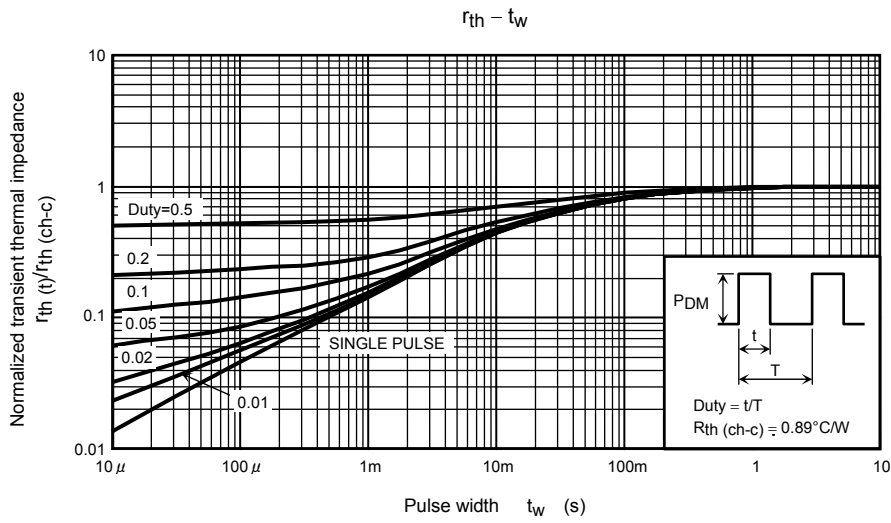
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	$I_{DR}$	—	—	—	70	A
Pulse drain reverse current (Note 1)	$I_{DRP}$	—	—	—	280	A
Forward voltage (diode)	$V_{DSF}$	$I_{DR} = 70\text{ A}, V_{GS} = 0\text{ V}$	—	-1.0	-1.2	V
Reverse recovery time	$t_{rr}$	$I_{DR} = 70\text{ A}, V_{GS} = 0\text{ V},$	—	60	—	ns
Reverse recovery charge	$Q_{rr}$	$dI_{DR}/dt = 50\text{ A}/\mu\text{s}$	—	51	—	nC

## Marking









$R_G = 1 \Omega$   
 $V_{DD} = 25 \text{ V}, L = 200 \mu\text{H}$

$$E_{AS} = \frac{1}{2} \cdot L \cdot I_{AR}^2 \cdot \left( \frac{B_{VDSS}}{B_{VDSS} - V_{DD}} \right)$$

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