

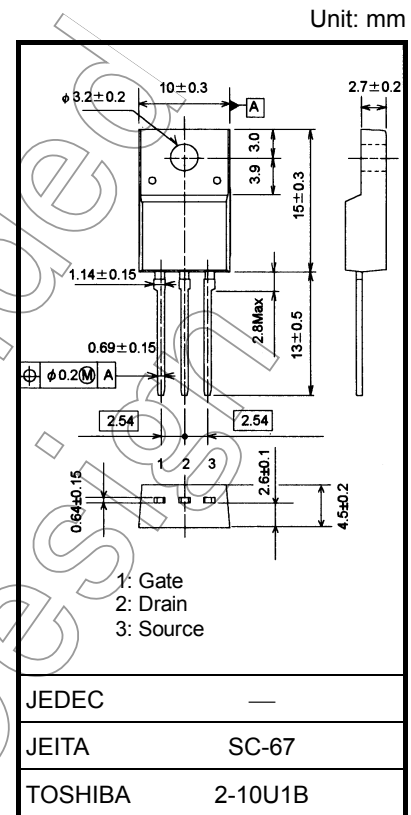
# TK40A10J1

## Switching Regulator Applications

- Small gate charge:  $Q_g = 76\text{nC}$  (typ.)
- Low drain-source ON-resistance:  $R_{DS(ON)} = 11.5\text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 90\text{ S}$
- Low leakage current:  $I_{DSS} = 10\text{ }\mu\text{A}$  (max) ( $V_{DS} = 100\text{ V}$ )
- Enhancement mode:  $V_{th} = 1.1\text{ to }2.3\text{ V}$  ( $V_{DS} = 10\text{ V}$ ,  $I_D = 1\text{ mA}$ )

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

Characteristics		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	100	V
Drain-gate voltage ( $R_{GS} = 20\text{ k}\Omega$ )		$V_{DGR}$	100	V
Gate-source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	40	A
	Pulse (Note 1)	$I_{DP}$	160	
Drain power dissipation ( $T_c = 25^\circ\text{C}$ )		$P_D$	40	W
Single pulse avalanche energy (Note 2)		$E_{AS}$	202	mJ
Avalanche current		$I_{AR}$	40	A
Repetitive avalanche energy (Note 3)		$E_{AR}$	2.4	mJ
Channel temperature		$T_{ch}$	150	$^\circ\text{C}$
Storage temperature range		$T_{stg}$	-55 to 150	$^\circ\text{C}$



Weight: 1.7 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

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to case	$R_{th(ch-c)}$	3.125	$^\circ\text{C/W}$
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	62.5	$^\circ\text{C/W}$

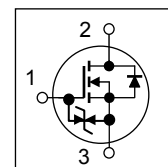
Note 1: Ensure that the channel and lead temperatures do not exceed  $150^\circ\text{C}$ .

Note 2:  $V_{DD} = 25\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$ ,  $L = 200\text{ }\mu\text{H}$ ,  $I_{AR} = 40\text{ A}$ ,  $R_G = 1\text{ }\Omega$

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

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

## Internal Connection



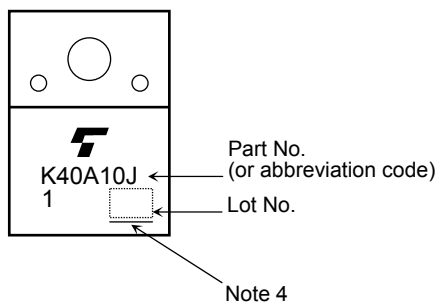
## Electrical Characteristics (Ta = 25°C)

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		$I_{DSS}$	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$	—	—	10	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	100	—	—	V
		$V_{(BR)DSX}$	$I_D = 10\text{ mA}, V_{GS} = -20\text{ V}$	60	—	—	
Gate threshold voltage		$V_{th}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	1.1	—	2.3	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = 4.5\text{ V}, I_D = 20\text{ A}$	—	13	17	$\text{m}\Omega$
			$V_{GS} = 10\text{ V}, I_D = 20\text{ A}$	—	11.5	15	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 20\text{ A}$	45	90	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	4300	—	pF
Reverse transfer capacitance		$C_{rss}$		—	230	—	
Output capacitance		$C_{oss}$		—	790	—	
Switching time	Rise time	$t_r$		—	14	—	ns
	Turn-ON time	$t_{on}$		—	22	—	
	Fall time	$t_f$		—	24	—	
	Turn-OFF time	$t_{off}$		Duty $\leq 1\%$ , $t_w = 10\ \mu\text{s}$	—	115	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx 80\text{ V}, V_{GS} = 5\text{ V}, I_D = 40\text{ A}$	—	44	—	nC
Gate-source charge 1		$Q_{gs1}$	$V_{DD} \approx 80\text{ V}, V_{GS} = 10\text{ V}, I_D = 40\text{ A}$	—	76	—	
Gate-drain ("miller") charge		$Q_{gd}$	$V_{DD} \approx 80\text{ V}, V_{GS} = 10\text{ V}, I_D = 40\text{ A}$	—	11	—	
Gate switch charge		$Q_{sw}$	$V_{DD} \approx 80\text{ V}, V_{GS} = 10\text{ V}, I_D = 40\text{ A}$	—	21	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	$I_{DR}$	—	—	—	40	A
Pulse drain reverse current (Note 1)	$I_{DRP}$	—	—	—	160	A
Forward voltage (diode)	$V_{DSF}$	$I_{DR} = 40\text{ A}, V_{GS} = 0\text{ V}$	—	-0.9	-1.2	V
Reverse recovery time	$t_{rr}$	$I_{DR} = 40\text{ A}, V_{GS} = 0\text{ V}$ ,	—	55	—	ns
Reverse recovery charge	$Q_{rr}$	$dI_{DR}/dt = 50\text{ A}/\mu\text{s}$	—	63	—	nC

## Marking

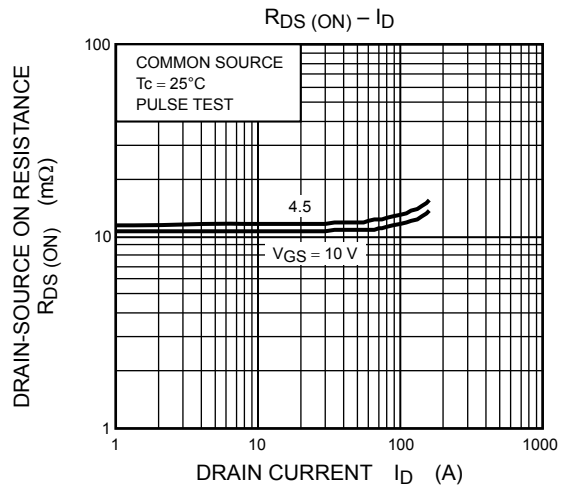
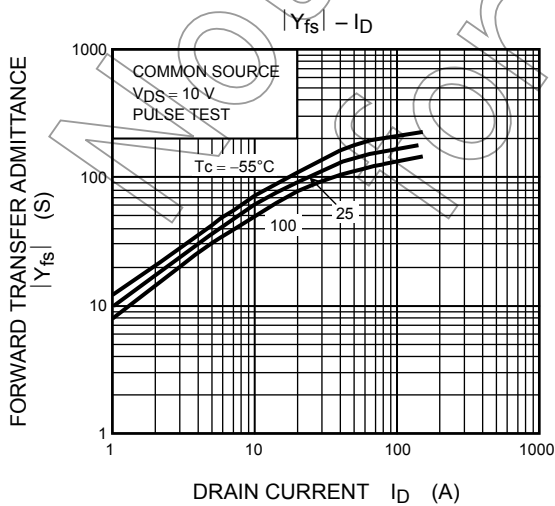
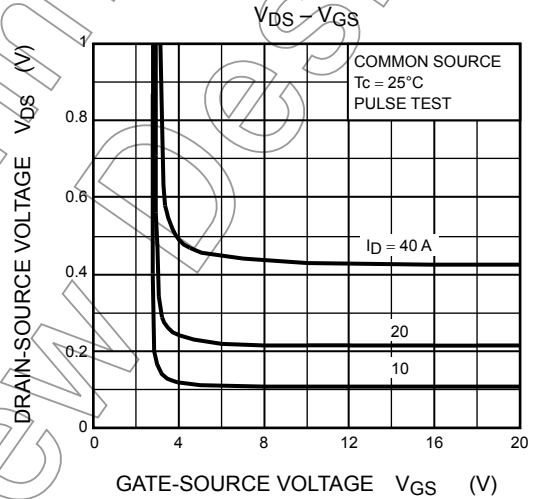
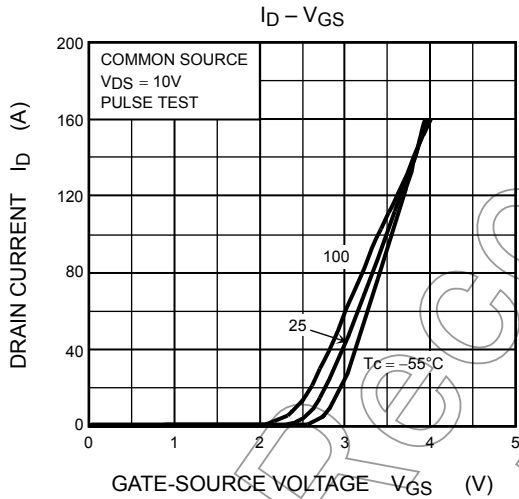
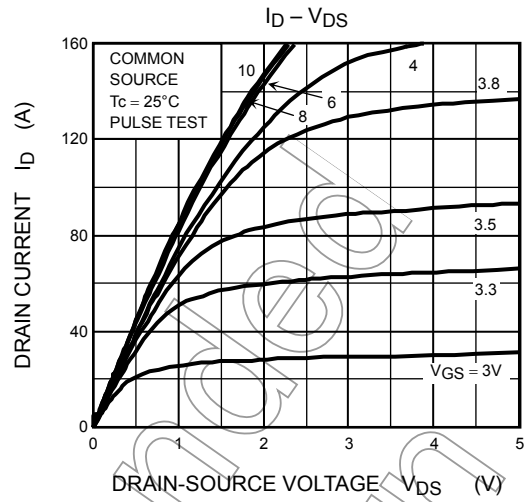
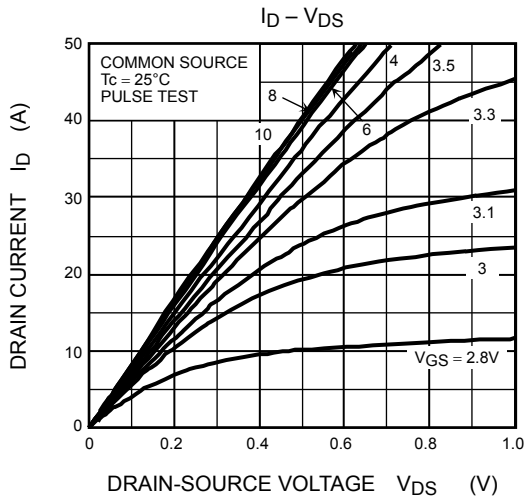


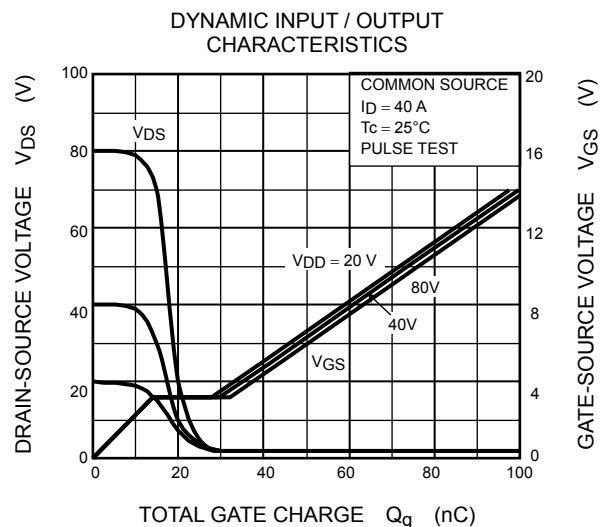
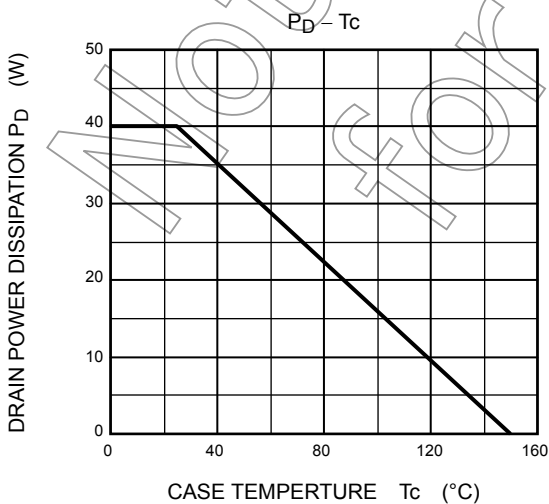
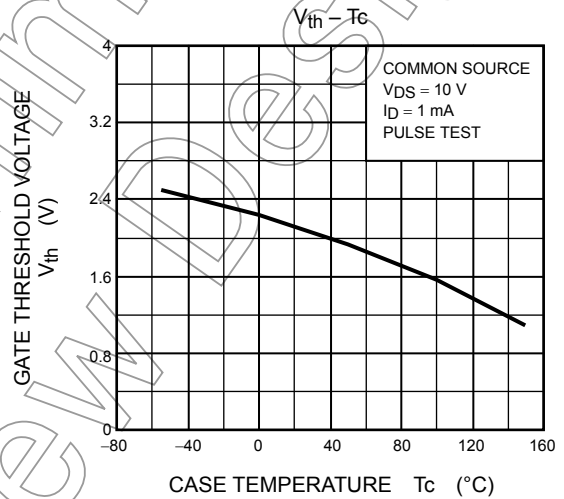
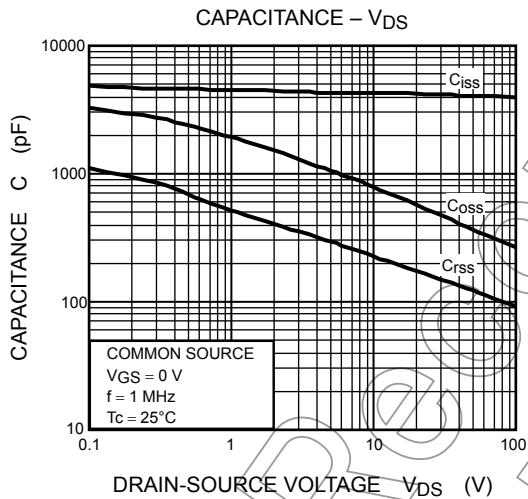
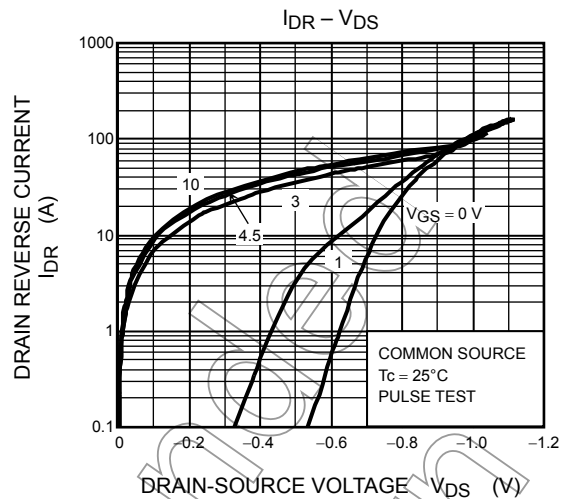
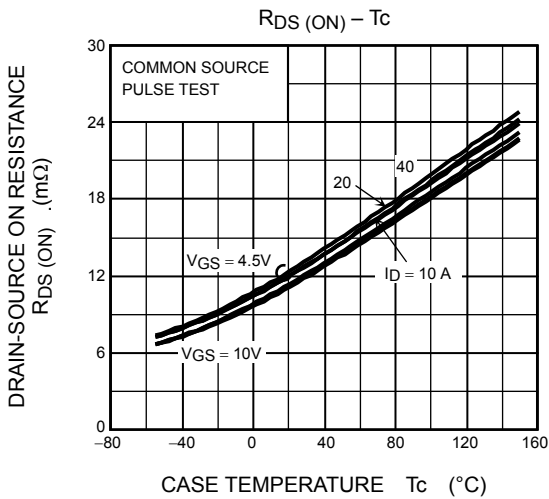
Note 4: A line under a Lot No. identifies the indication of product Labels.

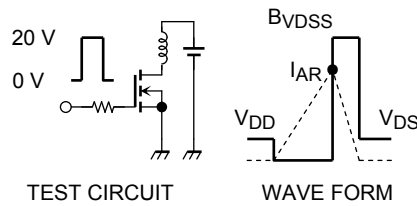
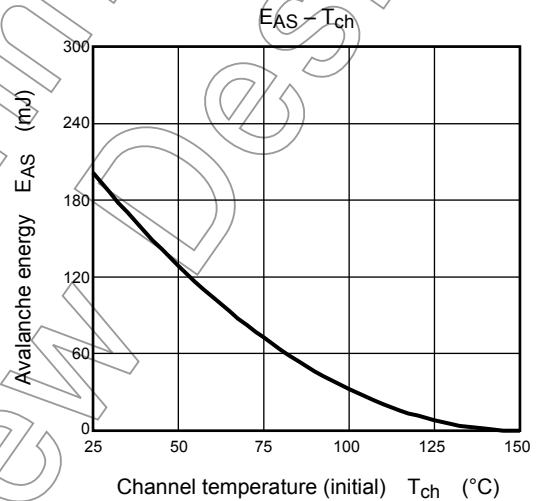
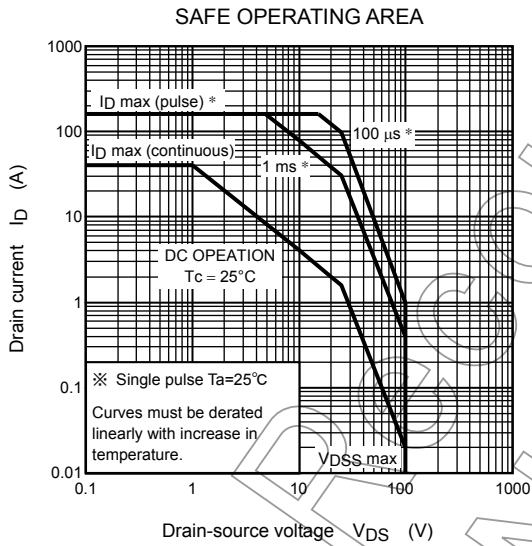
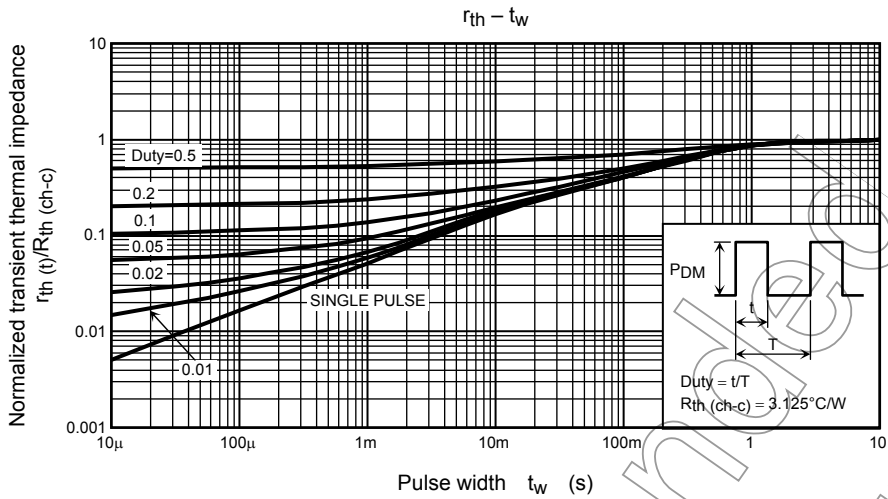
Not underlined: [[Pb]]/INCLUDES > MCV

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

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

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

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