

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (π -MOS VII)

TK4A53D

Switching Regulator Applications

- Low drain-source ON-resistance: $R_{DS(ON)} = 1.3 \Omega$ (typ.)
- High forward transfer admittance: $|Y_{fs}| = 3.0 \text{ S}$ (typ.)
- Low leakage current: $I_{DSS} = 10 \mu\text{A}$ (max) ($V_{DS} = 525 \text{ V}$)
- Enhancement mode: $V_{th} = 2.4$ to 4.4 V ($V_{DS} = 10 \text{ V}$, $I_D = 1 \text{ mA}$)

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

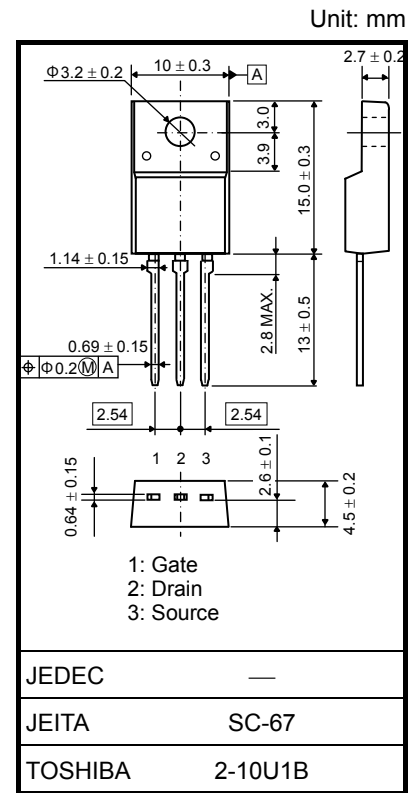
Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	525	V
Gate-source voltage		V_{GSS}	± 30	V
Drain current	DC (Note 1)	I_D	4	A
	Pulse (Note 1)	I_{DP}	16	
Drain power dissipation ($T_c = 25^\circ\text{C}$)		P_D	35	W
Single pulse avalanche energy (Note 2)		E_{AS}	252	mJ
Avalanche current		I_{AR}	4	A
Repetitive avalanche energy (Note 3)		E_{AR}	3.5	mJ
Channel temperature		T_{ch}	150	$^\circ\text{C}$
Storage temperature range		T_{stg}	-55 to 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.).

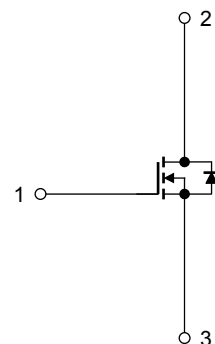
Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to case	$R_{th(ch-c)}$	3.57	$^\circ\text{C/W}$
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	62.5	$^\circ\text{C/W}$

- Note 1: Ensure that the channel temperature does not exceed 150°C .
- Note 2: $V_{DD} = 90 \text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 27 \text{ mH}$, $R_G = 25 \Omega$, $I_{AR} = 4 \text{ A}$
- Note 3: Repetitive rating: pulse width limited by maximum channel temperature
- This transistor is an electrostatic-sensitive device. Handle with care.



Weight: 1.7 g (typ.)



Start of commercial production
2009-04

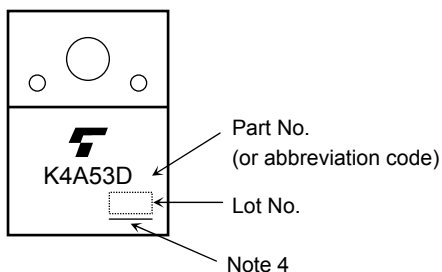
Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$	—	—	± 1	μA
Drain cut-off current		I_{DSS}	$V_{DS} = 525\text{ V}, V_{GS} = 0\text{ V}$	—	—	10	μA
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	525	—	—	V
Gate threshold voltage		V_{th}	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	2.4	—	4.4	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 2\text{ A}$	—	1.3	1.7	Ω
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 2\text{ A}$	0.6	3.0	—	S
Input capacitance		C_{iss}	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	490	—	pF
Reverse transfer capacitance		C_{rss}		—	3	—	
Output capacitance		C_{oss}		—	55	—	
Switching time	Rise time	t_r	<p>$I_D = 2\text{ A}$ $V_{GS} = 10\text{ V}$ $V_{DS} = 0\text{ V}$ $50\ \Omega$ $R_L = 100\ \Omega$ $V_{DD} \approx 200\text{ V}$</p>	—	18	—	ns
	Turn-on time	t_{on}		—	40	—	
	Fall time	t_f		—	8	—	
	Turn-off time	t_{off}		—	55	—	
Total gate charge		Q_g	$V_{DD} \approx 400\text{ V}, V_{GS} = 10\text{ V}, I_D = 4\text{ A}$	—	11	—	nC
Gate-source charge		Q_{gs}		—	6	—	
Gate-drain charge		Q_{gd}		—	5	—	

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

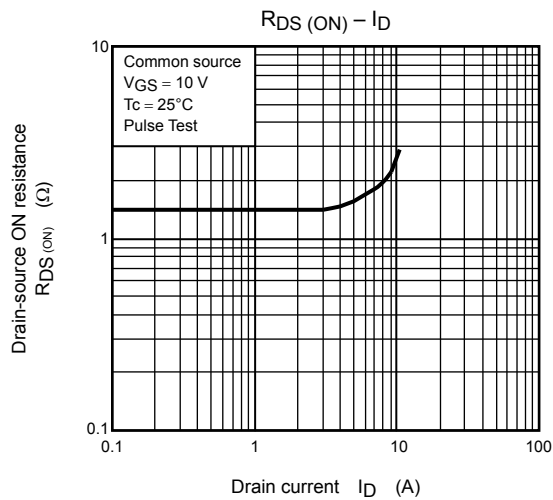
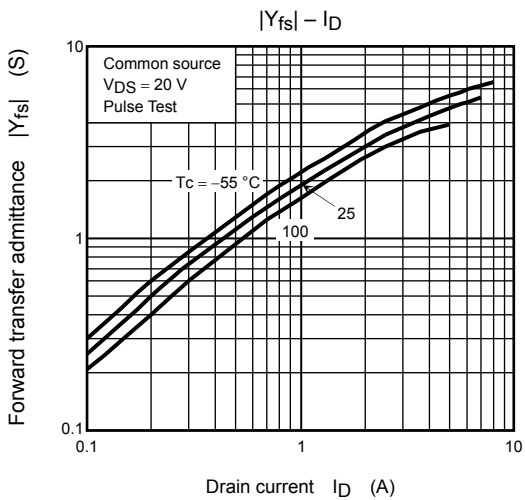
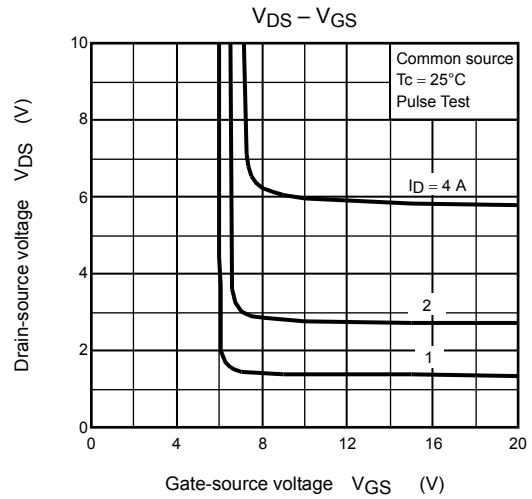
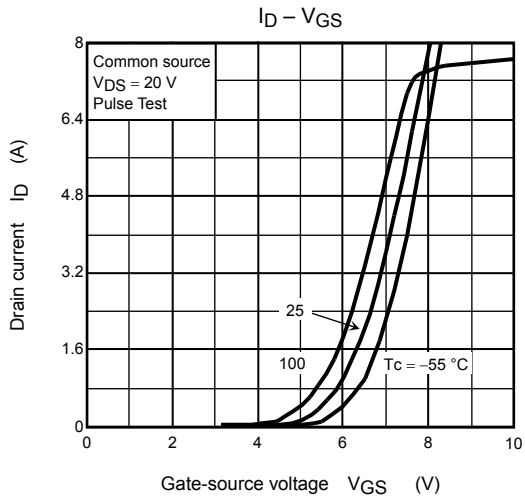
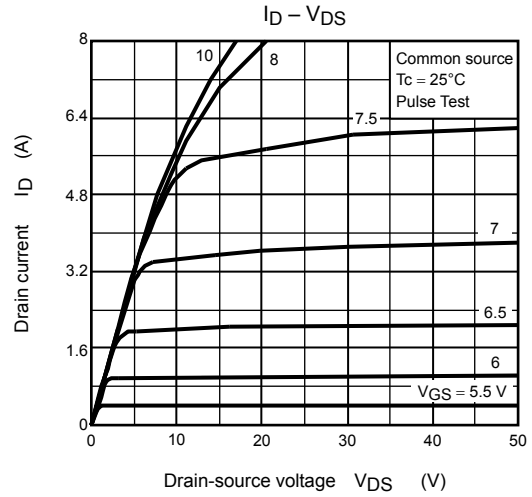
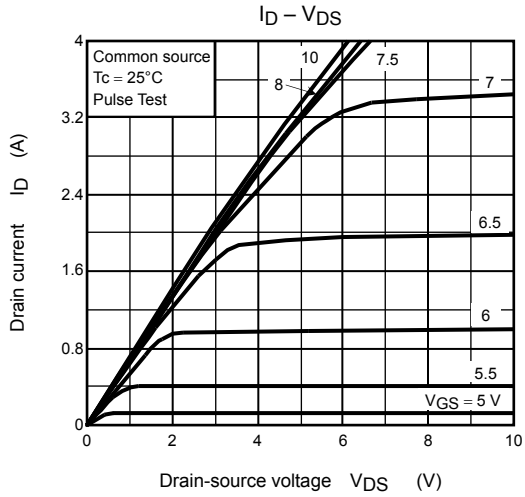
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)		I_{DR}	—	—	—	4	A
Pulse drain reverse current (Note 1)		I_{DRP}	—	—	—	16	A
Forward voltage (diode)		V_{DSF}	$I_{DR} = 4\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.7	V
Reverse recovery time		t_{rr}	$I_{DR} = 4\text{ A}, V_{GS} = 0\text{ V},$	—	1000	—	ns
Reverse recovery charge		Q_{rr}	$dI_{DR}/dt = 100\text{ A}/\mu\text{s}$	—	5.4	—	μC

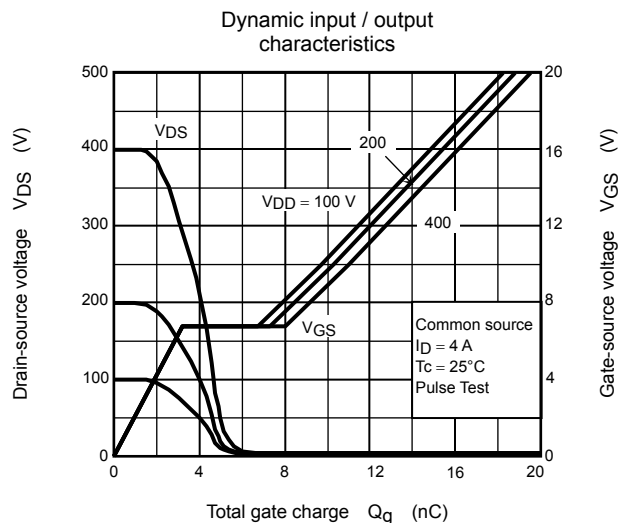
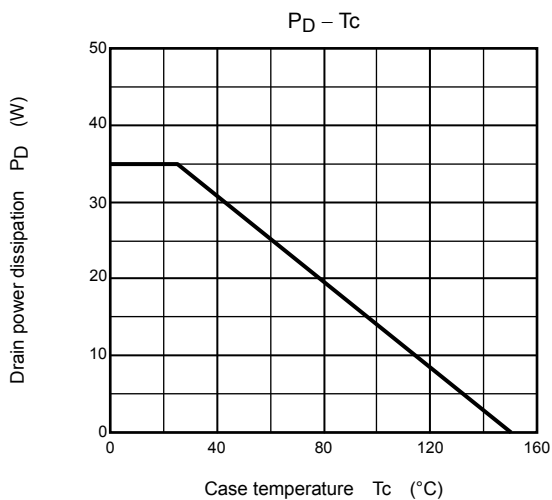
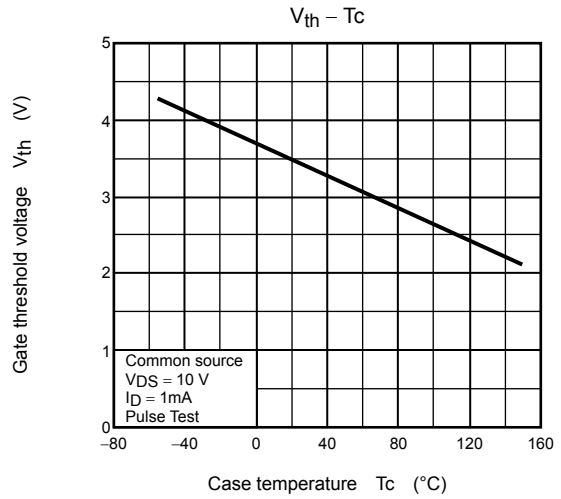
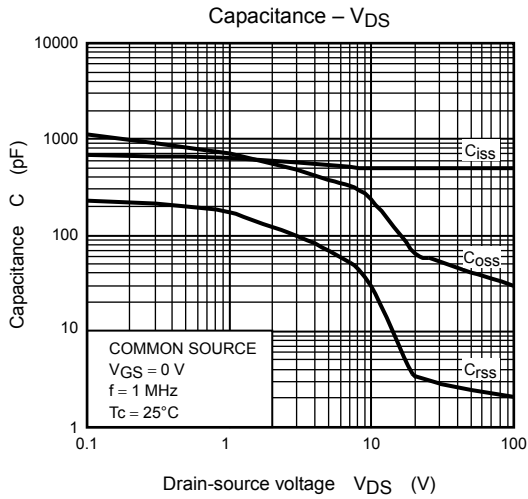
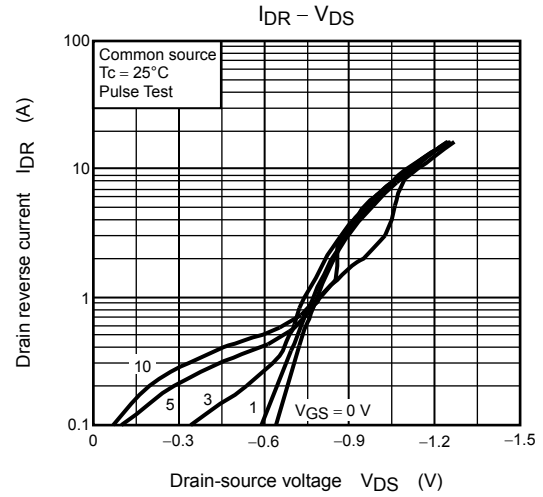
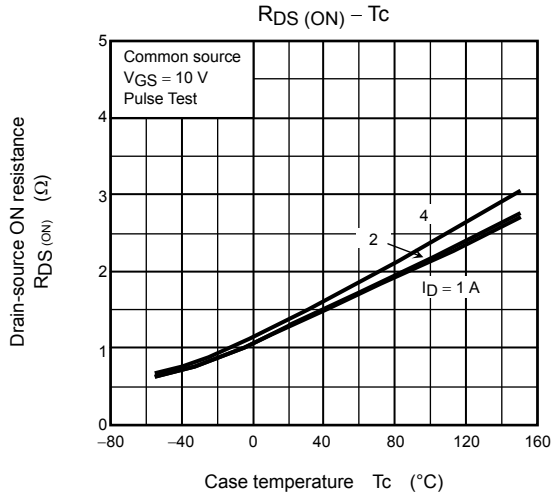
Marking

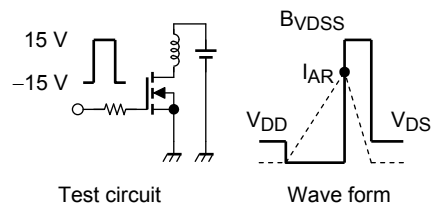
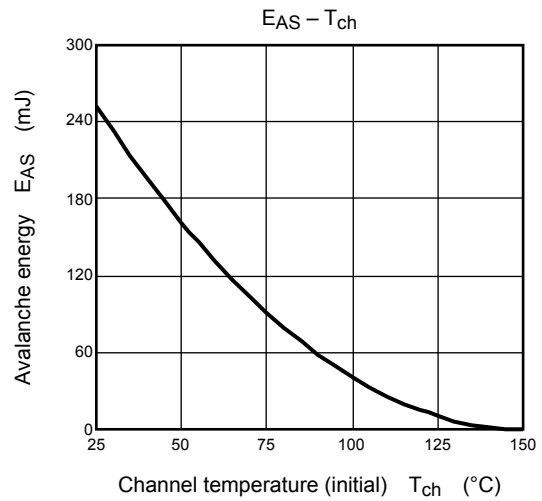
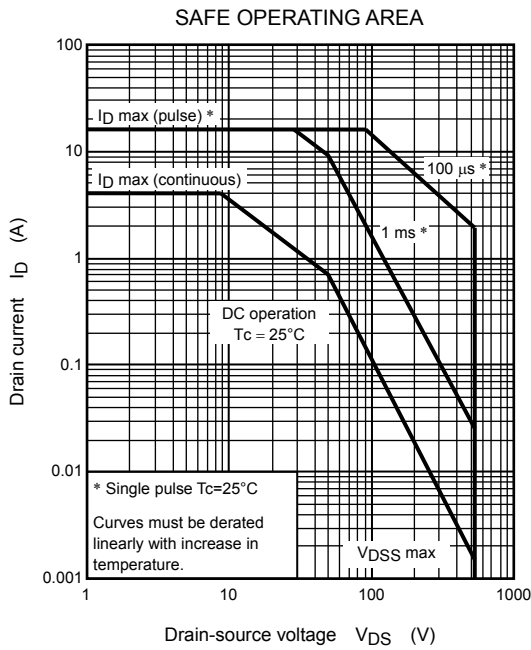
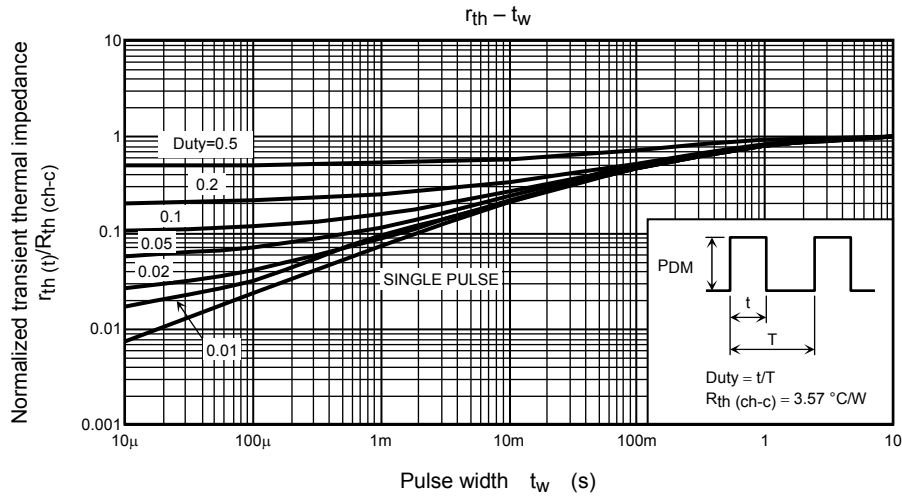


Note 4: A line under a Lot No. identifies the indication of product Labels [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.







$R_G = 25 \Omega$
 $V_{DD} = 90 \text{ V}, L = 27 \text{ mH}$

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

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