

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (Ultra-High-Speed U-MOSⅢ)

TK55D10J1

Switching Regulator Applications

- High-Speed switching
- Low gate charge: $Q_g = 110 \text{ nC}$ (typ.)
- Low drain-source ON resistance: $R_{DS(ON)} = 8.4 \text{ m}\Omega$ (typ.)
- High forward transfer admittance: $|Y_{fs}| = 110 \text{ S}$ (typ.)
- 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}	± 20	V
Drain current	DC (Note 1)	I_D	55	A
	Pulse (Note 1)	I_{DP}	210	
Drain power dissipation ($T_c = 25^\circ\text{C}$)		P_D	140	W
Single pulse avalanche energy (Note 2)		E_{AS}	382	mJ
Avalanche current		I_{AR}	55	A
Repetitive avalanche energy (Note 3)		E_{AR}	9.4	mJ
Channel temperature		T_{ch}	150	$^\circ\text{C}$
Storage temperature range		T_{stg}	-55 to 50	$^\circ\text{C}$

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	$^\circ\text{C/W}$

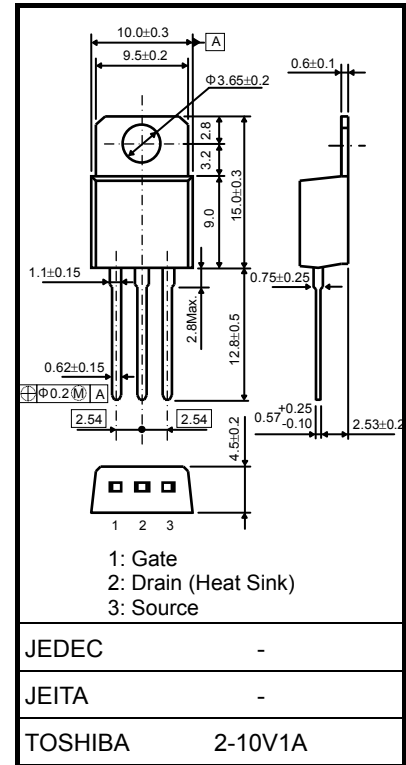
Note 1: Ensure that the channel and lead temperatures do not exceed 150°C .

Note 2: $V_{DD} = 25 \text{ V}$, $T_{ch} = 25^\circ\text{C}$, $L = 200 \text{ }\mu\text{H}$, $I_{AR} = 55 \text{ A}$, $R_G = 1 \Omega$

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

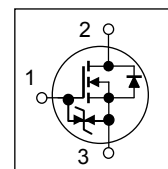
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 1.35 g (typ.)

Internal Connection



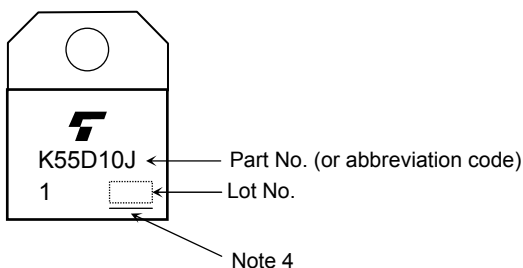
Electrical Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit	
Gate leakage current	I_{GSS}	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	± 10	μA	
Drain cut-OFF current	I_{DSS}	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$	—	—	10	μA	
Drain-source breakdown voltage	$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	100	—	—	V	
	$V_{(BR)DSX}$	$I_D = 10\text{ mA}, V_{GS} = -20\text{ V}$	55	—	—		
Gate threshold voltage	V_{th}	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	1.1	—	2.3	V	
Drain-source ON resistance	$R_{DS(ON)}$	$V_{GS} = 4.5\text{ V}, I_D = 27\text{ A}$	—	9.0	12.0	m Ω	
		$V_{GS} = 10\text{ V}, I_D = 27\text{ A}$	—	8.4	10.5		
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 27\text{ A}$	55	110	—	S	
Input capacitance	C_{iss}	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	5700	—	pF	
Reverse transfer capacitance	C_{rss}		—	390	—		
Output capacitance	C_{oss}		—	1000	—		
Switching time	Rise time	t_r		—	7	ns	
	Turn-ON time	t_{on}		—	30		—
	Fall time	t_f		—	20		—
	Turn-OFF time	t_{off}		—	130		—
Total gate charge (gate-source plus gate-drain)	Q_g	$V_{DD} \approx 80\text{ V}, V_{GS} = 5\text{ V}, I_D = 55\text{ A}$	—	63	—	nC	
		$V_{DD} \approx 80\text{ V}, V_{GS} = 10\text{ V}, I_D = 55\text{ A}$	—	110	—		
Gate-source charge 1	Q_{gs1}	$V_{DD} \approx 80\text{ V}, V_{GS} = 10\text{ V}, I_D = 55\text{ A}$	—	17	—		
Gate-drain ("miller") charge	Q_{gd}		—	32	—		
Gate switch charge	Q_{sw}		—	38	—		

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	I_{DR}	—	—	—	55	A
Pulse drain reverse current (Note 1)	I_{DRP}	—	—	—	220	A
Forward voltage (diode)	V_{DSF}	$I_{DR} = 55\text{ A}, V_{GS} = 0\text{ V}$	—	-0.9	-1.2	V
Reverse recovery time	t_{rr}	$I_{DR} = 55\text{ A}, V_{GS} = 0\text{ V},$	—	67	—	ns
Reverse recovery charge	Q_{rr}	$dI_{DR}/dt = 50\text{ A}/\mu\text{s}$	—	84	—	nC

Marking

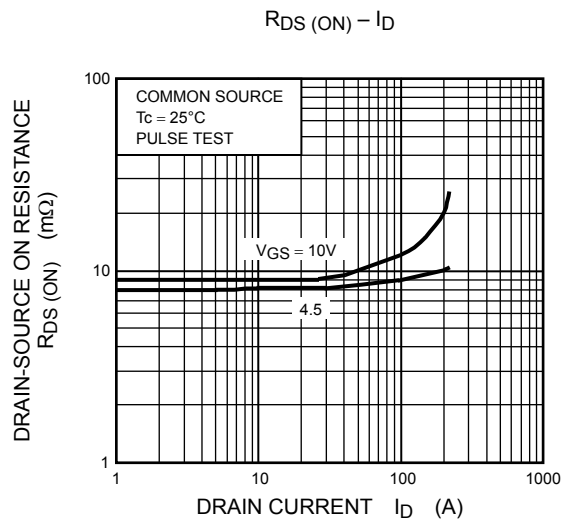
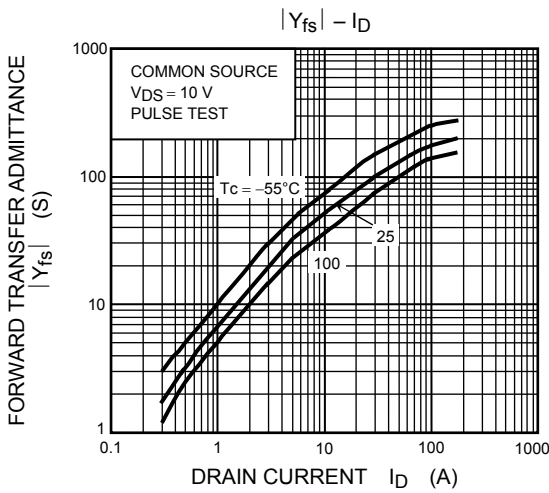
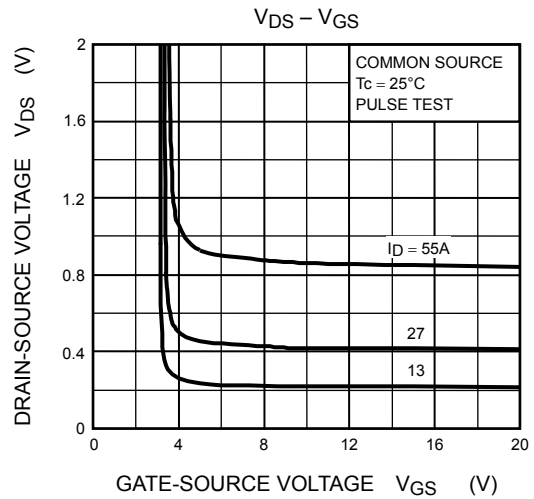
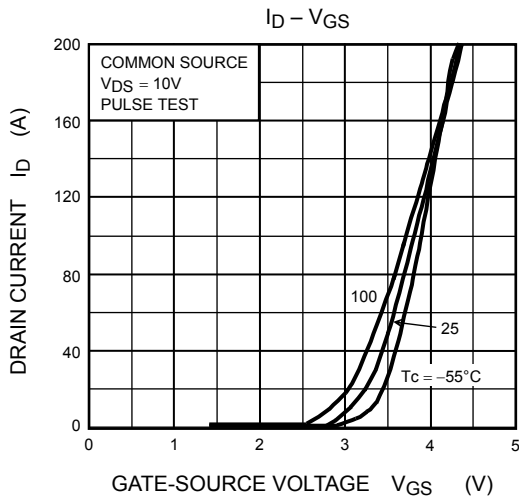
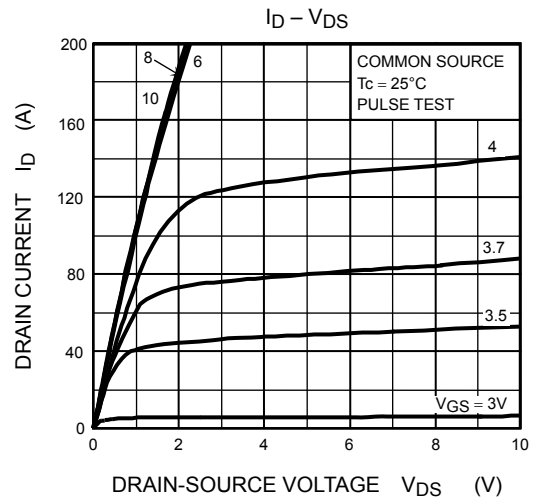
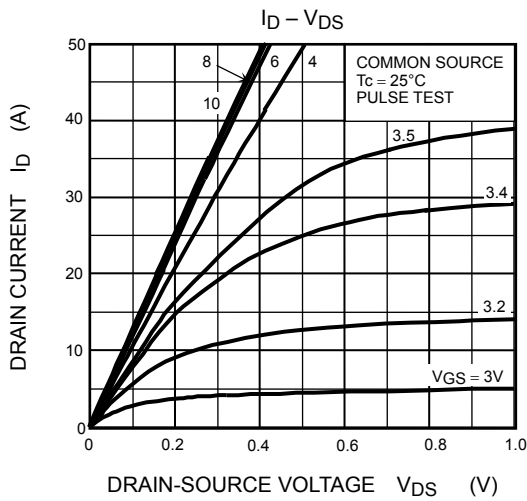


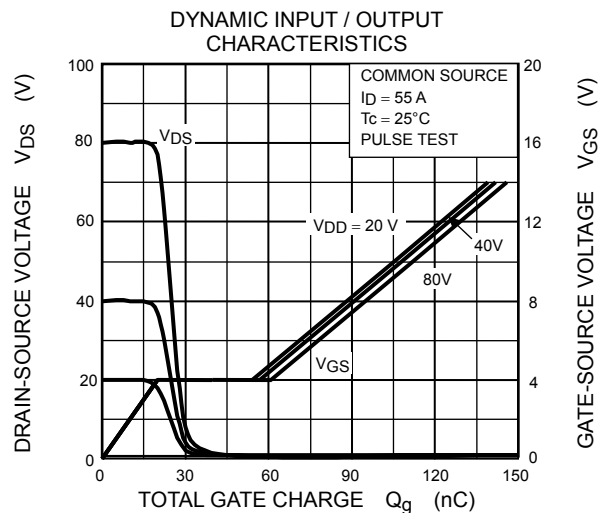
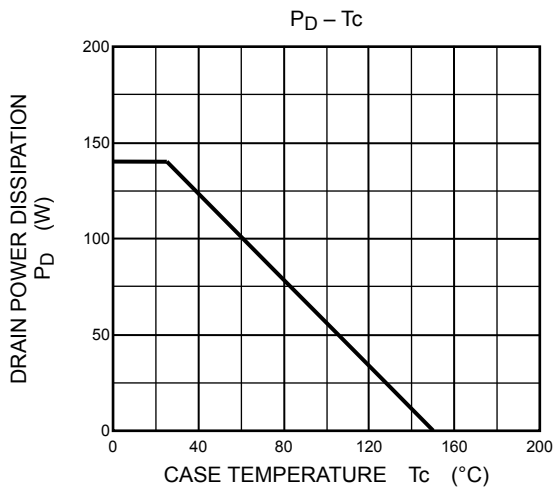
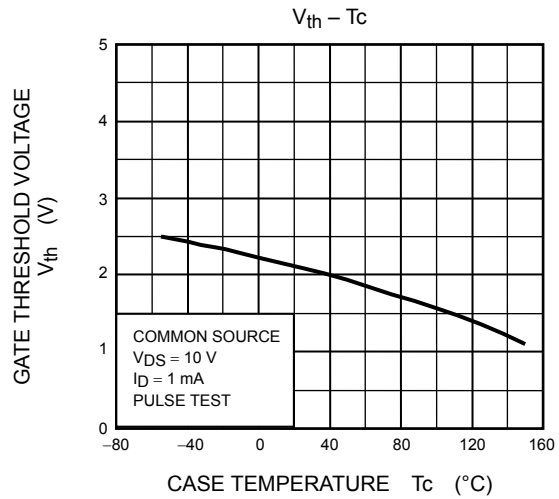
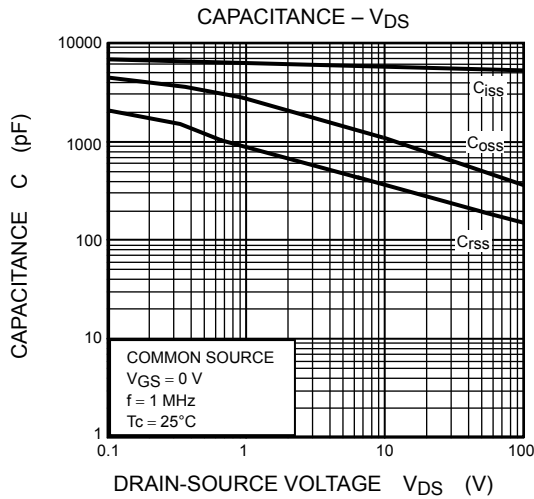
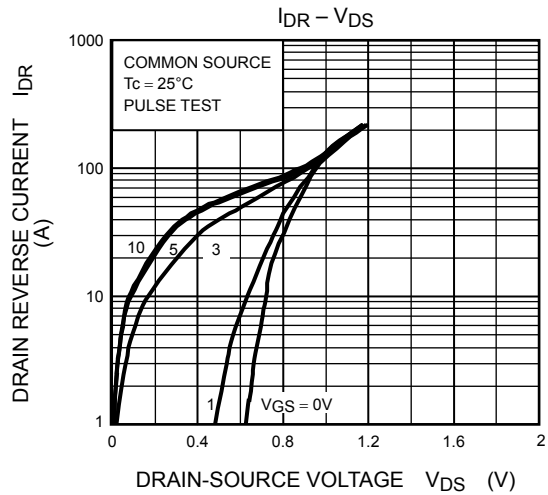
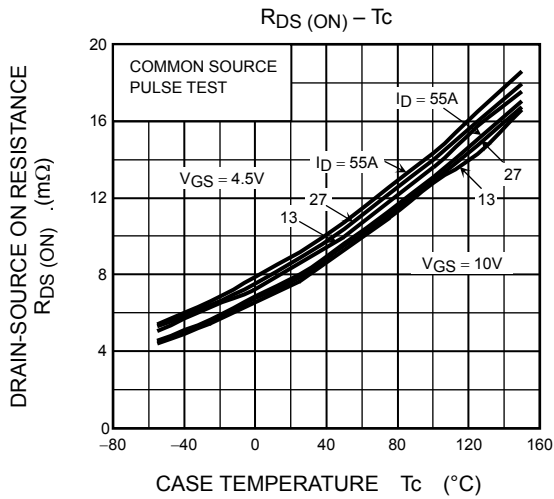
Note 4: A line under a Lot No. identifies the indication of product Labels.

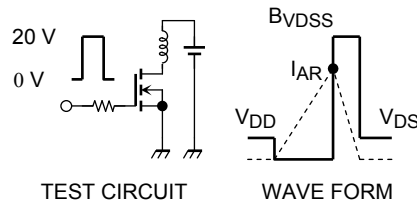
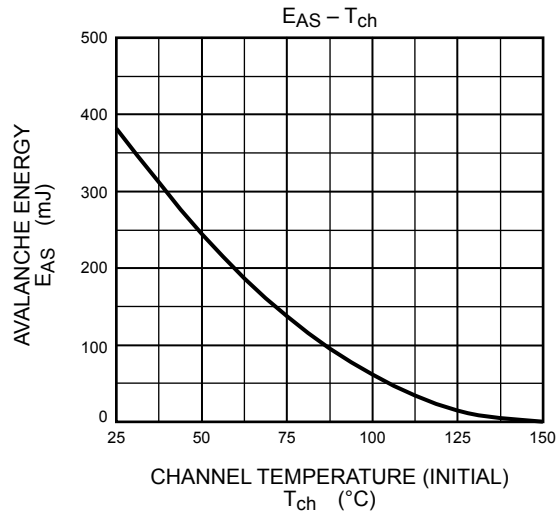
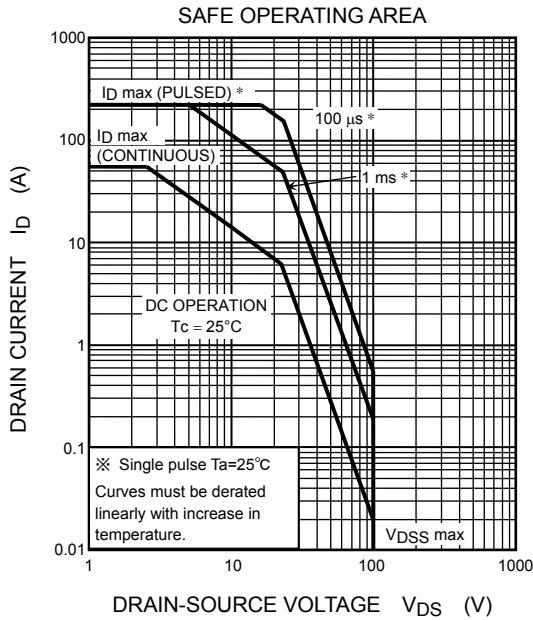
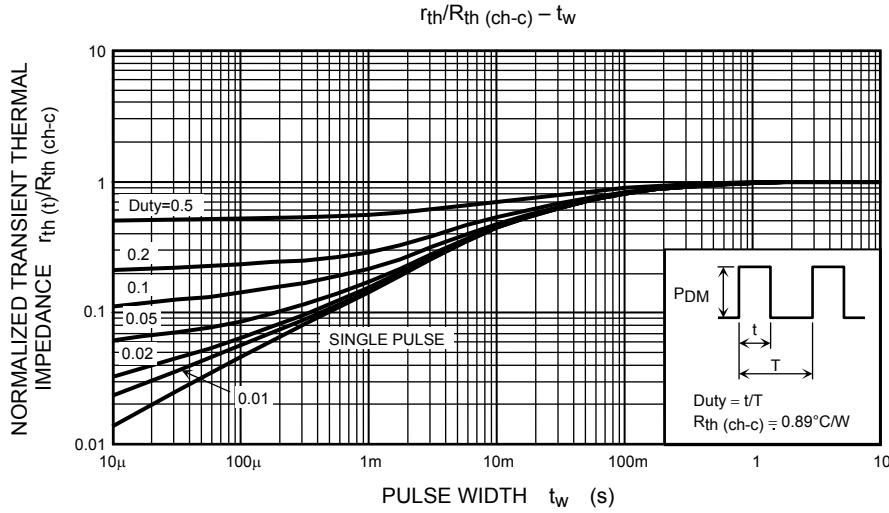
Not underlined: $[[\text{Pb}]]/\text{INCLUDES} > \text{MCV}$

Underlined: $[[\text{G}]]/\text{RoHS COMPATIBLE}$ or $[[\text{G}]]/\text{RoHS} [[\text{Pb}]]$

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

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

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