

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

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2SK3633

Switching Regulator Applications

- Low drain-source ON-resistance: $R_{DS(ON)} = 1.35 \Omega$ (typ.)
- High forward transfer admittance: $|Y_{fs}| = 5.2 S$ (typ.)
- Low leakage current: $I_{DSS} = 100 \mu A$ ($V_{DS} = 640 V$)
- Enhancement mode: $V_{th} = 2.0 \sim 4.0 V$ ($V_{DS} = 10 V, I_D = 1 mA$)

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

Characteristic	Symbol	Rating	Unit	
Drain-source voltage	V_{DSS}	800	V	
Drain-gate voltage ($R_{GS} = 20 k\Omega$)	V_{DGR}	800	V	
Gate-source voltage	V_{GSS}	± 30	V	
Drain current	DC (Note 1)	I_D	7	A
	Pulse ($t = 1 ms$) (Note 1)	I_{DP}	21	
Drain power dissipation ($T_c = 25^\circ C$)	P_D	150	W	
Single-pulse avalanche energy (Note 2)	E_{AS}	420	mJ	
Avalanche current	I_{AR}	7	A	
Repetitive avalanche energy (Note 3)	E_{AR}	15	mJ	
Channel temperature	T_{ch}	150	$^\circ C$	
Storage temperature range	T_{stg}	$-55 \sim 150$	$^\circ C$	

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

Characteristic	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	$^\circ C/W$

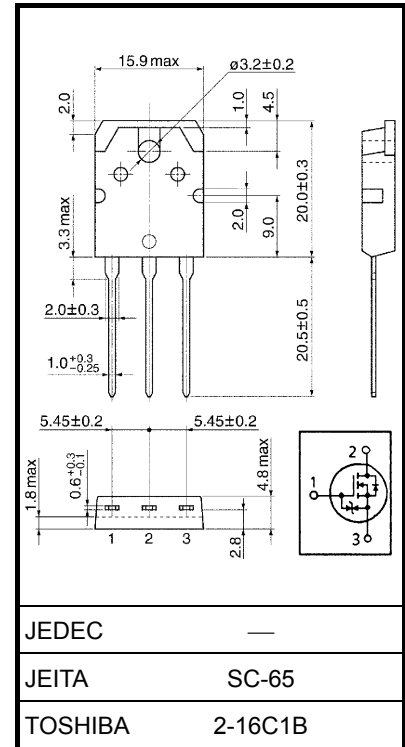
Note 1: Ensure that the channel temperature does not exceed $150^\circ C$.

Note 2: $V_{DD} = 90 V, T_{ch} = 25^\circ C$ (initial), $L = 15.7 mH, I_{AR} = 7 A, R_G = 25 \Omega$

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

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

Unit: mm



Weight: 4.6 g (typ.)

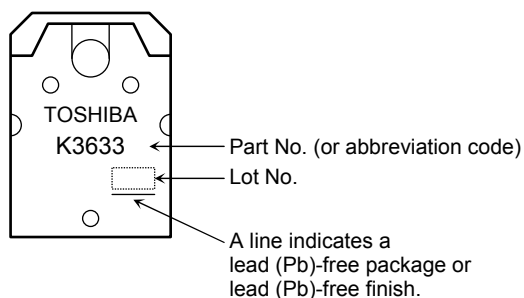
Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm 25\text{ V}, V_{DS} = 0\text{ V}$	—	—	± 10	μA
Gate-source breakdown voltage		$V_{(BR)GSS}$	$I_D = \pm 10\ \mu\text{A}, V_{GS} = 0\text{ V}$	± 30	—	—	V
Drain cutoff current		I_{DSS}	$V_{DS} = 640\text{ V}, V_{GS} = 0\text{ V}$	—	—	100	μA
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	800	—	—	V
Gate threshold voltage		V_{th}	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	2.0	—	4.0	V
Drain-source ON-resistance		$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 3.5\text{ A}$	—	1.35	1.7	Ω
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 20\text{ V}, I_D = 3.5\text{ A}$	2.5	5.2	—	S
Input capacitance		C_{iss}	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	1500	—	pF
Reverse transfer capacitance		C_{rss}		—	25	—	
Output capacitance		C_{oss}		—	140	—	
Switching time	Rise time	t_r		—	35	—	ns
	Turn-on time	t_{on}		—	80	—	
	Fall time	t_f		—	50	—	
	Turn-off time	t_{off}		—	220	—	
Total gate charge		Q_g	$V_{DD} \approx 400\text{ V}, V_{GS} = 10\text{ V}, I_D = 7\text{ A}$	—	35	—	nC
Gate-source charge		Q_{gs}		—	22	—	
Gate-drain charge		Q_{gd}		—	13	—	

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

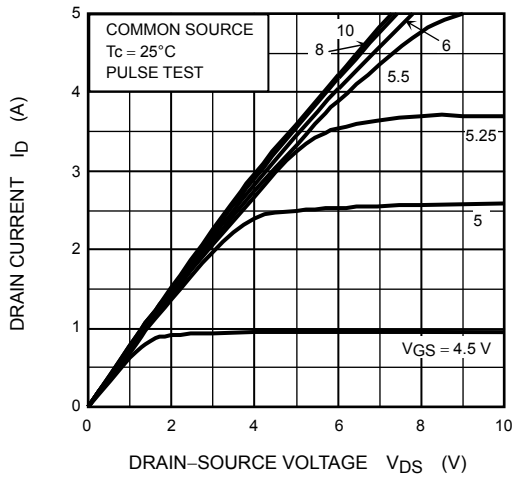
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	I_{DR}	—	—	—	7	A
Pulse drain reverse current (Note 1)	I_{DRP}	—	—	—	21	A
Forward voltage (diode)	V_{DSF}	$I_{DR} = 7\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.7	V
Reverse recovery time	t_{rr}	$I_{DR} = 7\text{ A}, V_{GS} = 0\text{ V},$	—	1200	—	ns
Reverse recovery charge	Q_{rr}	$dI_{DR}/dt = 100\text{ A}/\mu\text{s}$	—	11.5	—	μC

Marking

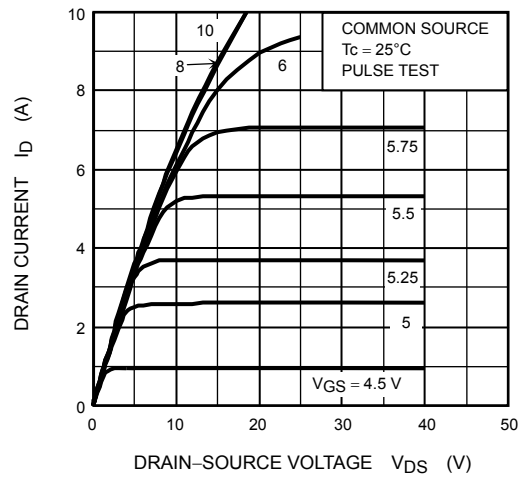


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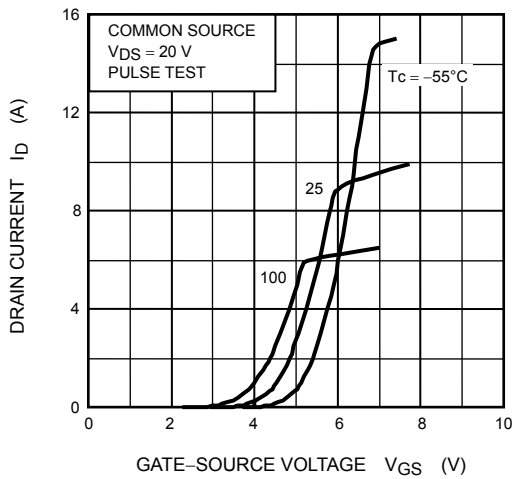
$I_D - V_{DS}$



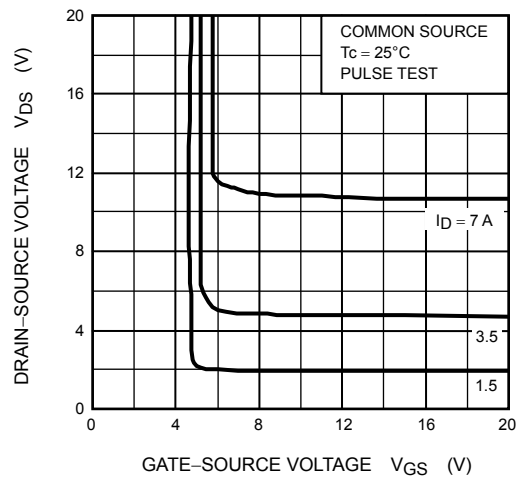
$I_D - V_{DS}$



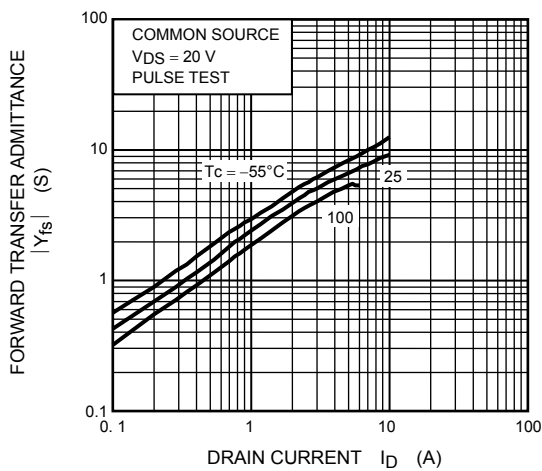
$I_D - V_{GS}$



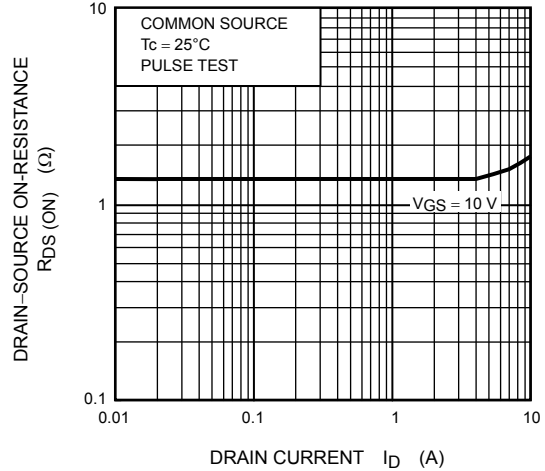
$V_{DS} - V_{GS}$



$|Y_{fs}| - I_D$

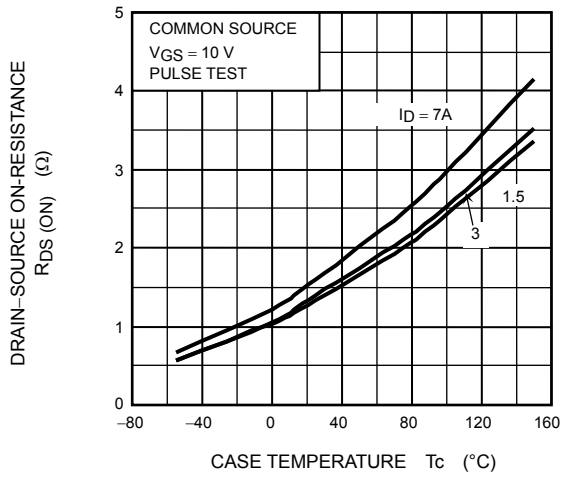


$R_{DS(ON)} - I_D$

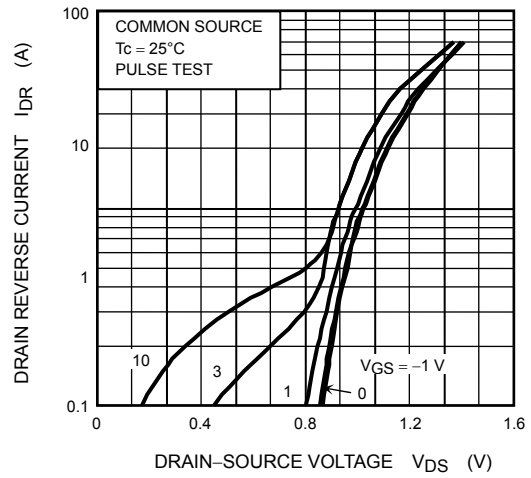


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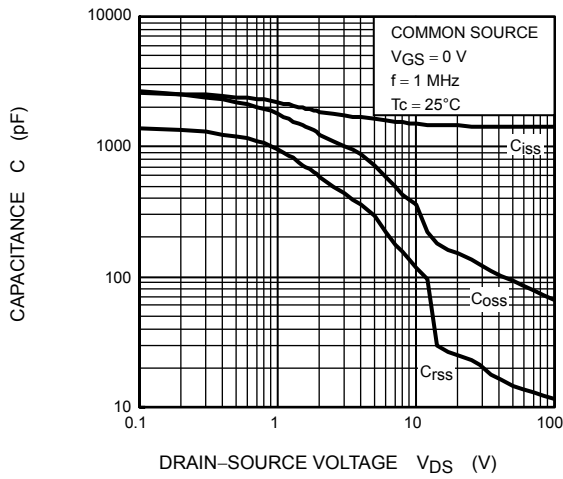
$R_{DS(ON)} - T_c$



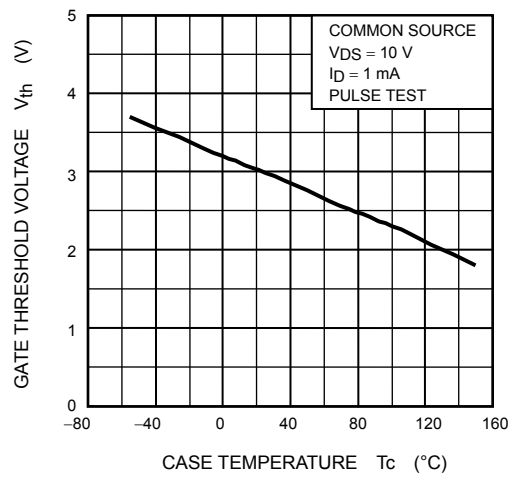
$I_{DR} - V_{DS}$



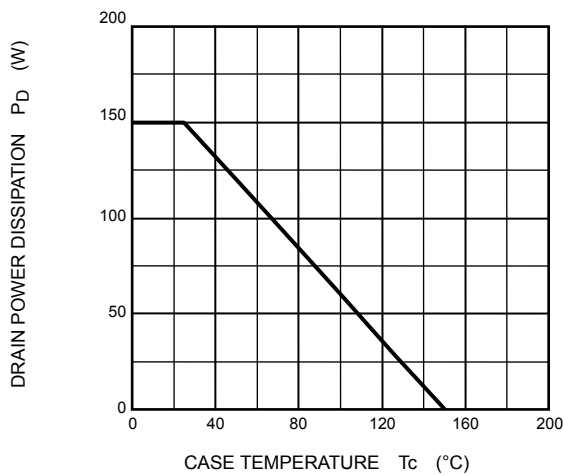
$C - V_{DS}$



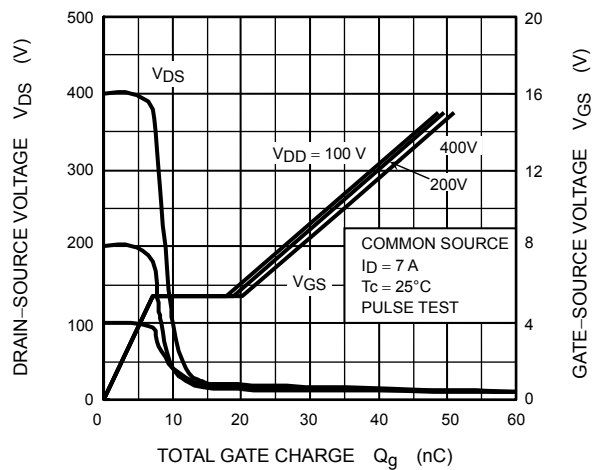
$V_{th} - T_c$



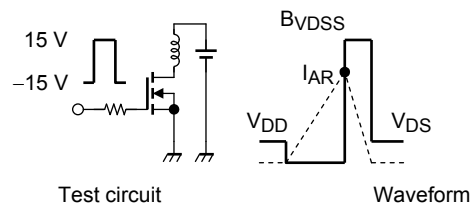
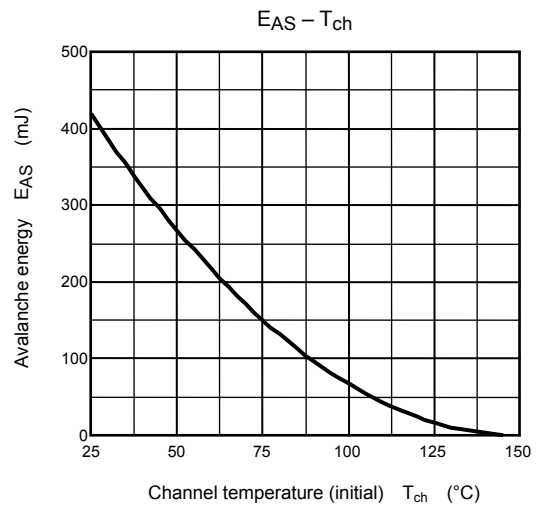
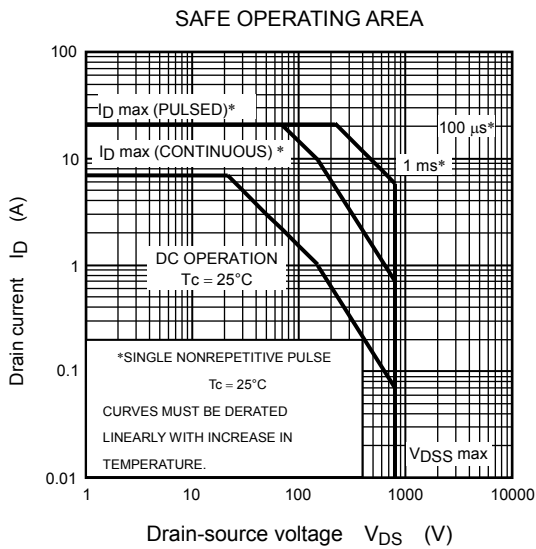
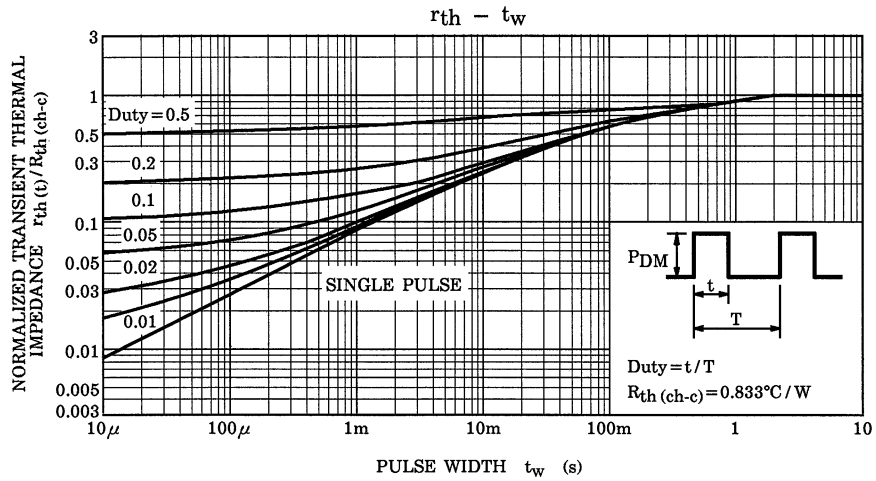
$P_D - T_c$



DYNAMIC INPUT/OUTPUT CHARACTERISTICS



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$$R_G = 25 \Omega$$

$$V_{DD} = 90 \text{ V}, L = 15.7 \text{ mH}$$

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

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