

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

2SK4022

Switching Regulators, DC-DC Converters and Motor Drive Applications

- 4-V gate drive
- Low drain-source ON-resistance: $R_{DS(ON)} = 1.2 \Omega$ (typ.)
- High forward transfer admittance: $|Y_{fs}| = 2.2 S$ (typ.)
- Low leakage current: $I_{DSS} = 100 \mu A$ (max) ($V_{DS} = 250 V$)
- Enhancement mode: $V_{th} = 1.5$ to $3.5 V$ ($V_{DS} = 10 V, I_D = 1 mA$)

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

Characteristic	Symbol	Rating	Unit
Drain-source voltage	V_{DSS}	250	V
Drain-gate voltage ($R_{GS} = 20 k\Omega$)	V_{DGR}	250	V
Gate-source voltage	V_{GSS}	± 20	V
Drain current	DC (Note 1)	I_D	3
	Pulse ($t = 1 ms$) (Note 1)	I_{DP}	6
Drain power dissipation ($T_c = 25^\circ C$)	P_D	20	W
Single-pulse avalanche energy (Note 2)	E_{AS}	36.2	mJ
Avalanche current	I_{AR}	3	A
Repetitive avalanche energy (Note 3)	E_{AR}	2	mJ
Channel temperature	T_{ch}	150	$^\circ C$
Storage temperature range	T_{stg}	-55 to 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

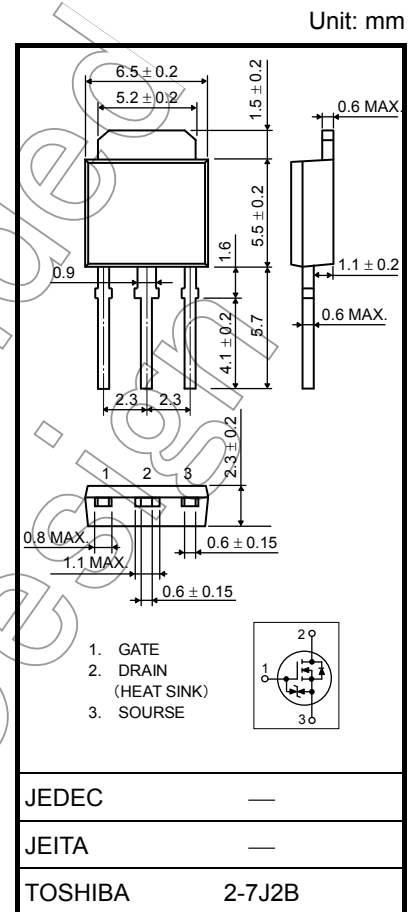
Characteristic	Symbol	Max	Unit
Thermal resistance, channel to case	$R_{th(ch-c)}$	6.25	$^\circ C/W$
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	125	$^\circ C/W$

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

Note 2: $V_{DD} = 50 V, T_{ch} = 25^\circ C, L = 6.7 mH, I_{AR} = 3 A, R_G = 25 \Omega$

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

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



Weight: 0.36 g (typ.)

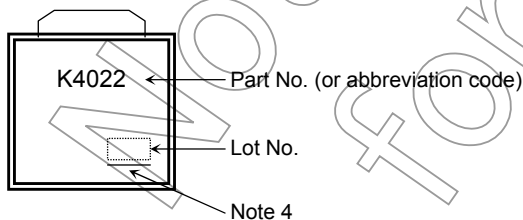
Electrical Characteristics (Ta = 25°C)

Characteristic		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 cutoff current		I_{DSS}	$V_{DS} = 250\text{ V}, V_{GS} = 0\text{ V}$	—	—	100	μA
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	250	—	—	V
Gate threshold voltage		V_{th}	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	1.5	—	3.5	V
Drain-source ON-resistance		$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 1.5\text{ A}$	—	1.2	1.7	Ω
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 1.5\text{ A}$	0.5	2.2	—	S
Input capacitance		C_{iss}	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	267	—	pF
Reverse transfer capacitance		C_{rss}		—	32	—	
Output capacitance		C_{oss}		—	98	—	
Switching time	Rise time	t_r	<p>$I_D = 1.5\text{ A}$ $R_L = 67\ \Omega$ $V_{DD} \approx 100\text{ V}$ Duty $\leq 1\%$, $t_w = 10\ \mu\text{s}$</p>	—	5	—	ns
	Turn-on time	t_{on}		—	20	—	
	Fall time	t_f		—	5	—	
	Turn-off time	t_{off}		—	30	—	
Total gate charge		Q_g	$V_{DD} \approx 200\text{ V}, V_{GS} = 10\text{ V}, I_D = 3\text{ A}$	—	12	—	nC
Gate-source charge		Q_{gs}		—	6	—	
Gate-drain charge		Q_{gd}		—	6	—	

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

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	I_{DR}	—	—	—	3	A
Pulse drain reverse current (Note 1)	I_{DRP}	—	—	—	6	A
Forward voltage (diode)	V_{DSF}	$I_{DR} = 3\text{ A}, V_{GS} = 0\text{ V}$	—	—	-2.0	V
Reverse recovery time	t_{rr}	$I_{DR} = 3\text{ A}, V_{GS} = 0\text{ V},$	—	125	—	ns
Reverse recovery charge	Q_{rr}	$dI_{DR}/dt = 100\text{ A}/\mu\text{s}$	—	470	—	nC

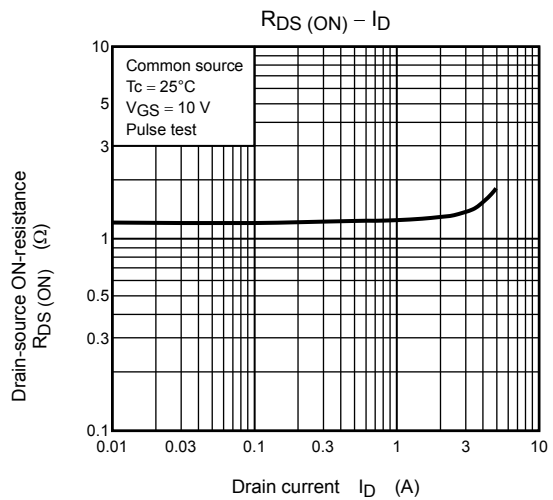
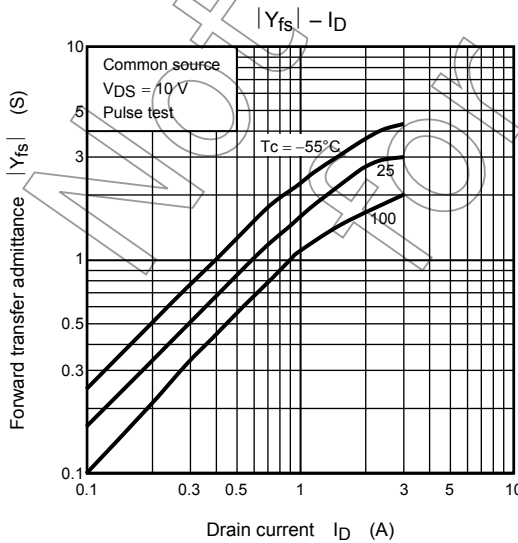
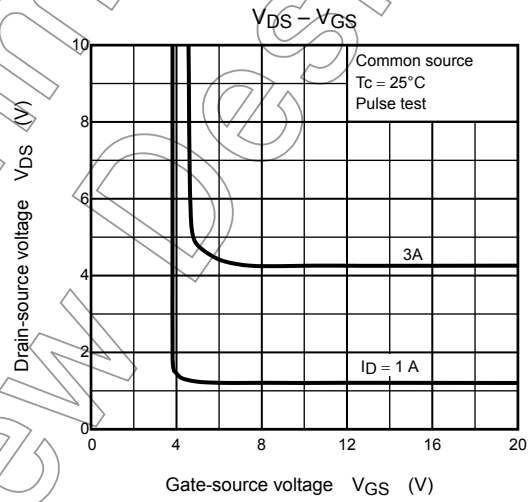
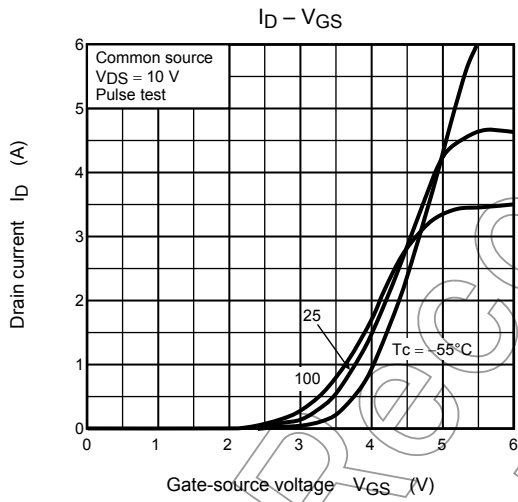
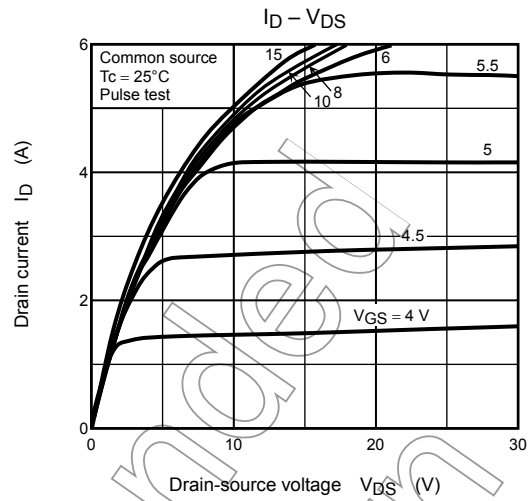
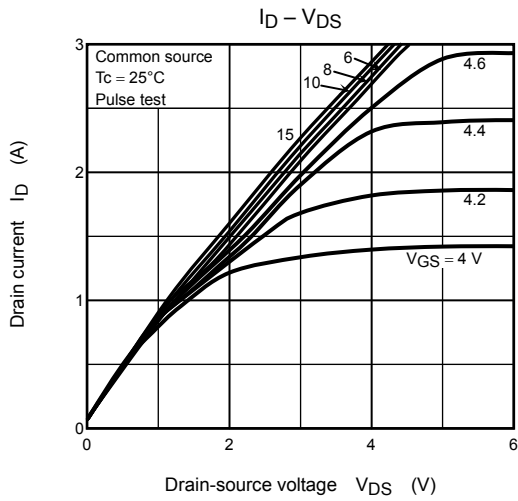
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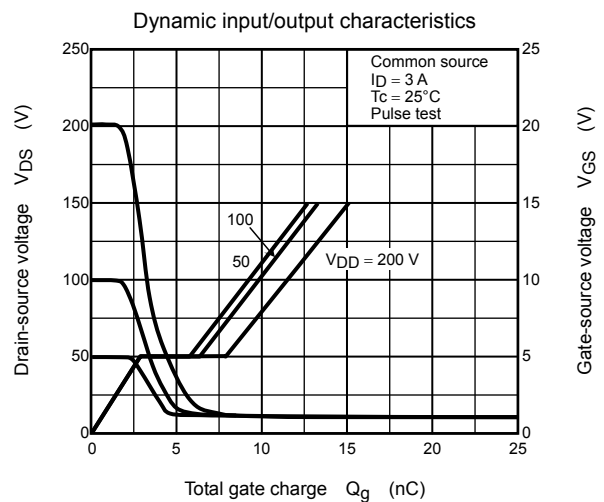
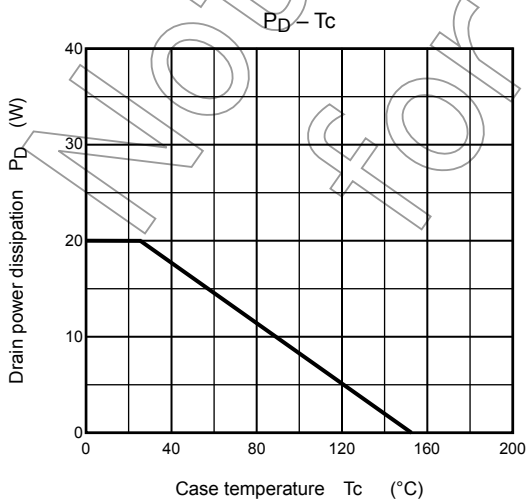
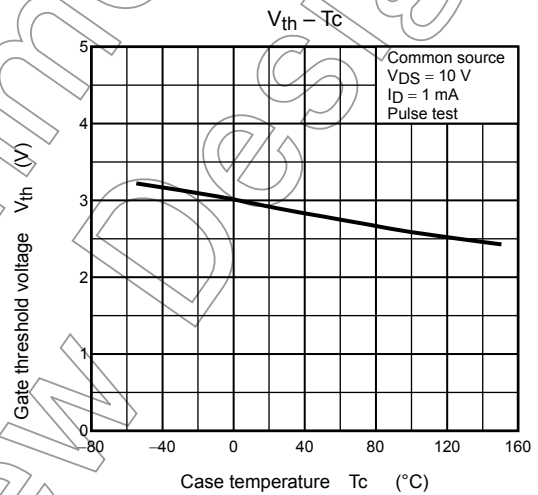
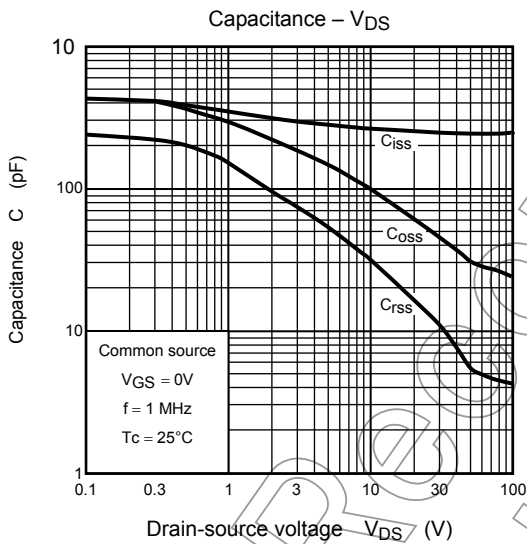
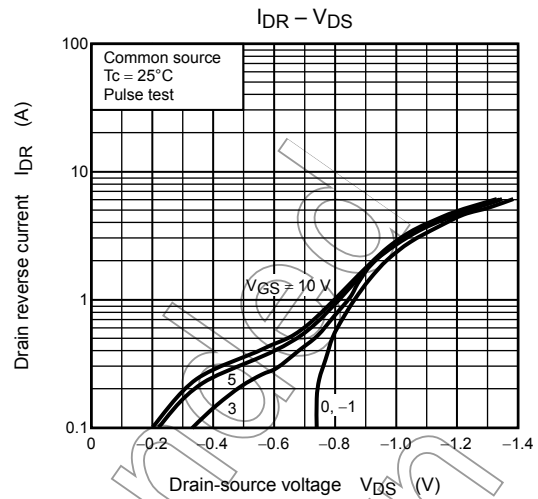
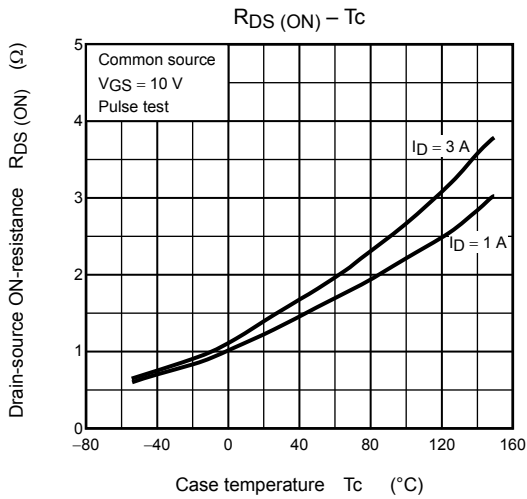


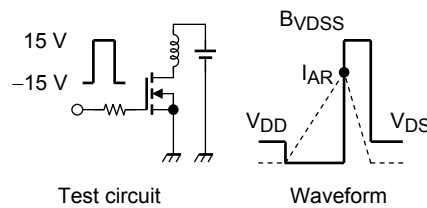
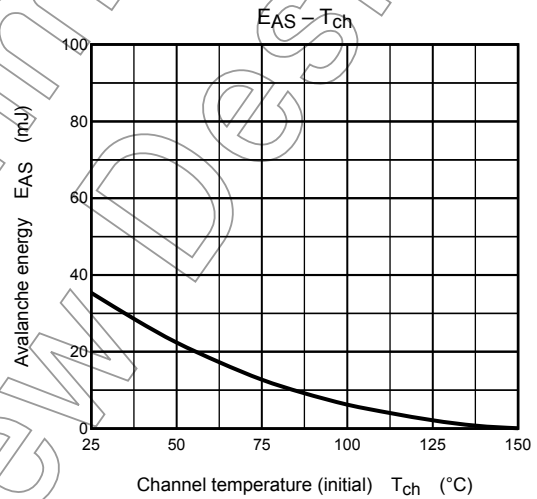
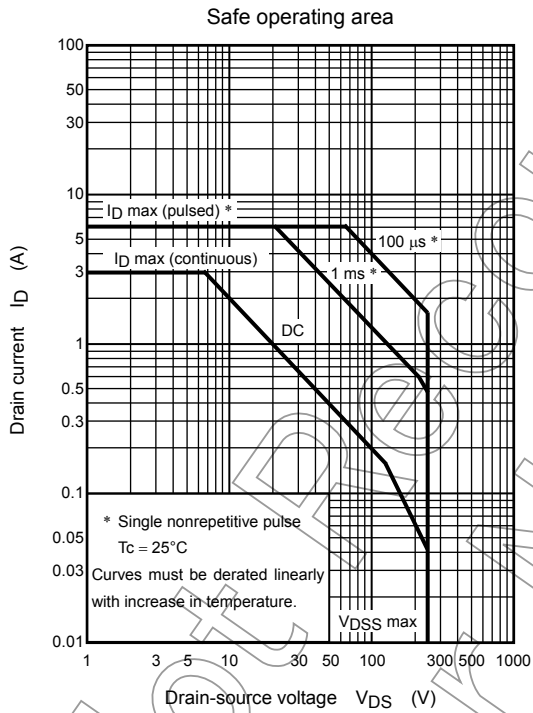
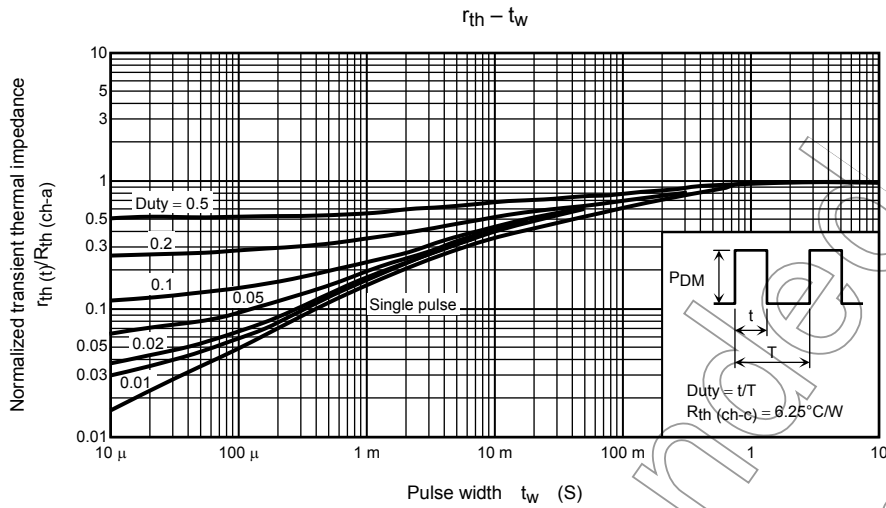
Note 4: A line under a Lot No. identifies the indication of product Labels.

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

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

$R_G = 25 \Omega$
 $V_{DD} = 50 \text{ V}, L = 6.7 \text{ mH}$

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