

2SK4020

Chopper Regulator, DC/DC Converter and Motor Drive Applications

- 4-V gate drive
- Low drain-source ON-resistance : $R_{DS(ON)} = 0.56 \Omega$ (typ.)
- High forward transfer admittance : $|Y_{fs}| = 4.5 S$ (typ.)
- Low leakage current : $I_{DSS} = 100 \mu A$ (max) ($V_{DS} = 200 V$)
- Enhancement mode : $V_{th} = 1.5\sim 3.5 V$ ($V_{DS} = 10 V, I_D = 1 mA$)

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

Characteristic	Symbol	Rating	Unit	
Drain-source voltage	V_{DSS}	200	V	
Drain-gate voltage ($R_{GS} = 20 k\Omega$)	V_{DGR}	200	V	
Gate-source voltage	V_{GSS}	± 20	V	
Drain current	DC (Note 1)	I_D	5	A
	Pulse (Note 1)	I_{DP}	20	A
Drain power dissipation ($T_c = 25^\circ C$)	P_D	20	W	
Single-pulse avalanche energy (Note 2)	E_{AS}	65	mJ	
Avalanche current	I_{AR}	5	A	
Repetitive avalanche energy (Note 3)	E_{AR}	2	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	$R_{th(ch-c)}$	6.25	$^\circ C / W$
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	125	$^\circ C / W$

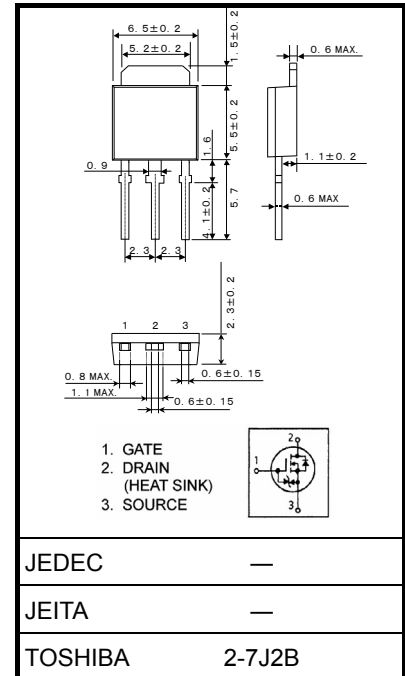
Note 1: Ensure that the channel temperature does not exceed $150^\circ C$.

Note 2: $V_{DD} = 50 V, T_{ch} = 25^\circ C$ (initial), $L = 4.2 mH, R_G = 25 \Omega, I_{AR} = 5 A$

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

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

Unit: mm



Weight: 0.36 g (typ.)

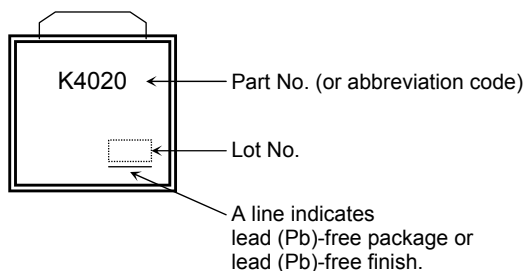
Electrical Characteristics (Ta = 25°C)

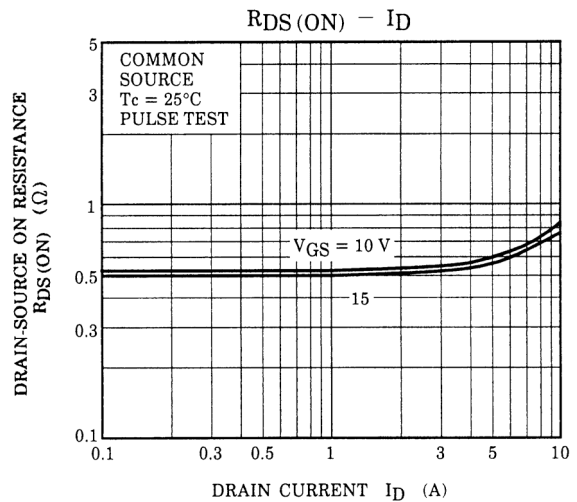
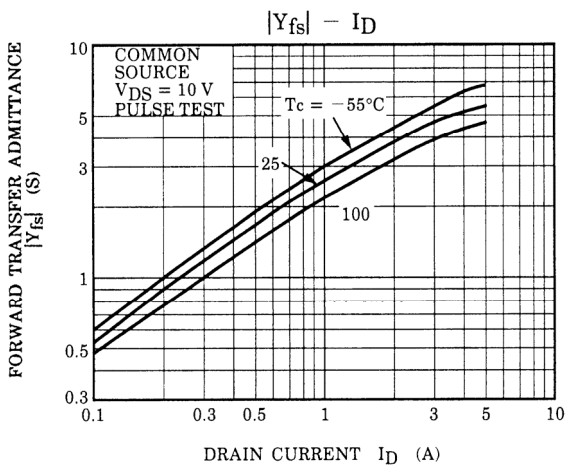
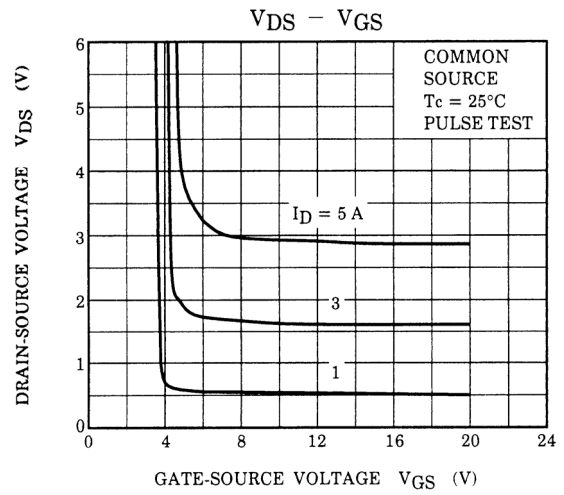
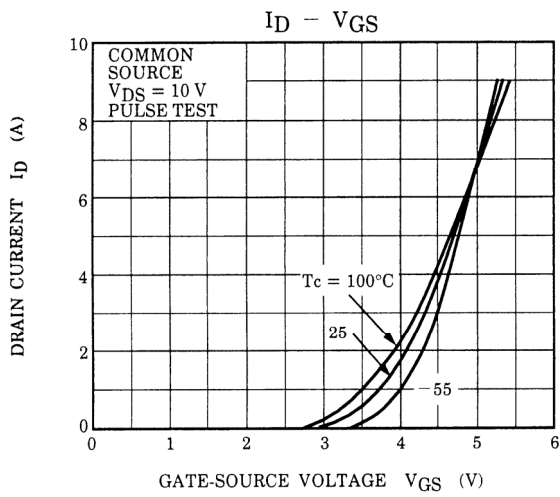
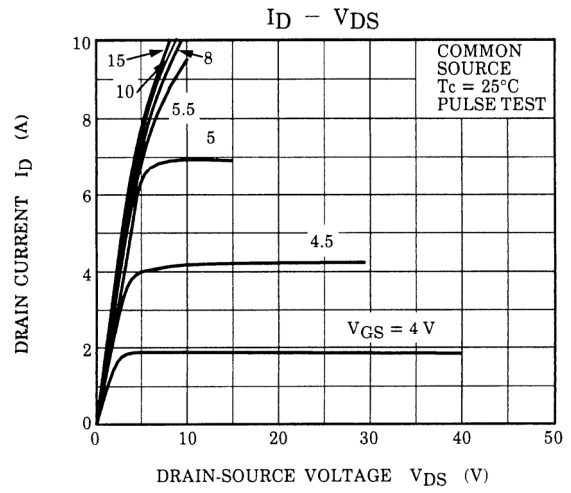
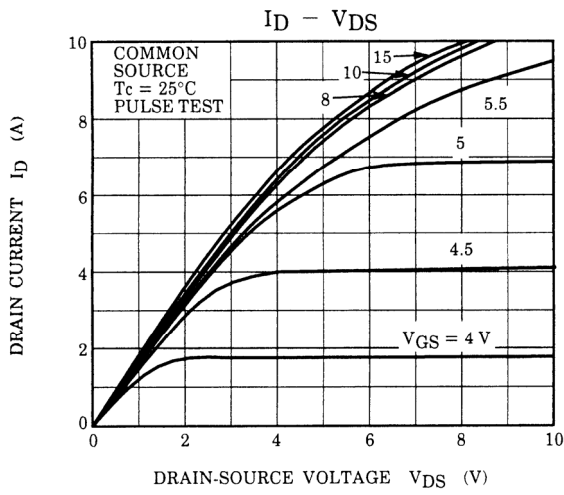
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	± 10	μA
Drain cutoff current		I_{DSS}	$V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}$	—	—	100	μA
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	200	—	—	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		$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 2.5\text{ A}$	—	0.56	0.8	Ω
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 2.5\text{ A}$	2.0	4.5	—	S
Input capacitance		C_{iss}	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	440	—	pF
Reverse transfer capacitance		C_{rss}		—	35	—	
Output capacitance		C_{oss}		—	120	—	
Switching time	Rise time	t_r		—	15	—	ns
	Turn-on time	t_{on}		—	20	—	
	Fall time	t_f		—	15	—	
	Turn-off time	t_{off}		Duty $\leq 1\%$, $t_w = 10\ \mu\text{s}$	—	60	
Total gate charge (gate-source plus gate-drain)		Q_g	$V_{DD} \approx 100\text{ V}, V_{GS} = 10\text{ V}, I_D = 5\text{ A}$	—	10	—	nC
Gate-source charge		Q_{gs}		—	6	—	
Gate-drain ("Miller") Charge		Q_{gd}		—	4	—	

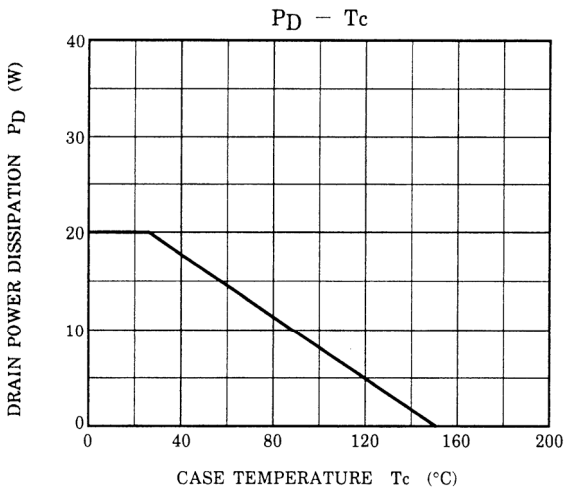
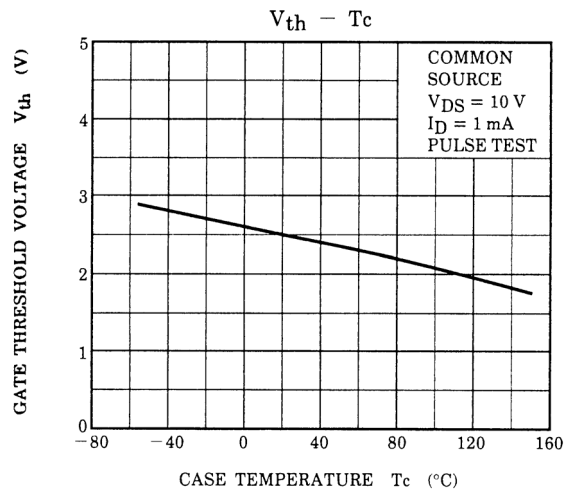
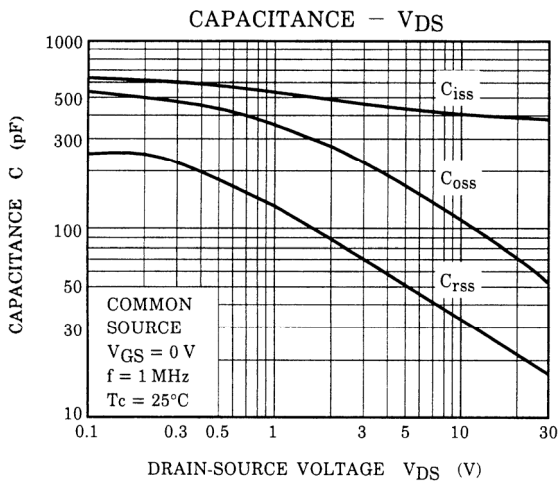
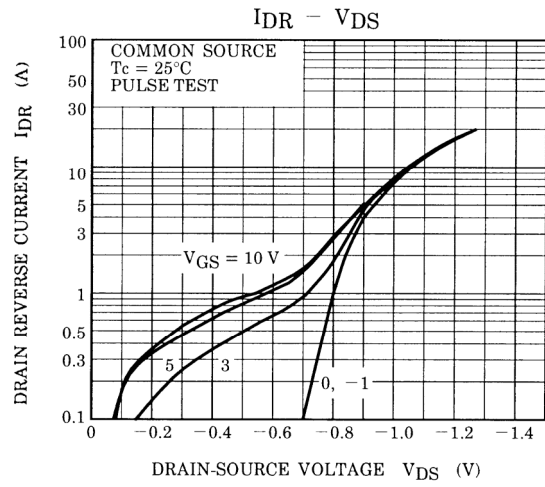
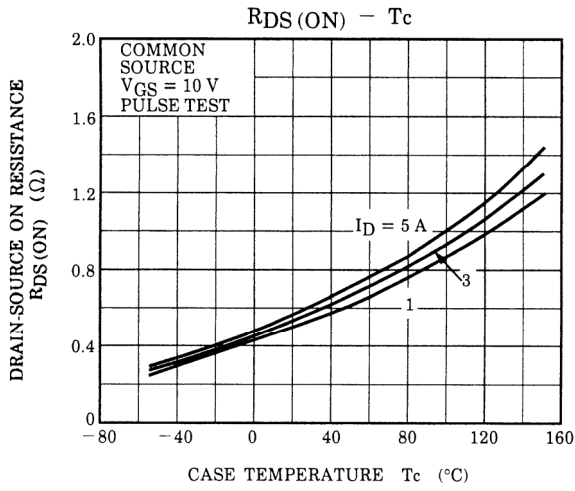
Source-Drain Ratings and Characteristics (Ta = 25°C)

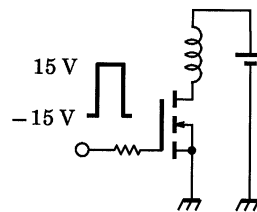
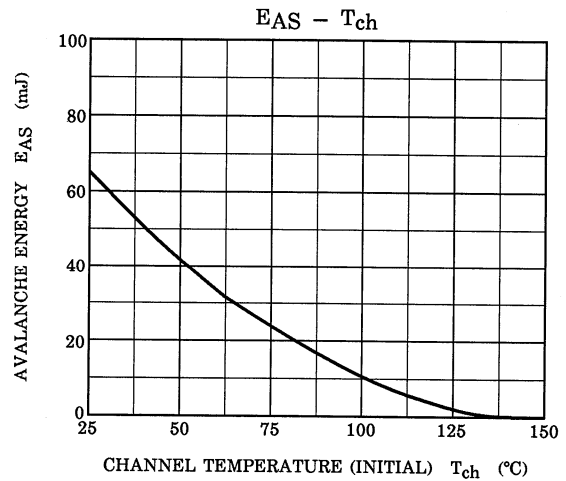
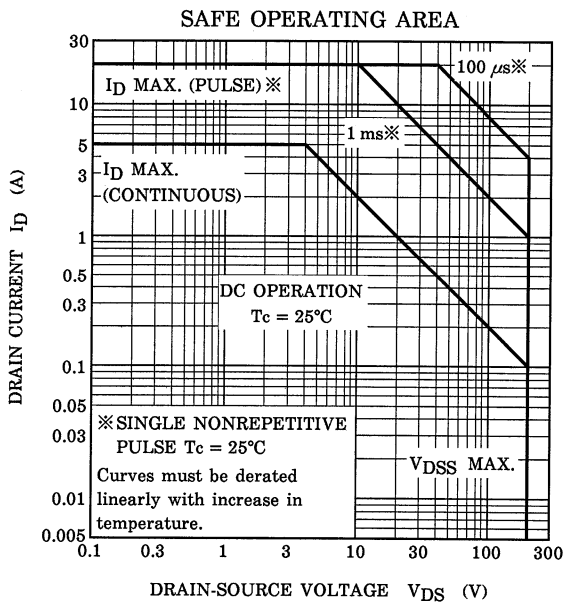
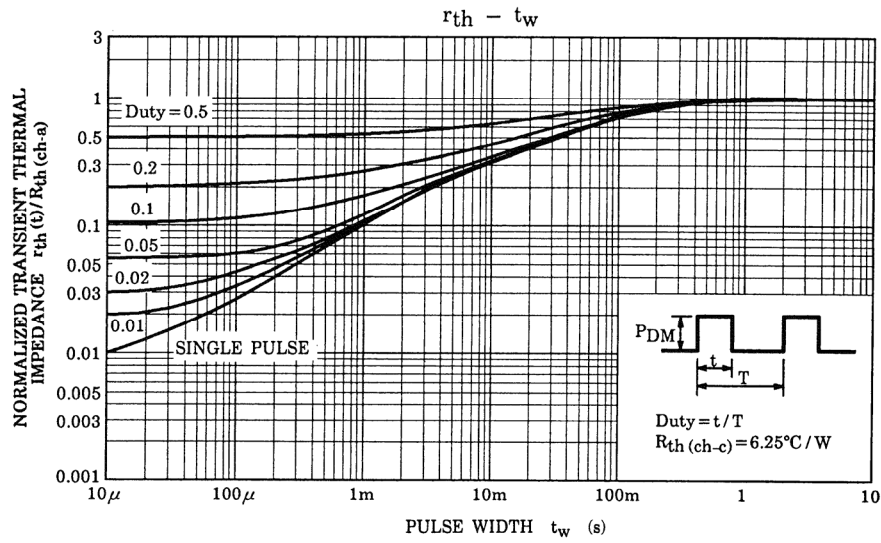
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	I_{DR}	—	—	—	5	A
Pulse drain reverse current (Note 1)	I_{DRP}	—	—	—	20	A
Forward voltage (diode)	V_{DSF}	$I_{DR} = 5\text{ A}, V_{GS} = 0\text{ V}$	—	—	-2.0	V
Reverse recovery time	t_{rr}	$I_{DR} = 5\text{ A}, V_{GS} = 0\text{ V}, dI_{DR} / dt = 100\text{ A} / \mu\text{s}$	—	150	—	ns
Reverse recovery charge	Q_{rr}		—	0.45	—	μC

Marking



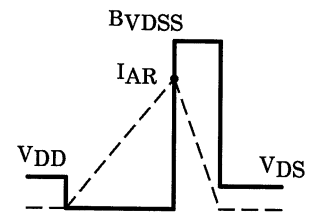






TEST CIRCUIT

$R_G = 25 \Omega$
 $V_{DD} = 25 \text{ V}, L = 4.2 \text{ mH}$



WAVE FORM

$$EAS = \frac{1}{2} \cdot L \cdot I^2 \cdot \left(\frac{BV_{DSS}}{BV_{DSS} - V_{DD}} \right)$$

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