

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

TK40X10J1

Switching Regulator, DC-DC Converter Applications
Motor Drive Applications

- Small gate charge : $Q_g = 59 \text{ nC (typ.)}$
- Low drain-source ON-resistance: $R_{DS(ON)} = 15 \text{ m}\Omega(\text{typ.})$
- High forward transfer admittance: $|Y_{fs}| = 60 \text{ S (typ.)}$
- Low leakage current: $I_{DSS} = 10 \text{ }\mu\text{A (max)} (V_{DS} = 100 \text{ V})$
- Enhancement mode: $V_{th} = 3.0 \text{ to } 4.0 \text{ V} (V_{DS} = 10 \text{ V}, I_D = 1 \text{ mA})$

Absolute Maximum Ratings (Ta = 25°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	40	A
	Pulse (Note 1)	I_{DP}	160	
Drain power dissipation ($T_c = 25^\circ\text{C}$)		P_D	125	W
Single pulse avalanche energy (Note 2)		E_{AS}	99	mJ
Avalanche current		I_{AR}	40	A
Repetitive avalanche energy (Note 3)		E_{AR}	12.5	mJ
Channel temperature (Note 4)		T_{ch}	175	°C
Storage temperature range (Note 4)		T_{stg}	-55 to 175	°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	$R_{th(ch-c)}$	1.2	°C/W

Note 1: Ensure that the channel temperature does not exceed 175°C.

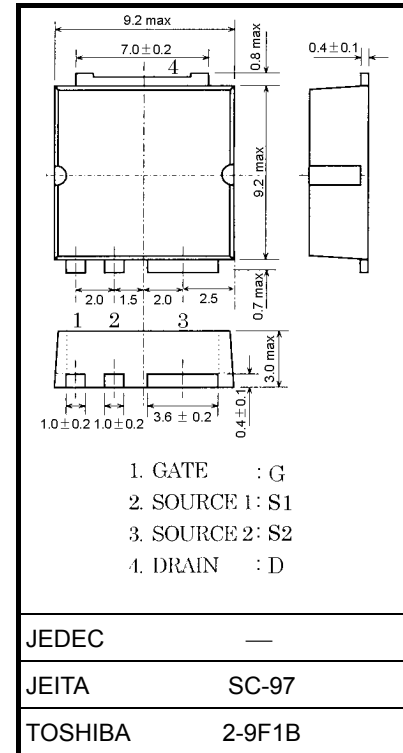
Note 2: $V_{DD} = 25 \text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 100 \text{ }\mu\text{H}$, $I_{AR} = 40 \text{ A}$, $R_G = 1 \text{ }\Omega$

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

Note 4: The definitions of the absolute maximum channel temperature and storage temperatures are based on AEC-Q101.

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

Unit: mm



Weight: 0.74 g (typ.)

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	—	—	V
Gate threshold voltage		V_{th}	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	3.0	—	4.0	V
Drain-source ON-resistance		$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 20\text{ A}$	—	15	20	$\text{m}\Omega$
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 20\text{ A}$	30	60	—	S
Input capacitance		C_{iss}	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	3300	—	pF
Reverse transfer capacitance		C_{rss}		—	180	—	
Output capacitance		C_{oss}		—	580	—	
Switching time	Rise time	t_r		—	7	—	ns
	Turn-on time	t_{on}		—	25	—	
	Fall time	t_f		—	11	—	
	Turn-off time	t_{off}		Duty $\leq 1\%$, $t_w = 10\ \mu\text{s}$	—	66	
Total gate charge (gate-source plus gate-drain)		Q_g	$V_{DD} \approx 80\text{ V}, V_{GS} = 10\text{ V}, I_D = 40\text{ A}$	—	59	—	nC
Gate-source charge		Q_{gs1}		—	16	—	
Gate-switch charge		Q_{gw}		—	25	—	
Gate-drain ("miller") charge		Q_{gd}		—	19	—	

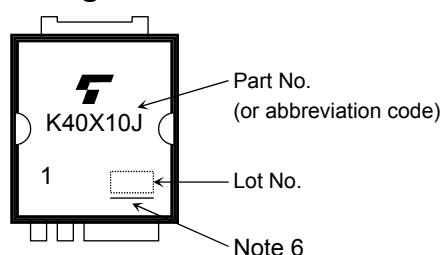
Source-Drain Ratings and Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1, Note 5)	I_{DR1}	—	—	—	40	A
Pulse drain reverse current (Note 1, Note 5)	I_{DRP1}	—	—	—	160	A
Continuous drain reverse current (Note 1, Note 5)	I_{DR2}	—	—	—	1	A
Pulse drain reverse current (Note 1, Note 5)	I_{DRP2}	—	—	—	4	A
Forward voltage (diode)	V_{DS2F}	$I_{DR1} = 40\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.2	V
Reverse recovery time	t_{rr}	$I_{DR} = 40\text{ A}, V_{GS} = 0\text{ V}, dI_{DR}/dt = 50\text{ A}/\mu\text{s}$	—	77	—	ns
Reverse recovery charge	Q_{rr}		—	110	—	nC

Note 5: I_{DR1}, I_{DRP1} : Current flowing between the drain and S2 pins. Ensure that the S1 pin is left open.
 I_{DR2}, I_{DRP2} : Current flowing between the drain and S1 pins. Ensure that the S2 pin is left open.

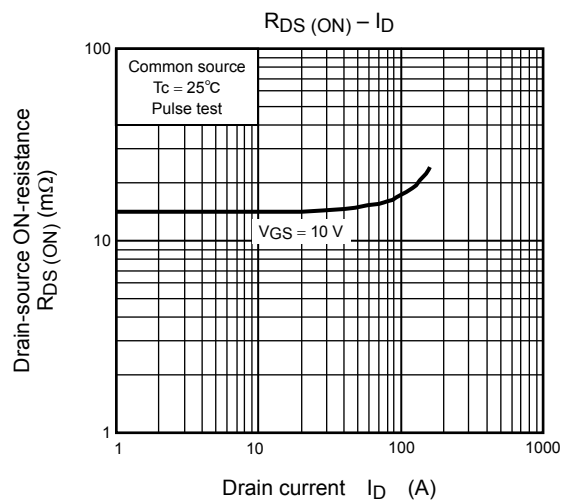
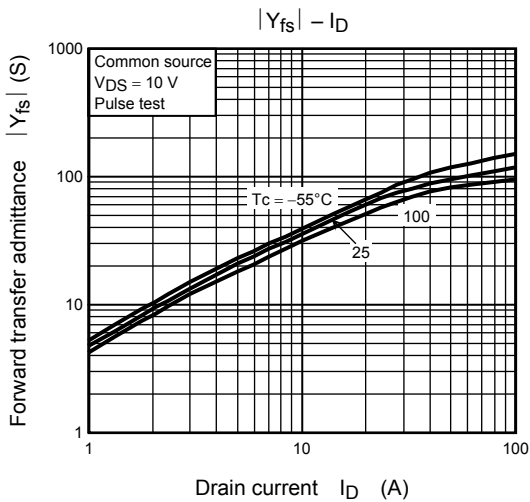
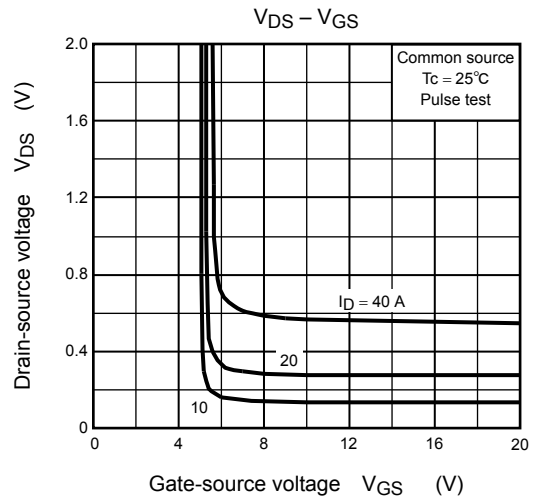
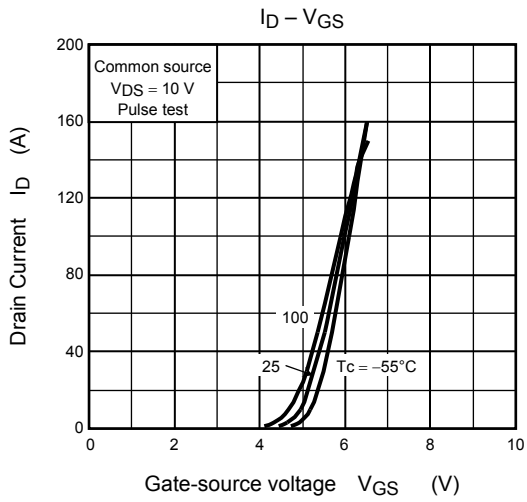
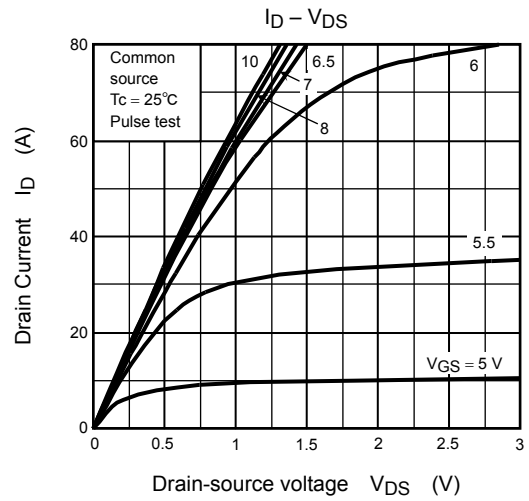
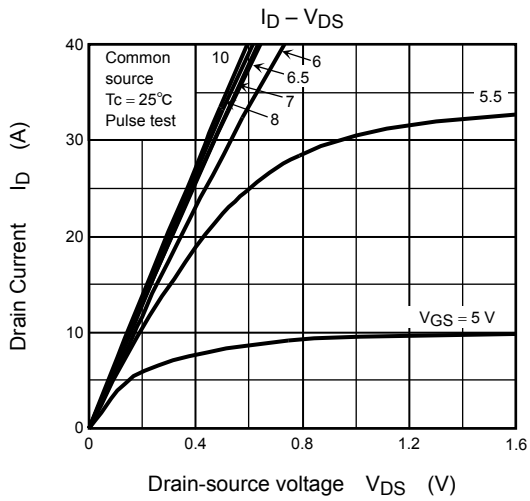
The S1 and S2 pins should be grounded together, unless otherwise noted.

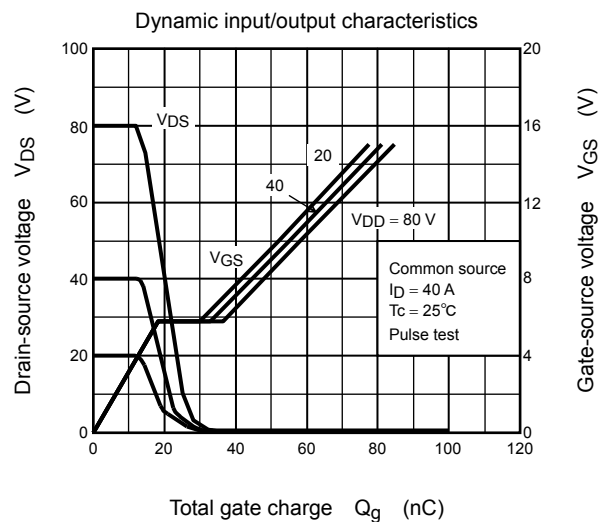
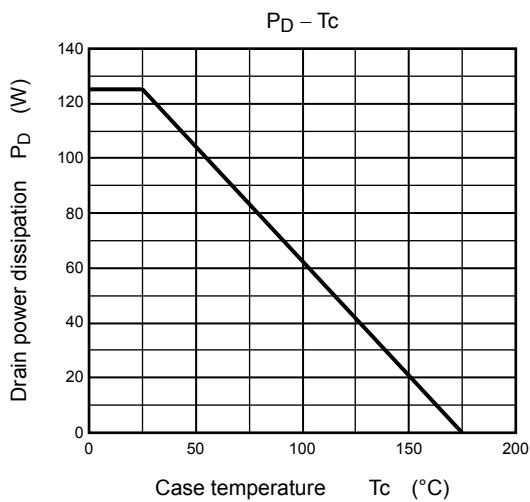
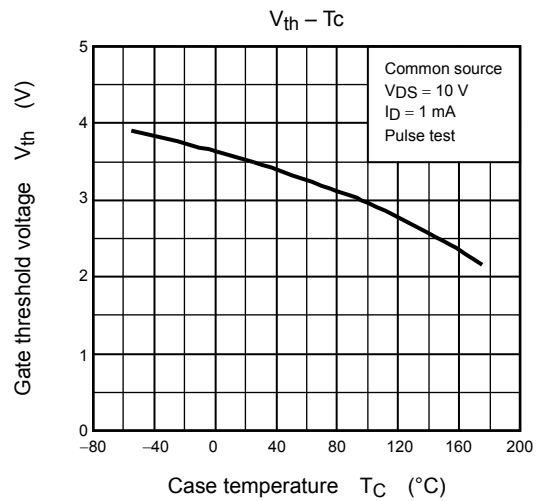
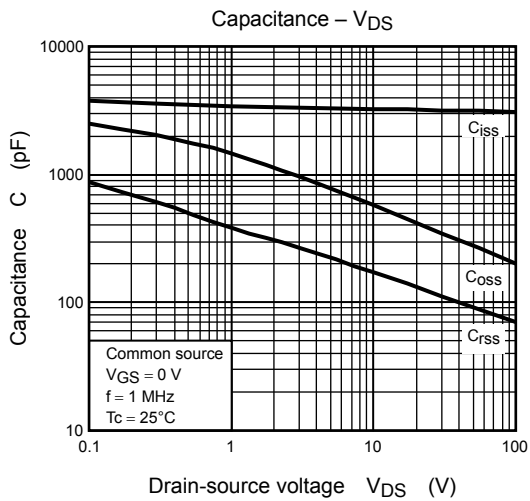
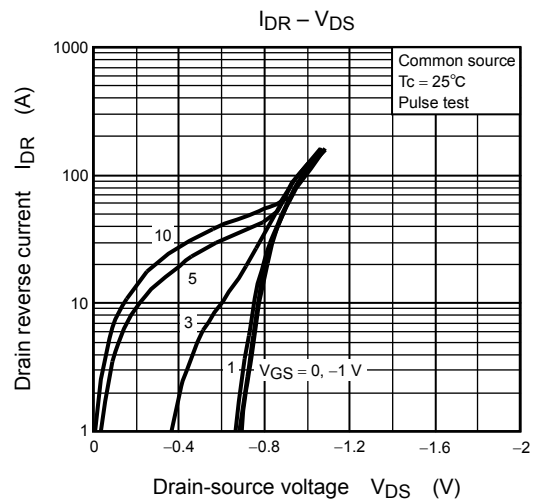
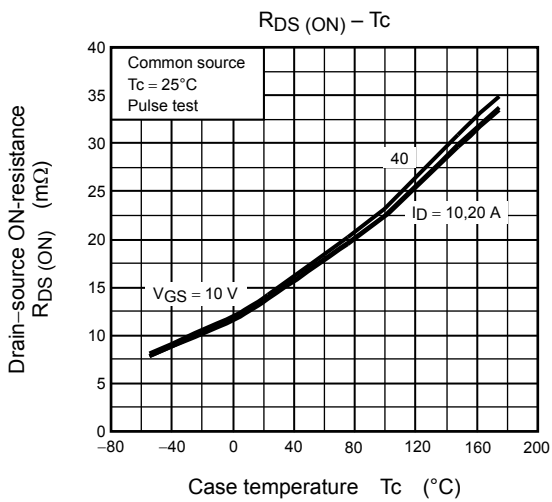
Marking

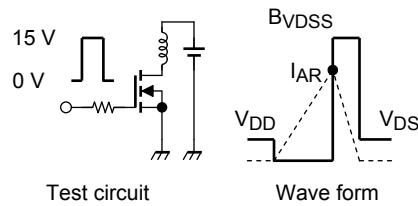
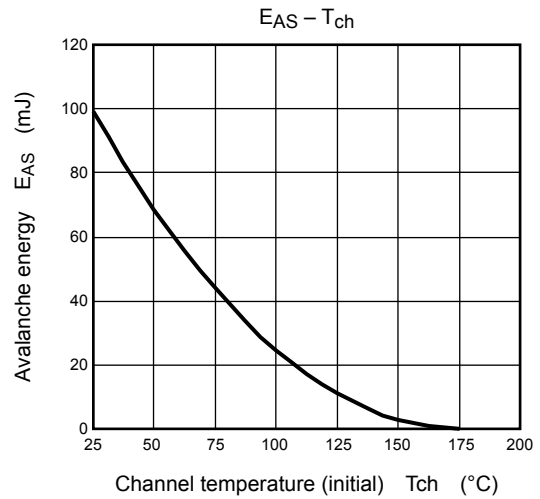
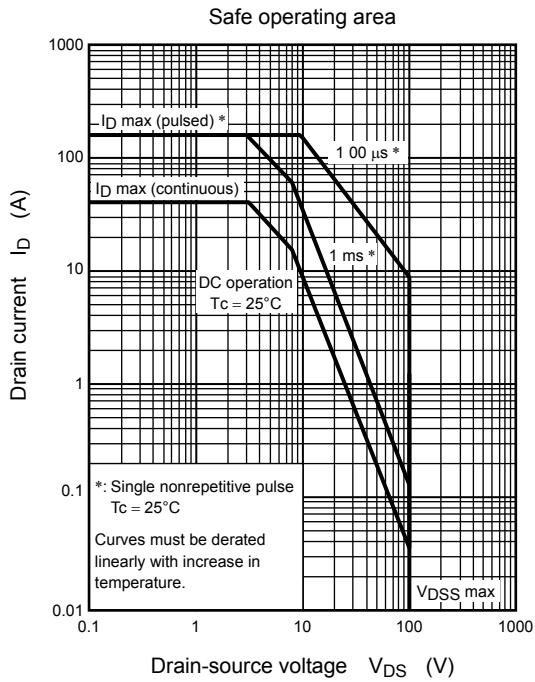
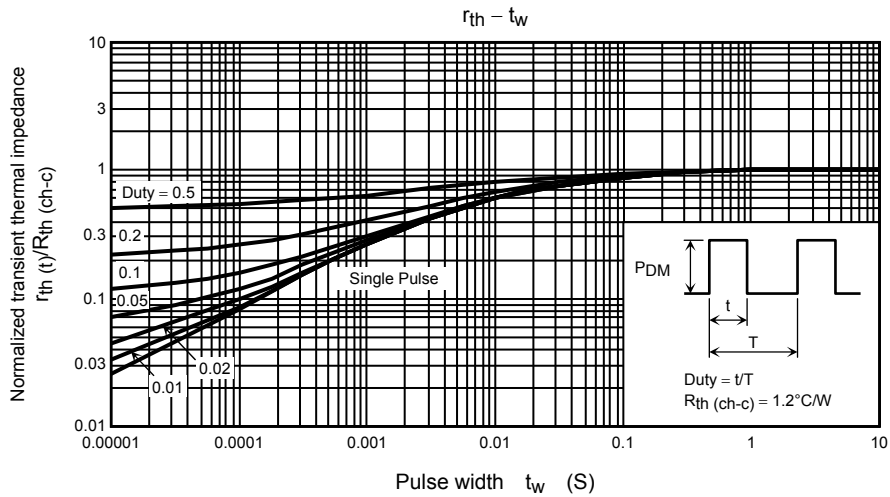


Note 6: A line under a Lot No. identifies the indication of product Labels [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

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$$R_G = 1 \Omega$$

$$V_{DD} = 25 V, L = 100 \mu H$$

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

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