

2SK3441

DC-DC Converter Applications

Relay Drive and Motor Drive Applications

- Low drain-source ON resistance: $R_{DS(ON)} = 4.5 \text{ m}\Omega$ (typ.)
- High forward transfer admittance: $|Y_{fs}| = 80 \text{ S}$ (typ.)
- Low leakage current: $I_{DSS} = 100 \text{ }\mu\text{A}$ (max) ($V_{DS} = 60 \text{ V}$)
- Enhancement mode: $V_{th} = 1.3 \text{ to } 2.5 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 1 \text{ mA}$)

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

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	60	V
Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$)		V_{DGR}	60	V
Gate-source voltage		V_{GSS}	± 20	V
Drain current	DC (Note 1)	I_D	75	A
	Pulse ($t \leq 1 \text{ ms}$) (Note 1)	I_{DP}	300	
Drain power dissipation ($T_c = 25^\circ\text{C}$)		P_D	125	W
Single pulse avalanche energy (Note 2)		E_{AS}	468	mJ
Avalanche current		I_{AR}	75	A
Repetitive avalanche energy (Note 3)		E_{AR}	12.5	mJ
Channel temperature		T_{ch}	150	$^\circ\text{C}$
Storage temperature range		T_{stg}	-55 to 150	$^\circ\text{C}$

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	$R_{th(ch-c)}$	1.00	$^\circ\text{C/W}$

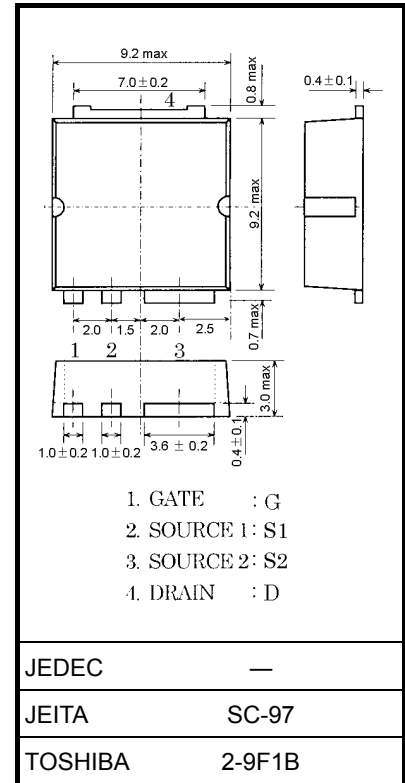
Note 1: Ensure that the channel temperature does not exceed 150°C .

Note 2: $V_{DD} = 25 \text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 113 \text{ }\mu\text{H}$, $R_G = 25 \text{ }\Omega$, $I_{AR} = 75 \text{ A}$

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

This transistor is an electrostatic-sensitive device. Please handle with caution.

Unit: mm

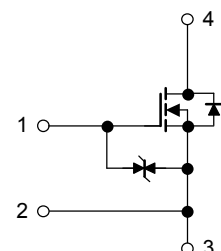


Weight: 0.74 g (typ.)

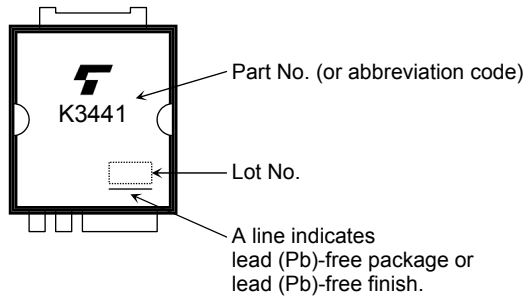
Circuit Configuration

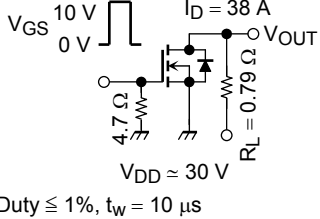
Notice:

Please use the S1 pin for gate input signal return. Make sure that the main current flows into the S2 pin.



Marking

Electrical Characteristics (Note 4) ($T_a = 25^\circ\text{C}$)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I _{GSS}	V _{GS} = ±16 V, V _{DS} = 0 V	—	—	±10	μA
Drain cut-off current		I _{DSS}	V _{DS} = 60 V, V _{GS} = 0 V	—	—	100	μA
Drain-source breakdown voltage		V (BR) DSS	I _D = 10 mA, V _{GS} = 0 V	60	—	—	V
		V (BR) DSX	I _D = 10 mA, V _{GS} = -20 V	40	—	—	
Gate threshold voltage		V _{th}	V _{DS} = 10 V, I _D = 1 mA	1.3	—	2.5	V
Drain-source ON resistance		R _{DS (ON)}	V _{GS} = 10 V, I _D = 38 A	—	4.5	5.8	mΩ
			V _{GS} = 4 V, I _D = 38 A	—	5.8	10	
Forward transfer admittance		Y _{fs}	V _{DS} = 10 V, I _D = 38 A	40	80	—	S
Input capacitance		C _{iss}	V _{DS} = 10 V, V _{GS} = 0 V, f = 1 MHz	—	9300	—	pF
Reverse transfer capacitance		C _{rss}		—	910	—	
Output capacitance		C _{oss}		—	1435	—	
Switching time	Rise time	t _r	 <p>V_{GS} 10 V 0 V</p> <p>I_D = 38 A</p> <p>V_{OUT}</p> <p>4.7 Ω</p> <p>R_L = 0.79 Ω</p> <p>V_{DD} ≈ 30 V</p> <p>Duty ≤ 1%, t_W = 10 μs</p>	—	18	—	ns
	Turn-on time	t _{on}		—	40	—	
	Fall time	t _f		—	42	—	
	Turn-off time	t _{off}		—	250	—	
Total gate charge (gate-source plus gate-drain)		Q _g	V _{DD} ≈ 48 V, V _{GS} = 10 V, I _D = 75 A	—	210	—	nC
Gate-source charge		Q _{gs}		—	145	—	
Gate-drain (“miller”) charge		Q _{gd}		—	65	—	

Note 4: Connect the S1 and S2 pins together, and ground them except during switching time measurement.

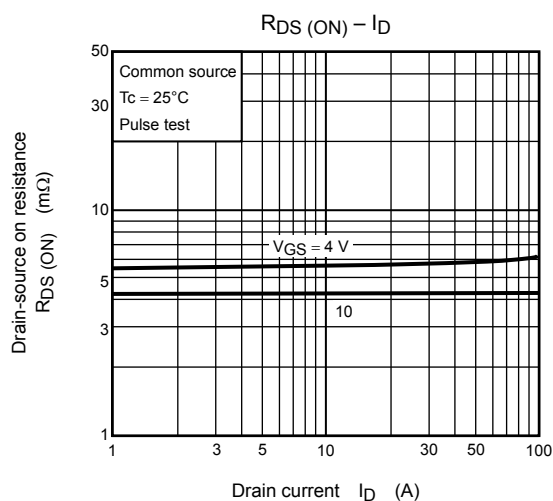
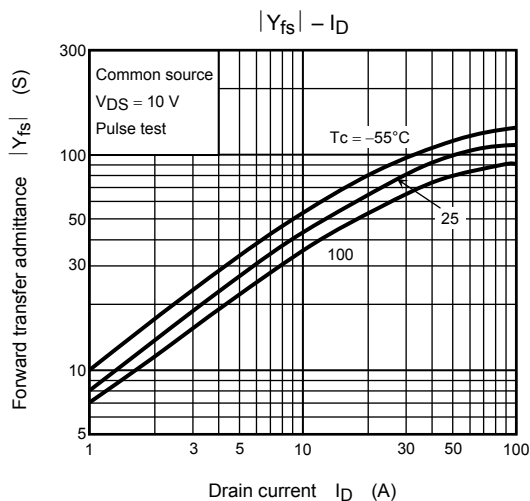
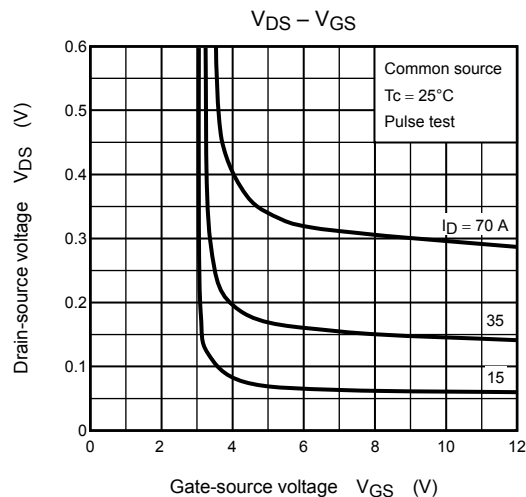
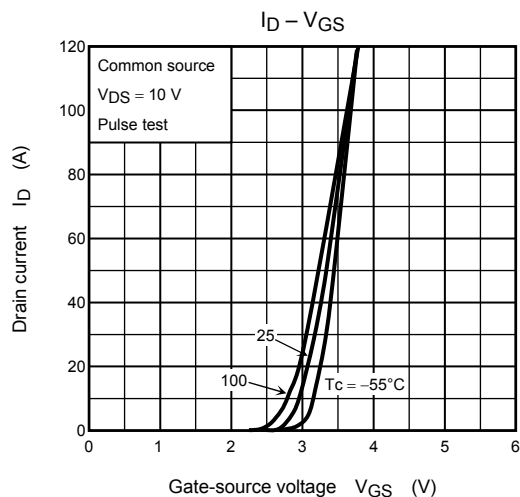
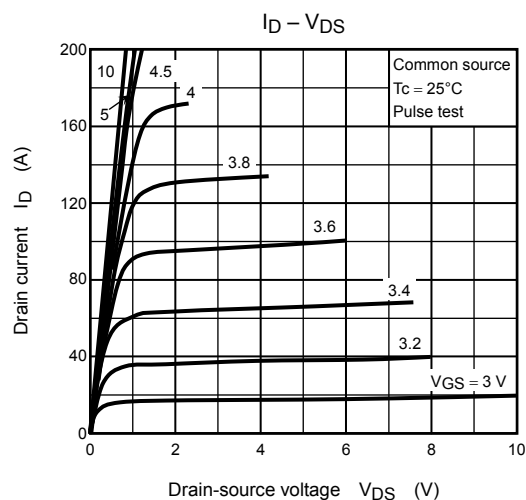
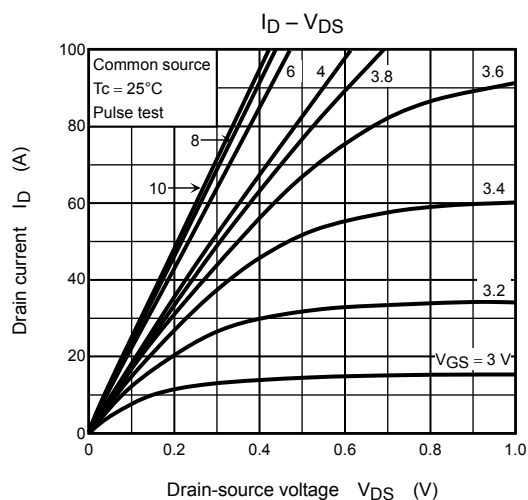
Source-Drain Ratings and Characteristics (Note 5) ($T_a = 25^\circ\text{C}$)

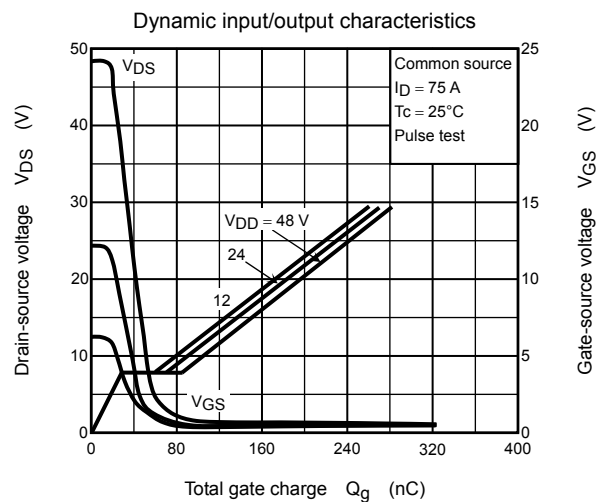
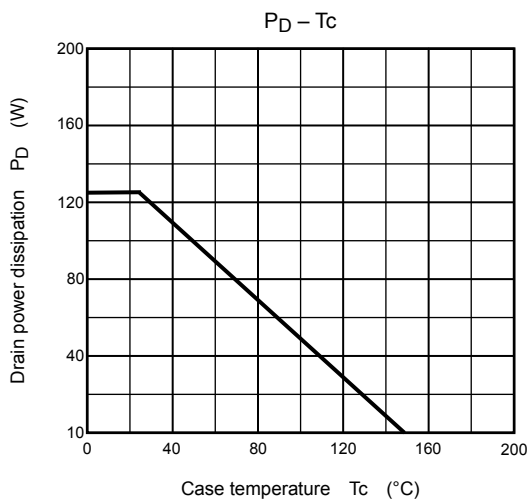
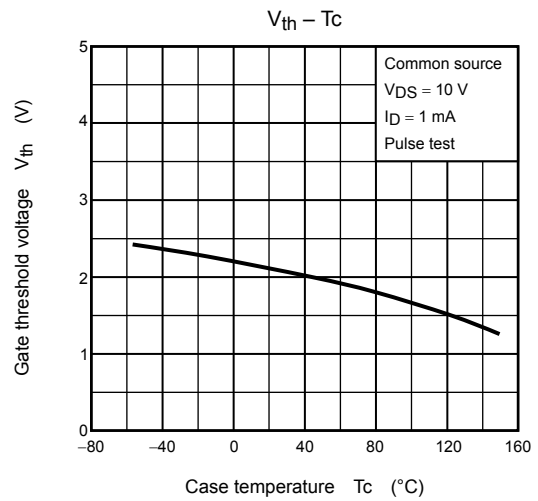
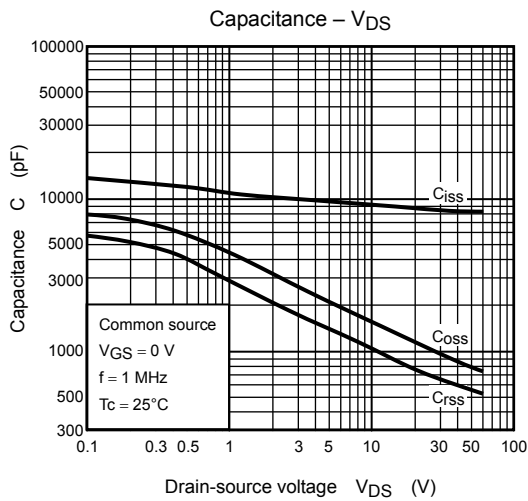
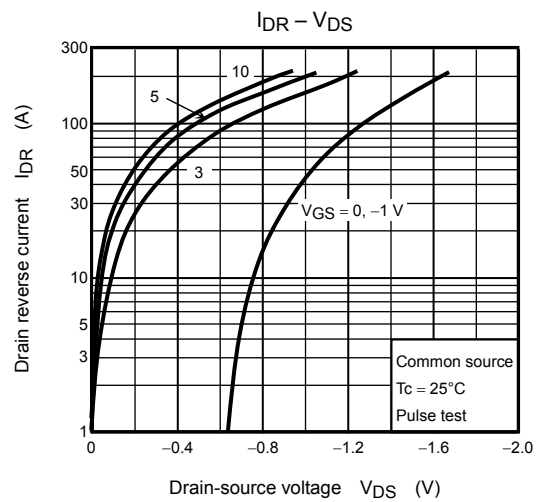
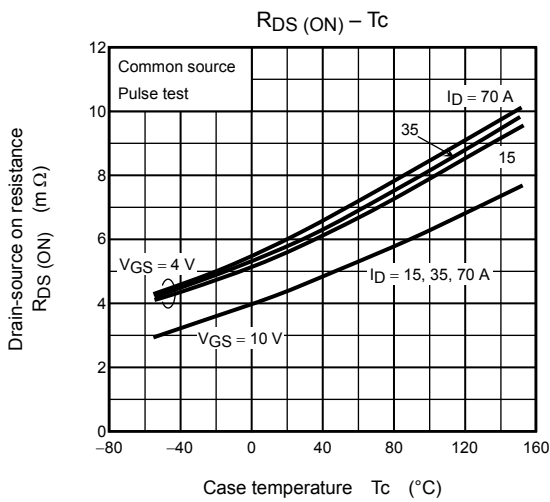
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1, Note 5)	I_{DR1}	—	—	—	75	A
Pulse drain reverse current (Note 1, Note 5)	I_{DRP1}	—	—	—	300	A
Continuous drain reverse current (Note 1, Note 5)	I_{DR2}	—	—	—	1	A
Pulse drain reverse current (Note 1, Note 5)	I_{DRP2}	—	—	—	4	A
Forward voltage (diode)	V_{DS2F}	$I_{DR1} = 75\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.5	V
Reverse recovery time	t_{rr}	$I_{DR} = 75\text{ A}, V_{GS} = 0\text{ V},$	—	60	—	ns
Reverse recovery charge	Q_{rr}	$dI_{DR}/dt = 50\text{ A}/\mu\text{s}$	—	50	—	nC

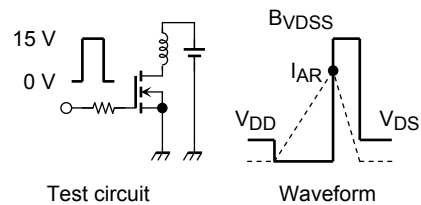
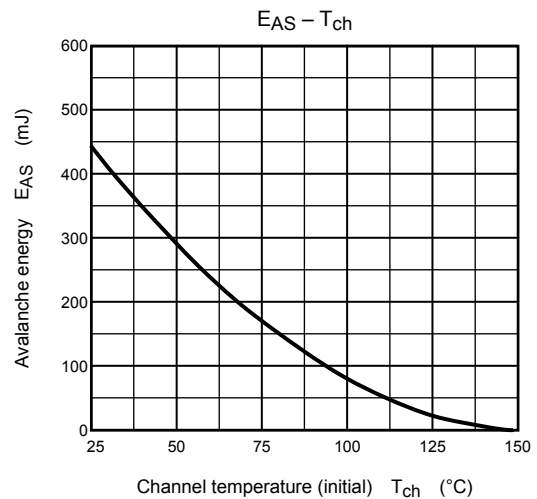
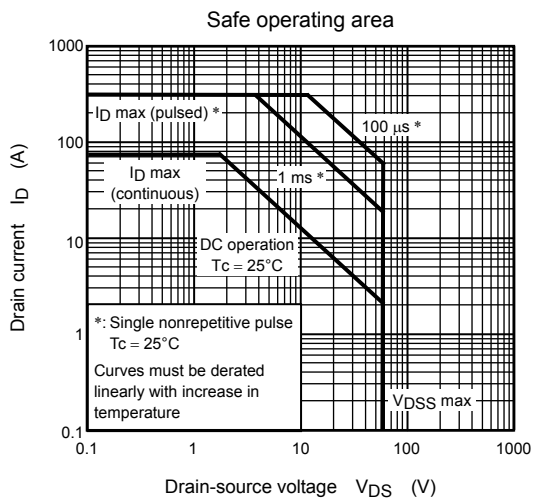
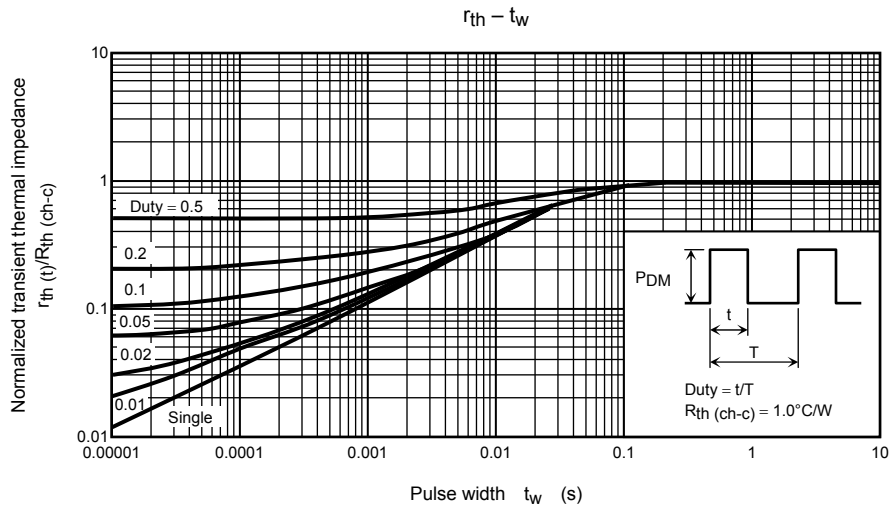
Note 5: I_{DR1}, I_{DRP1} : Current flowing between the drain and the S2 pin. Ensure that the S1 pin is left open.

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

Unless otherwise specified, connect the S1 and S2 pins together, and ground them.







$$R_G = 25 \, \Omega$$

$$V_{DD} = 25 \, V, L = 236 \, \mu H$$

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

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