

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (U-MOSII)

2SK3397

Relay Drive and DC-DC Converter Applications
Motor Drive Applications

- Low drain-source ON resistance: $R_{DS(ON)} = 4.0 \text{ m}\Omega$ (typ.)
- High forward transfer admittance: $|Y_{fs}| = 110 \text{ S}$ (typ.)
- Low leakage current: $I_{DSS} = 10 \text{ }\mu\text{A}$ (max) ($V_{DS} = 30 \text{ V}$)
- Enhancement mode: $V_{th} = 1.5 \text{ to } 3.0 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 1 \text{ mA}$)

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

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	30	V
Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$)		V_{DGR}	30	V
Gate-source voltage		V_{GSS}	± 20	V
Drain current	DC (Note 1)	I_D	70	A
	Pulse (Note 1)	I_{DP}	210	
Drain power dissipation ($T_c = 25^\circ\text{C}$)		P_D	125	W
Single pulse avalanche energy (Note 2)		E_{AS}	273	mJ
Avalanche current		I_{AR}	70	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	$R_{th(ch-c)}$	1.0	$^\circ\text{C/W}$

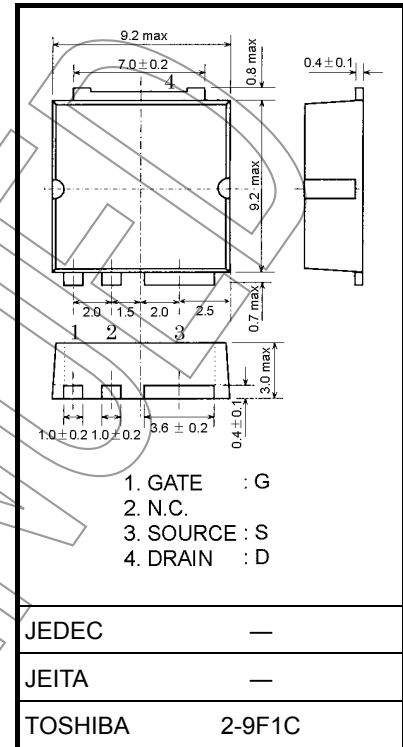
Note 1: Ensure that the channel temperature does not exceed 150°C .

Note 2: $V_{DD} = 25 \text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 40 \text{ }\mu\text{H}$, $I_{AR} = 70 \text{ A}$, $R_G = 25 \text{ }\Omega$

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

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

Unit: mm



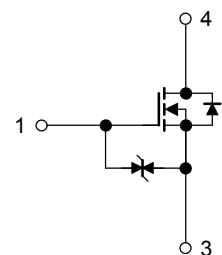
JEDEC —

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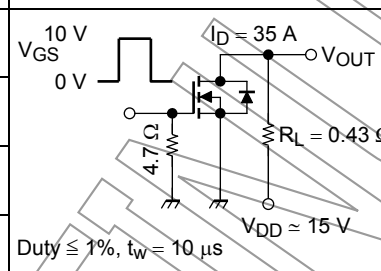
TOSHIBA 2-9F1C

Weight: 0.74 g (typ.)

Circuit Configuration



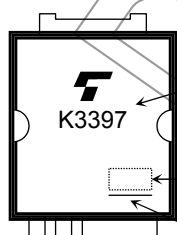
Electrical Characteristics (Ta = 25°C)

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}	$V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	10	μA
Drain-source breakdown voltage	$V_{(BR) DSS}$		$I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$	30	—	—	V
	$V_{(BR) DSX}$		$I_D = 10 \text{ mA}, V_{GS} = -20 \text{ V}$	15	—	—	
Gate threshold voltage		V_{th}	$V_{DS} = 10 \text{ V}, I_D = 1 \text{ mA}$	1.5	—	3.0	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = 10 \text{ V}, I_D = 35 \text{ A}$	—	4.0	6.0	$\text{m}\Omega$
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10 \text{ V}, I_D = 35 \text{ A}$	55	110	—	S
Input capacitance		C_{iss}	$V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	5000	—	pF
Reverse transfer capacitance		C_{rss}		—	550	—	
Output capacitance		C_{oss}		—	1000	—	
Switching time	Rise time	t_r		—	8.0	—	ns
	Turn-ON time	t_{on}		—	25	—	
	Fall time	t_f		—	48	—	
	Turn-OFF time	t_{off}		—	180	—	
Total gate charge (gate-source plus gate-drain)		Q_g	$V_{DD} \approx 24 \text{ V}, V_{GS} = 10 \text{ V}, I_D \approx 70 \text{ A}$	—	110	—	nC
Gate-source charge		Q_{gs}		—	87	—	
Gate-drain ("miller") charge		Q_{gd}		—	23	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	I_{DR}	—	—	—	70	A
Pulse drain reverse current (Note 1)	I_{DRP}	—	—	—	210	A
Forward voltage (diode)	V_{DSF}	$I_{DR} = 70 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	-1.7	V
Reverse recovery time	t_{rr}	$I_{DR} = 70 \text{ A}, V_{GS} = 0 \text{ V},$	—	40	—	ns
Reverse recovery charge	Q_{rr}	$dI_{DR}/dt = 30 \text{ A}/\mu\text{s}$	—	40	—	nC

Marking



Part No. (or abbreviation code)

Lot No.

Note 4

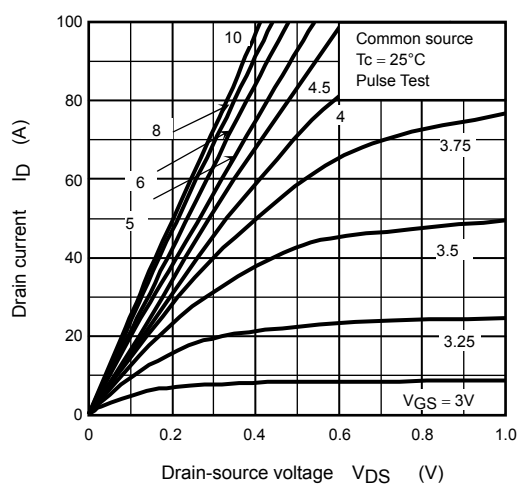
Note 4: A line under a Lot No. identifies the indication of product Labels.

Not underlined: $[[Pb]]/INCLUDES > MCV$

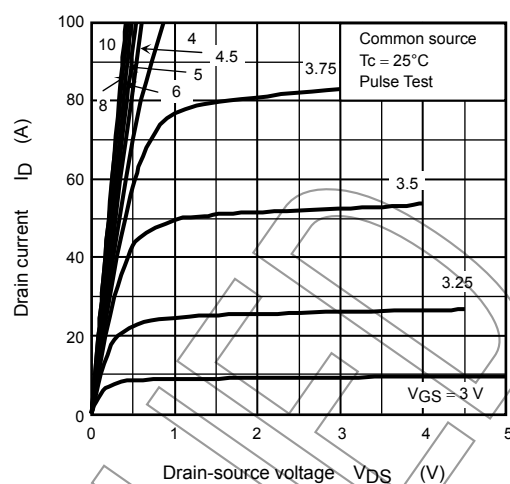
Underlined: $[[G]]/RoHS \text{ COMPATIBLE}$ or $[[G]]/RoHS [[Pb]]$

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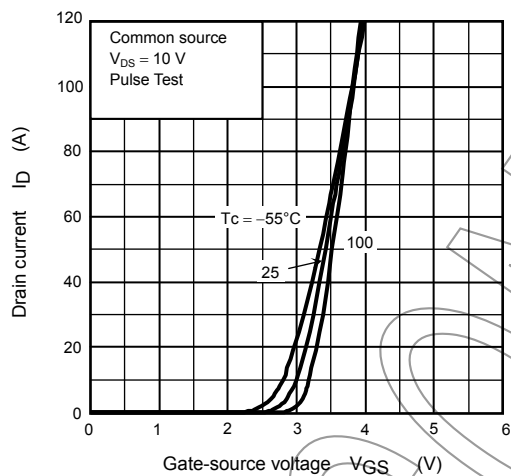
$I_D - V_{DS}$



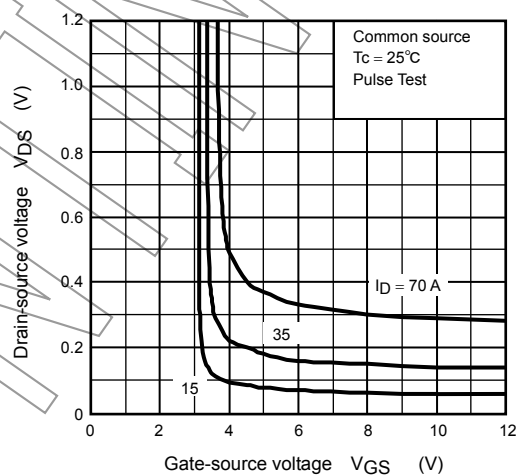
$I_D - V_{DS}$



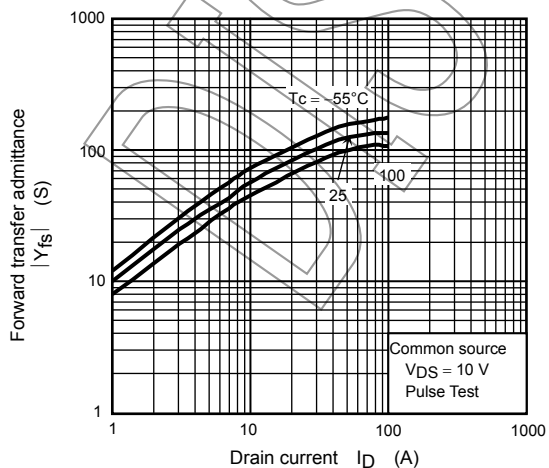
$I_D - V_{GS}$



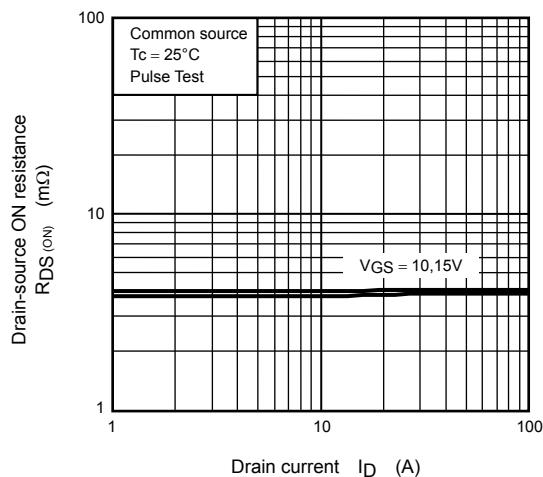
$V_{DS} - V_{GS}$

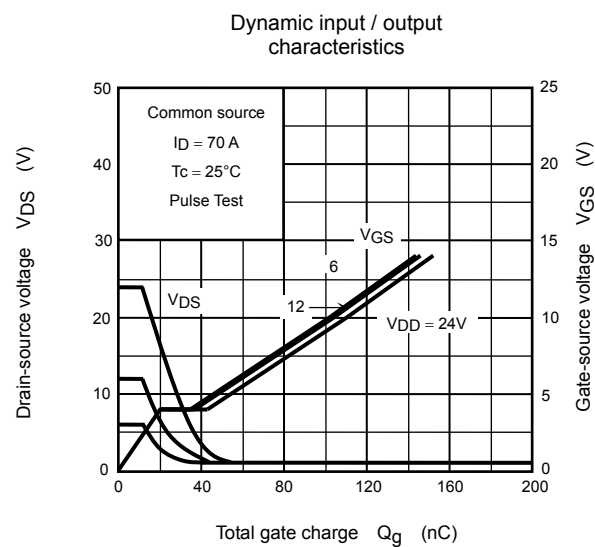
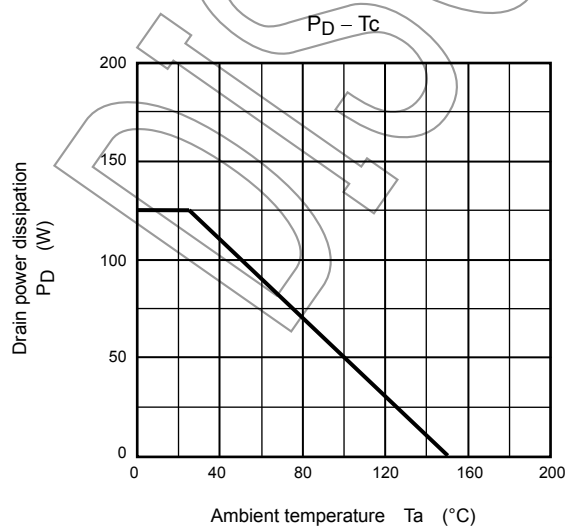
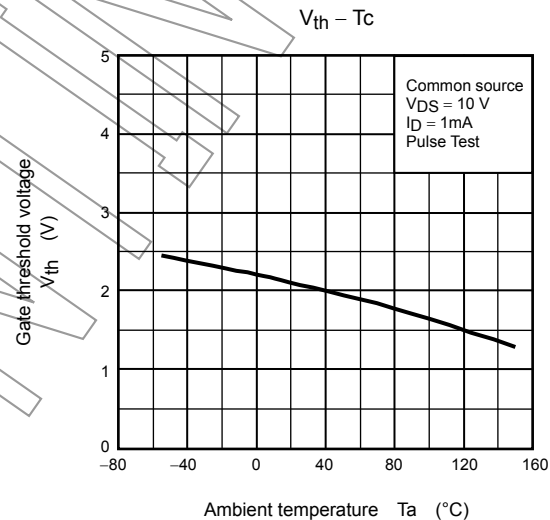
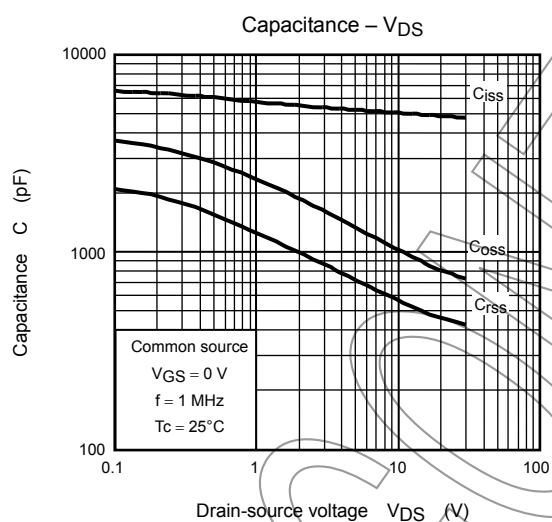
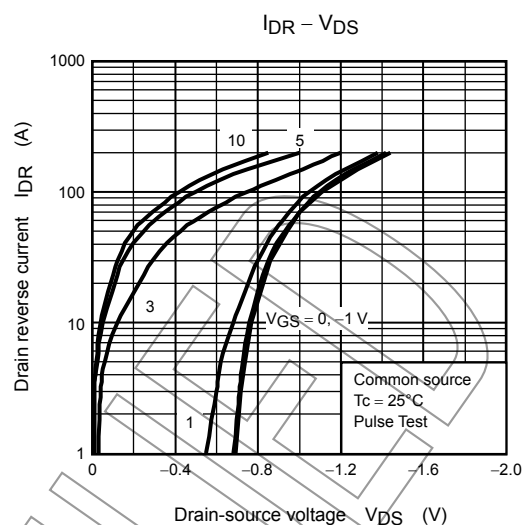
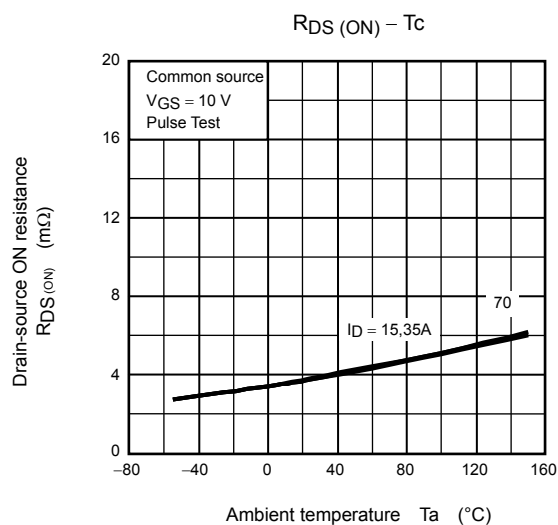


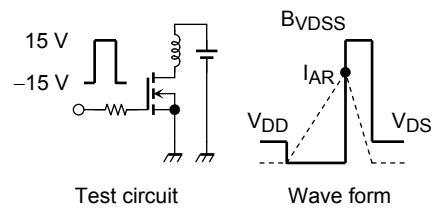
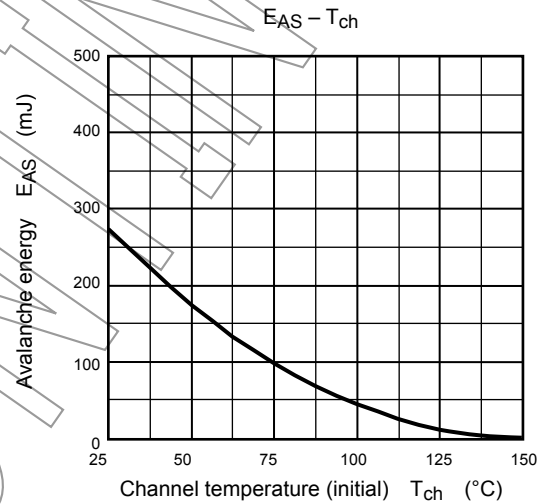
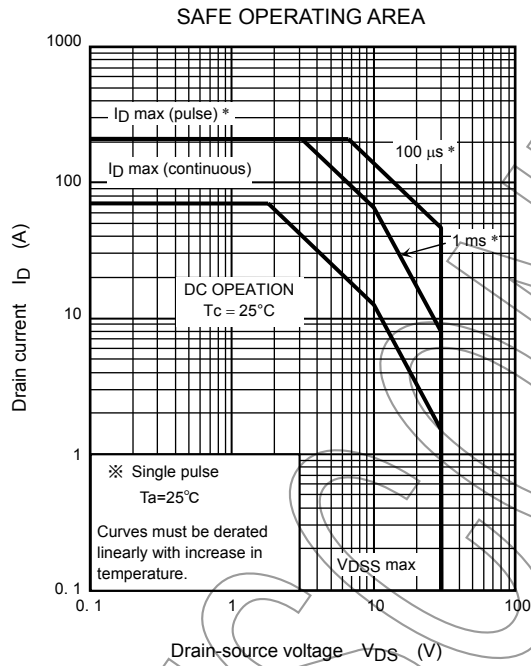
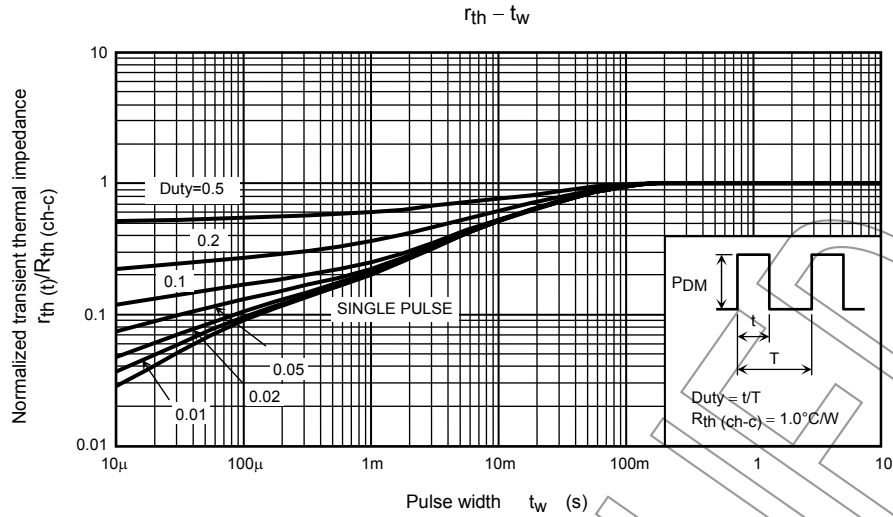
$|Y_{fs}| - I_D$



$R_{DS(ON)} - I_D$







$$R_G = 25\ \Omega$$

$$V_{DD} = 25\ V, L = 40\ \mu H$$

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

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