

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (L<sup>2</sup>-π-MOSV)

# 2SK2391

Chopper Regulator, DC-DC Converter and Motor Drive Applications

- 4-V gate drive
- Low drain-source ON resistance : R<sub>DS (ON)</sub> = 66 mΩ (typ.)
- High forward transfer admittance : |Y<sub>fs</sub>| = 16 S (typ.)
- Low leakage current : I<sub>DSS</sub> = 100 μA (max) (V<sub>DS</sub> = 100 V)
- Enhancement mode : V<sub>th</sub> = 0.8 to 2.0 V (V<sub>DS</sub> = 10 V, I<sub>D</sub> = 1 mA)

## Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V <sub>DSS</sub>	100	V
Drain-gate voltage (R <sub>GS</sub> = 20 kΩ)		V <sub>DGR</sub>	100	V
Gate-source voltage		V <sub>GSS</sub>	±20	V
Drain current	DC (Note 1)	I <sub>D</sub>	20	A
	Pulse (Note 1)	I <sub>DP</sub>	80	A
Drain power dissipation (T <sub>c</sub> = 25°C)		P <sub>D</sub>	35	W
Single pulse avalanche energy (Note 2)		E <sub>AS</sub>	208	mJ
Avalanche current		I <sub>AR</sub>	20	A
Repetitive avalanche energy (Note 3)		E <sub>AR</sub>	3.5	mJ
Channel temperature		T <sub>ch</sub>	150	°C
Storage temperature range		T <sub>stg</sub>	-55 to 150	°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 <sub>th (ch-c)</sub>	3.57	°C / W
Thermal resistance, channel to ambient	R <sub>th (ch-a)</sub>	62.5	°C / W

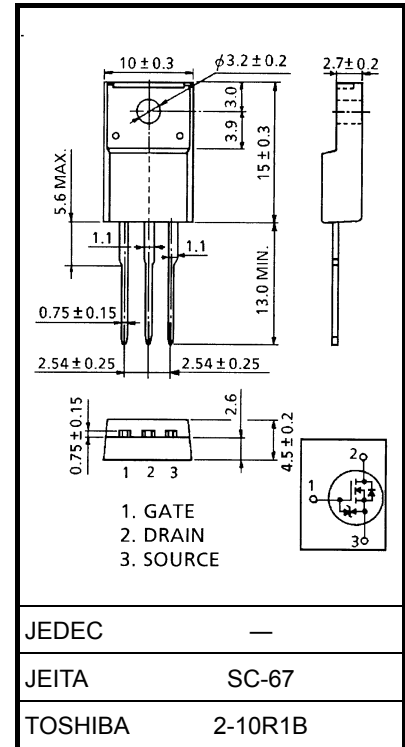
Note 1: Ensure that the channel temperature does not exceed 150°C.

Note 2: V<sub>DD</sub> = 25 V, T<sub>ch</sub> = 25°C (initial), L = 840 μH, R<sub>G</sub> = 25 Ω, I<sub>AR</sub> = 20 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: 1.9 g (typ.)

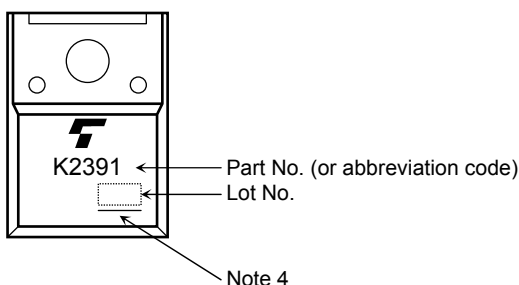
## Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cut-off current		$I_{DSS}$	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$	—	—	100	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	100	—	—	V
Gate threshold voltage		$V_{th}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	0.8	—	2.0	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = 4\text{ V}, I_D = 10\text{ A}$	—	0.09	0.13	$\Omega$
			$V_{GS} = 10\text{ V}, I_D = 10\text{ A}$	—	0.066	0.085	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 10\text{ A}$	8	16	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	1100	—	pF
Reverse transfer capacitance		$C_{rss}$		—	180	—	
Output capacitance		$C_{oss}$		—	400	—	
Switching time	Rise time	$t_r$	<p><math>Duty \leq 1\%, t_w = 10\ \mu s</math></p>	—	20	—	ns
	Turn-on time	$t_{on}$		—	30	—	
	Fall time	$t_f$		—	50	—	
	Turn-off time	$t_{off}$		—	140	—	
Total gate charge (Gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx 80\text{ V}, V_{GS} = 10\text{ V}, I_D = 27\text{ A}$	—	50	—	nC
Gate-source charge		$Q_{gs}$		—	34	—	
Gate-drain ("miller") charge		$Q_{gd}$		—	16	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	$I_{DR}$	—	—	—	20	A
Pulse drain reverse current (Note 1)	$I_{DRP}$	—	—	—	80	A
Forward voltage (diode)	$V_{DSF}$	$I_{DR} = 20\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.7	V
Reverse recovery time	$t_{rr}$	$I_{DR} = 20\text{ A}, V_{GS} = 0\text{ V}, dI_{DR}/dt = 50\text{ A}/\mu s$	—	155	—	ns
Reverse recovery charge	$Q_{rr}$		—	0.31	—	$\mu\text{C}$

## Marking

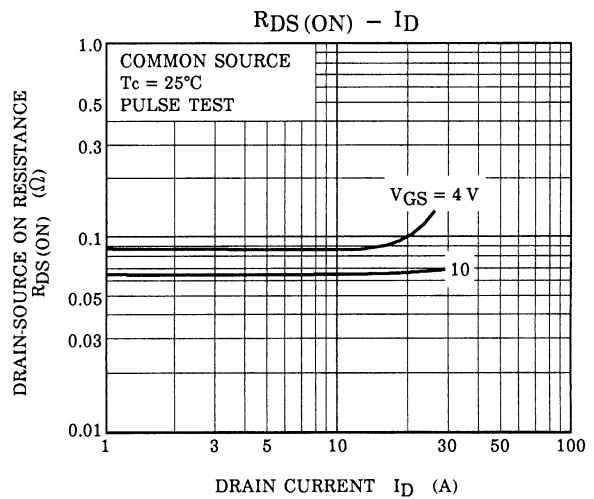
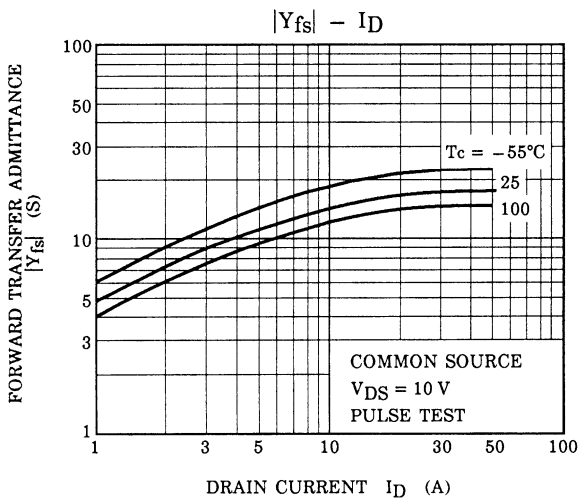
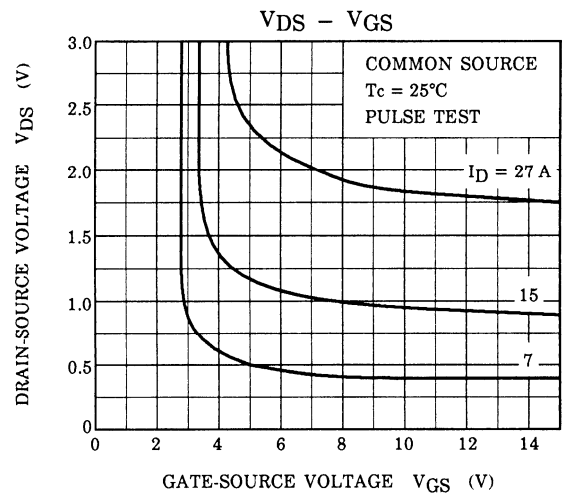
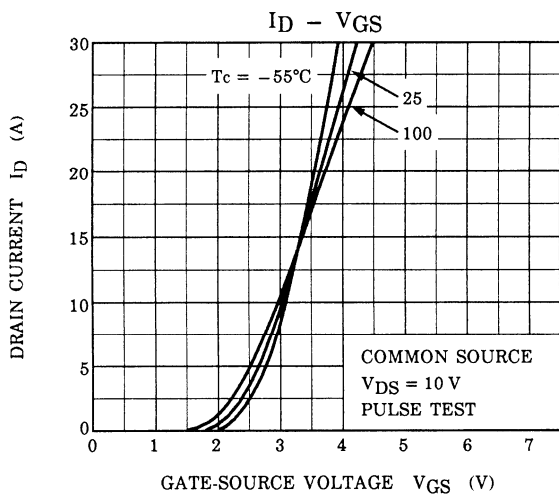
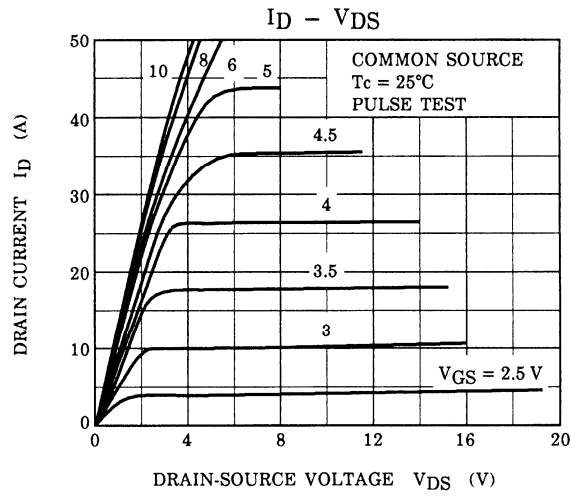
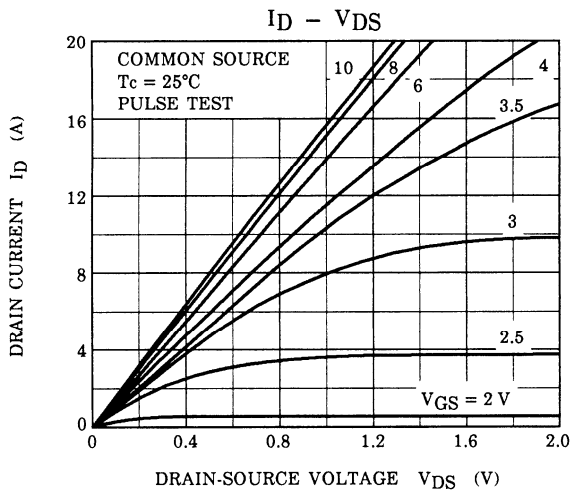


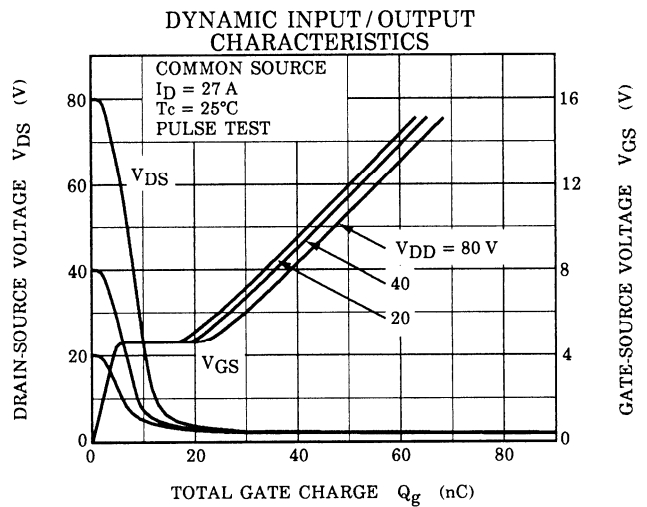
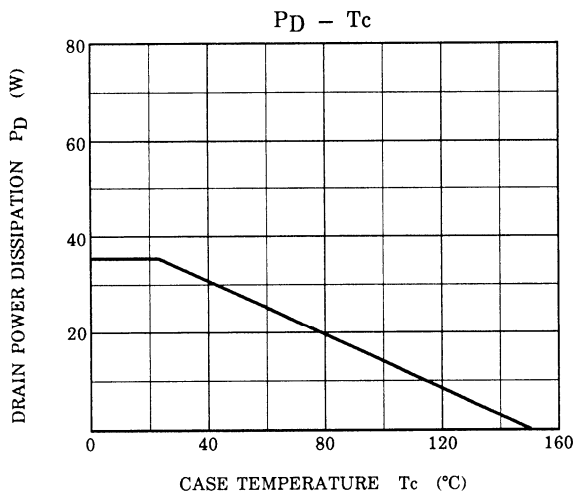
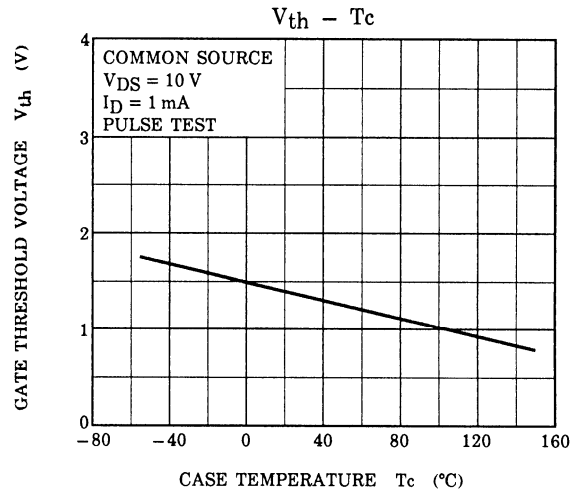
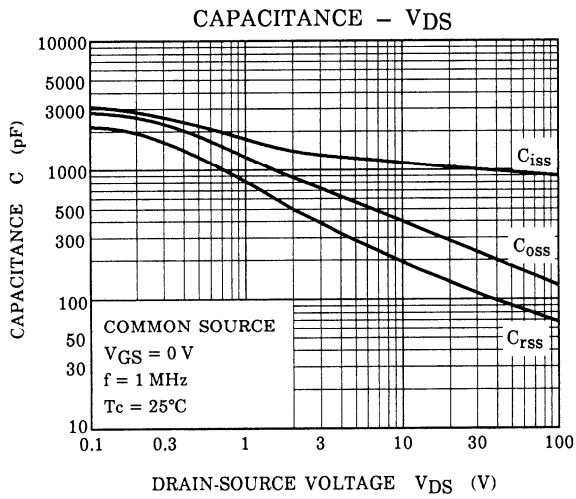
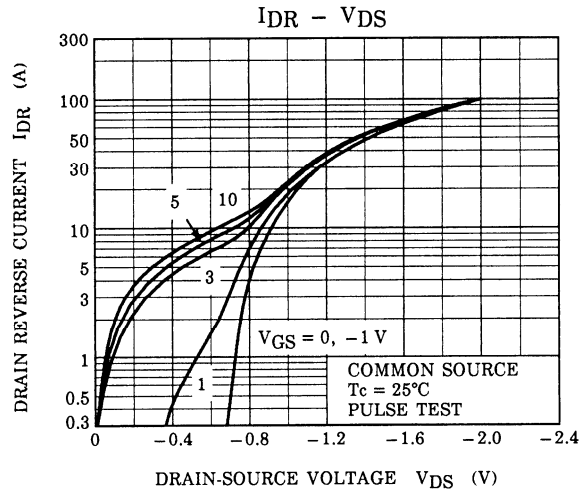
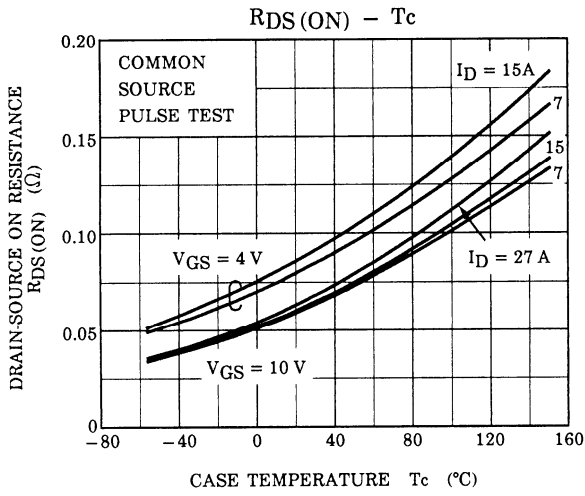
Note 4: A line under a Lot No. identifies the indication of product Labels.

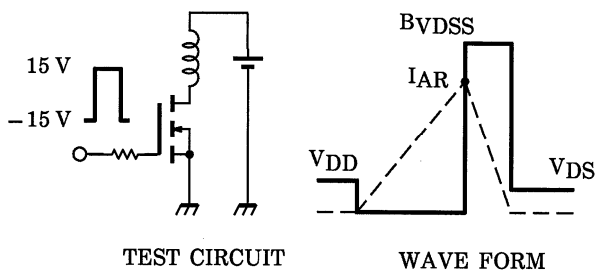
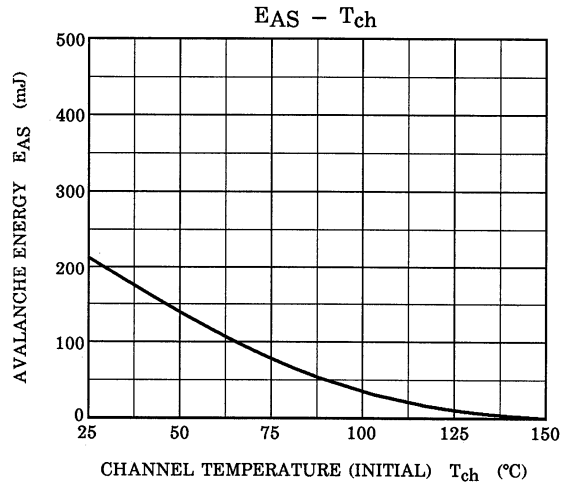
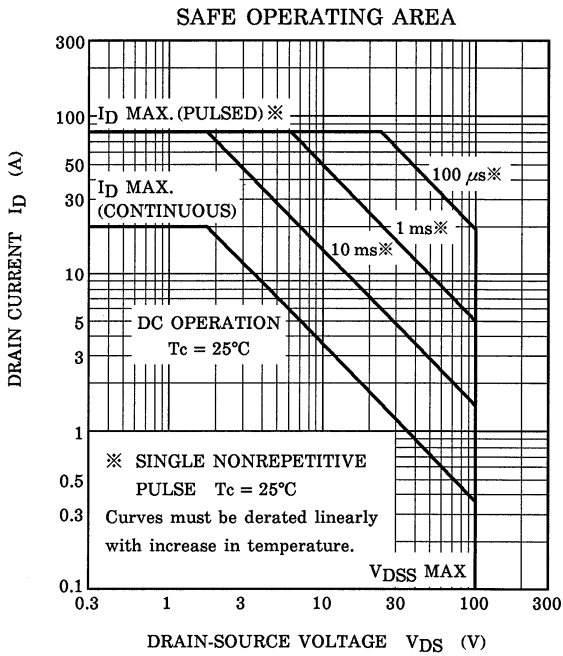
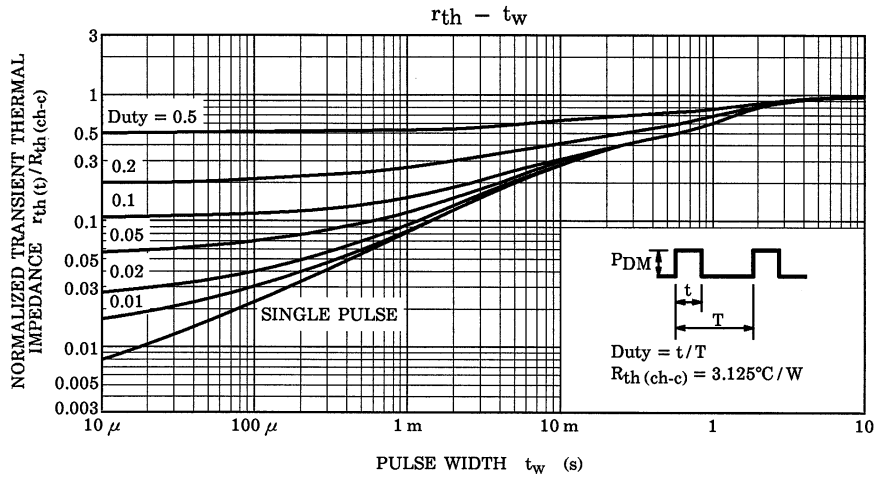
Not underlined:  $[[Pb]]/INCLUDES > MCV$

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

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$R_G = 25 \Omega$   
 $V_{DD} = 25 \text{ V}, L = 840 \mu\text{H}$

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

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