

TOSHIBA Field Effect Transistor Silicon P Channel MOS Type ( $L^2$ - $\pi$ -MOSV)

## 2SJ378

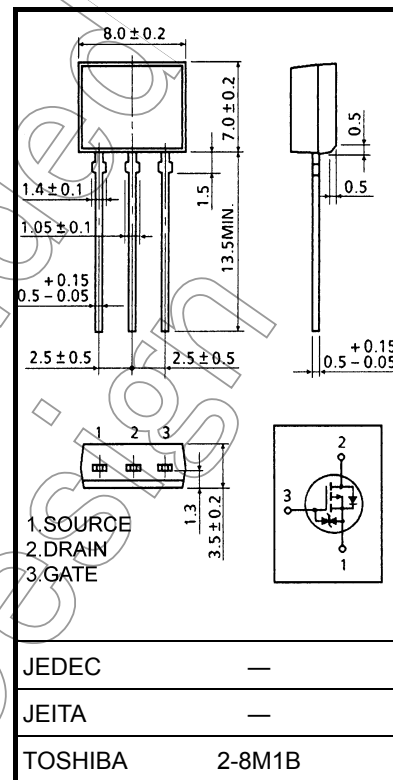
Relay Drive, DC-DC Converter and Motor Drive Applications

Unit: mm

- 4-V gate drive
- Low drain-source ON resistance :  $R_{DS(ON)} = 0.16 \Omega$  (typ.)
- High forward transfer admittance :  $|Y_{fs}| = 4.0 \text{ S}$  (typ.)
- Low leakage current :  $I_{DSS} = -100 \mu\text{A}$  (max) ( $V_{DS} = -60 \text{ V}$ )
- Enhancement mode :  $V_{th} = -0.8$  to  $-2.0 \text{ V}$  ( $V_{DS} = -10 \text{ V}$ ,  $I_D = -1 \text{ mA}$ )

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

Characteristics	Symbol	Rating	Unit
Drain-source voltage	$V_{DSS}$	-60	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )	$V_{DGR}$	-60	V
Gate-source voltage	$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	-5
	Pulse (Note 1)	$I_{DP}$	-20
Drain power dissipation	$P_D$	1.3	W
Single pulse avalanche energy (Note 2)	$E_{AS}$	273	mJ
Avalanche current	$I_{AR}$	-5	A
Repetitive avalanche energy (Note 3)	$E_{AR}$	0.13	mJ
Channel temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage temperature range	$T_{stg}$	-55~150	$^\circ\text{C}$



Weight: 0.54 g (typ.)

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 ambient	$R_{th(ch-a)}$	96.1	$^\circ\text{C} / \text{W}$

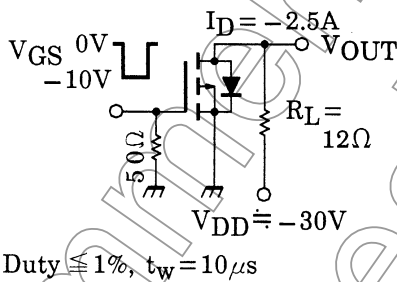
Note 1: Ensure that the channel temperature does not exceed  $150^\circ\text{C}$ .

Note 2:  $V_{DD} = -25 \text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 14.84 \text{ mH}$ ,  $R_G = 25 \Omega$ ,  $I_{AR} = -5 \text{ A}$

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

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

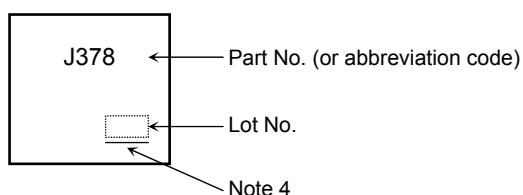
## Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I <sub>GSS</sub>	V <sub>GS</sub> = ±16 V, V <sub>DS</sub> = 0 V	—	—	±10	μA
Drain cut-off current		I <sub>DSS</sub>	V <sub>DS</sub> = -60 V, V <sub>GS</sub> = 0 V	—	—	-100	μA
Drain-source breakdown voltage		V <sub>(BR)</sub> DSS	I <sub>D</sub> = -10 mA, V <sub>GS</sub> = 0 V	-60	—	—	V
Gate threshold voltage		V <sub>th</sub>	V <sub>DS</sub> = -10 V, I <sub>D</sub> = -1 mA	-0.8	—	-2.0	V
Drain-source ON resistance		R <sub>DS</sub> (ON)	V <sub>GS</sub> = -4 V, I <sub>D</sub> = -2.5 A	—	0.24	0.28	Ω
			V <sub>GS</sub> = -10 V, I <sub>D</sub> = -2.5 A	—	0.16	0.19	
Forward transfer admittance		Y <sub>fs</sub>	V <sub>DS</sub> = -10 V, I <sub>D</sub> = -2.5 A	2.0	4.0	—	S
Input capacitance		C <sub>iss</sub>	V <sub>DS</sub> = -10 V, V <sub>GS</sub> = 0 V, f = 1 MHz	—	630	—	pF
Reverse transfer capacitance		C <sub>rss</sub>		—	95	—	
Output capacitance		C <sub>oss</sub>		—	290	—	
Switching time	Rise time	t <sub>r</sub>		—	25	—	ns
	Turn-on time	t <sub>on</sub>		—	45	—	
	Fall time	t <sub>f</sub>		—	55	—	
	Turn-off time	t <sub>off</sub>		—	200	—	
Total gate charge (Gate-source plus gate-drain)		Q <sub>g</sub>	V <sub>DD</sub> ≈ -48 V, V <sub>GS</sub> = -10 V, I <sub>D</sub> = -5 A	—	22	—	nC
Gate-source charge		Q <sub>gs</sub>		—	16	—	
Gate-drain ("miller") charge		Q <sub>gd</sub>		—	6	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	I <sub>DR</sub>	—	—	—	-5	A
Pulse drain reverse current (Note 1)	I <sub>DRP</sub>	—	—	—	-20	A
Forward voltage (diode)	V <sub>DSF</sub>	I <sub>DR</sub> = -5 A, V <sub>GS</sub> = 0 V	—	—	1.7	V
Reverse recovery time	t <sub>rr</sub>	I <sub>DR</sub> = -5 A, V <sub>GS</sub> = 0 V	—	80	—	ns
Reverse recovery charge	Q <sub>rr</sub>	dI <sub>DR</sub> / dt = 50 A / μS	—	0.1	—	μC

## Marking

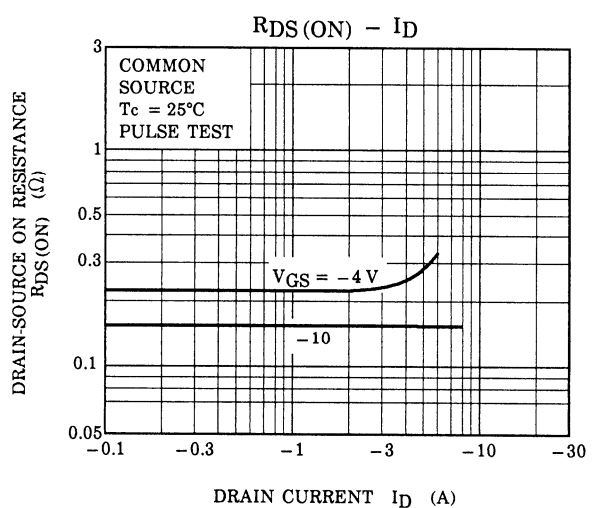
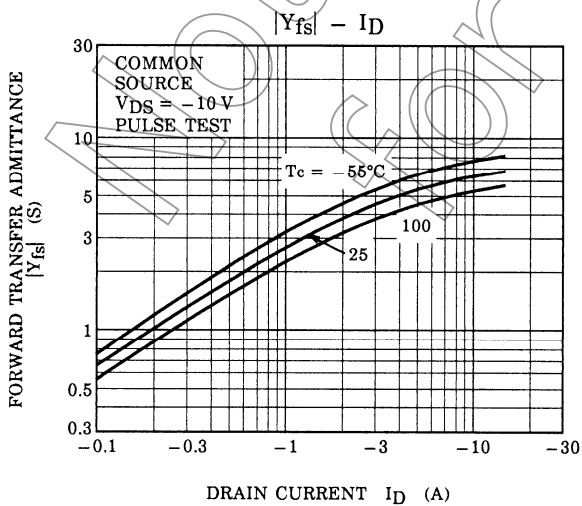
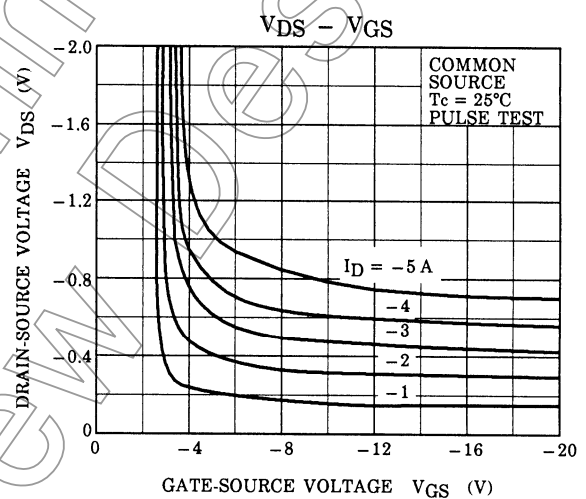
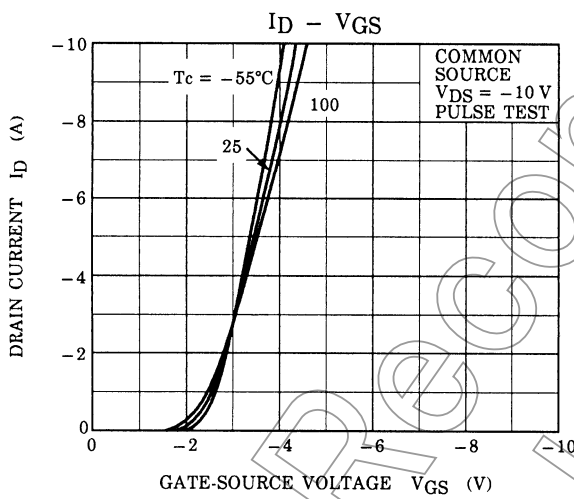
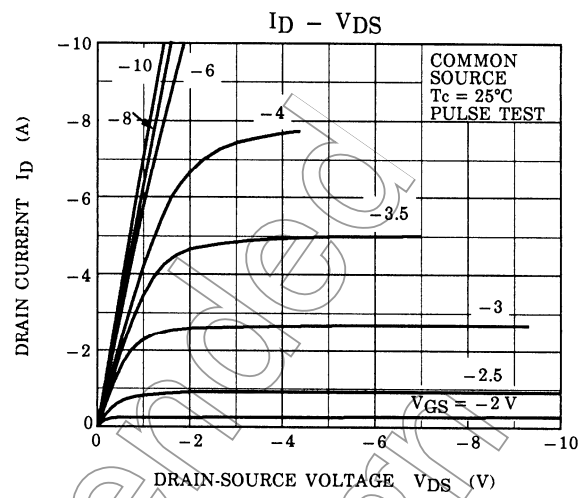
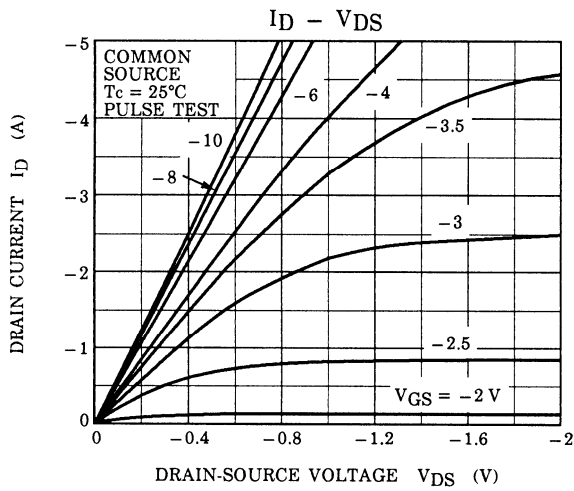


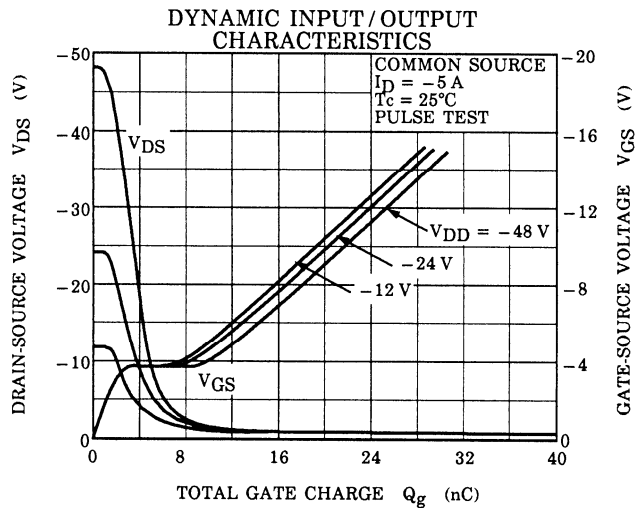
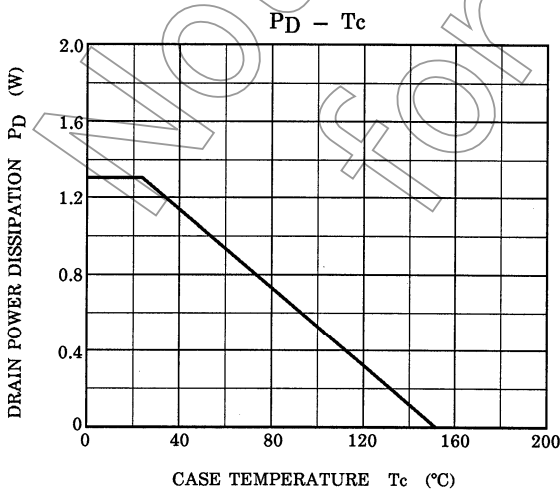
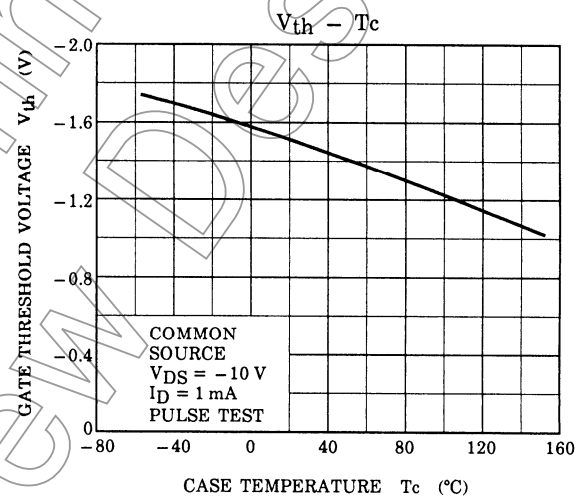
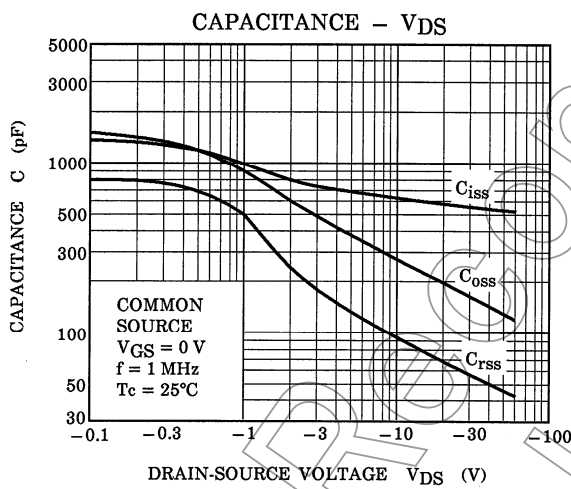
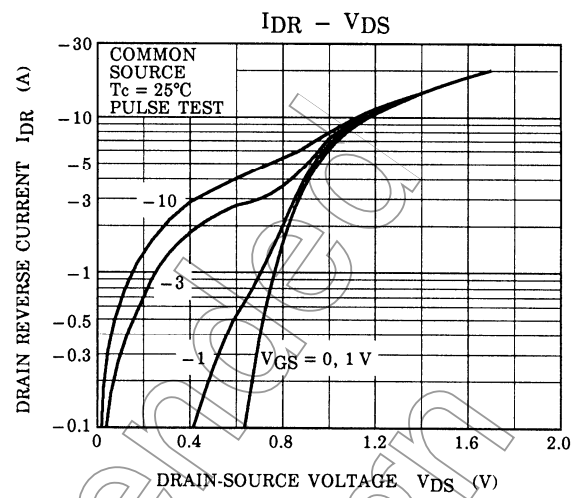
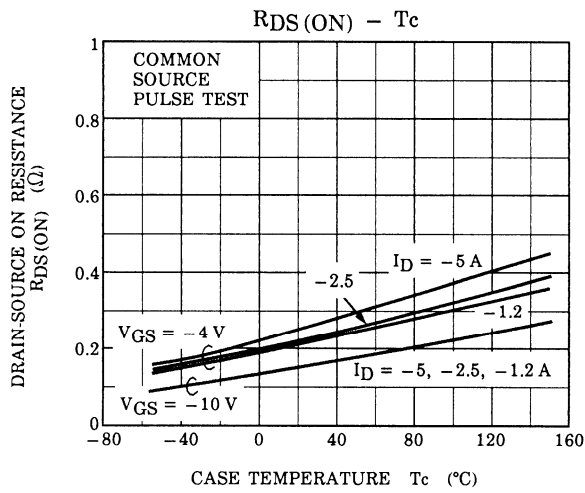
Note 4: A line under a Lot No. identifies the indication of product Labels.

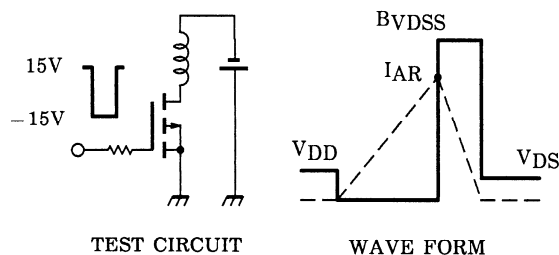
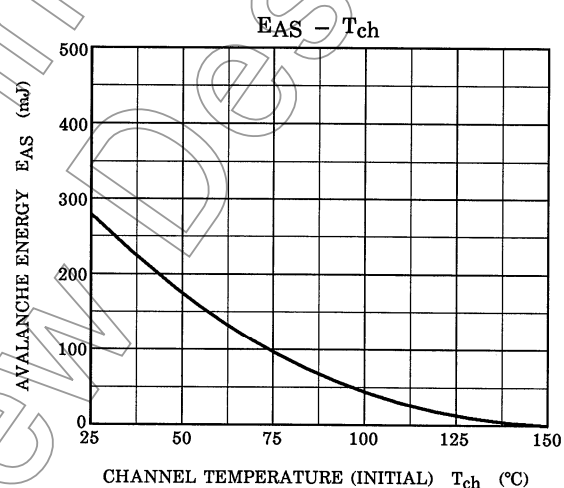
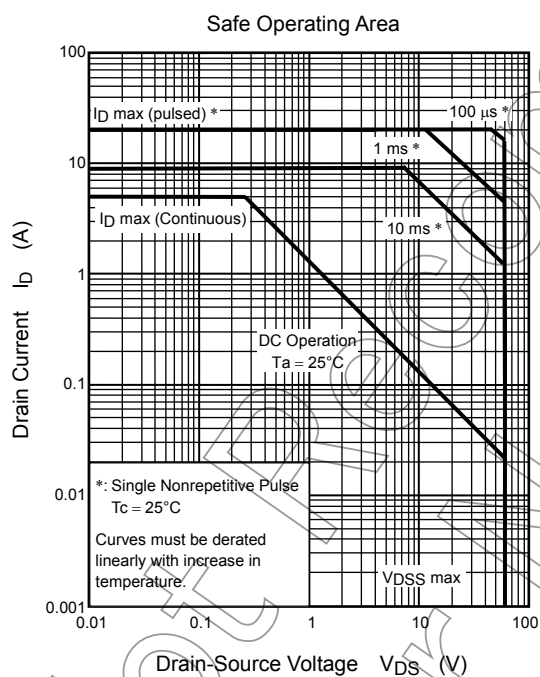
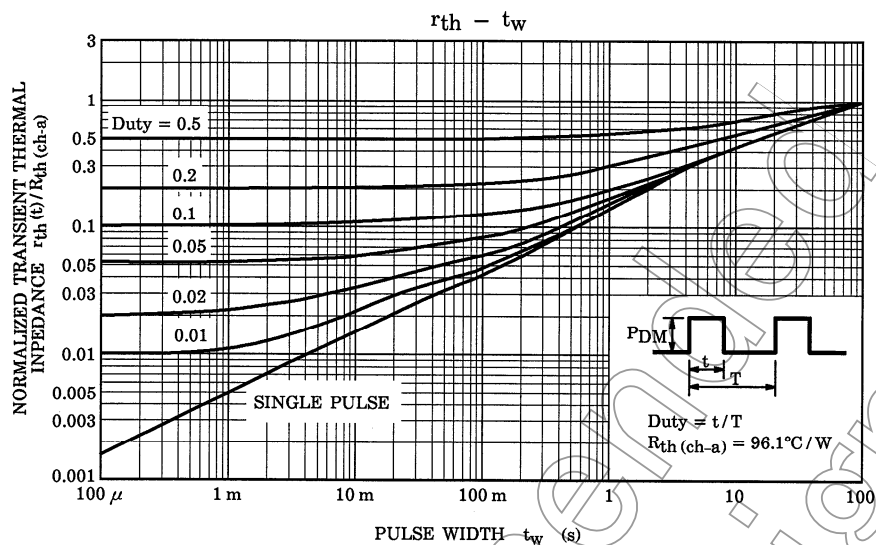
Not underlined: [[Pb]]/INCLUDES > MCV

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$$R_G = 25\Omega$$

$$V_{DD} = -25V, L = 14.84mH$$

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

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