

# 2SJ412

DC-DC Converter, Relay Drive and Motor Drive Applications

- 4-V gate drive
- Low drain-source ON resistance:  $R_{DS(ON)} = 0.15 \Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 7.7 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = -100 \mu\text{A}$  (max) ( $V_{DS} = -100 \text{ V}$ )
- Enhancement mode:  $V_{th} = -0.8$  to  $-2.0 \text{ V}$  ( $V_{DS} = -10 \text{ V}$ ,  $I_D = -1 \text{ mA}$ )

### Absolute Maximum Ratings (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		$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	-16	A
	Pulse (Note 1)	$I_{DP}$	-64	
Drain power dissipation ( $T_c = 25^\circ\text{C}$ )		$P_D$	60	W
Single pulse avalanche energy (Note 2)		$E_{AS}$	292	mJ
Avalanche current		$I_{AR}$	-16	A
Repetitive avalanche energy (Note 3)		$E_{AR}$	6	mJ
Channel temperature		$T_{ch}$	150	°C
Storage temperature range		$T_{stg}$	-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	$R_{th(ch-c)}$	2.08	°C/W
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	83.3	°C/W

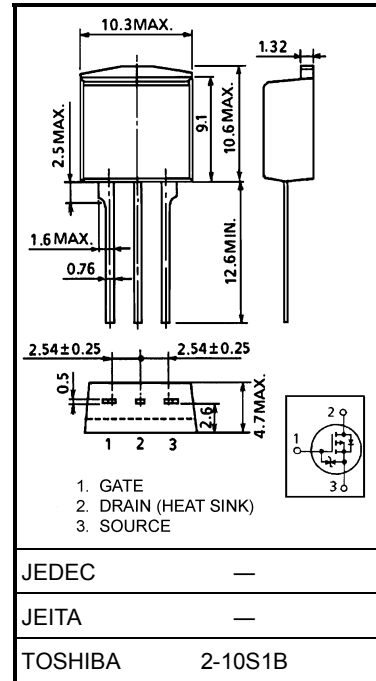
Note1: Ensure that the channel temperature does not exceed 150°C.

Note 2:  $V_{DD} = -25 \text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 1.84 \text{ mH}$ ,  $R_G = 25 \Omega$ ,  $I_{AR} = -16 \text{ A}$

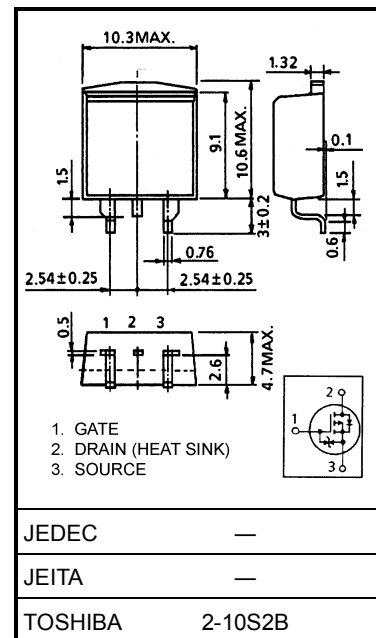
Note 3: Repetitive rating: pulse width limited by maximum junction temperature

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

Unit: mm



Weight: 1.5 g (typ.)



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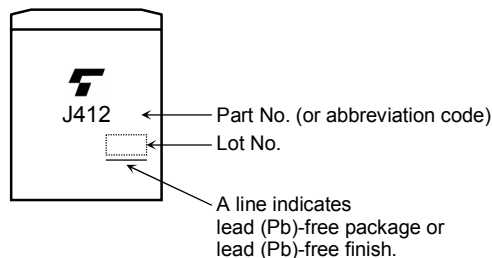
## Electrical Characteristics (Ta = 25°C)

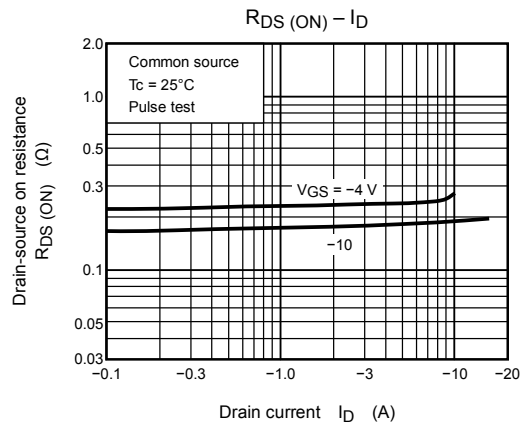
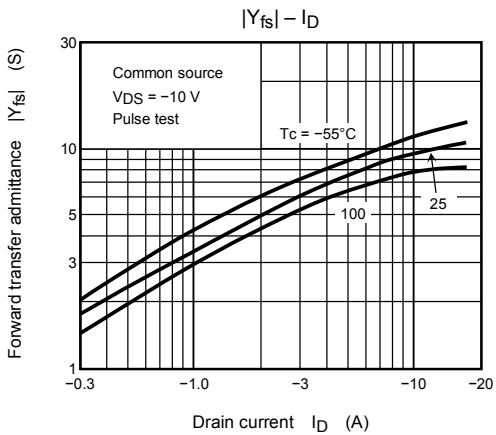
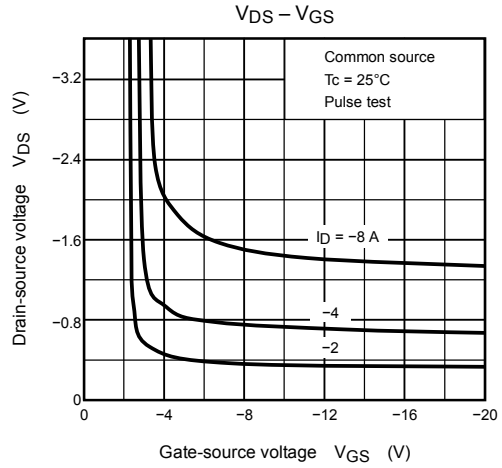
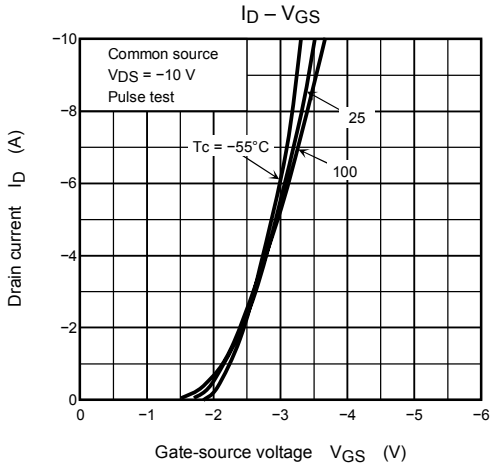
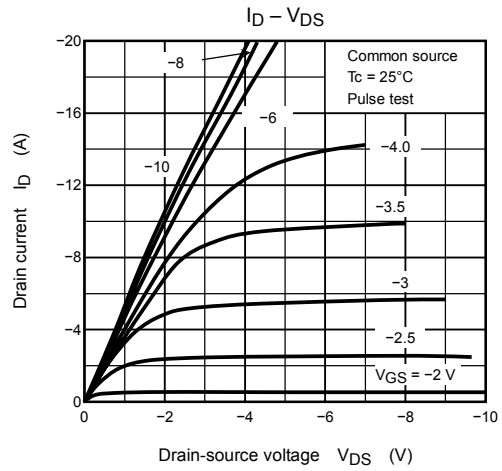
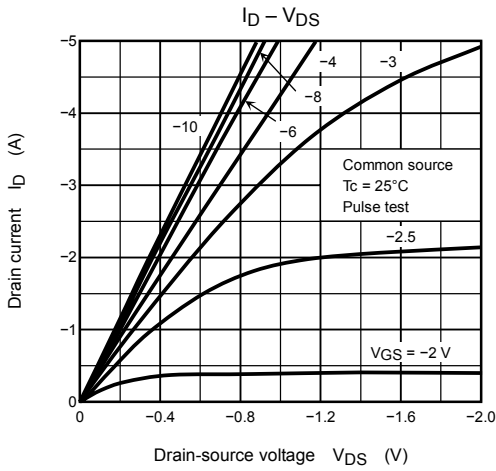
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cut-off current		$I_{DSS}$	$V_{DS} = -100 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	-100	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = -10 \text{ mA}, V_{GS} = 0 \text{ V}$	-100	—	—	V
Gate threshold voltage		$V_{th}$	$V_{DS} = -10 \text{ V}, I_D = -1 \text{ mA}$	-0.8	—	-2.0	V
Gate-source ON resistance		$R_{DS(ON)}$	$V_{GS} = -4 \text{ V}, I_D = -6 \text{ A}$	—	0.25	0.32	$\Omega$
			$V_{GS} = -10 \text{ V}, I_D = -6 \text{ A}$	—	0.15	0.21	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = -10 \text{ V}, I_D = -6 \text{ A}$	4.5	7.7	—	S
Input capacitance		$C_{iss}$	$V_{DS} = -10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	1100	—	$\mu\text{F}$
Reverse transfer capacitance		$C_{rss}$		—	210	—	$\mu\text{F}$
Output capacitance		$C_{oss}$		—	440	—	$\mu\text{F}$
Switching time	Rise time	$t_r$		—	18	—	ns
	Turn-on time	$t_{on}$		—	30	—	
	Fall time	$t_f$		—	18	—	
	Turn-off time	$t_{off}$		—	65	—	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx -80 \text{ V}, V_{GS} = -10 \text{ V}, I_D = -16 \text{ A}$	—	48	—	nC
Gate-source charge		$Q_{gs}$		—	29	—	nC
Gate-drain ("miller") charge		$Q_{gd}$		—	19	—	nC

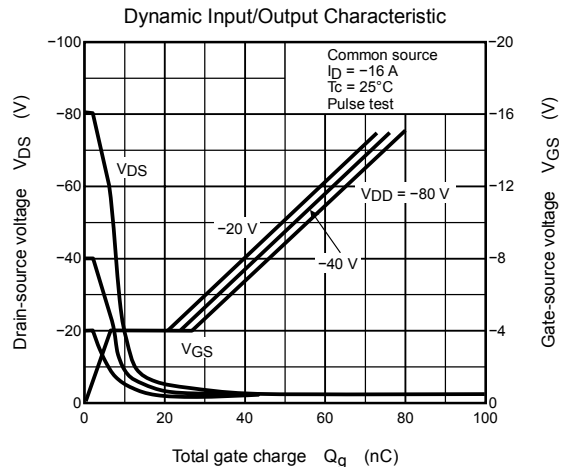
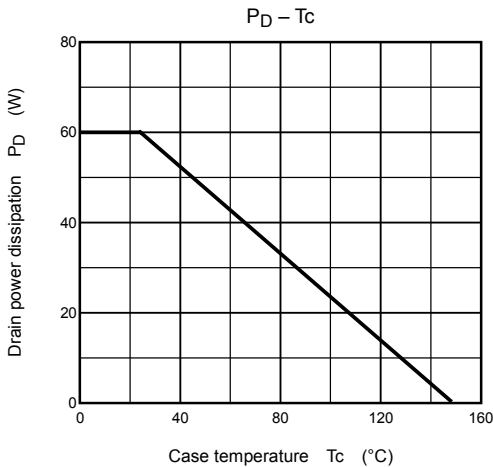
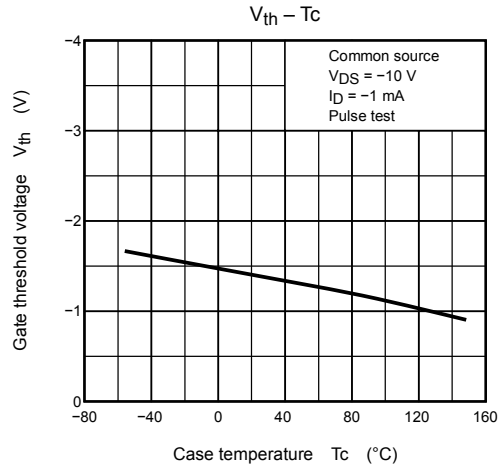
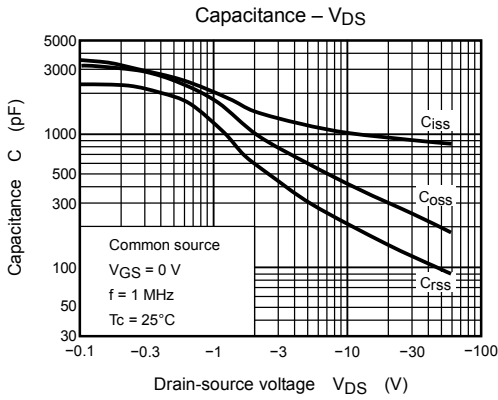
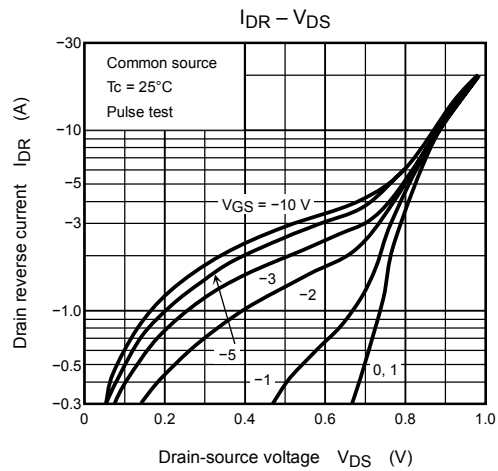
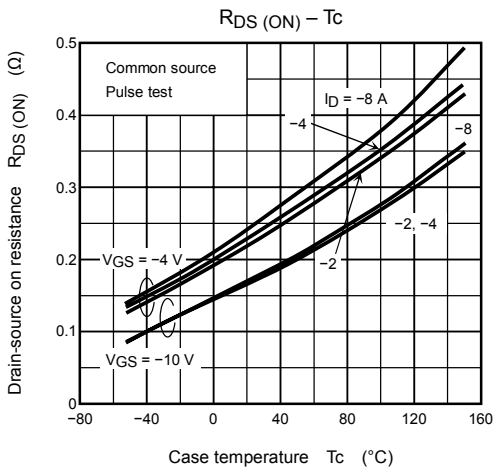
## Source-Drain Rating and Characteristics (Ta = 25°C)

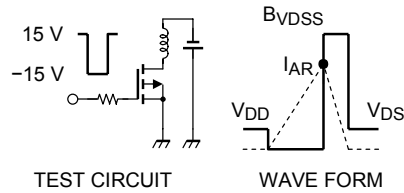
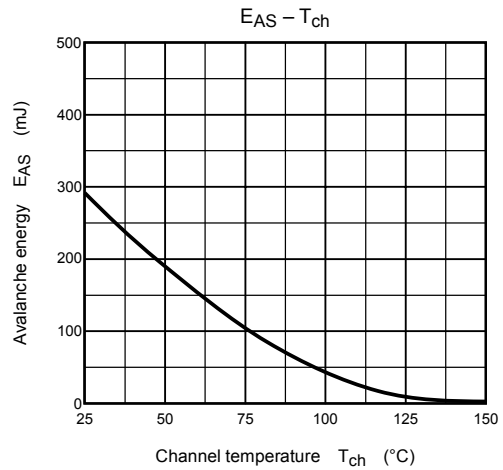
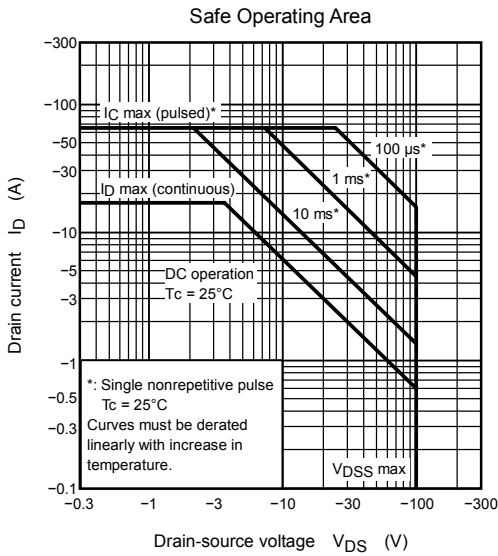
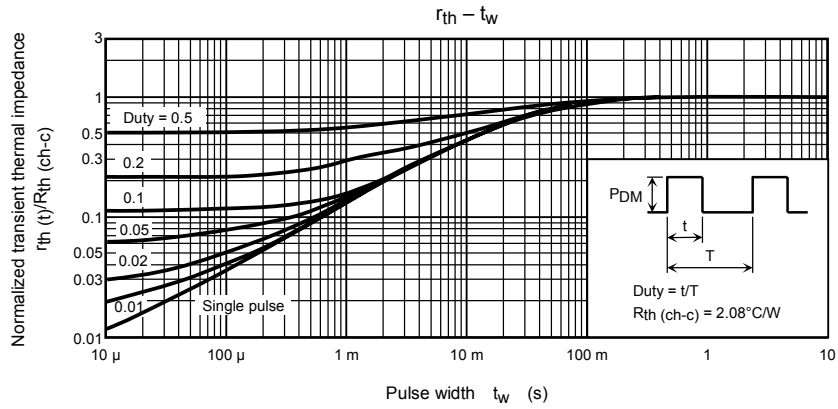
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)		$I_{DR}$	—	—	—	-16	A
Pulse drain reverse current (Note 1)		$I_{DRP}$	—	—	—	-64	A
Forward voltage (diode)		$V_{DSF}$	$I_{DR} = -16 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	1.7	V
Reverse recovery time		$t_{rr}$	$I_{DR} = -16 \text{ A}, V_{GS} = 0 \text{ V}$	—	160	—	ns
Reverse recovery charge		$Q_{rr}$	$dI_{DR}/dt = 50 \text{ A}/\mu\text{s}$	—	0.5	—	$\mu\text{C}$

## Marking









$R_G = 25 \Omega$   
 $V_{DD} = -25 V, L = 1.84 mH$

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

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