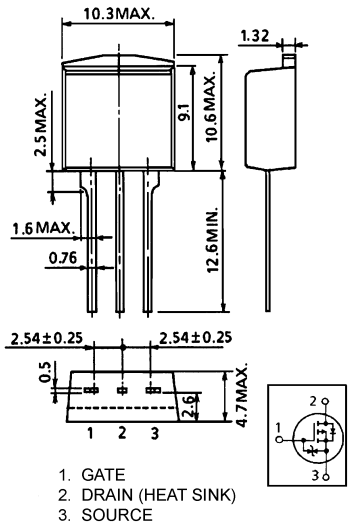
TOSHIBA Field Effect Transistor Silicon P Channel MOS Type (L^2-π-MOSV)

2SJ412

DC-DC Converter, Relay Drive and Motor Drive Applications

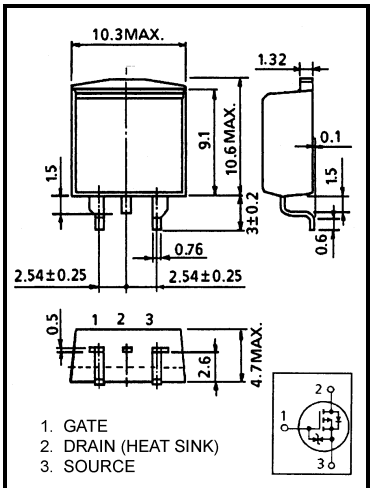
- 4-V gate drive
- Low drain-source ON resistance: $R_{DS\ (ON)}$ = 0.15 Ω (typ.)
- High forward transfer admittance: $|Y_{fs}|$ = 7.7 S (typ.)
- Low leakage current: I_{DSS} = −100 μA (max) (V_{DS} = −100 V)
- Enhancement mode: V_{th} = −0.8 to −2.0 V (V_{DS} = −10 V, I_D = −1 mA)

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	2-10S1B

Weight: 1.5 g (typ.)



JEDEC	—
JEITA	—
TOSHIBA	2-10S2B

Weight: 1.5 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	−100	V
Drain-gate voltage (R_{GS} = 20 kΩ)		V_{DGR}	−100	V
Gate-source voltage		V_{GSS}	±20	V
Drain current	DC (Note 1)	I_D	−16	A
	Pulse (Note 1)	I_{DP}	−64	
Drain power dissipation (Tc = 25°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	$R_{th\ (ch\text{-}c)}$	2.08	°C/W
Thermal resistance, channel to ambient	$R_{th\ (ch\text{-}a)}$	83.3	°C/W

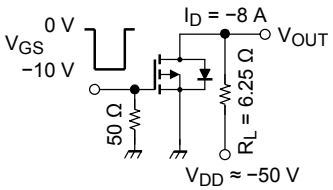
Note1: Ensure that the channel temperature does not exceed 150°C.

Note 2: V_{DD} = −25 V, T_{ch} = 25°C (initial), L = 1.84 mH, R_G = 25 Ω, I_{AR} = −16 A

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

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

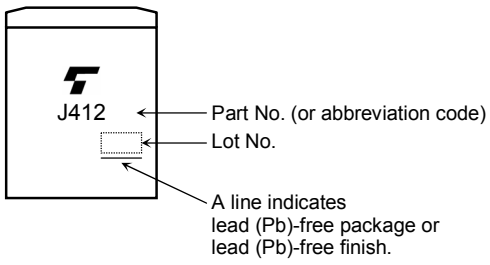
Electrical Characteristics (Ta = 25°C)

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

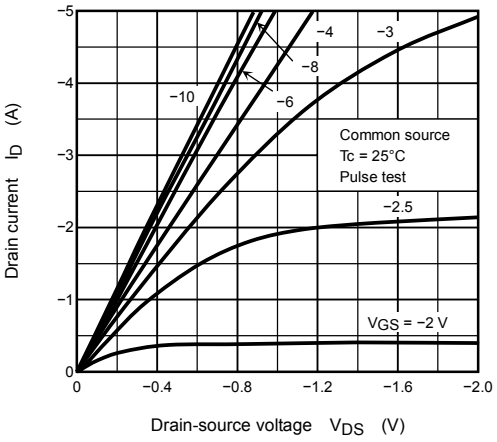
Source-Drain Rating and Characteristics (Ta = 25°C)

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 A, V_{GS} = 0 V	—	—	1.7	V
Reverse recovery time	t_{rr}	I_{DR} = −16 A, V_{GS} = 0 V	—	160	—	ns
Reverse recovery charge	Q_{rr}	dI_{DR}/dt = 50 A/μs	—	0.5	—	μC

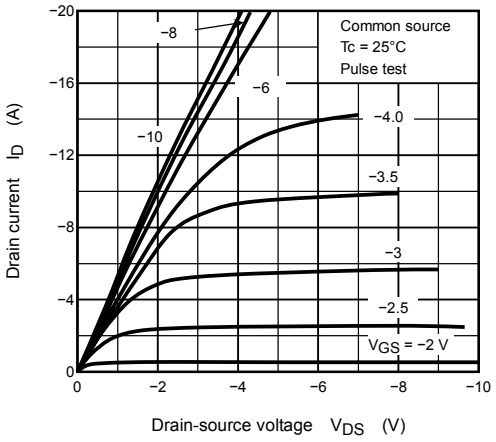
Marking



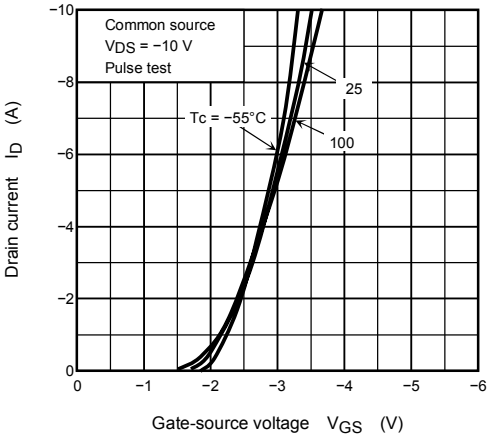
$I_D - V_{DS}$



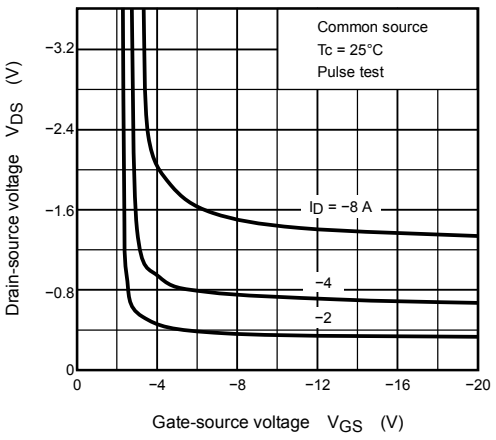
$I_D - V_{DS}$



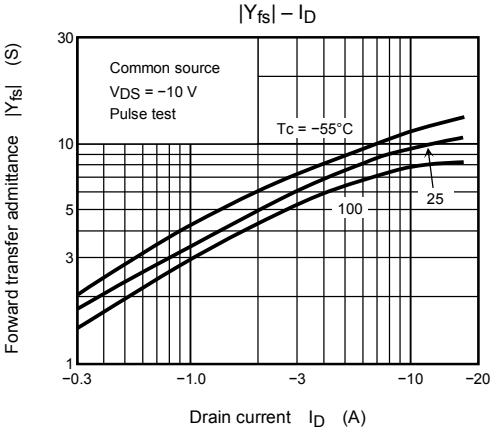
$I_D - V_{GS}$



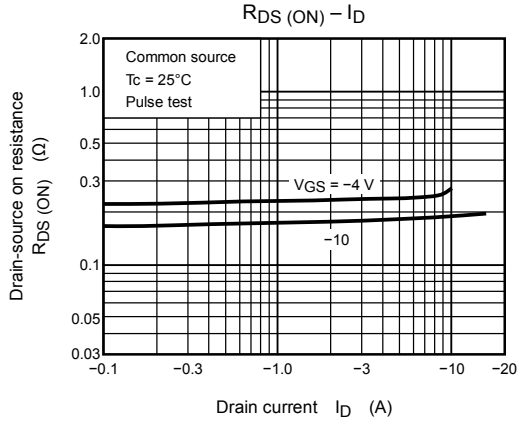
$V_{DS} - V_{GS}$



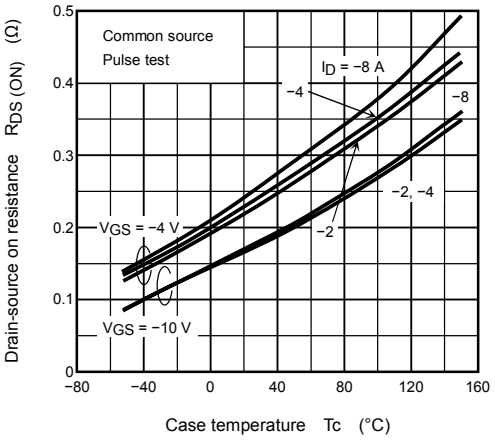
$|Y_{fs}| - I_D$



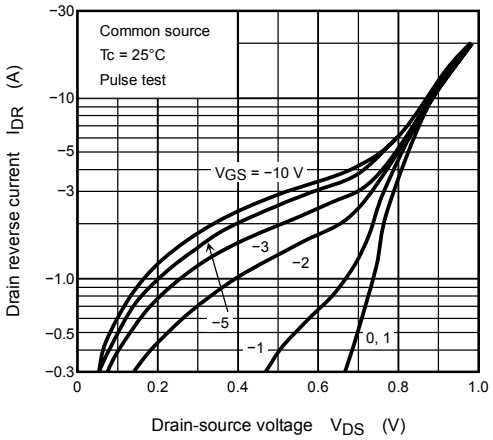
$R_{DS\ (ON)} - I_D$



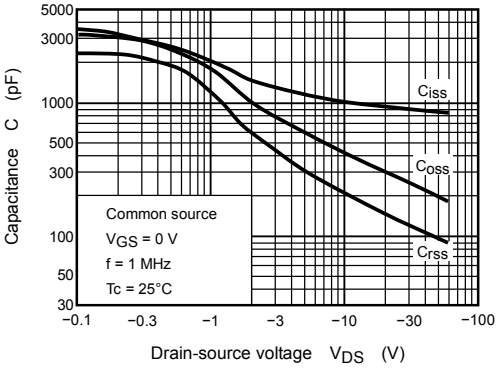
$R_{DS\ (ON)}$ – Tc



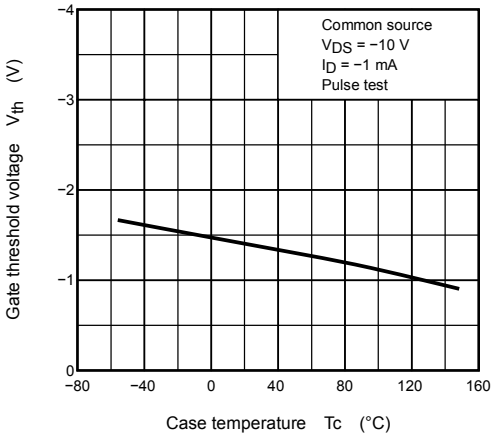
I_{DR} – V_{DS}



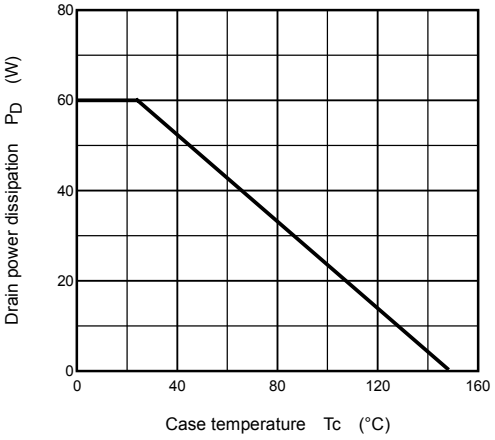
Capacitance – V_{DS}



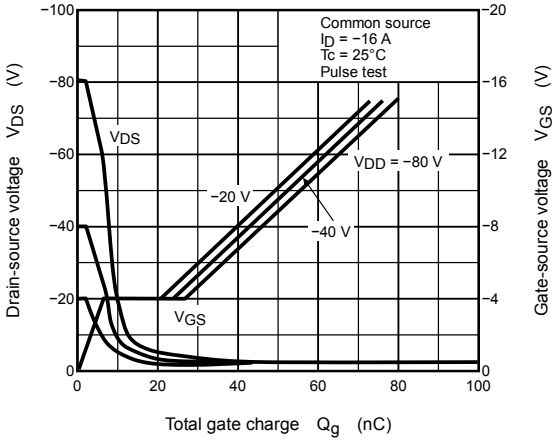
V_{th} – Tc



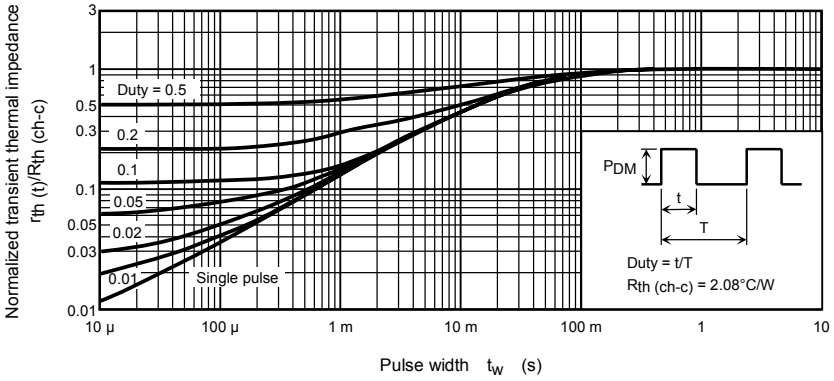
P_D – Tc



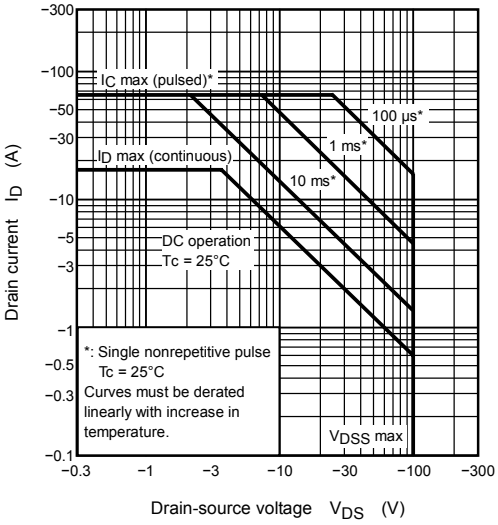
Dynamic Input/Output Characteristic



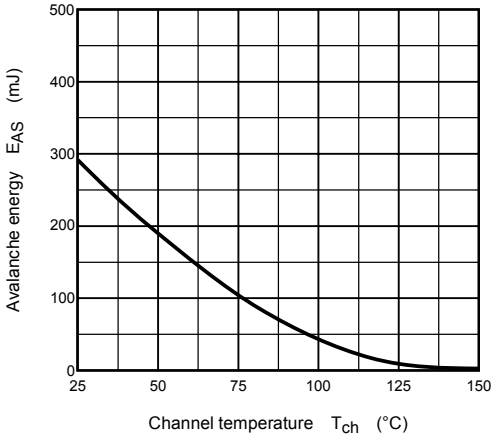
$r_{th} - t_w$

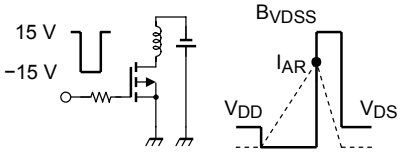


Safe Operating Area



$E_{AS} - T_{ch}$





TEST CIRCUIT WAVE FORM

$R_G = 25\ \Omega$

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

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

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