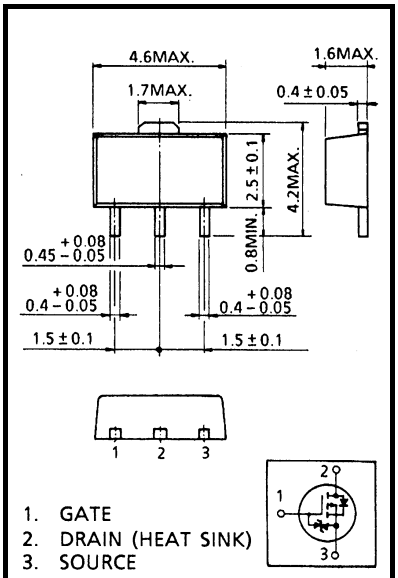
TOSHIBA Field Effect Transistor Silicon P Channel MOS Type (L^2−π−MOSV)

2SJ511

Chopper Regulator, DC−DC Converter and Motor Drive Applications

- 4-V gate drive
- Low drain−source ON resistance : $R_{DS\ (ON)}$ = 0.32 Ω (typ.)
- High forward transfer admittance : $|Y_{fs}|$ = 1.4 S (typ.)
- Low leakage current : I_{DSS} = −100 μA (max) (V_{DS} = −30 V)
- Enhancement mode : V_{th} = −0.8 to −2.0 V (V_{DS} = −10 V, I_D = −1 mA)

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	2−5K1B

Weight: 0.05 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain−source voltage		V_{DSS}	−30	V
Drain−gate voltage (R_{GS} = 20 kΩ)		V_{DGR}	−30	V
Gate−source voltage		V_{GSS}	±20	V
Drain current	DC (Note 1)	I_D	−2	A
	Pulse (Note 1)	I_{DP}	−6	A
Drain power dissipation		P_D	0.5	W
Drain power dissipation (Note 2)		P_D	1.5	W
Single pulse avalanche energy (Note 3)		E_{AS}	55	mJ
Avalanche current		I_{AR}	−2	A
Repetitive avalanche energy (Note 4)		E_{AR}	0.05	mJ
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55~150	°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 ambient	$R_{th\ (ch-a)}$	250	°C / W

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

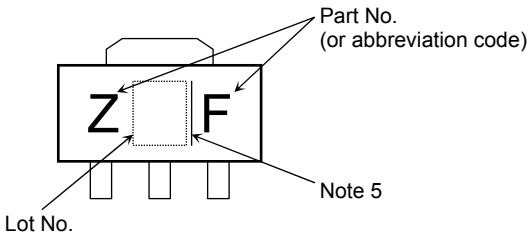
Note 2: Mounted on a ceramic substrate (25.4 mm × 25.4 mm × 0.8 mm)

Note 3: V_{DD} = −25 V, T_{ch} = 25°C (initial), L = 10 mH, R_G = 25 Ω, I_{AR} = −2 A

Note 4: Repetitive rating: pulse width limited by maximum channel temperature

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

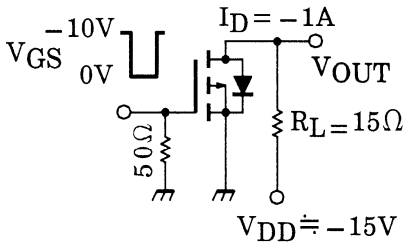
Marking



Note 5: A line to the right of a Lot No. identifies the indication of product Labels.
Without a line: [[Pb]]/INCLUDES > MCV
With a line: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

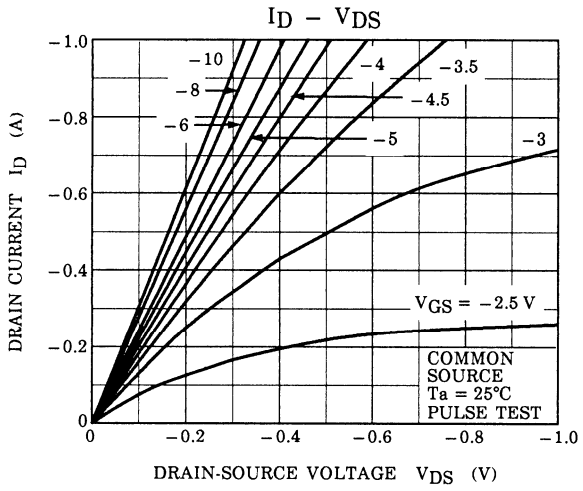
Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

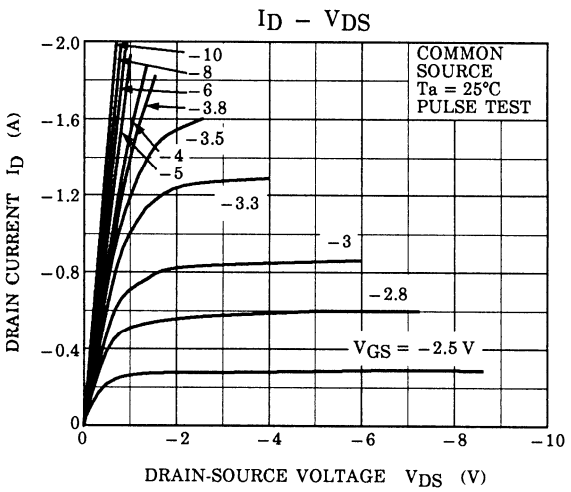
Electrical Characteristics (Ta = 25°C)

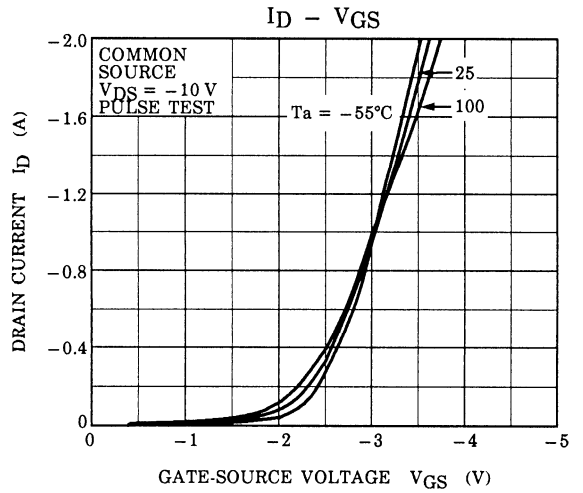
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0 V	—	—	±10	μA
Drain cut−off current		I_{DSS}	V_{DS} = −30 V, V_{GS} = 0 V	—	—	−100	μA
Drain−source breakdown voltage		$V_{(BR)\ DSS}$	I_D = −10 mA, V_{GS} = 0 V	−30	—	—	V
Gate threshold voltage		V_{th}	V_{DS} = −10 V, I_D = −1 mA	−0.8	—	−2.0	V
Drain−source ON resistance		$R_{DS\ (ON)}$	V_{GS} = −4 V, I_D = −1 A	—	0.55	0.76	Ω
			V_{GS} = −10 V, I_D = −1 A	—	0.32	0.45	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = −10 V, I_D = −1 A	0.7	1.4	—	S
Input capacitance		C_{iss}	V_{DS} = −10 V, V_{GS} = 0 V, f = 1 MHz	—	160	—	pF
Reverse transfer capacitance		C_{rss}		—	30	—	
Output capacitance		C_{oss}		—	85	—	
Switching time	Rise time	t_r		—	30	—	ns
	Turn−on time	t_{on}		—	45	—	
	Fall time	t_f		—	30	—	
	Turn−off time	t_{off}		—	120	—	
Total gate charge (Gate−source plus gate−drain)		Q_g	V_{DD} ≈ −24 V, V_{GS} = −10 V, I_D = −2 A	—	5.5	—	nC
Gate−source charge		Q_{gs}		—	4.3	—	
Gate−drain (“miller”) charge		Q_{gd}		—	1.2	—	

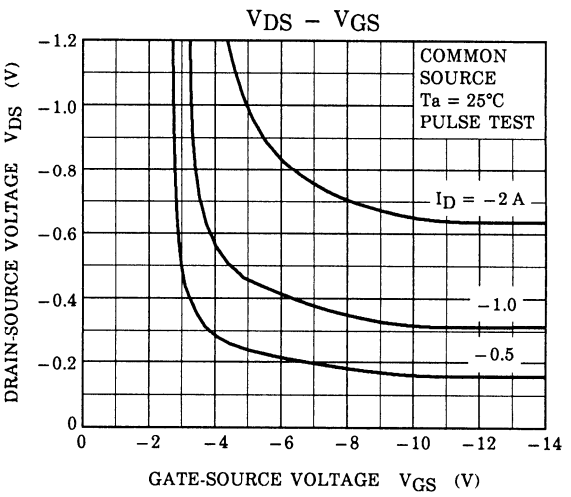
Source−Drain Ratings and Characteristics (Ta = 25°C)

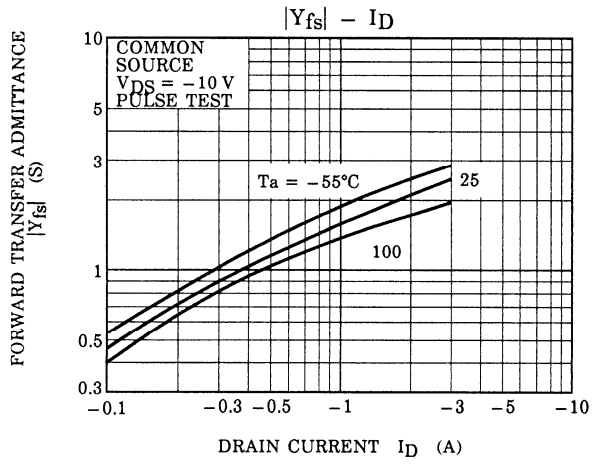
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	I_{DR} (Note 1)	—	—	—	−2	A
Pulse drain reverse current (Note 1)	I_{DRP} (Note 1)	—	—	—	−6	A
Forward voltage (diode)	V_{DSF}	I_{DR} = −2 A, V_{GS} = 0 V	—	—	1.5	V
Reverse recovery time	t_{rr}	I_{DR} = −2 A, V_{GS} = 0 V dI_{DR} / dt = 50 A / μs	—	40	—	ns
Reverse recovery charge	Q_{rr}		—	18	—	nC

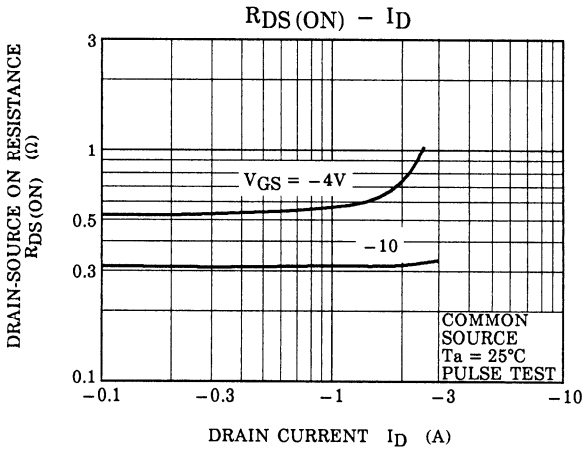

$I_D - V_{DS}$
DRAIN CURRENT I_D (A)
DRAIN-SOURCE VOLTAGE V_{DS} (V)
−10
−8
−6
−4
−3.5
−4.5
−5
−3
V_{GS} = −2.5 V
COMMON SOURCE
Ta = 25°C
PULSE TEST


$I_D - V_{DS}$
DRAIN CURRENT I_D (A)
DRAIN-SOURCE VOLTAGE V_{DS} (V)
COMMON SOURCE
Ta = 25°C
PULSE TEST
−10
−8
−6
−3.8
−3.5
−4
−5
−3.3
−3
−2.8
V_{GS} = −2.5 V

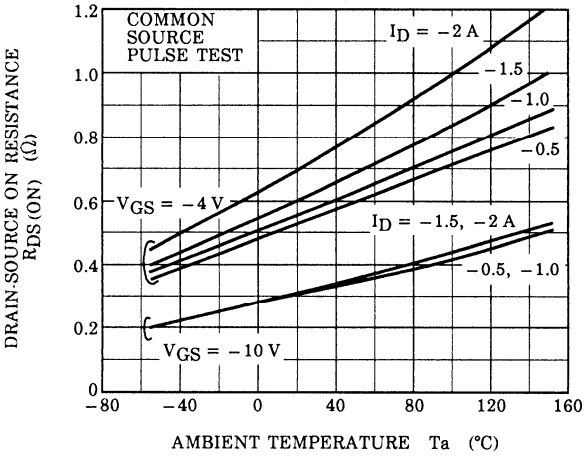

$I_D - V_{GS}$
DRAIN CURRENT I_D (A)
GATE-SOURCE VOLTAGE V_{GS} (V)
COMMON SOURCE
V_{DS} = −10 V
PULSE TEST
Ta = −55°C
25
100


$V_{DS} - V_{GS}$
DRAIN-SOURCE VOLTAGE V_{DS} (V)
GATE-SOURCE VOLTAGE V_{GS} (V)
COMMON SOURCE
Ta = 25°C
PULSE TEST
I_D = −2 A
−1.0
−0.5

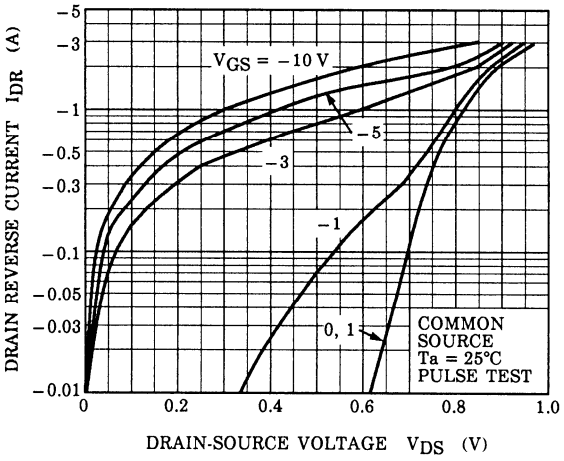

$|Y_{fs}| - I_D$
FORWARD TRANSFER ADMITTANCE $|Y_{fs}|$ (S)
DRAIN CURRENT I_D (A)
COMMON SOURCE
V_{DS} = −10 V
PULSE TEST
Ta = −55°C
25
100


$R_{DS(ON)} - I_D$
DRAIN-SOURCE ON RESISTANCE $R_{DS(ON)}$ (Ω)
DRAIN CURRENT I_D (A)
V_{GS} = −4V
−10
COMMON SOURCE
Ta = 25°C
PULSE TEST

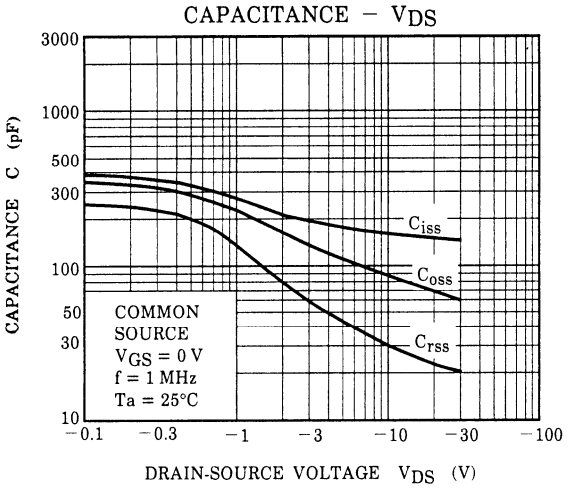
$R_{DS\,(ON)}$ – Ta



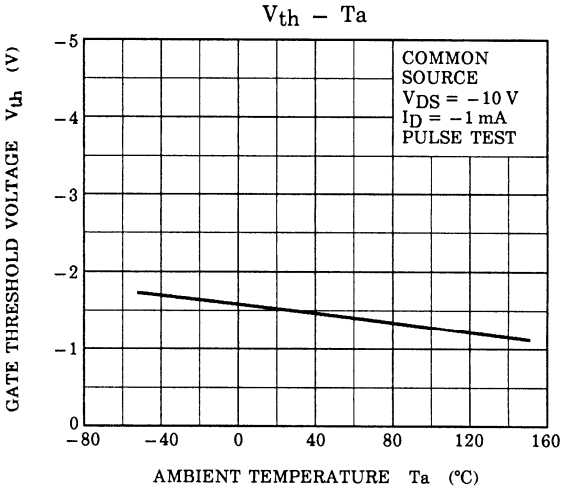
I_{DR} – V_{DS}



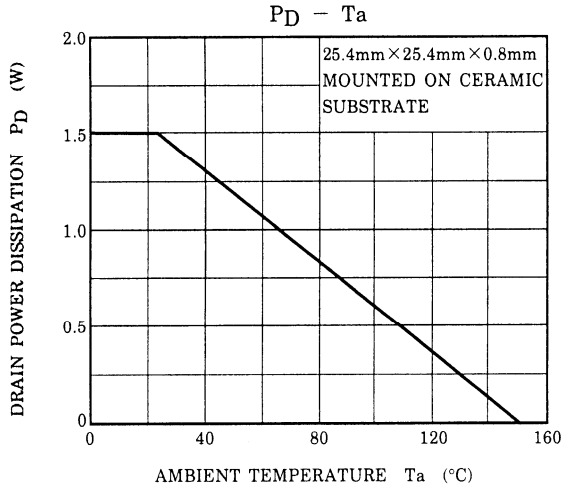
CAPACITANCE – V_{DS}



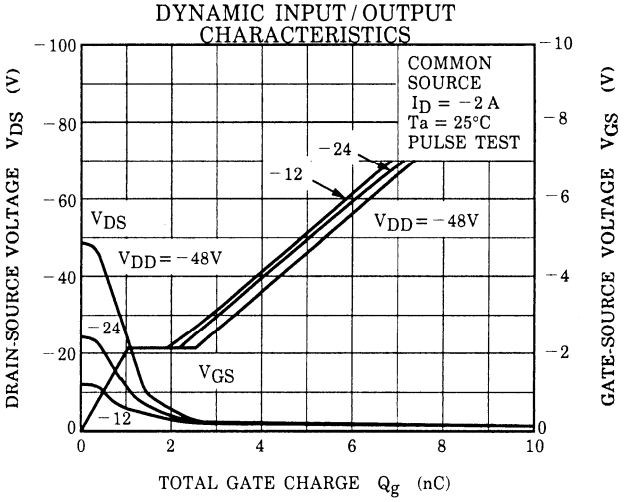
V_{th} – Ta



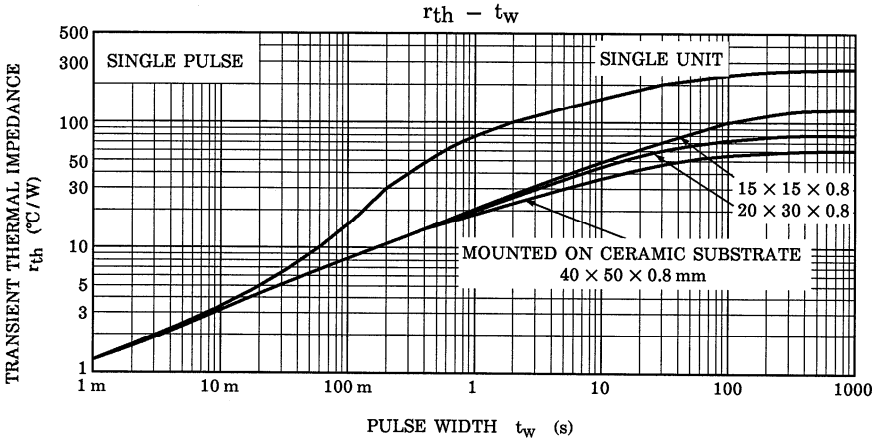
P_D – Ta



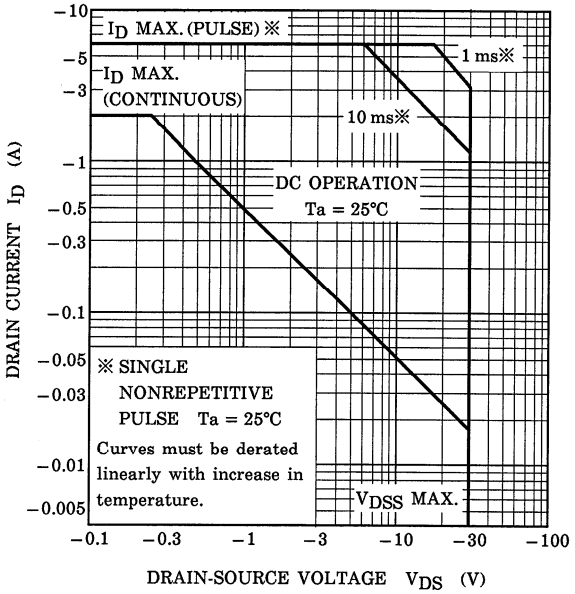
DYNAMIC INPUT / OUTPUT CHARACTERISTICS



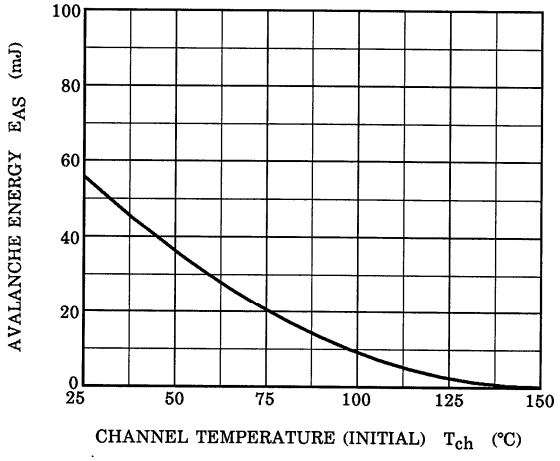
r_{th} – t_w

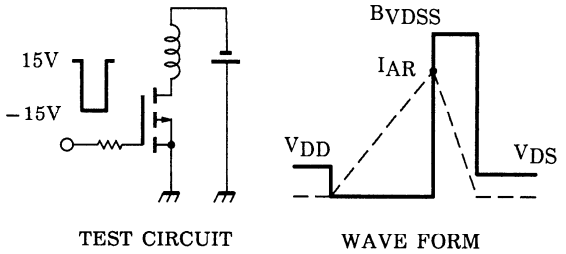


SAFE OPERATING AREA



E_{AS} – T_{ch}





$R_G = 25\Omega$
$V_{DD} = -25V$, L = 10mH

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

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