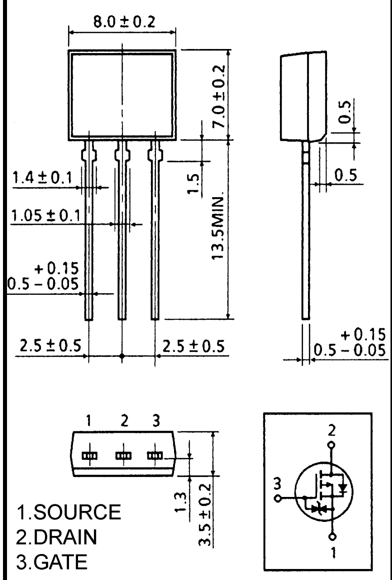
TOSHIBA Field Effect Transistor Silicon P Channel MOS Type (L^2−π−MOSV)

2SJ378

Relay Drive, DC−DC Converter and Motor Drive Applications

Unit: mm



JEDEC	―
JEITA	―
TOSHIBA	2-8M1B

Weight: 0.54 g (typ.)

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

Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain−source voltage		V_{DSS}	−60	V
Drain−gate voltage (R_{GS} = 20 kΩ)		V_{DGR}	−60	V
Gate−source voltage		V_{GSS}	±20	V
Drain current	DC (Note 1)	I_D	−5	A
	Pulse (Note 1)	I_{DP}	−20	A
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 avalenche energy (Note 3)		E_{AR}	0.13	mJ
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55~150	°C

Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to ambient	$R_{th\ (ch-a)}$	96.1	°C / W

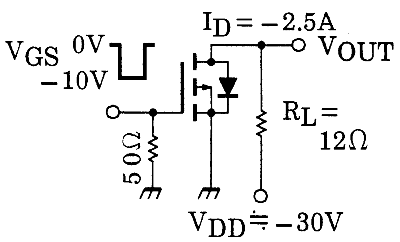
Note 1: Please use devices on condition that the channel temperature is below 150°C.

Note 2: V_{DD} = −25 V, T_{ch} = 25°C (initial), L = 14.84 mH, R_G = 25 Ω, I_{AR} = −5 A

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

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

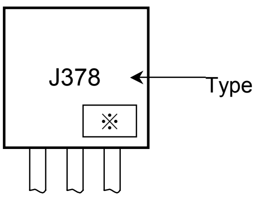
Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0 V	—	—	±10	μA
Drain cut−off current		I_{DSS}	V_{DS} = −60 V, V_{GS} = 0 V	—	—	−100	μA
Drain−source breakdown voltage		$V_{(BR)DSS}$	I_D = −10 mA, V_{GS} = 0 V	−60	—	—	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 = −2.5 A	—	0.24	0.28	Ω
			V_{GS} = −10 V, I_D = −2.5 A	—	0.16	0.19	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = −10 V, I_D = −2.5 A	2.0	4.0	—	S
Input capacitance		C_{iss}	V_{DS} = −10 V, V_{GS} = 0 V, f = 1 MHz	—	630	—	pF
Reverse transfer capacitance		C_{rss}		—	95	—	
Output capacitance		C_{oss}		—	290	—	
Switching time	Rise time	t_r	 Duty ≦ 1%, t_w = 10 μs	—	25	—	ns
	Turn−on time	t_{on}		—	45	—	
	Fall time	t_f		—	55	—	
	Turn−off time	t_{off}		—	200	—	
Total gate charge (Gate−source plus gate−drain)		Q_g	V_{DD} ≈ −48 V, V_{GS} = −10 V, I_D = −5 A	—	22	—	nC
Gate−source charge		Q_{gs}		—	16	—	
Gate−drain (“miller”) charge		Q_{gd}		—	6	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	I_{DR}	—	—	—	−5	A
Pulse drain reverse current (Note 1)	I_{DRP}	—	—	—	−20	A
Forward voltage (diode)	V_{DSF}	I_{DR} = −5 A, V_{GS} = 0 V	—	—	1.7	V
Reverse recovery time	t_{rr}	I_{DR} = −5 A, V_{GS} = 0 V dI_{DR} / dt = 50 A / μS	—	80	—	ns
Reverse recovery charge	Qrr		—	0.1	—	μC

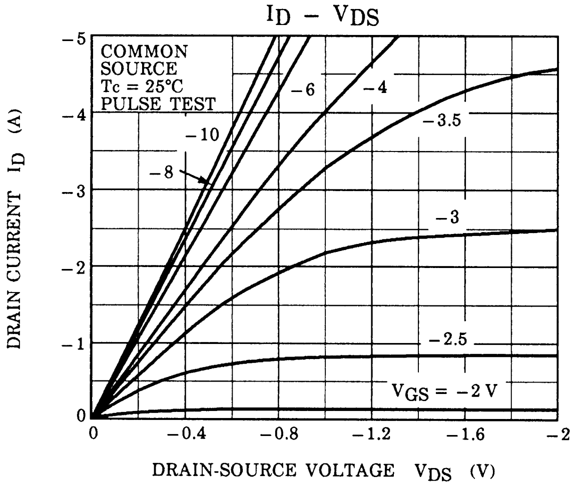
Marking

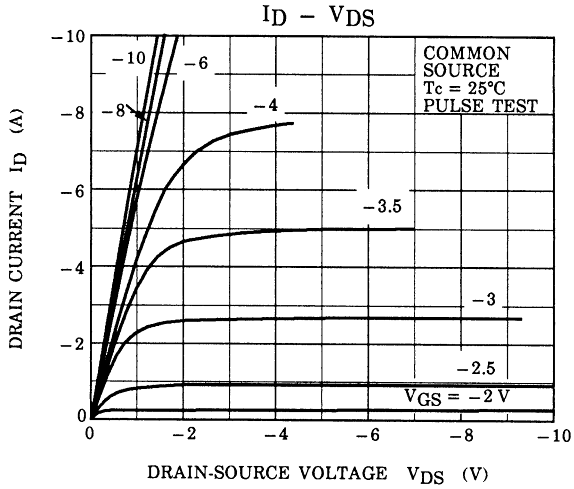


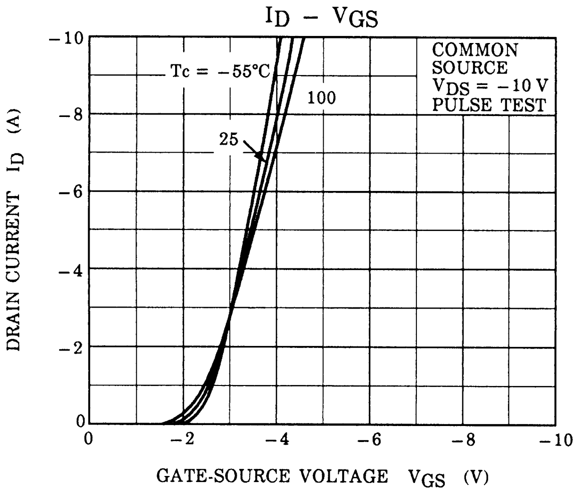
※ Lot Number

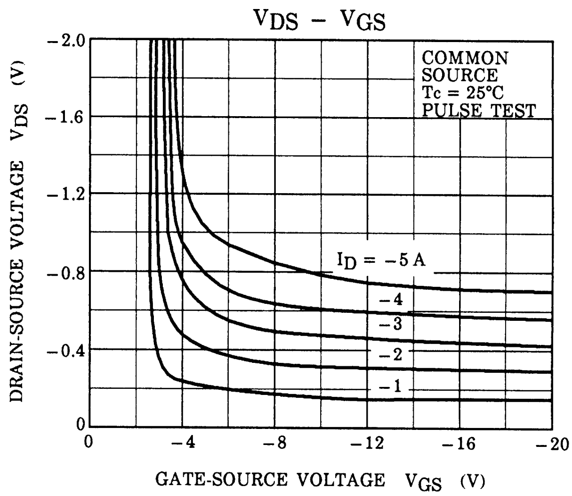
Month (starting from alphabet A)

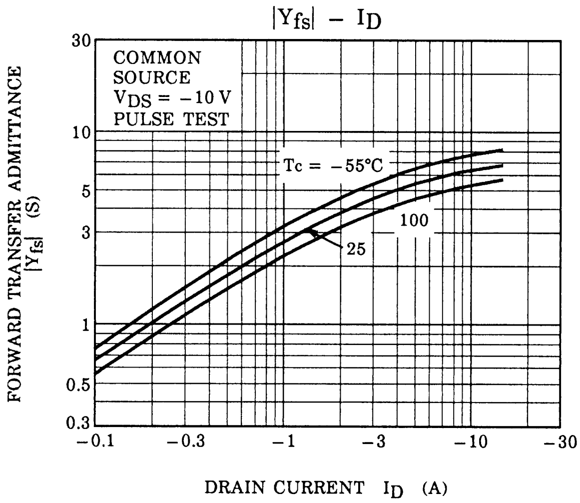
Year (last number of the christian era)

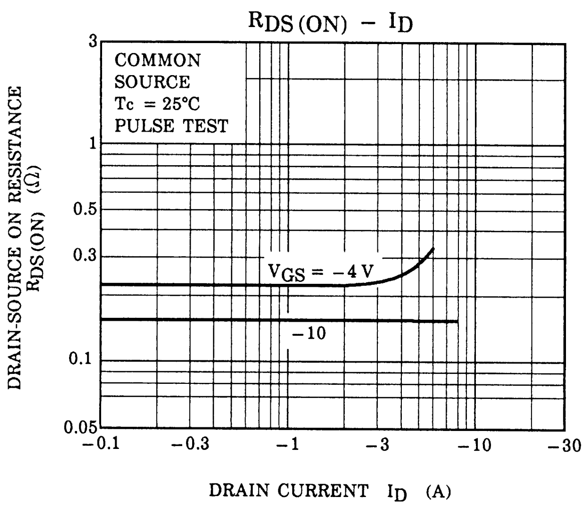

ID – VDS
COMMON SOURCE
Tc = 25°C
PULSE TEST
−10
−8
−6
−4
−3.5
−3
−2.5
VGS = −2 V
DRAIN CURRENT ID (A)
−5
−4
−3
−2
−1
0
0
−0.4
−0.8
−1.2
−1.6
−2
DRAIN-SOURCE VOLTAGE VDS (V)


ID – VDS
COMMON SOURCE
Tc = 25°C
PULSE TEST
−10
−8
−6
−4
−3.5
−3
−2.5
VGS = −2 V
DRAIN CURRENT ID (A)
−10
−8
−6
−4
−2
0
0
−2
−4
−6
−8
−10
DRAIN-SOURCE VOLTAGE VDS (V)

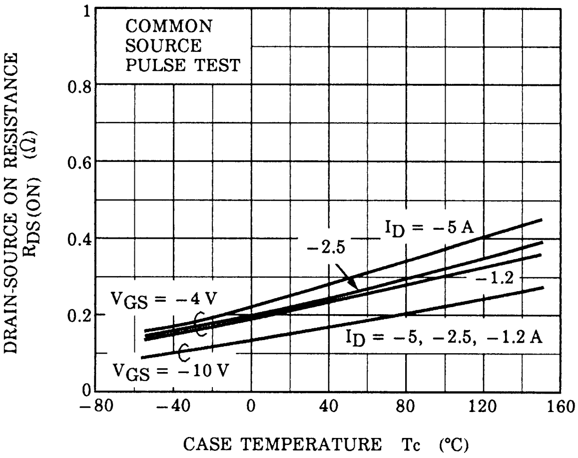

ID – VGS
COMMON SOURCE
VDS = −10 V
PULSE TEST
Tc = −55°C
100
25
DRAIN CURRENT ID (A)
−10
−8
−6
−4
−2
0
0
−2
−4
−6
−8
−10
GATE-SOURCE VOLTAGE VGS (V)


VDS – VGS
COMMON SOURCE
Tc = 25°C
PULSE TEST
ID = −5 A
−4
−3
−2
−1
DRAIN-SOURCE VOLTAGE VDS (V)
−2.0
−1.6
−1.2
−0.8
−0.4
0
0
−4
−8
−12
−16
−20
GATE-SOURCE VOLTAGE VGS (V)

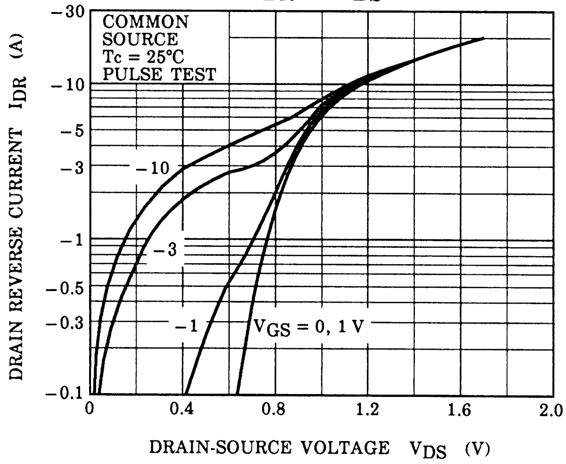

|Yfs| – ID
COMMON SOURCE
VDS = −10 V
PULSE TEST
Tc = −55°C
100
25
FORWARD TRANSFER ADMITTANCE |Yfs| (S)
30
10
5
3
1
0.5
0.3
−0.1
−0.3
−1
−3
−10
−30
DRAIN CURRENT ID (A)


RDS (ON) – ID
COMMON SOURCE
Tc = 25°C
PULSE TEST
VGS = −4 V
−10
DRAIN-SOURCE ON RESISTANCE RDS (ON) (Ω)
3
1
0.5
0.3
0.1
0.05
−0.1
−0.3
−1
−3
−10
−30
DRAIN CURRENT ID (A)

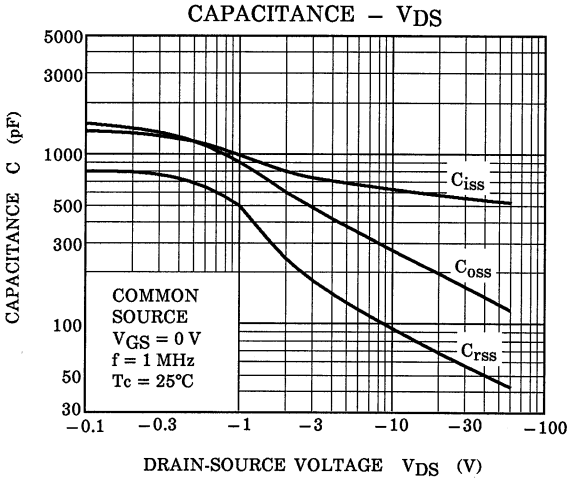
$R_{DS\,(ON)}$ – Tc



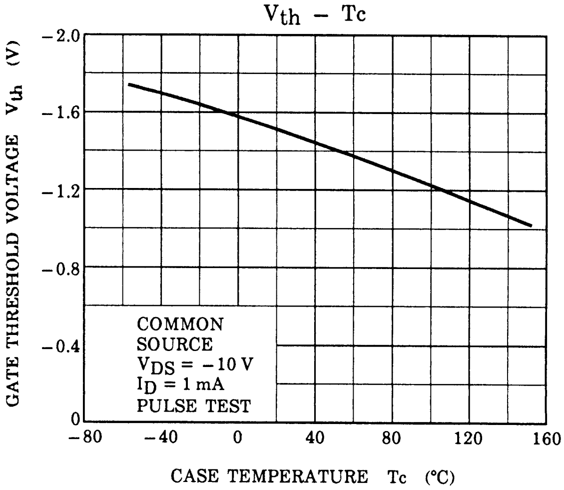
I_{DR} – V_{DS}



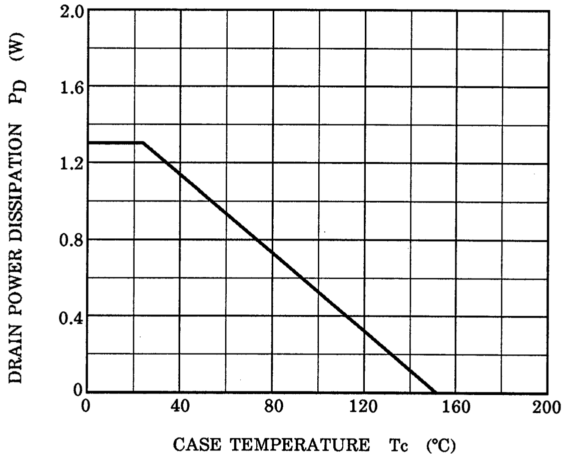
CAPACITANCE – V_{DS}



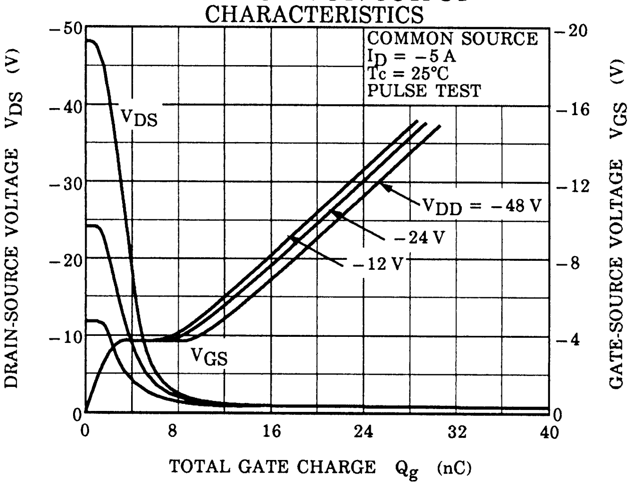
V_{th} – Tc



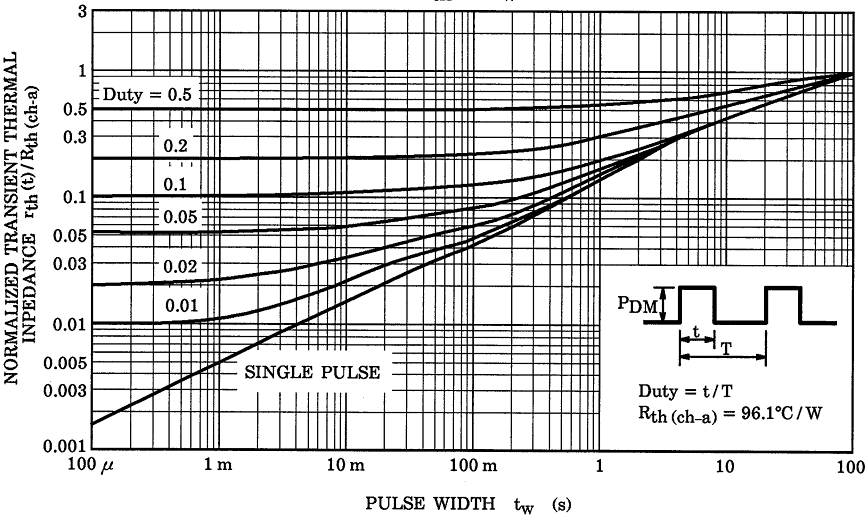
P_D – Tc



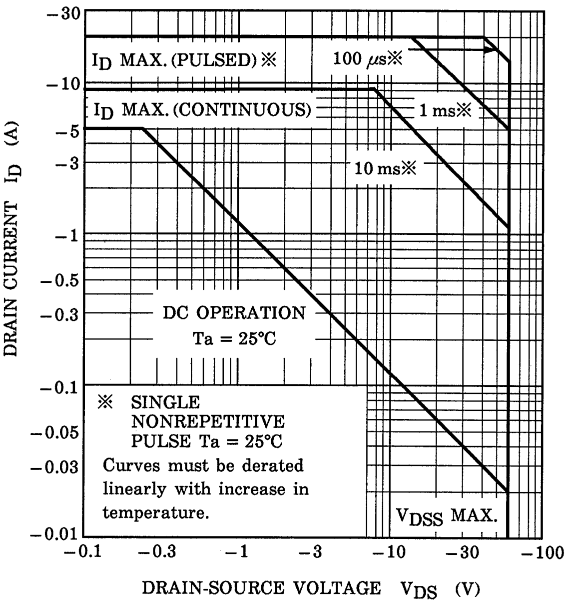
DYNAMIC INPUT / OUTPUT CHARACTERISTICS



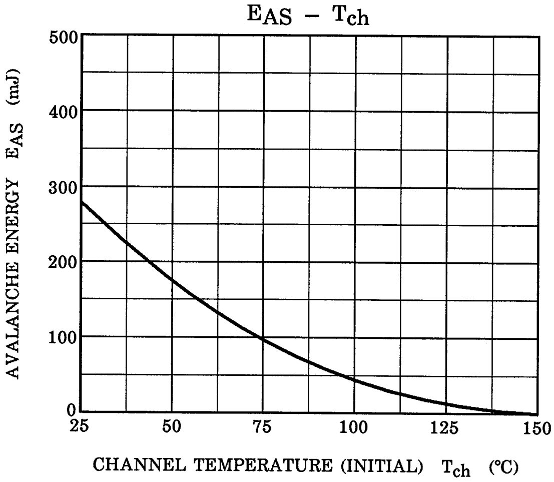
$r_{th} - t_w$

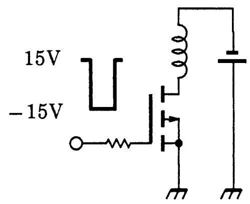


SAFE OPERATING AREA

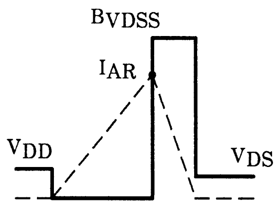


$E_{AS} - T_{ch}$





TEST CIRCUIT



WAVE FORM

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

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

RESTRICTIONS ON PRODUCT USE

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