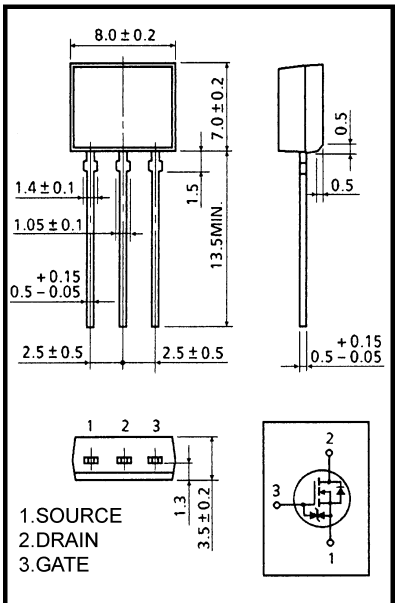
TOSHIBA Field Effect Transistor Silicon N Channel MOS Type ($L^2-\pi-MOSV$)

2SK2200

Chopper Regulator, 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 : $R_{DS (ON)}$ = 0.28 Ω (typ.)
- High forward transfer admittance : $|Y_{fs}|$ = 3.5 S (typ.)
- Low leakage current : I_{DSS} = 100 μA (max) (V_{DS} = 100 V)
- Enhancement mode : V_{th} = 0.8~2.0 V (V_{DS} = 10 V, I_D = 1 mA)

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	3	A
	Pulse (Note 1)	I_{DP}	12	A
Drain power dissipation (Tc = 25°C)		P_D	1.3	W
Single pulse avalanche energy (Note 2)		E_{AS}	140	mJ
Avalanche current		I_{AR}	3	A
Repetitive avalanche energy (Note 3)		E_{AR}	0.13	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	$R_{th (ch-a)}$	96.1	°C / W

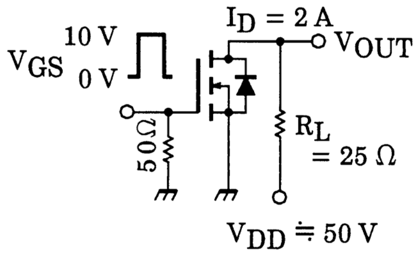
Note 1: Ensure that the channel temperature does not exceed 150°C.

Note 2: V_{DD} = 50 V, T_{ch} = 25°C (initial), L = 25 mH, R_G = 25 Ω, I_{AR} = 3 A

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

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

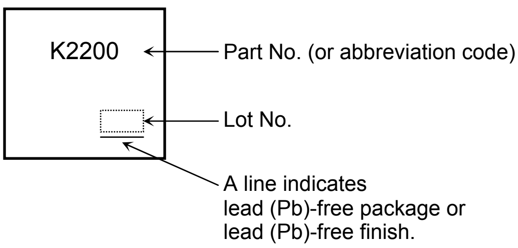
Electrical Characteristics (Ta = 25°C)

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} = 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
Drain−source ON resistance		$R_{DS\ (ON)}$	V_{GS} = 4 V, I_D = 2 A	—	0.36	0.45	mΩ
			V_{GS} = 10 V, I_D = 2 A	—	0.28	0.35	
Forward transfer admittance		$\lvert Y_{fs}\rvert$	V_{DS} = 10 V, I_D = 2 A	1.5	3.5	—	S
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	280	—	pF
Reverse transfer capacitance		C_{rss}		—	50	—	
Output capacitance		C_{oss}		—	105	—	
Switching time	Rise time	t_r		—	20	—	ns
	Turn−on time	t_{on}		—	50	—	
	Fall time	t_f		—	40	—	
	Turn−off time	t_{off}	Duty ≦ 1%, t_w = 10 μs	—	170	—	
Total gate charge (Gate−source plus gate−drain)		Q_g	V_{DD} ≈ 80 V, V_{GS} = 10 V, I_D = 3 A	—	13.5	—	nC
Gate−source charge		Q_{gs}		—	8.5	—	
Gate−drain ("miller") charge		Q_{gd}		—	5	—	

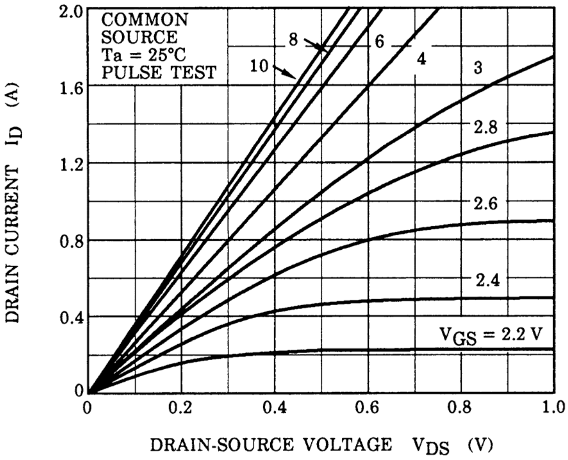
Source−Drain Ratings and Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	I_{DR}	—	—	—	3	A
Pulse drain reverse current (Note 1)	I_{DRP}	—	—	—	12	A
Forward voltage (diode)	V_{DSF}	I_{DR} = 3 A, V_{GS} = 0 V	—	—	−1.5	V
Reverse recovery time	t_{rr}	I_{DR} = 3 A, V_{GS} = 0 V, dI_{DR} / dt = 50 A / μs	—	100	—	ns
Reverse recovered charge	Q_{rr}		—	0.2	—	μC

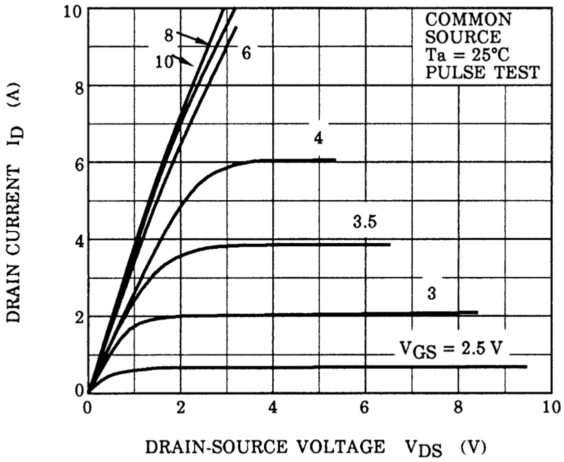
Marking



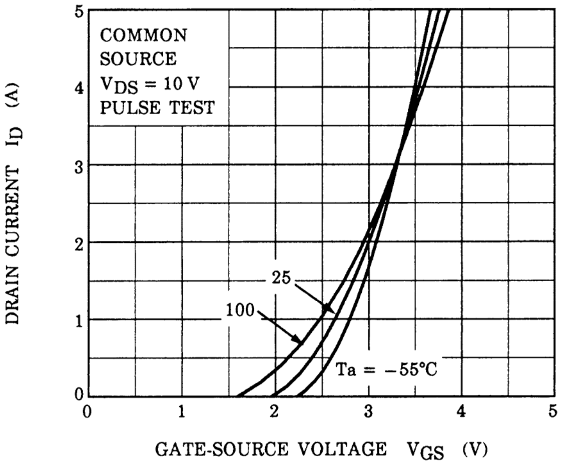
I_D – V_{DS}



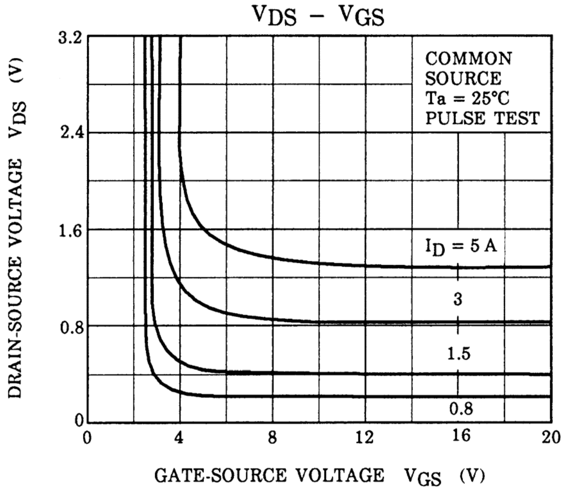
I_D – V_{DS}



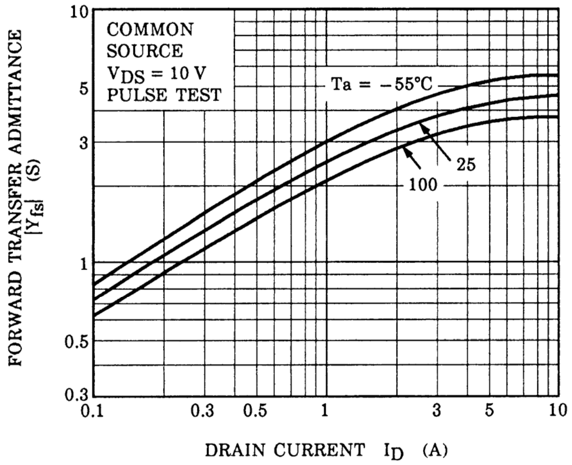
I_D – V_{GS}



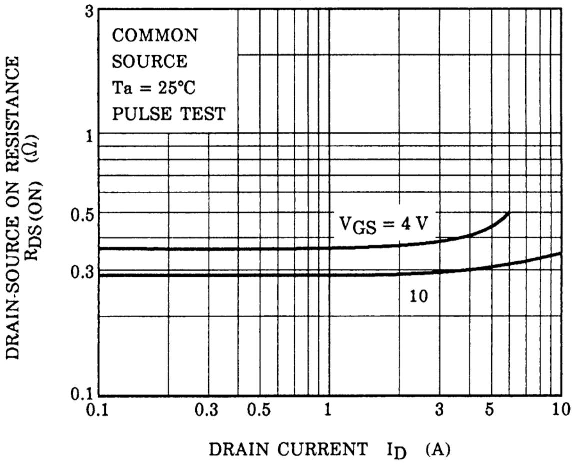
V_{DS} – V_{GS}

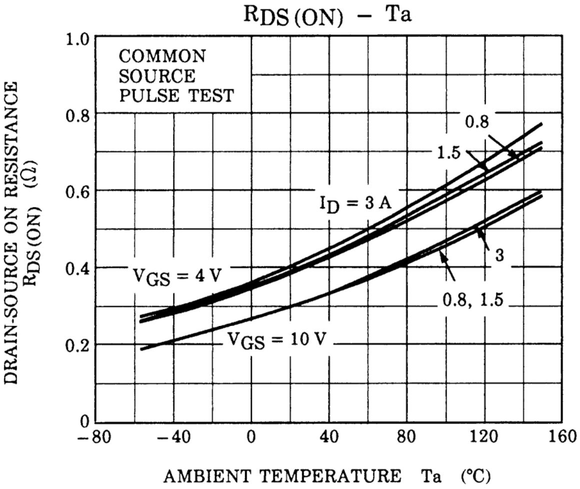


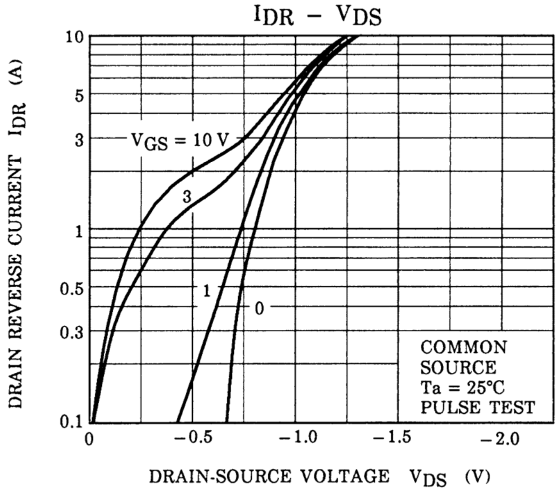
$|Y_{fs}|$ – I_D

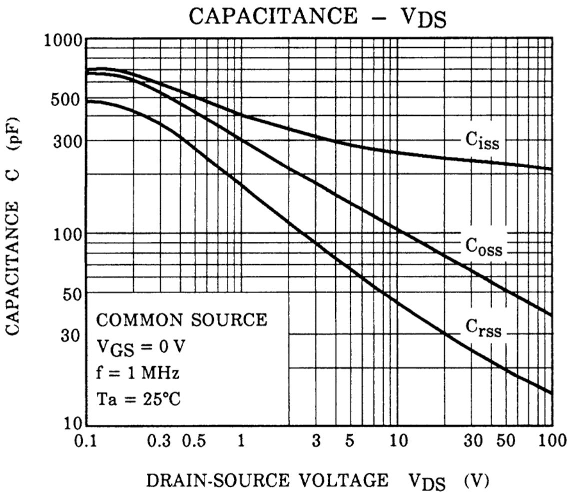


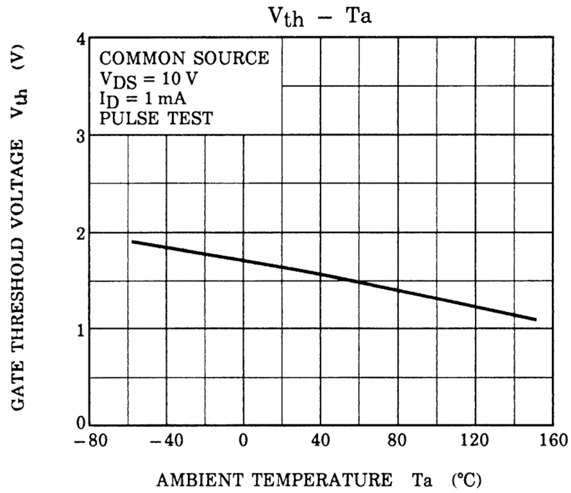
$R_{DS(ON)}$ – I_D

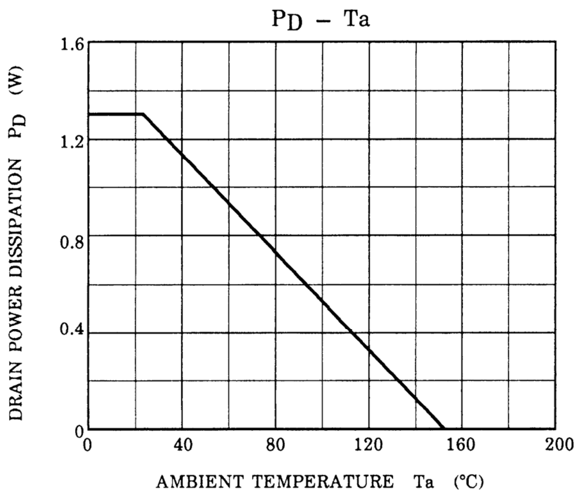


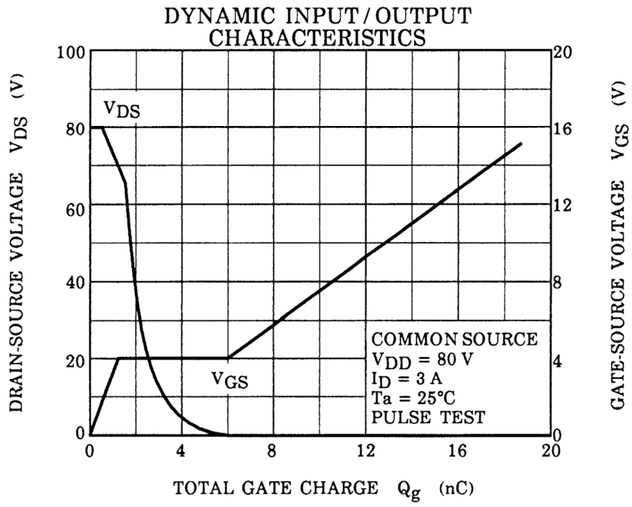

RDS (ON) – Ta
COMMON SOURCE PULSE TEST
ID = 3 A
0.8
1.5
3
0.8, 1.5
VGS = 4 V
VGS = 10 V
DRAIN-SOURCE ON RESISTANCE RDS (ON) (Ω)
AMBIENT TEMPERATURE Ta (°C)

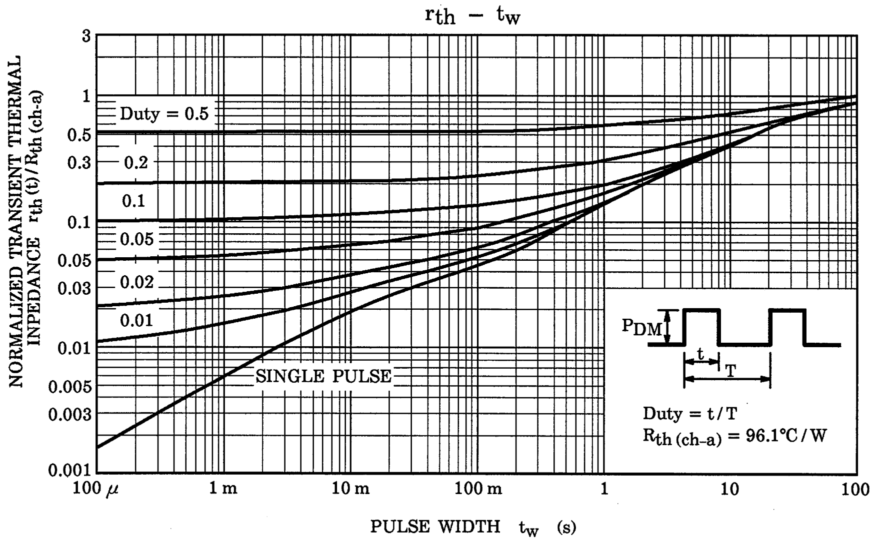

IDR – VDS
VGS = 10 V
3
1
0
COMMON SOURCE Ta = 25°C PULSE TEST
DRAIN REVERSE CURRENT IDR (A)
DRAIN-SOURCE VOLTAGE VDS (V)

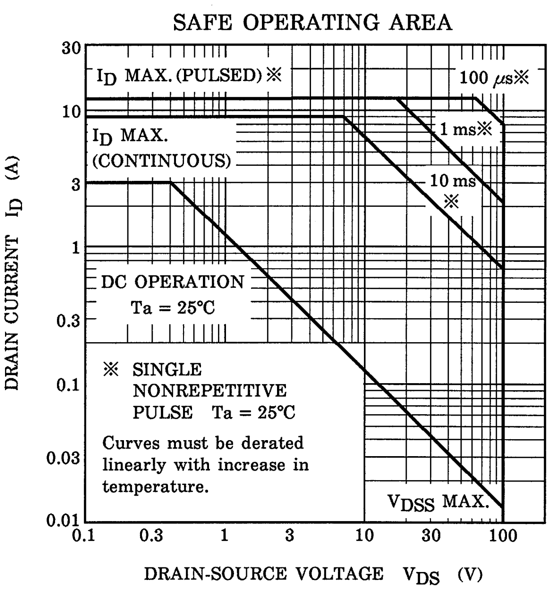

CAPACITANCE – VDS
Ciss
Coss
Crss
COMMON SOURCE VGS = 0 V f = 1 MHz Ta = 25°C
CAPACITANCE C (pF)
DRAIN-SOURCE VOLTAGE VDS (V)

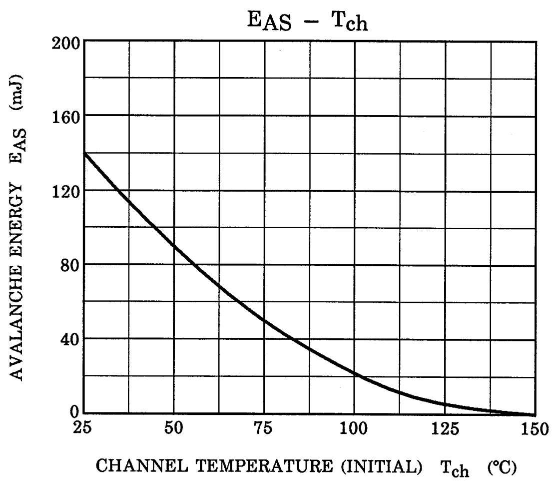

Vth – Ta
COMMON SOURCE VDS = 10 V ID = 1 mA PULSE TEST
GATE THRESHOLD VOLTAGE Vth (V)
AMBIENT TEMPERATURE Ta (°C)

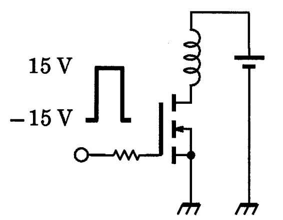

PD – Ta
DRAIN POWER DISSIPATION PD (W)
AMBIENT TEMPERATURE Ta (°C)


DYNAMIC INPUT / OUTPUT CHARACTERISTICS
VDS
VGS
COMMON SOURCE VDD = 80 V ID = 3 A Ta = 25°C PULSE TEST
DRAIN-SOURCE VOLTAGE VDS (V)
GATE-SOURCE VOLTAGE VGS (V)
TOTAL GATE CHARGE Qg (nC)

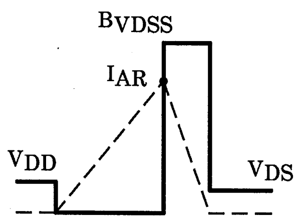








TEST CIRCUIT



WAVE FORM

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

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

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20070701-EN

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