TOSHIBA POWER MOS FET MODULE SILICON N CHANNEL MOS TYPE (L^2-π-MOSⅤ 4 IN 1)

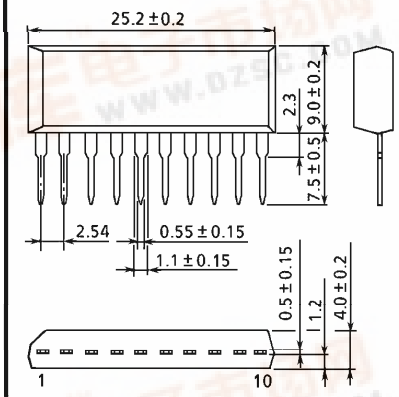
MP4209

HIGH POWER, HIGH SPEED SWITCHING APPLICATIONS
FOR PRINTER HEAD PIN DRIVER AND PULSE MOTOR DRIVER
FOR SOLENOID DRIVER

INDUSTRIAL APPLICATIONS

- 4 V Gate Drive Available
- Small Package by Full Molding (SIP 10 Pin)
- High Drain Power Dissipation (4 Devices Operation)
  : P_T = 4 W (Ta = 25°C)
- 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_{GSS} = ±10 μA (max.) (V_{GS} = ±16 V)
  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)

Unit in mm

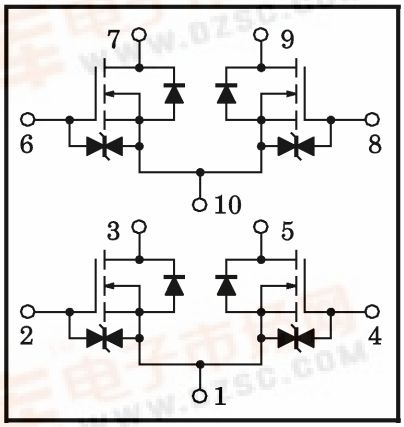


1, 10 SOURCE
2, 4, 6, 8 GATE
3, 5, 7, 9 DRAIN
(PIN 1 AND PIN 10 IS DISCONNECTED INTERNALLY)

JEDEC	—
EIAJ	—
TOSHIBA	2-25A1C

Weight : 2.1 g (typ.)

ARRAY CONFIGURATION



MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		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	I_D	3	A
	Pulse	I_{DP}	12	
Drain Power Dissipation (1 Device Operation, Ta = 25°C)		P_D	2.0	W
Drain Power Dissipation (4 Devices Operation, Ta = 25°C)		P_{DT}	4.0	W
Single Pulse Avalanche Energy*		E_{AS}	140	mJ
Avalanche Current		I_{AR}	3	A
Repetitive Avalanche Energy**	1 Device Operation	E_{AR}	0.2	mJ
	4 Devices Operation	E_{ART}	0.4	
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	−55~150	°C

Note ;
* Avalanche energy (single pulse) applied condition
V_{DD} = 50 V, Starting T_{ch} = 25°C, L = 20 mH, R_G = 25 Ω, I_{AR} = 3 A
** Repetitive rating ; Pulse Width Limited by maximum channel temperature.

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

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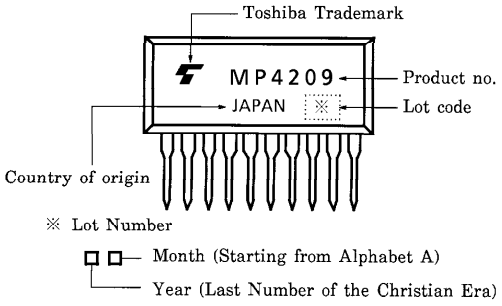
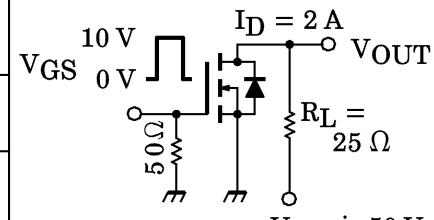
THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance of Channel to Ambient (4 Devices Operation, Ta = 25°C)	$\Sigma R_{th\,(ch\text{-}a)}$	31.2	°C / W
Maximum Lead Temperature for Soldering Purposes (3.2 mm from Case for t = 10 s)	T_L	260	°C

MARKING



ELECTRICAL CHARACTERISTICS (Ta = 25°C)

CHARACTERISTIC		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	Ω
			V_{GS} = 10 V, I_D = 2 A	—	0.28	0.35	
Forward Transfer Admittance		$\|Y_{fs}\|$	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}		—	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 DIODE RATINGS AND CHARACTERISTICS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Drain Reverse Current	I_{DR}	—	—	—	3	A
Pulse Drain Reverse Current	I_{DRP}	—	—	—	12	A
Diode Forward Voltage	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 Recovery Charge	Q_{rr}		—	0.2	—	μC

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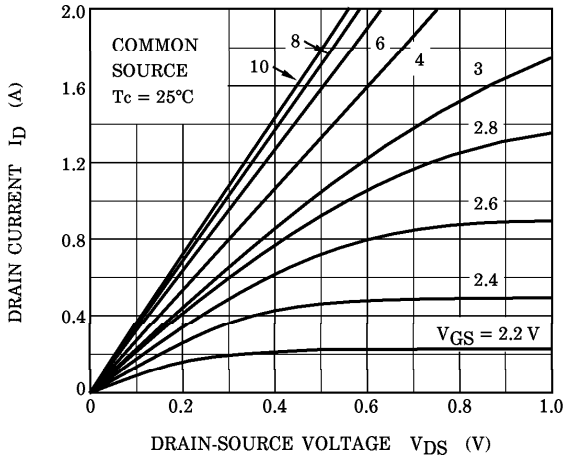
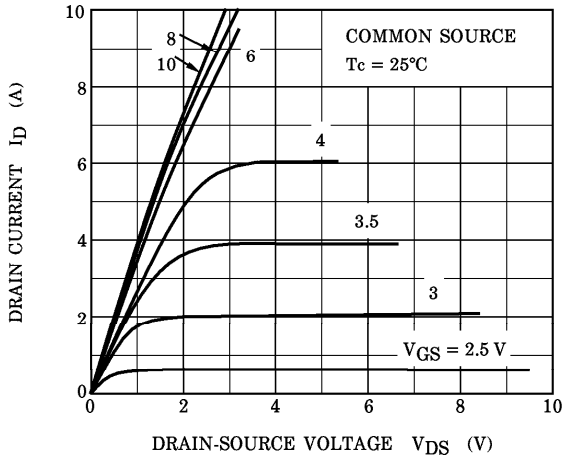
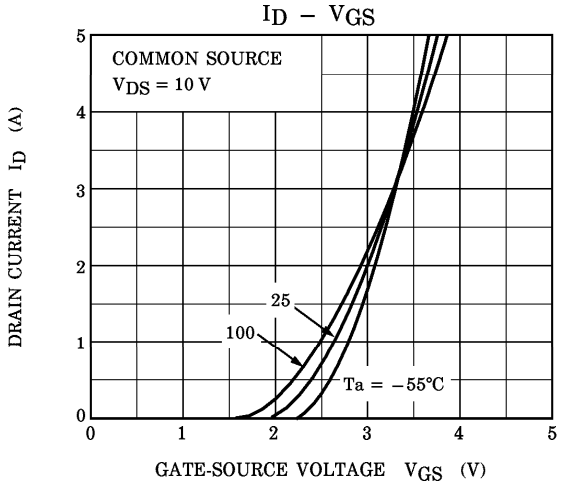
$I_D - V_{DS}$



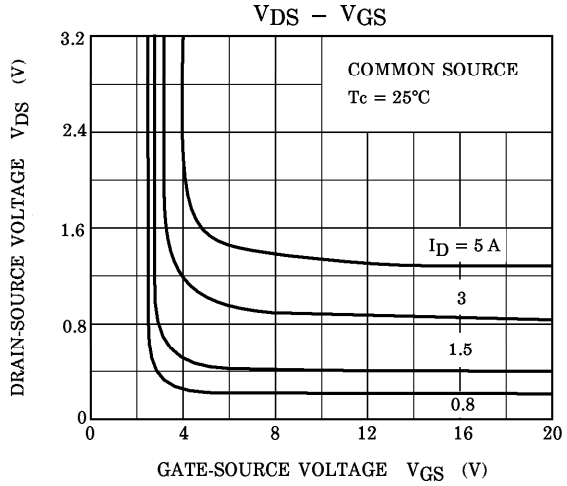
$I_D - V_{DS}$



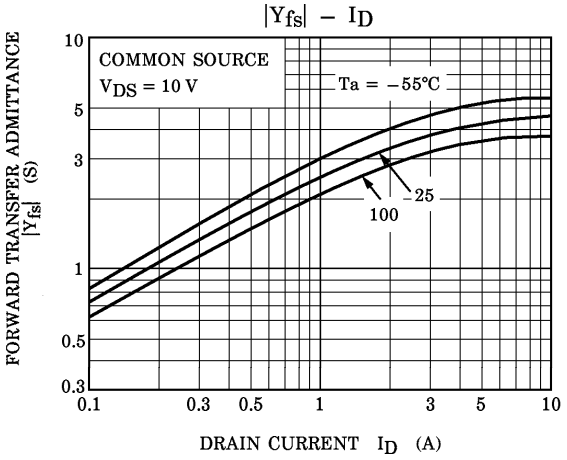
$I_D - V_{GS}$



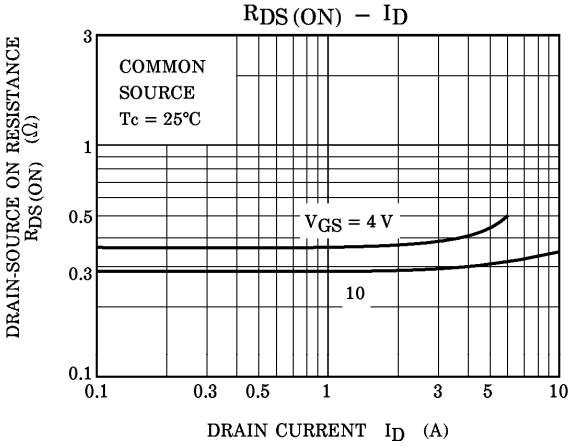
$V_{DS} - V_{GS}$



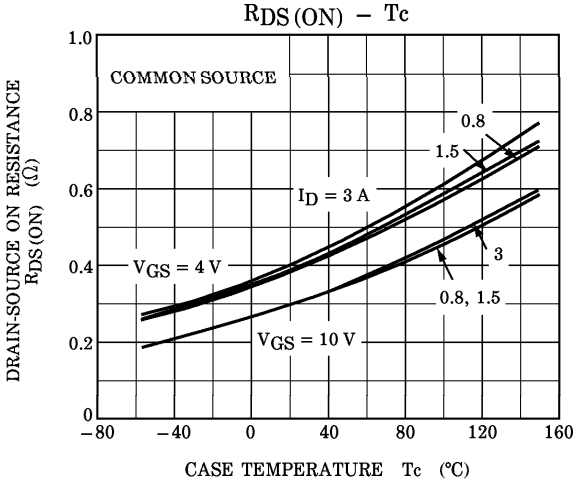
$|Y_{fs}| - I_D$



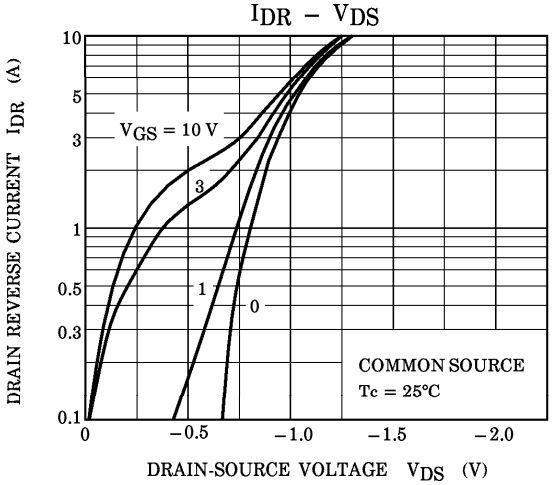
$R_{DS\,(ON)} - I_D$



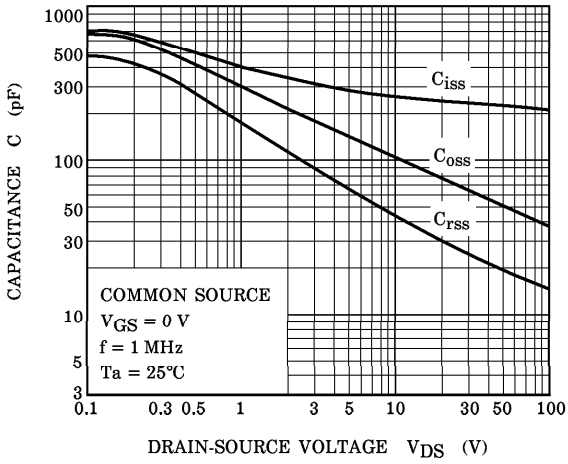
$R_{DS\,(ON)}$ – Tc



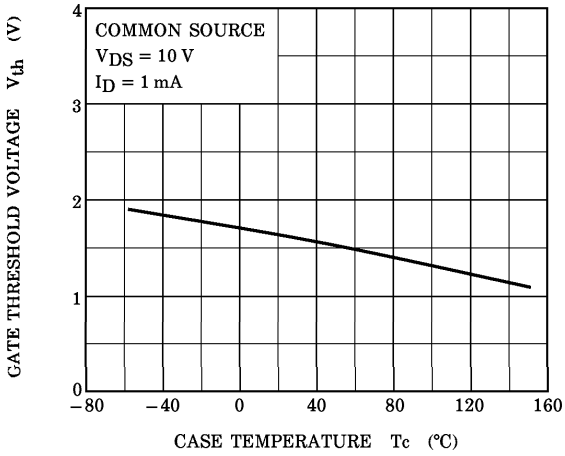
I_{DR} – V_{DS}



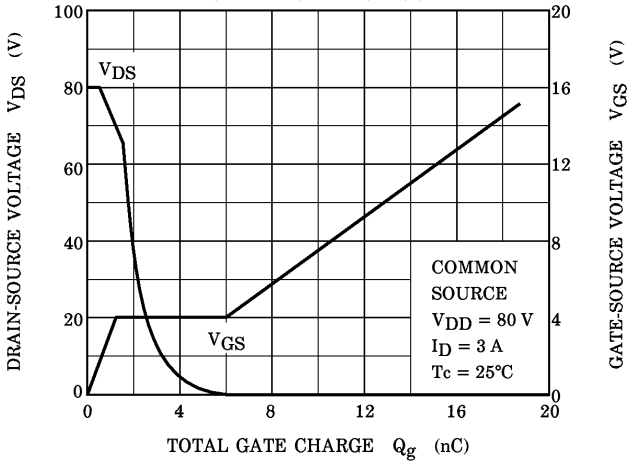
CAPACITANCE – V_{DS}



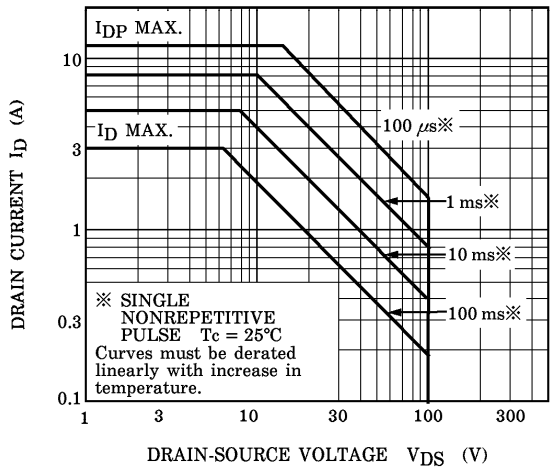
V_{th} – Tc



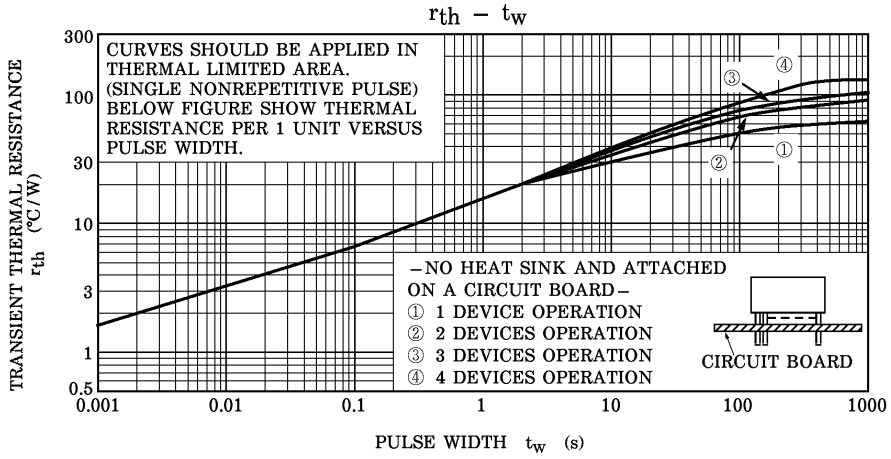
DYNAMIC INPUT / OUTPUT CHARACTERISTICS



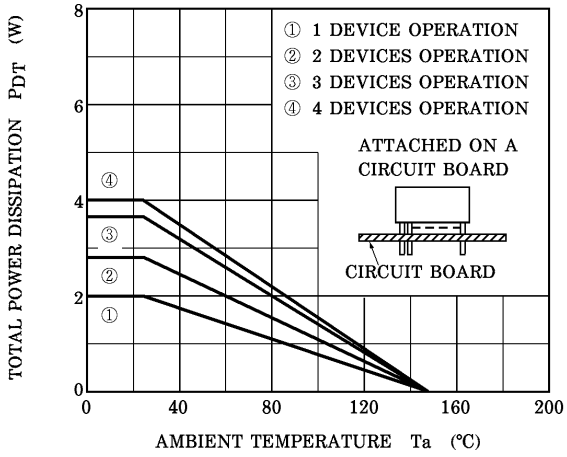
SAFE OPERATING AREA



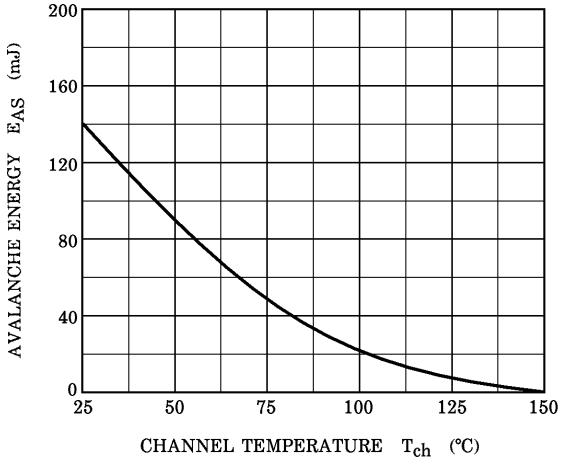
$r_{th} - t_w$



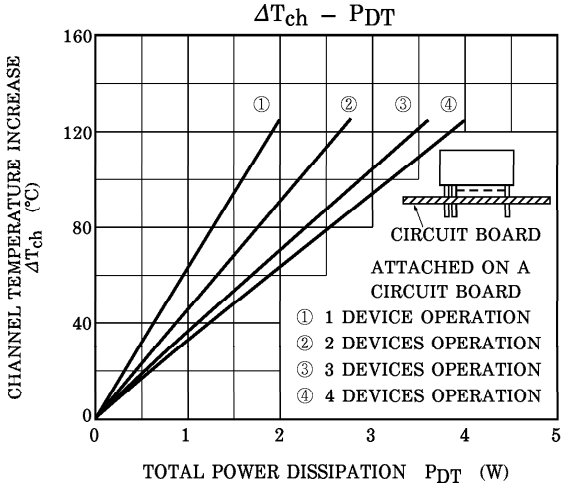
$P_{DT} - Ta$

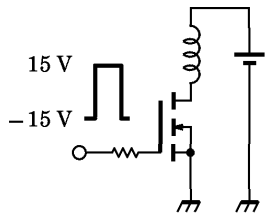


$E_{AS} - T_{ch}$

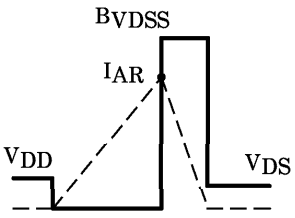


$\Delta T_{ch} - P_{DT}$





TEST CIRCUIT



TEST WAVE FORM

Peak $I_{AR} = 3$ A, $R_G = 25\Omega$
$V_{DD} = 50$ V, L = 20 mH

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