

TOSHIBA Power MOS FET Module Silicon N Channel MOS Type (L²-π-MOSV 4 in 1)

MP4412

High Power, High Speed Switching Applications
 For Printer Head Pin Driver and Pulse Motor Driver
 For Solenoid Driver

- 4 V gate drive available
- Small package by full molding (SIP 12 pin)
- High drain power dissipation (4 devices operation)
 : P_T = 28 W (T_c = 25°C)
- Low drain-source ON resistance: R_{DS (ON)} = 0.17 Ω (typ.)
- High forward transfer admittance: |Y_{fs}| = 4.5 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 to 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}	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	5	A
	Pulse	I _{DP}	20	
Drain power dissipation (1 device operation, Ta = 25°C)		P _D	2.2	W
Drain power dissipation (4 devices operation)	Ta = 25°C	P _{DT}	4.4	W
	Tc = 25°C		28	
Single Pulse avalanche energy (Note 1)		E _{AS}	180	mJ
Avalanche current		I _{AR}	5	A
Repetitive avalanche energy (Note 2)	1 device operation	E _{AR}	0.22	mJ
	4 device operation	E _{ART}	0.44	
Channel temperature		T _{ch}	150	°C
Storage temperature range		T _{stg}	-55 to 150	°C

Note 1: Avalanche energy (single pulse) applied condition

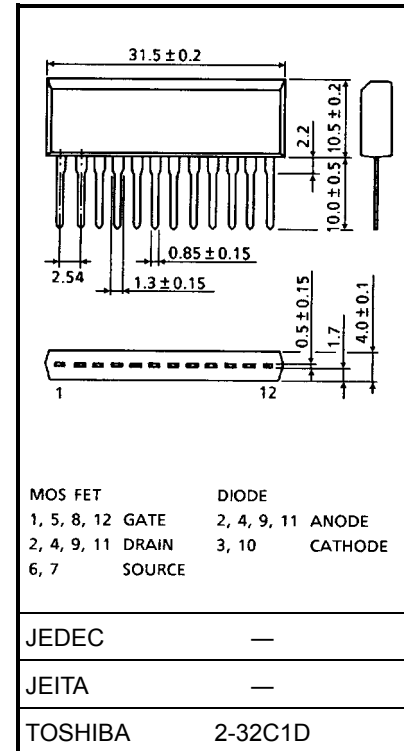
$$V_{DD} = 25 \text{ V, starting } T_{ch} = 25^\circ\text{C, } L = 11.6 \text{ mH, } R_G = 25 \Omega, I_{AR} = 5 \text{ A}$$

Note 2: Repetitive rating; pulse width limited by maximum channel temperature.

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

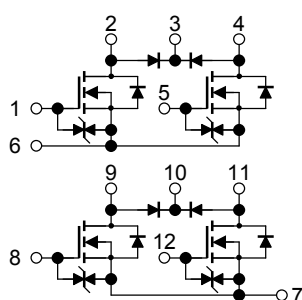
Industrial Applications

Unit: mm



Weight: 3.9 g (typ.)

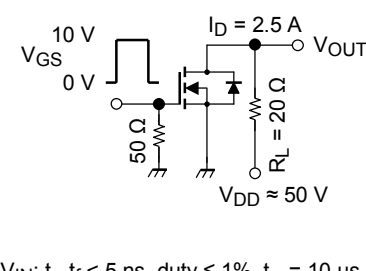
Array Configuration



Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance of channel to ambient (4 devices operation, $T_a = 25^\circ\text{C}$)	$\Sigma R_{\text{th (ch-a)}}$	28.4	$^\circ\text{C/W}$
Thermal resistance of channel to case (4 devices operation, $T_c = 25^\circ\text{C}$)	$\Sigma R_{\text{th (ch-c)}}$	4.46	$^\circ\text{C/W}$
Maximum lead temperature for soldering purposes (3.2 mm from case for $t = 10$ s)	T_L	260	$^\circ\text{C}$

Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	± 10	μA
Drain cut-off current		I_{DSS}	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$	—	—	100	μA
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	100	—	—	V
Gate threshold voltage		V_{th}	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	0.8	—	2.0	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = 4\text{ V}, I_D = 2.5\text{ A}$	—	0.22	0.30	Ω
			$V_{GS} = 10\text{ V}, I_D = 2.5\text{ A}$	—	0.17	0.23	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 2.5\text{ A}$	2.0	4.5	—	S
Input capacitance		C_{iss}	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}$ $f = 1\text{ MHz}$	—	500	—	μF
Reverse transfer capacitance		C_{rss}		—	80	—	μF
Output capacitance		C_{oss}		—	190	—	μF
Switching time	Rise time	t_r		—	17	—	μs
	Turn-on time	t_{on}		—	25	—	
	Fall time	t_f		—	50	—	
	Turn-off time	t_{off}		—	195	—	
Total gate charge (gate-source plus gate-drain)		Q_g	$V_{DD} \approx 80\text{ V}, V_{GS} = 10\text{ V}$	—	22	—	nC
Gate-source charge		Q_{gs}	$I_D = 5\text{ A}$	—	15	—	nC
Gate-drain ("miller") charge		Q_{gd}		—	7	—	nC

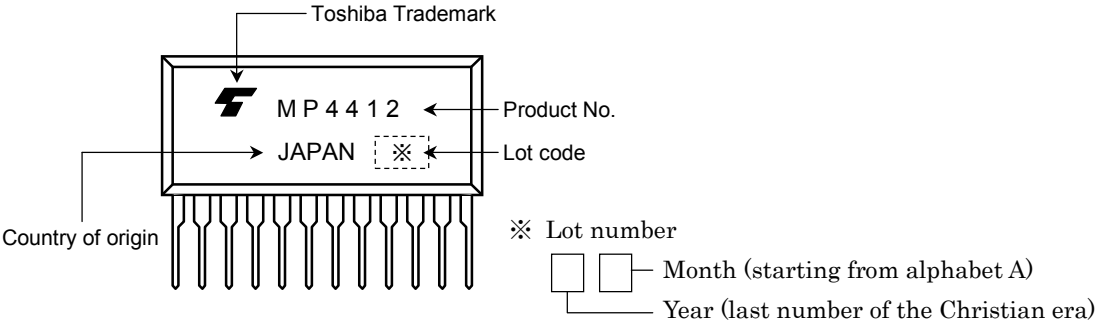
Source-Drain Diode Ratings and Characteristics (Ta = 25°C)

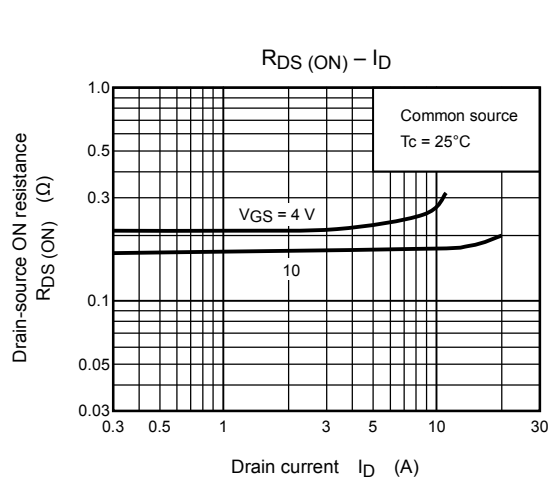
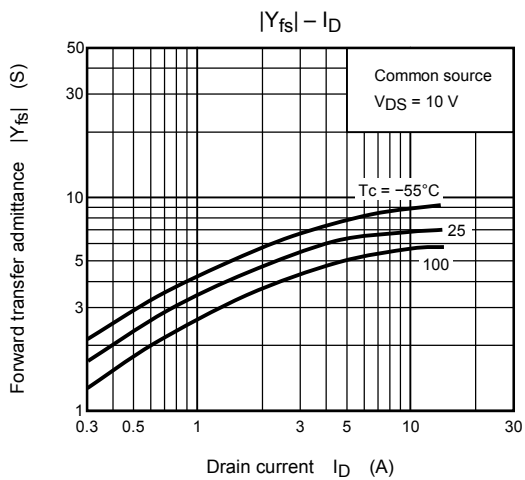
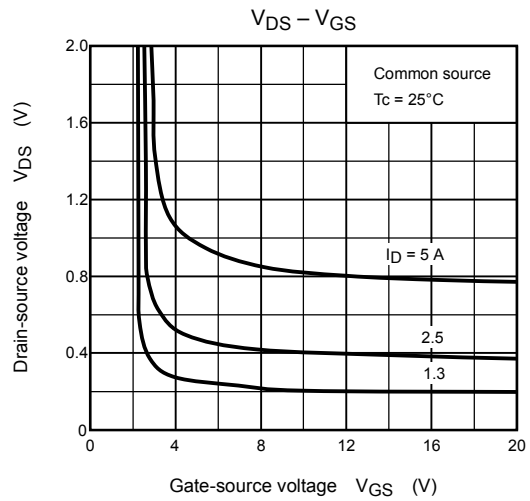
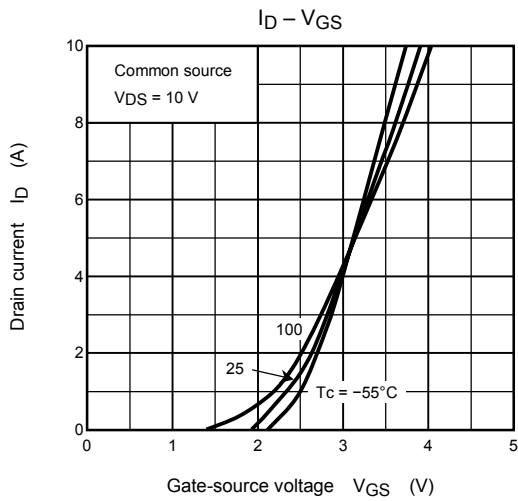
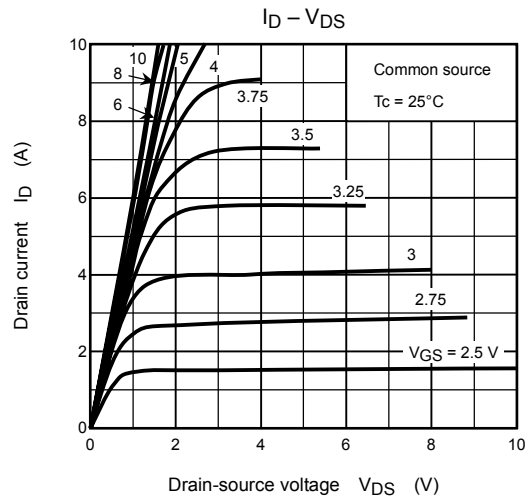
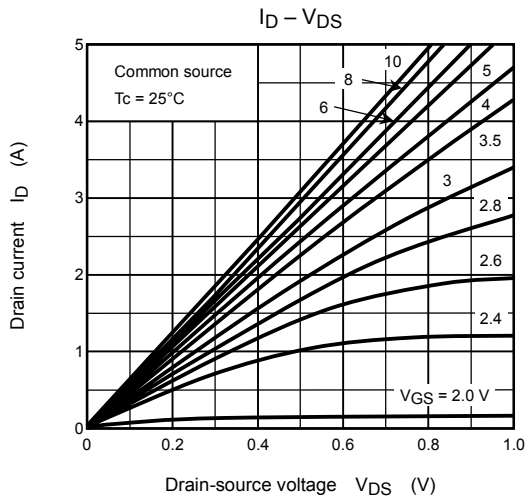
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current	I_{DR}	—	—	—	5	A
Pulse drain reverse current	I_{DRP}	—	—	—	20	A
Diode forward voltage	V_{DSF}	$I_{DR} = 5\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.7	V
Reverse recovery time	t_{rr}	$I_{DR} = 5\text{ A}, V_{GS} = 0\text{ V}$	—	160	—	ns
Reverse recovery charge	Q_{rr}	$di_{DR}/dt = 50\text{ A}/\mu\text{s}$	—	0.28	—	μC

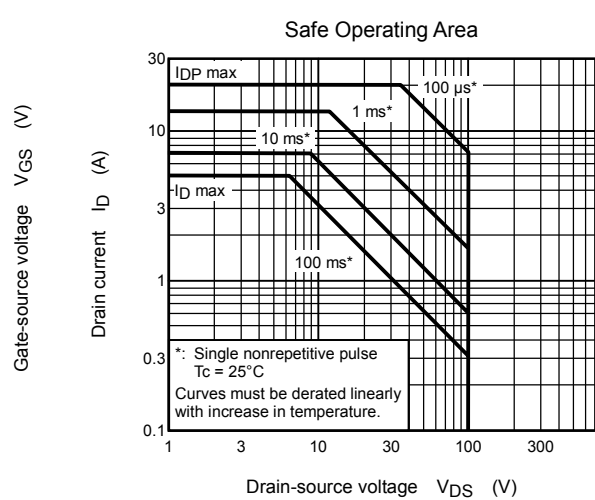
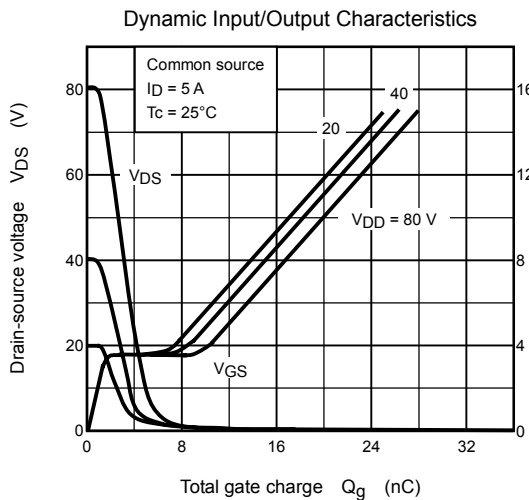
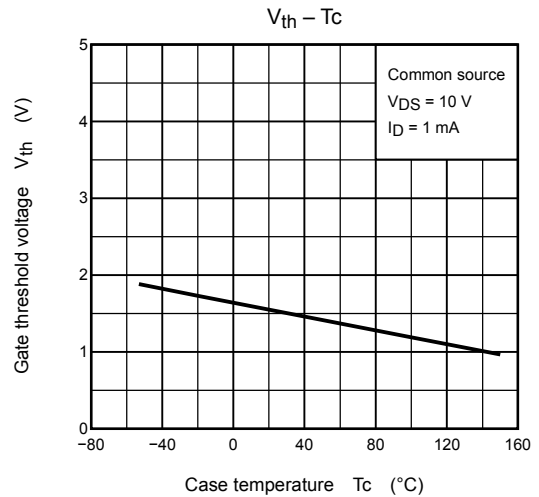
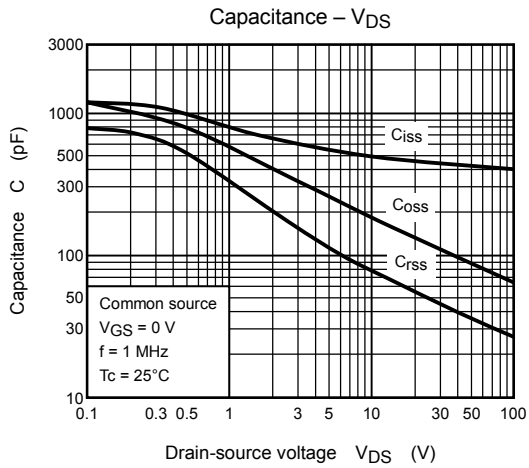
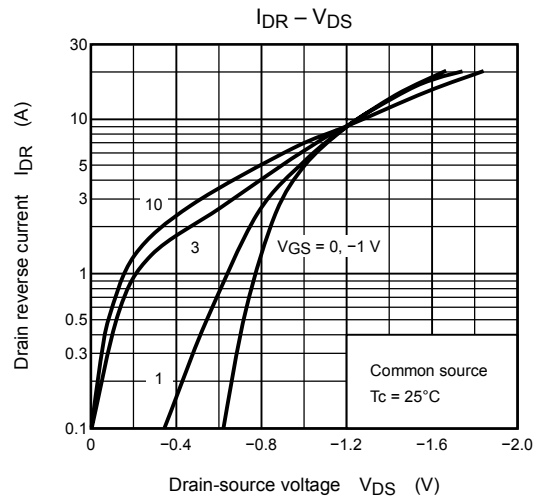
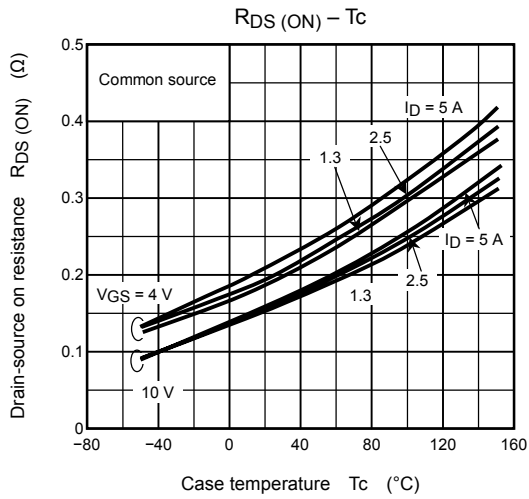
Flyback-Diode Rating and Characteristics (Ta = 25°C)

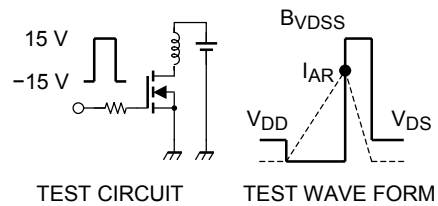
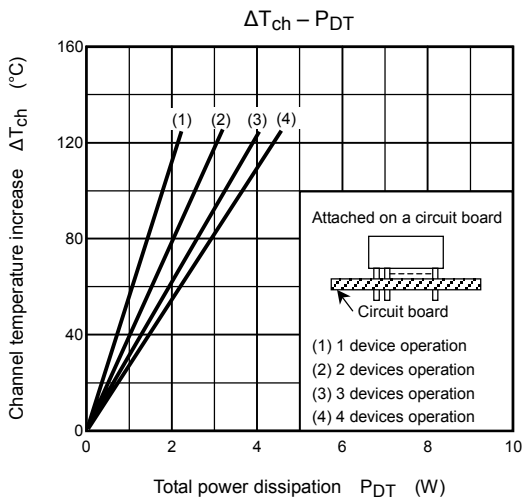
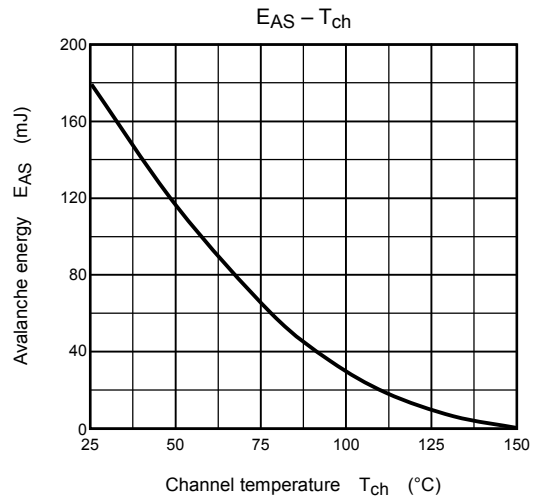
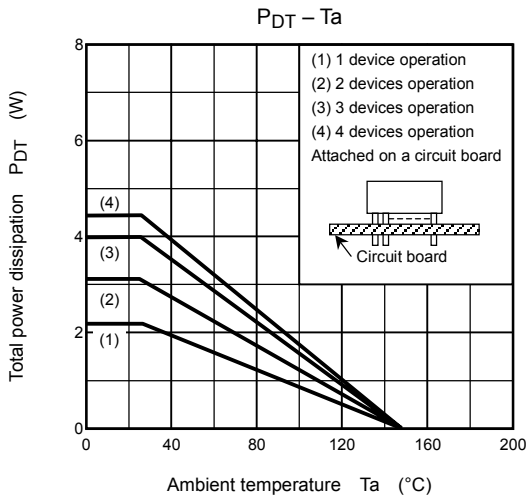
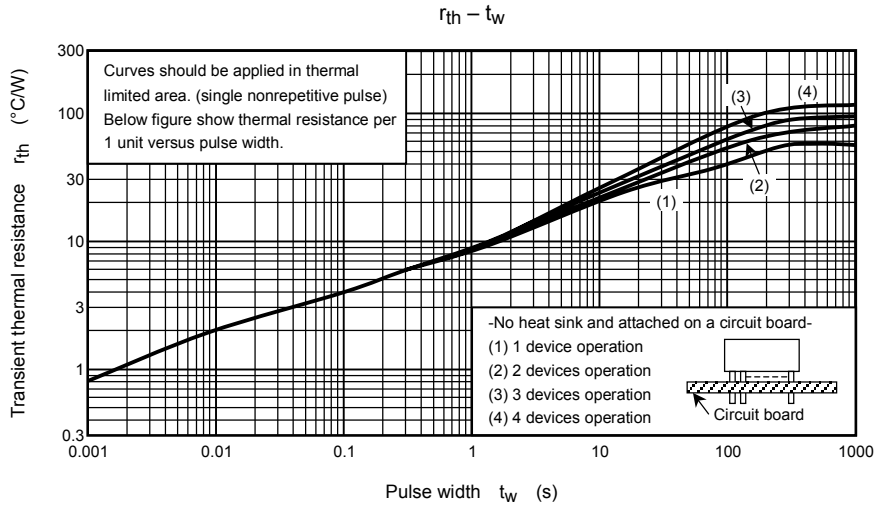
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Forward current	I_{FM}	—	—	—	5	A
Reverse current	I_R	$V_R = 100\text{ V}$	—	—	0.4	μA
Reverse voltage	V_R	$I_R = 100\text{ }\mu\text{A}$	100	—	—	V
Forward voltage	V_F	$I_F = 2\text{ A}$	—	—	2.3	V

Marking









Peak $I_{AR} = 5 \text{ A}$, $R_G = 25 \Omega$
 $V_{DD} = 25 \text{ V}$, $L = 11.6 \text{ mH}$

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

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