

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

MP4411

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

- 4-V gate drivability
- Small package by full molding (SIP 12 pin)
- High drain power dissipation (4-device operation)
 : P_T = 28 W (T_c = 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 to 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	I _D	3	A
	Pulse	I _{DP}	12	
Drain power dissipation (1-device operation, Ta = 25°C)		P _D	2.2	W
Drain power dissipation (4-device operation)	Ta = 25°C	P _{DT}	4.4	W
	Tc = 25°C		28	
Single pulse avalanche energy (Note 1)		E _{AS}	140	mJ
Avalanche current		I _{AR}	3	A
Repetitive avalanche energy (Note 2)	1 device operation	E _{AR}	0.22	mJ
	4 devices operation	E _{ART}	0.44	
Channel temperature		T _{ch}	150	°C
Storage temperature range		T _{stg}	-55 to 150	°C

Note 1: Condition for avalanche energy (single pulse) measurement
 V_{DD} = 50 V, starting T_{ch} = 25°C, L = 20 mH, R_G = 25 Ω, I_{AR} = 3 A

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

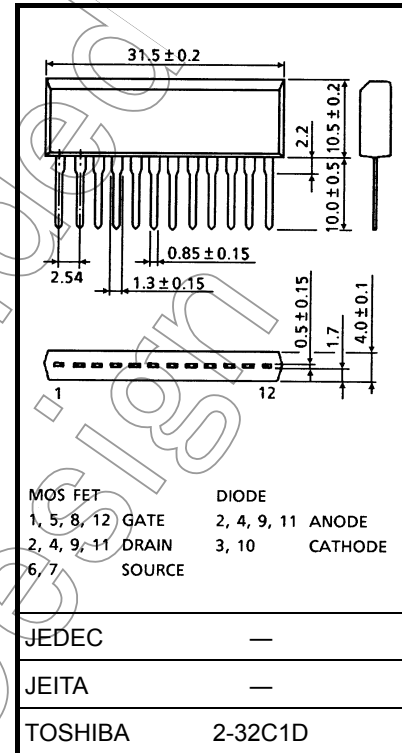
Note 3: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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).

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

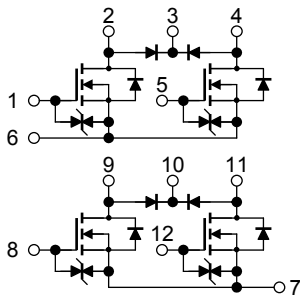
Industrial Applications

Unit: mm



Weight: 3.9 g (typ.)

Array Configuration



Thermal Characteristics

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

Electrical Characteristics ($T_a = 25^\circ\text{C}$)

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		$R_{DS(ON)}$	$V_{GS} = 4\text{ V}, I_D = 2\text{ A}$	—	0.36	0.45	Ω
			$V_{GS} = 10\text{ V}, I_D = 2\text{ A}$	—	0.28	0.35	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 2\text{ A}$	1.5	3.5	—	S
Input capacitance		C_{iss}	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	280	—	μF
Reverse transfer capacitance		C_{rss}		—	50	—	μF
Output capacitance		C_{oss}		—	105	—	μF
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	$V_{DD} \approx 80\text{ V}, V_{GS} = 10\text{ V}, I_D = 3\text{ A}$	—	13.5	—	nC
Gate-source charge		Q_{gs}		—	8.5	—	nC
Gate-drain ("miller") charge		Q_{gd}		—	5	—	nC

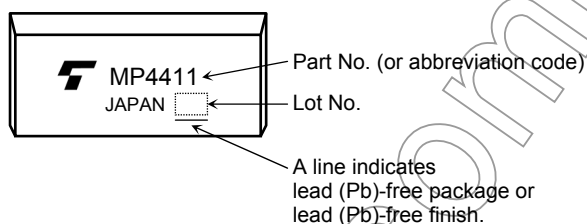
Source-Drain Diode Ratings and Characteristics (Ta = 25°C)

Characteristics	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}	$I_{DR} = 3\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.5	V
Reverse recovery time	t_{rr}	$I_{DR} = 3\text{ A}, V_{GS} = 0\text{ V},$ $dI_{DR}/dt = 50\text{ A}/\mu\text{s}$	—	100	—	ns
Reverse recovery charge	Q_{rr}		—	0.2	—	μC

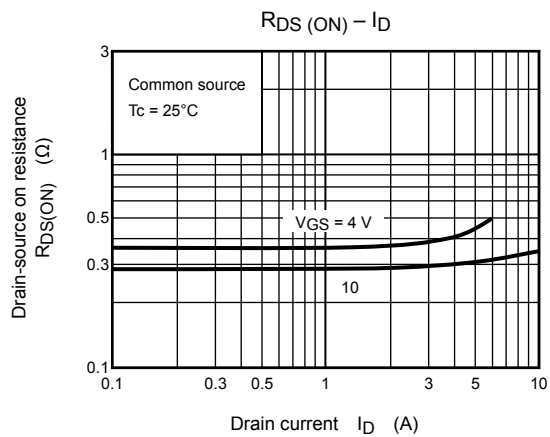
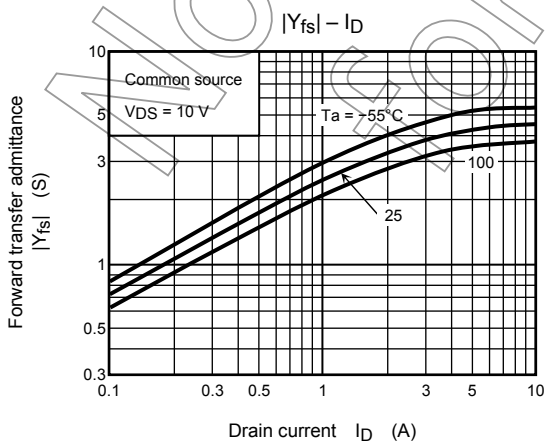
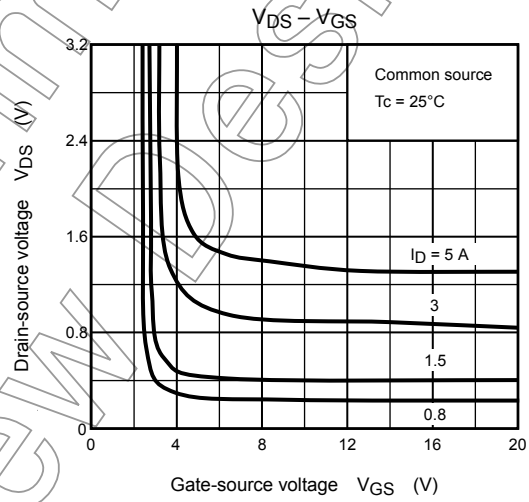
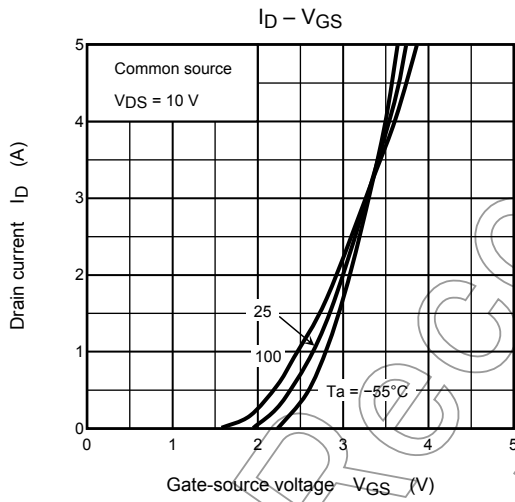
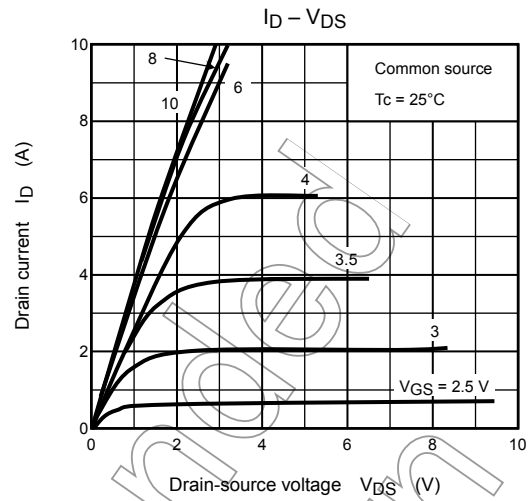
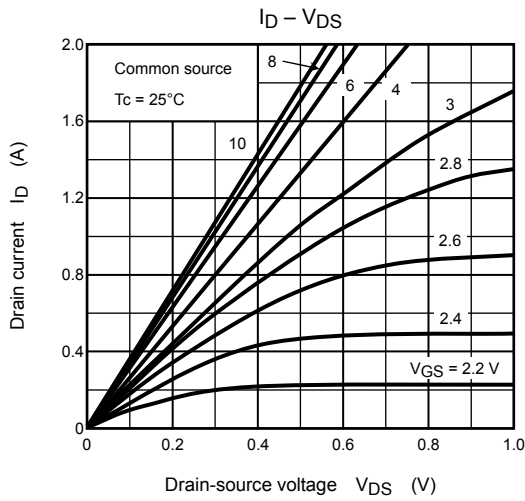
Flyback-Diode Rating and Characteristics (Ta = 25°C)

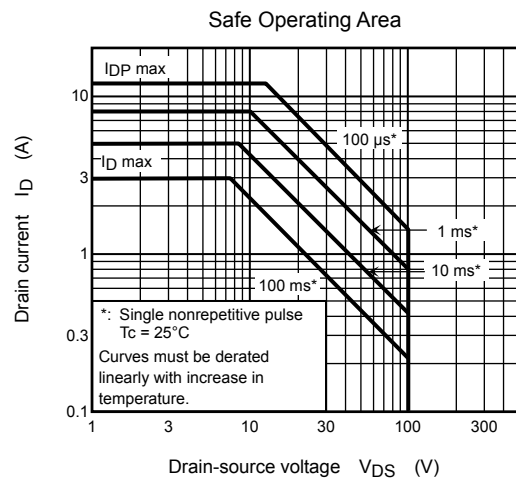
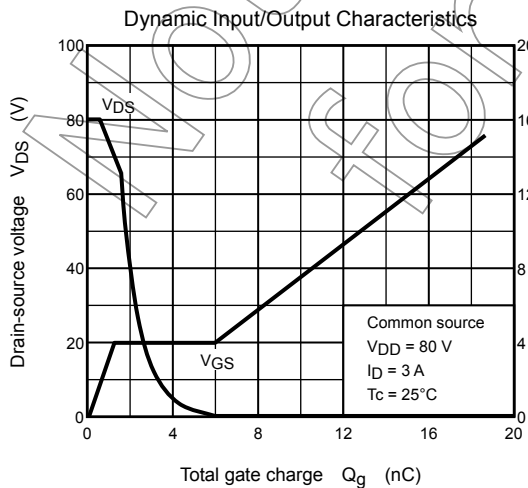
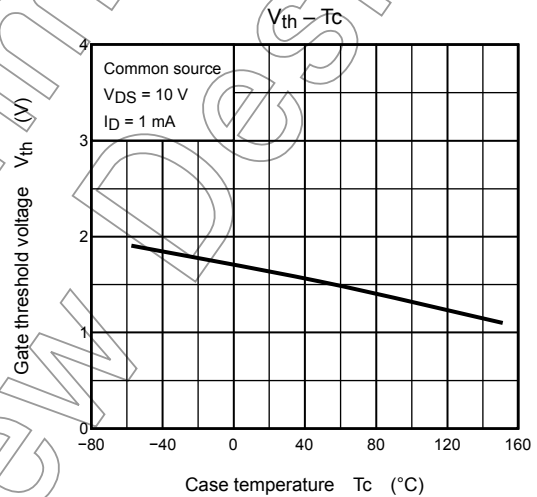
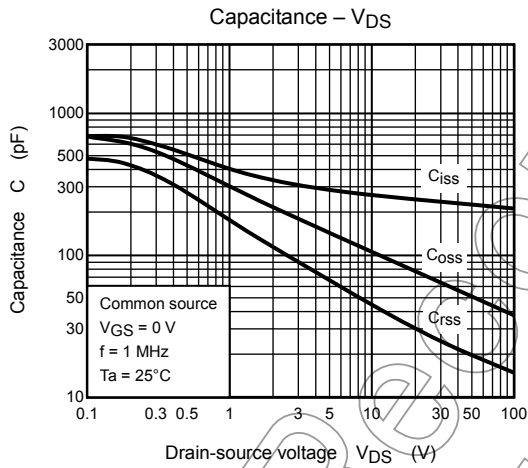
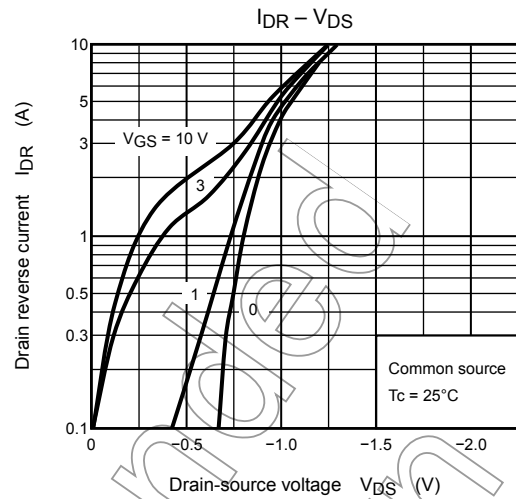
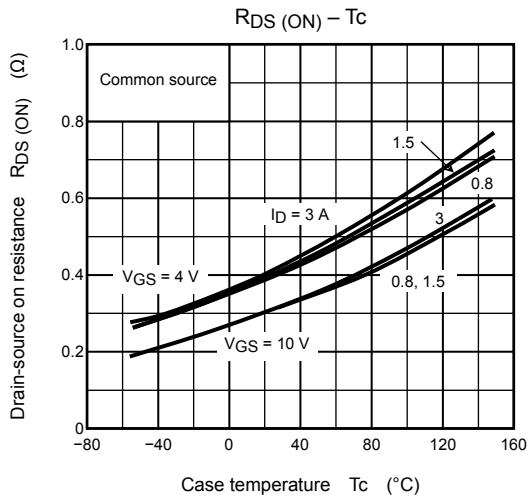
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Forward current	I_{FM}	—	—	—	3	A
Reverse current	I_R	$V_R = 100\text{ V}$	—	—	0.4	μA
Reverse voltage	V_R	$I_R = 100\text{ }\mu\text{A}$	100	—	—	V
Forward voltage	V_F	$I_F = 0.5\text{ A}$	—	—	1.8	V

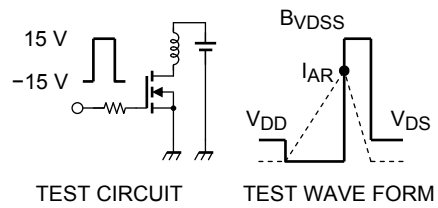
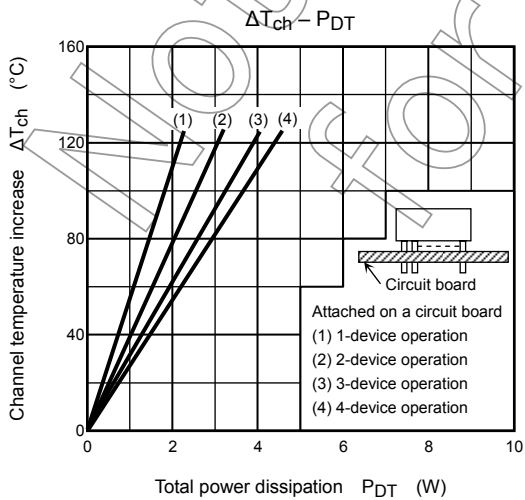
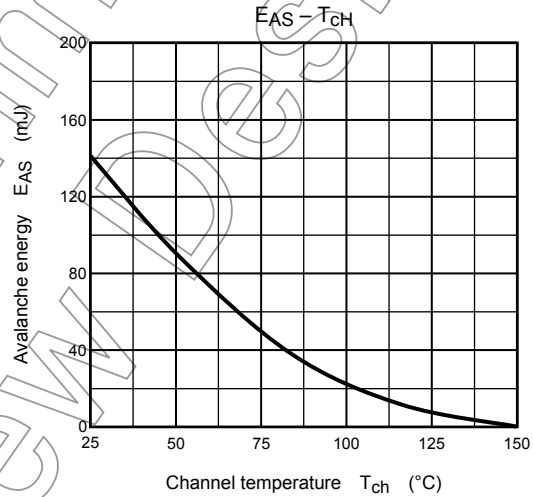
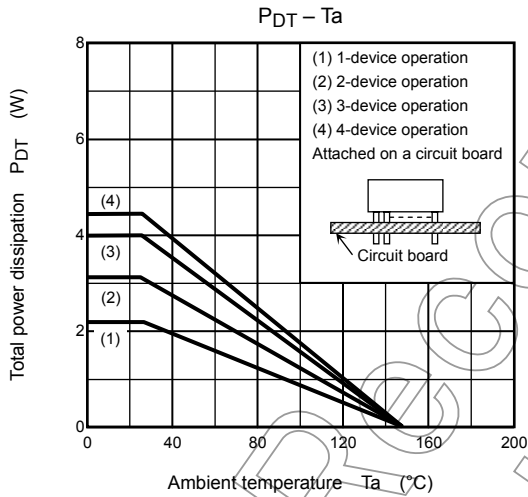
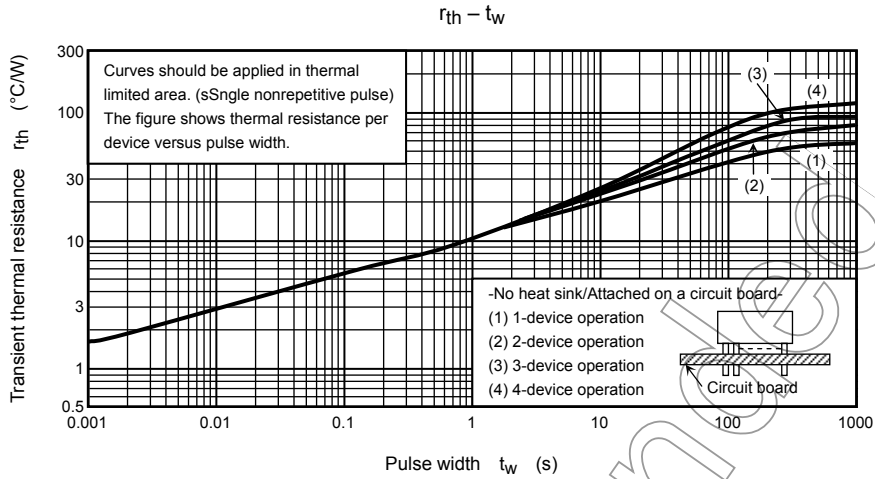
Marking



Not Recommended for New Designs







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

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

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