

TOSHIBA Power MOS FET Module Silicon N Channel MOS Type (L<sup>2</sup>-π-MOSV 4 in 1)

## MP4411

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<sub>T</sub> = 28 W (T<sub>c</sub> = 25°C)
- Low drain-source ON resistance: R<sub>DS (ON)</sub> = 0.28 Ω (typ.)
- High forward transfer admittance: |Y<sub>fs</sub>| = 3.5 S (typ.)
- Low leakage current: I<sub>GSS</sub> = ±10 μA (max) (V<sub>GS</sub> = ±16 V)  
 I<sub>DSS</sub> = 100 μA (max) (V<sub>DS</sub> = 100 V)
- Enhancement-mode: V<sub>th</sub> = 0.8 to 2.0 V (V<sub>DS</sub> = 10 V, I<sub>D</sub> = 1 mA)

### Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V <sub>DSS</sub>	100	V
Drain-gate voltage (R <sub>GS</sub> = 20 kΩ)		V <sub>DGR</sub>	100	V
Gate-source voltage		V <sub>GSS</sub>	±20	V
Drain current	DC	I <sub>D</sub>	3	A
	Pulse	I <sub>DP</sub>	12	
Drain power dissipation (1 device operation, Ta = 25°C)		P <sub>D</sub>	2.2	W
Drain power dissipation (4 devices operation)	Ta = 25°C	P <sub>DT</sub>	4.4	W
	Tc = 25°C		28	
Single pulse avalanche energy (Note 1)		E <sub>AS</sub>	140	mJ
Avalanche current		I <sub>AR</sub>	3	A
Repetitive avalanche energy (Note 2)	1 device operation	E <sub>AR</sub>	0.22	mJ
	4 devices operation	E <sub>ART</sub>	0.44	
Channel temperature		T <sub>ch</sub>	150	°C
Storage temperature range		T <sub>stg</sub>	-55 to 150	°C

Note 1: Avalanche energy (single pulse) applied condition

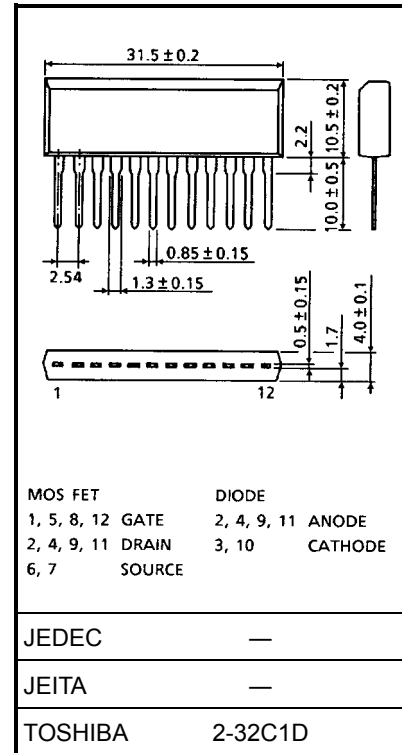
$$V_{DD} = 50 \text{ V, starting } T_{ch} = 25^\circ\text{C, } L = 20 \text{ mH, } R_G = 25 \text{ } \Omega, I_{AR} = 3 \text{ A}$$

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

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

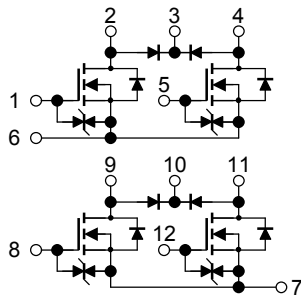
Industrial Applications

Unit: mm



Weight: 3.9 g (typ.)

## Array Configuration



## Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance of channel to ambient (4 devices operation, $T_a = 25^\circ\text{C}$ )	$\Sigma R_{th}(\text{ch-a})$	28.4	$^\circ\text{C/W}$
Thermal resistance of channel to case (4 devices operation, $T_c = 25^\circ\text{C}$ )	$\Sigma R_{th}(\text{ch-c})$	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		$I_{GSS}$	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cut-off current		$I_{DSS}$	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$	—	—	100	$\mu\text{A}$
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	$\Omega$
			$V_{GS} = 10\text{ V}, I_D = 2\text{ A}$	—	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	—	pF
Reverse transfer capacitance		$C_{rss}$		—	50	—	pF
Output capacitance		$C_{oss}$		—	105	—	pF
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

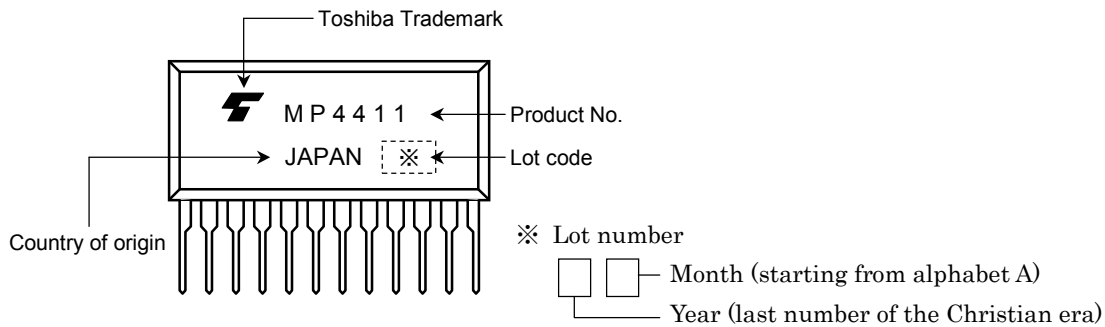
## Source-Drain Diode Ratings and Characteristics (Ta = 25°C)

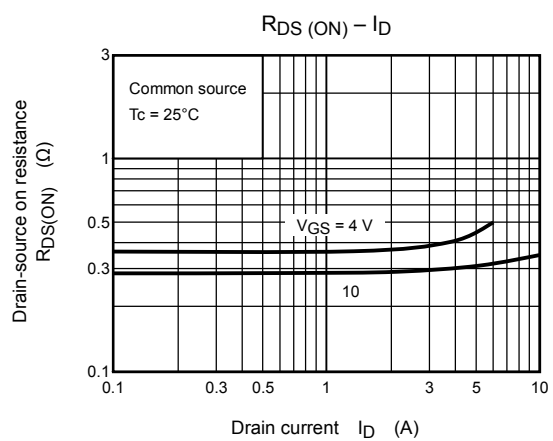
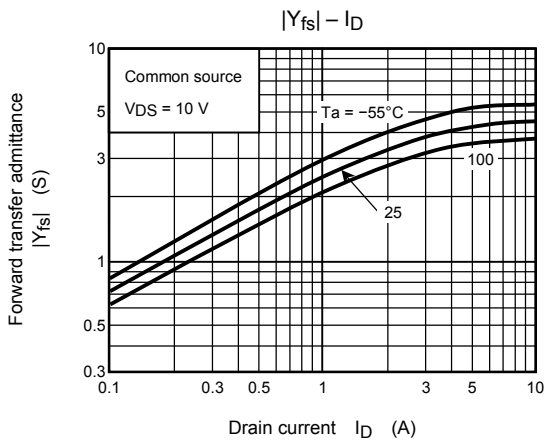
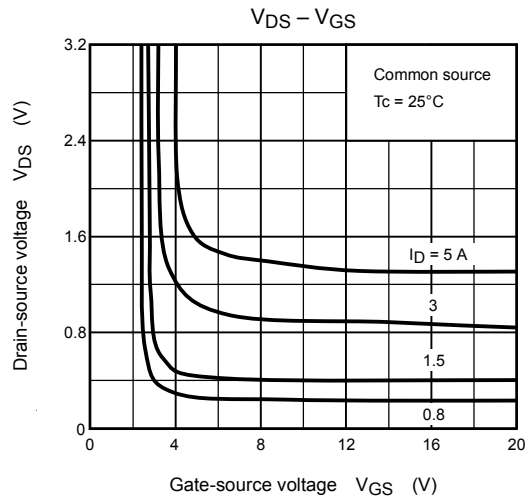
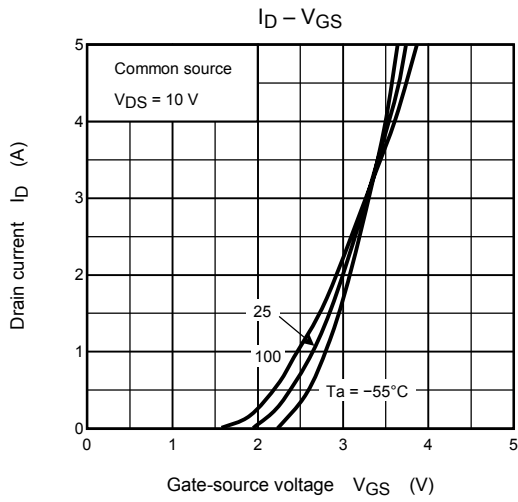
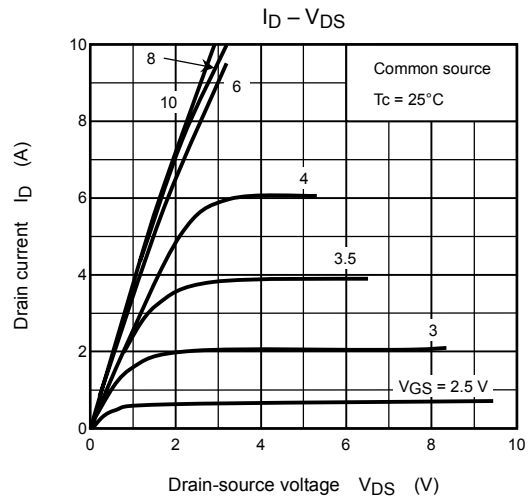
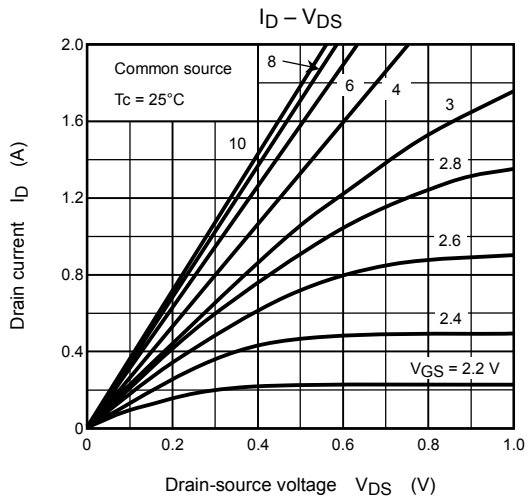
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current	$I_{DR}$	—	—	—	3	A
Pulse drain reverse current	$I_{DRP}$	—	—	—	12	A
Diode forward voltage	$V_{DSF}$	$I_{DR} = 3\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.5	V
Reverse recovery time	$t_{rr}$	$I_{DR} = 3\text{ A}, V_{GS} = 0\text{ V},$ $dI_{DR}/dt = 50\text{ A}/\mu\text{s}$	—	100	—	ns
Reverse recovery charge	$Q_{rr}$		—	0.2	—	$\mu\text{C}$

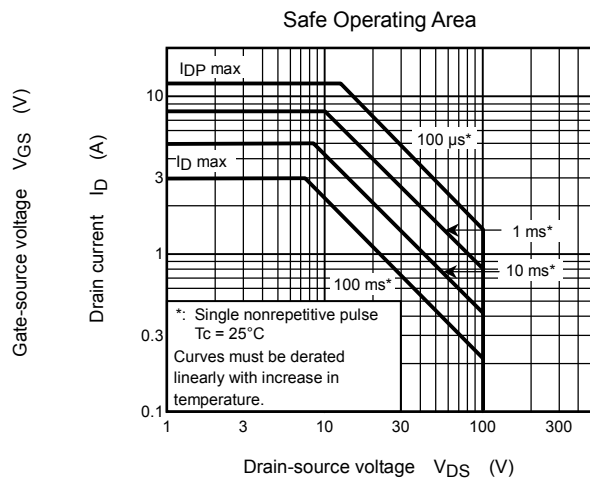
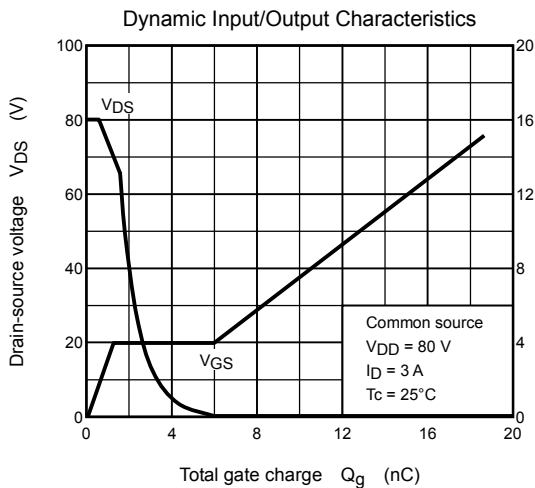
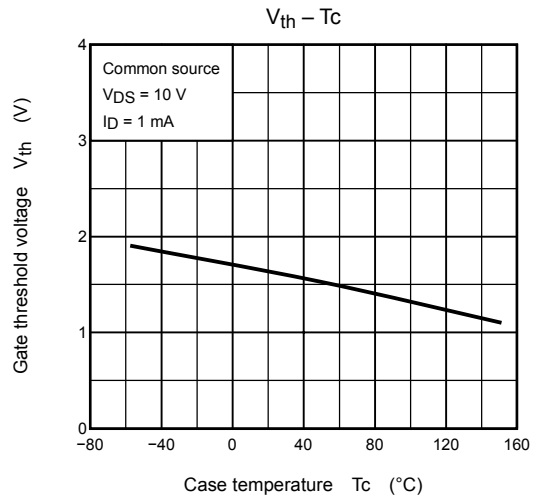
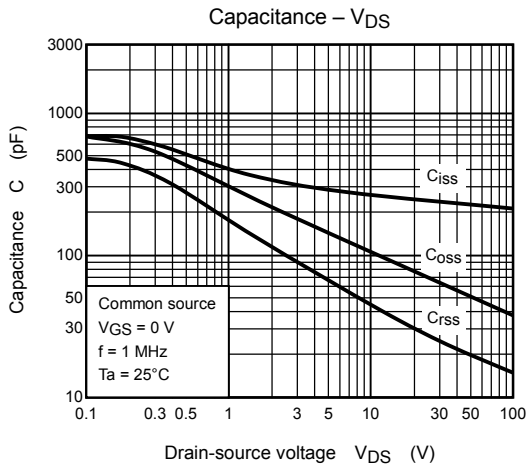
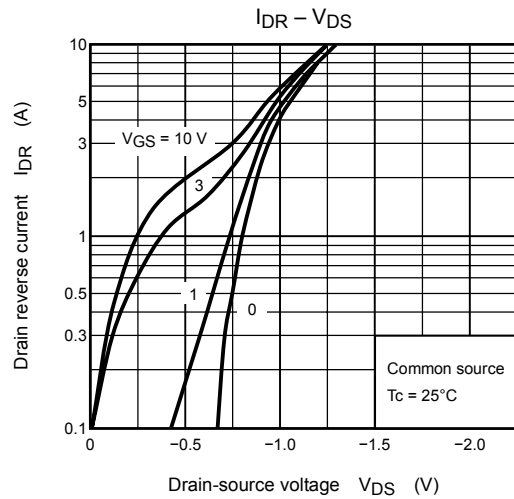
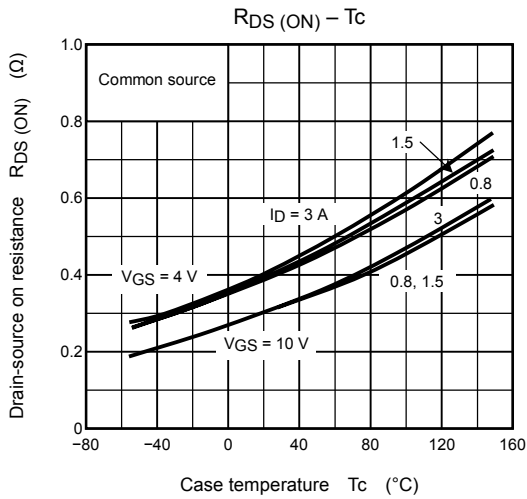
## Flyback-Diode Rating and Characteristics (Ta = 25°C)

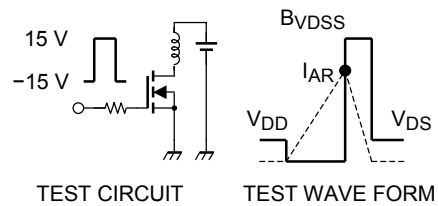
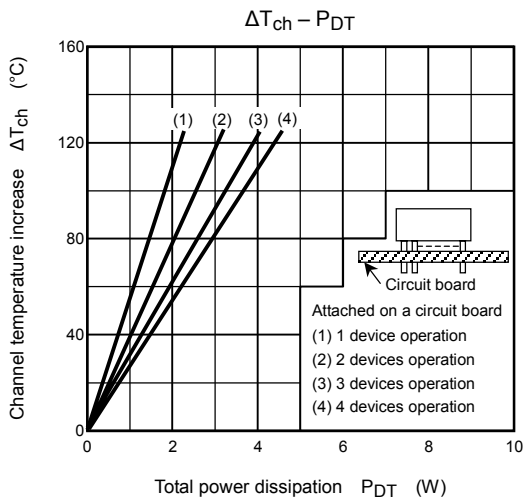
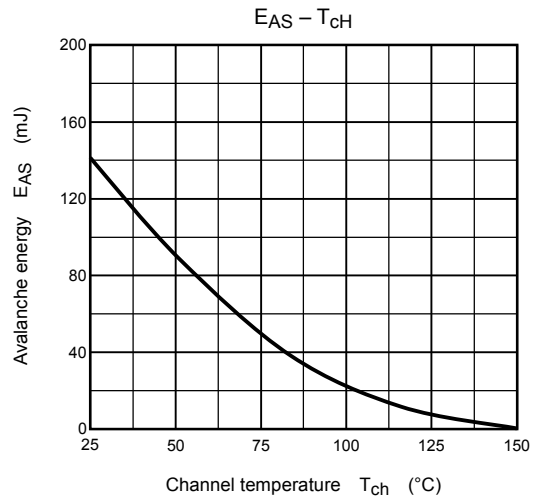
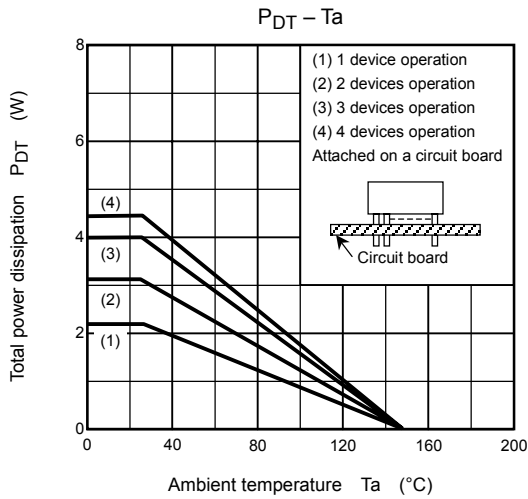
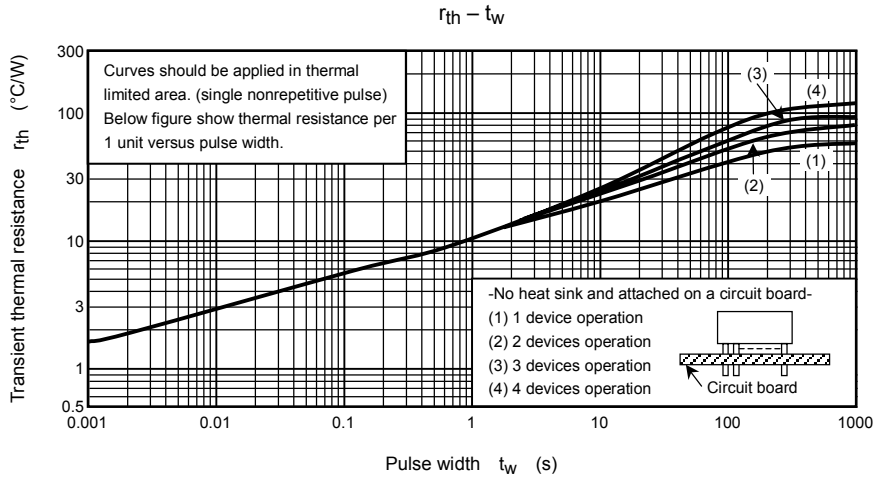
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Forward current	$I_{FM}$	—	—	—	3	A
Reverse current	$I_R$	$V_R = 100\text{ V}$	—	—	0.4	$\mu\text{A}$
Reverse voltage	$V_R$	$I_R = 100\text{ }\mu\text{A}$	100	—	—	V
Forward voltage	$V_F$	$I_F = 0.5\text{ A}$	—	—	1.8	V

## Marking









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

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

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