

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<br>(1 device operation, Ta = 25°C) |                     | P <sub>D</sub>   | 2.2        | W    |
| Drain power dissipation<br>(4 devices operation)           | Ta = 25°C           | P <sub>DT</sub>  | 4.4        | W    |
|  | Tc = 25°C           |                  | 28         |      |
| Single pulse avalanche energy<br>(Note 1)                  |                     | E <sub>AS</sub>  | 140        | mJ   |
| Avalanche current  |                     | I <sub>AR</sub>  | 3          | A    |
| Repetitive avalanche energy<br>(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

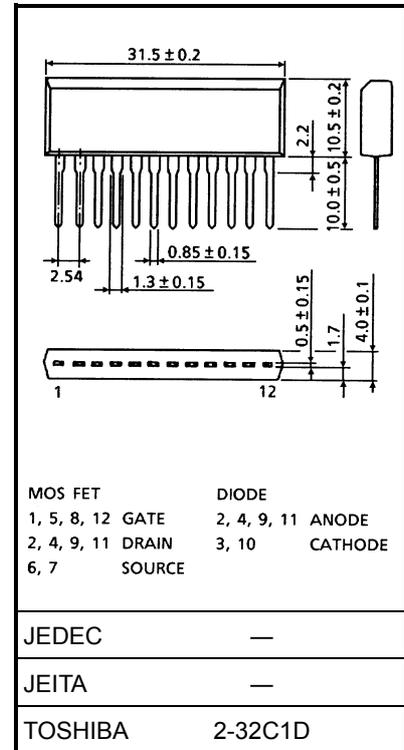
$$V_{DD} = 50 \text{ V, starting } T_{ch} = 25^\circ\text{C, } L = 20 \text{ mH, } R_G = 25 \text{ } \Omega, I_{AR} = 3 \text{ A}$$

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

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

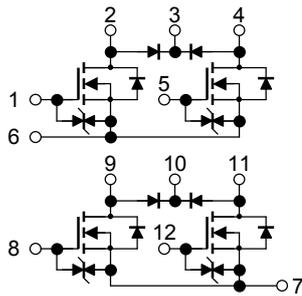
Industrial Applications

Unit: mm



Weight: 3.9 g (typ.)

## Array Configuration



## Thermal Characteristics

| Characteristics  | Symbol                        | Max  | Unit               |
|--|-------------------------------|------|--------------------|
| Thermal resistance of channel to ambient<br>(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<br>(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<br>(3.2 mm from case for $t = 10$ 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                               |               | $I_{\text{GSS}}$            | $V_{\text{GS}} = \pm 16 \text{ V}, V_{\text{DS}} = 0 \text{ V}$                                | —   | —    | $\pm 10$ | $\mu\text{A}$ |
| Drain cut-off current                              |               | $I_{\text{DSS}}$            | $V_{\text{DS}} = 100 \text{ V}, V_{\text{GS}} = 0 \text{ V}$                                   | —   | —    | 100      | $\mu\text{A}$ |
| Drain-source breakdown voltage                     |               | $V_{(\text{BR})\text{DSS}}$ | $I_{\text{D}} = 10 \text{ mA}, V_{\text{GS}} = 0 \text{ V}$                                    | 100 | —    | —        | V             |
| Gate threshold voltage                             |               | $V_{\text{th}}$             | $V_{\text{DS}} = 10 \text{ V}, I_{\text{D}} = 1 \text{ mA}$                                    | 0.8 | —    | 2.0      | V             |
| Drain-source ON resistance                         |               | $R_{\text{DS (ON)}}$        | $V_{\text{GS}} = 4 \text{ V}, I_{\text{D}} = 2 \text{ A}$                                      | —   | 0.36 | 0.45     | $\Omega$      |
|  |               |                             | $V_{\text{GS}} = 10 \text{ V}, I_{\text{D}} = 2 \text{ A}$                                     | —   | 0.28 | 0.35     |               |
| Forward transfer admittance                        |               | $ Y_{\text{fs}} $           | $V_{\text{DS}} = 10 \text{ V}, I_{\text{D}} = 2 \text{ A}$                                     | 1.5 | 3.5  | —        | S             |
| Input capacitance                                  |               | $C_{\text{iSS}}$            | $V_{\text{DS}} = 10 \text{ V}, V_{\text{GS}} = 0 \text{ V}, f = 1 \text{ MHz}$                 | —   | 280  | —        | pF            |
| Reverse transfer capacitance                       |               | $C_{\text{rSS}}$            |  | —   | 50   | —        | pF            |
| Output capacitance                                 |               | $C_{\text{oSS}}$            |  | —   | 105  | —        | pF            |
| Switching time                                     | Rise time     | $t_r$                       |  | —   | 20   | —        | ns            |
|  | Turn-on time  | $t_{\text{on}}$             |  | —   | 50   | —        |               |
|  | Fall time     | $t_f$                       |  | —   | 40   | —        |               |
|  | Turn-off time | $t_{\text{off}}$            |  | —   | 170  | —        |               |
| Total gate charge<br>(gate-source plus gate-drain) |               | $Q_g$                       | $V_{\text{DD}} \approx 80 \text{ V}, V_{\text{GS}} = 10 \text{ V}, I_{\text{D}} = 3 \text{ A}$ | —   | 13.5 | —        | nC            |
| Gate-source charge                                 |               | $Q_{\text{gs}}$             |  | —   | 8.5  | —        | nC            |
| Gate-drain ("miller") charge                       |               | $Q_{\text{gd}}$             |  | —   | 5    | —        | nC            |

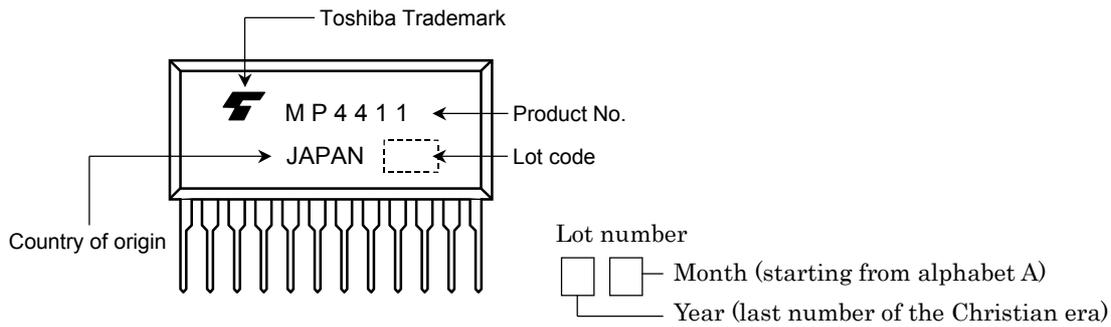
## Source-Drain Diode Ratings and Characteristics (Ta = 25°C)

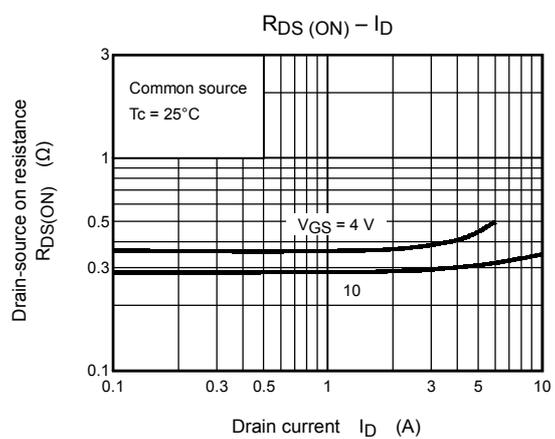
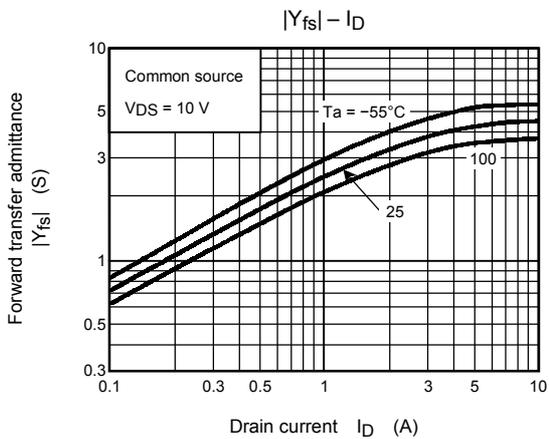
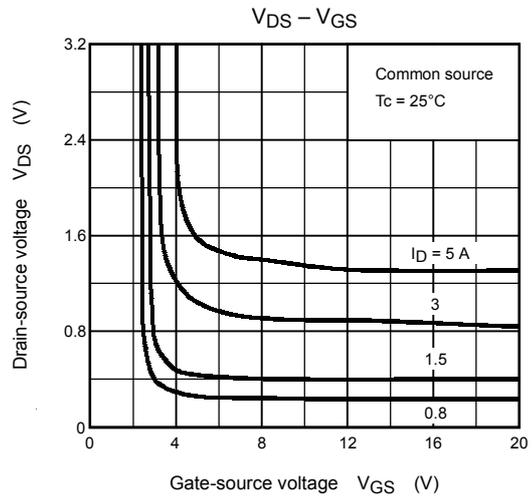
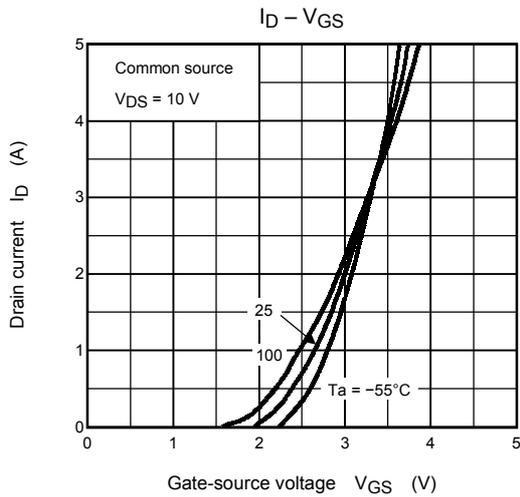
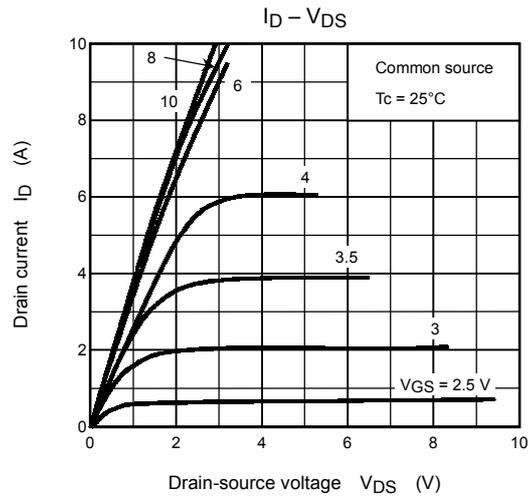
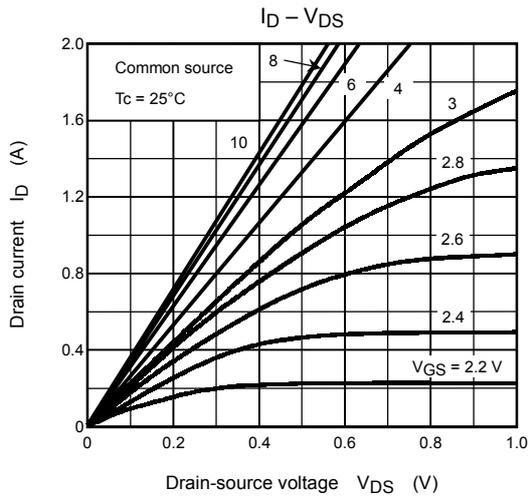
| Characteristics                  | Symbol    | Test Condition  | Min | Typ. | Max  | Unit          |
|----------------------------------|-----------|---|-----|------|------|---------------|
| Continuous drain reverse current | $I_{DR}$  | —   | —   | —    | 3    | A             |
| Pulse drain reverse 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            | $t_{rr}$  | $I_{DR} = 3\text{ A}, V_{GS} = 0\text{ V},$<br>$dI_{DR}/dt = 50\text{ A}/\mu\text{s}$ | —   | 100  | —    | ns            |
| Reverse recovery charge          | $Q_{rr}$  |   | —   | 0.2  | —    | $\mu\text{C}$ |

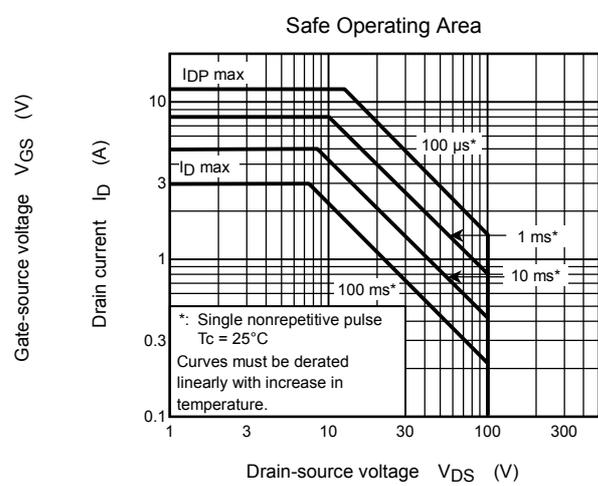
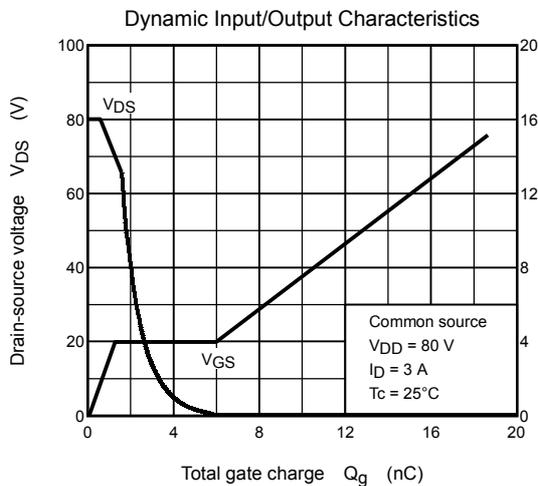
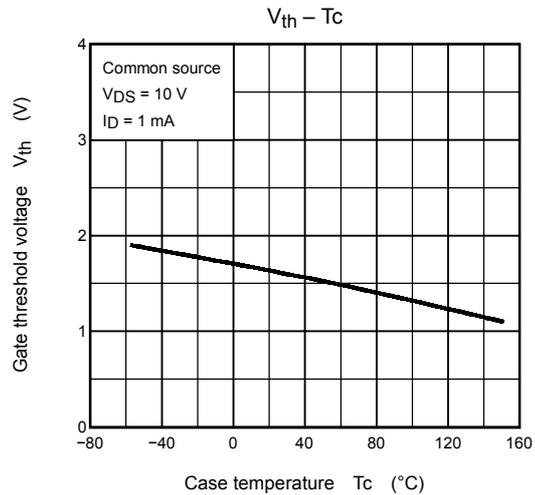
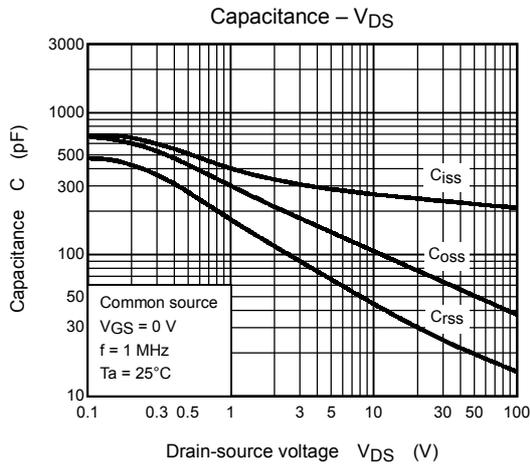
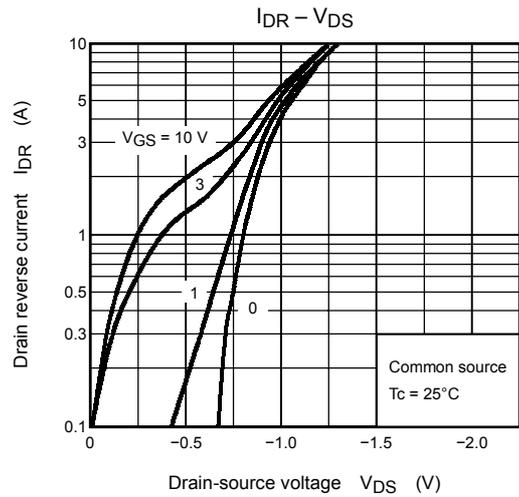
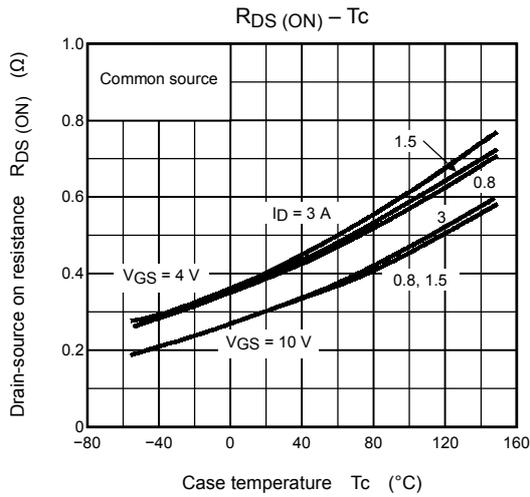
## Flyback-Diode Rating and Characteristics (Ta = 25°C)

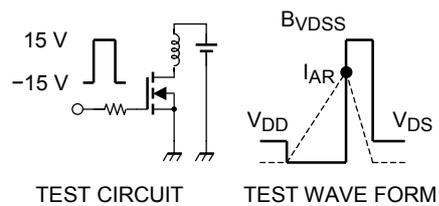
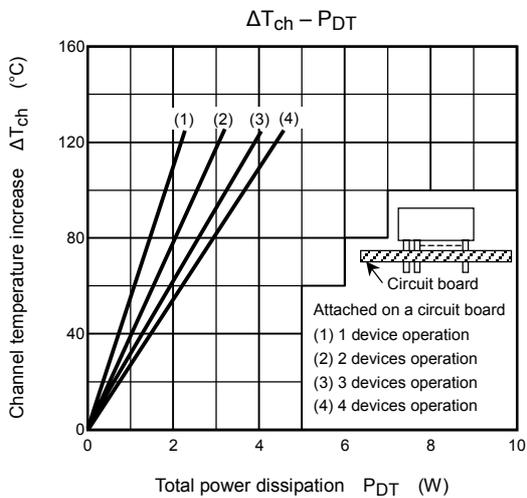
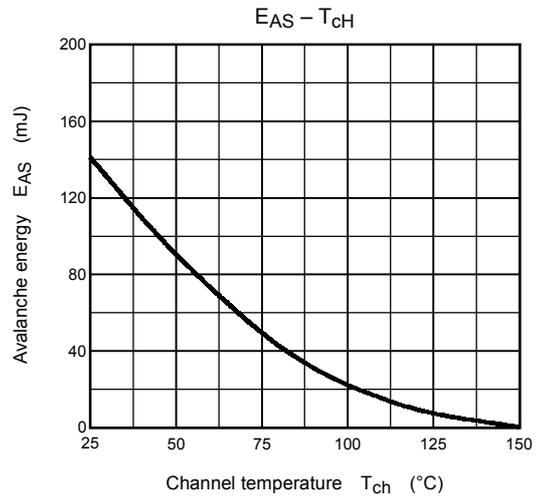
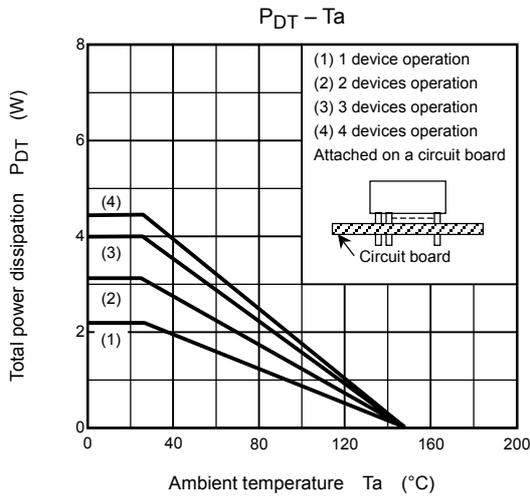
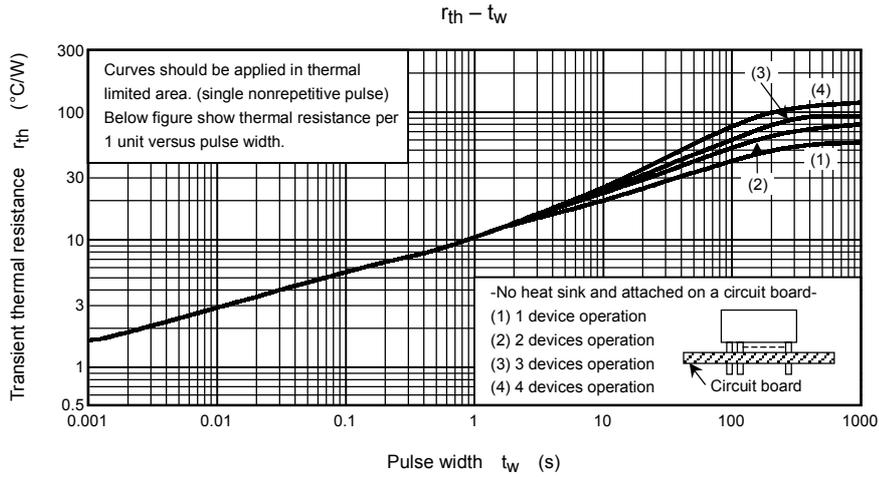
| Characteristics | Symbol   | Test Condition                 | Min | Typ. | Max | Unit          |
|-----------------|----------|--------------------------------|-----|------|-----|---------------|
| Forward current | $I_{FM}$ | —                              | —   | —    | 3   | A             |
| Reverse 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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