

## N-Channel Enhancement Mode MOSFET

TDM3404B

## DESCRIPTION

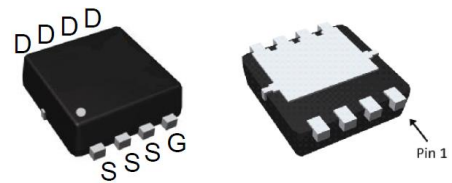
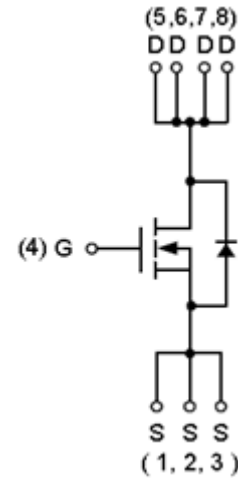
The TDM3404B uses advanced trench technology to provide excellent  $R_{DS(ON)}$  and low gate charge. This device is suitable for use as a load switch or in PWM applications.

## GENERAL FEATURES

- $R_{DS(ON)} < 4m\Omega$  @  $V_{GS}=4.5V$   
 $R_{DS(ON)} < 6m\Omega$  @  $V_{GS}=2.5V$
- High Power and current handling capability
- Surface Mount Package
- Lead Free and Green Devices available(RoHS Compliant)

## Application

- PWM applications
- Load switch
- Power management
- Powered Systems



PPAK-3\*3-8

ABSOLUTE MAXIMUM RATINGS( $T_c=25^\circ\text{C}$  unless otherwise noted)

| Parameter                               | Symbol                              | Limit      | Unit                      |
|-----------------------------------------|-------------------------------------|------------|---------------------------|
| Drain-Source Voltage                    | $V_{DS}$                            | 20         | V                         |
| Gate-Source Voltage                     | $V_{GS}$                            | $\pm 12$   | V                         |
| Drain Current @ Continuous              | $I_D$ ( $T_c=25^\circ\text{C}$ )    | 55         | A                         |
|                                         | $I_D$ ( $T_c=100^\circ\text{C}$ )   | 35         | A                         |
| Drain Current @ Current-Pulsed (Note 1) | $I_{DM}$ ( $T_c=25^\circ\text{C}$ ) | 220        | A                         |
| Maximum Power Dissipation               | $P_D$ ( $T_c=25^\circ\text{C}$ )    | 35         | W                         |
|                                         | Derate above $25^\circ\text{C}$     | 0.54       | W/ $^\circ\text{C}$       |
| Single Pulsed Avalanche Energy (Note 2) | $E_{AS}(L=0.5mH)$                   | 110        | mJ                        |
| Thermal Resistance,Junction-to-Case     | $R_{\theta JC}$                     | 3.5        | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance,Junction-to-Ambient  | $R_{\theta JA}$                     | 78         | $^\circ\text{C}/\text{W}$ |
| Operating Junction Temperature Range    | $T_J$                               | -55 To 150 | $^\circ\text{C}$          |
| Storage Temperature Range               | $T_{STG}$                           | -55 To 150 | $^\circ\text{C}$          |

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ELECTRICAL CHARACTERISTICS (T<sub>c</sub>=25°C unless otherwise noted)

| Parameter                                                | Symbol              | Condition                                                                                 | Min | Typ  | Max  | Unit |
|----------------------------------------------------------|---------------------|-------------------------------------------------------------------------------------------|-----|------|------|------|
| OFF CHARACTERISTICS                                      |                     |                                                                                           |     |      |      |      |
| Drain-Source Breakdown Voltage                           | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                                 | 20  | -    | -    | V    |
| Zero Gate Voltage Drain Current                          | I <sub>DSS</sub>    | V <sub>DS</sub> =19.5V, V <sub>GS</sub> =0V                                               | -   | -    | 1    | μ A  |
| Gate-Body Leakage Current                                | I <sub>GSS</sub>    | V <sub>GS</sub> =±12V, V <sub>DS</sub> =0V                                                | -   | -    | ±100 | nA   |
| ON CHARACTERISTICS                                       |                     |                                                                                           |     |      |      |      |
| Gate Threshold Voltage                                   | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                  | 0.4 | 0.7  | 1.1  | V    |
| Drain-Source On-State Resistance                         | R <sub>DS(ON)</sub> | V <sub>GS</sub> =4.5V, I <sub>D</sub> =30A                                                | -   | 2.8  | 4    | mΩ   |
|                                                          |                     | V <sub>GS</sub> =2.5V, I <sub>D</sub> =20A                                                | -   | 4    | 6    | mΩ   |
| DYNAMIC CHARACTERISTICS (Note3)                          |                     |                                                                                           |     |      |      |      |
| Input Capacitance                                        | C <sub>iss</sub>    | V <sub>DS</sub> =15V, V <sub>GS</sub> =0V, F=1.0MHz                                       | -   | 3200 | -    | PF   |
| Output Capacitance                                       | C <sub>oss</sub>    |                                                                                           | -   | 460  | -    | PF   |
| Reverse Transfer Capacitance                             | C <sub>rss</sub>    |                                                                                           | -   | 445  | -    | PF   |
| SWITCHING CHARACTERISTICS (Note 3)                       |                     |                                                                                           |     |      |      |      |
| Turn-on Delay Time                                       | t <sub>d(on)</sub>  | V <sub>DS</sub> =15V, V <sub>GS</sub> =4.5V,<br>R <sub>G</sub> =1.8Ω, I <sub>D</sub> =17A | -   | 9.7  | -    | nS   |
| Turn-on Rise Time                                        | t <sub>r</sub>      |                                                                                           | -   | 37   | -    | nS   |
| Turn-Off Delay Time                                      | t <sub>d(off)</sub> |                                                                                           | -   | 63   | -    | nS   |
| Turn-Off Fall Time                                       | t <sub>f</sub>      |                                                                                           | -   | 52   | -    | nS   |
| Total Gate Charge                                        | Q <sub>g</sub>      | V <sub>DS</sub> =15V, I <sub>D</sub> =17A,<br>V <sub>GS</sub> =4.5V                       | -   | 48   | -    | nC   |
| Gate-Source Charge                                       | Q <sub>gs</sub>     |                                                                                           | -   | 3.6  | -    | nC   |
| Gate-Drain Charge                                        | Q <sub>gd</sub>     |                                                                                           | -   | 19   | -    | nC   |
| DRAIN-SOURCE DIODE CHARACTERISTICS                       |                     |                                                                                           |     |      |      |      |
| Maximum Continuous Drain<br>Source Diode Forward Current | I <sub>s</sub>      |                                                                                           | -   | -    | 90   | A    |
| Diode Forward Voltage                                    | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>s</sub> =30A                                                  | -   | -    | 1.2  | V    |
| Reverse Recovery Time                                    | T <sub>rr</sub>     | I <sub>F</sub> =30A, dI/dt=100A/μs                                                        | -   | 23   | -    | nS   |
| Reverse Recovery Charge                                  | Q <sub>rr</sub>     |                                                                                           | -   | 10   | -    | nC   |

## NOTES:

1. Repetitive Rating : Pulse width limited by maximum junction temperature.
2. EAS condition: T<sub>J</sub> =25°C, V<sub>DD</sub> =15V, V<sub>G</sub> =4.5V, L=0.5mH, I<sub>AS</sub> =21A.
3. Guaranteed by design, not subject to production testing.

## Typical Operating Characteristics

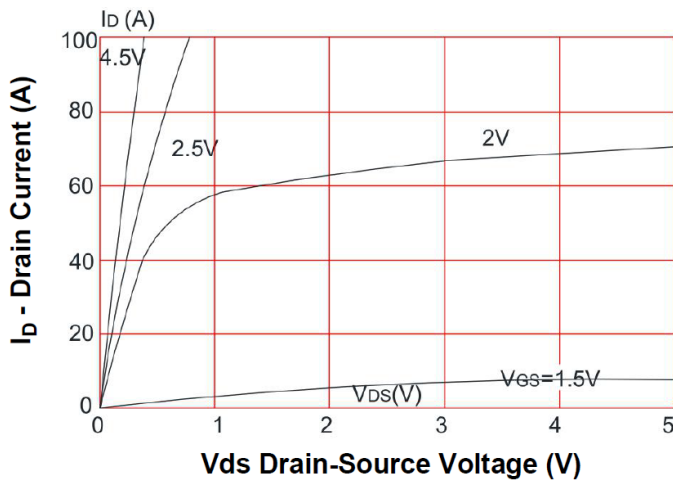


Figure 1. On-Region Characteristics

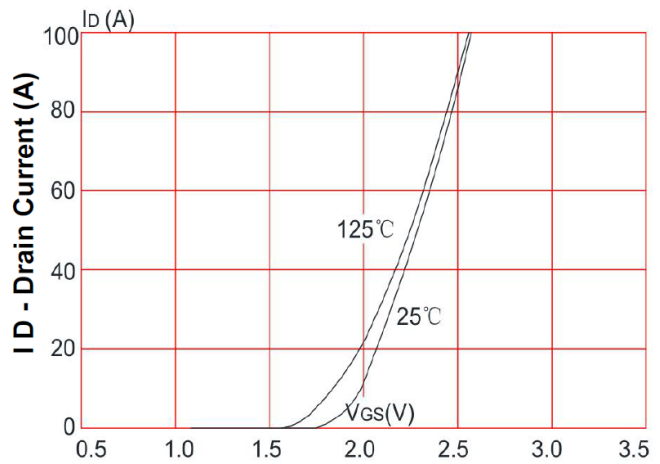


Figure 2. Transfer Characteristics

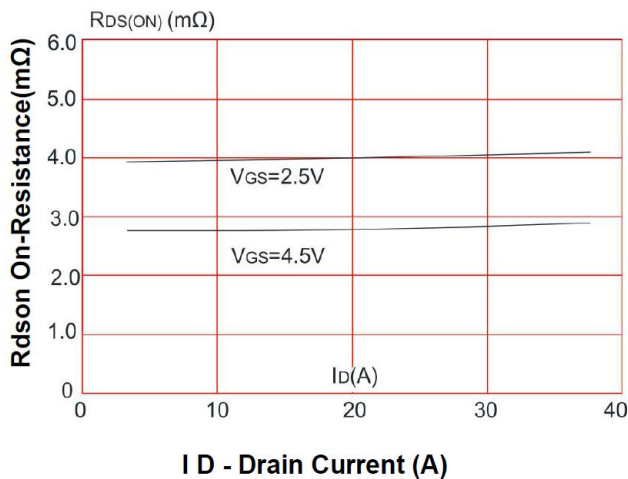


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

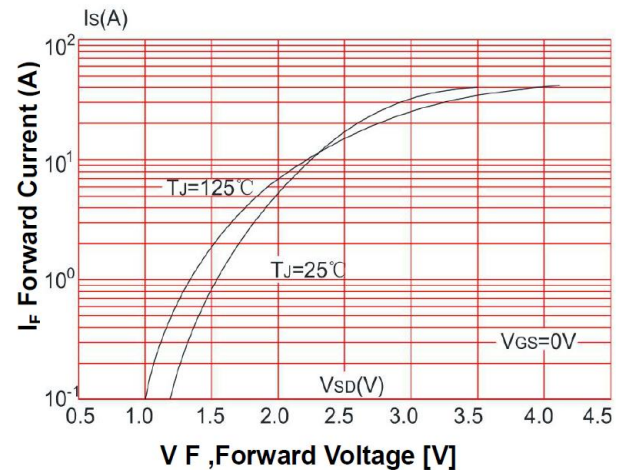


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

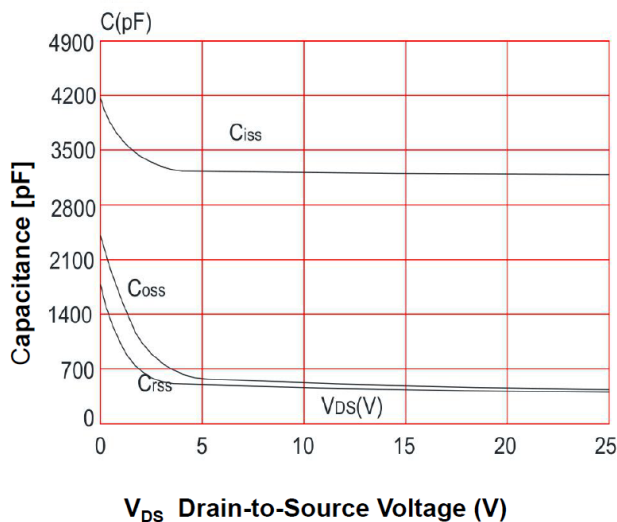


Figure 5. Capacitance Characteristics

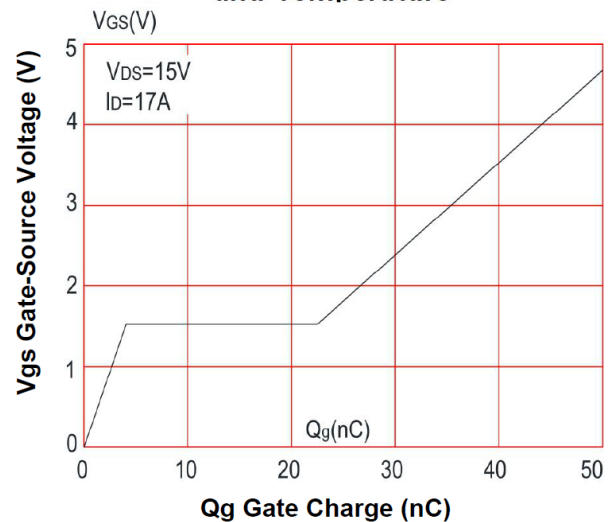
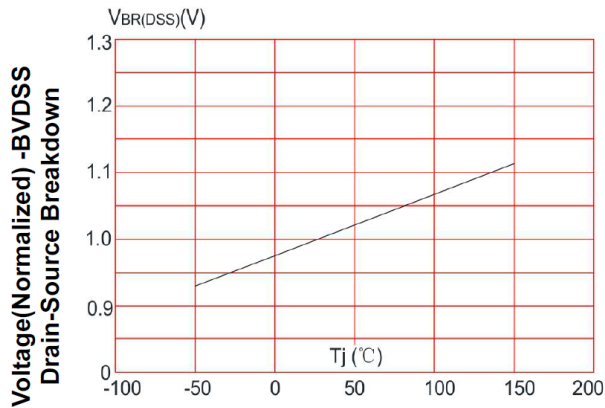
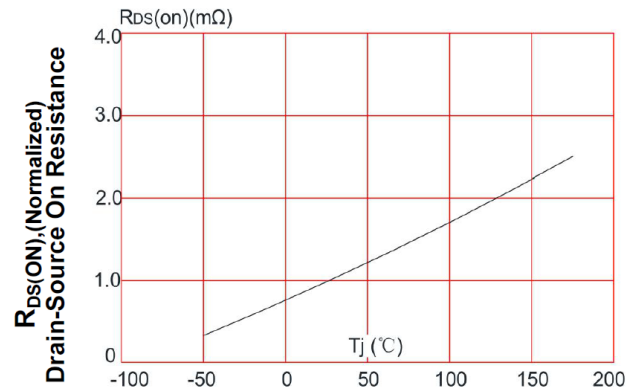


Figure 6. Gate Charge Characteristics

## Typical Operating Characteristics(Cont.)



T<sub>J</sub> , Junction Temperature [°C]  
Figure 7. Breakdown Voltage Variation vs Temperature



T<sub>J</sub> , Junction Temperature [°C]  
Figure 8. On-Resistance Variation vs Temperature

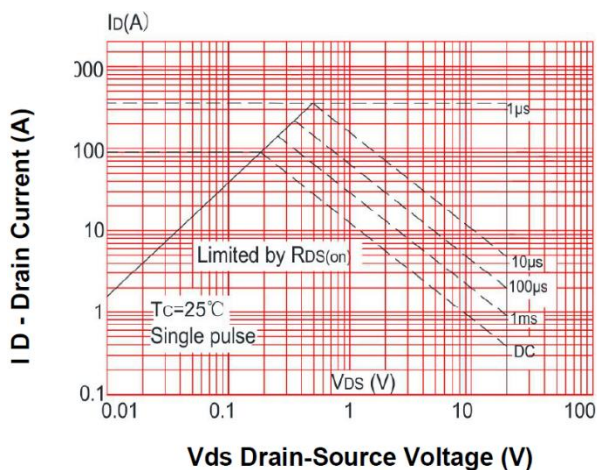


Figure 9. Maximum Safe Operating Area

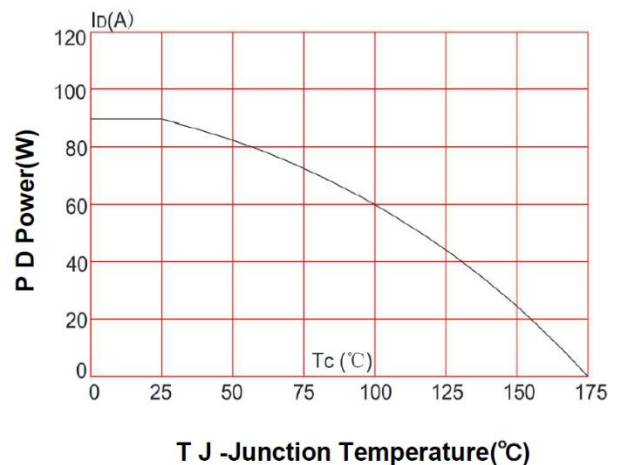


Figure 10. Maximum Power Dissipation vs Case Temperature

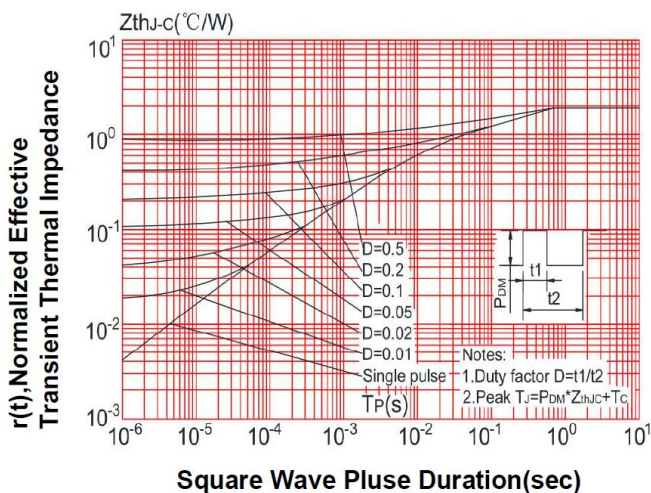


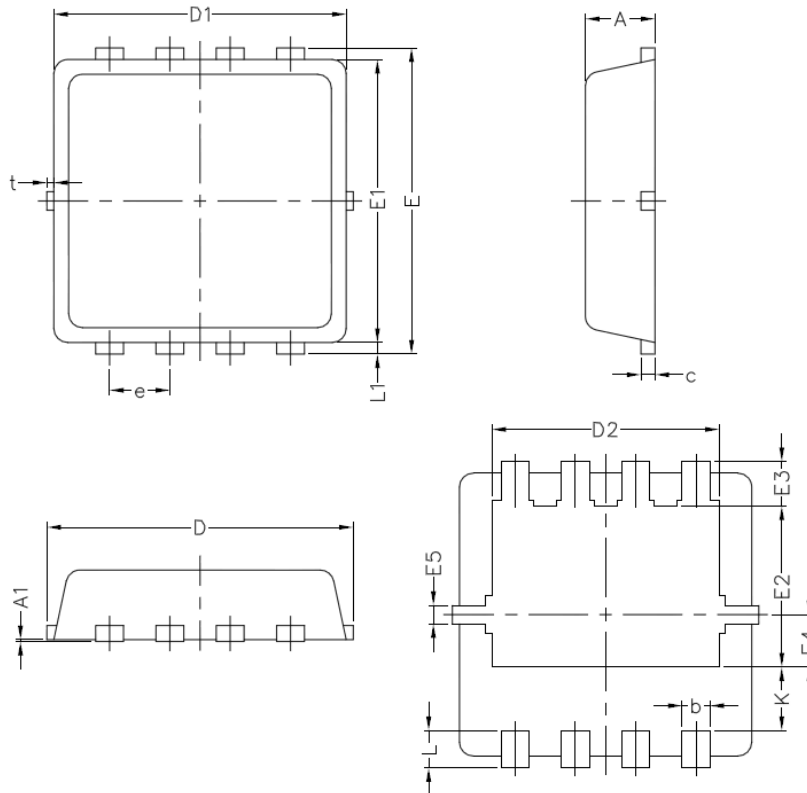
Figure 11. Transient Thermal Response Curve

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TDM3404B

## Package Information

PPAK-3\*3-8 Package



| Symbol | PPAK-3*3-8(mm) |       |      |
|--------|----------------|-------|------|
|        | Min            | Nom   | Max  |
| A      | 0.70           | 0.75  | 0.85 |
| A1     | /              | /     | 0.05 |
| b      | 0.20           | 0.30  | 0.40 |
| c      | 0.10           | 0.152 | 0.25 |
| D      | 3.15           | 3.3   | 3.45 |
| D1     | 3.00           | 3.15  | 3.30 |
| D2     | 2.25           | 2.45  | 2.65 |
| E      | 3.15           | 3.30  | 3.45 |
| E1     | 2.90           | 3.05  | 3.20 |
| E2     | 1.54           | 1.74  | 1.94 |
| E3     | 0.28           | 0.48  | 0.68 |
| E4     | 0.37           | 0.57  | 0.77 |
| E5     | 0.10           | 0.20  | 0.30 |
| e      | 0.60           | 0.65  | 0.70 |
| K      | 0.49           | 0.69  | 0.89 |
| L      | 0.30           | 0.40  | 0.50 |
| L1     | 0.06           | 0.125 | 0.20 |
| t      | /              | /     | 0.13 |

Design Notes