

# MDD50N10D

100V N-Channel Enhancement Mode POWER MOSFET

## 1. Description

This N-Channel MOSFET is produced using MDD's advanced Power Trench technology. This process has been optimized to minimize on-state resistance and yet maintain superior switching performance with best in class soft body diode.

## 2. Features

- Max  $R_{DS(on)}$  = 17m $\Omega$  at  $V_{GS}$  = 10 V,  $I_D$  = 20 A
- Extremely Low Reverse Recovery Charge,  $Q_g$
- 100% UIS Tested
- RoHS Compliant

## 3. Application

- Power Management in Telecom., Industrial Automation
- Motor Drives and Uninterruptible Power Supplies
- Current Switching in DC/DC&AC/DC(SR) Sub-systems

## 4. Absolute Maximum Ratings ( $T_A=25^{\circ}\text{C}$ unless otherwise noted)

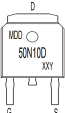
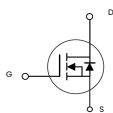
| Parameter                               | Symbol          | Value           | Unit                        |
|-----------------------------------------|-----------------|-----------------|-----------------------------|
| Drain-Source Voltage                    | $V_{DS}$        | 100             | V                           |
| Gate-Source Voltage                     | $V_{GS}$        | $\pm 20$        | V                           |
| Continuous Drain Current (Note 1)       | $I_D$           | 50              | A                           |
| Pulsed Drain Current (Note 2)           | $I_{DM}$        | 200             | A                           |
| Single Pulsed Avalanche Energy (Note 3) | $E_{AS}$        | 25              | mJ                          |
| Thermal Resistance, steady-state        | $R_{\theta JA}$ | 55              | $^{\circ}\text{C}/\text{W}$ |
| Power Dissipation                       | $P_D$           | 60              | W                           |
| Junction Temperature                    | $T_J$           | $-55 \sim +150$ | $^{\circ}\text{C}$          |
| Storage Temperature                     | $T_{stg}$       | $-55 \sim +150$ | $^{\circ}\text{C}$          |

Note: 1) Calculated continuous current based on maximum allowable junction temperature.

2) Repetitive rating, pulse width limited by max. junction temperature.

3)  $E_{AS}$  condition :  $T_J=25^{\circ}\text{C}$ ,  $V_{DD}=50\text{V}$ ,  $V_{GS}=10\text{V}$ ,  $L=0.5\text{mH}$ ,  $R_g=25\Omega$ ,  $I_{AS}=10\text{A}$ .

## 5. Pinning information

| Pin | Symbol | Description | Simplified outline                                                                | Equivalent Circuit                                                                | Marking                         | Package |
|-----|--------|-------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------|---------|
| 1   | G      | Gate        |  |  | MDD<br>50N10D<br>XXY: Date code | TO-252  |
| 2   | D      | Drain       |                                                                                   |                                                                                   |                                 |         |
| 3   | S      | Source      |                                                                                   |                                                                                   |                                 |         |

## 6. T<sub>A</sub>=25°C unless otherwise specified

| Symbol               | Parameter                        |         | Condition                                                | Min | Typ  | Max  | Unit |
|----------------------|----------------------------------|---------|----------------------------------------------------------|-----|------|------|------|
| V <sub>(BR)DSS</sub> | Drain-Source Breakdown Voltage   |         | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA               | 100 | —    | —    | V    |
| I <sub>SS</sub>      | Gate-Source Leakage Current      | Forward | V <sub>GS</sub> =20V                                     | —   | —    | 100  | nA   |
|                      |                                  | Reverse | V <sub>GS</sub> =-20V                                    | —   | —    | -100 | nA   |
| I <sub>DSS</sub>     | Drain-Source Leakage Current     |         | V <sub>DS</sub> =100V, V <sub>GS</sub> =0V               | —   | —    | 1    | μA   |
| V <sub>GS(TH)</sub>  | Gate Threshold Voltage           |         | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA | 1.5 | 2.0  | 2.5  | V    |
| R <sub>DS(ON)</sub>  | Drain-Source On-State Resistance |         | V <sub>GS</sub> =10V, I <sub>D</sub> =20A                | —   | 15   | 17   | mΩ   |
|                      |                                  |         | V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A               | —   | 19.5 | 23   | mΩ   |

## 7. Dynamic Electrical Characteristics

| Symbol           | Parameter                    | Condition                                                                | Min | Typ | Max | Unit |
|------------------|------------------------------|--------------------------------------------------------------------------|-----|-----|-----|------|
| C <sub>iss</sub> | Input Capacitance            | V <sub>GS</sub> =0V<br>V <sub>DS</sub> =40V<br>f=1MHz                    | —   | 867 | —   | pF   |
| C <sub>oss</sub> | Output Capacitance           |                                                                          | —   | 263 | —   | pF   |
| C <sub>rss</sub> | Reverse Transfer Capacitance |                                                                          | —   | 7   | —   | pF   |
| Q <sub>g</sub>   | Total Gate Charge            | V <sub>GS</sub> =0 to 10V<br>V <sub>DS</sub> =50V<br>I <sub>D</sub> =40A | —   | 13  | —   | nC   |
| Q <sub>gs</sub>  | Gate Source Charge           |                                                                          | —   | 6   | —   | nC   |
| Q <sub>gd</sub>  | Gate Drain Charge            |                                                                          | —   | 2.6 | —   | nC   |

## 8. Switching Characteristics

| Symbol              | Parameter           | Condition                                                                                 | Min | Typ | Max | Unit |
|---------------------|---------------------|-------------------------------------------------------------------------------------------|-----|-----|-----|------|
| t <sub>d(on)</sub>  | Turn on Delay Time  | V <sub>GS</sub> =10V<br>V <sub>DD</sub> =50V<br>I <sub>D</sub> =40A<br>R <sub>θ</sub> =3Ω | —   | 25  | —   | ns   |
| t <sub>r</sub>      | Turn on Rise Time   |                                                                                           | —   | 56  | —   | ns   |
| t <sub>d(off)</sub> | Turn Off Delay Time |                                                                                           | —   | 189 | —   | ns   |
| t <sub>f</sub>      | Turn Off Fall Time  |                                                                                           | —   | 95  | —   | ns   |

## 9. Source Drain Diode Characteristics

| Symbol          | Parameter                          | Condition                                | Min | Typ | Max | Unit |
|-----------------|------------------------------------|------------------------------------------|-----|-----|-----|------|
| V <sub>SD</sub> | Drain-Source Diode Forward Voltage | I <sub>S</sub> =20A, V <sub>GS</sub> =0V | —   | 0.8 | 1.2 | V    |
| t <sub>rr</sub> | Body Diode Reverse Recovery Time   | I <sub>F</sub> =20A                      | —   | 33  | —   | ns   |
| Q <sub>rr</sub> | Body Diode Reverse Recovery Charge | di/dt=100A/μs                            | —   | 28  | —   | nC   |

### 10. Test Circuits And Waveforms

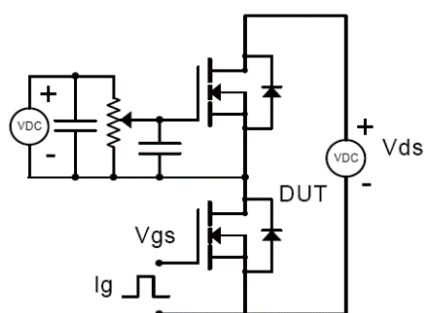


Figure 1. Gate charge test circuit & waveform

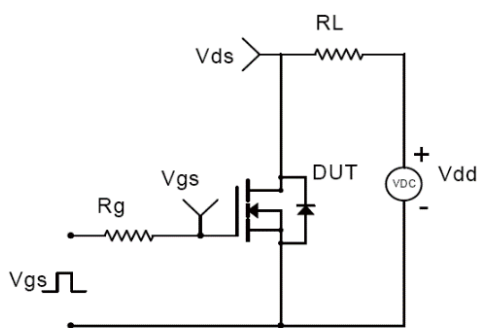
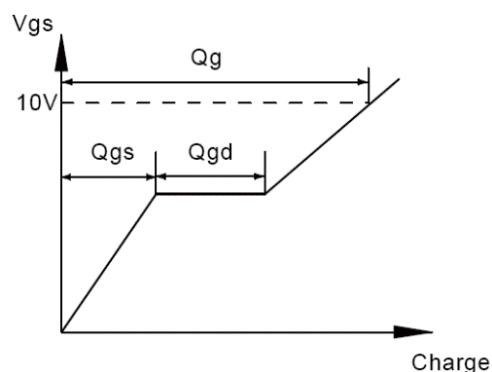


Figure 2. Switching time test circuit & waveforms

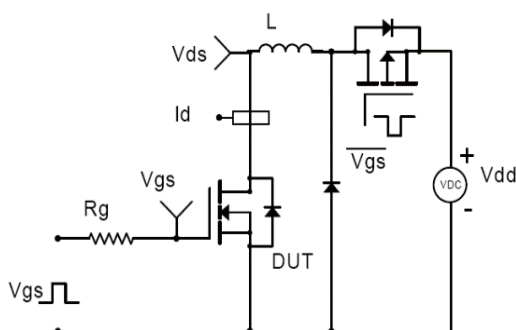
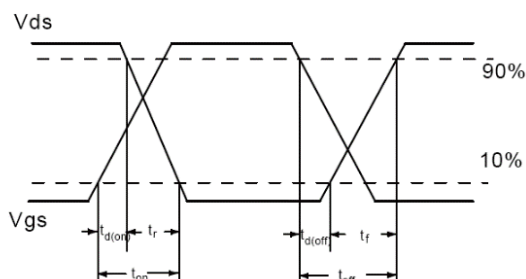


Figure 3. Unclamped inductive switching (UIS) test circuit & waveforms

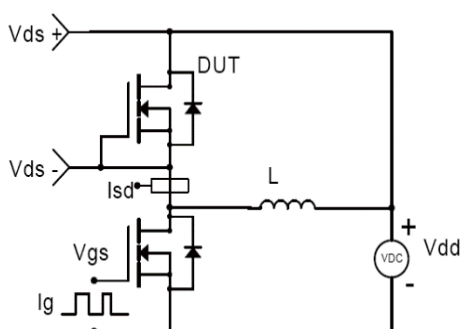
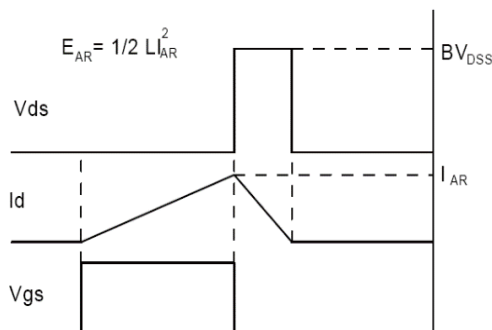
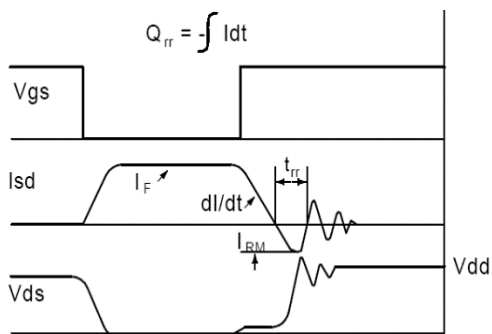


Figure 4. Diode reverse recovery test circuit & waveforms



### 11. Electrical Characteristics Diagrams

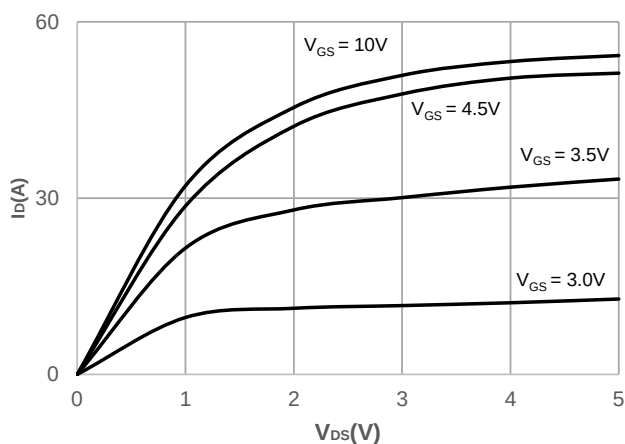


Figure 1. Typ. output characteristics

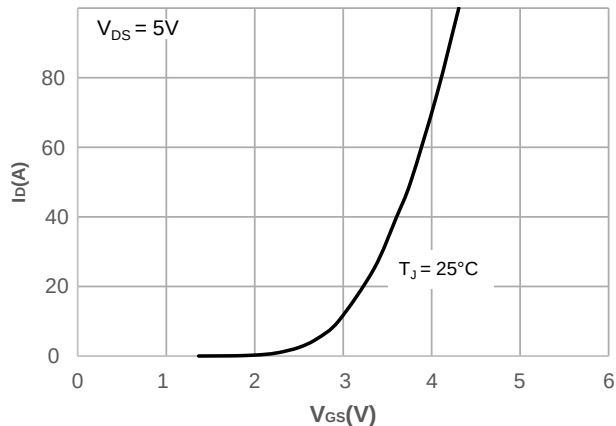


Figure 2. Typ. transfer characteristics

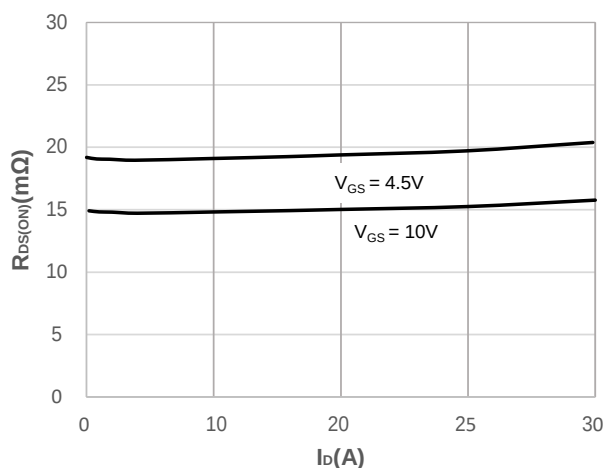


Figure 3. On-Resistance vs. Drain Current

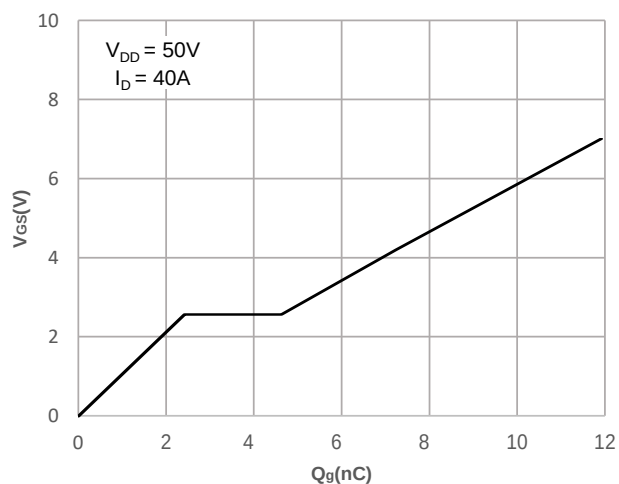


Figure 4. Gate Charge Characteristics

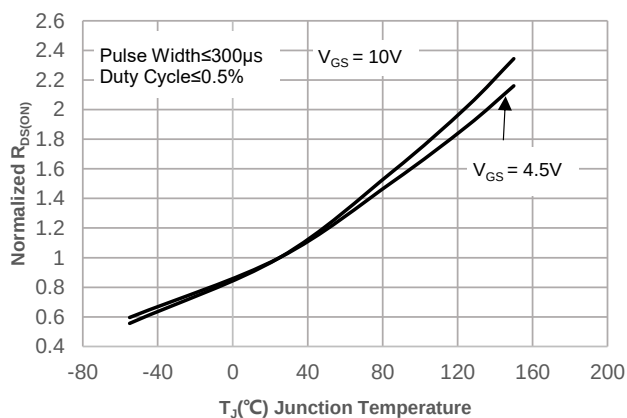


Figure 5. Normalized on Resistance vs. Junction Temperature

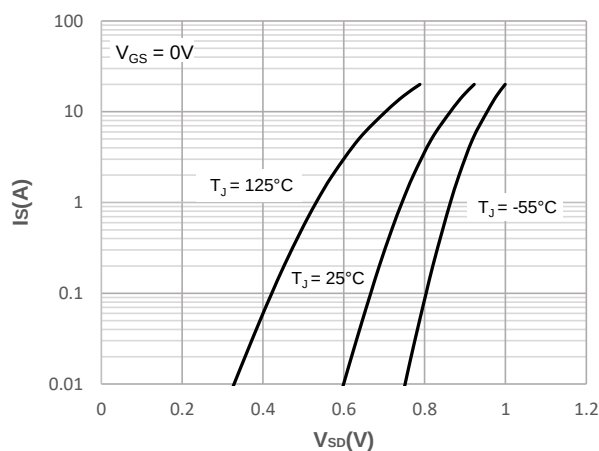
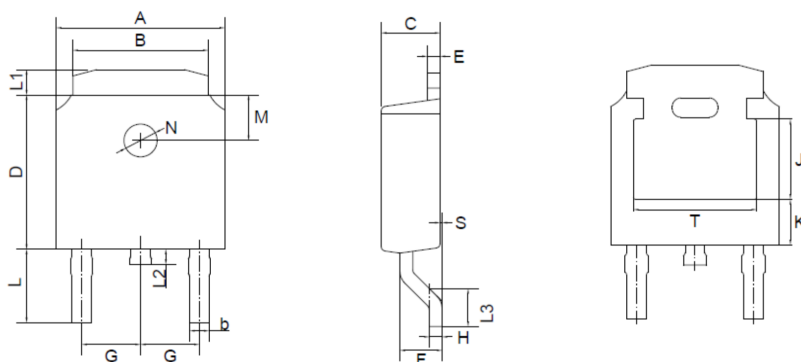


Figure 6. Forward characteristic of body diode

## 12. Outline Drawing

TO-252 Package Outline Dimensions



TO-252(D-PAK) mechanical data

| UNIT |     | A   | B   | b   | C   | D   | E   | F   | G       | H    | L   | L1  | L2  | L3   | S   | M       | N       | J    | K    | T    |
|------|-----|-----|-----|-----|-----|-----|-----|-----|---------|------|-----|-----|-----|------|-----|---------|---------|------|------|------|
| mm   | max | 6.7 | 5.5 | 0.8 | 2.5 | 6.3 | 0.6 | 1.8 | 2.29    | 0.55 | 3.1 | 1.2 | 1.0 | 1.75 | 0.1 | 1.8     | 1.3     | 3.16 | 1.80 | 4.83 |
|      | min | 6.3 | 5.1 | 0.3 | 2.1 | 5.9 | 0.4 | 1.3 | TYPICAL | 0.45 | 2.7 | 0.8 | 0.6 | 1.40 | 0.0 | TYPICAL | TYPICAL | ref. | ref. | ref. |
| mil  | max | 264 | 217 | 31  | 98  | 248 | 24  | 71  | 90      | 22   | 122 | 47  | 39  | 69   | 4   | 71      | 51      | 124  | 71   | 190  |
|      | min | 248 | 201 | 12  | 83  | 232 | 16  | 51  | TYPICAL | 18   | 106 | 31  | 24  | 55   | 0   | TYPICAL | TYPICAL | ref. | ref. | ref. |

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