

## HM12N15I-VB Datasheet

### N-Channel 200V (D-S) MOSFET

#### PRODUCT SUMMARY

| $V_{DS}$ (V) | $R_{DS(on)}$ ( $\Omega$ ) | $I_D$ (A) |
|--------------|---------------------------|-----------|
| 200          | 0.056 at $V_{GS} = 10$ V  | 25        |
|              | 0.070 at $V_{GS} = 6$ V   | 23        |

#### FEATURES

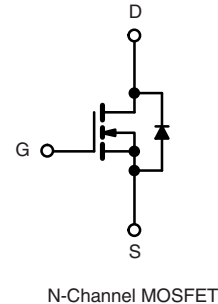
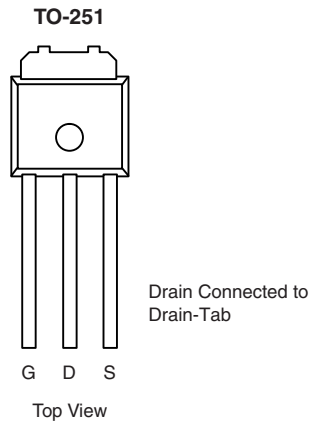
- Trench Power MOSFET
- 175 °C Junction Temperature
- PWM Optimized
- 100 %  $R_g$  Tested
- Compliant to RoHS Directive 2002/95/EC



**RoHS**  
COMPLIANT

#### APPLICATIONS

- Primary Side Switch



#### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)

| Parameter                                                                     |                                     | Symbol         | Limit            | Unit               |
|-------------------------------------------------------------------------------|-------------------------------------|----------------|------------------|--------------------|
| Drain-Source Voltage                                                          |                                     | $V_{DS}$       | 200              | V                  |
| Gate-Source Voltage                                                           |                                     | $V_{GS}$       | $\pm 20$         |                    |
| Continuous Drain Current ( $T_J = 175\text{ }^{\circ}\text{C}$ ) <sup>b</sup> | $T_C = 25\text{ }^{\circ}\text{C}$  | $I_D$          | 25               | A                  |
|                                                                               | $T_C = 125\text{ }^{\circ}\text{C}$ |                | 17               |                    |
| Pulsed Drain Current                                                          |                                     | $I_{DM}$       | 60               |                    |
| Continuous Source Current (Diode Conduction)                                  |                                     | $I_S$          | 19               |                    |
| Avalanche Current                                                             |                                     | $I_{AS}$       | 25               |                    |
| Single Pulse Avalanche Energy                                                 | $L = 0.1\text{ mH}$                 | $E_{AS}$       | 18               | mJ                 |
| Maximum Power Dissipation                                                     | $T_C = 25\text{ }^{\circ}\text{C}$  | $P_D$          | 145 <sup>b</sup> | W                  |
|                                                                               | $T_A = 25\text{ }^{\circ}\text{C}$  |                | 3.5 <sup>a</sup> |                    |
| Operating Junction and Storage Temperature Range                              |                                     | $T_J, T_{stg}$ | - 55 to 175      | $^{\circ}\text{C}$ |

#### THERMAL RESISTANCE RATINGS

| Parameter                        | Symbol     | Typical | Maximum | Unit |
|----------------------------------|------------|---------|---------|------|
| Junction-to-Ambient <sup>a</sup> | $R_{thJA}$ | 15      | 18      | °C/W |
|                                  |            | 40      | 50      |      |
| Junction-to-Case (Drain)         | $R_{thJC}$ | 0.85    | 1.1     |      |

Notes:

a. Surface mounted on 1" x 1" FR4 board.

b. See SOA curve for voltage derating.

| SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)         |                     |                                                                                                                           |      |                   |       |      |
|-------------------------------------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------|------|-------------------|-------|------|
| Parameter                                                               | Symbol              | Test Conditions                                                                                                           | Min. | Typ. <sup>a</sup> | Max.  | Unit |
| Static                                                                  |                     |                                                                                                                           |      |                   |       |      |
| Drain-Source Breakdown Voltage                                          | V <sub>DS</sub>     | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA                                                                            | 200  |                   |       | V    |
| Gate Threshold Voltage                                                  | V <sub>GS(th)</sub> | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                                                               | 2    |                   | 4     |      |
| Gate-Body Leakage                                                       | I <sub>GSS</sub>    | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V                                                                           |      |                   | ± 100 | nA   |
| Zero Gate Voltage Drain Current                                         | I <sub>DSS</sub>    | V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V                                                                            |      |                   | 1     | μA   |
|                                                                         |                     | V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C                                                   |      |                   | 50    |      |
|                                                                         |                     | V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 175 °C                                                   |      |                   | 250   |      |
| On-State Drain Current <sup>b</sup>                                     | I <sub>D(on)</sub>  | V <sub>DS</sub> = 5 V, V <sub>GS</sub> = 10 V                                                                             | 40   |                   |       | A    |
| Drain-Source On-State Resistance <sup>b</sup>                           | R <sub>DS(on)</sub> | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 5 A                                                                              |      | 0.056             |       | Ω    |
|                                                                         |                     | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 5 A, T <sub>J</sub> = 125 °C                                                     |      | 0.130             |       |      |
|                                                                         |                     | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 5 A, T <sub>J</sub> = 175 °C                                                     |      | 0.260             |       |      |
|                                                                         |                     | V <sub>GS</sub> = 6 V, I <sub>D</sub> = 5 A                                                                               |      | 0.070             |       |      |
| Forward Transconductance <sup>b</sup>                                   | g <sub>fs</sub>     | V <sub>DS</sub> = 15 V, I <sub>D</sub> = 19 A                                                                             |      | 35                |       | S    |
| Dynamic <sup>a</sup>                                                    |                     |                                                                                                                           |      |                   |       |      |
| Input Capacitance                                                       | C <sub>iss</sub>    | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 25 V, F = 1 MHz                                                                  |      | 2400              |       | pF   |
| Output Capacitance                                                      | C <sub>oss</sub>    |                                                                                                                           |      | 280               |       |      |
| Reverse Transfer Capacitance                                            | C <sub>rss</sub>    |                                                                                                                           |      | 180               |       |      |
| Total Gate Charge <sup>c</sup>                                          | Q <sub>g</sub>      | V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 19 A                                                    |      | 40                |       | nC   |
| Gate-Source Charge <sup>c</sup>                                         | Q <sub>gs</sub>     |                                                                                                                           |      | 10                |       |      |
| Gate-Drain Charge <sup>c</sup>                                          | Q <sub>gd</sub>     |                                                                                                                           |      | 15                |       |      |
| Gate Resistance                                                         | R <sub>g</sub>      |                                                                                                                           | 0.5  |                   | 2.9   | Ω    |
| Turn-On Delay Time <sup>c</sup>                                         | t <sub>d(on)</sub>  | V <sub>DD</sub> = 100 V, R <sub>L</sub> = 5.2 Ω<br>I <sub>D</sub> ≅ 19 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 2.5 Ω |      | 15                | 25    | ns   |
| Rise Time <sup>c</sup>                                                  | t <sub>r</sub>      |                                                                                                                           |      | 50                | 75    |      |
| Turn-Off Delay Time <sup>c</sup>                                        | t <sub>d(off)</sub> |                                                                                                                           |      | 30                | 45    |      |
| Fall Time <sup>c</sup>                                                  | t <sub>f</sub>      |                                                                                                                           |      | 60                | 90    |      |
| Source-Drain Diode Ratings and Characteristics (T <sub>C</sub> = 25 °C) |                     |                                                                                                                           |      |                   |       |      |
| Pulsed Current                                                          | I <sub>SM</sub>     |                                                                                                                           |      |                   | 50    | A    |
| Diode Forward Voltage <sup>b</sup>                                      | V <sub>SD</sub>     | I <sub>F</sub> = 19 A, V <sub>GS</sub> = 0 V                                                                              |      | 0.9               | 1.5   | V    |
| Source-Drain Reverse Recovery Time                                      | t <sub>rr</sub>     | I <sub>F</sub> = 19 A, dI/dt = 100 A/μs                                                                                   |      | 180               | 250   | ns   |

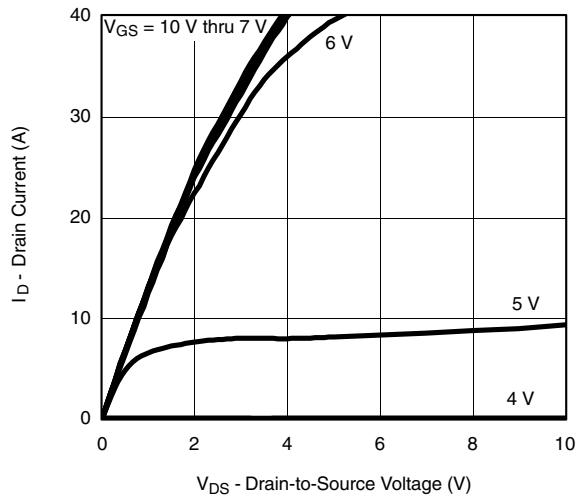
Notes:

a. Guaranteed by design, not subject to production testing.

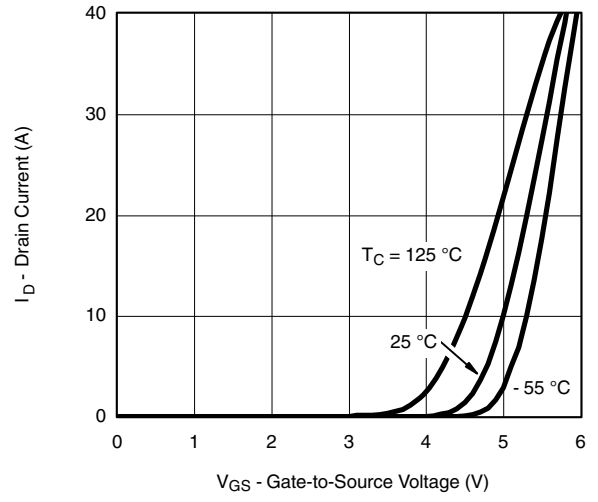
b. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

c. Independent of operating temperature.

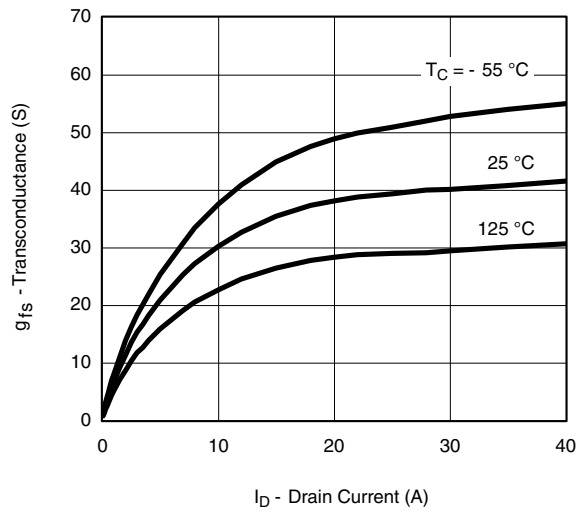
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



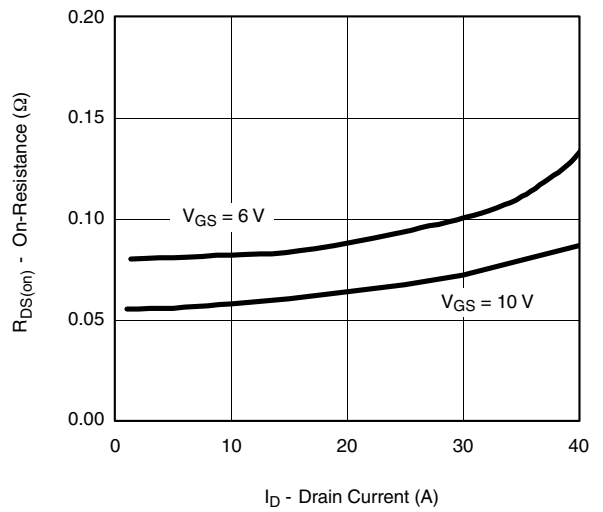
**Output Characteristics**



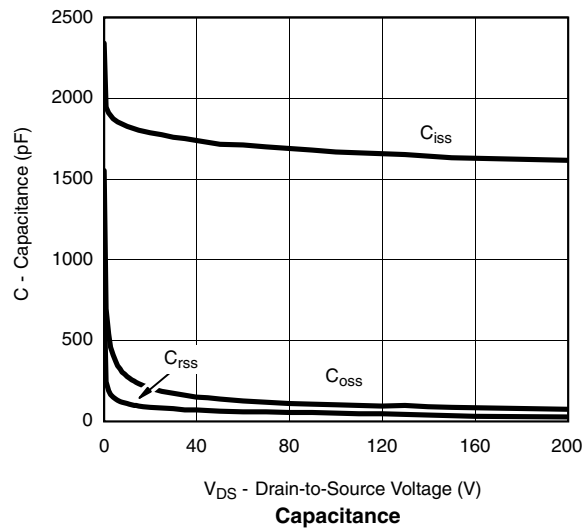
**Transfer Characteristics**



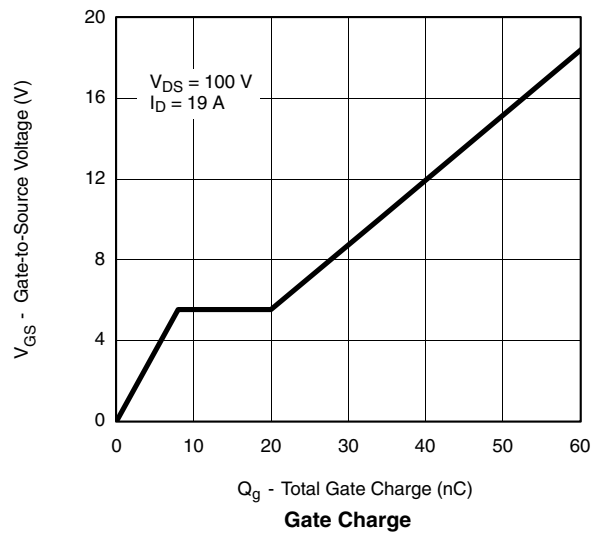
**Transconductance**



**On-Resistance vs. Drain Current**

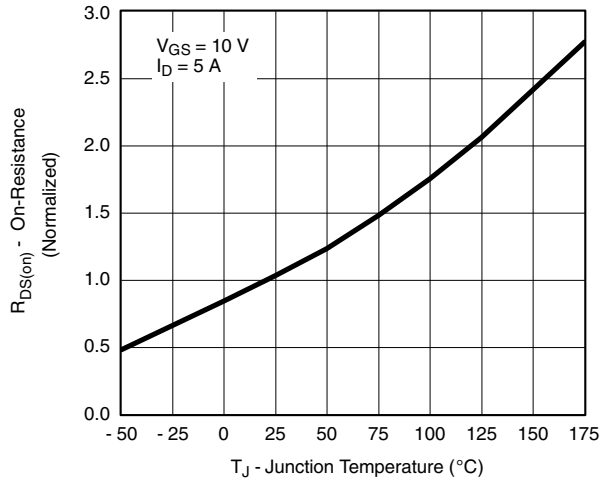


**Capacitance**

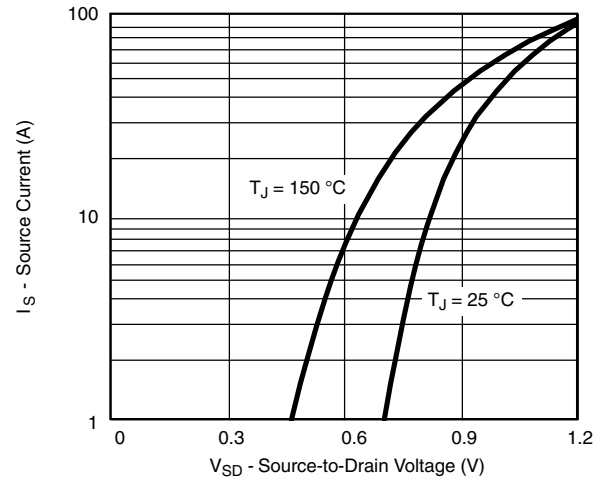


**Gate Charge**

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

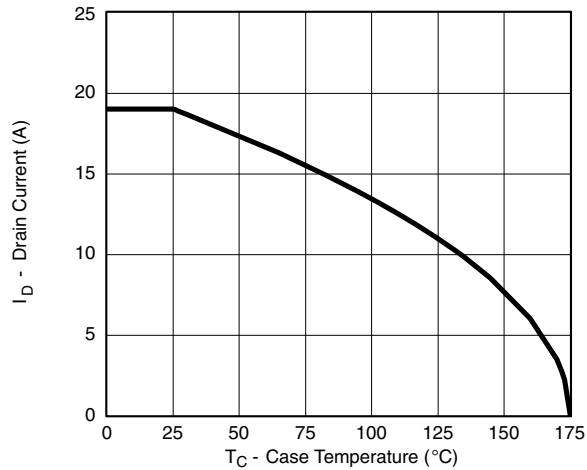


On-Resistance vs. Junction Temperature

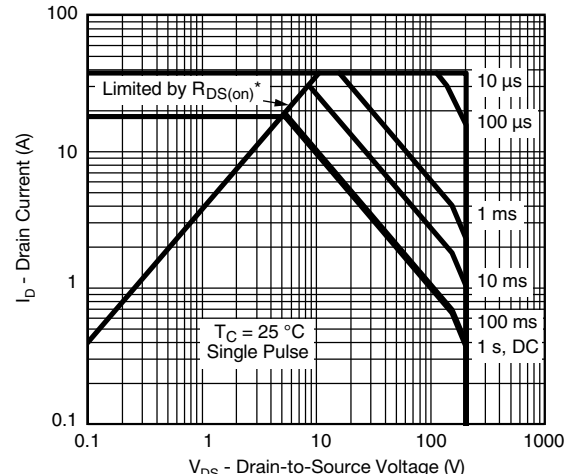


Source-Drain Diode Forward Voltage

**THERMAL RATINGS**

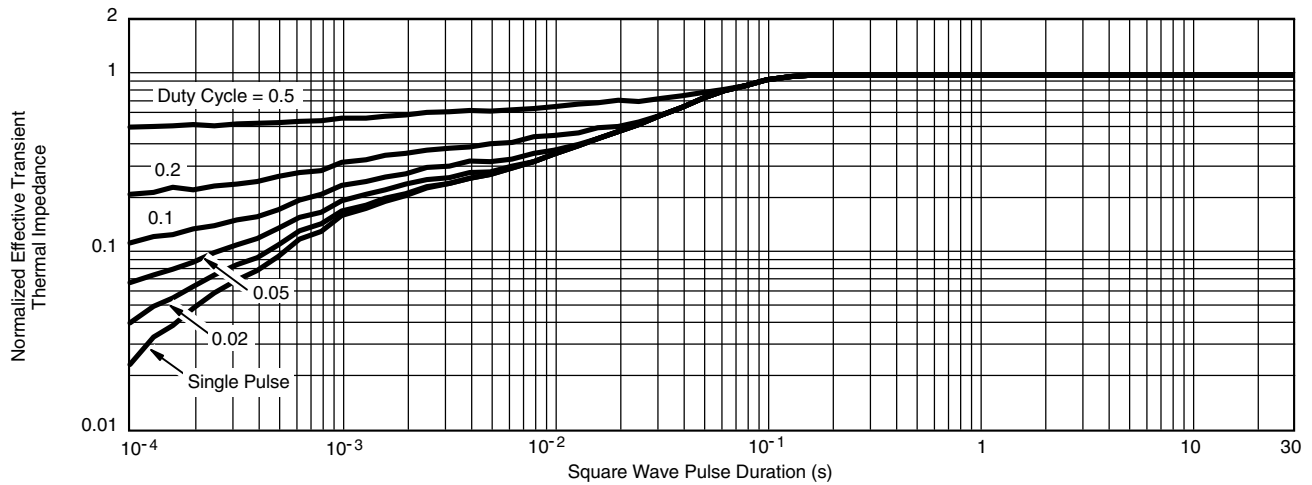


Maximum Avalanche Drain Current vs. Case Temperature



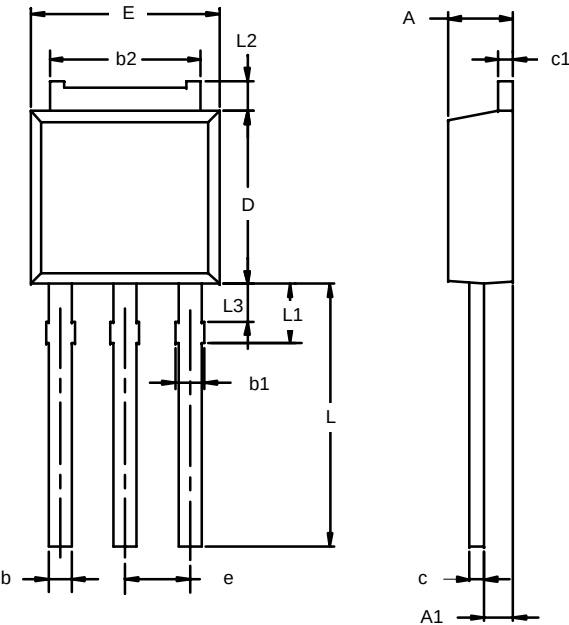
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case

TO-251AA



Note: Dimension L3 is for reference only.

| Dim | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | Min         | Max  | Min       | Max   |
| A   | 2.21        | 2.38 | 0.087     | 0.094 |
| A1  | 0.89        | 1.14 | 0.035     | 0.045 |
| b   | 0.71        | 0.89 | 0.028     | 0.035 |
| b1  | 0.76        | 1.14 | 0.030     | 0.045 |
| b2  | 5.23        | 5.43 | 0.206     | 0.214 |
| c   | 0.46        | 0.58 | 0.018     | 0.023 |
| c1  | 0.46        | 0.58 | 0.018     | 0.023 |
| D   | 5.97        | 6.22 | 0.235     | 0.245 |
| E   | 6.48        | 6.73 | 0.255     | 0.265 |
| e   | 2.28 BSC    |      | 0.090 BSC |       |
| L   | 3.89        | 9.53 | 0.153     | 0.375 |
| L1  | 1.91        | 2.28 | 0.075     | 0.090 |
| L2  | 0.89        | 1.27 | 0.035     | 0.050 |
| L3  | 1.15        | 1.52 | 0.045     | 0.060 |

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