

## VST013N10MS-VB Datasheet

### N-Channel 100-V (D-S) 175 °C MOSFET

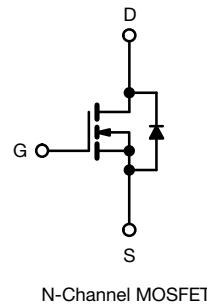
| PRODUCT SUMMARY                               |        |
|-----------------------------------------------|--------|
| $V_{DS}$ (V)                                  | 100    |
| $R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 10$ V  | 0.009  |
| $R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 4.5$ V | 0.020  |
| $I_D$ (A)                                     | 100    |
| Configuration                                 | Single |

#### FEATURES

- TrenchFET® Power MOSFET
- 175 °C Maximum Junction Temperature
- Compliant to RoHS Directive 2002/95/EC



TO-220AB



| ABSOLUTE MAXIMUM RATINGS T <sub>A</sub> = 25 °C, unless otherwise noted |                                              |                                   |                  |      |
|-------------------------------------------------------------------------|----------------------------------------------|-----------------------------------|------------------|------|
| Parameter                                                               |                                              | Symbol                            | Limit            | Unit |
| Drain-Source Voltage                                                    |                                              | V <sub>DS</sub>                   | 100              | V    |
| Gate-Source Voltage                                                     |                                              | V <sub>GS</sub>                   | ± 20             |      |
| Continuous Drain Current (T <sub>J</sub> = 150 °C)                      | T <sub>C</sub> = 25 °C                       | I <sub>D</sub>                    | 100              | A    |
|                                                                         | T <sub>C</sub> = 125 °C                      |                                   | 75 <sup>a</sup>  |      |
| Pulsed Drain Current                                                    |                                              | I <sub>DM</sub>                   | 300              |      |
| Avalanche Current                                                       | L = 0.1 mH                                   | I <sub>AS</sub>                   | 75               |      |
| Single Pulse Avalanche Energy <sup>b</sup>                              |                                              | E <sub>AS</sub>                   | 280              |      |
| Maximum Power Dissipation <sup>b</sup>                                  | T <sub>C</sub> = 25 °C (TO-220AB and TO-263) | P <sub>D</sub>                    | 250 <sup>c</sup> | W    |
|                                                                         | T <sub>A</sub> = 25 °C (TO-263) <sup>d</sup> |                                   | 3.75             |      |
| Operating Junction and Storage Temperature Range                        |                                              | T <sub>J</sub> , T <sub>stg</sub> | - 55 to 175      | °C   |

| THERMAL RESISTANCE RATINGS |                                 |                   |       |      |
|----------------------------|---------------------------------|-------------------|-------|------|
| Parameter                  |                                 | Symbol            | Limit | Unit |
| Junction-to-Ambient        | PCB Mount (TO-263) <sup>d</sup> | R <sub>thJA</sub> | 40    | °C/W |
|                            | Free Air (TO-220AB)             |                   | 62.5  |      |
| Junction-to-Case           |                                 | R <sub>thJC</sub> | 0.6   |      |

Notes:

- a. Pulse test; pulse width  $\leq 300$   $\mu$ s, duty cycle  $\leq 2$  %.
- b. Guaranteed by design, not subject to production testing.
- c. Independent of operating temperature.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

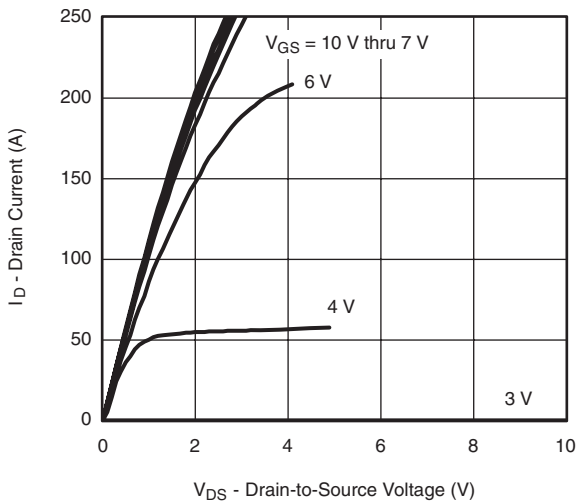
| SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted                     |               |                                                                                                                            |      |       |           |               |
|------------------------------------------------------------------------------------------------|---------------|----------------------------------------------------------------------------------------------------------------------------|------|-------|-----------|---------------|
| Parameter                                                                                      | Symbol        | Test Conditions                                                                                                            | Min. | Typ.  | Max.      | Unit          |
| Static                                                                                         |               |                                                                                                                            |      |       |           |               |
| Drain-Source Breakdown Voltage                                                                 | $V_{DS}$      | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$                                                                        | 100  |       |           | V             |
| Gate-Threshold Voltage                                                                         | $V_{GS(th)}$  | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$                                                                            | 2    |       | 4         |               |
| Gate-Body Leakage                                                                              | $I_{GSS}$     | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$                                                                            |      |       | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current                                                                | $I_{DSS}$     | $V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$                                                                               |      |       | 1         | $\mu\text{A}$ |
|                                                                                                |               | $V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^{\circ}\text{C}$                                            |      |       | 50        |               |
|                                                                                                |               | $V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}, T_J = 175\text{ }^{\circ}\text{C}$                                            |      |       | 250       |               |
| On-State Drain Current <sup>a</sup>                                                            | $I_{D(on)}$   | $V_{DS} = \geq 5\text{ V}, V_{GS} = 10\text{ V}$                                                                           | 120  |       |           | A             |
| Drain-Source On-State Resistance <sup>a</sup>                                                  | $R_{DS(on)}$  | $V_{GS} = 10\text{ V}, I_D = 30\text{ A}$                                                                                  |      | 0.009 |           | $\Omega$      |
|                                                                                                |               | $V_{GS} = 4.5\text{ V}, I_D = 20\text{ A}$                                                                                 |      | 0.020 |           |               |
|                                                                                                |               | $V_{GS} = 10\text{ V}, I_D = 30\text{ A}, T_J = 125\text{ }^{\circ}\text{C}$                                               |      | 0.023 |           |               |
|                                                                                                |               | $V_{GS} = 10\text{ V}, I_D = 30\text{ A}, T_J = 175\text{ }^{\circ}\text{C}$                                               |      | 0.030 |           |               |
| Forward Transconductance <sup>a</sup>                                                          | $g_{fs}$      | $V_{DS} = 15\text{ V}, I_D = 30\text{ A}$                                                                                  | 25   |       |           | S             |
| Dynamic <sup>b</sup>                                                                           |               |                                                                                                                            |      |       |           |               |
| Input Capacitance                                                                              | $C_{iss}$     | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$                                                              |      | 4700  |           | pF            |
| Output Capacitance                                                                             | $C_{oss}$     |                                                                                                                            |      | 665   |           |               |
| Reverse Transfer Capacitance                                                                   | $C_{rss}$     |                                                                                                                            |      | 265   |           |               |
| Total Gate Charge <sup>c</sup>                                                                 | $Q_g$         | $V_{DS} = 50\text{ V}, V_{GS} = 10\text{ V}, I_D = 85\text{ A}$                                                            |      | 105   | 160       | nC            |
| Gate-Source Charge <sup>c</sup>                                                                | $Q_{gs}$      |                                                                                                                            |      | 17    |           |               |
| Gate-Drain Charge <sup>c</sup>                                                                 | $Q_{gd}$      |                                                                                                                            |      | 23    |           |               |
| Turn-On Delay Time <sup>c</sup>                                                                | $t_{d(on)}$   | $V_{DD} = 50\text{ V}, R_L = 0.6\text{ }\Omega$<br>$I_D \cong 85\text{ A}, V_{GEN} = 10\text{ V}, R_g = 2.5\text{ }\Omega$ |      | 12    | 25        | ns            |
| Rise Time <sup>c</sup>                                                                         | $t_r$         |                                                                                                                            |      | 90    | 135       |               |
| Turn-Off DelayTime <sup>c</sup>                                                                | $t_{d(off)}$  |                                                                                                                            |      | 55    | 85        |               |
| Fall Time <sup>c</sup>                                                                         | $t_f$         |                                                                                                                            |      | 130   | 195       |               |
| Source-Drain Diode Ratings and Characteristics $T_C = 25\text{ }^{\circ}\text{C}$ <sup>b</sup> |               |                                                                                                                            |      |       |           |               |
| Continuous Current                                                                             | $I_S$         |                                                                                                                            |      |       | 85        | A             |
| Pulsed Current                                                                                 | $I_{SM}$      |                                                                                                                            |      |       | 240       |               |
| Forward Voltage <sup>a</sup>                                                                   | $V_{SD}$      | $I_F = 85\text{ A}, V_{GS} = 0\text{ V}$                                                                                   |      | 1.0   | 1.5       | V             |
| Reverse Recovery Time                                                                          | $t_{rr}$      | $I_F = 50\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$                                                                      |      | 85    | 140       | ns            |
| Peak Reverse Recovery Current                                                                  | $I_{RM(REC)}$ |                                                                                                                            |      | 4.5   | 7         | A             |
| Reverse Recovery Charge                                                                        | $Q_{rr}$      |                                                                                                                            |      | 0.17  | 0.35      | $\mu\text{C}$ |

Notes:

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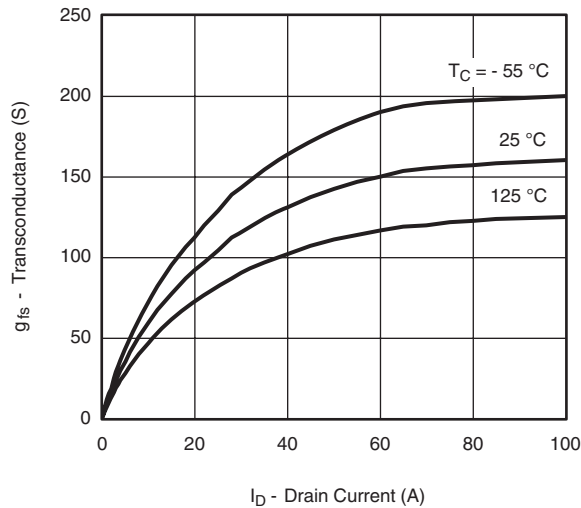
**TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted



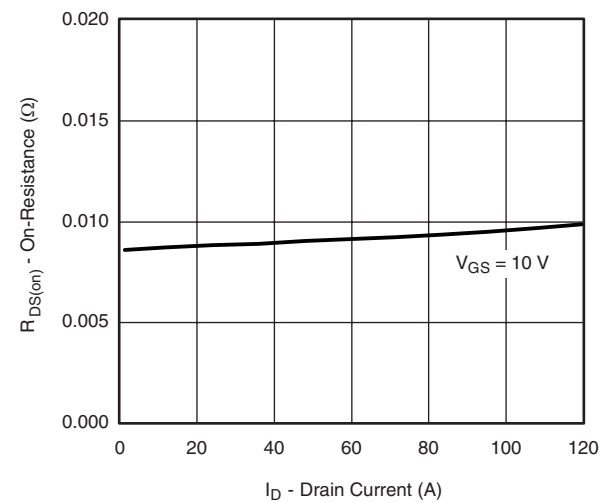
**Output Characteristics**



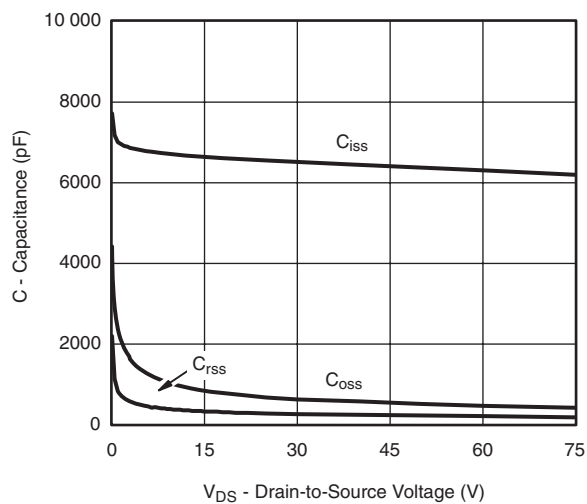
**Transfer Characteristics**



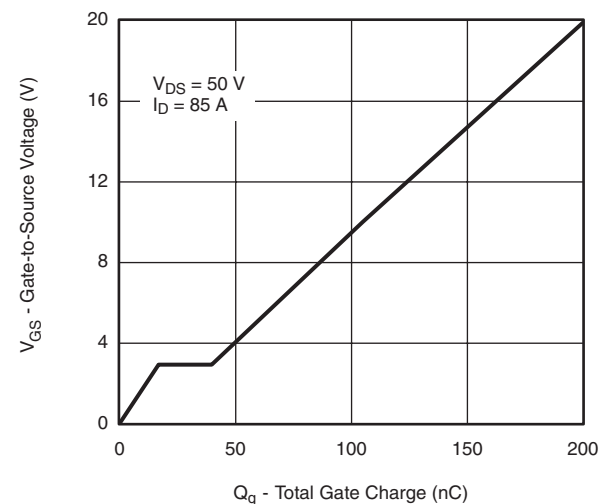
**Transconductance**



**On-Resistance vs. Drain Current**



**Capacitance**

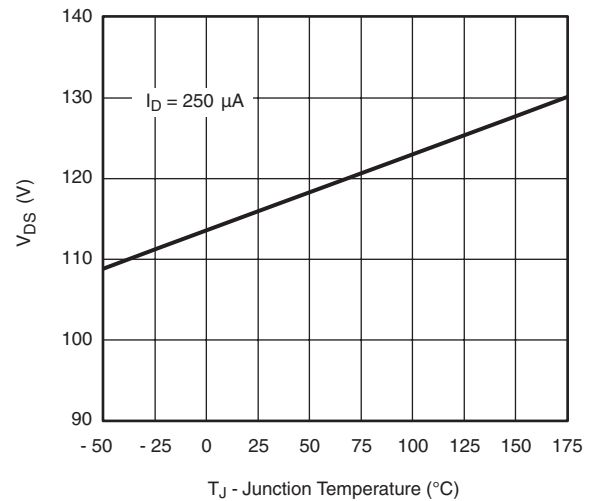


**Gate Charge**

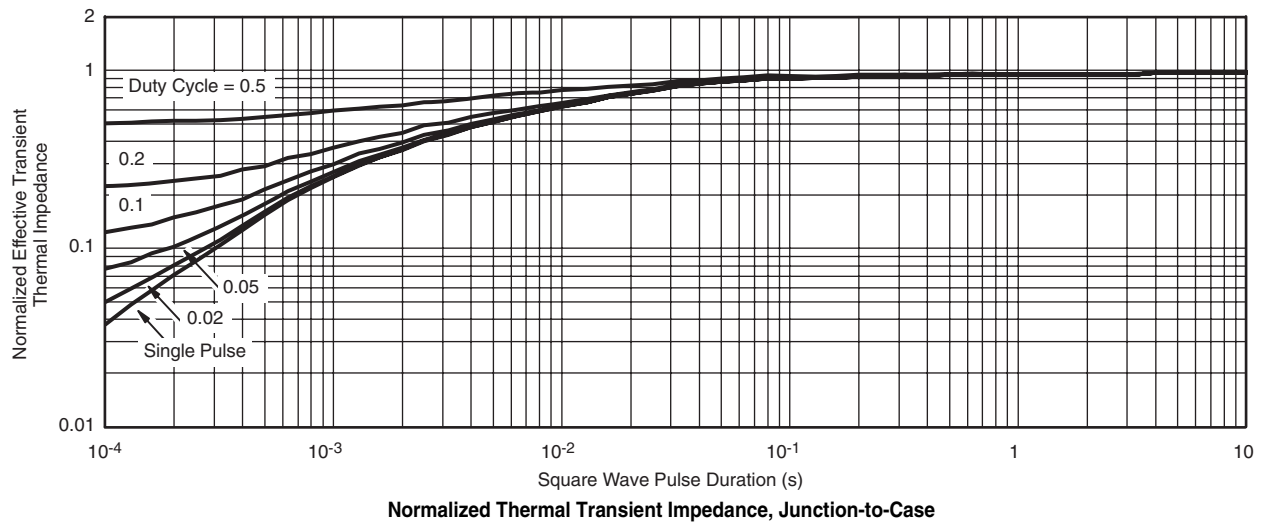
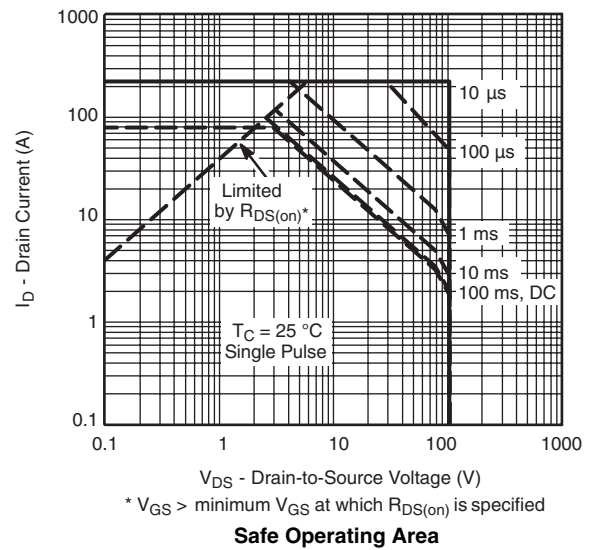
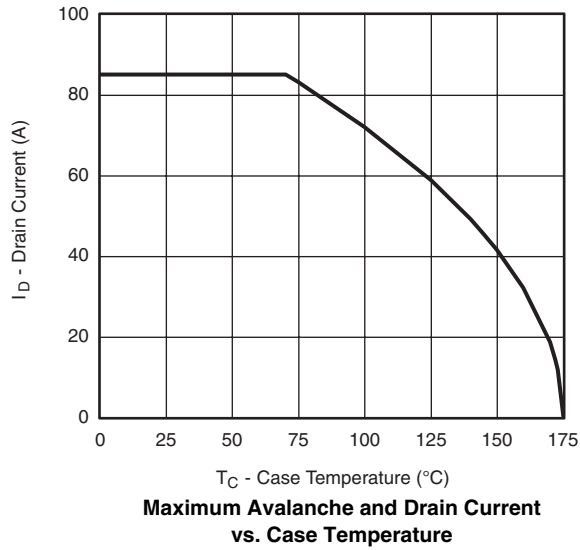
**TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted

**On-Resistance vs. Junction Temperature**

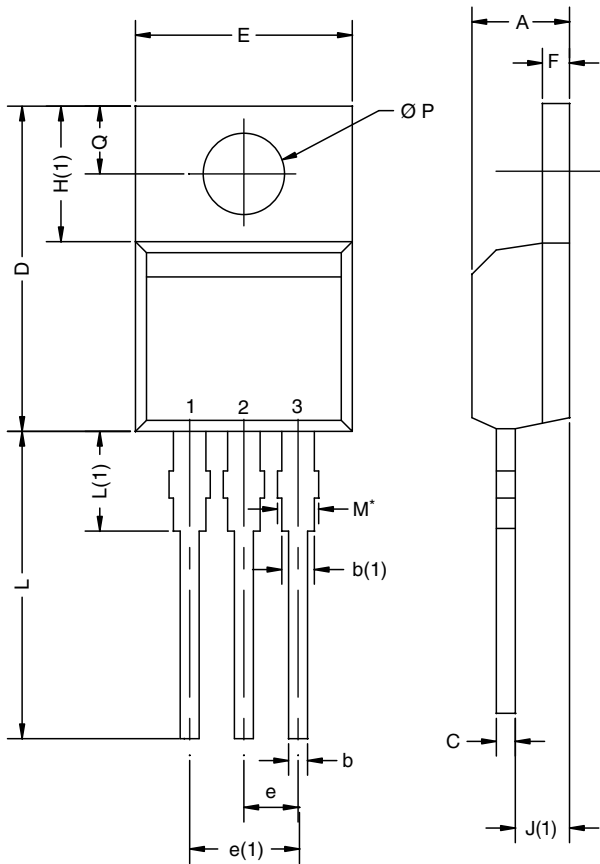
**Source-Drain Diode Forward Voltage**

**Avalanche Current vs. Time**

 **$T_J$  - Drain-Source Breakdown vs. Junction-Temperature**

## THERMAL RATINGS



## TO-220AB



| DIM. | MILLIMETERS |       | INCHES |       |
|------|-------------|-------|--------|-------|
|      | MIN.        | MAX.  | MIN.   | MAX.  |
| A    | 4.25        | 4.65  | 0.167  | 0.183 |
| b    | 0.69        | 1.01  | 0.027  | 0.040 |
| b(1) | 1.20        | 1.73  | 0.047  | 0.068 |
| c    | 0.36        | 0.61  | 0.014  | 0.024 |
| D    | 14.85       | 15.49 | 0.585  | 0.610 |
| D2   | 12.19       | 12.70 | 0.480  | 0.500 |
| E    | 10.04       | 10.51 | 0.395  | 0.414 |
| e    | 2.41        | 2.67  | 0.095  | 0.105 |
| e(1) | 4.88        | 5.28  | 0.192  | 0.208 |
| F    | 1.14        | 1.40  | 0.045  | 0.055 |
| H(1) | 6.09        | 6.48  | 0.240  | 0.255 |
| J(1) | 2.41        | 2.92  | 0.095  | 0.115 |
| L    | 13.35       | 14.02 | 0.526  | 0.552 |
| L(1) | 3.32        | 3.82  | 0.131  | 0.150 |
| Ø P  | 3.54        | 3.94  | 0.139  | 0.155 |
| Q    | 2.60        | 3.00  | 0.102  | 0.118 |

ECN: T14-0413-Rev. P, 16-Jun-14  
DWG: 5471

**Note**

\* M = 1.32 mm to 1.62 mm (dimension including protrusion)  
Heatsink hole for HVM

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