

## Description

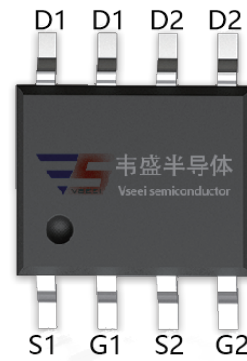
The VSM3DN10 uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

## General Features

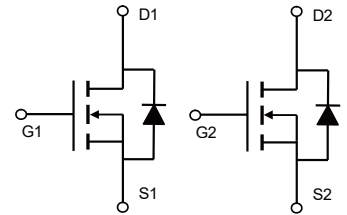
- $V_{DS}=100V, I_D=3A$   
 $R_{DS(ON)} < 110m\Omega @ V_{GS}=10V$   
 $R_{DS(ON)} < 120m\Omega @ V_{GS}=4.5V$
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current

## Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply



SOP-8



Schematic

## Package Marking and Ordering Information

| Device Marking | Device      | Device Package | Reel Size | Tape width | Quantity   |
|----------------|-------------|----------------|-----------|------------|------------|
| VSM3DN10       | VSM3DN10-S8 | SOP-8          | Ø330mm    | 12mm       | 4000 units |

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

| Parameter                                        | Symbol              | Limit      | Unit        |
|--------------------------------------------------|---------------------|------------|-------------|
| Drain-Source Voltage                             | $V_{DS}$            | 100        | V           |
| Gate-Source Voltage                              | $V_{GS}$            | $\pm 20$   | V           |
| Drain Current-Continuous                         | $I_D$               | 3          | A           |
| Drain Current-Continuous( $T_C=100^{\circ}C$ )   | $I_D(100^{\circ}C)$ | 2.1        | A           |
| Pulsed Drain Current <sup>(Note 1)</sup>         | $I_{DM}$            | 12         | A           |
| Maximum Power Dissipation                        | $P_D$               | 2          | W           |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$      | -55 To 150 | $^{\circ}C$ |

## Thermal Characteristic

| Parameter                                                   | Symbol          | Typ  | Max | Unit          |
|-------------------------------------------------------------|-----------------|------|-----|---------------|
| Thermal Resistance, Junction-to-Ambient <sup>(Note 2)</sup> | $R_{\theta JA}$ | 62.5 | 85  | $^{\circ}C/W$ |

**Electrical Characteristics ( $T_A=25^{\circ}\text{C}$  unless otherwise noted)**

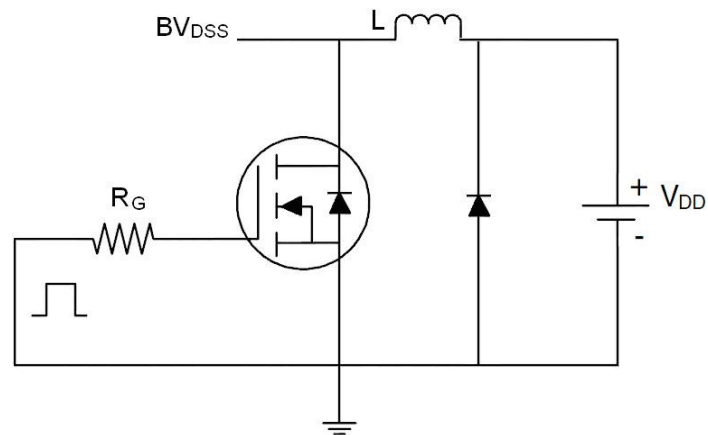
| Parameter                          | Symbol       | Condition                                                            | Min | Typ  | Max       | Unit       |
|------------------------------------|--------------|----------------------------------------------------------------------|-----|------|-----------|------------|
| Off Characteristics                |              |                                                                      |     |      |           |            |
| Drain-Source Breakdown Voltage     | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$                                            | 100 | 110  | -         | V          |
| Zero Gate Voltage Drain Current    | $I_{DSS}$    | $V_{DS}=100V, V_{GS}=0V$                                             | -   | -    | 1         | $\mu A$    |
| Gate-Body Leakage Current          | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$                                          | -   | -    | $\pm 100$ | nA         |
| On Characteristics (Note 3)        |              |                                                                      |     |      |           |            |
| Gate Threshold Voltage             | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$                                        | 1.0 | 1.5  | 2.0       | V          |
| Drain-Source On-State Resistance   | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=3A$                                                 | -   | -    | 110       | m $\Omega$ |
|                                    |              | $V_{GS}=4.5V, I_D=3A$                                                | -   | -    | 120       |            |
| Forward Transconductance           | $g_{FS}$     | $V_{DS}=5V, I_D=3A$                                                  | 3.5 | -    | -         | S          |
| Dynamic Characteristics (Note4)    |              |                                                                      |     |      |           |            |
| Input Capacitance                  | $C_{iss}$    | $V_{DS}=50V, V_{GS}=0V,$<br>$F=1.0MHz$                               | -   | 714  | -         | PF         |
| Output Capacitance                 | $C_{oss}$    |                                                                      | -   | 32   | -         | PF         |
| Reverse Transfer Capacitance       | $C_{rss}$    |                                                                      | -   | 27   | -         | PF         |
| Switching Characteristics (Note 4) |              |                                                                      |     |      |           |            |
| Turn-on Delay Time                 | $t_{d(on)}$  | $V_{DD}=50V, R_L=15\Omega$<br>$V_{GS}=10V, R_G=2.5\Omega$            | -   | 11   | -         | nS         |
| Turn-on Rise Time                  | $t_r$        |                                                                      | -   | 7.4  | -         | nS         |
| Turn-Off Delay Time                | $t_{d(off)}$ |                                                                      | -   | 35   | -         | nS         |
| Turn-Off Fall Time                 | $t_f$        |                                                                      | -   | 9.1  | -         | nS         |
| Total Gate Charge                  | $Q_g$        | $V_{DS}=50V, I_D=3A,$<br>$V_{GS}=10V$                                | -   | 21.8 | -         | nC         |
| Gate-Source Charge                 | $Q_{gs}$     |                                                                      | -   | 2.7  | -         | nC         |
| Gate-Drain Charge                  | $Q_{gd}$     |                                                                      | -   | 5    | -         | nC         |
| Drain-Source Diode Characteristics |              |                                                                      |     |      |           |            |
| Diode Forward Voltage (Note 3)     | $V_{SD}$     | $V_{GS}=0V, I_S=3A$                                                  | -   | -    | 1.2       | V          |
| Diode Forward Current (Note 2)     | $I_S$        |                                                                      | -   | -    | 3         | A          |
| Reverse Recovery Time              | $t_{rr}$     | $T_J = 25^{\circ}C, I_F = 3A$<br>$di/dt = 100A/\mu s^{(Note3)}$      | -   | 26   |           | nS         |
| Reverse Recovery Charge            | $Q_{rr}$     |                                                                      | -   | 27   |           | nC         |
| Forward Turn-On Time               | $t_{on}$     | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) |     |      |           |            |

**Notes:**

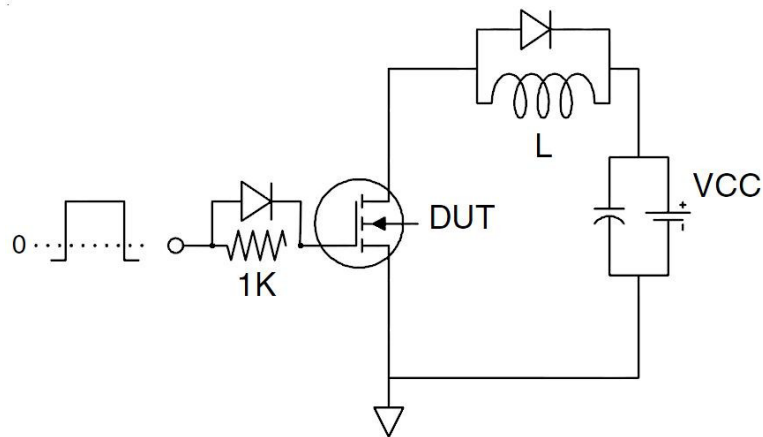
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. The value of  $R_{\theta JA}$  is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^{\circ}\text{C}$ . The value in any given application depends on the user's specific board design. Surface Mounted on FR4 Board,  $t \leq 10$  sec. The current rating is based on the  $t \leq 10$ s thermal resistance rating.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production.

## Test Circuit

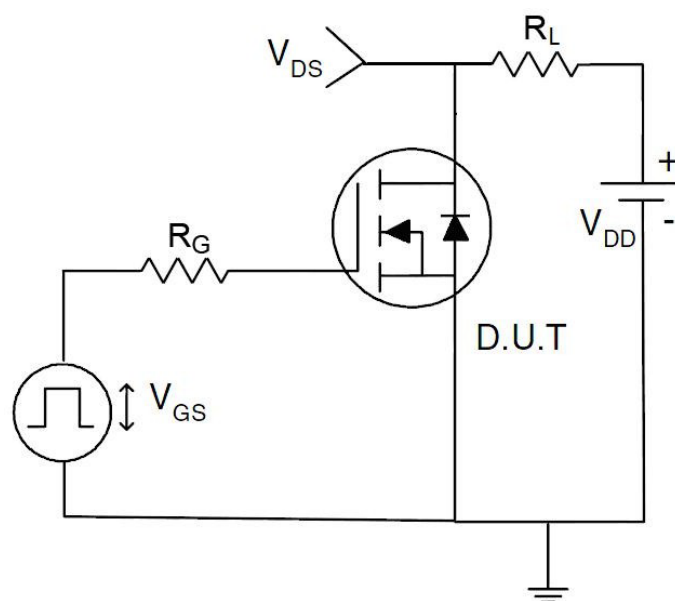
### 1) $E_{AS}$ Test Circuits



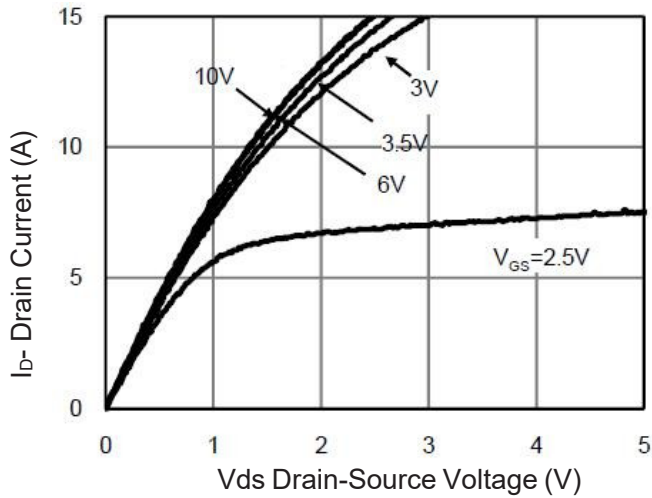
### 2) Gate Charge Test Circuit:



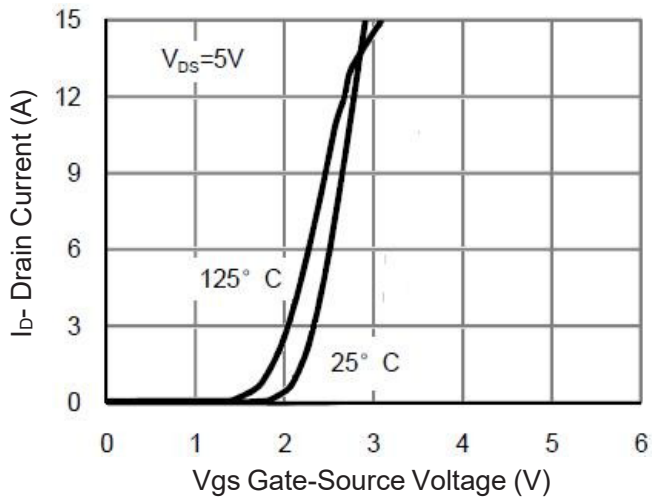
### 3) Switch Time Test Circuit:



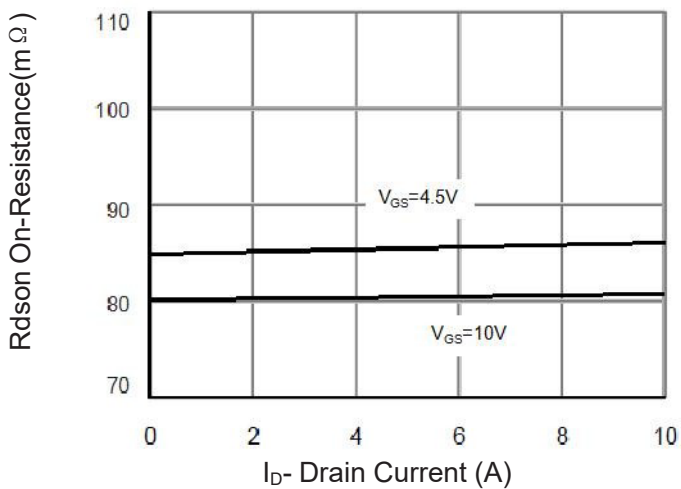
## N-channel Typical Electrical and Thermal Characteristics (Curves)



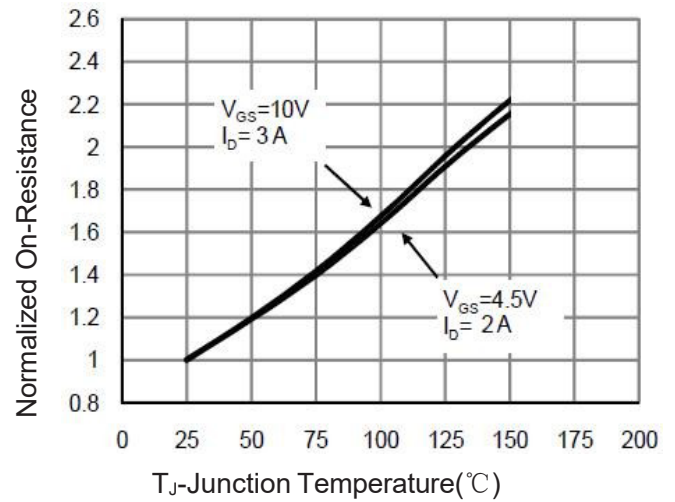
**Figure 1 Output Characteristics**



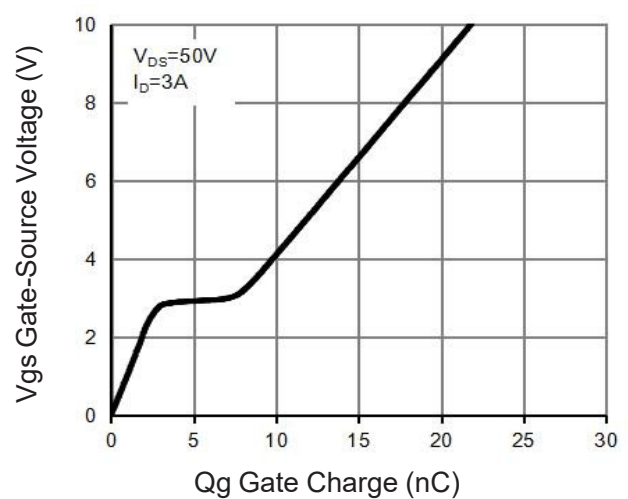
**Figure 2 Transfer Characteristics**



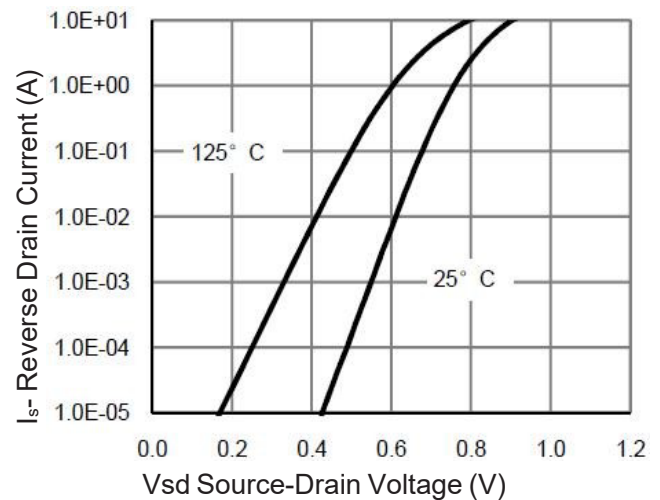
**Figure 3 Rdson- Drain Current**



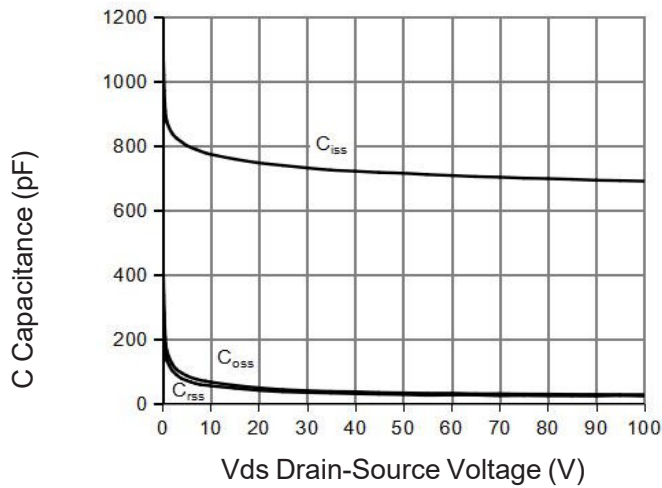
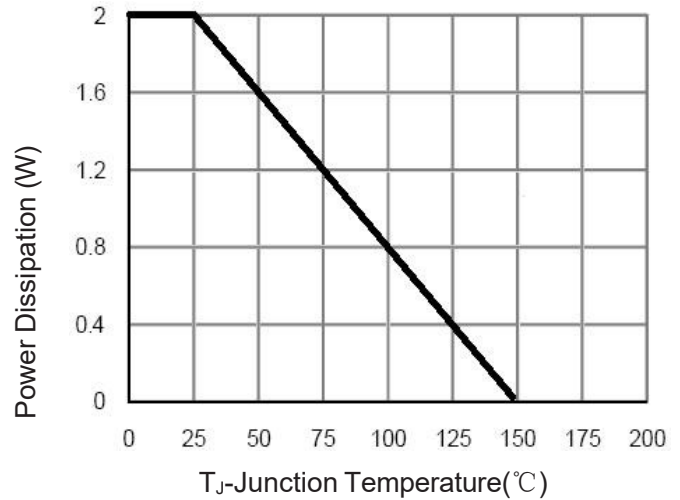
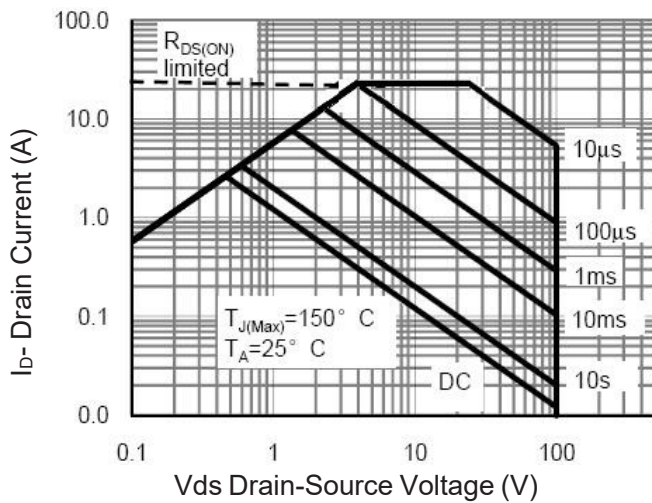
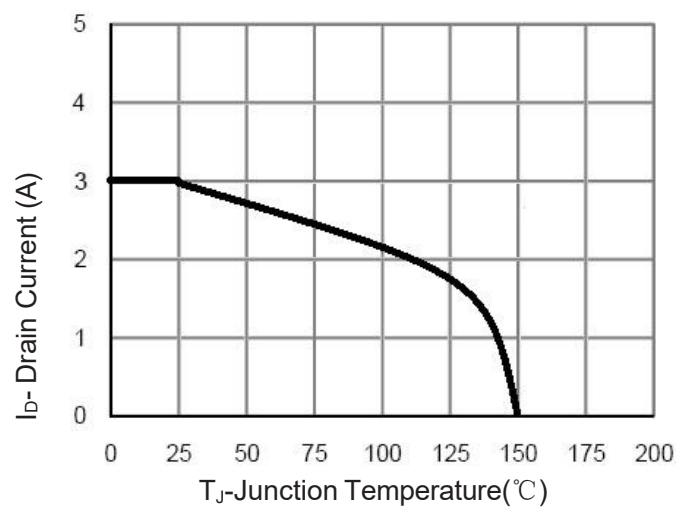
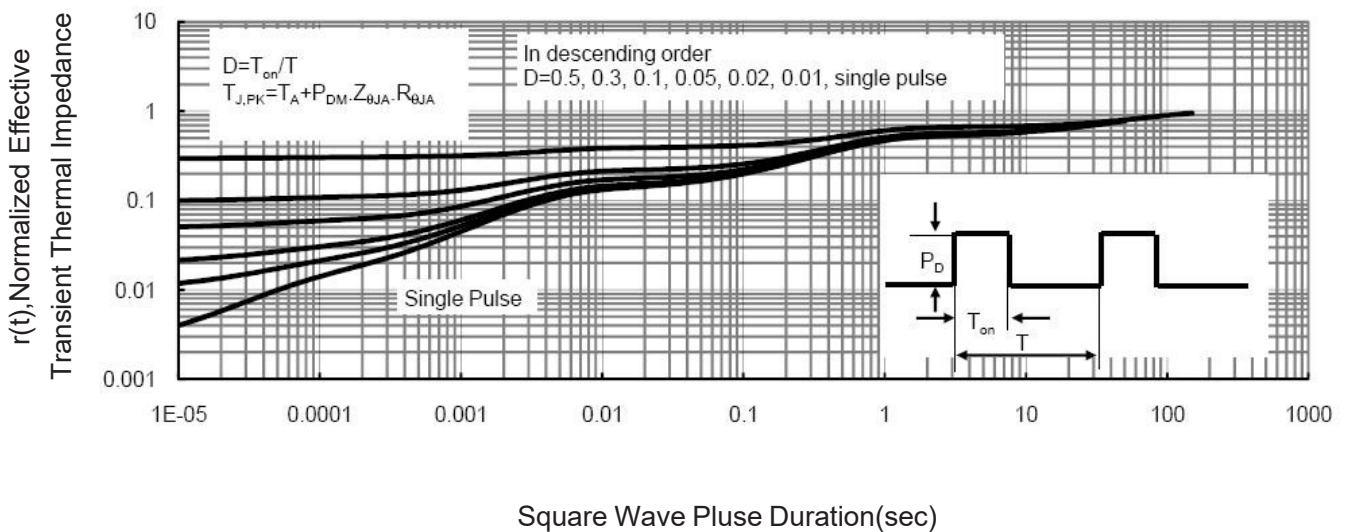
**Figure 4 Rdson-Junction Temperature**



**Figure 5 Gate Charge**



**Figure 6 Source- Drain Diode Forward**


**Figure 7 Capacitance vs Vds**

**Figure 9 Power De-rating**

**Figure 8 Safe Operation Area**

**Figure 10 Current De-rating**

**Figure 11 Normalized Maximum Transient Thermal Impedance**