

## Description

The VSM150N06 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

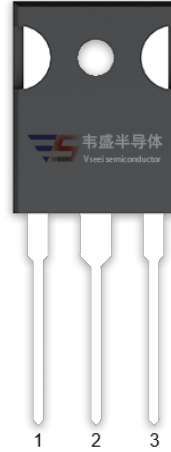
- $V_{DS} = 60V, I_D = 150A$   
 $R_{DS(ON)} < 3.1m\Omega @ V_{GS} = 10V$
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

## Application

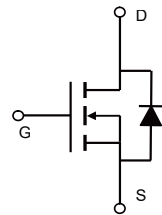
- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply

**100% UIS TESTED!**

**100%  $\Delta V_{ds}$  TESTED!**



TO-247



Schematic

## Package Marking and Ordering Information

| Device Marking | Device       | Device Package | Reel Size | Tape width | Quantity |
|----------------|--------------|----------------|-----------|------------|----------|
| VSM150N06      | VSM150N06-T7 | TO-247         | -         | -          | -        |

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

| Parameter                                         | Symbol              | Limit      | Unit          |
|---------------------------------------------------|---------------------|------------|---------------|
| Drain-Source Voltage                              | $V_{DS}$            | 60         | V             |
| Gate-Source Voltage                               | $V_{GS}$            | $\pm 20$   | V             |
| Drain Current-Continuous                          | $I_D$               | 150        | A             |
| Drain Current-Continuous( $T_c = 100^\circ C$ )   | $I_D (100^\circ C)$ | 105        | A             |
| Pulsed Drain Current                              | $I_{DM}$            | 600        | A             |
| Maximum Power Dissipation <sup>(Note 1)</sup>     | $P_D$               | 220        | W             |
| Derating factor                                   |                     | 1.47       | W/ $^\circ C$ |
| Single pulse avalanche energy <sup>(Note 5)</sup> | $E_{AS}$            | 1950       | mJ            |
| Operating Junction and Storage Temperature Range  | $T_J, T_{STG}$      | -55 To 175 | $^\circ C$    |

## Thermal Characteristic

|                                                          |                 |      |                      |
|----------------------------------------------------------|-----------------|------|----------------------|
| Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup> | $R_{\theta JC}$ | 0.68 | $^{\circ}\text{C/W}$ |
|----------------------------------------------------------|-----------------|------|----------------------|

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

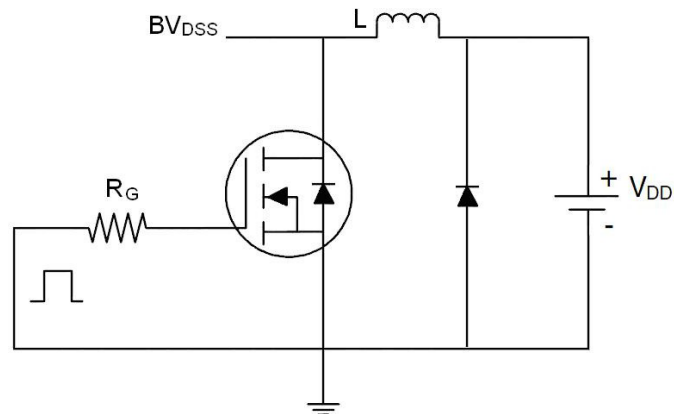
| Parameter                                         | Symbol              | Condition                                                                                | Min | Typ  | Max  | Unit |
|---------------------------------------------------|---------------------|------------------------------------------------------------------------------------------|-----|------|------|------|
| Off Characteristics                               |                     |                                                                                          |     |      |      |      |
| Drain-Source Breakdown Voltage                    | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                                | 60  |      | -    | V    |
| Zero Gate Voltage Drain Current                   | I <sub>DSS</sub>    | V <sub>DS</sub> =60V, V <sub>GS</sub> =0V                                                | -   | -    | 1    | μA   |
| Gate-Body Leakage Current                         | I <sub>GSS</sub>    | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                               | -   | -    | ±100 | nA   |
| On Characteristics <small>(Note 3)</small>        |                     |                                                                                          |     |      |      |      |
| Gate Threshold Voltage                            | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                 | 1.3 | 1.7  | 2.1  | V    |
| Drain-Source On-State Resistance                  | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =75A                                                | -   | 2.8  | 3.1  | mΩ   |
| Forward Transconductance                          | g <sub>FS</sub>     | V <sub>DS</sub> =10V, I <sub>D</sub> =75A                                                | -   | 75   | -    | S    |
| Dynamic Characteristics <small>(Note4)</small>    |                     |                                                                                          |     |      |      |      |
| Input Capacitance                                 | C <sub>iss</sub>    | V <sub>DS</sub> =30V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                   | -   | 8730 | -    | PF   |
| Output Capacitance                                | C <sub>oss</sub>    |                                                                                          | -   | 625  | -    | PF   |
| Reverse Transfer Capacitance                      | C <sub>rss</sub>    |                                                                                          | -   | 599  | -    | PF   |
| Switching Characteristics <small>(Note 4)</small> |                     |                                                                                          |     |      |      |      |
| Turn-on Delay Time                                | t <sub>d(on)</sub>  | V <sub>DD</sub> =30V, R <sub>L</sub> =0.4Ω<br>V <sub>GS</sub> =10V, R <sub>G</sub> =2.5Ω | -   | 23   | -    | nS   |
| Turn-on Rise Time                                 | t <sub>r</sub>      |                                                                                          | -   | 40   | -    | nS   |
| Turn-Off Delay Time                               | t <sub>d(off)</sub> |                                                                                          | -   | 120  | -    | nS   |
| Turn-Off Fall Time                                | t <sub>f</sub>      |                                                                                          | -   | 33   | -    | nS   |
| Total Gate Charge                                 | Q <sub>g</sub>      | V <sub>DS</sub> =30V, I <sub>D</sub> =75A,<br>V <sub>GS</sub> =10V                       | -   | 184  |      | nC   |
| Gate-Source Charge                                | Q <sub>gs</sub>     |                                                                                          | -   | 28   |      | nC   |
| Gate-Drain Charge                                 | Q <sub>gd</sub>     |                                                                                          | -   | 40   |      | nC   |
| Drain-Source Diode Characteristics                |                     |                                                                                          |     |      |      |      |
| Diode Forward Voltage <small>(Note 3)</small>     | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =75A                                                 | -   |      | 1.2  | V    |
| Diode Forward Current <small>(Note 2)</small>     | I <sub>S</sub>      |                                                                                          | -   | -    | 150  | A    |
| Reverse Recovery Time                             | t <sub>rr</sub>     | TJ = 25°C, IF = 75A                                                                      | -   | 54   |      | nS   |
| Reverse Recovery Charge                           | Q <sub>rr</sub>     | di/dt = 100A/μs <sup>(Note3)</sup>                                                       | -   | 110  |      | nC   |
| Forward Turn-On Time                              | t <sub>on</sub>     | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)                     |     |      |      |      |

**Notes:**

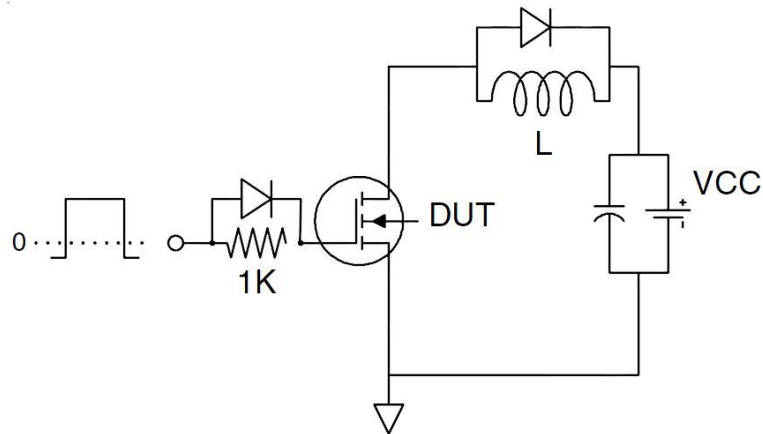
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition:  $T_J=25^{\circ}\text{C}, V_{DD}=30V, V_G=10V, L=0.5mH, R_g=25\Omega$

## Test circuit

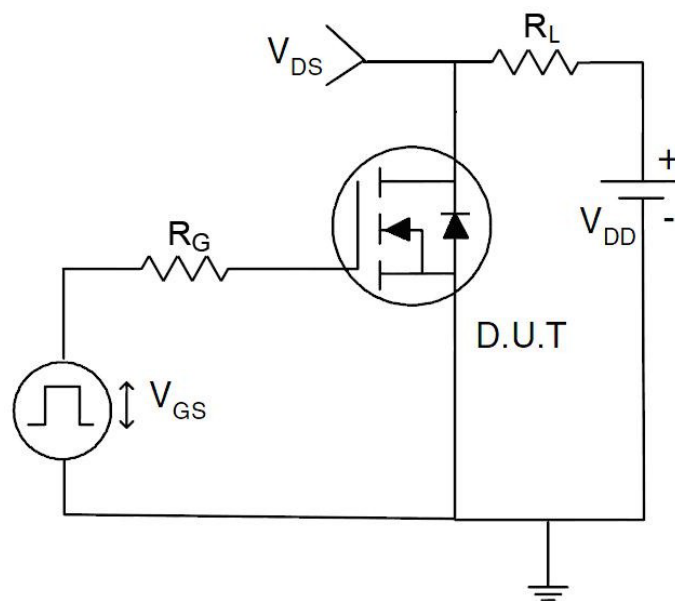
### 1) $E_{AS}$ test Circuits



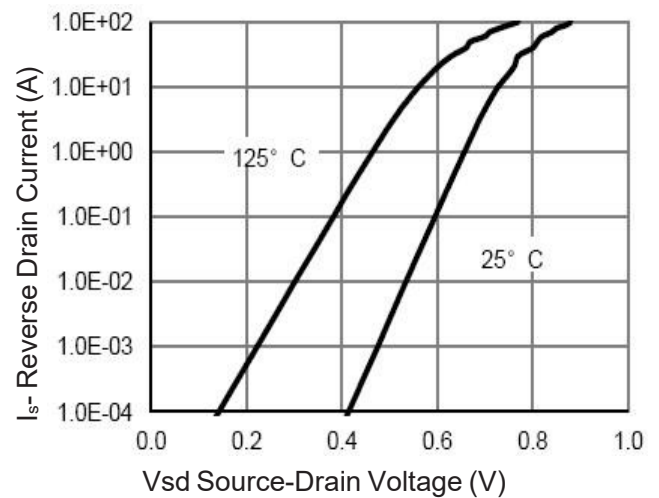
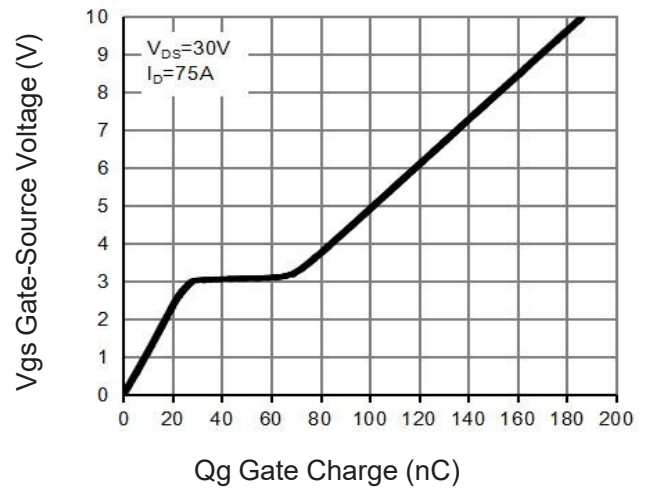
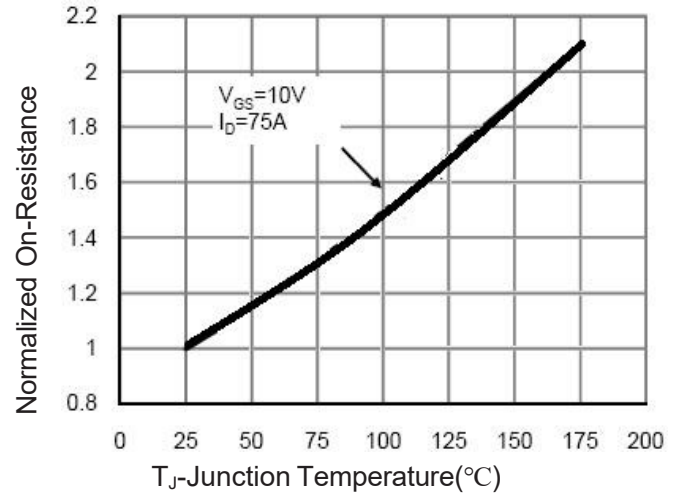
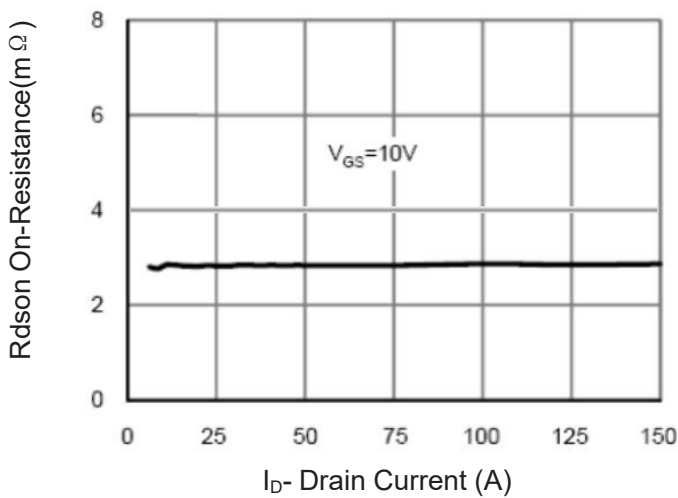
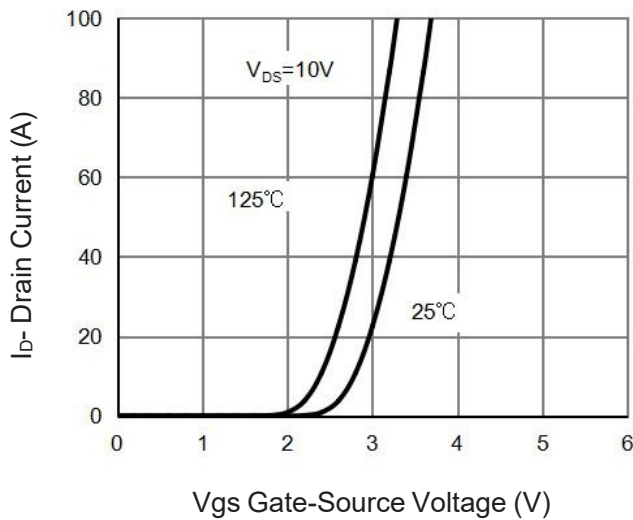
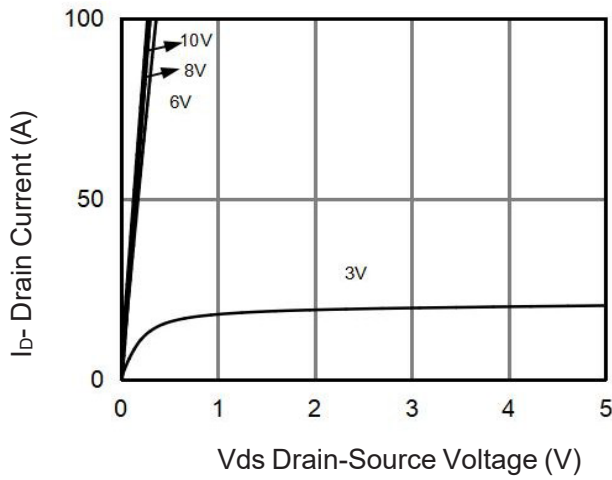
### 2) Gate charge test Circuit:

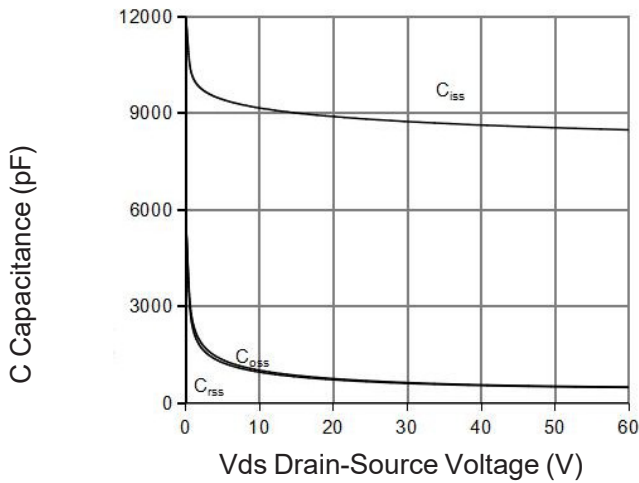
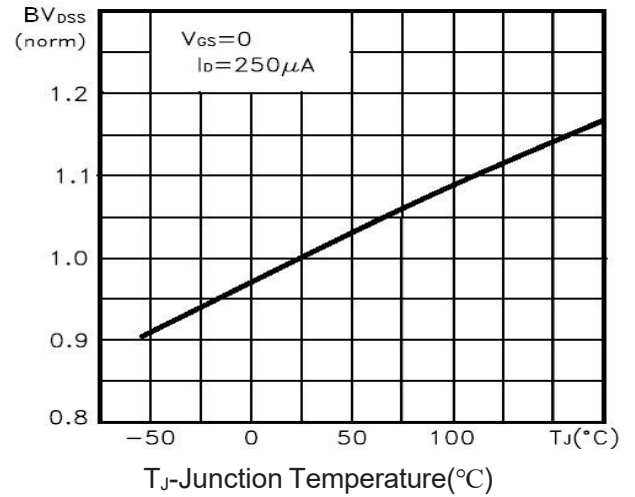
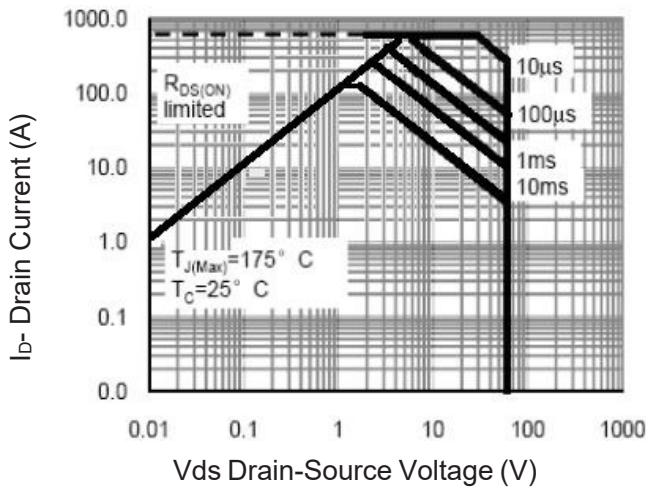
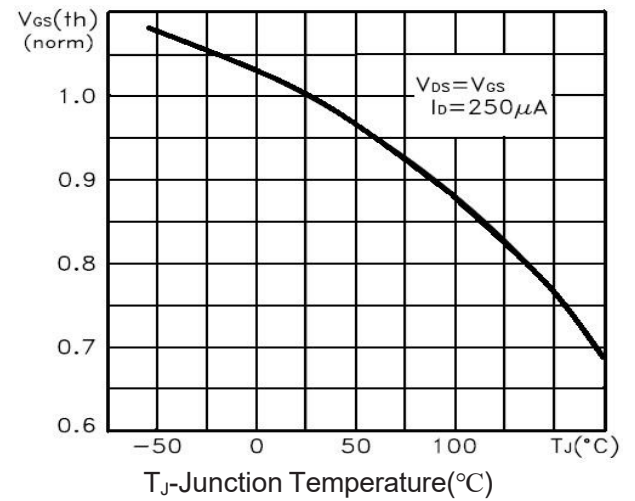
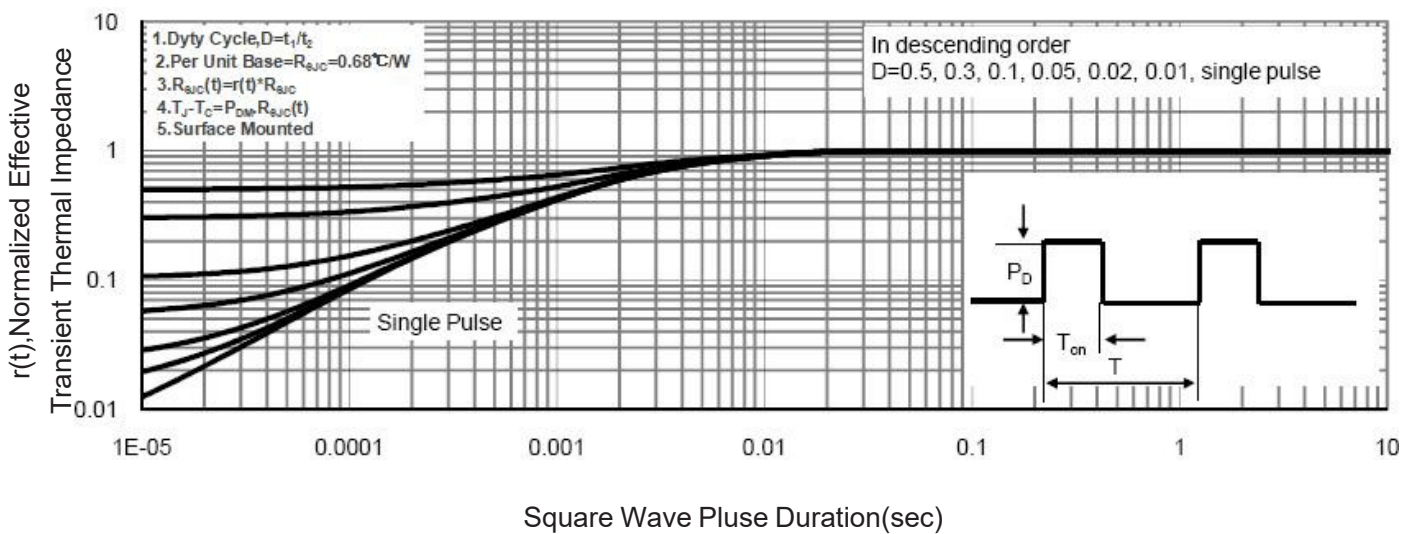


### 3) Switch Time Test Circuit:



## Typical Electrical and Thermal Characteristics (Curves)




**Figure 7 Capacitance vs Vds**

**Figure 9  $BV_{DSS}$  vs Junction Temperature**

**Figure 8 Safe Operation Area**

**Figure 10  $V_{GS(th)}$  vs Junction Temperature**

**Figure 11 Normalized Maximum Transient Thermal Impedance**