

## Description

The VSM25N10 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

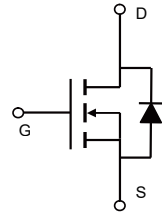
- $V_{DS} = 100V, I_D = 25A$   
 $R_{DS(ON)} < 35m\Omega @ V_{GS}=10V$  (Typ:28m $\Omega$ )  
 $R_{DS(ON)} < 38m\Omega @ V_{GS}=3V$  (Typ:30m $\Omega$ )
- Special process technology for high ESD capability
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation

## Application

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



TO-252



Schematic

## Package Marking and Ordering Information

| Device Marking | Device      | Device Package | Reel Size | Tape width | Quantity |
|----------------|-------------|----------------|-----------|------------|----------|
| VSM25N10       | VSM25N10-T2 | TO-252         | -         | -          | -        |

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

| Symbol               | Parameter                                         | Limit      | Unit           |
|----------------------|---------------------------------------------------|------------|----------------|
| $V_{DS}$             | Drain-Source Voltage                              | 100        | V              |
| $V_{GS}$             | Gate-Source Voltage                               | $\pm 20$   | V              |
| $I_D$                | Drain Current-Continuous                          | 25         | A              |
| $I_D (100^{\circ}C)$ | Drain Current-Continuous( $T_C=100^{\circ}C$ )    | 17.6       | A              |
| $I_{DM}$             | Pulsed Drain Current                              | 70         | A              |
| $P_D$                | Maximum Power Dissipation                         | 70         | W              |
|                      | Derating factor                                   | 0.5        | W/ $^{\circ}C$ |
| $E_{AS}$             | Single pulse avalanche energy <sup>(Note 5)</sup> | 110        | mJ             |
| $T_J, T_{STG}$       | Operating Junction and Storage Temperature Range  | -55 To 175 | $^{\circ}C$    |

## Thermal Characteristic

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

**Electrical Characteristics (T<sub>c</sub>=25°C unless otherwise noted)**

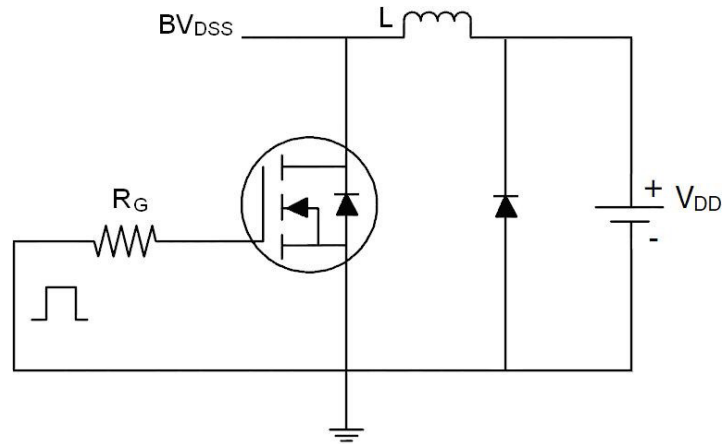
| Symbol                             |                                  | Parameter                                 | Condition                                                                              | Min | Typ  | Max  | Unit |
|------------------------------------|----------------------------------|-------------------------------------------|----------------------------------------------------------------------------------------|-----|------|------|------|
| Off Characteristics                |                                  |                                           |                                                                                        |     |      |      |      |
| BV <sub>DSS</sub>                  | Drain-Source Breakdown Voltage   |                                           | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                              | 100 | 110  | -    | V    |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current  |                                           | V <sub>DS</sub> =100V, V <sub>GS</sub> =0V                                             | -   | -    | 1    | μA   |
| I <sub>GSS</sub>                   | Gate-Body Leakage Current        |                                           | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                             | -   | -    | ±100 | nA   |
| On Characteristics (Note 3)        |                                  |                                           |                                                                                        |     |      |      |      |
| V <sub>GS(th)</sub>                | Gate Threshold Voltage           |                                           | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                               | 0.8 | 1.2  | 1.6  | V    |
| R <sub>DS(ON)</sub>                | Drain-Source On-State Resistance | V <sub>GS</sub> =10V, I <sub>D</sub> =15A | -                                                                                      | 28  | 35   | mΩ   |      |
|                                    |                                  | V <sub>GS</sub> =3V, I <sub>D</sub> =15A  |                                                                                        | 30  | 38   |      |      |
| g <sub>FS</sub>                    | Forward Transconductance         |                                           | V <sub>DS</sub> =5V, I <sub>D</sub> =15A                                               | -   | 12   | -    | S    |
| Dynamic Characteristics (Note4)    |                                  |                                           |                                                                                        |     |      |      |      |
| C <sub>iss</sub>                   | Input Capacitance                |                                           | V <sub>DS</sub> =50V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                 | -   | 3000 | -    | PF   |
| C <sub>oss</sub>                   | Output Capacitance               |                                           |                                                                                        | -   | 92   | -    | PF   |
| C <sub>rss</sub>                   | Reverse Transfer Capacitance     |                                           |                                                                                        | -   | 18.3 | -    | PF   |
| Switching Characteristics (Note 4) |                                  |                                           |                                                                                        |     |      |      |      |
| t <sub>d(on)</sub>                 | Turn-on Delay Time               |                                           | V <sub>DD</sub> =50V, R <sub>L</sub> =5Ω<br>V <sub>GS</sub> =10V, R <sub>GEN</sub> =3Ω | -   | 9    | -    | nS   |
| t <sub>r</sub>                     | Turn-on Rise Time                |                                           |                                                                                        | -   | 9    | -    | nS   |
| t <sub>d(off)</sub>                | Turn-Off Delay Time              |                                           |                                                                                        | -   | 31   | -    | nS   |
| t <sub>f</sub>                     | Turn-Off Fall Time               |                                           |                                                                                        | -   | 9    | -    | nS   |
| Q <sub>g</sub>                     | Total Gate Charge                |                                           | V <sub>DS</sub> =50V, I <sub>D</sub> =25A,<br>V <sub>GS</sub> =10V                     | -   | 70.4 | -    | nC   |
| Q <sub>gs</sub>                    | Gate-Source Charge               |                                           |                                                                                        | -   | 9.0  | -    | nC   |
| Q <sub>gd</sub>                    | Gate-Drain Charge                |                                           |                                                                                        | -   | 15.3 | -    | nC   |
| Drain-Source Diode Characteristics |                                  |                                           |                                                                                        |     |      |      |      |
| V <sub>SD</sub>                    | Diode Forward Voltage (Note 3)   |                                           | V <sub>GS</sub> =0V, I <sub>S</sub> =25A                                               | -   | -    | 1.2  | V    |
| I <sub>S</sub>                     | Diode Forward Current (Note 2)   |                                           | -                                                                                      | -   | -    | 25   | A    |
| t <sub>rr</sub>                    | Reverse Recovery Time            |                                           | TJ = 25°C, IF = 25A                                                                    | -   | 34   | -    | nS   |
| Q <sub>rr</sub>                    | Reverse Recovery Charge          |                                           | di/dt = 100A/μs (Note3)                                                                | -   | 56   | -    | nC   |

**Notes:**

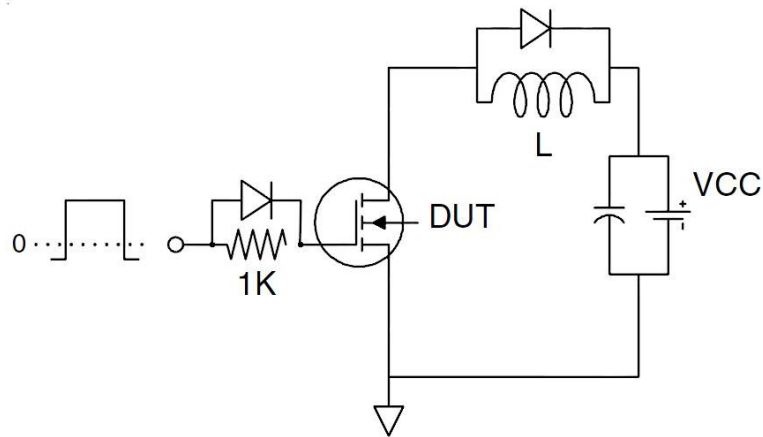
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. EAS Condition : T<sub>J</sub>=25°C, V<sub>DD</sub>=50V, V<sub>G</sub>=10V, L=0.5mH, R<sub>g</sub>=25Ω

## Test Circuit

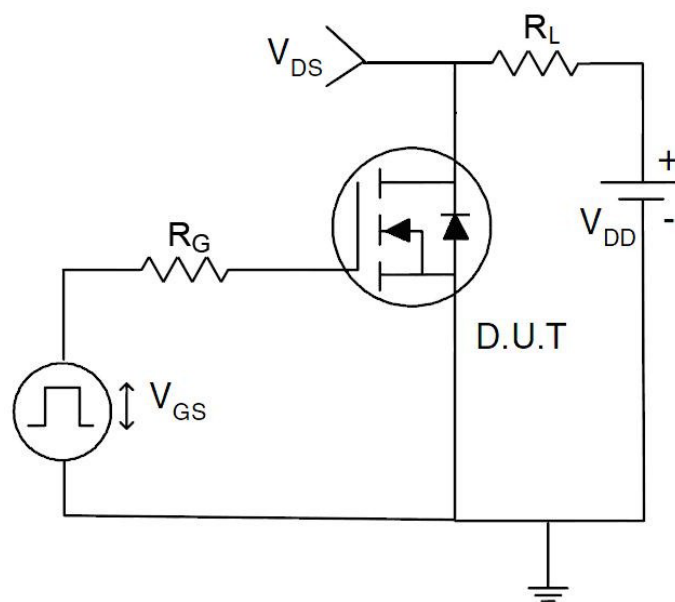
### 1) $E_{AS}$ Test Circuit



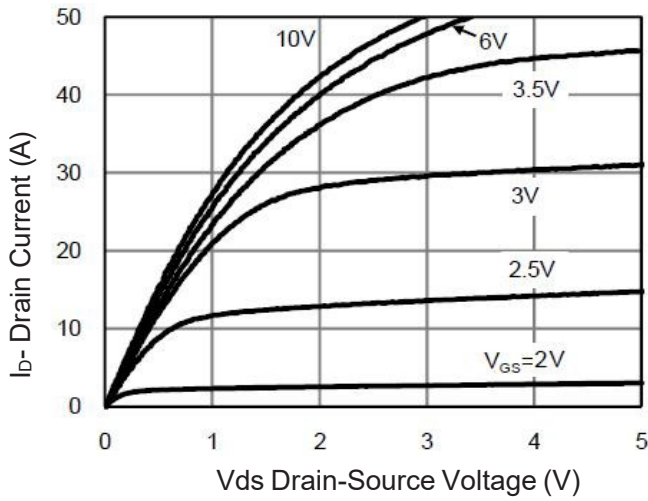
### 2) Gate Charge Test Circuit



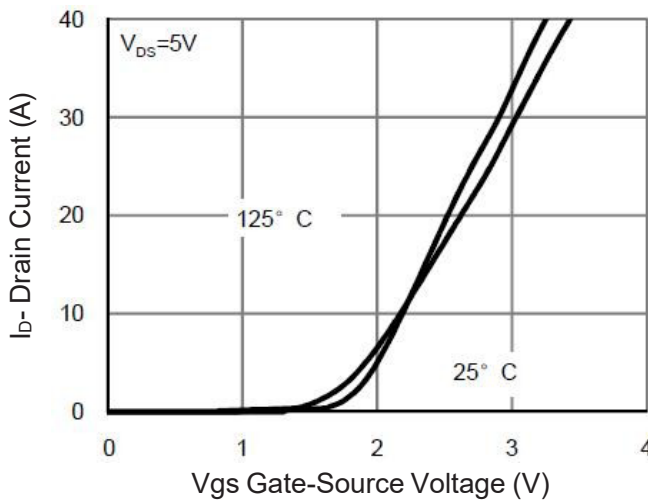
### 3) Switch Time Test Circuit



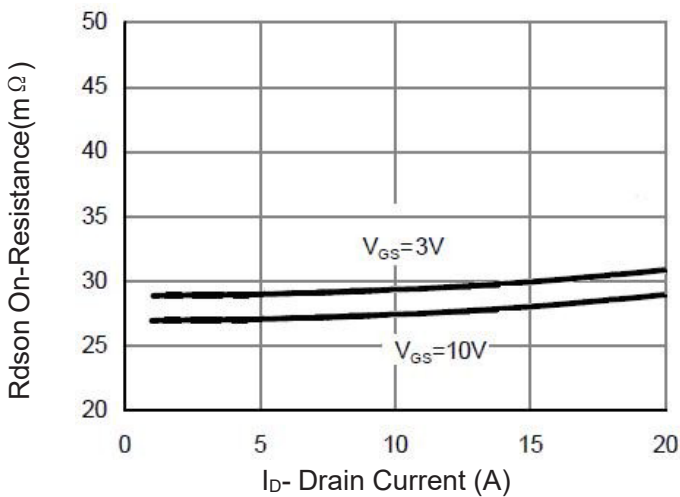
## Typical Electrical and Thermal Characteristics (Curves)



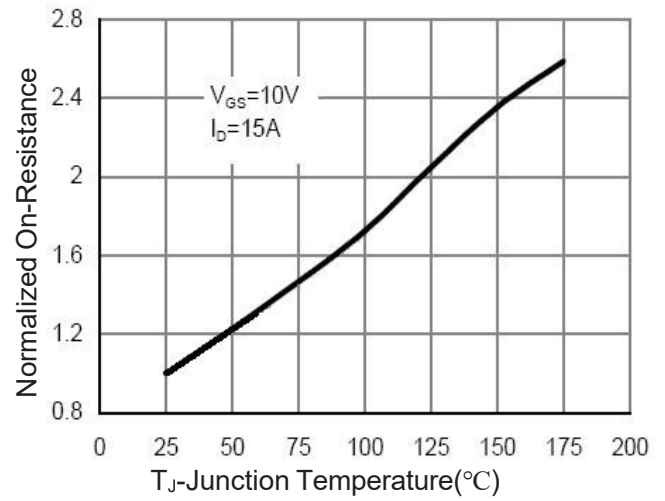
**Figure 1 Output Characteristics**



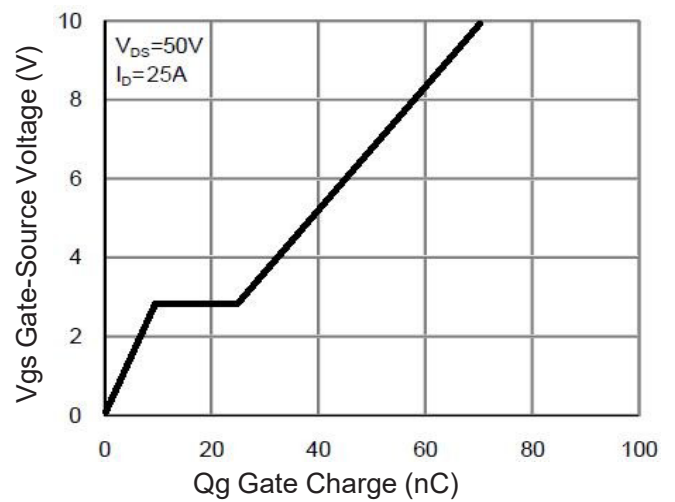
**Figure 2 Transfer Characteristics**



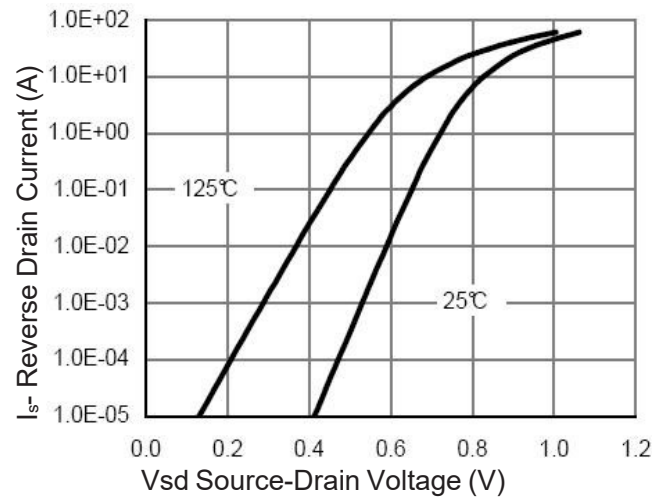
**Figure 3 Rdson- Drain Current**



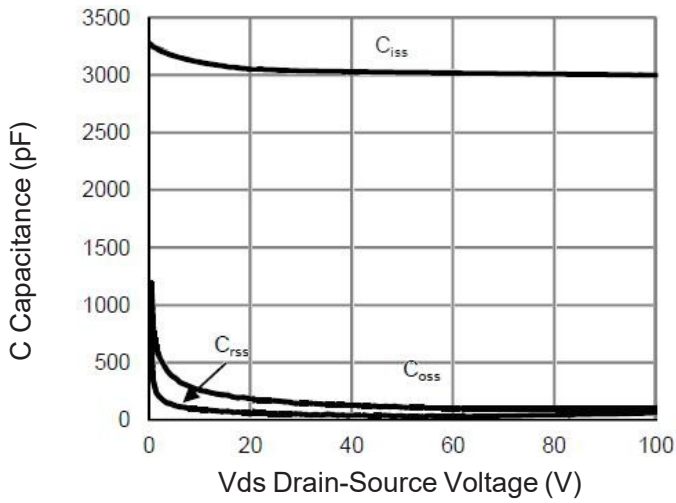
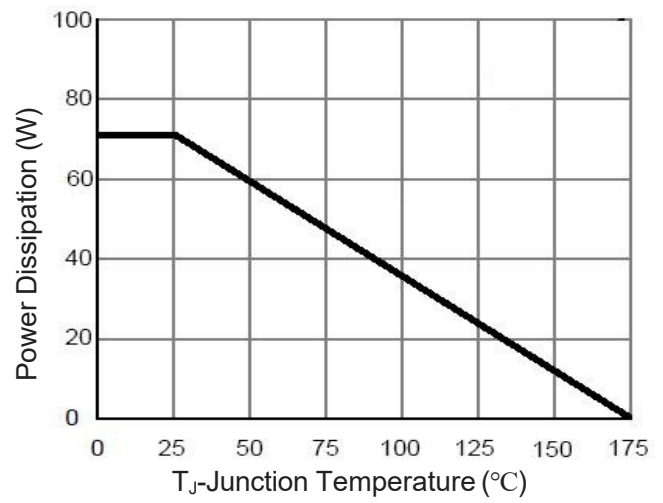
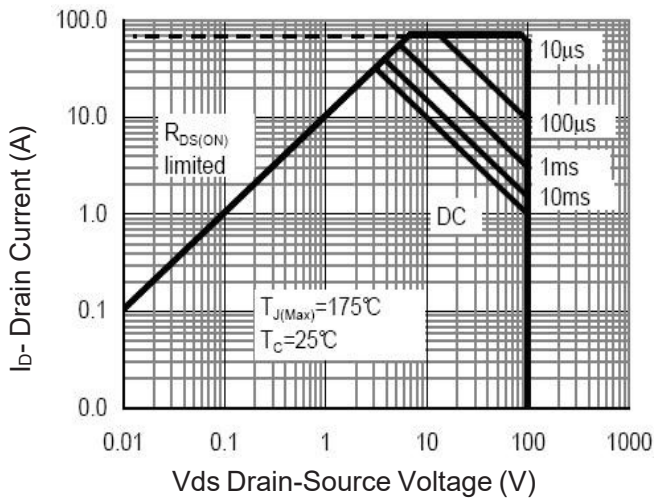
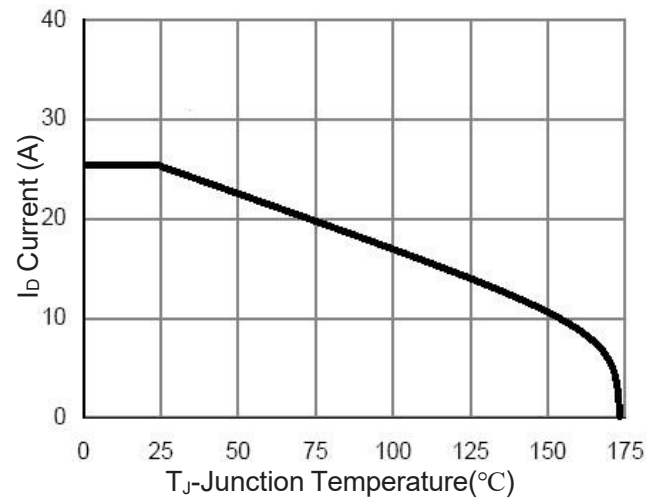
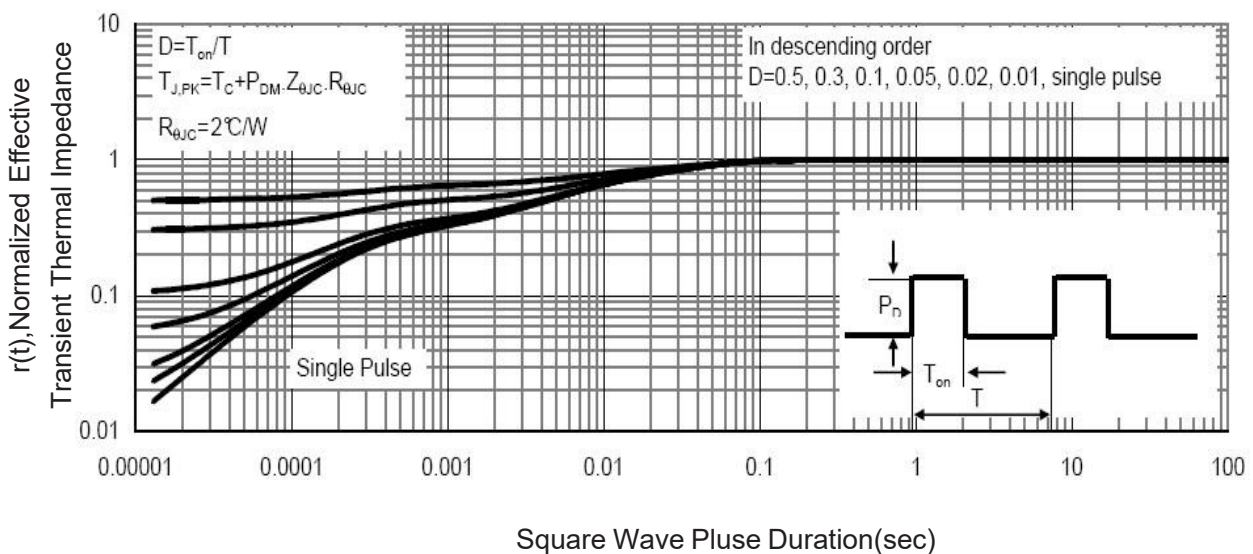
**Figure 4 Rdson-Junction Temperature**



**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 ID Current- Junction Temperature**

**Figure 11 Normalized Maximum Transient Thermal Impedance**