

## Description

The VSM65N03 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

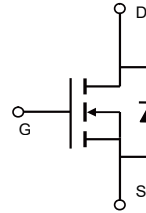
- $V_{DS} = 30V, I_D = 65A$   
 $R_{DS(ON)} < 5.2m\Omega @ V_{GS} = 10V$   
 $R_{DS(ON)} < 11m\Omega @ V_{GS} = 5V$
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good 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 |
|----------------|-------------|----------------|-----------|------------|----------|
| VSM65N03       | VSM65N03-T2 | TO-252         | -         | -          | -        |

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

| Parameter                                        | Symbol             | Limit      | Unit          |
|--------------------------------------------------|--------------------|------------|---------------|
| Drain-Source Voltage                             | $V_{DS}$           | 30         | V             |
| Gate-Source Voltage                              | $V_{GS}$           | $\pm 20$   | V             |
| Drain Current-Continuous                         | $I_D$              | 65         | A             |
| Drain Current-Continuous( $T_C = 100^\circ C$ )  | $I_D(100^\circ C)$ | 46         | A             |
| Pulsed Drain Current                             | $I_{DM}$           | 200        | A             |
| Maximum Power Dissipation                        | $P_D$              | 65         | W             |
| Derating factor                                  |                    | 0.43       | W/ $^\circ C$ |
| Single pulse avalanche energy (Note 5)           | $E_{AS}$           | 150        | mJ            |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$     | -55 To 175 | $^\circ C$    |

## Thermal Characteristic

|                                               |                 |     |              |
|-----------------------------------------------|-----------------|-----|--------------|
| Thermal Resistance, Junction-to-Case (Note 2) | $R_{\theta JC}$ | 2.3 | $^\circ C/W$ |
|-----------------------------------------------|-----------------|-----|--------------|

**Electrical Characteristics (TC=25°C unless otherwise noted)**

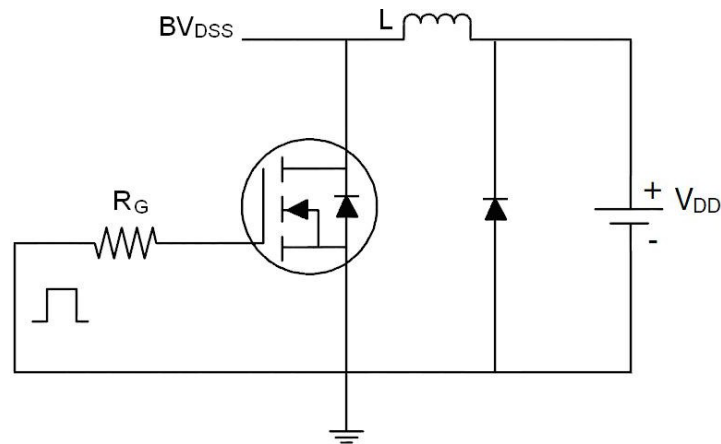
| Parameter                          | Symbol              | Condition                                                                              | Min | Typ  | Max  | Unit |
|------------------------------------|---------------------|----------------------------------------------------------------------------------------|-----|------|------|------|
| Off Characteristics                |                     |                                                                                        |     |      |      |      |
| Drain-Source Breakdown Voltage     | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                              | 30  | -    | -    | V    |
| Zero Gate Voltage Drain Current    | I <sub>DSS</sub>    | V <sub>DS</sub> =30V, 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 (Note 3)        |                     |                                                                                        |     |      |      |      |
| Gate Threshold Voltage             | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                               | 1   | 1.6  | 2.5  | V    |
| Drain-Source On-State Resistance   | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =20A                                              | -   | 4.5  | 5.2  | mΩ   |
|                                    |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A                                             | -   | 8.2  | 11   |      |
| Forward Transconductance           | g <sub>FS</sub>     | V <sub>DS</sub> =5V, I <sub>D</sub> =20A                                               | 20  | -    | -    | S    |
| Dynamic Characteristics (Note4)    |                     |                                                                                        |     |      |      |      |
| Input Capacitance                  | C <sub>iss</sub>    | V <sub>DS</sub> =15V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                 | -   | 1400 | -    | PF   |
| Output Capacitance                 | C <sub>oss</sub>    |                                                                                        | -   | 205  | -    | PF   |
| Reverse Transfer Capacitance       | C <sub>rss</sub>    |                                                                                        | -   | 177  | -    | PF   |
| Switching Characteristics (Note 4) |                     |                                                                                        |     |      |      |      |
| Turn-on Delay Time                 | t <sub>d(on)</sub>  | V <sub>DD</sub> =5V, I <sub>D</sub> =20A<br>V <sub>GS</sub> =10V, R <sub>GEN</sub> =6Ω | -   | 9    | -    | nS   |
| Turn-on Rise Time                  | t <sub>r</sub>      |                                                                                        | -   | 8    | -    | nS   |
| Turn-Off Delay Time                | t <sub>d(off)</sub> |                                                                                        | -   | 28   | -    | nS   |
| Turn-Off Fall Time                 | t <sub>f</sub>      |                                                                                        | -   | 5    | -    | nS   |
| Total Gate Charge                  | Q <sub>g</sub>      | V <sub>DS</sub> =15V, I <sub>D</sub> =20A,<br>V <sub>GS</sub> =10V                     | -   | 32.3 | -    | nC   |
| Gate-Source Charge                 | Q <sub>gs</sub>     |                                                                                        | -   | 4.9  | -    | nC   |
| Gate-Drain Charge                  | Q <sub>gd</sub>     |                                                                                        | -   | 6.9  | -    | nC   |
| Drain-Source Diode Characteristics |                     |                                                                                        |     |      |      |      |
| Diode Forward Voltage (Note 3)     | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =20A                                               | -   | 0.85 | 1.2  | V    |
| Diode Forward Current (Note 2)     | I <sub>S</sub>      |                                                                                        | -   | -    | 65   | A    |
| Reverse Recovery Time              | t <sub>rr</sub>     | T <sub>J</sub> = 25°C, I <sub>F</sub> = 20A<br>di/dt = 100A/μs (Note3)                 | -   | -    | 27   | nS   |
| Reverse Recovery Charge            | Q <sub>rr</sub>     |                                                                                        | -   | -    | 20   | nC   |
| Forward Turn-On Time               | t <sub>on</sub>     | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)                   |     |      |      |      |

**Notes:**

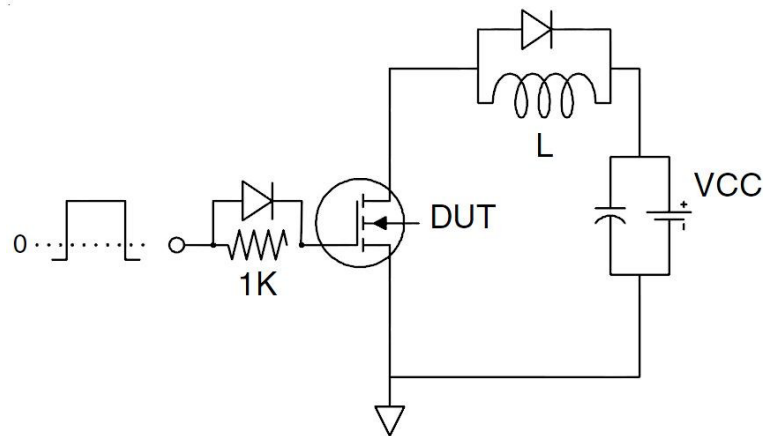
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition:  $T_J=25^\circ C, V_{DD}=15V, V_G=10V, L=0.5mH, R_g=25\Omega$

## Test Circuit

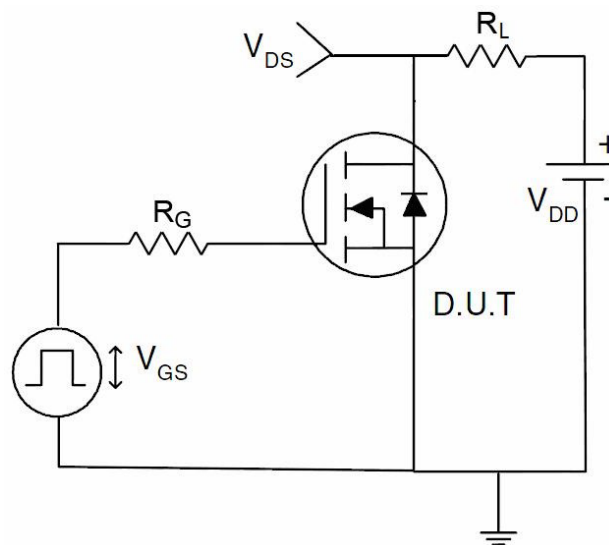
### 1) $E_{AS}$ Test Circuits



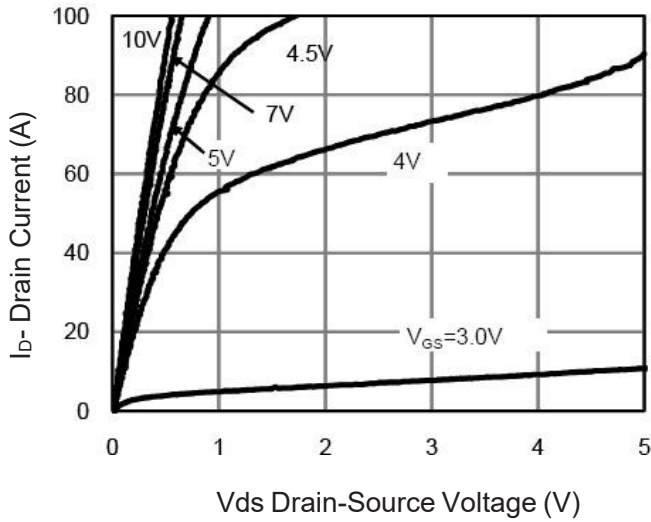
### 2) Gate Charge Test Circuit



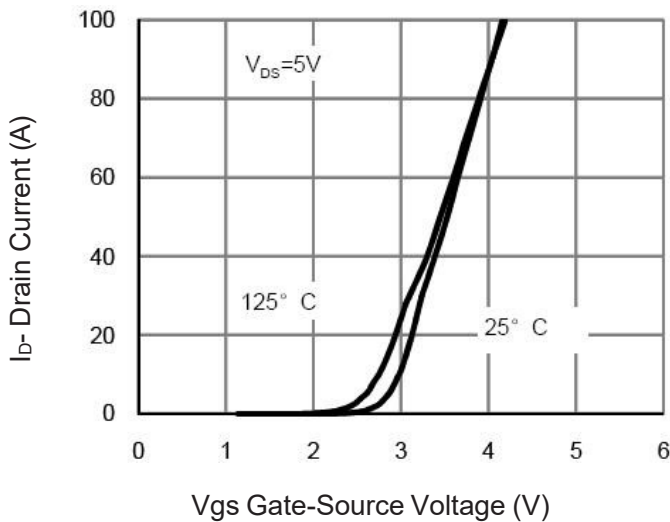
### 3) Switch Time Test Circuit



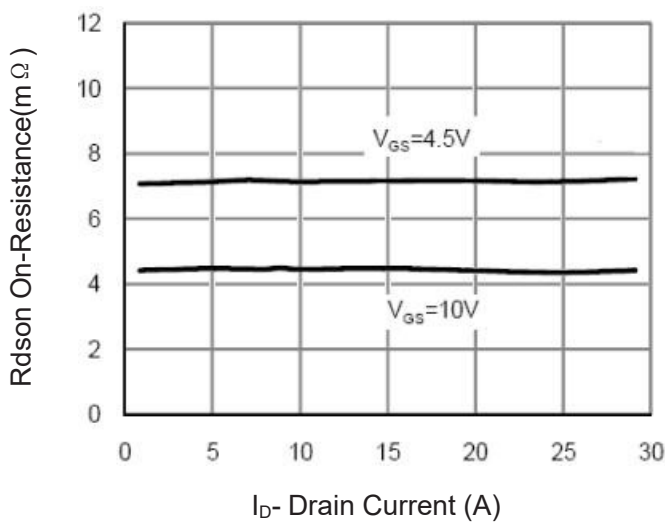
## Typical Electrical and Thermal Characteristics (Curves)



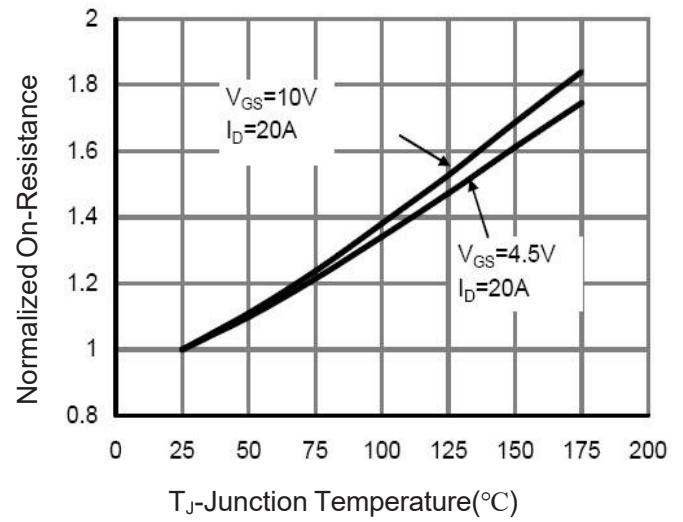
**Figure 1 Output Characteristics**



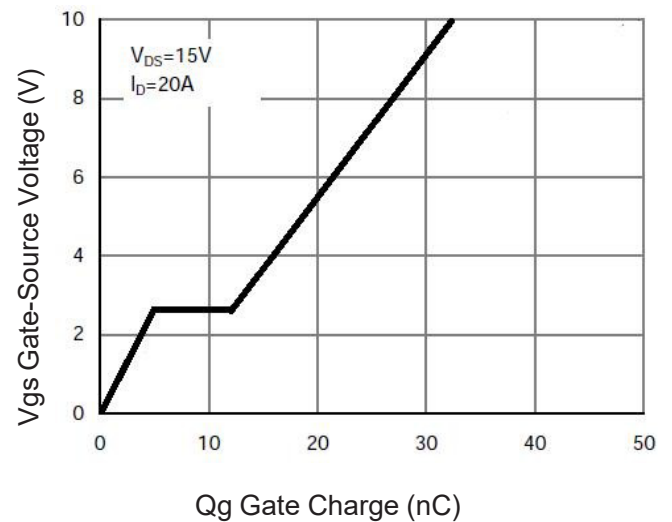
**Figure 2 Transfer Characteristics**



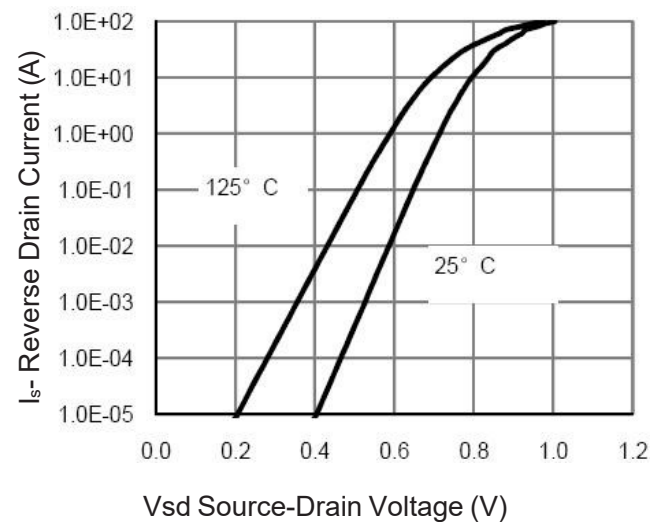
**Figure 3 Rdson- Drain Current**



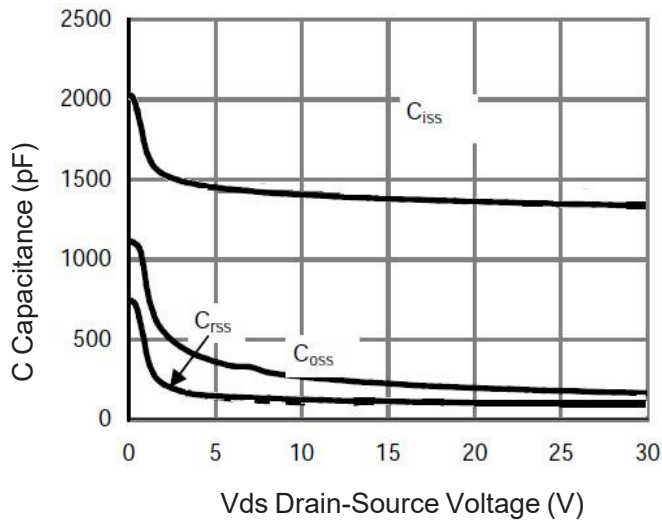
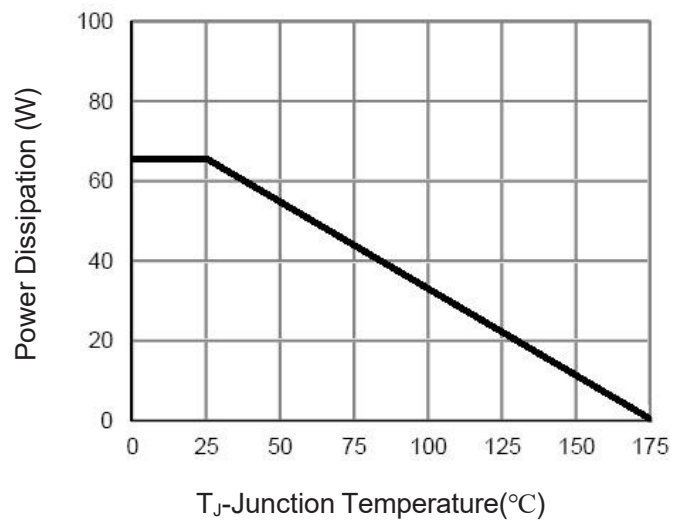
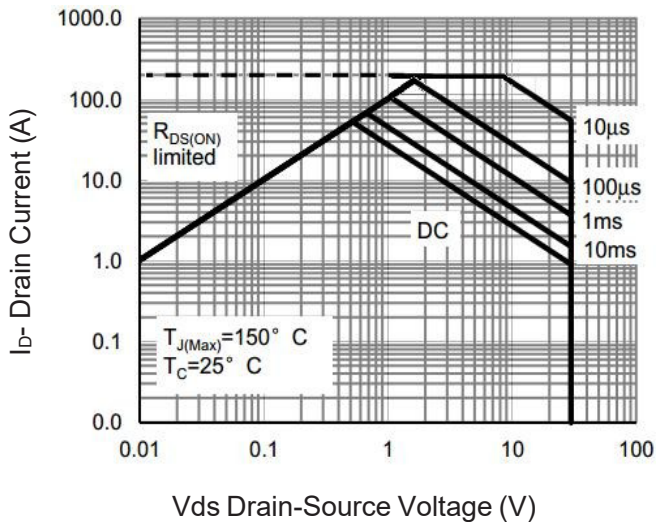
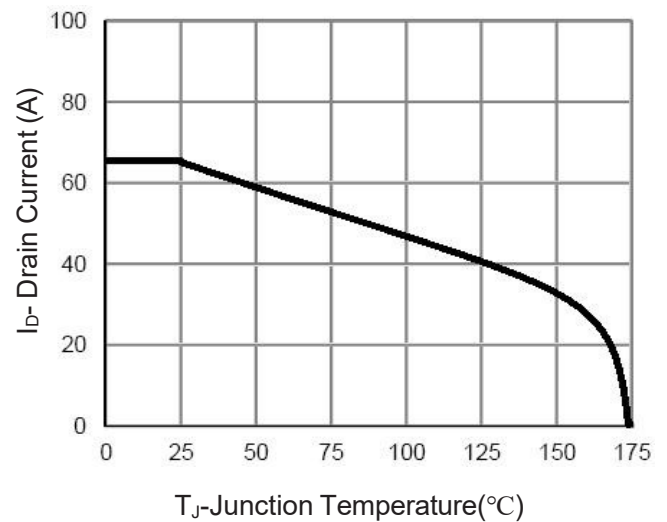
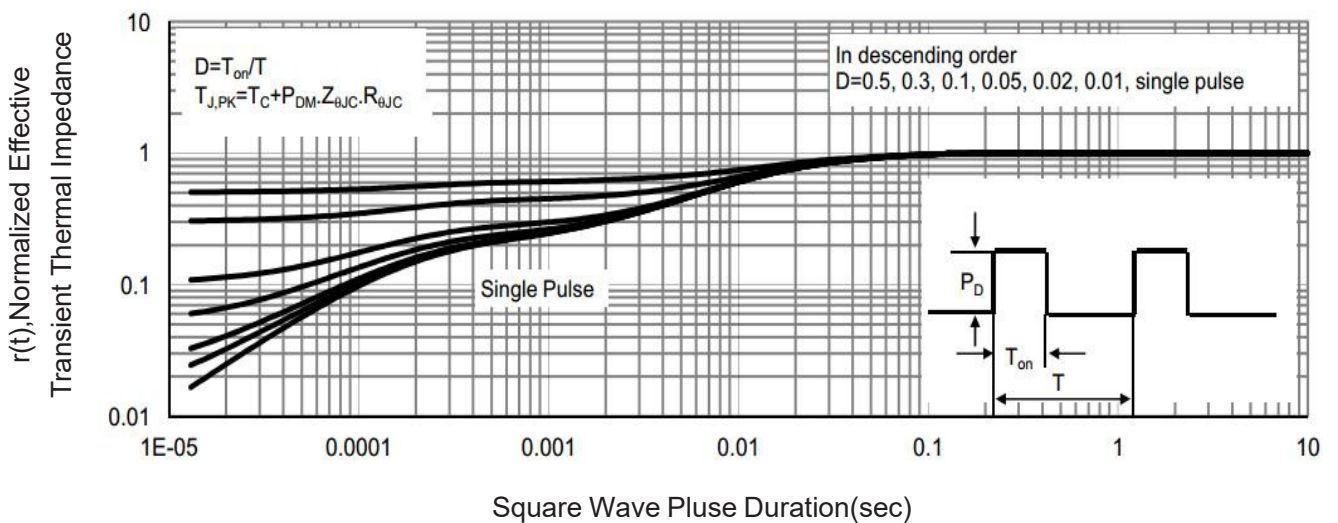
**Figure 4 Rdson-Junction Temperature**



**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**