

## Description

The VSM95N03 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.

## Application

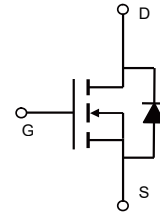
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

## General Features

- $V_{DS} = 30V, I_D = 95A$   
 $R_{DS(ON)} = 3.5m\Omega$  (typical) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 5.5m\Omega$  (typical) @  $V_{GS} = 4.5V$
- High density cell design for ultra low  $R_{DS(on)}$
- Very low on-resistance  $R_{DS(on)}$
- Good stability and uniformity with high  $E_{AS}$
- 150 °C operating temperature
- Pb-free lead plating



DFN5x6



Schematic

## Package Marking and Ordering Information

| Device Marking | Device       | Device Package | Reel Size | Tape width | Quantity |
|----------------|--------------|----------------|-----------|------------|----------|
| VSM95N03       | VSM95N03-D56 | DFN5x6         | -         | -          | -        |

## 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                         | $I_D$              | 95         | A             |
| Drain Current-Continuous( $T_C = 100^\circ C$ )  | $I_D(100^\circ C)$ | 63.6       | A             |
| Pulsed Drain Current                             | $I_{DM}$           | 300        | A             |
| Maximum Power Dissipation                        | $P_D$              | 80         | W             |
| Derating factor                                  |                    | 0.64       | 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 150 | $^\circ C$    |

## Thermal Characteristic

|                                               |                 |      |              |
|-----------------------------------------------|-----------------|------|--------------|
| Thermal Resistance, Junction-to-Case (Note 2) | $R_{\theta JC}$ | 1.56 | $^\circ C/W$ |
|-----------------------------------------------|-----------------|------|--------------|

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

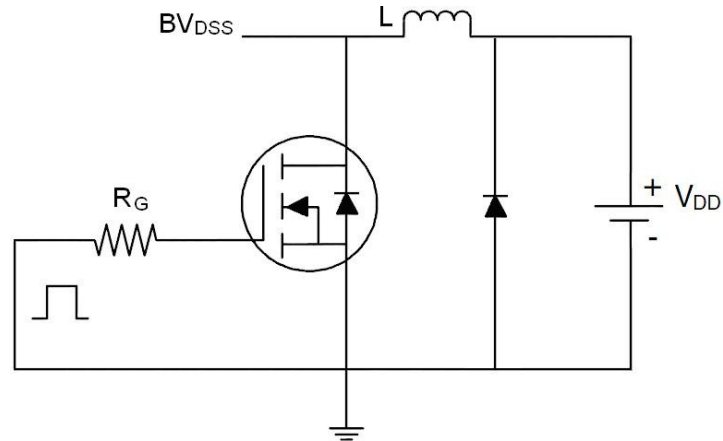
| Parameter                                         | Symbol              | Condition                                                                              | Min | Typ  | Max  | Unit |
|---------------------------------------------------|---------------------|----------------------------------------------------------------------------------------|-----|------|------|------|
| 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 <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   | 1.5  | 2.5  | V    |
| Drain-Source On-State Resistance                  | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =20A                                              | -   | 3.5  | 4.4  | mΩ   |
|                                                   |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A                                             | -   | 5.5  | 7.5  |      |
| Forward Transconductance                          | g <sub>FS</sub>     | V <sub>DS</sub> =5V, I <sub>D</sub> =20A                                               | 30  | -    | -    | S    |
| Dynamic Characteristics <small>(Note4)</small>    |                     |                                                                                        |     |      |      |      |
| Input Capacitance                                 | C <sub>iss</sub>    | V <sub>DS</sub> =15V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                 | -   | 1784 | -    | PF   |
| Output Capacitance                                | C <sub>oss</sub>    |                                                                                        | -   | 266  | -    | PF   |
| Reverse Transfer Capacitance                      | C <sub>rss</sub>    |                                                                                        | -   | 212  | -    | PF   |
| Switching Characteristics <small>(Note 4)</small> |                     |                                                                                        |     |      |      |      |
| 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 | -   | 7    | -    | nS   |
| Turn-on Rise Time                                 | t <sub>r</sub>      |                                                                                        | -   | 6    | -    | nS   |
| Turn-Off Delay Time                               | t <sub>d(off)</sub> |                                                                                        | -   | 30   | -    | nS   |
| Turn-Off Fall Time                                | t <sub>f</sub>      |                                                                                        | -   | 8    | -    | nS   |
| Total Gate Charge                                 | Q <sub>g</sub>      | V <sub>DS</sub> =15V, I <sub>D</sub> =20A,<br>V <sub>GS</sub> =10V                     | -   | 38.4 | -    | nC   |
| Gate-Source Charge                                | Q <sub>gs</sub>     |                                                                                        | -   | 5.8  | -    | nC   |
| Gate-Drain Charge                                 | Q <sub>gd</sub>     |                                                                                        | -   | 7.9  | -    | 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> =20A                                               | -   | 0.85 | 1.2  | V    |
| Diode Forward Current <small>(Note 2)</small>     | I <sub>S</sub>      |                                                                                        | -   | -    | 95   | A    |
| Reverse Recovery Time                             | t <sub>rr</sub>     | T <sub>J</sub> = 25°C, I <sub>F</sub> = 20A<br>di/dt = 100A/μs <sup>(Note3)</sup>      | -   | -    | 47   | nS   |
| Reverse Recovery Charge                           | Q <sub>rr</sub>     |                                                                                        | -   | -    | 25   | nC   |
| Forward Turn-On Time                              | t <sub>on</sub>     | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)                   |     |      |      |      |

**Notes:**

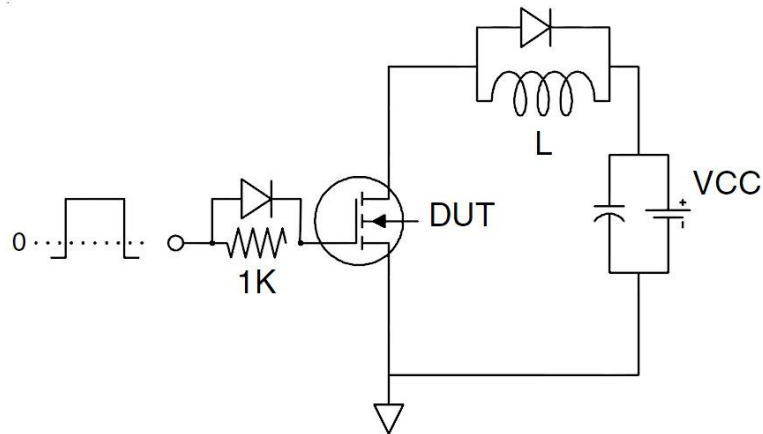
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition:  $T_J=25^\circ C, V_{DD}=15V, V_G=10V, L=0.1mH, R_g=25\Omega$

## Test Circuit

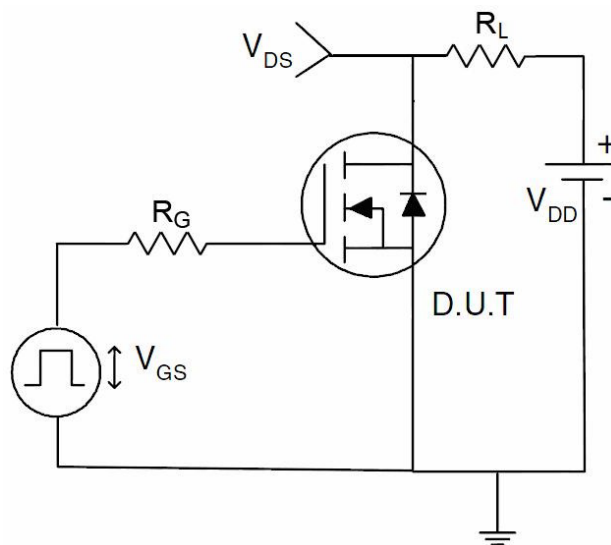
### 1) $E_{AS}$ Test Circuits



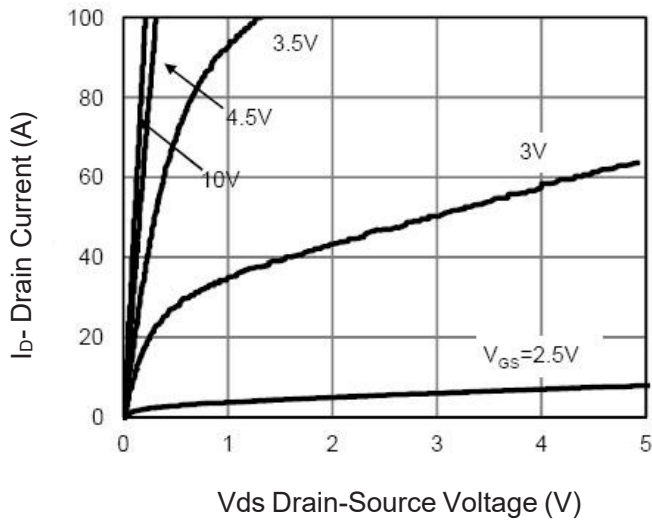
### 2) Gate Charge Test Circuit



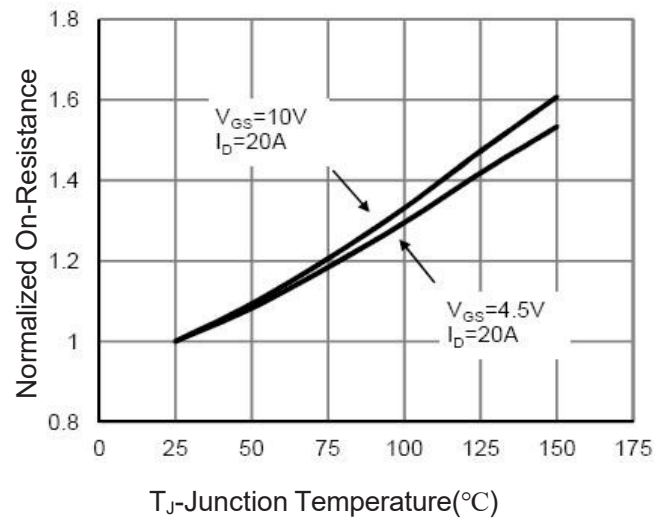
### 3) Switch Time Test Circuit



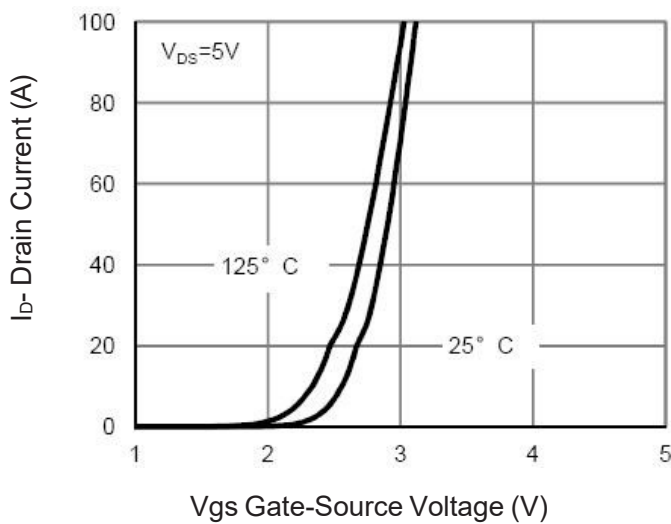
## Typical Electrical and Thermal Characteristics (Curves)



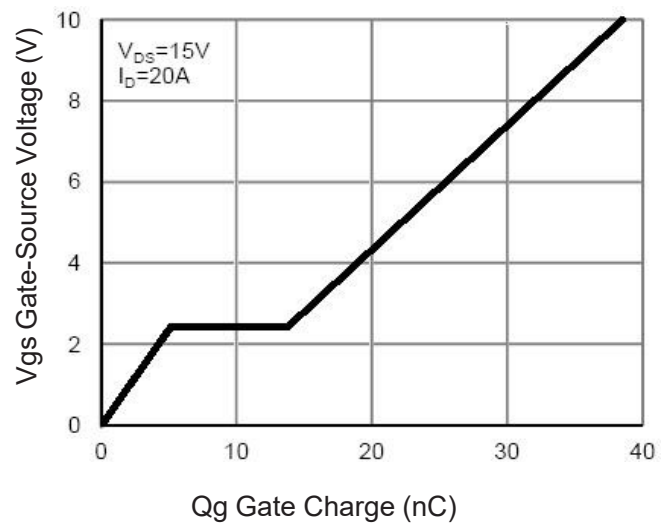
**Figure 1 Output Characteristics**



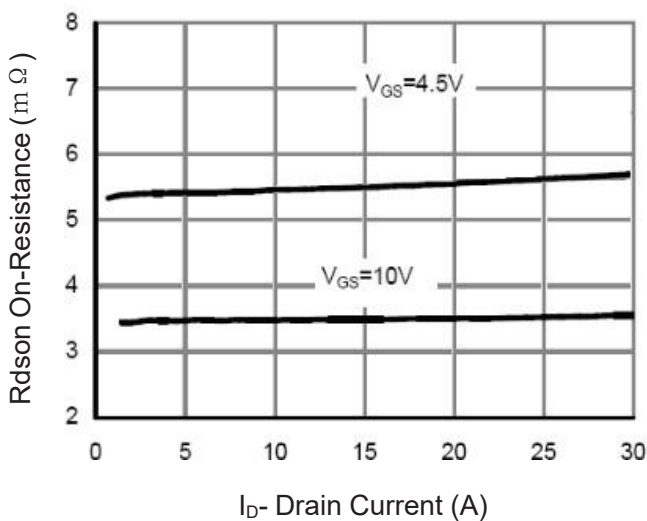
**Figure 4 Rdson-Junction Temperature**



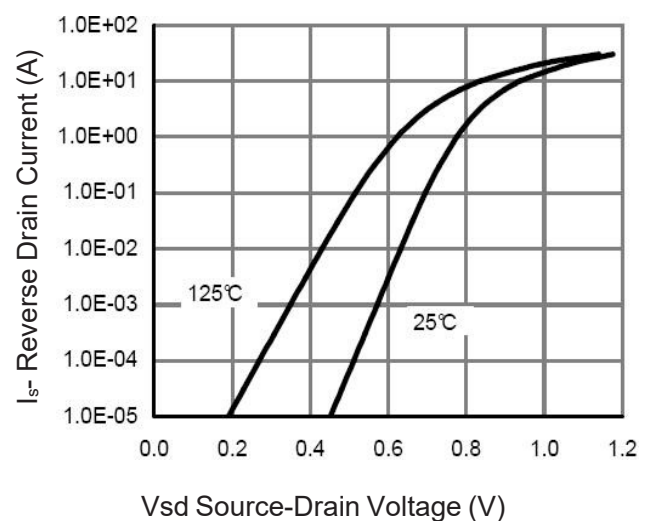
**Figure 2 Transfer Characteristics**



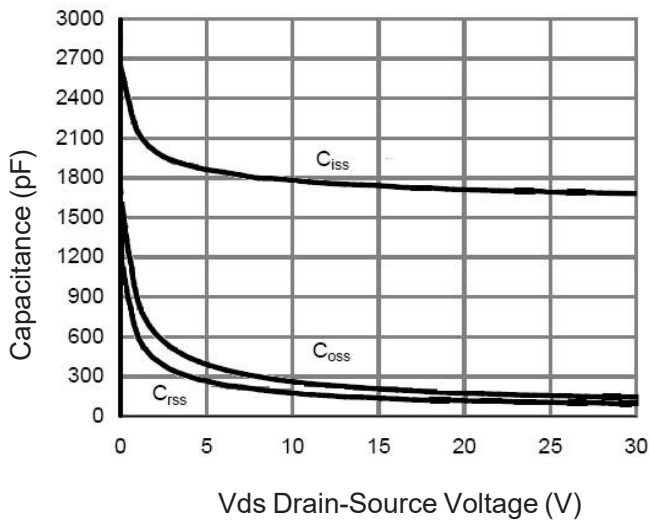
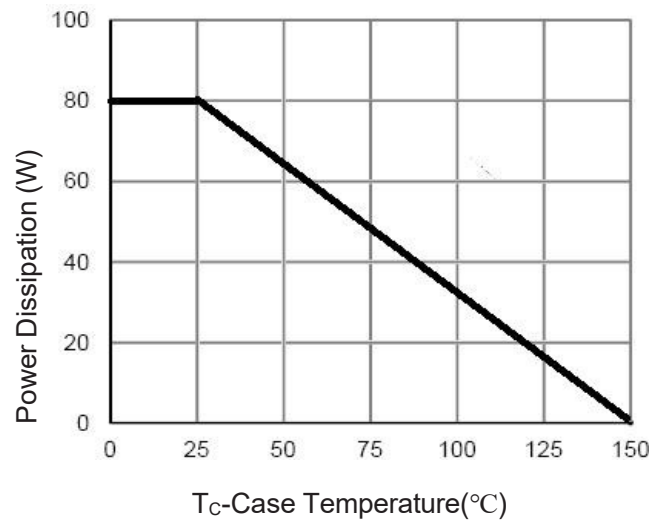
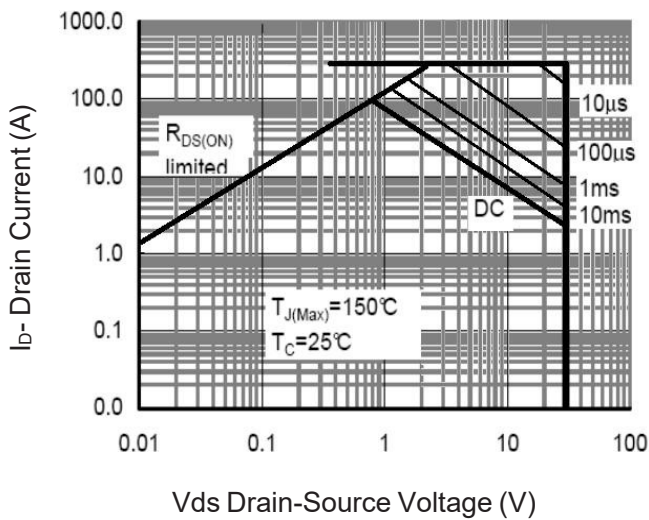
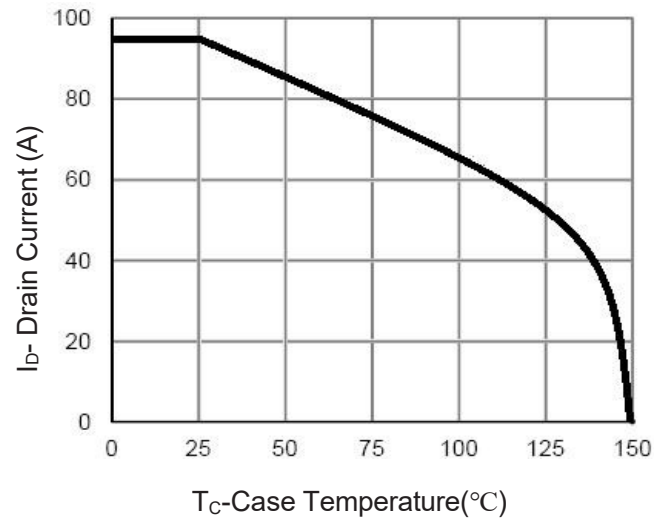
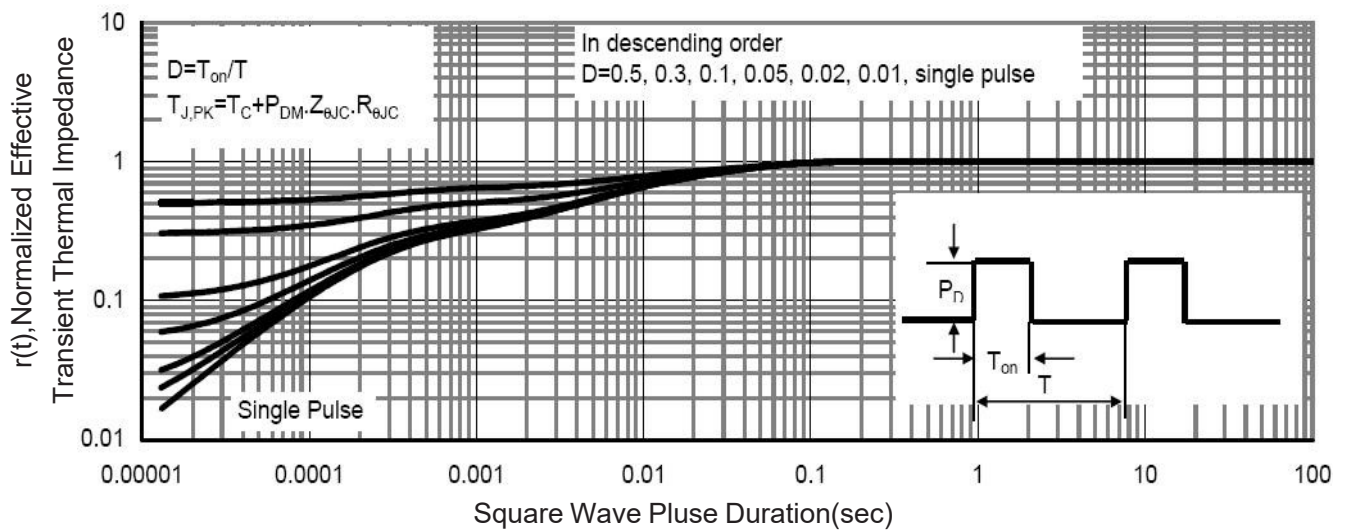
**Figure 5 Gate Charge**



**Figure 3 Rdson- Drain Current**



**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**