## Description

The VSM9P03 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 4.5V.

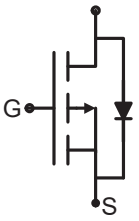
## General Features

- $V_{DS}$ = -30V,$I_D$ = -9.1A
  $R_{DS(ON)}$ < 35mΩ @ $V_{GS}$=-4.5V
  $R_{DS(ON)}$ < 20mΩ @ $V_{GS}$=-10V
- High power and current handing capability
- Lead free product is acquired
- Surface mount package

## Application

- Battery Switch
- Load switch
- Power management


SOP-8




Schematic Diagram

## Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|---|---|---|---|---|---|
| VSM9P03-S8 | VSM9P03 | SOP-8 | Ø330mm | 12mm | 4000 units |

## Absolute Maximum Ratings ($T_A$=25℃unless otherwise noted)

| Parameter | | Symbol | Limit | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | -30 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current ($T_J$ =150℃) | $T_C$ =25℃ | $I_D$ | -11 | A |
| | $T_C$ =70℃ | | -9 | |
| | $T_A$ =25℃ | | -9.1 | |
| | $T_A$ =70℃ | | -7.2 | |
| Drain Current-Pulsed (Note 1) | | $I_{DM}$ | -50 | A |
| Maximum Power Dissipation | | $P_D$ | 3.1 | W |
| Operating Junction and Storage Temperature Range | | $T_J$,$T_{STG}$ | -55 To 150 | ℃ |

## Thermal Characteristic

| | | | |
|---|---|---|---|
| Thermal Resistance,Junction-to-Ambient (Note 2) | $R_{\theta JA}$ | 40 | ℃/W |
| Thermal Resistance,Junction-to-Lead (Note 2) | $R_{\theta JL}$ | 24 | ℃/W |

## Electrical Characteristics ($T_A$=25℃unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V $I_D$=-250μA | -30 | -33 | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=-30V,$V_{GS}$=0V | - | - | -1 | μA |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V,$V_{DS}$=0V | - | - | ±100 | nA |
| **On Characteristics** (Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=-250μA | -1 | -1.5 | -3 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$=-10V, $I_D$=-9.1A | - | 16 | 20 | mΩ |
| | | $V_{GS}$=-4.5V, $I_D$=-6.9A | - | 21 | 35 | mΩ |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$=-15V,$I_D$=-9.1A | 10 | - | - | S |
| **Dynamic Characteristics** (Note4) | | | | | | |
| Input Capacitance | $C_{lss}$ | $V_{DS}$=-15V,$V_{GS}$=0V, F=1.0MHz | - | 1600 | - | PF |
| Output Capacitance | $C_{oss}$ | | - | 350 | - | PF |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 300 | - | PF |
| **Switching Characteristics** (Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=-15V, ID=-1A, $V_{GS}$=-10V,$R_{GEN}$=6Ω | - | 10 | - | nS |
| Turn-on Rise Time | $t_r$ | | - | 15 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 110 | - | nS |
| Turn-Off Fall Time | $t_f$ | | | 70 | - | nS |
| Total Gate Charge | $Q_g$ | $V_{DS}$=-15V,$I_D$=-9.1A $V_{GS}$=-10V | - | 30 | - | nC |
| Gate-Source Charge | $Q_{gs}$ | | - | 5.5 | - | nC |
| Gate-Drain Charge | $Q_{gd}$ | | - | 8 | - | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| Diode Forward Voltage (Note 3) | $V_{SD}$ | $V_{GS}$=0V,$I_S$=-9.1A | - | - | -1.2 | V |

## 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 1 in 2 FR-4 board with 2oz. Copper, in a still air environment with $T_A$ = 25° C. The value in any given application depends on the user's specific board design. The current rating is based on the t ≤ 10s thermal resistance rating. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ and lead to ambient.

**3.** Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.

**4.** Guaranteed by design, not subject to production

## Typical Electrical and Thermal Characteristics

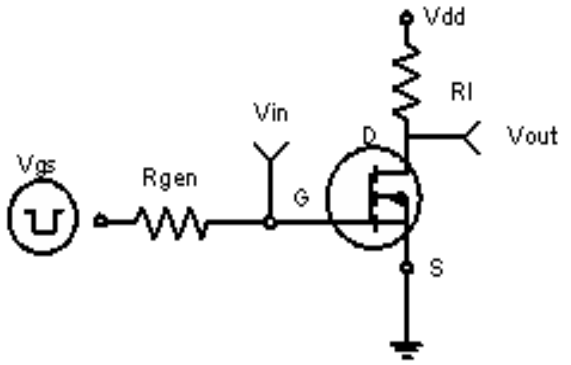



**Figure 1:Switching Test Circuit**

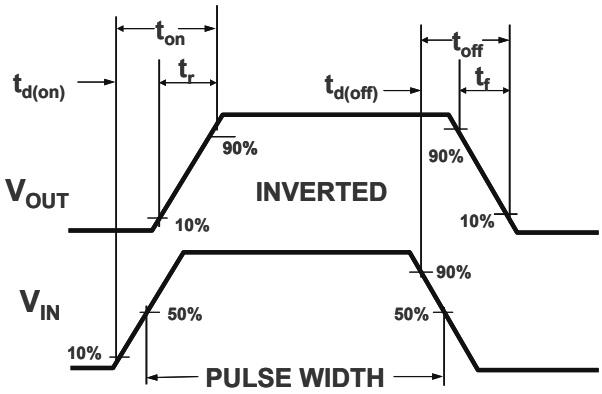
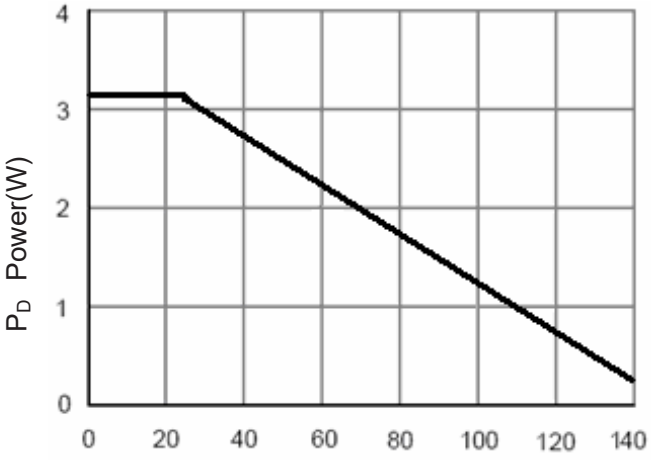
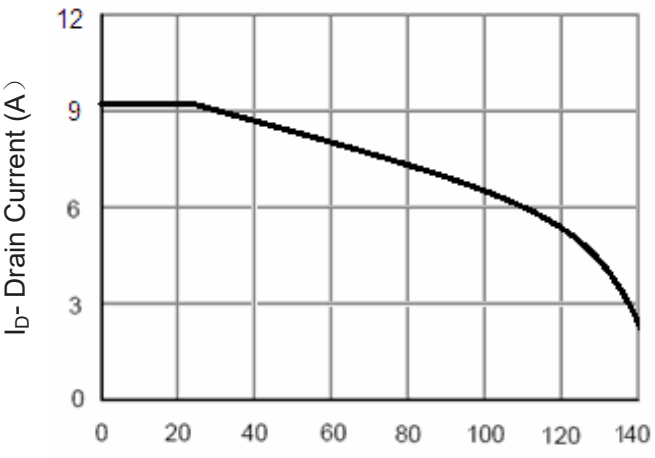



**Figure 2:Switching Waveforms**



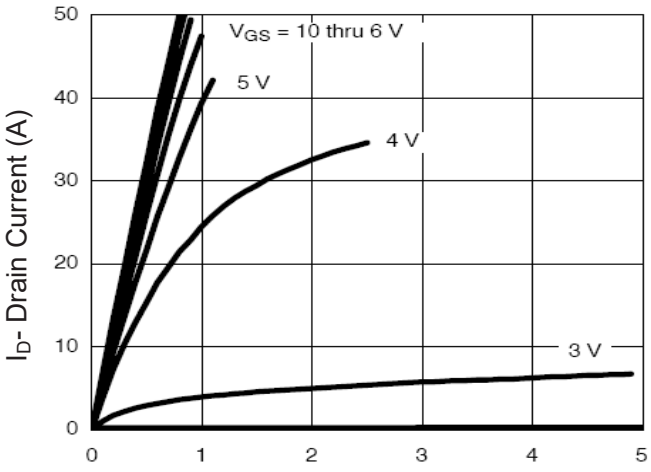

TJ-Junction Temperature(℃)

**Figure 3 Power Dissipation**



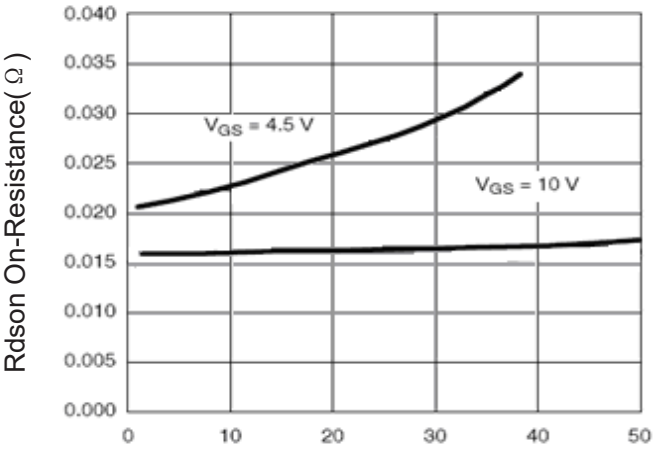

TJ-Junction Temperature(℃)

**Figure 4 Drain Current**




Vds Drain-Source Voltage (V)

**Figure 5 Output Characteristics**




ID- Drain Current (A)

**Figure 6 Drain-Source On-Resistance**

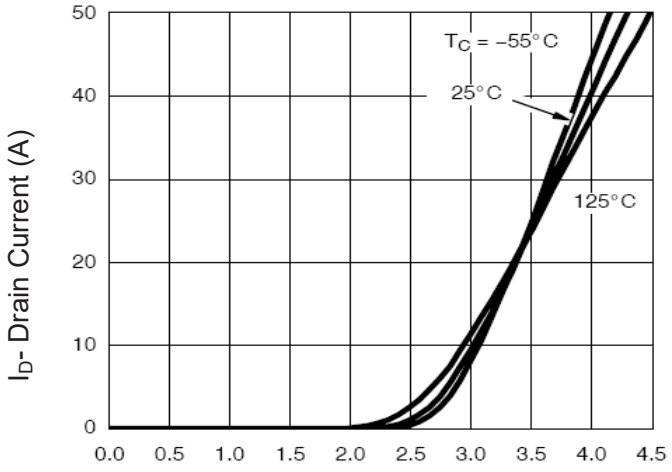



**Figure 7 Transfer Characteristics**

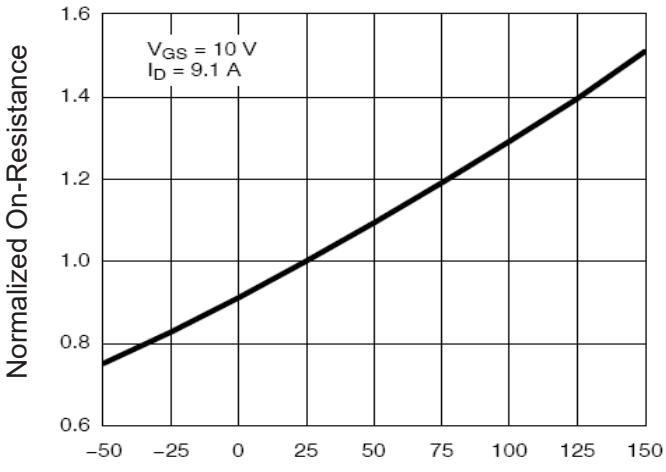



**Figure 8 Drain-Source On-Resistance**

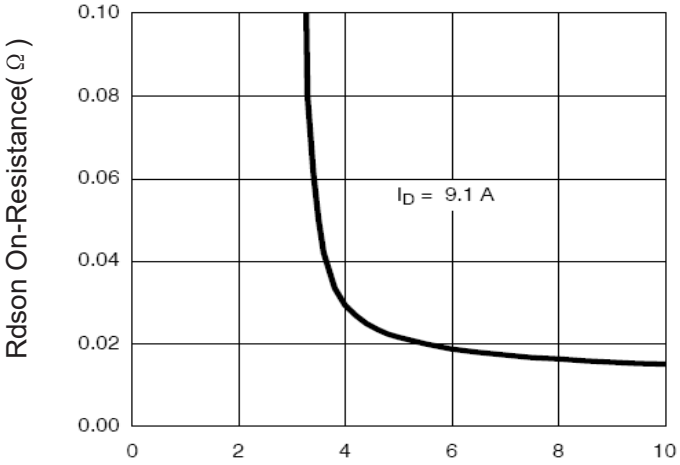



**Figure 9 Rdson vs Vgs**

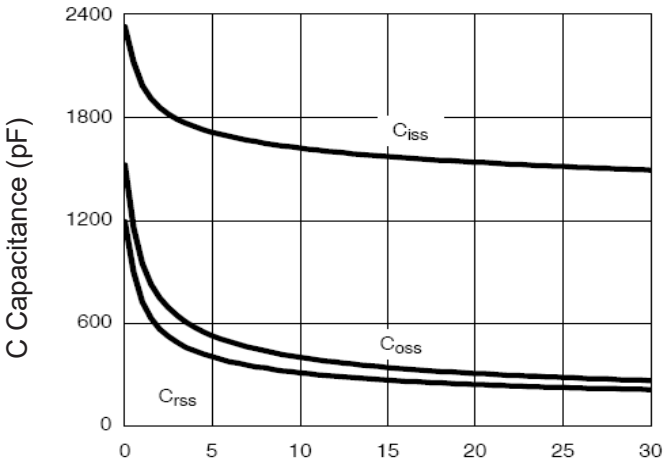



**Figure 10 Capacitance vs Vds**

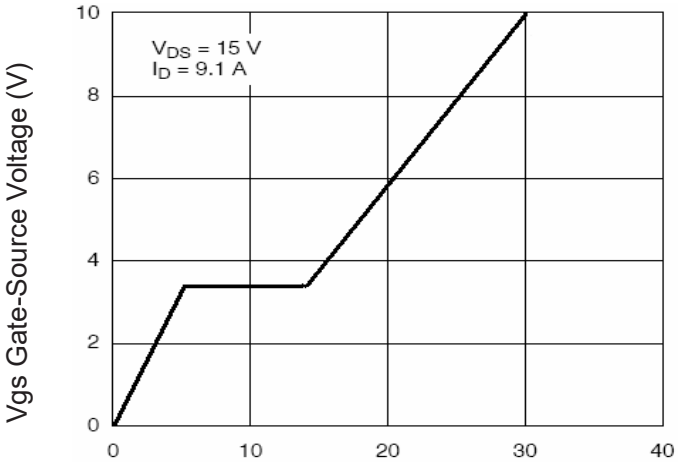



**Figure 11 Gate Charge**

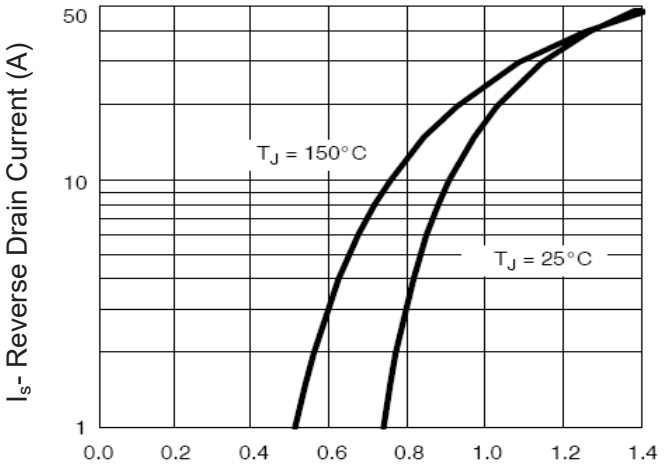



**Figure 12 Source- Drain Diode Forward**

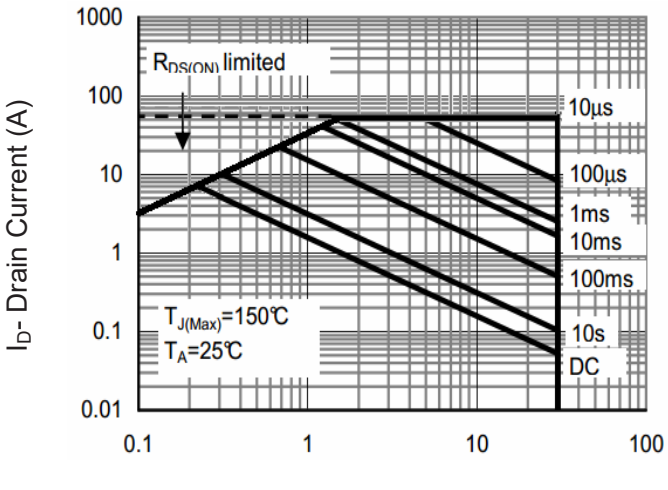



**Figure 13 Safe Operation Area**

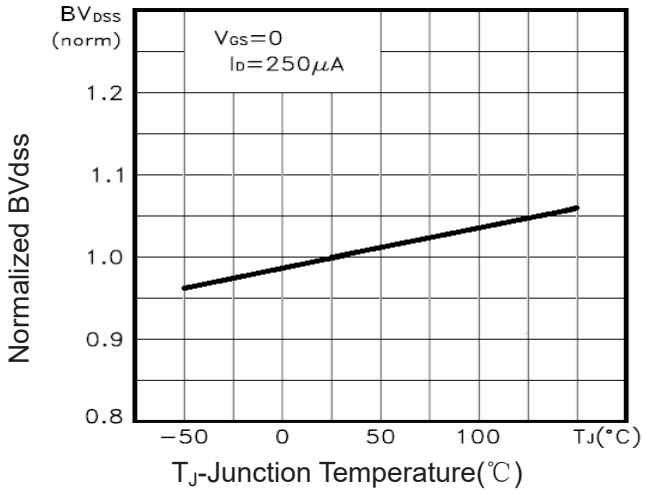



**Figure 14$BV_{DSS}$ vs Junction Temperature**

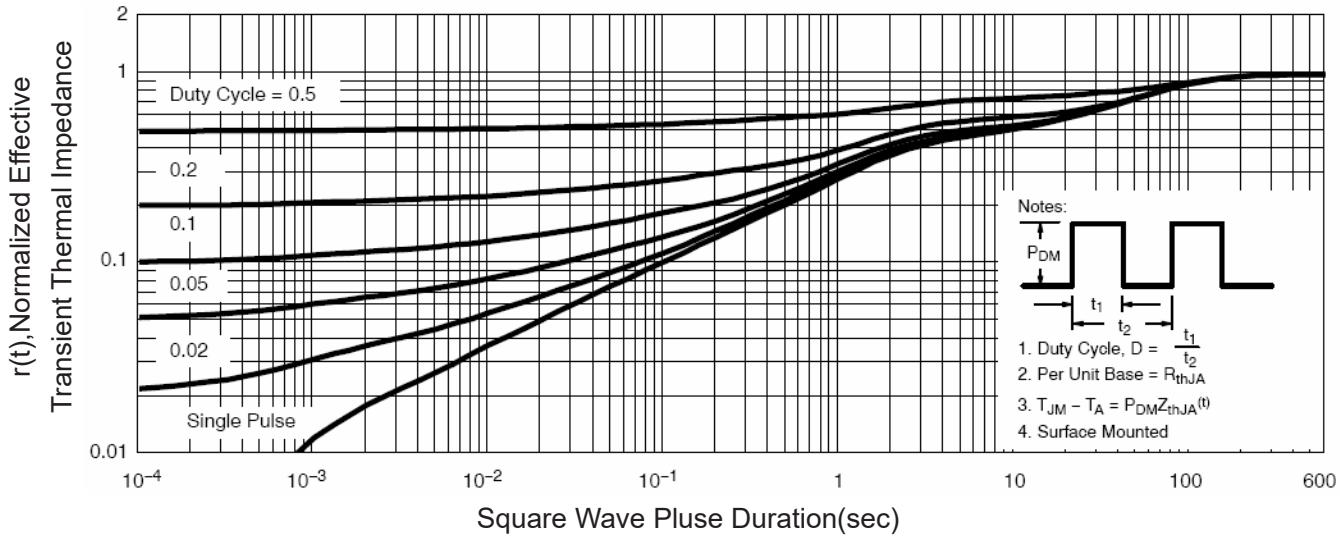



**Figure 15Normalized Maximum Transient Thermal Impedance**