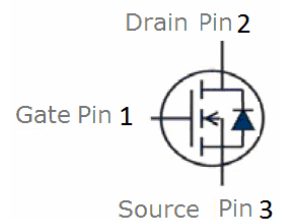
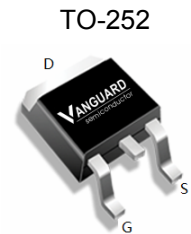


## Features

- N-Channel
- Enhancement mode
- Very low on-resistance  $R_{DS(on)}$  @  $V_{GS}=4.5V$
- Fast Switching
- 100% Avalanche Tested
- Pb-free lead plating; RoHS compliant



|                              |    |            |
|------------------------------|----|------------|
| $V_{DS}$                     | 30 | V          |
| $R_{DS(on),TYP@V_{GS}=10V}$  | 9  | m $\Omega$ |
| $R_{DS(on),TYP@V_{GS}=4.5V}$ | 12 | m $\Omega$ |
| $I_D$                        | 60 | A          |



| Part ID     | Package Type | Marking | Tape and reel information |
|-------------|--------------|---------|---------------------------|
| VSD012N03MS | TO-252       | 012N03M | 2500pcs/Reel              |

## Maximum ratings, at $T_j=25^\circ\text{C}$ , unless otherwise specified

| Symbol        | Parameter                               | Rating                  | Unit             |
|---------------|---|-------------------------|------------------|
| $V_{(BR)DSS}$ | Drain-Source breakdown voltage          | 30                      | V                |
| $I_S$         | Diode continuous forward current        | $T_C=25^\circ\text{C}$  | 60<br>A          |
| $I_D$         | Continuous drain current@ $V_{GS}=10V$  | $T_C=25^\circ\text{C}$  | 60<br>A          |
|               |   | $T_A=100^\circ\text{C}$ | 38<br>A          |
| $I_{DM}$      | Pulse drain current tested ①            | $T_C=25^\circ\text{C}$  | 150<br>A         |
| EAS           | Avalanche energy, single pulsed ②       | $I_D=20A$               | 48<br>mJ         |
| IAS           | Avalanche energy, single pulsed ②       |                         | 30<br>A          |
| $P_D$         | Maximum power dissipation               | $T_A=25^\circ\text{C}$  | 50<br>W          |
| $V_{GS}$      | Gate-Source voltage                     | $\pm 20$                | V                |
| $T_{STG} T_J$ | Storage and operating temperature range | -55 to 175              | $^\circ\text{C}$ |

## Thermal Characteristics

| Symbol          | Parameter                           | Typical | Unit               |
|-----------------|-------------------------------------|---------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance-Junction to Case | 3       | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient | 45      | $^\circ\text{C/W}$ |

**Typical Characteristics**

| Symbol  | Parameter  | Condition  | Min. | Typ. | Max. | Unit |
|---|--|--|------|------|------|------|
| <b>Static Electrical Characteristics @ T<sub>c</sub> = 25°C (unless otherwise stated)</b>   |  |  |      |      |      |      |
| V <sub>(BR)DSS</sub>  | Drain-Source Breakdown Voltage                         | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA   | 30   | --   | --   | V    |
| I <sub>DSS</sub>  | Zero Gate Voltage Drain Current(T <sub>c</sub> =25°C)  | V <sub>DS</sub> =24V, V <sub>GS</sub> =0V  | --   | --   | 1    | μA   |
|   | Zero Gate Voltage Drain Current(T <sub>c</sub> =125°C) | V <sub>DS</sub> =24V, V <sub>GS</sub> =0V  | --   | --   | 100  | μA   |
| I <sub>GSS</sub>  | Gate-Body Leakage Current                              | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V   | --   | --   | ±100 | nA   |
| V <sub>GS(TH)</sub>   | Gate Threshold Voltage                                 | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                       | 0.8  | 1.5  | 2.5  | V    |
| R <sub>DS(ON)</sub>   | Drain-Source On-State Resistance <sup>③</sup>          | V <sub>GS</sub> =10V, I <sub>D</sub> =30A  | --   | 9    | 12   | mΩ   |
| R <sub>DS(ON)</sub>   | Drain-Source On-State Resistance <sup>③</sup>          | V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A   | --   | 12   | 16   | mΩ   |
| <b>Dynamic Electrical Characteristics @ T<sub>c</sub> = 25°C (unless otherwise stated)</b>  |  |  |      |      |      |      |
| C <sub>iss</sub>  | Input Capacitance                                      | V <sub>DS</sub> =15V, V <sub>GS</sub> =0V,<br>f=1MHz   | --   | 980  | --   | pF   |
| C <sub>oss</sub>  | Output Capacitance                                     |  | --   | 160  | --   | pF   |
| C <sub>rss</sub>  | Reverse Transfer Capacitance                           |  | --   | 115  | --   | pF   |
| Q <sub>g</sub>  | Total Gate Charge                                      | V <sub>DS</sub> =15V, I <sub>D</sub> =20A,<br>V <sub>GS</sub> =10V                             | --   | 18   | --   | nC   |
| Q <sub>gs</sub>   | Gate-Source Charge                                     |  | --   | 4.5  | --   | nC   |
| Q <sub>gd</sub>   | Gate-Drain Charge                                      |  | --   | 5.5  | --   | nC   |
| <b>Switching Characteristics</b>  |  |  |      |      |      |      |
| t <sub>d(on)</sub>  | Turn-on Delay Time                                     | V <sub>DD</sub> =15V,<br>I <sub>D</sub> =10A,<br>R <sub>G</sub> =6.8Ω,<br>V <sub>GS</sub> =10V | --   | 7    | --   | nS   |
| t <sub>r</sub>  | Turn-on Rise Time                                      |  | --   | 14   | --   | nS   |
| t <sub>d(off)</sub>   | Turn-Off Delay Time                                    |  | --   | 22   | --   | nS   |
| t <sub>f</sub>  | Turn-Off Fall Time                                     |  | --   | 8    | --   | nS   |
| <b>Source- Drain Diode Characteristics @ T<sub>c</sub> = 25°C (unless otherwise stated)</b> |  |  |      |      |      |      |
| V <sub>SD</sub>   | Forward on voltage                                     | I <sub>SD</sub> =2A, V <sub>GS</sub> =0V   | --   | 0.74 | 1.2  | V    |
| t <sub>rr</sub>   | Reverse Recovery Time                                  | T <sub>J</sub> =25°C, I <sub>sd</sub> =10A,<br>V <sub>GS</sub> =0V<br>di/dt=100A/μs            | --   | 21   | --   | nS   |
| Q <sub>rr</sub>   | Reverse Recovery Charge                                |  | 11   |      |      | nC   |

**NOTE:**

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Limited by T<sub>Jmax</sub>, starting T<sub>J</sub> = 25°C, L = 0.3mH, R<sub>G</sub> = 25Ω, I<sub>AS</sub> = 18A, V<sub>GS</sub> = 10V. Part not recommended for use above this value
- ③ Pulse width ≤ 300μs; duty cycle ≤ 2%.

**Typical Characteristics**

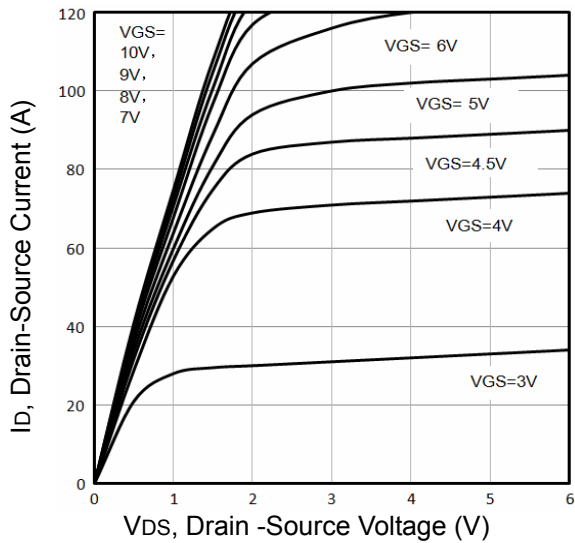


Fig1. Typical Output Characteristics

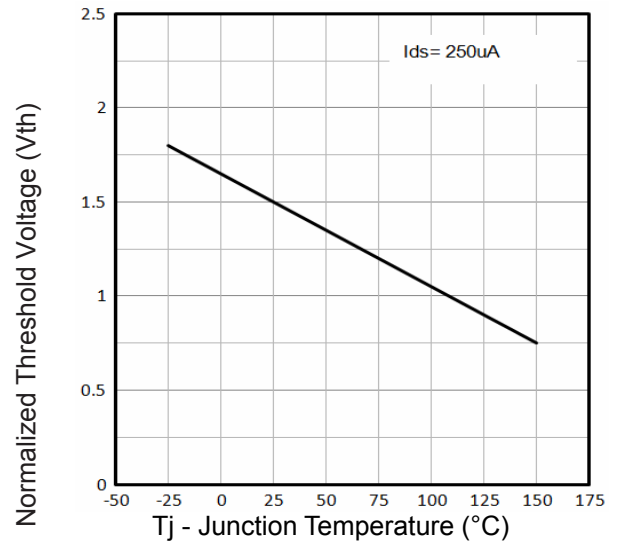


Fig2. Normalized Threshold Voltage Vs. Temperature

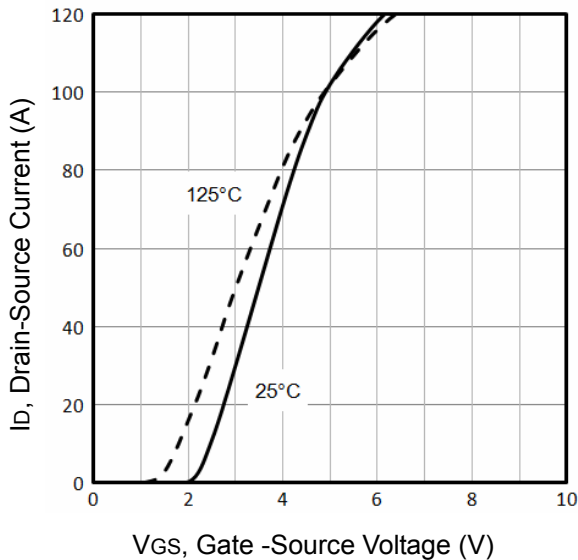


Fig3. Typical Transfer Characteristics

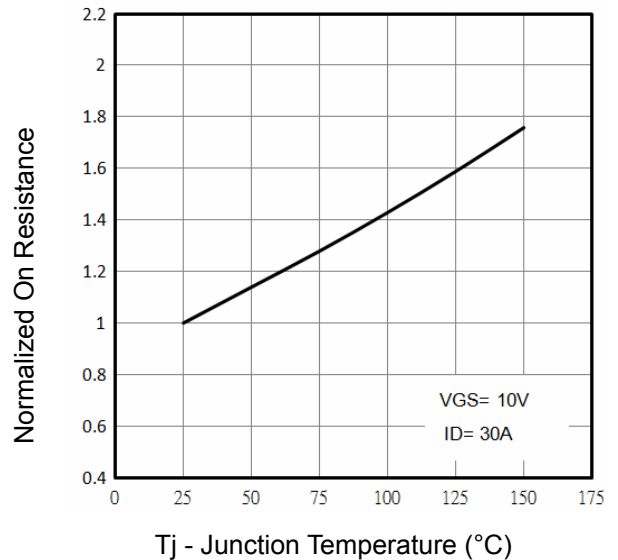


Fig4. Normalized On-Resistance Vs. Temperature

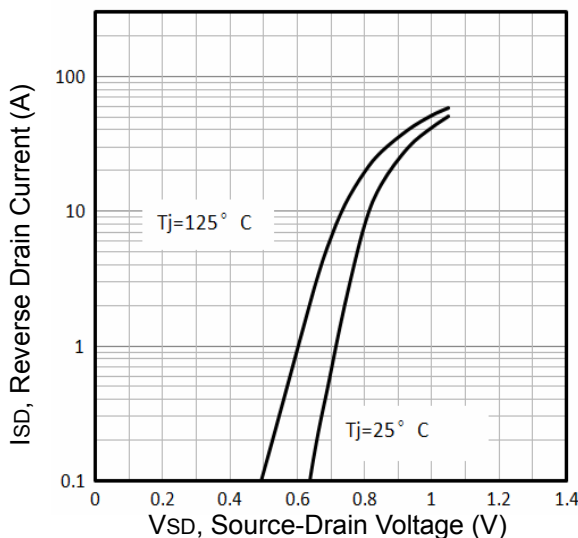


Fig5. Typical Source-Drain Diode Forward Voltage

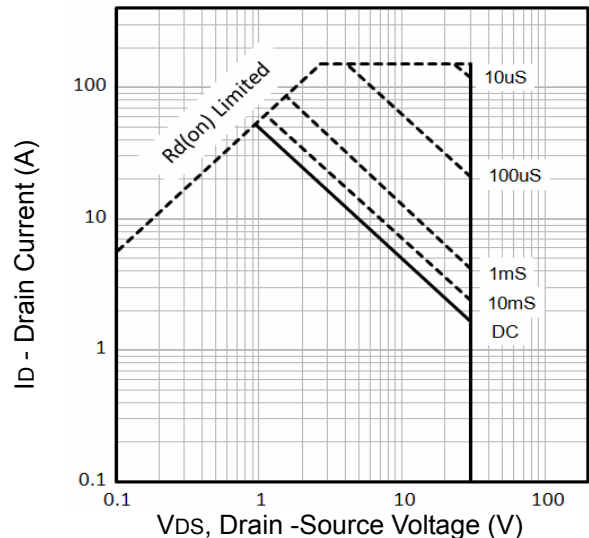


Fig6. Maximum Safe Operating Area

**Typical Characteristics**

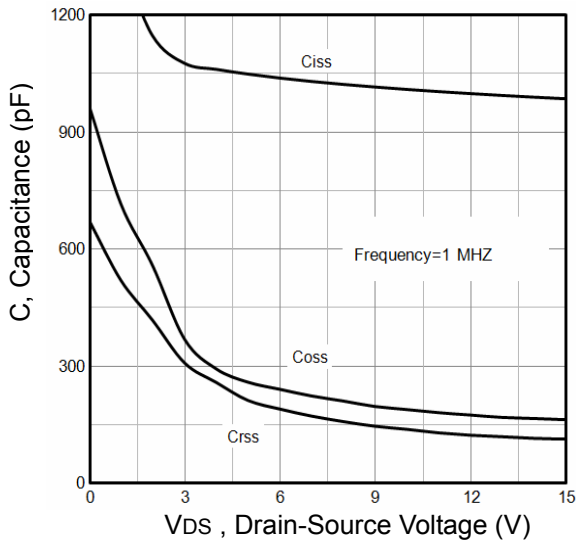


Fig7. Typical Capacitance Vs.Drain-Source Voltage

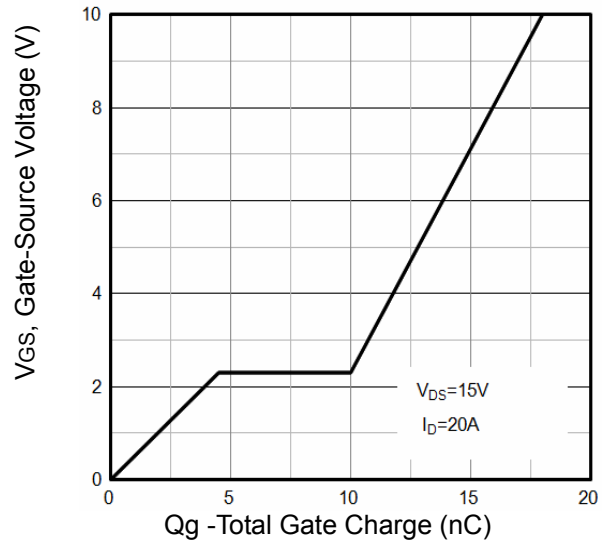


Fig8. Typical Gate Charge Vs.Gate-Source

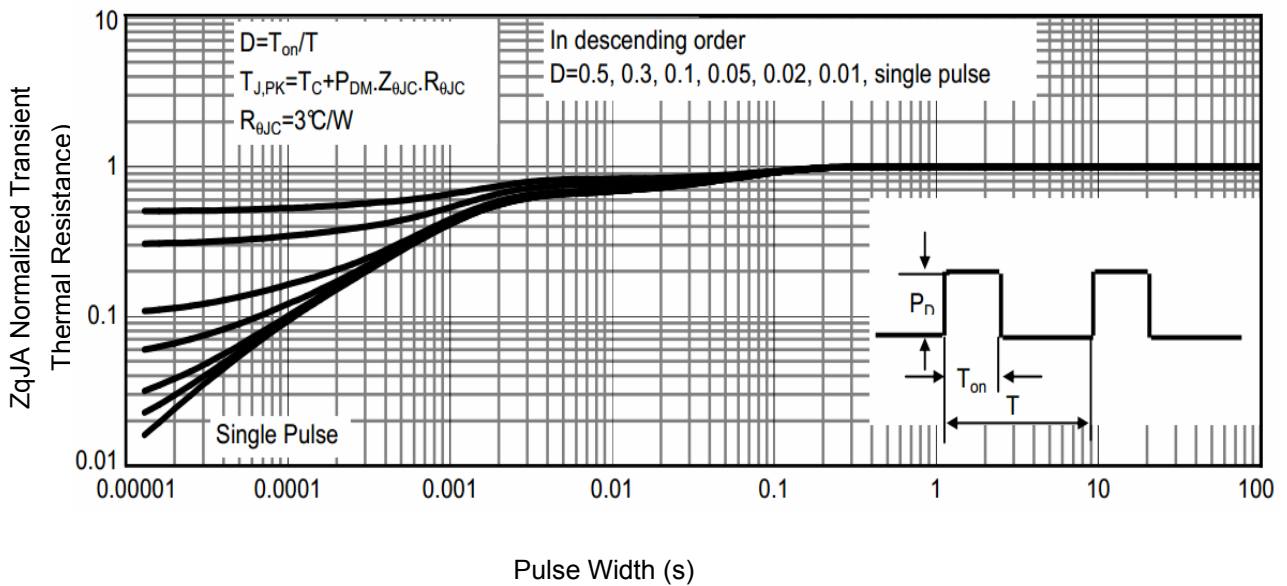


Fig 9 . Normalized Maximum Transient Thermal Impedance

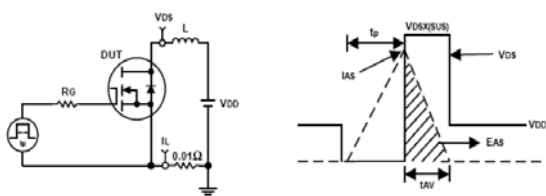


Fig10. Unclamped Inductive Test Circuit and waveforms

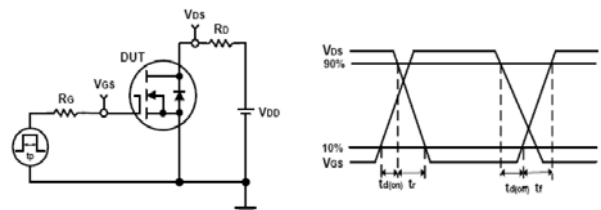
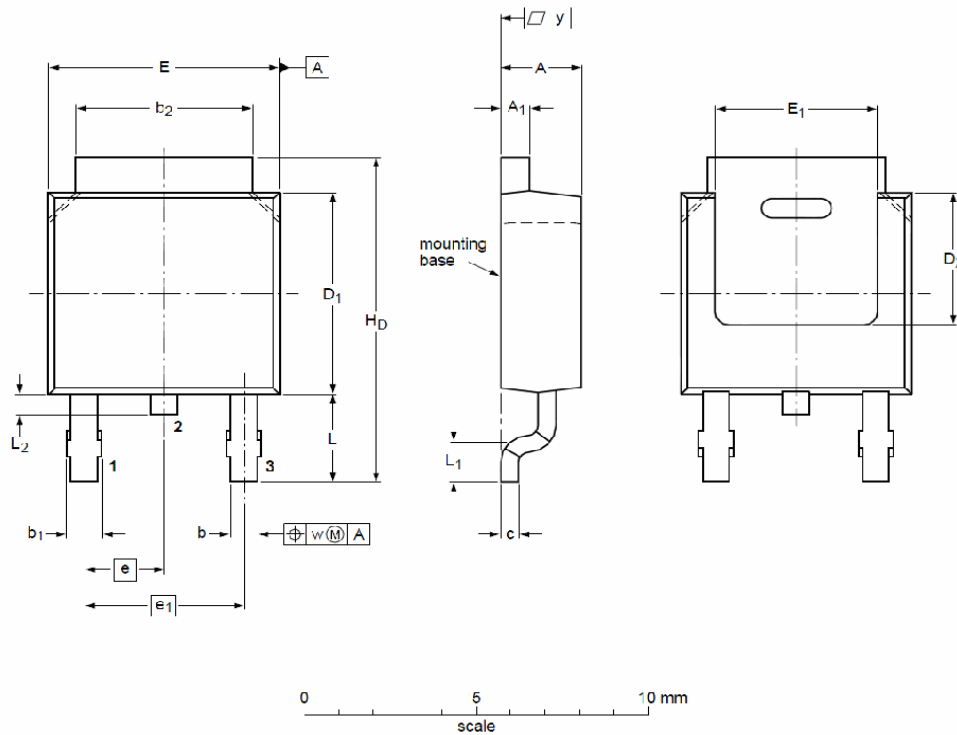


Fig11. Switching Time Test Circuit and waveforms

**TO-252 Package Outline**



**DIMENSIONS** ( unit : mm )

| Symbol         | Min  | Typ   | Max   | Symbol         | Min  | Typ  | Max  |
|----------------|------|-------|-------|----------------|------|------|------|
| A              | 2.22 | 2.30  | 2.38  | A <sub>1</sub> | 0.46 | 0.58 | 0.93 |
| b              | 0.71 | 0.79  | 0.89  | b <sub>1</sub> | 0.90 | 0.98 | 1.10 |
| b <sub>2</sub> | 5.00 | 5.30  | 5.46  | c              | 0.20 | 0.40 | 0.56 |
| D <sub>1</sub> | 5.98 | 6.05  | 6.22  | D <sub>2</sub> | --   | 4.00 | --   |
| E              | 6.47 | 6.60  | 6.73  | E <sub>1</sub> | 5.10 | 5.28 | 5.45 |
| e              | --   | 2.28  | --    | e <sub>1</sub> | --   | 4.57 | --   |
| H <sub>D</sub> | 9.60 | 10.08 | 10.40 | L              | 2.75 | 2.95 | 3.05 |
| L <sub>1</sub> | --   | 0.50  | --    | L <sub>2</sub> | 0.80 | 0.90 | 1.10 |
| w              | --   | 0.20  | --    | y              | 0.20 | --   | --   |

**Customer Service**

**Sales and Service:**  
[sales@vgsemi.com](mailto:sales@vgsemi.com)

**Vanguard Semiconductor CO., LTD**  
**TEL:** (86-755) -26902410  
**FAX:** (86-755) -26907027  
**WEB:** [www.vgsemi.com](http://www.vgsemi.com)