

# MSKSEMI 美森科

SEMICONDUCTOR



ESD



TVS



TSS



MOV



GDT



PLED

## SI2333DDS-T1-GE3-MS

Product specification

## Description

These P-Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency fast switching applications.

| BVDSS | RDSON | ID    |
|-------|-------|-------|
| -12V  | 25mΩ  | -5.5A |

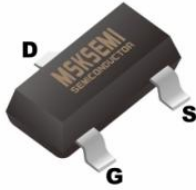
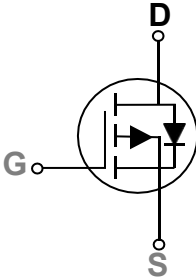

## Features

- -12V, -5.5A,  $R_{DS(ON)} = 25m\Omega @ V_{GS} = -4.5V$
- Improved  $dv/dt$  capability
- Fast switching
- Green Device Available

## Applications

- Notebook
- Load Switch
- Battery Protection
- Hand-held Instruments

## Reference News

| PACKAGE OUTLINE  | P-Channel MOSFET   | Marking   |
|--|--|---|
| <br>SOT-23 |  |  |

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

| Symbol    | Parameter  | Rating     | Units               |
|-----------|--|------------|---------------------|
| $V_{DS}$  | Drain-Source Voltage                                     | -12        | V                   |
| $V_{GS}$  | Gate-Source Voltage                                      | $\pm 12$   | V                   |
| $I_D$     | Drain Current – Continuous ( $T_C = 25^\circ\text{C}$ )  | -5.5       | A                   |
|           | Drain Current – Continuous ( $T_C = 100^\circ\text{C}$ ) | -3.5       | A                   |
| $I_{DM}$  | Drain Current – Pulsed <sup>1</sup>                      | -21.2      | A                   |
| $P_D$     | Power Dissipation ( $T_C = 25^\circ\text{C}$ )           | 1.56       | W                   |
|           | Power Dissipation – Derate above $25^\circ\text{C}$      | 0.012      | W/ $^\circ\text{C}$ |
| $T_{STG}$ | Storage Temperature Range                                | -55 to 150 | $^\circ\text{C}$    |
| $T_J$     | Operating Junction Temperature Range                     | -55 to 150 | $^\circ\text{C}$    |

## Thermal Characteristics

| Symbol          | Parameter                              | Typ. | Max. | Unit               |
|-----------------|--|------|------|--------------------|
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient | ---  | 80   | $^\circ\text{C/W}$ |

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

| Symbol                              | Parameter                                 | Conditions   | Min. | Typ.  | Max. | Unit |
|-------------------------------------|---|--|------|-------|------|------|
| BV <sub>DSS</sub>                   | Drain-Source Breakdown Voltage            | V <sub>GS</sub> =0V , I <sub>D</sub> =-250uA                         | -12  | ---   | ---  | V    |
| ΔBV <sub>DSS</sub> /ΔT <sub>J</sub> | BV <sub>DSS</sub> Temperature Coefficient | Reference to 25°C , I <sub>D</sub> =-1mA                             | ---  | -0.02 | ---  | V/°C |
| I <sub>DSS</sub>                    | Drain-Source Leakage Current              | V <sub>DS</sub> =-20V , V <sub>GS</sub> =0V , T <sub>J</sub> =25°C   | ---  | ---   | -1   | uA   |
|                                     |   | V <sub>DS</sub> =-16V , V <sub>GS</sub> =0V , T <sub>J</sub> = 125°C | ---  | ---   | -10  | uA   |
| I <sub>GSS</sub>                    | Gate-Source Leakage Current               | V <sub>GS</sub> =±12V , V <sub>DS</sub> =0V                          | ---  | ---   | ±100 | nA   |

**On Characteristics**

|                      |   |   |      |      |     |       |
|----------------------|---|---|------|------|-----|-------|
| R <sub>DS(ON)</sub>  | Static Drain-Source On-Resistance           | V <sub>GS</sub> =-4.5V , I <sub>D</sub> =-4A              | ---  | 25   | 35  | mΩ    |
|                      |   | V <sub>GS</sub> =-2.5V , I <sub>D</sub> =-3A              | ---  | 35   | 50  |       |
| V <sub>GS(th)</sub>  | Gate Threshold Voltage                      | V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250uA | -0.3 | -0.6 | -1  | V     |
| ΔV <sub>GS(th)</sub> | V <sub>GS(th)</sub> Temperature Coefficient |   | ---  | 2    | --- | mV/°C |
| g <sub>fs</sub>      | Forward Transconductance                    | V <sub>DS</sub> =-12V , I <sub>S</sub> =-3A               | ---  | 8.4  | --- | S     |

**Dynamic and switching Characteristics**

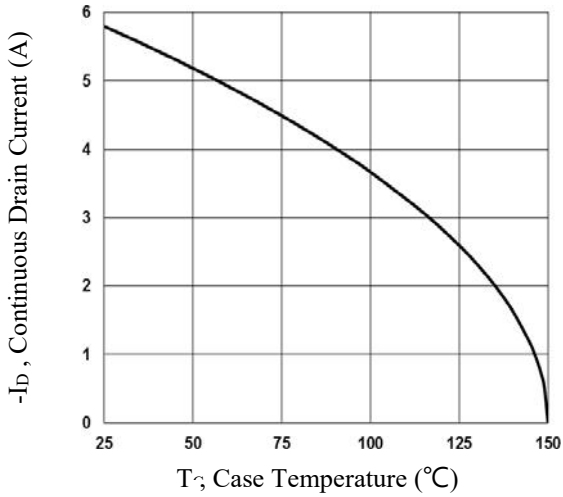
|                     |                                      |   |     |      |     |    |
|---------------------|--------------------------------------|---|-----|------|-----|----|
| Q <sub>g</sub>      | Total Gate Charge <sup>2 , 3</sup>   | V <sub>DS</sub> =-10V , V <sub>GS</sub> =-4.5V , I <sub>D</sub> =-4A                        | --- | 16.1 | --- | nC |
| Q <sub>gs</sub>     | Gate-Source Charge <sup>2 , 3</sup>  |   | --- | 1.8  | --- |    |
| Q <sub>gd</sub>     | Gate-Drain Charge <sup>2 , 3</sup>   |   | --- | 3.8  | --- |    |
| T <sub>d(on)</sub>  | Turn-On Delay Time <sup>2 , 3</sup>  | V <sub>DD</sub> =-10V , V <sub>GS</sub> =-4.5V ,<br>R <sub>G</sub> =25Ω I <sub>D</sub> =-1A | --- | 8.2  | --- | nS |
| T <sub>r</sub>      | Rise Time <sup>2 , 3</sup>           |   | --- | 30   | --- |    |
| T <sub>d(off)</sub> | Turn-Off Delay Time <sup>2 , 3</sup> |   | --- | 71.1 | --- |    |
| T <sub>f</sub>      | Fall Time <sup>2 , 3</sup>           |   | --- | 19.8 | --- |    |
| C <sub>iss</sub>    | Input Capacitance                    | V <sub>DS</sub> =-15V , V <sub>GS</sub> =0V , F= 1MHz                                       | --- | 1440 | --- | pF |
| C <sub>oss</sub>    | Output Capacitance                   |   | --- | 155  | --- |    |
| C <sub>rss</sub>    | Reverse Transfer Capacitance         |   | --- | 115  | --- |    |

**Drain-Source Diode Characteristics and Maximum Ratings**

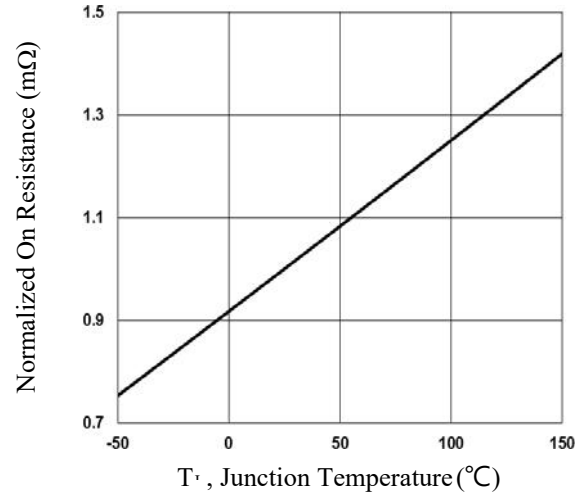
| Symbol          | Parameter                 | Conditions   | Min. | Typ. | Max.  | Unit |
|-----------------|---------------------------|--|------|------|-------|------|
| I <sub>S</sub>  | Continuous Source Current | V <sub>G</sub> =V <sub>D</sub> =0V , Force Current               | ---  | ---  | -5.5  | A    |
| I <sub>SM</sub> | Pulsed Source Current     |  | ---  | ---  | -21.2 | A    |
| V <sub>SD</sub> | Diode Forward Voltage     | V <sub>GS</sub> =0V , I <sub>S</sub> =-1A , T <sub>J</sub> =25°C | ---  | ---  | -1.2  | V    |

**Note :**

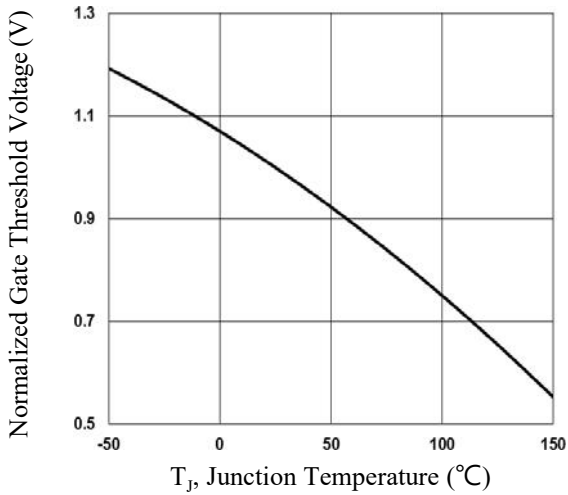
1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. The data tested by pulsed , pulse width ≤ 300us , duty cycle ≤ 2%.
3. Essentially independent of operating temperature.



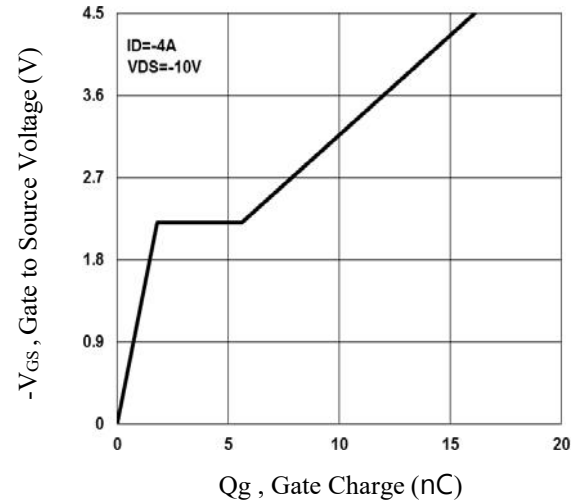
**Fig.1 Continuous Drain Current vs.  $T_c$**



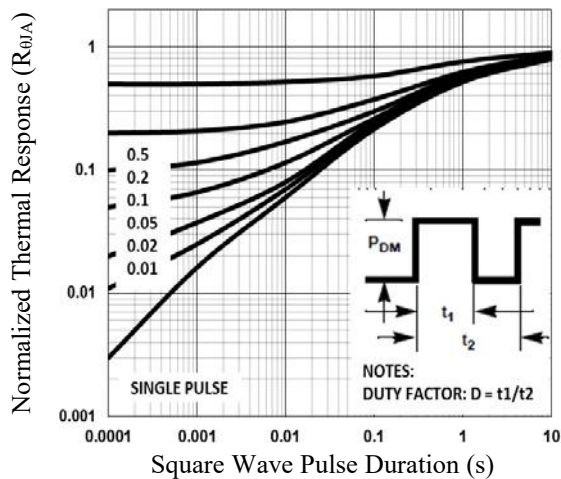
**Fig.2 Normalized  $R_{DS(on)}$  vs.  $T_J$**



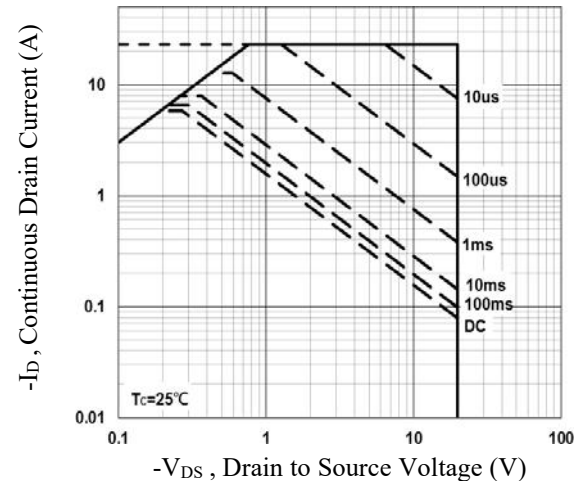
**Fig.3 Normalized  $V_{th}$  vs.  $T_J$**



**Fig.4 Gate Charge Waveform**

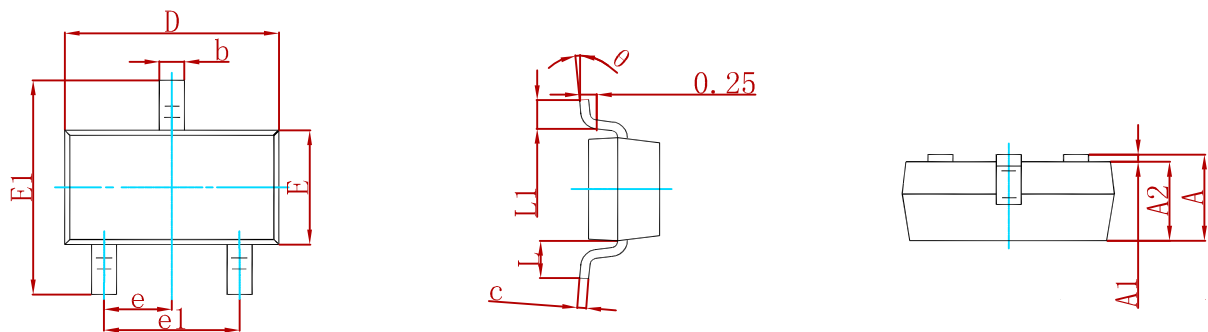


**Fig.5 Normalized Transient Impedance**



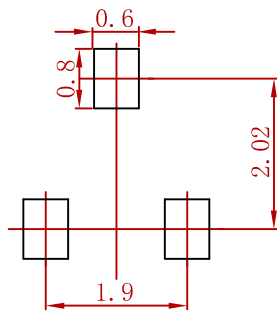
**Fig.6 Maximum Safe Operation Area**

PACKAGE MECHANICAL DATA



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 0.900                     | 1.150 | 0.035                | 0.045 |
| A1     | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2     | 0.900                     | 1.050 | 0.035                | 0.041 |
| b      | 0.300                     | 0.500 | 0.012                | 0.020 |
| c      | 0.080                     | 0.150 | 0.003                | 0.006 |
| D      | 2.800                     | 3.000 | 0.110                | 0.118 |
| E      | 1.200                     | 1.400 | 0.047                | 0.055 |
| E1     | 2.250                     | 2.550 | 0.089                | 0.100 |
| e      | 0.950 TYP                 |       | 0.037 TYP            |       |
| e1     | 1.800                     | 2.000 | 0.071                | 0.079 |
| L      | 0.550 REF                 |       | 0.022 REF            |       |
| L1     | 0.300                     | 0.500 | 0.012                | 0.020 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |

Suggested Pad Layout



Note:  
1.Controlling dimension:in millimeters.  
2.General tolerance:± 0.05mm.  
3.The pad layout is for reference purposes only.

REELSPECIFICATION

| P/N                 | PKG    | QTY  |
|---------------------|--------|------|
| SI2333DDS-T1-GE3-MS | SOT-23 | 3000 |

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