

# MSKSEMI

SEMICONDUCTOR



ESD



TVS



TSS



MOV

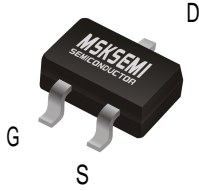


GDT

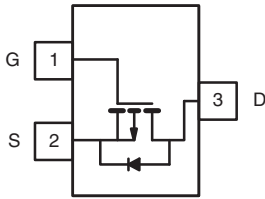


PLED

Product data sheet



SOT-23



**Features**

- -60V, -1.8A,  $R_{DS(ON)} = 200m\Omega @ V_{GS} = -10V$
- Improved dv/dt capability
- Fast switching
- Green Device Available

**Applications**

- Motor Drive
- Power Tools
- LED Lighting

|       |       |       |
|-------|-------|-------|
| BVDSS | RDSON | ID    |
| -60V  | 200mΩ | -1.8A |

**Absolute Maximum Ratings**  $T_c=25^\circ\text{C}$  unless otherwise noted

| Symbol    | Parameter   | Rating     | Units |
|-----------|---|------------|-------|
| $V_{DS}$  | Drain-Source Voltage                                  | -60        | V     |
| $V_{GS}$  | Gate-Source Voltage                                   | $\pm 20$   | V     |
| $I_D$     | Drain Current – Continuous ( $T_A=25^\circ\text{C}$ ) | -1.8       | A     |
|           | Drain Current – Continuous ( $T_A=70^\circ\text{C}$ ) | -1.5       | A     |
| $I_{DM}$  | Drain Current – Pulsed <sup>1</sup>                   | -8         | A     |
| $P_D$     | Power Dissipation ( $T_A=25^\circ\text{C}$ )          | 1.56       | W     |
|           | Power Dissipation – Derate above 25°C                 | 0.012      | W/°C  |
| $T_{STG}$ | Storage Temperature Range                             | -55 to 150 | °C    |
| $T_J$     | Operating Junction Temperature Range                  | -55 to 150 | °C    |

**Thermal Characteristics**

| Symbol          | Parameter                              | Typ. | Max. | Unit |
|-----------------|--|------|------|------|
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient | ---  | 80   | °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                       | -60  | ---   | ---  | V    |
| ΔBV <sub>DSS</sub> /ΔT <sub>J</sub> | BV <sub>DSS</sub> Temperature Coefficient | Reference to 25°C, I <sub>D</sub> =-1mA                           | ---  | -0.05 | ---  | V/°C |
| I <sub>DSS</sub>                    | Drain-Source Leakage Current              | V <sub>DS</sub> =-60V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C  | ---  | ---   | -1   | uA   |
|                                     |   | V <sub>DS</sub> =-48V, 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> =±20V, V <sub>DS</sub> =0V                        | ---  | ---   | ±100 | nA   |

**On Characteristics**

|                      |   |   |      |      |      |       |
|----------------------|---|---|------|------|------|-------|
| R <sub>DS(ON)</sub>  | Static Drain-Source On-Resistance           | V <sub>GS</sub> =-10V, I <sub>D</sub> =-1.8A              | ---  | 200  | 300  | mΩ    |
|                      |   | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-1.5A             | ---  | 300  | 400  | mΩ    |
| V <sub>GS(th)</sub>  | Gate Threshold Voltage                      | V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250uA | -1.0 | -1.7 | -2.5 | V     |
| ΔV <sub>GS(th)</sub> | V <sub>GS(th)</sub> Temperature Coefficient |   | ---  | 5    | ---  | mV/°C |
| g <sub>fs</sub>      | Forward Transconductance                    | V <sub>DS</sub> =-10V, I <sub>D</sub> =-2A                | ---  | 3.5  | ---  | S     |

**Dynamic and switching Characteristics**

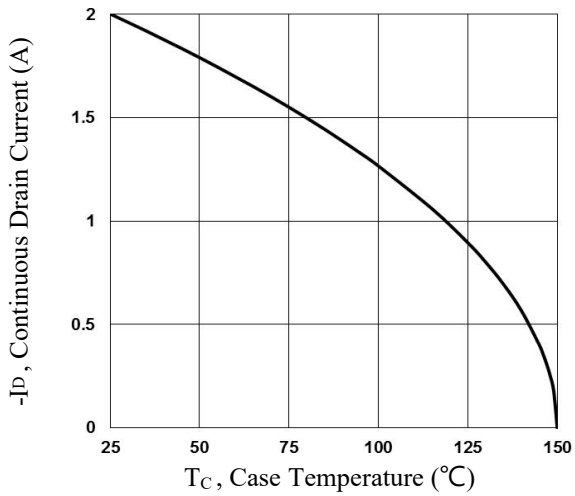
|                     |                                     |   |     |      |     |    |
|---------------------|-------------------------------------|---|-----|------|-----|----|
| Q <sub>g</sub>      | Total Gate Charge <sup>2, 3</sup>   | V <sub>DS</sub> =-30V, V <sub>GS</sub> =-10V, I <sub>D</sub> =-2A                       | --- | 8.2  | --- | 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>   |   | --- | 1.5  | --- |    |
| T <sub>d(on)</sub>  | Turn-On Delay Time <sup>2, 3</sup>  | V <sub>DD</sub> =-30V, V <sub>GS</sub> =-10V, R <sub>G</sub> =6Ω<br>I <sub>D</sub> =-1A | --- | 5.2  | --- | ns |
| T <sub>r</sub>      | Rise Time <sup>2, 3</sup>           |   | --- | 19   | --- |    |
| T <sub>d(off)</sub> | Turn-Off Delay Time <sup>2, 3</sup> |   | --- | 35   | --- |    |
| T <sub>f</sub>      | Fall Time <sup>2, 3</sup>           |   | --- | 10.6 | --- |    |
| C <sub>iss</sub>    | Input Capacitance                   | V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V, F=1MHz                                      | --- | 425  | --- | pF |
| C <sub>oss</sub>    | Output Capacitance                  |   | --- | 35   | --- |    |
| C <sub>rss</sub>    | Reverse Transfer Capacitance        |   | --- | 20   | --- |    |
| R <sub>g</sub>      | Gate resistance                     | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz  | --- | 17   | --- | Ω  |

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

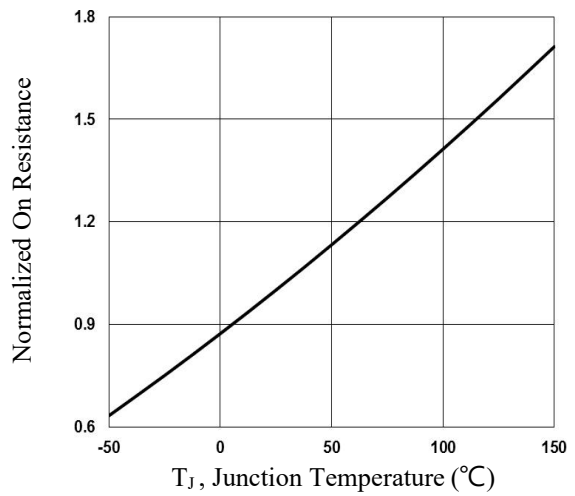
| Symbol          | Parameter                 | Conditions   | Min. | Typ. | Max. | Unit |
|-----------------|---------------------------|--|------|------|------|------|
| I <sub>S</sub>  | Continuous Source Current | V <sub>G</sub> =V <sub>D</sub> =0V, Force Current              | ---  | ---  | -1.8 | A    |
| I <sub>SM</sub> | Pulsed Source Current     |  | ---  | ---  | -3.6 | 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 :

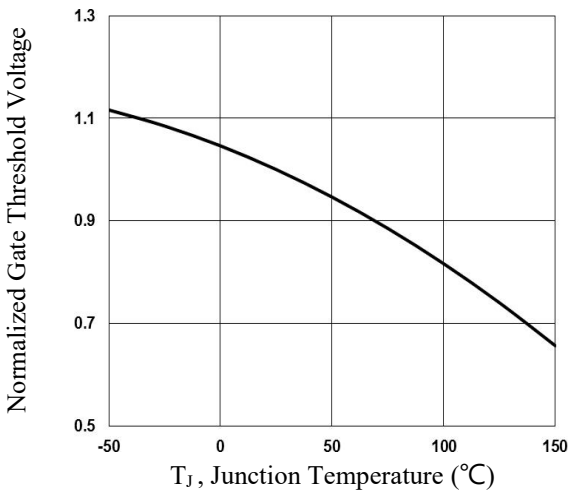
1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%.
3. Essentially independent of operating temperature.



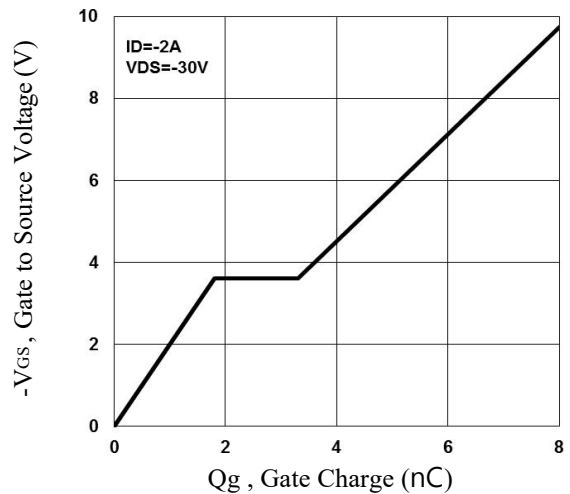
**Fig.1 Continuous Drain Current vs.  $T_c$**



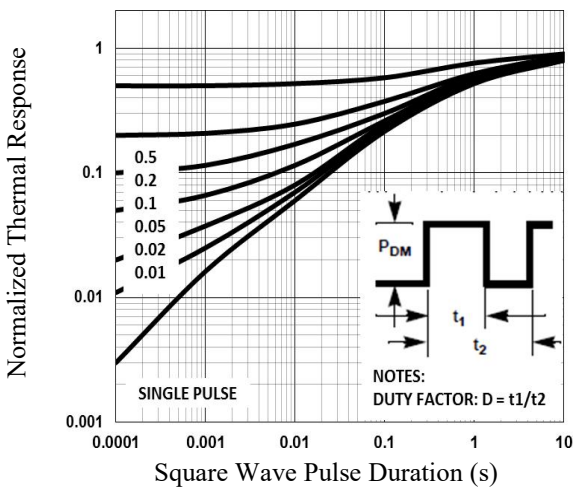
**Fig.2 Normalized  $R_{DS(on)}$  vs.  $T_j$**



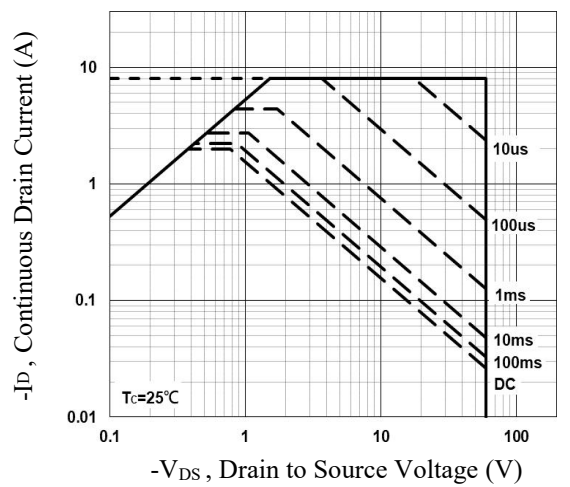
**Fig.3 Normalized  $V_{th}$  vs.  $T_j$**



**Fig.4 Gate Charge Waveform**

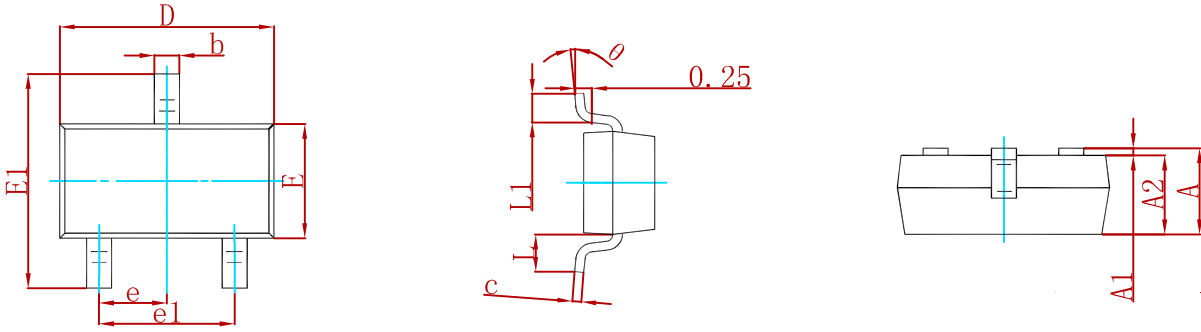


**Fig.5 Normalized Transient Impedance**



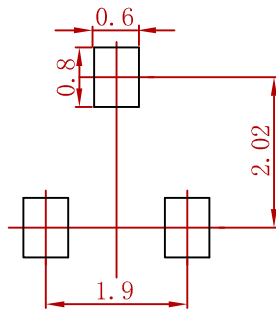
**Fig.6 Maximum Safe Operation Area**

**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.

**REEL SPECIFICATION**

| P/N                 | PKG    | QTY  |
|---------------------|--------|------|
| SI2309CDS-T1-GE3-MS | SOT-23 | 3000 |

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