

### Product Summary

| $V_{(BR)DSS}$ | $R_{DS(on)MAX}$ | $I_D$ |
|---------------|-----------------|-------|
| 60V           | 100mΩ@10V       | 3A    |
|               | 110mΩ@4.5V      |       |

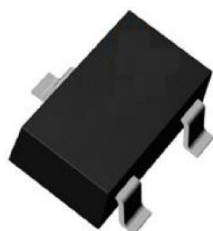
### Feature

- Advanced trench technology
- Excellent  $R_{DS(ON)}$
- Low gate charge

### Application

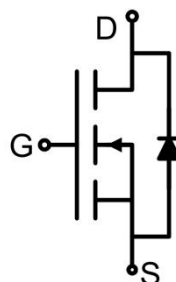
- Battery protection
- Load switch
- Uninterruptible power supply

### Package

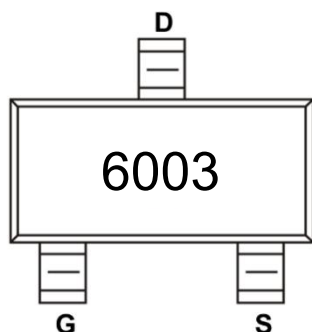


SOT-23

### Circuit diagram



### Marking



### Absolute maximum ratings (T<sub>C</sub>=25°C unless otherwise noted)

| Parameter                                                                           | Symbol                | Value      | Unit |
|-------------------------------------------------------------------------------------|-----------------------|------------|------|
| Drain-Source Voltage                                                                | V <sub>DS</sub>       | 60         | V    |
| Gate-Source Voltage                                                                 | V <sub>GS</sub>       | ±20        | V    |
| Continuous Drain Current <sup>1)</sup> (V <sub>GS</sub> =10V, T <sub>A</sub> =25°C) | I <sub>D</sub>        | 3          | A    |
| Continuous Drain Current <sup>1)</sup> (V <sub>GS</sub> =10V, T <sub>A</sub> =70°C) | I <sub>D</sub> (70°C) | 1.8        | A    |
| Pulsed Drain Current <sup>2)</sup>                                                  | I <sub>DM</sub>       | 9.2        | A    |
| Power Dissipation <sup>3)</sup> (T <sub>A</sub> =25°C)                              | P <sub>D</sub>        | 1          | W    |
| Thermal Resistance Junction to Ambient <sup>1)</sup>                                | R <sub>θJA</sub>      | 125        | °C/W |
| Operating Junction Temperature                                                      | T <sub>J</sub>        | -55 ~ +150 | °C   |
| Storage Temperature                                                                 | T <sub>STG</sub>      | -55 ~ +150 | °C   |

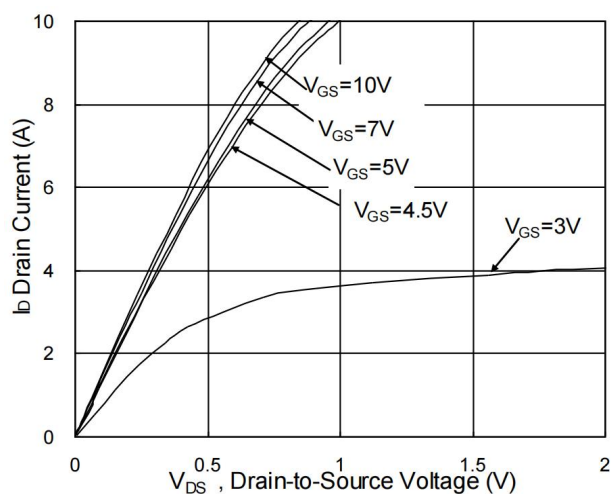
### Electrical characteristics (T<sub>A</sub>=25 °C, unless otherwise noted)

| Parameter                                | Symbol               | Test Condition                                                                         | Min. | Typ. | Max. | Unit |
|------------------------------------------|----------------------|----------------------------------------------------------------------------------------|------|------|------|------|
| Static Characteristics                   |                      |                                                                                        |      |      |      |      |
| Drain-source breakdown voltage           | V <sub>(BR)DSS</sub> | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA                                             | 60   |      |      | V    |
| Zero gate voltage drain current          | I <sub>DSS</sub>     | V <sub>DS</sub> =48V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C                        |      |      | 1    | μA   |
| Gate-body leakage current                | I <sub>GSS</sub>     | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V                                             |      |      | ±100 | nA   |
| Gate threshold voltage                   | V <sub>GS(th)</sub>  | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                               | 1.2  |      | 2.5  | V    |
| Drain-source on-resistance <sup>2)</sup> | R <sub>DS(on)</sub>  | V <sub>GS</sub> =10V, I <sub>D</sub> =2A                                               |      | 80   | 100  | mΩ   |
|                                          |                      | V <sub>GS</sub> =4.5V, I <sub>D</sub> =1A                                              |      | 85   | 110  |      |
| Dynamic characteristics <sup>4)</sup>    |                      |                                                                                        |      |      |      |      |
| Input Capacitance                        | C <sub>iss</sub>     | V <sub>DS</sub> =15V, V <sub>GS</sub> =0V, f =1MHz                                     |      | 511  |      | pF   |
| Output Capacitance                       | C <sub>oss</sub>     |                                                                                        |      | 38   |      |      |
| Reverse Transfer Capacitance             | C <sub>rss</sub>     |                                                                                        |      | 25   |      |      |
| Total Gate Charge                        | Q <sub>g</sub>       | V <sub>DS</sub> =48V, V <sub>GS</sub> =4.5V, I <sub>D</sub> =2A                        |      | 5    |      | nC   |
| Gate-Source Charge                       | Q <sub>gs</sub>      |                                                                                        |      | 1.68 |      |      |
| Gate-Drain Charge                        | Q <sub>gd</sub>      |                                                                                        |      | 1.9  |      |      |
| Turn-on delay time                       | t <sub>d(on)</sub>   | V <sub>DS</sub> =30V, V <sub>GS</sub> =10V, I <sub>D</sub> =2A<br>R <sub>G</sub> =3.3Ω |      | 1.6  |      | nS   |
| Turn-on rise time                        | t <sub>r</sub>       |                                                                                        |      | 7.2  |      |      |
| Turn-off delay time                      | t <sub>d(off)</sub>  |                                                                                        |      | 25   |      |      |
| Turn-off fall time                       | t <sub>f</sub>       |                                                                                        |      | 14.4 |      |      |
| Source-Drain Diode characteristics       |                      |                                                                                        |      |      |      |      |
| Diode Forward Current                    | I <sub>S</sub>       | V <sub>G</sub> =V <sub>D</sub> =0V , Force Current                                     |      |      | 3    | A    |
| Diode Forward voltage                    | V <sub>SD</sub>      | V <sub>GS</sub> =0V, I <sub>S</sub> =1A, T <sub>J</sub> =25°C                          |      |      | 1.2  | V    |
| Reverse recover time                     | T <sub>rr</sub>      | I <sub>F</sub> =2A, di/dt =100A/us                                                     |      | 9.7  |      | nS   |
| Reverse recovery charge                  | Q <sub>rr</sub>      | T <sub>J</sub> =25°C                                                                   |      | 5.8  |      | nC   |

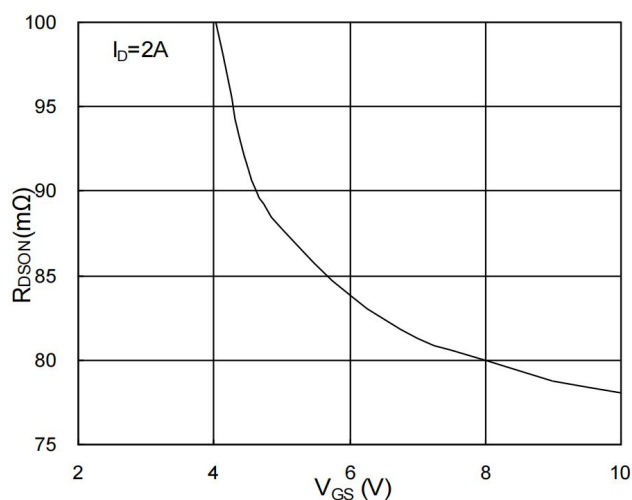
Notes:

- 1) The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 20Z copper.
- 2) The data tested by pulsed , pulse width ≤300us , duty cycle ≤2%.
- 3) The power dissipation is limited by 150°C junction temperature.
- 4) Guaranteed by design, not subject to production testing.

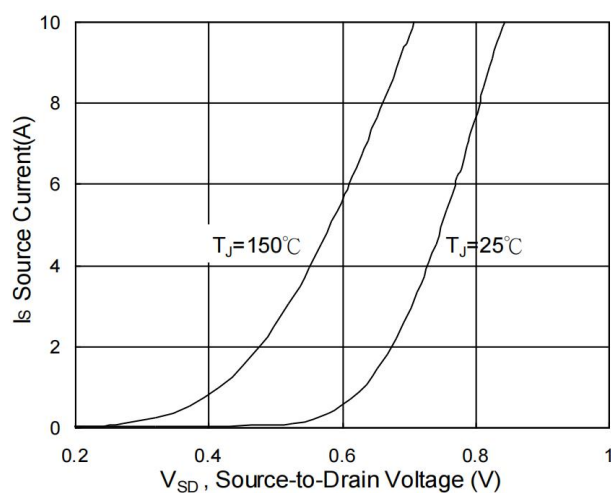
### Typical Characteristics



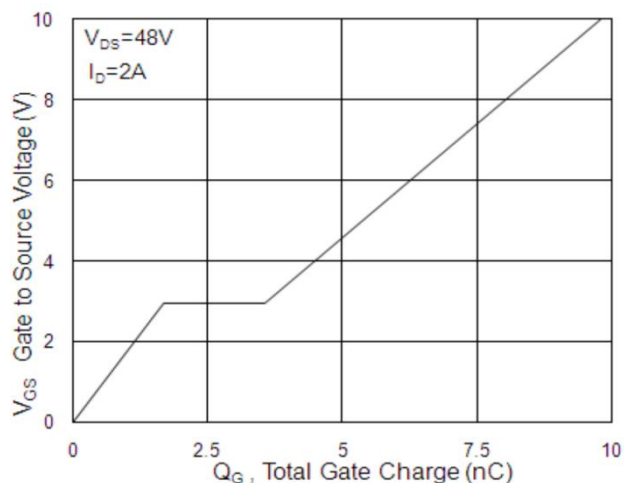
**Fig.1 Typical Output Characteristics**



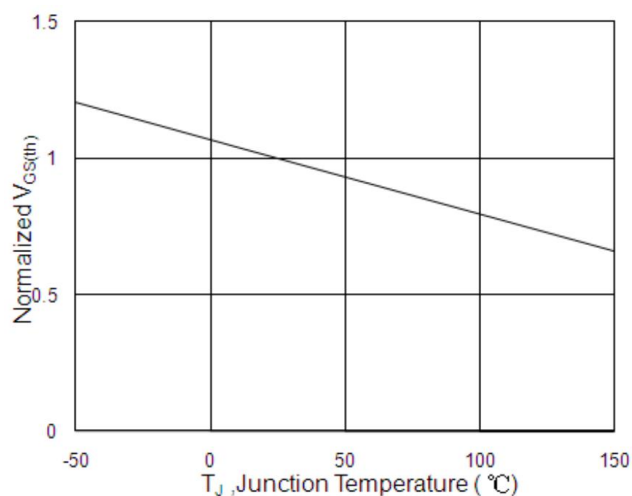
**Fig.2 On-Resistance v.s Gate-Source**



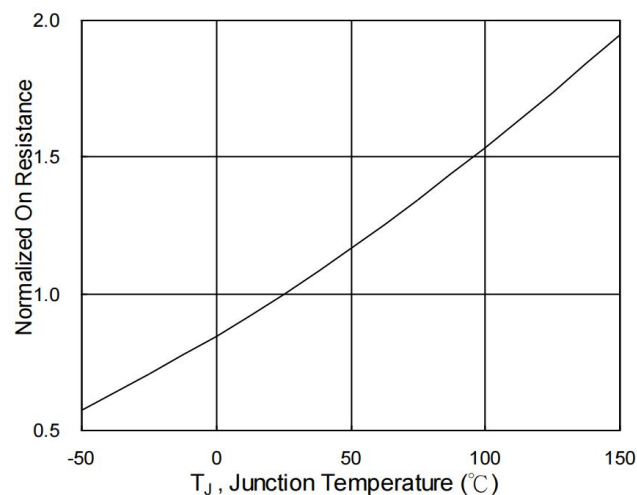
**Fig.3 Forward Characteristics of Reverse**



**Fig.4 Gate-Charge Characteristics**

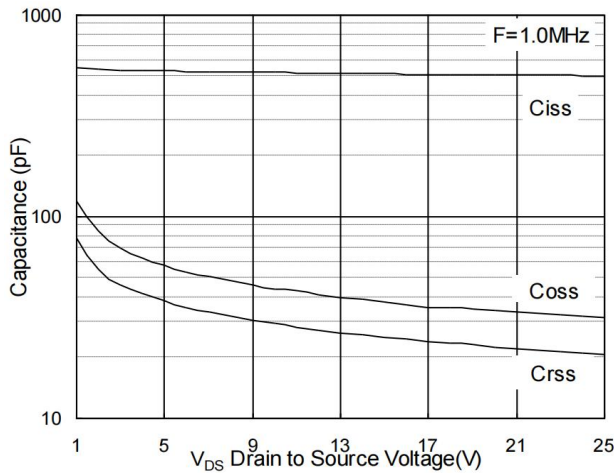


**Fig.5 Normalized  $V_{GS(th)}$  v.s  $T_J$**

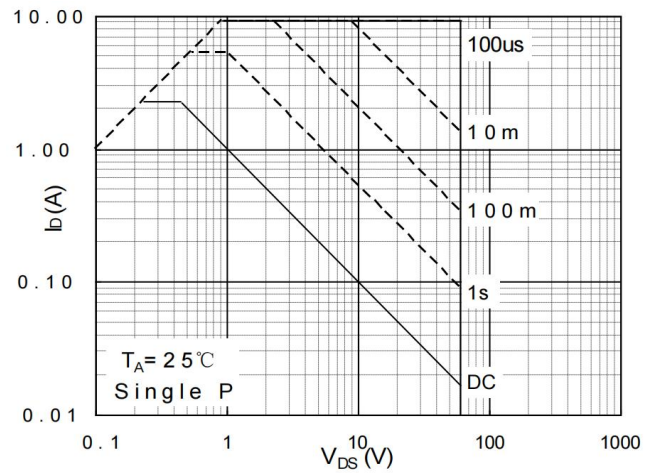


**Fig.6 Normalized  $R_{DS(on)}$  v.s  $T_J$**

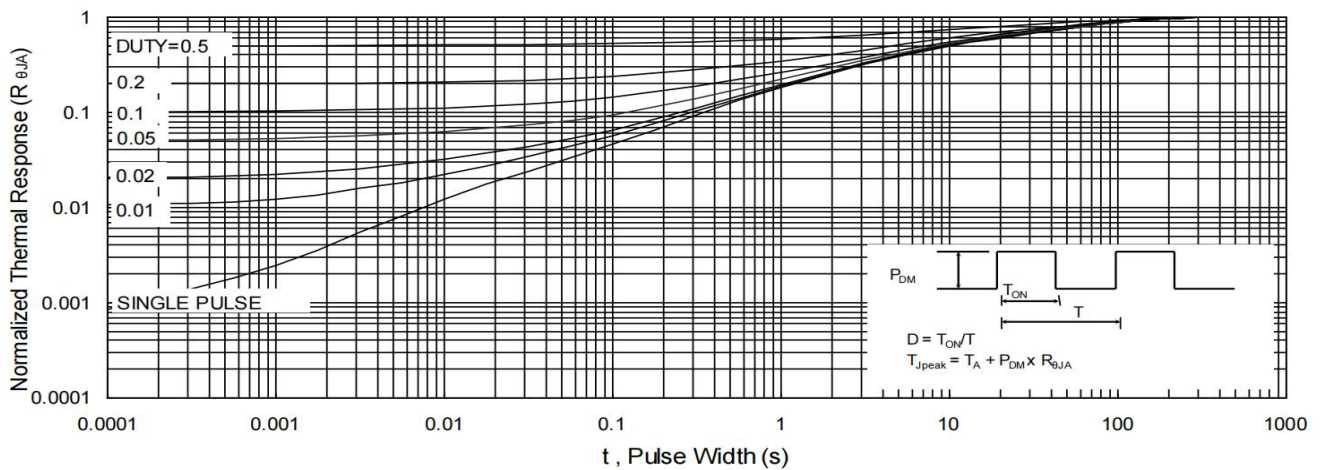
### Typical Characteristics



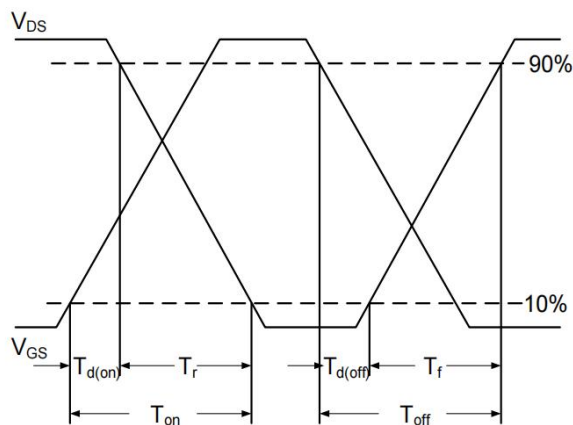
**Fig.7 Capacitance**



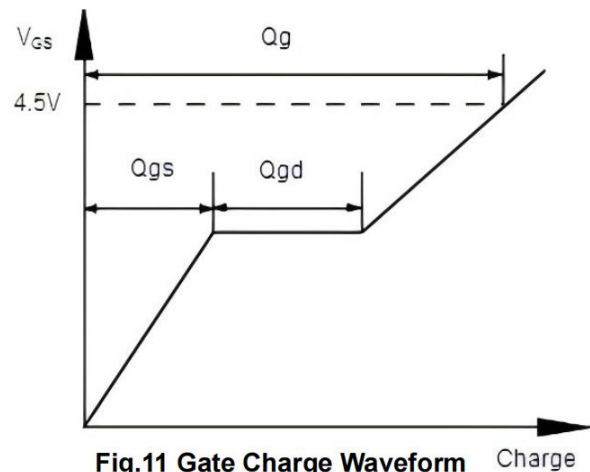
**Fig.8 Safe Operating Area**



**Fig.9 Normalized Maximum Transient Thermal Impedance**

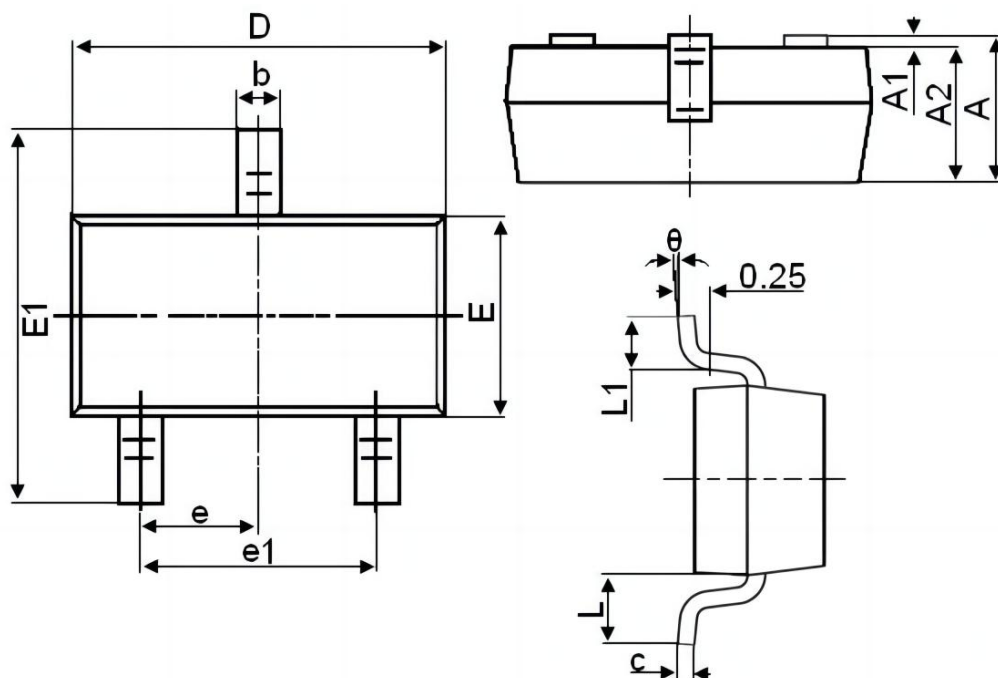


**Fig.10 Switching Time Waveform**



**Fig.11 Gate Charge Waveform**

### SOT-23 Package Information



| 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 REF.                |       | 0.037 REF.           |       |
| 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°    |