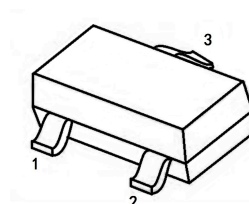


## -20V P-Channel Mosfet

### FEATURES

- $R_{DS(ON)} \leq 45m\Omega$  (38m $\Omega$  Typ.)  
@ $V_{GS} = -4.5V$
- $R_{DS(ON)} \leq 60m\Omega$  (48m $\Omega$  Typ.)  
@ $V_{GS} = -2.5V$
- ESD Rating: HBM 2.0KV

### SOT-23

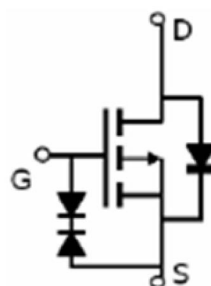


1. GATE
2. SOURCE
3. DRAIN

### APPLICATIONS

- PWM Applications
- Load Switch
- Power Management

### P-CHANNEL MOSFET



### MARKING



Other marks: "3415" or "AF4E"

### Absolute Maximum Ratings ( $T_C = 25^\circ C$ unless otherwise specified)

| Symbol          | Parameter                               |                     | Max.        | Units        |
|-----------------|-----------------------------------------|---------------------|-------------|--------------|
| $V_{DSS}$       | Drain-Source Voltage                    |                     | -20         | V            |
| $V_{GSS}$       | Gate-Source Voltage                     |                     | $\pm 10$    | V            |
| $I_D$           | Continuous Drain Current                | $T_C = 25^\circ C$  | -4          | A            |
|                 |                                         | $T_C = 100^\circ C$ | -2.6        |              |
| $I_{DM}$        | Pulsed Drain Current <sup>note1</sup>   |                     | -20         | A            |
| $P_D$           | Power Dissipation                       | $T_A = 25^\circ C$  | 1.67        | W            |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient |                     | 75          | $^\circ C/W$ |
| $T_J, T_{STG}$  | Operating and Storage Temperature Range |                     | -55 to +150 | $^\circ C$   |

**Electrical Characteristics (T<sub>c</sub>=25°C unless otherwise specified)**

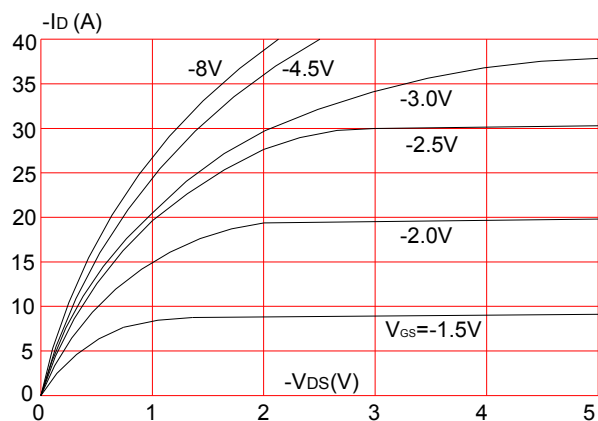
| Symbol                                                 | Parameter                                                 | Test Condition                                                                               | Min. | Typ. | Max. | Units |
|--------------------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------------------------------|------|------|------|-------|
| Off Characteristic                                     |                                                           |                                                                                              |      |      |      |       |
| V <sub>(BR)DSS</sub>                                   | Drain-Source Breakdown Voltage                            | V <sub>GS</sub> =0V, I <sub>D</sub> = -250μA                                                 | -20  | -    | -    | V     |
| I <sub>DSS</sub>                                       | Zero Gate Voltage Drain Current                           | V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V,                                                | -    | -    | -1   | μA    |
| I <sub>GSS</sub>                                       | Gate to Body Leakage Current                              | V <sub>DS</sub> =0V, V <sub>GS</sub> = ±8V                                                   | -    | -    | ±10  | μA    |
| On Characteristics                                     |                                                           |                                                                                              |      |      |      |       |
| V <sub>GS(th)</sub>                                    | Gate Threshold Voltage                                    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA                                  | -0.4 | -    | -1.0 | V     |
| R <sub>DS(on)</sub>                                    | Static Drain-Source on-Resistance<br><small>note2</small> | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-4A                                                  | -    | 38   | 45   | mΩ    |
|                                                        |                                                           | V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-3A                                                  | -    | 48   | 60   |       |
| g <sub>FS</sub>                                        | Forward Transconductance                                  | V <sub>DS</sub> =-5V, I <sub>D</sub> = -4A                                                   | 8    | -    | -    | S     |
| Dynamic Characteristics                                |                                                           |                                                                                              |      |      |      |       |
| C <sub>iss</sub>                                       | Input Capacitance                                         | V <sub>DS</sub> = -10V, V <sub>GS</sub> = 0V,<br>f = 1.0MHz                                  | -    | 950  | -    | pF    |
| C <sub>oss</sub>                                       | Output Capacitance                                        |                                                                                              | -    | 165  | -    | pF    |
| C <sub>rss</sub>                                       | Reverse Transfer Capacitance                              |                                                                                              | -    | 120  | -    | pF    |
| Q <sub>g</sub>                                         | Total Gate Charge                                         | V <sub>DS</sub> = -10V, I <sub>D</sub> = -4A,<br>V <sub>GS</sub> = -4.5V                     | -    | 12   | -    | nC    |
| Q <sub>gs</sub>                                        | Gate-Source Charge                                        |                                                                                              | -    | 1.4  |      | nC    |
| Q <sub>gd</sub>                                        | Gate-Drain(“Miller”) Charge                               |                                                                                              | -    | 3.6  |      | nC    |
| Switching Characteristics                              |                                                           |                                                                                              |      |      |      |       |
| t <sub>d(on)</sub>                                     | Turn-on Delay Time                                        | V <sub>DD</sub> =-10V, V <sub>GS</sub> =-4.5A,<br>R <sub>L</sub> =2.5Ω, R <sub>GEN</sub> =3Ω | -    | 12   | -    | ns    |
| t <sub>r</sub>                                         | Turn-on Rise Time                                         |                                                                                              | -    | 10   | -    | ns    |
| t <sub>d(off)</sub>                                    | Turn-off Delay Time                                       |                                                                                              | -    | 19   | -    | ns    |
| t <sub>f</sub>                                         | Turn-off Fall Time                                        |                                                                                              | -    | 25   | -    | ns    |
| Drain-Source Diode Characteristics and Maximum Ratings |                                                           |                                                                                              |      |      |      |       |
| I <sub>S</sub>                                         | Maximum Continuous Drain to Source Diode Forward Current  |                                                                                              | -    | -    | -4   | A     |
| I <sub>SM</sub>                                        | Maximum Pulsed Drain to Source Diode Forward Current      |                                                                                              | -    | -    | -20  | A     |
| V <sub>SD</sub>                                        | Drain to Source Diode Forward Voltage                     | V <sub>GS</sub> = 0V, I <sub>S</sub> = -4A                                                   | -    | -    | -1.2 | V     |

Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

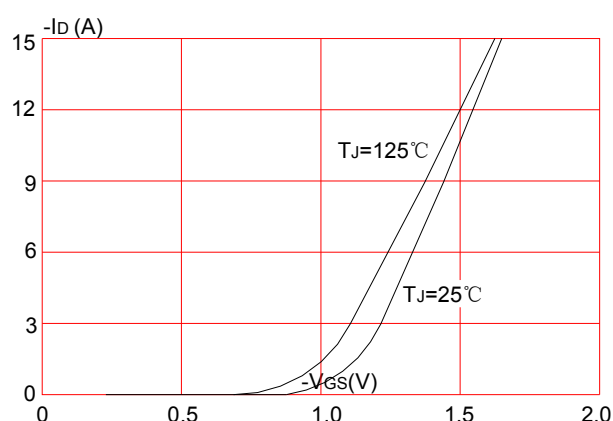
2. Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

## Typical Performance Characteristics

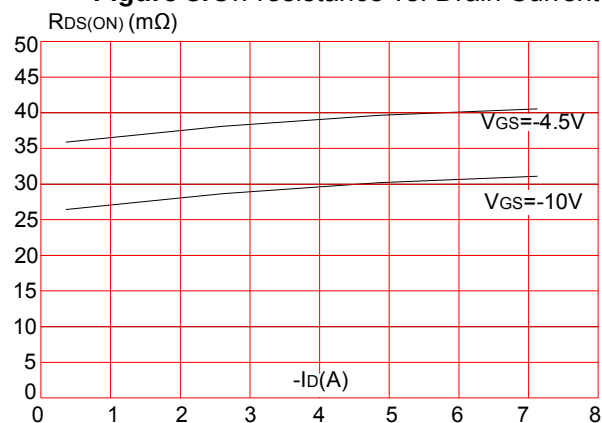
**Figure1: Output Characteristics**



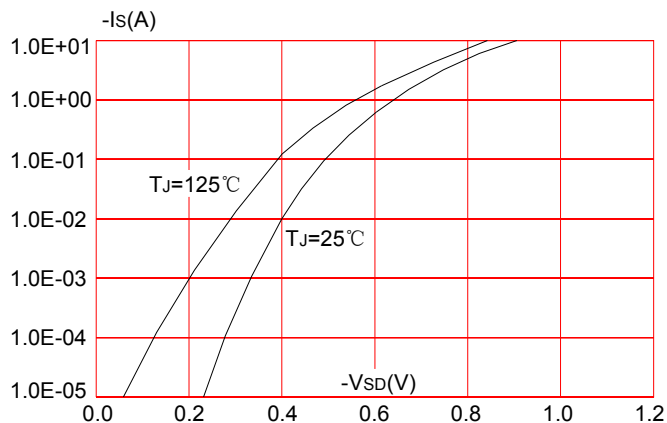
**Figure 2: Typical Transfer Characteristics**



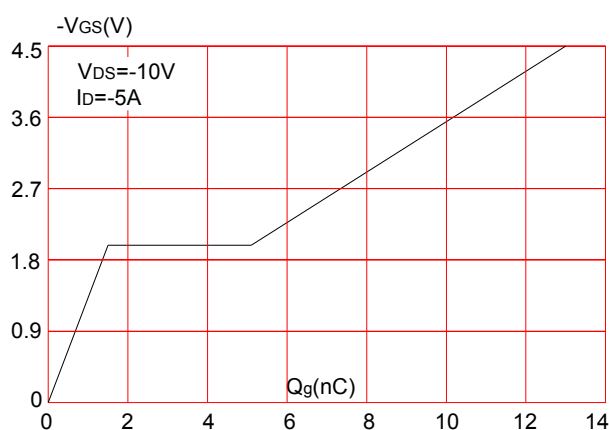
**Figure 3: On-resistance vs. Drain Current**



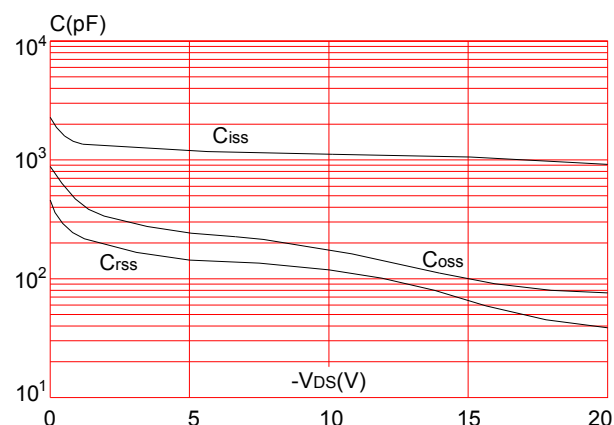
**Figure 4: Body Diode Characteristics**



**Figure 5: Gate Charge Characteristics**

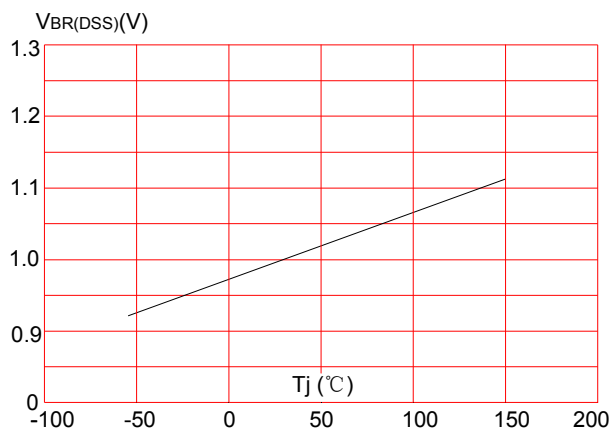


**Figure 6: Capacitance Characteristics**

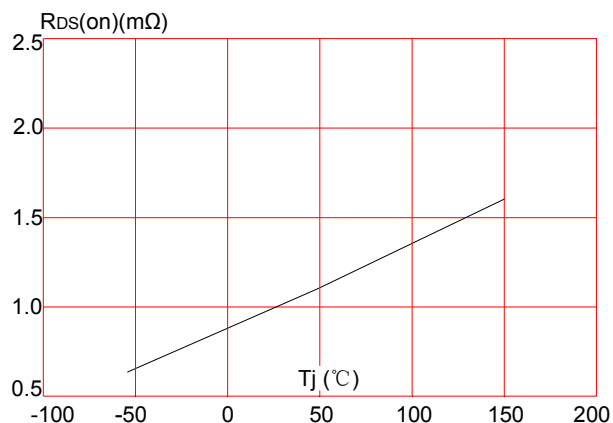


## Typical Performance Characteristics (cont.)

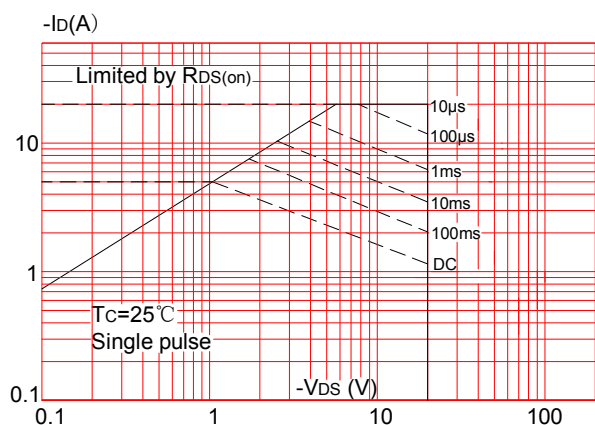
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



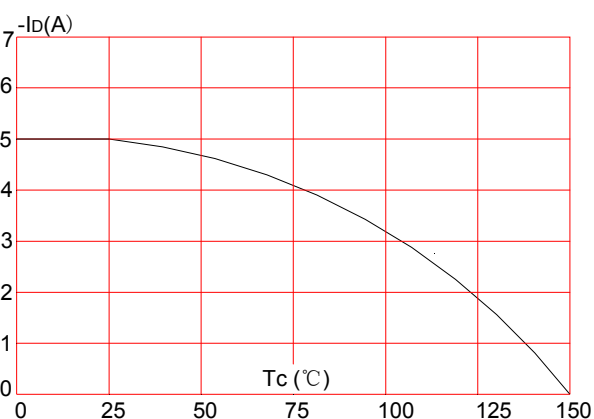
**Figure 8:** Normalized on Resistance vs. Junction Temperature



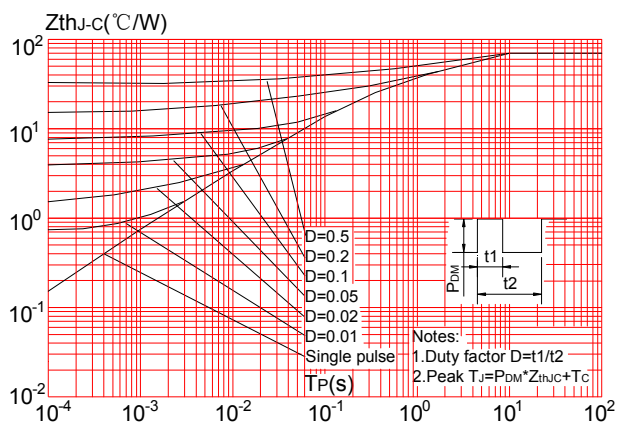
**Figure 9:** Maximum Safe Operating Area



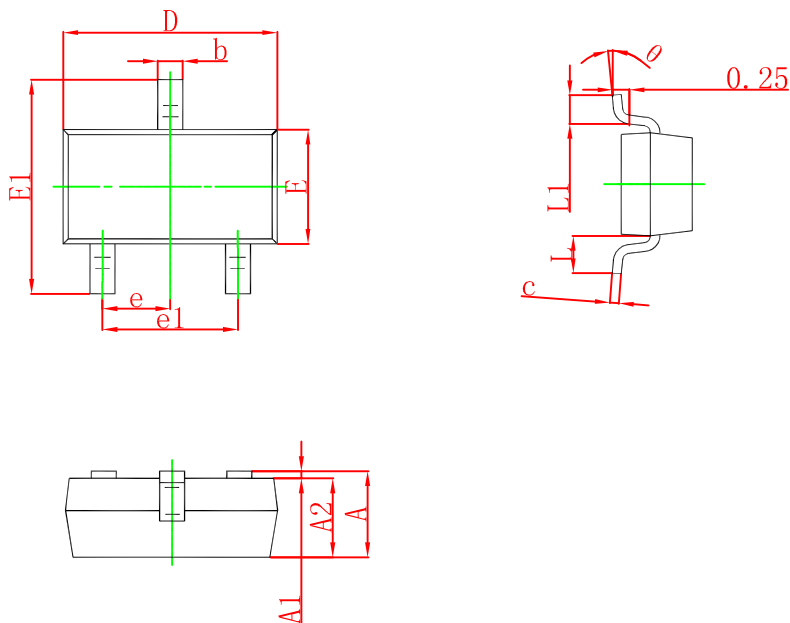
**Figure 10:** Maximum Continuous Drain Current vs. Case Temperature



**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient (SOT-23)



## SOT-23 PACKAGE OUTLINE DRAWING



| 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°    |