

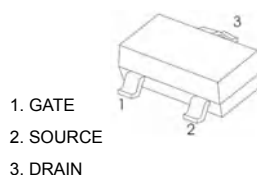
## FEATURES

- High density cell design for low  $R_{DS(ON)}$
- Voltage controlled small signal switch
- Rugged and reliable
- High saturation current capability

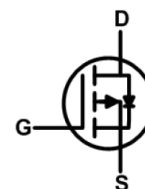
$V_{DS}$  -20 V  
 $I_D$  -3.0 A  
 $R_{DS(ON)}$  55 m  $\Omega$

A1SHB

## SOT-23



## Equivalent Circuit



## MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

### Maximum ratings ( $T_a=25^\circ\text{C}$ unless otherwise noted)

| Parameter                                                  | Symbol          | Value      | Unit               |
|------------------------------------------------------------|-----------------|------------|--------------------|
| Drain-Source Voltage                                       | $V_{DS}$        | -20        | V                  |
| Gate-Source Voltage                                        | $V_{GS}$        | $\pm 12$   |                    |
| Continuous Drain Current                                   | $I_D$           | -3         | A                  |
| Pulsed Drain Current                                       | $I_{DM}$        | -10        |                    |
| Continuous Source-Drain Diode Current                      | $I_S$           | -0.72      |                    |
| Maximum Power Dissipation                                  | $P_D$           | 1.2        | W                  |
| Thermal Resistance from Junction to Ambient( $t \leq 5s$ ) | $R_{\theta JA}$ | 357        | $^\circ\text{C/W}$ |
| Junction Temperature                                       | $T_J$           | 150        | $^\circ\text{C}$   |
| Storage Temperature                                        | $T_{stg}$       | -55 ~ +150 |                    |

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

| Parameter                                     | Symbol               | Test Condition                                                                                                        | Min  | Typ   | Max   | Units |
|-----------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------|------|-------|-------|-------|
| Static                                        |                      |                                                                                                                       |      |       |       |       |
| Drain-source breakdown voltage                | V <sub>(BR)DSS</sub> | V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA                                                                         | -20  |       |       | V     |
| Gate-source threshold voltage                 | V <sub>GS(th)</sub>  | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> = -250μA                                                            | -0.4 |       | -1    |       |
| Gate-source leakage                           | I <sub>GSS</sub>     | V <sub>DS</sub> =0V, V <sub>GS</sub> =±8V                                                                             |      |       | ±100  | nA    |
| Zero gate voltage drain current               | I <sub>DSS</sub>     | V <sub>DS</sub> = -20V, V <sub>GS</sub> =0V                                                                           |      |       | -1    | μA    |
| Drain-source on-state resistance <sup>a</sup> | R <sub>DS(on)</sub>  | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3A                                                                         |      | 0.055 | 0.080 | Ω     |
|                                               |                      | V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -2.0A                                                                       |      | 0.080 | 0.122 |       |
| Forward transconductance <sup>a</sup>         | g <sub>fs</sub>      | V <sub>DS</sub> = -5V, I <sub>D</sub> = -3A                                                                           |      | 6.5   |       | S     |
| Dynamic <sup>b</sup>                          |                      |                                                                                                                       |      |       |       |       |
| Input capacitance                             | C <sub>iss</sub>     | V <sub>DS</sub> = -10V, V <sub>GS</sub> =0V, f =1MHz                                                                  |      | 405   |       | pF    |
| Output capacitance                            | C <sub>oss</sub>     |                                                                                                                       |      | 75    |       |       |
| Reverse transfer capacitance                  | C <sub>rss</sub>     |                                                                                                                       |      | 55    |       |       |
| Total gate charge                             | Q <sub>g</sub>       | V <sub>DS</sub> = -10V, V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3A                                                 |      | 5.5   | 10    | nC    |
|                                               |                      | V <sub>DS</sub> = -10V, V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -3A                                                 |      | 3.3   | 6     |       |
| Gate-source charge                            | Q <sub>gs</sub>      |                                                                                                                       |      | 0.7   |       |       |
| Gate-drain charge                             | Q <sub>gd</sub>      |                                                                                                                       |      | 1.3   |       |       |
| Gate resistance                               | R <sub>g</sub>       | f =1MHz                                                                                                               |      | 6.0   |       | Ω     |
| Turn-on delay time                            | t <sub>d(on)</sub>   | V <sub>DD</sub> = -10V,<br>R <sub>L</sub> =10Ω, I <sub>D</sub> = -1A,<br>V <sub>GEN</sub> = -4.5V, R <sub>g</sub> =1Ω |      | 11    | 20    | ns    |
| Rise time                                     | t <sub>r</sub>       |                                                                                                                       |      | 35    | 60    |       |
| Turn-off delay time                           | t <sub>d(off)</sub>  |                                                                                                                       |      | 30    | 50    |       |
| Fall time                                     | t <sub>f</sub>       |                                                                                                                       |      | 10    | 20    |       |
| Drain-source body diode characteristics       |                      |                                                                                                                       |      |       |       |       |
| Continuous source-drain diode current         | I <sub>S</sub>       | T <sub>C</sub> =25°C                                                                                                  |      |       | -1.3  | A     |
| Pulse diode forward current <sup>a</sup>      | I <sub>SM</sub>      |                                                                                                                       |      |       | -10   |       |
| Body diode voltage                            | V <sub>SD</sub>      | I <sub>S</sub> =-0.7A                                                                                                 |      | -0.8  | -1.2  | V     |

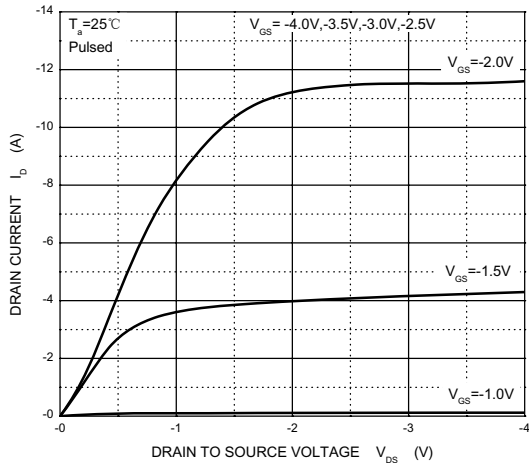
### Notes :

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

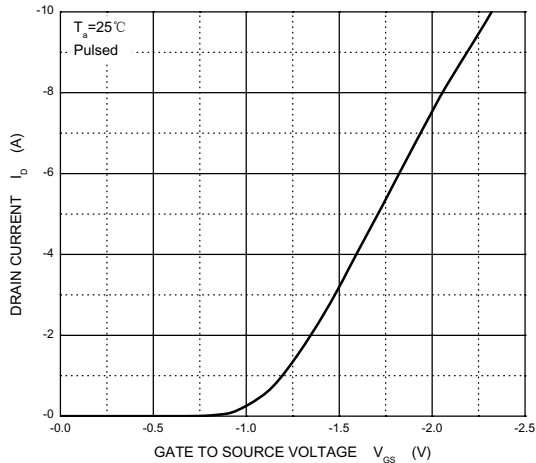
b. Guaranteed by design, not subject to production testing.

## RATING AND CHARACTERISTIC CURVES

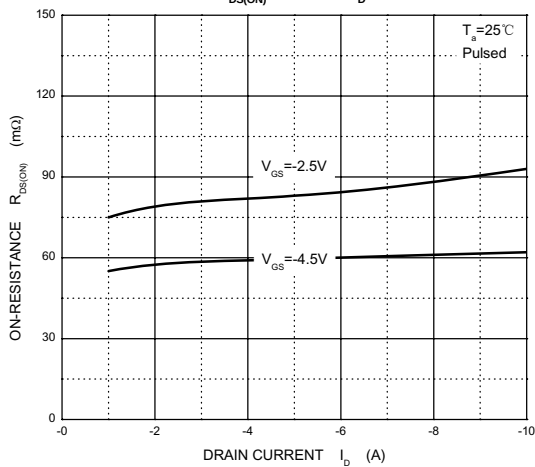
**Output Characteristics**



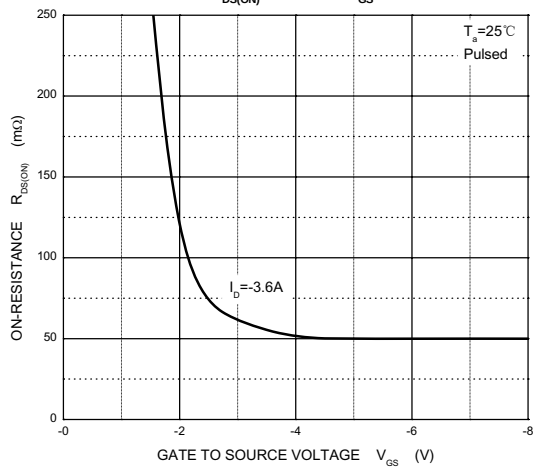
**Transfer Characteristics**



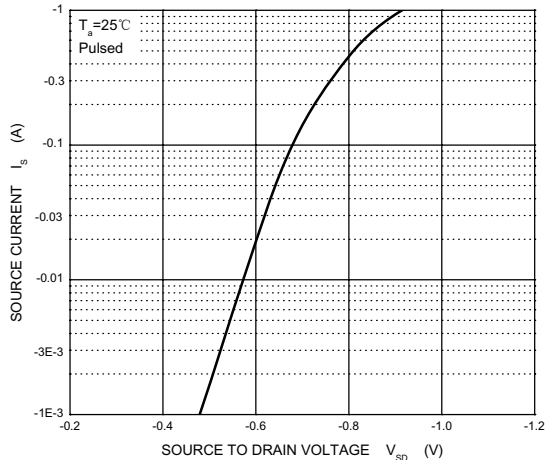
**$R_{DS(ON)}$  —  $I_D$**



**$R_{DS(ON)}$  —  $V_{GS}$**

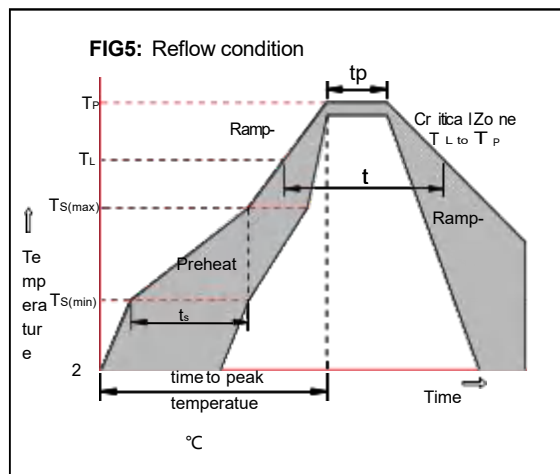


**$I_S$  —  $V_{SD}$**



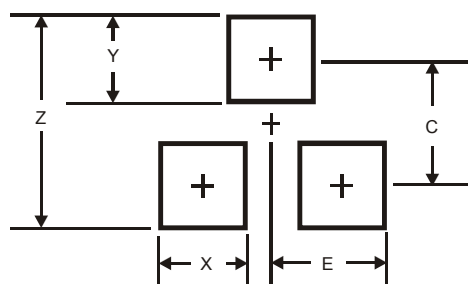
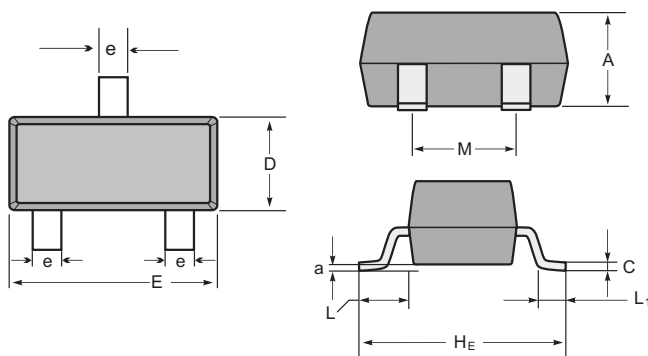
## Soldering parameters

| Reflow Condition                                        |                                   | Pb-Free assembly<br>(see as below) |
|---------------------------------------------------------|-----------------------------------|------------------------------------|
| Pre Heat                                                | -Temperature Min ( $T_{s(min)}$ ) | +150°C                             |
|                                                         | -Temperature Max( $T_{s(max)}$ )  | +200°C                             |
|                                                         | -Time (Min to Max) (ts)           | 60-180 secs.                       |
| Average ramp up rate (Liquid us Temp ( $T_L$ ) to peak) |                                   | 3°C/sec. Max                       |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                    |                                   | 3°C/sec. Max                       |
| Reflow                                                  | -Temperature( $T_L$ )(Liquid us)  | +217°C                             |
|                                                         | -Temperature( $t_L$ )             | 60-150 secs.                       |
| Peak Temp ( $T_P$ )                                     |                                   | +260(+0/-5)°C                      |
| Time within 5°C of actual Peak Temp ( $t_P$ )           |                                   | 30 secs. Max                       |
| Ramp-down Rate                                          |                                   | 6°C/sec. Max                       |
| Time 25°C to Peak Temp ( $T_P$ )                        |                                   | 8 min. Max                         |
| Do not exceed                                           |                                   | +260°C                             |



## Package Dimensions & Suggested Pad Layout

### SOT23



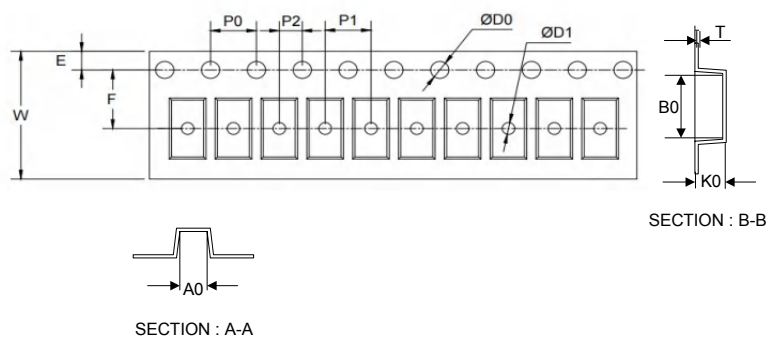
### SOT-23 mechanical data

| UNIT |     | A   | C    | D   | E   | H <sub>E</sub> | e   | M    | L          | L <sub>1</sub> | a    |
|------|-----|-----|------|-----|-----|----------------|-----|------|------------|----------------|------|
| mm   | max | 1.1 | 0.15 | 1.4 | 3.0 | 2.6            | 0.5 | 1.95 | 0.55 (ref) | 0.36 (ref)     | 0.0  |
|      | min | 0.9 | 0.08 | 1.2 | 2.8 | 2.2            | 0.3 | 1.7  |            |                | 0.15 |
| mil  | max | 43  | 6    | 55  | 118 | 102            | 20  | 77   | 22 (ref)   | 14 (ref)       | 0.0  |
|      | min | 35  | 3    | 47  | 110 | 87             | 12  | 67   |            |                | 6    |

| Dimensions | SOT23 |
|------------|-------|
| Z          | 2.9   |
| X          | 0.8   |
| Y          | 0.9   |
| C          | 2.0   |
| E          | 1.35  |

## Tape & reel specification

### Tape



| Symbol | Dimension (mm) |
|--------|----------------|
| P0     | 4.00±0.10      |
| P1     | 4.00±0.10      |
| P2     | 2.00±0.10      |
| D0     | 1.55±0.10      |
| D1     | 1.05±0.10      |
| E      | 1.55±0.10      |
| F      | 3.60±0.10      |
| W      | 8.00±0.10      |
| A0     | 3.80±0.20      |
| B0     | 3.25±0.20      |
| K0     | 1.45±0.10      |
| T      | 0.25±0.05      |
| D2     | 178.0±3.0      |
| D3     | 55Min.         |
| D4     | R24.0±3.0      |
| G      | R82.0±3.0      |
| I      | 13.0±2.0       |
| W1     | 11.0±3.0       |

Quantity: 3000PCS

### 7" Reel

