

## General Description

These N-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.

## Features

30V, 250mA,  $R_{DS(ON)} = 1.5\Omega @ V_{GS} = 10V$

Improved  $dv/dt$  capability

Fast switching

Green Device Available

## Applications

Notebook

Load Switch

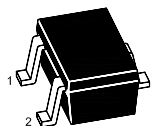
Battery Protection

Hand-held Instruments

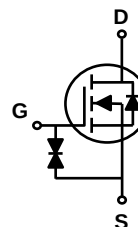
$V_{DSS}$  30 V  
 $I_D$  250 mA  
 $R_{DS(ON)}$  1.5  $\Omega$



SOT-323



Equivalent Circuit



## MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

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

| Symbol    | Parameter                                             | Rating     | Units                |
|-----------|-------------------------------------------------------|------------|----------------------|
| $V_{DS}$  | Drain-Source Voltage                                  | 30         | V                    |
| $V_{GS}$  | Gate-Source Voltage                                   | $\pm 20$   | V                    |
| $I_D$     | Drain Current – Continuous ( $T_A=25^\circ\text{C}$ ) | 250        | mA                   |
|           | Drain Current – Continuous ( $T_A=70^\circ\text{C}$ ) | 200        | mA                   |
| $I_{DM}$  | Drain Current – Pulsed <sup>1</sup>                   | 1.0        | A                    |
| $P_D$     | Power Dissipation ( $T_c=25^\circ\text{C}$ )          | 300        | mW                   |
|           | Power Dissipation – Derate above $25^\circ\text{C}$   | 2.4        | mW/ $^\circ\text{C}$ |
| $T_{STG}$ | Storage Temperature Range                             | -55 to 150 | $^\circ\text{C}$     |
| $T_J$     | Operating Junction Temperature Range                  | -55 to 125 | $^\circ\text{C}$     |

### Thermal Characteristics

| Symbol          | Parameter                              | Typ. | Max. | Unit                      |
|-----------------|----------------------------------------|------|------|---------------------------|
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient | ---  | 400  | $^\circ\text{C}/\text{W}$ |

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

### Off Characteristics

| Symbol                       | Parameter                          | Conditions                                            | Min. | Typ. | Max.    | Unit                 |
|------------------------------|------------------------------------|-------------------------------------------------------|------|------|---------|----------------------|
| $BV_{DSS}$                   | Drain-Source Breakdown Voltage     | $V_{GS}=0V$ , $I_D=250\mu A$                          | 30   | ---  | ---     | V                    |
| $\Delta BV_{DSS}/\Delta T_J$ | $BV_{DSS}$ Temperature Coefficient | Reference to $25^{\circ}\text{C}$ , $I_D=1\text{mA}$  | ---  | 0.05 | ---     | $V/^{\circ}\text{C}$ |
| $I_{DSS}$                    | Drain-Source Leakage Current       | $V_{DS}=30V$ , $V_{GS}=0V$ , $T_J=50^{\circ}\text{C}$ | ---  | ---  | 100     | nA                   |
|                              |                                    | $V_{DS}=30V$ , $V_{GS}=0V$ , $T_J=85^{\circ}\text{C}$ | ---  | ---  | 400     | nA                   |
| $I_{GSS}$                    | Gate-Source Leakage Current        | $V_{GS}=\pm 20V$ , $V_{DS}=0V$                        | ---  | ---  | $\pm 6$ | $\mu A$              |

### On Characteristics

|                     |                                      |                                  |     |     |     |                              |
|---------------------|--------------------------------------|----------------------------------|-----|-----|-----|------------------------------|
| $R_{DS(ON)}$        | Static Drain-Source On-Resistance    | $V_{GS}=10V$ , $I_D=0.3A$        | --- | 1.5 | 3   | $\Omega$                     |
|                     |                                      | $V_{GS}=4.5V$ , $I_D=0.2A$       | --- | 1.6 | 4   |                              |
| $V_{GS(th)}$        | Gate Threshold Voltage               | $V_{GS}=V_{DS}$ , $I_D=250\mu A$ | 0.8 | 1.1 | 1.6 | V                            |
| $\Delta V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient |                                  | --- | 3   | --- | $\text{mV}/^{\circ}\text{C}$ |

### Dynamic and switching Characteristics

|           |                              |                                              |     |    |     |    |
|-----------|------------------------------|----------------------------------------------|-----|----|-----|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS}=30V$ , $V_{GS}=0V$ , $F=1\text{MHz}$ | --- | 20 | --- | pF |
| $C_{oss}$ | Output Capacitance           |                                              | --- | 12 | --- |    |
| $C_{rss}$ | Reverse Transfer Capacitance |                                              | --- | 6  | --- |    |

### Drain-Source Diode Characteristics and Maximum Ratings

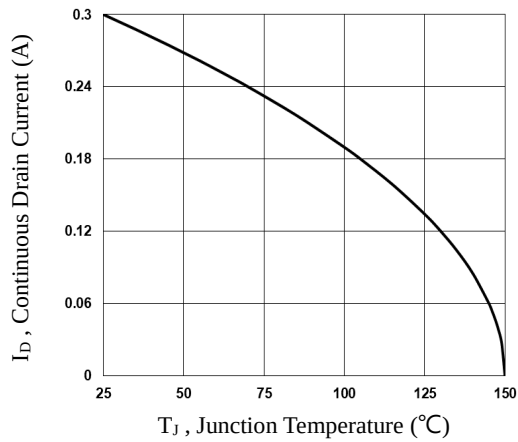
| Symbol   | Parameter                 | Conditions                                          | Min. | Typ. | Max. | Unit |
|----------|---------------------------|-----------------------------------------------------|------|------|------|------|
| $I_S$    | Continuous Source Current | $V_G=V_D=0V$ , Force Current                        | ---  | ---  | 250  | mA   |
| $I_{SM}$ | Pulsed Source Current     |                                                     | ---  | ---  | 500  | mA   |
| $V_{SD}$ | Diode Forward Voltage     | $V_{GS}=0V$ , $I_S=0.2A$ , $T_J=25^{\circ}\text{C}$ | ---  | ---  | 1.2  | V    |

Note :

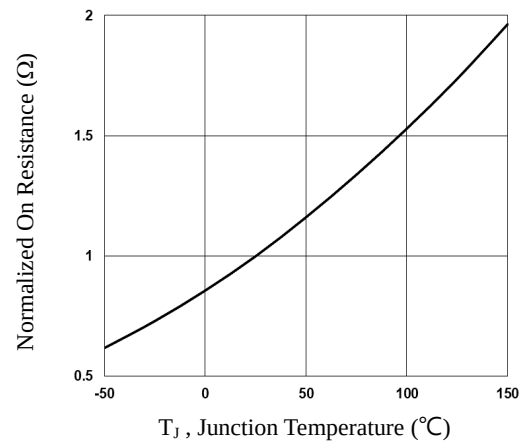
1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. The data tested by pulsed , pulse width  $\leq 300\mu s$  , duty cycle  $\leq 2\%$ .
3. Essentially independent of operating temperature.



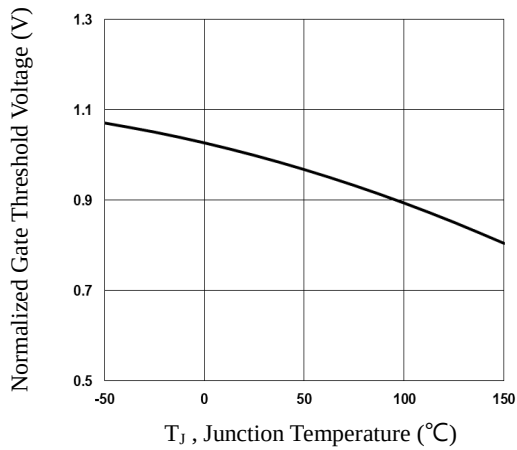
## RATING AND CHARACTERISTIC CURVES



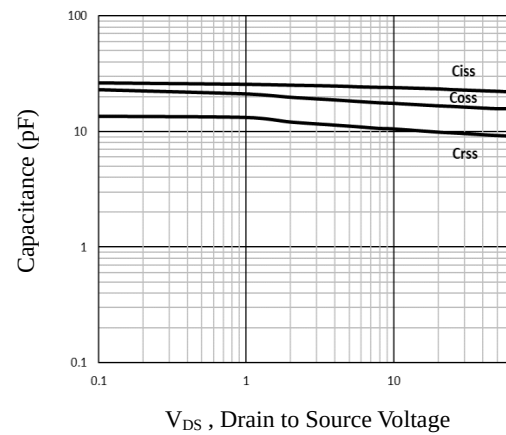
**Fig.1 Continuous Drain Current vs.  $T_j$**



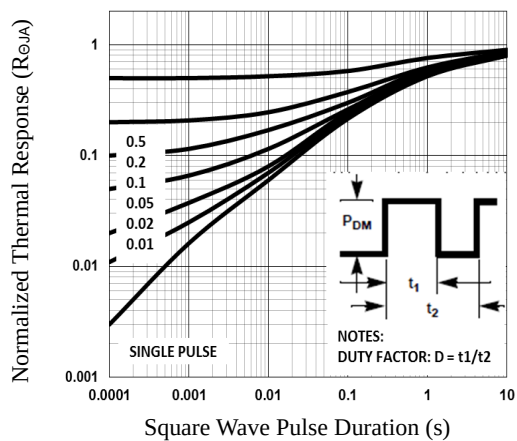
**Fig.2 Normalized  $R_{DS(on)}$  vs.  $T_j$**



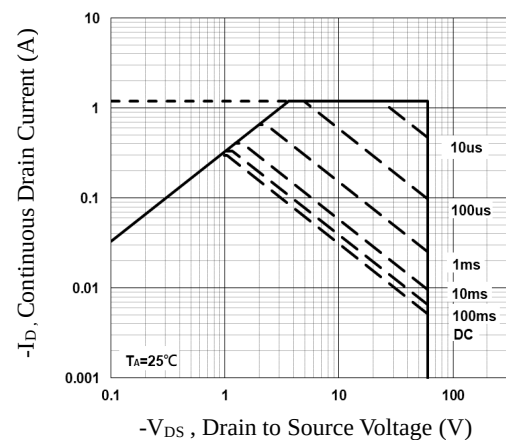
**Fig.3 Normalized  $V_{th}$  vs.  $T_j$**



**Fig.4 Capacitance Characteristics**

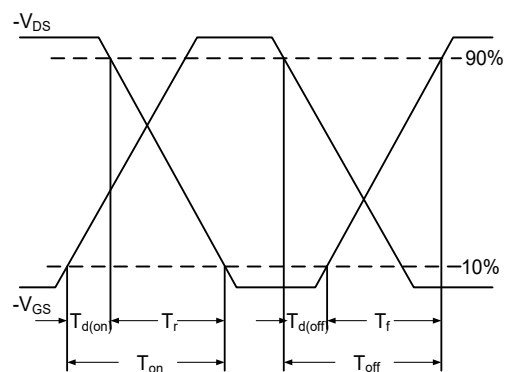


**Fig.5 Normalized Transient Response**

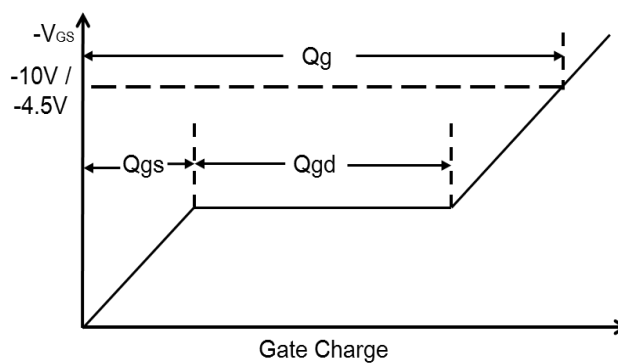


**Fig.6 Maximum Safe Operation Area**

## RATING AND CHARACTERISTIC CURVES



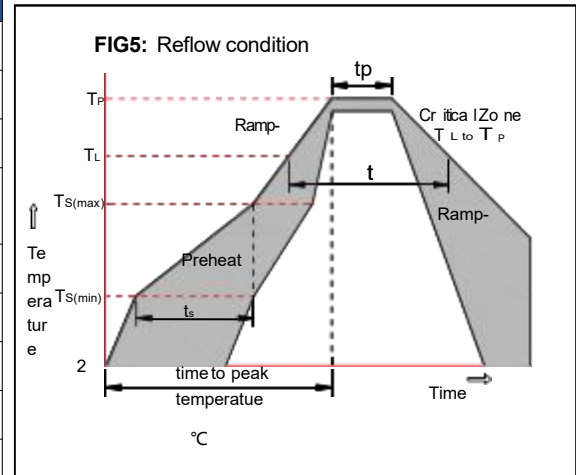
**Fig.7 Switching Time Waveform**



**Fig.8 Gate Charge Waveform**

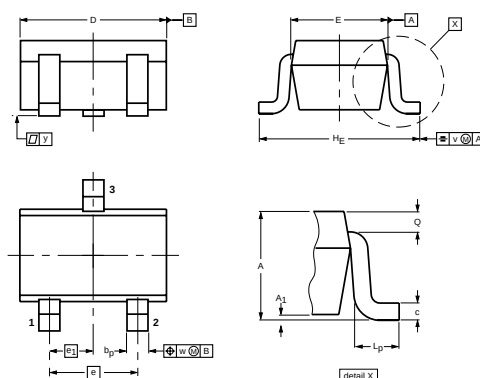
## Soldering parameters

| 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                            |



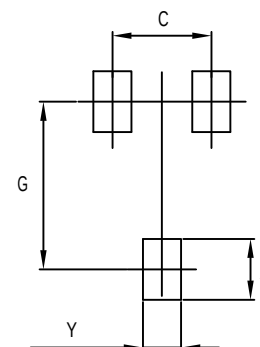
## Package Dimensions & Suggested Pad Layout

### SOT-323



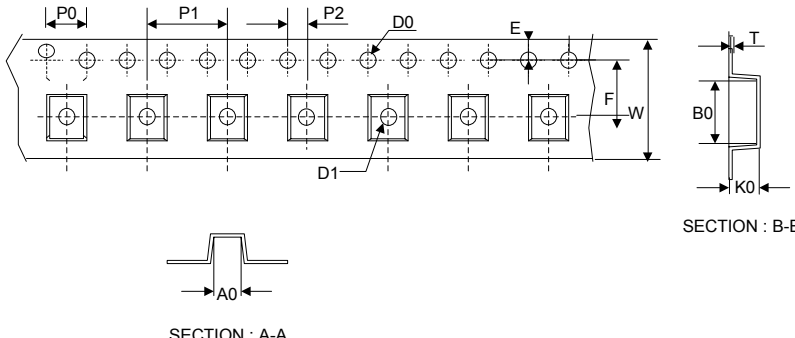
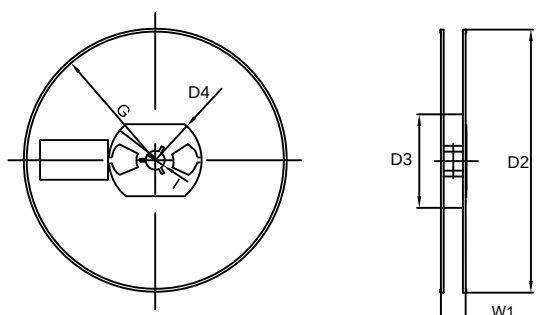
DIMENSIONS (mm are the original dimensions)

| UNIT | A          | A <sub>1</sub><br>max | b <sub>p</sub> | c            | D          | E            | e   | e <sub>1</sub> | H <sub>E</sub> | L <sub>p</sub> | Q            | v   | w   |
|------|------------|-----------------------|----------------|--------------|------------|--------------|-----|----------------|----------------|----------------|--------------|-----|-----|
| mm   | 1.1<br>0.8 | 0.1                   | 0.4<br>0.3     | 0.25<br>0.10 | 2.2<br>1.8 | 1.35<br>1.15 | 1.3 | 0.65           | 2.2<br>2.0     | 0.45<br>0.15   | 0.23<br>0.13 | 0.2 | 0.2 |



| Dimensions | Value<br>(in mm) |
|------------|------------------|
| C          | 1.30             |
| G          | 2.00             |
| X          | 0.90             |
| Y          | 0.65             |

## Tape & reel specification

| Tape                                                                               |  | Symbol            | Dimension (mm) |
|------------------------------------------------------------------------------------|--|-------------------|----------------|
|   |  | P0                | 4.00±0.20      |
|                                                                                    |  | P1                | 4.00±0.20      |
|                                                                                    |  | P2                | 2.00±0.20      |
|                                                                                    |  | D0                | 1.55±0.20      |
|                                                                                    |  | D1                | 1.00±0.20      |
|                                                                                    |  | E                 | 1.55±0.25      |
|                                                                                    |  | F                 | 3.60±0.20      |
|                                                                                    |  | W                 | 8.00±0.20      |
|                                                                                    |  | A0                | 2.50±0.20      |
|                                                                                    |  | B0                | 2.60±0.20      |
|                                                                                    |  | K0                | 1.40±0.20      |
|                                                                                    |  | T                 | 0.20±0.20      |
|                                                                                    |  | D2                | 177.0±5.0      |
|                                                                                    |  | D3                | 55Min.         |
|                                                                                    |  | D4                | R24.6±2.0      |
| 7" Reel                                                                            |  | G                 | R82.0±2.0      |
|  |  | I                 | 13.0±2.0       |
|                                                                                    |  | W1                | 10.20±3.0      |
|                                                                                    |  | Quantity: 3000PCS |                |