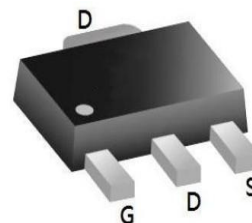


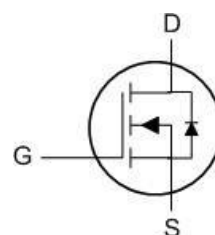
### Product Summary

| BVDSS | RDS(on) | ID  |
|-------|---------|-----|
| 60V   | 28mΩ    | 15A |



SOT89-3L

- ★ Green Device Available
- ★ Super Low Gate Charge
- ★ Excellent CdV/dt effect decline
- ★ Advanced high cell density Trench technology



### Absolute Maximum Ratings

| Symbol                               | Parameter                                                    | Rating     | Units |
|--------------------------------------|--------------------------------------------------------------|------------|-------|
| V <sub>DS</sub>                      | Drain-Source Voltage                                         | 60         | V     |
| V <sub>GS</sub>                      | Gate-Source Voltage                                          | ±20        | V     |
| I <sub>D</sub> @T <sub>A</sub> =25°C | Continuous Drain Current, V <sub>GS</sub> @ 10V <sup>1</sup> | 15         | A     |
| I <sub>D</sub> @T <sub>A</sub> =70°C | Continuous Drain Current, V <sub>GS</sub> @ 10V <sup>1</sup> | 7.5        | A     |
| I <sub>DM</sub>                      | Pulsed Drain Current <sup>2</sup>                            | 22         | A     |
| EAS                                  | Single Pulse Avalanche Energy <sup>3</sup>                   | 22         | mJ    |
| I <sub>AS</sub>                      | Avalanche Current                                            | 23         | A     |
| P <sub>D</sub> @T <sub>A</sub> =25°C | Total Power Dissipation <sup>4</sup>                         | 1.5        | W     |
| T <sub>STG</sub>                     | Storage Temperature Range                                    | -55 to 150 | °C    |
| T <sub>J</sub>                       | Operating Junction Temperature Range                         | -55 to 150 | °C    |

### Thermal Data

| Symbol           | Parameter                                        | Typ. | Max. | Unit |
|------------------|--------------------------------------------------|------|------|------|
| R <sub>θJA</sub> | Thermal Resistance Junction-ambient <sup>1</sup> | ---  | 85   | °C/W |
| R <sub>θJC</sub> | Thermal Resistance Junction-Case <sup>1</sup>    | ---  | 25   | °C/W |

**Electrical Characteristics** ( $T_J=25^{\circ}\text{C}$  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                                              | 60   | -    | -    | V     |
| I <sub>DSS</sub>                                       | Zero Gate Voltage Drain Current                           | V <sub>DS</sub> =60V, V <sub>GS</sub> = 0V,                                             | -    | -    | 1.0  | μA    |
| I <sub>GSS</sub>                                       | Gate to Body Leakage Current                              | V <sub>DS</sub> =0V, V <sub>GS</sub> = ±20V                                             | -    | -    | ±100 | nA    |
| On Characteristics                                     |                                                           |                                                                                         |      |      |      |       |
| V <sub>GS(th)</sub>                                    | Gate Threshold Voltage                                    | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                | 1.0  | 1.6  | 2.5  | V     |
| R <sub>DS(on)</sub>                                    | Static Drain-Source on-Resistance<br><small>note3</small> | V <sub>GS</sub> =10V, I <sub>D</sub> =5A                                                | -    | 28   | 40   | mΩ    |
|                                                        |                                                           | V <sub>GS</sub> =4.5V, I <sub>D</sub> =3A                                               | -    | 36   | 50   |       |
| Dynamic Characteristics                                |                                                           |                                                                                         |      |      |      |       |
| C <sub>iss</sub>                                       | Input Capacitance                                         | V <sub>DS</sub> =25V, V <sub>GS</sub> =0V,<br>f=1.0MHz                                  | -    | 1148 | -    | pF    |
| C <sub>oss</sub>                                       | Output Capacitance                                        |                                                                                         | -    | 58.5 | -    | pF    |
| C <sub>rss</sub>                                       | Reverse Transfer Capacitance                              |                                                                                         | -    | 49.4 | -    | pF    |
| Q <sub>g</sub>                                         | Total Gate Charge                                         | V <sub>DS</sub> =30V, I <sub>D</sub> =2.5A,<br>V <sub>GS</sub> =10V                     | -    | 20.3 | -    | nC    |
| Q <sub>gs</sub>                                        | Gate-Source Charge                                        |                                                                                         | -    | 3.7  | -    | nC    |
| Q <sub>gd</sub>                                        | Gate-Drain(“Miller”) Charge                               |                                                                                         | -    | 5.3  | -    | nC    |
| Switching Characteristics                              |                                                           |                                                                                         |      |      |      |       |
| t <sub>d(on)</sub>                                     | Turn-on Delay Time                                        | V <sub>DS</sub> =30V, I <sub>D</sub> =5A,<br>R <sub>G</sub> =1.8Ω, V <sub>GS</sub> =10V | -    | 7.6  | -    | ns    |
| t <sub>r</sub>                                         | Turn-on Rise Time                                         |                                                                                         | -    | 20   | -    | ns    |
| t <sub>d(off)</sub>                                    | Turn-off Delay Time                                       |                                                                                         | -    | 15   | -    | ns    |
| t <sub>f</sub>                                         | Turn-off Fall Time                                        |                                                                                         | -    | 24   | -    | ns    |
| Drain-Source Diode Characteristics and Maximum Ratings |                                                           |                                                                                         |      |      |      |       |
| I <sub>S</sub>                                         | Maximum Continuous Drain to Source Diode Forward Current  |                                                                                         | -    | -    | 5    | 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> =5A                                                 | -    | -    | 1.2  | V     |
| t <sub>rr</sub>                                        | Body Diode Reverse Recovery Time                          | I <sub>F</sub> =5A, dI/dt=100A/μs                                                       | -    | 29   | -    | ns    |
| Q <sub>rr</sub>                                        | Body Diode Reverse Recovery Charge                        |                                                                                         | -    | 43   | -    | nC    |

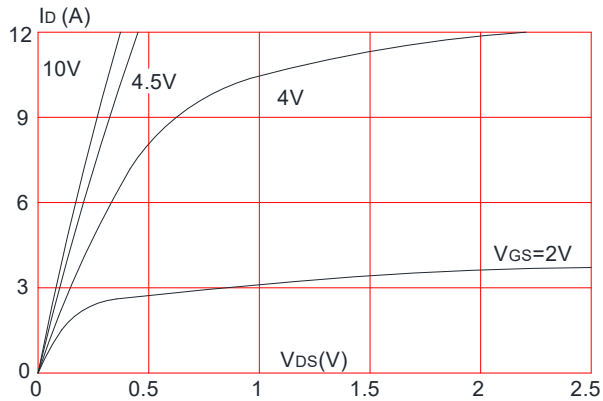
Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. EAS condition :  $T_J=25^{\circ}\text{C}, V_{DD}=30V, V_G=10V, L=0.5mH, R_g=25\Omega, I_{AS}=8.7A$

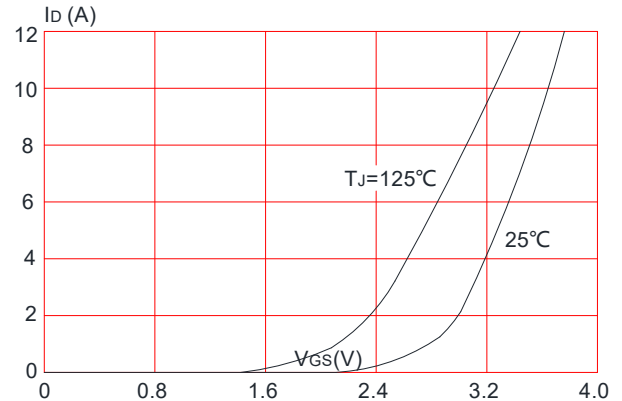
3. Pulse Test: Pulse Width $\leq 300\mu s$ , Duty Cycle $\leq 0.5\%$

## Typical Performance Characteristics

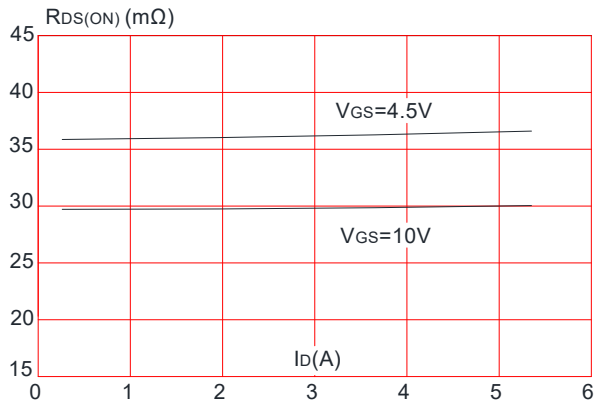
**Figure 1:** Output Characteristics



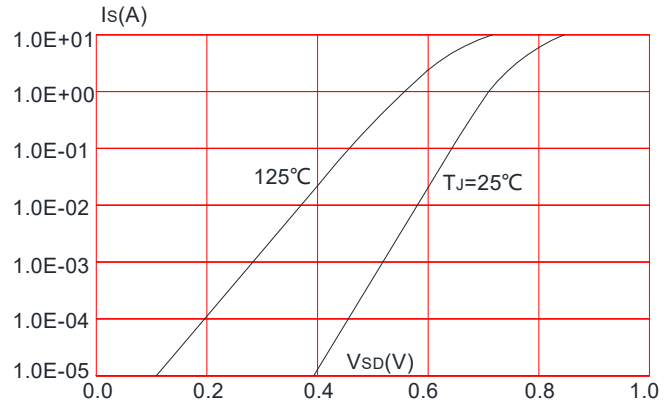
**Figure 2:** Typical Transfer Characteristics



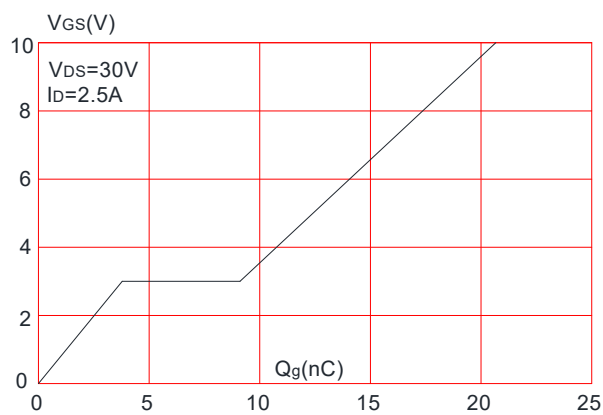
**Figure 3:** On-resistance vs. Drain Current



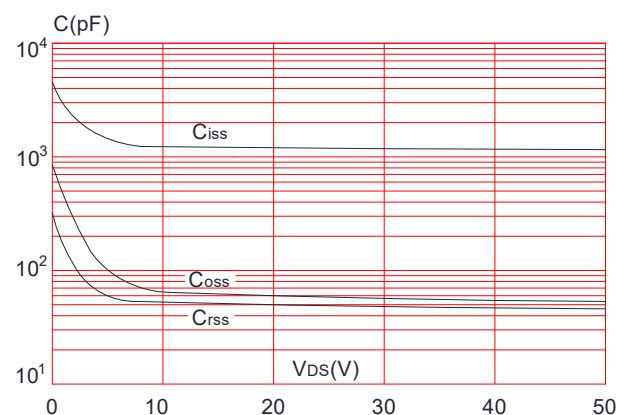
**Figure 4:** Body Diode Characteristics



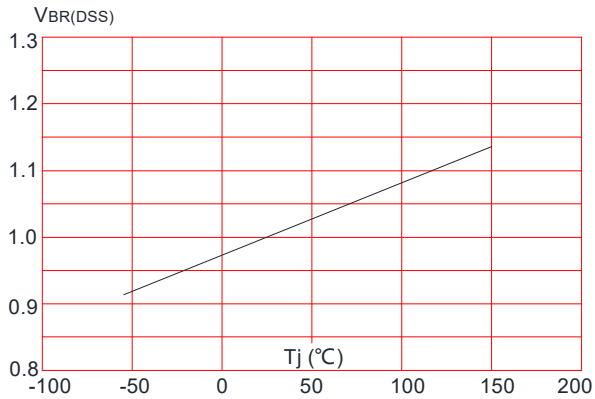
**Figure 5:** Gate Charge Characteristics



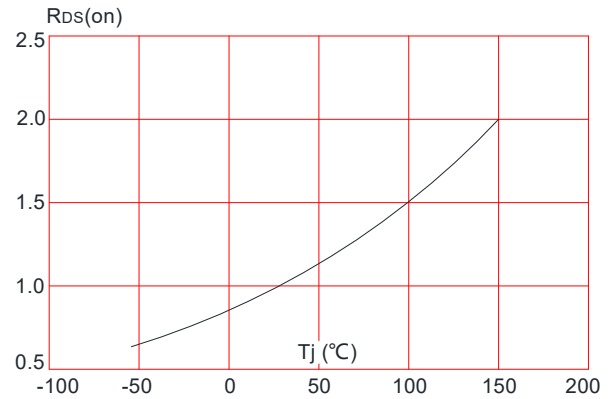
**Figure 6:** Capacitance Characteristics



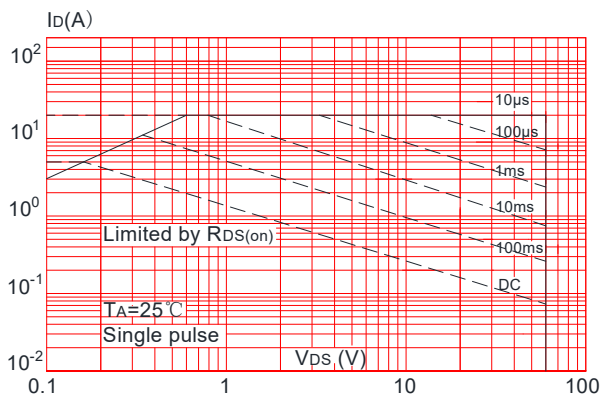
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



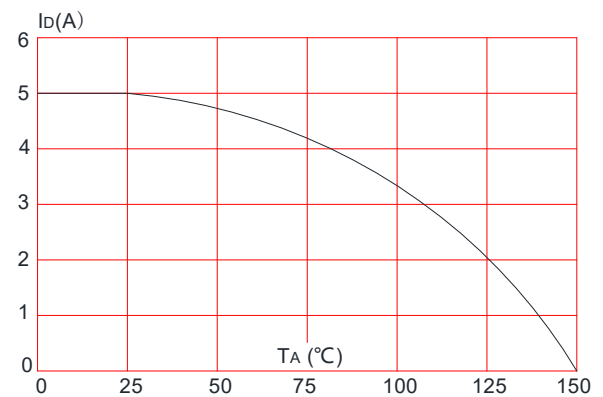
**Figure 8:** Normalized on Resistance vs. Junction Temperature



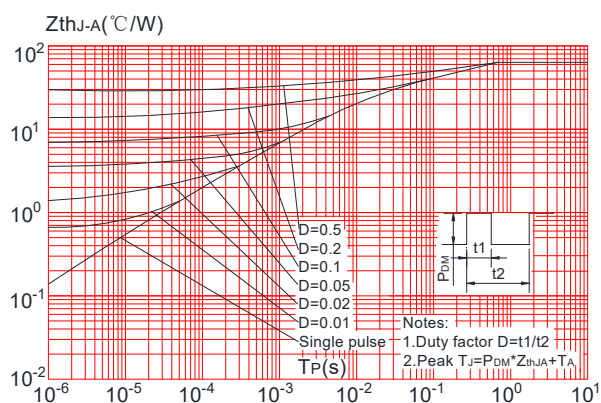
**Figure 9:** Maximum Safe Operating Area



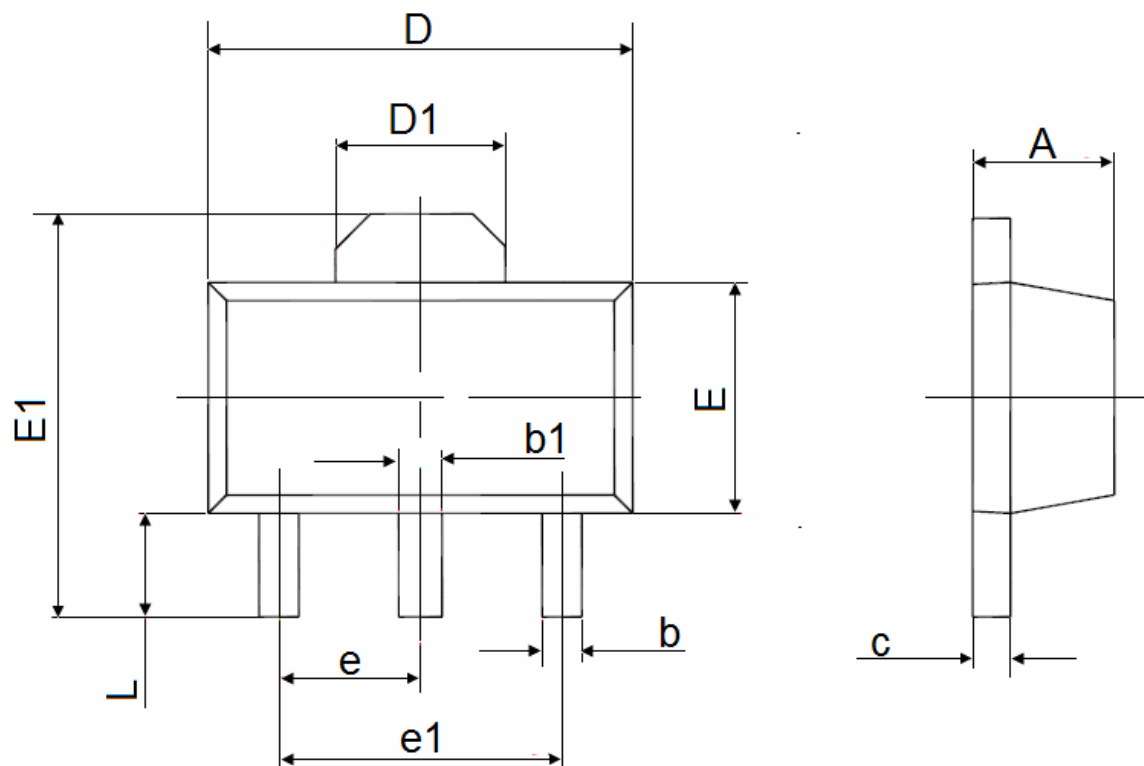
**Figure 10:** Maximum Continuous Drain Current vs. Ambient Temperature



**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



## SOT-89-3L Package Information



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 1.400                     | 1.600 | 0.055                | 0.063 |
| b      | 0.320                     | 0.520 | 0.013                | 0.020 |
| b1     | 0.400                     | 0.580 | 0.016                | 0.023 |
| c      | 0.350                     | 0.440 | 0.014                | 0.017 |
| D      | 4.400                     | 4.600 | 0.173                | 0.181 |
| D1     | 1.550 REF.                |       | 0.061 REF.           |       |
| E      | 2.300                     | 2.600 | 0.091                | 0.102 |
| E1     | 3.940                     | 4.250 | 0.155                | 0.167 |
| e      | 1.500 TYP.                |       | 0.060 TYP.           |       |
| e1     | 3.000 TYP.                |       | 0.118 TYP.           |       |
| L      | 0.900                     | 1.200 | 0.035                | 0.047 |