

|                                                                                                                                                                                                                                   |              |              |           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|-----------|
| <b>Features</b><br><ul style="list-style-type: none"> <li>➤ Super Low Gate Charge</li> <li>➤ Green Device Available</li> <li>➤ Excellent Cdv/dt effect decline</li> <li>➤ Advanced high cell density Trench technology</li> </ul> | <b>Bvdss</b> | <b>Rdson</b> | <b>ID</b> |
|                                                                                                                                                                                                                                   | <b>20V</b>   | <b>43mΩ</b>  | <b>3A</b> |
| <b>Application</b><br><ul style="list-style-type: none"> <li>➤ Battery protection</li> <li>➤ Load Switch</li> <li>➤ Uninterruptible power supply</li> </ul>                                                                       |              |              |           |

|                                                                                                                                                                                                                                                                                                                                                                                         |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| <b>Package</b><br><div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <br/>             1. Marking and pin assignment         </div> <div style="text-align: center;"> <br/>             2. SOT23 top view         </div> <div style="text-align: center;"> <br/>             3. Schematic diagram         </div> </div> |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|

### Package Marking and Ordering Information

| Device Marking | Device | Device Package | Quantity |
|----------------|--------|----------------|----------|
| 2300           | 2300   | SOT23          | 3000     |

### Absolute Maximum Ratings (T<sub>c</sub>=25°C unless otherwise specified)

| Parameter                              | Symbol                               | Value      | Unit |
|----------------------------------------|--------------------------------------|------------|------|
| Drain-Source Voltage                   | V <sub>DS</sub>                      | 20         | V    |
| Gate-Source Voltage                    | V <sub>GS</sub>                      | ±12        | V    |
| Continuous Drain Current, VGS @10V (1) | I <sub>D</sub> @T <sub>A</sub> =25°C | 3.0        | A    |
| Continuous Drain Current, VGS @10V (1) | I <sub>D</sub> @T <sub>A</sub> =70°C | 1.2        | A    |
| Pulsed Drain Current(2)                | I <sub>DM</sub>                      | 12         | A    |
| Total Power Dissipation(3)             | P <sub>D</sub> @T <sub>A</sub> =25°C | 0.85       | W    |
| Storage Temperature Range              | T <sub>STG</sub>                     | -55 to 150 | °C   |
| Operating Junction Temperature Range   | T <sub>J</sub>                       | -55 to 150 | °C   |

### Thermal Resistance Ratings

| Parameter                              | Symbol           | Value | Unit |
|----------------------------------------|------------------|-------|------|
| Thermal Resistance Junction-ambient(1) | R <sub>θJA</sub> | 162   | °C/W |
| Thermal Resistance Junction-Case(1)    | R <sub>θJC</sub> | -     | °C/W |

### Ordering Information



| Ordering Number | Package | Pin Assignment |   |   | Packing   |
|-----------------|---------|----------------|---|---|-----------|
| Halogen Free    |         | G              | S | D |           |
| HL2300          | SOT23   | 1              | 2 | 3 | Tape Reel |

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

| Parameter                                     | Symbol        | Test Conditions                                         | Min | Typ | Max       | Units      |
|-----------------------------------------------|---------------|---------------------------------------------------------|-----|-----|-----------|------------|
| Drain-Source Breakdown Voltage                | $V_{(BR)DSS}$ | $V_{GS}=0V, I_D=250\mu A$                               | 20  | -   | -         | V          |
| Zero Gate Voltage Drain Current               | $I_{DSS}$     | $V_{DS}=20V, V_{GS}=0V,$                                | -   | -   | 1.0       | $\mu A$    |
| Gate to Body Leakage Current                  | $I_{GSS}$     | $V_{DS}=0V, V_{GS}=\pm 12V$                             | -   | -   | $\pm 100$ | nA         |
| Gate Threshold Voltage                        | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=250\mu A$                           | 0.4 | 0.7 | 1.0       | V          |
| Static Drain to Source On-State Resistance(2) | $R_{DS(on)}$  | $V_{GS}=4.5V, I_D=3A$                                   | -   | 45  | 55        | m $\Omega$ |
|                                               |               | $V_{GS}=2.5V, I_D=2A$                                   | -   | 62  | 85        |            |
| Input Capacitance                             | $C_{iss}$     | $V_{DS}=10V, V_{GS}=0V,$<br>$f=1.0\text{MHz}$           | -   | 184 | -         | pF         |
| Output Capacitance                            | $C_{oss}$     |                                                         | -   | 38  | -         | pF         |
| Reverse Transfer Capacitance                  | $C_{rss}$     |                                                         | -   | 28  | -         | pF         |
| Turn-ON Delay Time                            | $t_{d(on)}$   | $V_{DS}=10V, I_D=3A,$<br>$R_{GEN}=3\Omega, V_{GS}=4.5V$ | -   | 8   | -         | ns         |
| Rise Time                                     | $t_r$         |                                                         | -   | 27  | -         | ns         |
| Turn-OFF Delay Time                           | $t_{d(off)}$  |                                                         | -   | 26  | -         | ns         |
| Fall Time                                     | $t_f$         |                                                         | -   | 33  | -         | ns         |
| Total Gate Charge                             | $Q_g$         | $V_{DS}=10V, I_D=3A,$<br>$V_{GS}=4.5V$                  | -   | 2.7 | -         | nC         |
|                                               | $Q_{gs}$      |                                                         | -   | 0.4 | -         | nC         |
|                                               | $Q_{gd}$      |                                                         | -   | 0.5 | -         | nC         |
| Continuous Diode Forward Current              | $I_S$         |                                                         | -   | -   | 3         | A          |
| Continuous Diode Pulse Current                | $I_{sm}$      |                                                         | -   | -   | 12        | A          |
| Drain to Source Diode Forward Voltage         | $V_{SD}$      | $V_{GS}=0V, I_S=3A$                                     | -   | -   | 1.2       | V          |

Notes:

1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
2. Pulse Test: Pulse Width  $\leq 300 \mu s$ , Duty Cycle  $\leq 0.5\%$

Typical Characteristics

Figure 1: Output Characteristics

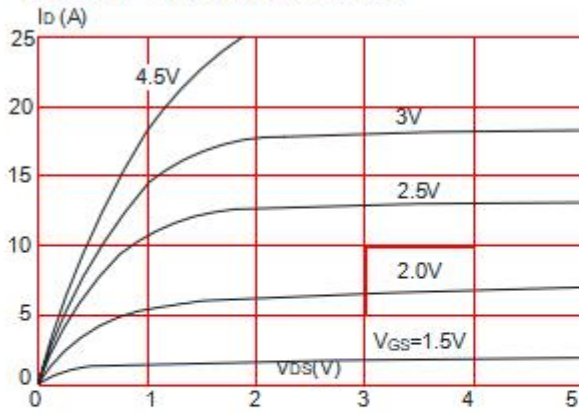


Figure 2: Typical Transfer Characteristics

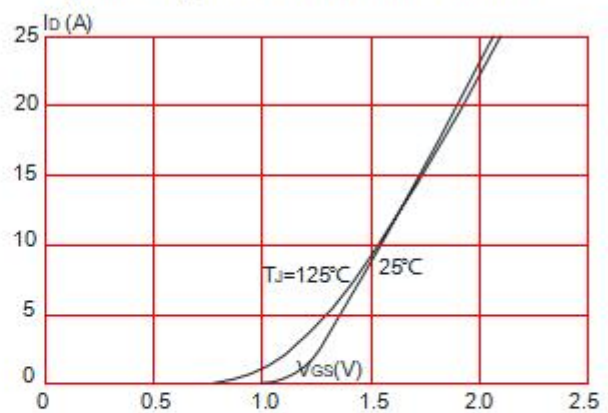


Figure 3: On-resistance vs. Drain Current

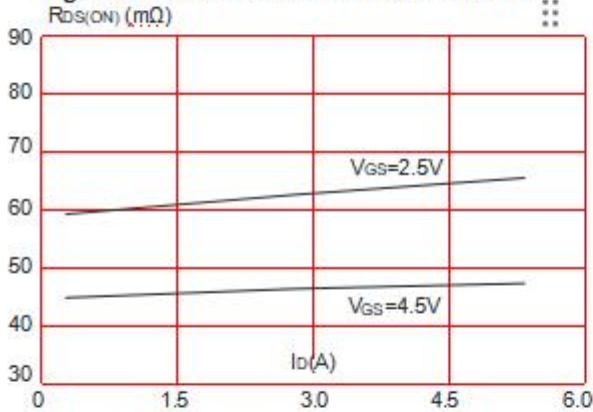


Figure 4: Body Diode Characteristics

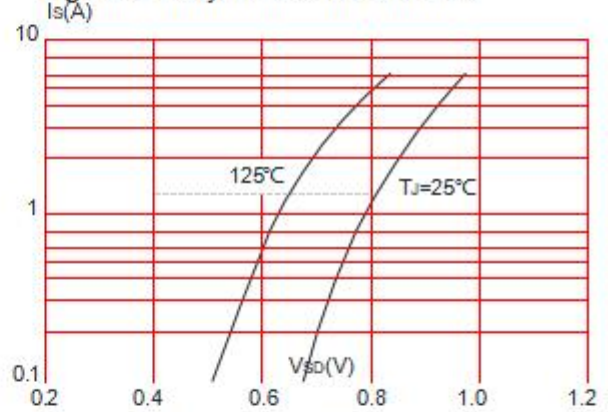


Figure 5: Gate Charge Characteristics

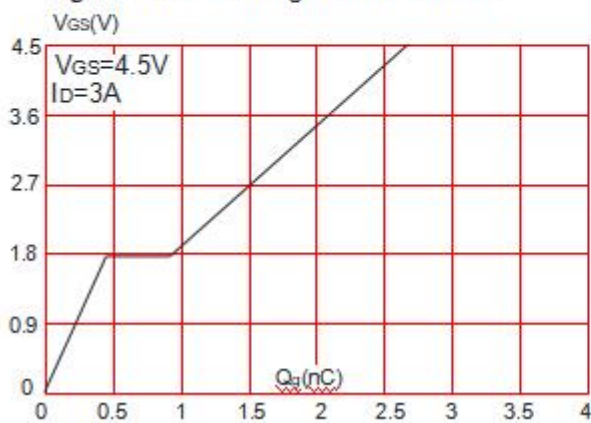
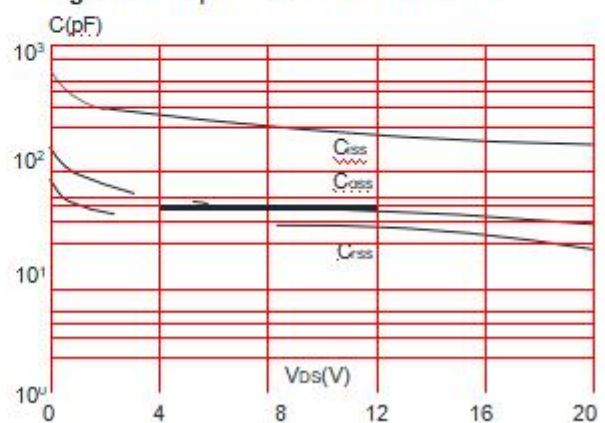
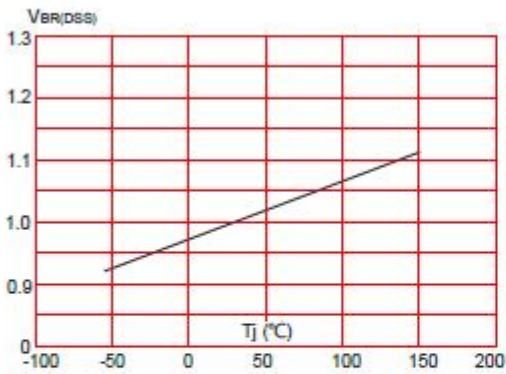


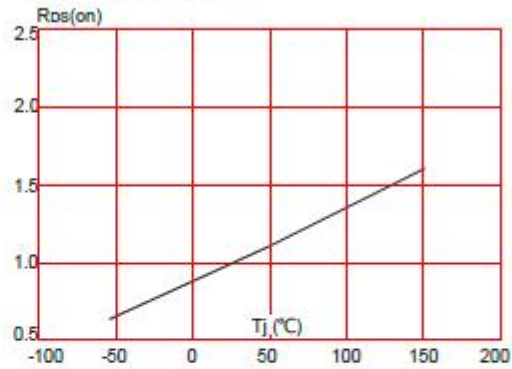
Figure 6: Capacitance Characteristics



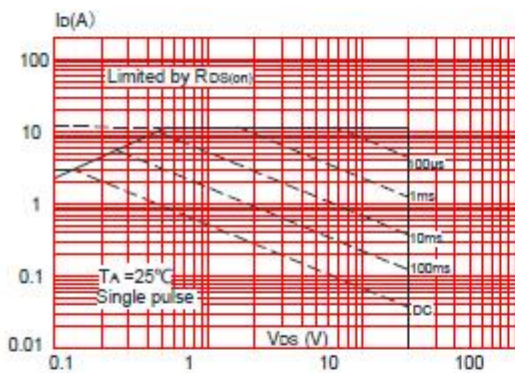
**Figure 7: Normalized Breakdown Voltage vs. Junction Temperature**



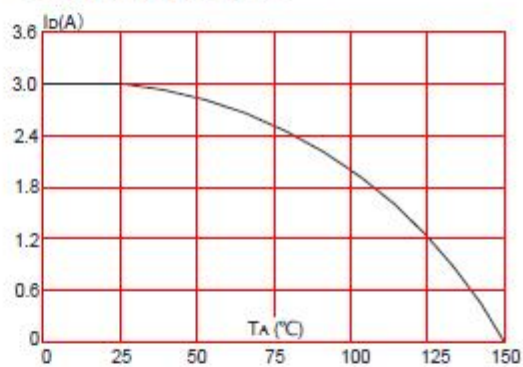
**Figure 8: Normalized on Resistance vs. Junction Temperature**



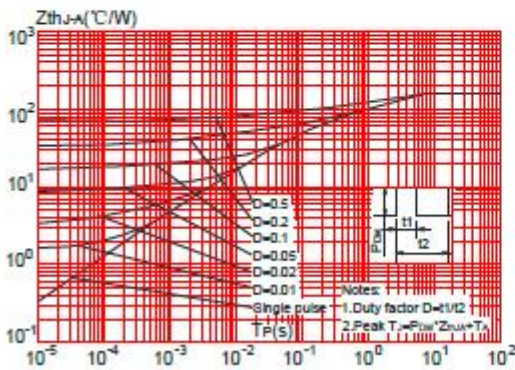
**Figure 9: Maximum Safe Operating Area**



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

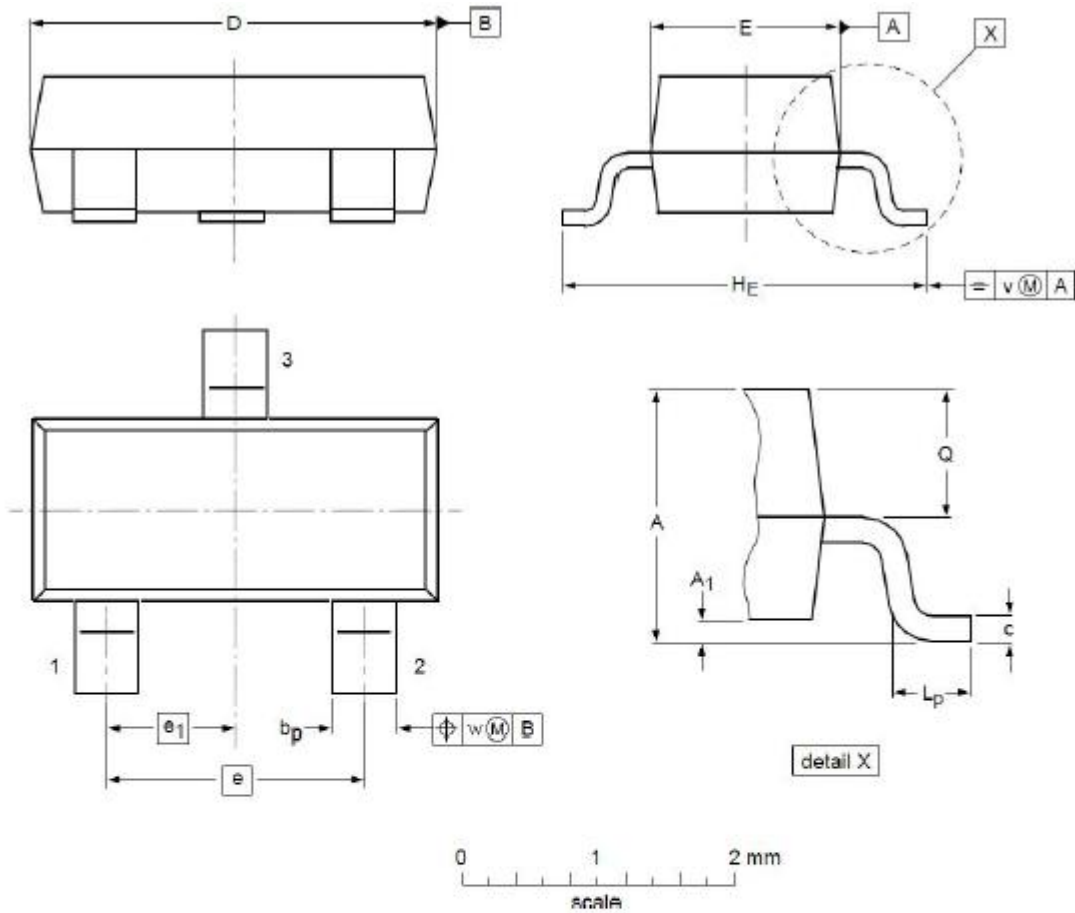


**Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient**



### Package Dimensions

➤ SOT23



**DIMENSIONS** ( unit : mm )

| Symbol         | Min  | Typ  | Max  | Symbol         | Min  | Typ  | Max  |
|----------------|------|------|------|----------------|------|------|------|
| A              | 0.90 | 1.01 | 1.15 | A <sub>1</sub> | 0.01 | 0.05 | 0.10 |
| b <sub>p</sub> | 0.30 | 0.42 | 0.50 | c              | 0.08 | 0.13 | 0.15 |
| D              | 2.80 | 2.92 | 3.00 | E              | 1.20 | 1.33 | 1.40 |
| e              | --   | 1.90 | --   | e <sub>1</sub> | --   | 0.95 | --   |
| H <sub>E</sub> | 2.25 | 2.40 | 2.55 | L <sub>p</sub> | 0.30 | 0.42 | 0.50 |
| Q              | 0.45 | 0.49 | 0.55 | v              | --   | 0.20 | --   |
| w              | --   | 0.10 | --   |                |      |      |      |



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