

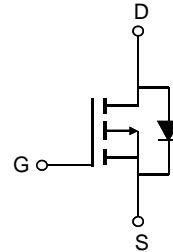
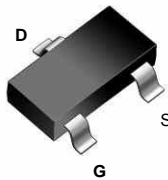
### General Description

The SQ2303ES uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a load switch or in PWM applications.

### Features

|                                   |           |
|-----------------------------------|-----------|
| $V_{DS}$                          | -30V      |
| $I_D$ (at $V_{GS}=-10V$ )         | -5.0A     |
| $R_{DS(ON)}$ (at $V_{GS}=-10V$ )  | 50mΩ(Max) |
| $R_{DS(ON)}$ (at $V_{GS}=-4.5V$ ) | 65mΩ(Max) |
| $R_{DS(ON)}$ (at $V_{GS}=-2.5V$ ) | 90mΩ(Max) |

**SOT23**



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

| Parameter                              | Symbol         | Maximum    | Units |   |
|--|----------------|------------|-------|---|
| Drain-Source Voltage                   | $V_{DS}$       | -30        | V     |   |
| Gate-Source Voltage                    | $V_{GS}$       | $\pm 12$   | V     |   |
| Drain Current-Continuous               | TC=25°C        | $I_D$      | -5.0  | A |
|  | TC=100°C       | $I_D$      | -3.5  | A |
| Drain Current – Pulsed                 | $I_{DM}$       | -20        | A     |   |
| Maximum Power Dissipation              | $P_D$          | 2.1        | W     |   |
| Junction and Storage Temperature Range | $T_J, T_{STG}$ | -55 To 150 | °C    |   |

### Thermal Characteristics

| Parameter                              | Symbol          | Typ | Max | Unit  |
|--|-----------------|-----|-----|-------|
| Thermal Resistance junction-case       | $R_{\theta Jc}$ |     | 1.1 | °C /W |
| Thermal Resistance junction-to-Ambient | $R_{\theta JA}$ |     | 60  | °C /W |

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

| Symbol                      | Parameter                        | Condition   | Min  | Typ  | Max  | Unit |
|-----------------------------|----------------------------------|---|------|------|------|------|
| <b>STATIC PARAMETERS</b>    |                                  |   |      |      |      |      |
| BV <sub>DSS</sub>           | Drain-Source Breakdown Voltage   | V <sub>GS</sub> =0V, I <sub>D</sub> =-250μA   | -30  |      |      | V    |
| I <sub>DSS</sub>            | Zero Gate Voltage Drain Current  | V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V  |      |      | 1    | μA   |
| I <sub>GSS</sub>            | Gate-Body Leakage Current        | V <sub>GS</sub> =±12V, V <sub>DS</sub> =0V  |      |      | ±100 | nA   |
| V <sub>GS(th)</sub>         | Gate Threshold Voltage           | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA                                   | -0.5 | -0.9 | -1.5 | V    |
| R <sub>DS(ON)</sub>         | Drain-Source On-State Resistance | V <sub>GS</sub> =-10V, I <sub>D</sub> =-4.0A  |      | 41   | 50   | mΩ   |
|                             |                                  | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-3.5A   |      | 50   | 65   | mΩ   |
|                             |                                  | V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-2.0A   |      | 60   | 90   | mΩ   |
| <b>DYNAMIC PARAMETERS</b>   |                                  |   |      |      |      |      |
| C <sub>ISS</sub>            | Input Capacitance                | V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                     |      | 640  |      | pF   |
| C <sub>OSS</sub>            | Output Capacitance               |   |      | 80   |      | pF   |
| C <sub>RSS</sub>            | Reverse Transfer Capacitance     |   |      | 55   |      | pF   |
| <b>SWITCHING PARAMETERS</b> |                                  |   |      |      |      |      |
| t <sub>d(on)</sub>          | Turn-on Delay Time               | V <sub>DS</sub> =-15V, I <sub>D</sub> =-1A,<br>V <sub>GS</sub> =-10V,<br>R <sub>G</sub> =3Ω |      | 6.5  |      | nS   |
| t <sub>r</sub>              | Turn-on Rise Time                |   |      | 3.5  |      | nS   |
| t <sub>d(off)</sub>         | Turn-Off Delay Time              |   |      | 41   |      | nS   |
| t <sub>f</sub>              | Turn-Off Fall Time               |   |      | 9    |      | nS   |
| Q <sub>g</sub>              | Total Gate Charge                | V <sub>DS</sub> =-15V, I <sub>D</sub> =-4.0A,<br>V <sub>GS</sub> =-10V                      |      | 14   |      | nC   |
| Q <sub>gs</sub>             | Gate-Source Charge               |   |      | 1.5  |      | nC   |
| Q <sub>gd</sub>             | Gate-Drain Charge                |   |      | 1.6  |      | nC   |
| V <sub>SD</sub>             | Diode Forward Voltage            | V <sub>GS</sub> =0V, I <sub>SD</sub> =-1A   |      | 0.72 | 1.4  | V    |
| R <sub>g</sub>              | Gate resistance                  | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V,<br>F=1MHz   |      | 7    |      | Ω    |

**Note:**

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

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

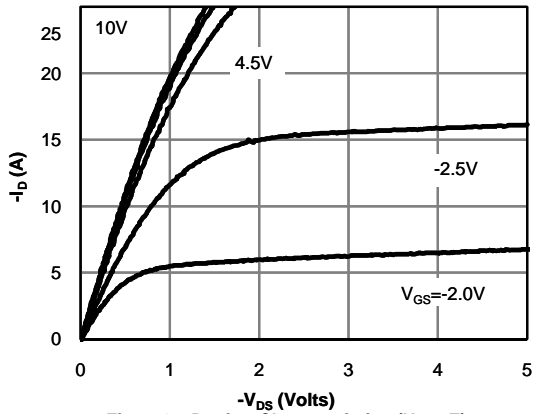


Fig 1: On-Region Characteristics (Note E)

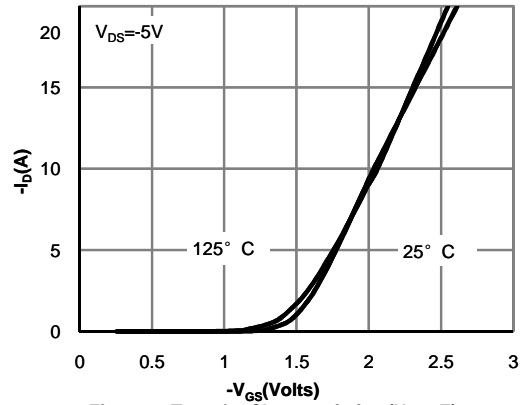


Figure 2: Transfer Characteristics (Note E)

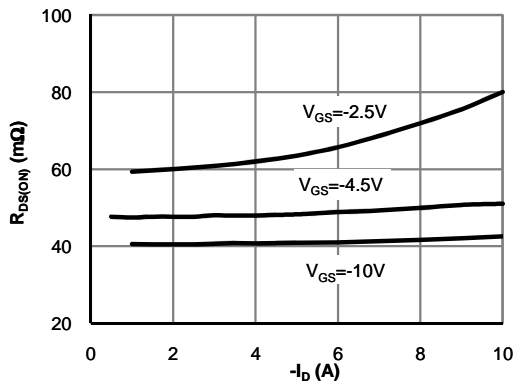


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

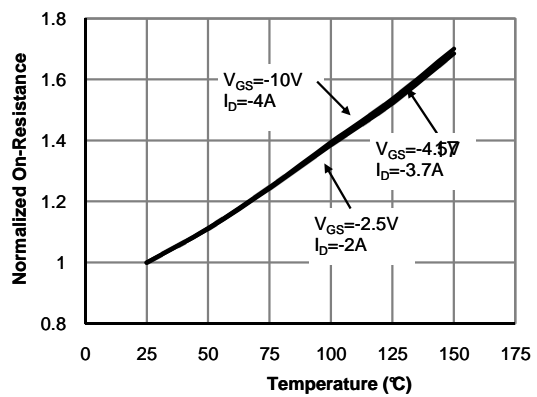


Figure 4: On-Resistance vs. Junction Temperature (Note E)

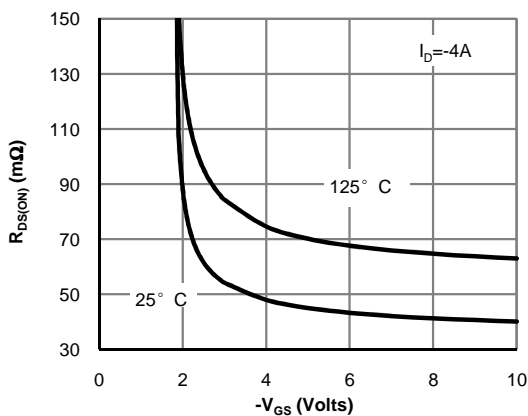


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

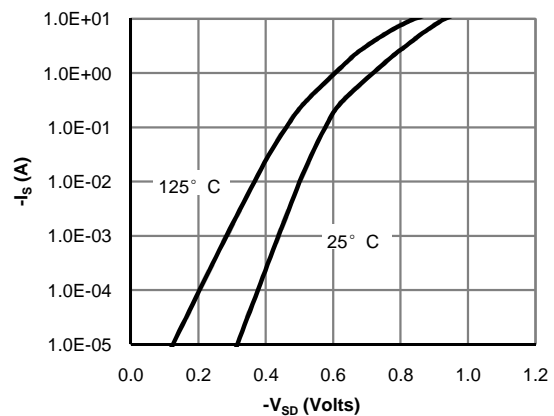


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

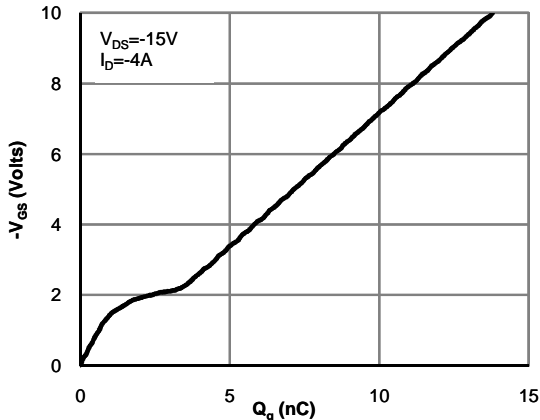


Figure 7: Gate-Charge Characteristics

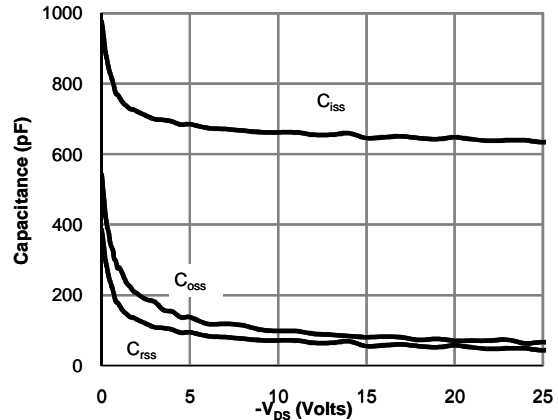


Figure 8: Capacitance Characteristics

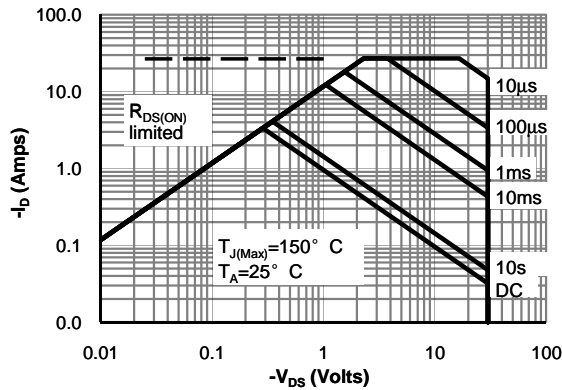


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

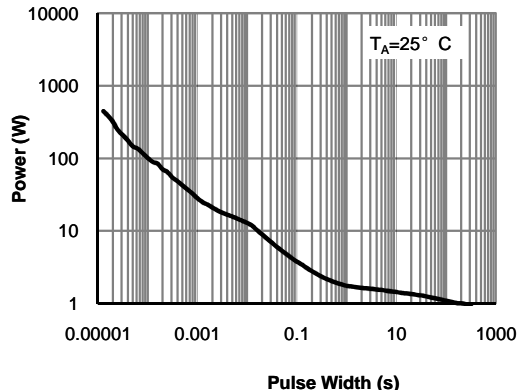


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

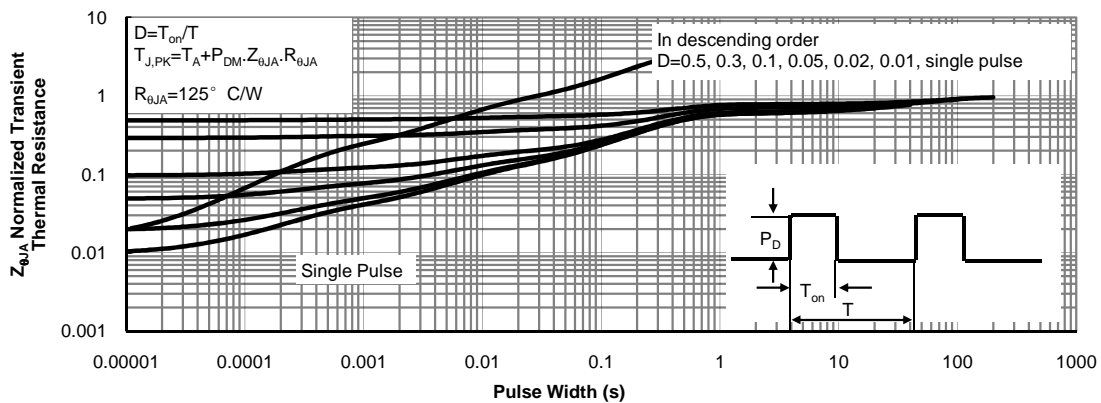
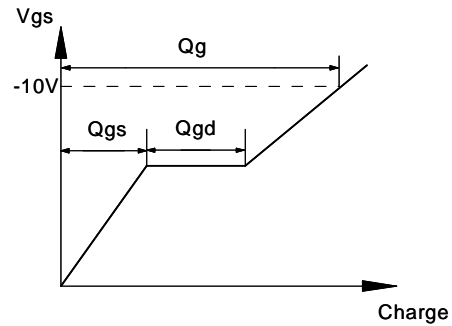
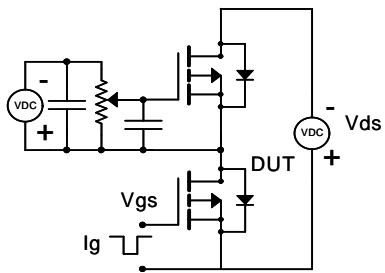
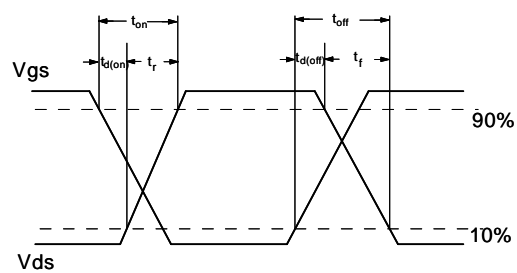
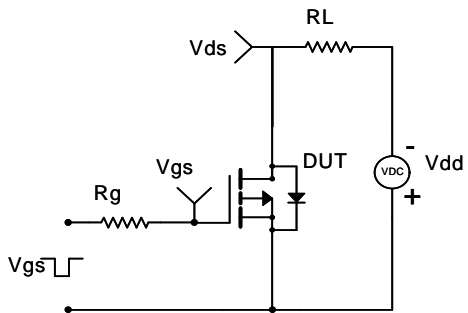


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

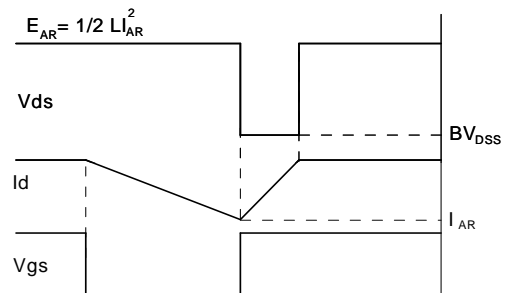
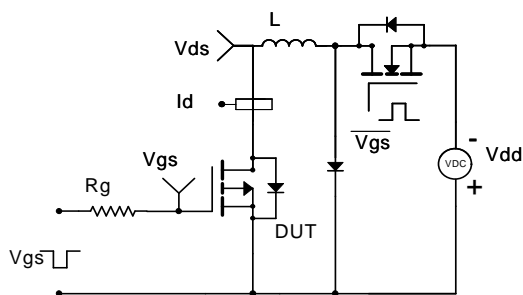
### Gate Charge Test Circuit & Waveform



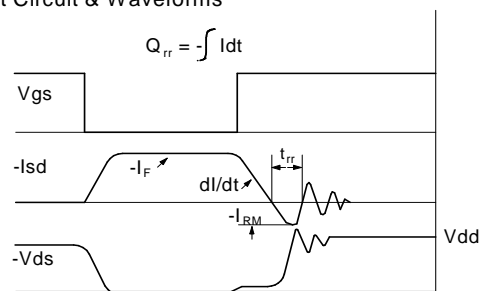
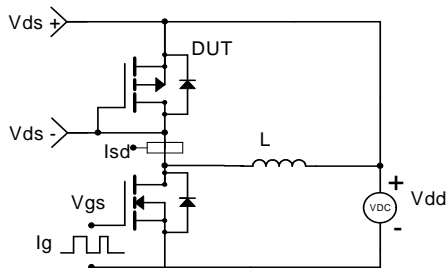
### Resistive Switching Test Circuit & Waveforms



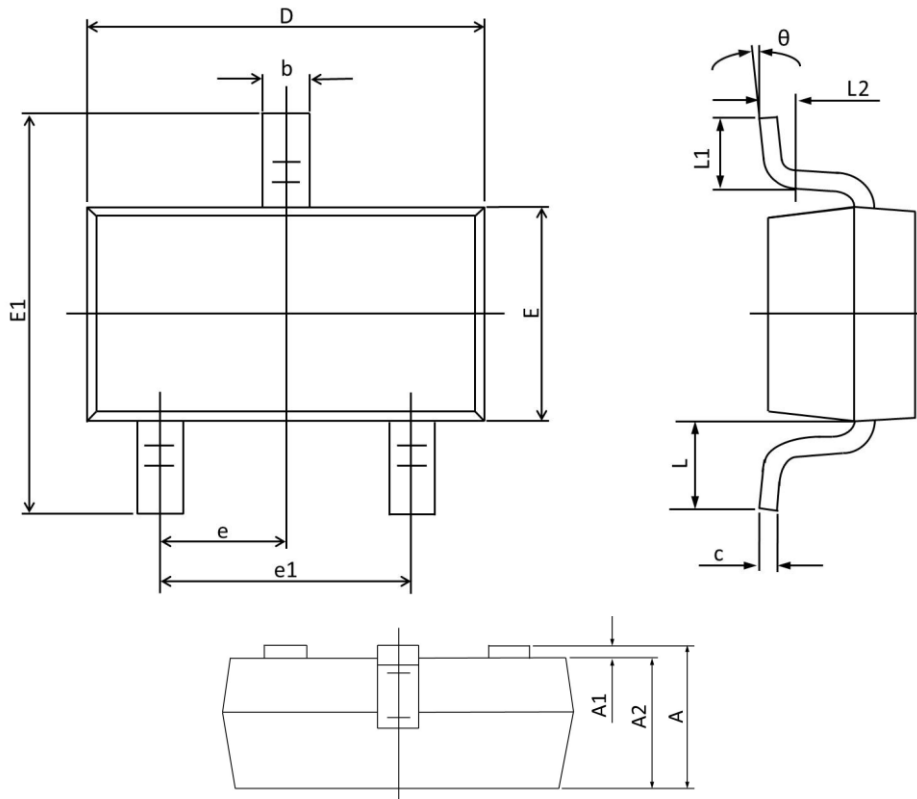
### Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



### Diode Recovery Test Circuit & Waveforms



SOT23 PACKAGE INFORMATION



| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | Max                       | Min   | Max                  | Min   |
| A        | 1.150                     | 0.900 | 0.045                | 0.035 |
| A1       | 0.100                     | 0.000 | 0.004                | 0.000 |
| A2       | 1.050                     | 0.900 | 0.041                | 0.035 |
| b        | 0.500                     | 0.300 | 0.020                | 0.012 |
| c        | 0.150                     | 0.080 | 0.006                | 0.003 |
| D        | 3.000                     | 2.800 | 0.118                | 0.110 |
| E        | 1.400                     | 1.200 | 0.055                | 0.047 |
| E1       | 2.550                     | 2.250 | 0.100                | 0.089 |
| e        | 0.95 TYP.                 |       | 0.037 TYP.           |       |
| e1       | 2.000                     | 1.800 | 0.079                | 0.071 |
| L        | 0.55 REF.                 |       | 0.022 REF.           |       |
| L1       | 0.500                     | 0.300 | 0.020                | 0.012 |
| L2       | 0.25 TYP.                 |       | 0.01 TYP.            |       |
| $\theta$ | 8°                        | 0°    | 8°                   | 0°    |

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