



## Description

The IRLL024NTRPBF uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.

## General Features

$V_{DS} = 60V$   $I_D = 5A$

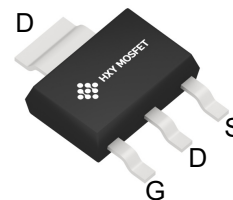
$R_{DS(ON)} < 85m\Omega$  @  $V_{GS}=10V$

## Application

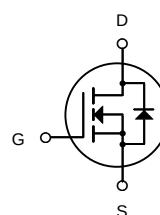
Battery protection

Load switch

Uninterruptible power supply



SOT-223



N-Channel MOSFET

## Ordering Information

| Product ID    | Pack    | Brand      | Qty(PCS) |
|---------------|---------|------------|----------|
| IRLL024NTRPBF | SOT-223 | HXY MOSFET | 2500     |

## Absolute Maximum Ratings ( $T_C=25^{\circ}C$ unless otherwise specified)

| Symbol                | Parameter                                                       | Rating     | Units         |
|-----------------------|-----------------------------------------------------------------|------------|---------------|
| $V_{DS}$              | Drain-Source Voltage                                            | 60         | V             |
| $V_{GS}$              | Gate-Source Voltage                                             | $\pm 20$   | V             |
| $I_D@T_A=25^{\circ}C$ | Continuous Drain Current, $V_{GS} @ 10V^1$                      | 5          | A             |
| $I_{DM}$              | Pulsed Drain Current <sup>2</sup>                               | 20         | A             |
| $P_D@T_A=25^{\circ}C$ | Total Power Dissipation <sup>4</sup>                            | 3          | W             |
| $T_{STG}$             | Storage Temperature Range                                       | -55 to 150 | $^{\circ}C$   |
| $T_J$                 | Operating Junction Temperature Range                            | -55 to 150 | $^{\circ}C$   |
| $R_{\theta JA}$       | Thermal Resistance Junction-ambient (Steady State) <sup>1</sup> | 85         | $^{\circ}C/W$ |



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

| Symbol       | Parameter                             | Conditions                                                        | Min. | Typ. | Max.      | Unit      |
|--------------|---------------------------------------|-------------------------------------------------------------------|------|------|-----------|-----------|
| $BV_{DSS}$   | Drain-Source Breakdown Voltage        | $V_{GS}=0V$ , $I_D=250\mu A$                                      | 60   | ---  | ---       | V         |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance     | $V_{GS}=10V$ , $I_D=3A$ ,                                         | ---  | 62   | 85        | $m\Omega$ |
|              |                                       | $V_{GS}=4.5V$ , $I_D=3A$ ,                                        | ---  | 69   | 95        | $m\Omega$ |
| $V_{GS(th)}$ | Gate Threshold Voltage                | $V_{GS}=V_{DS}$ , $I_D=250\mu A$                                  | 0.9  | 1.35 | 2         | V         |
| $I_{DSS}$    | Drain-Source Leakage Current          | $V_{DS}=60V$ , $V_{GS}=0V$ , $T_J=25^{\circ}\text{C}$             | ---  | ---  | 1         | $\mu A$   |
| $I_{GSS}$    | Gate-Source Leakage Current           | $V_{GS}=\pm 20V$ , $V_{DS}=0V$                                    | ---  | ---  | $\pm 100$ | nA        |
| $Q_g$        | Total Gate Charge                     | $V_{DS}=30V$ , $V_{GS}=10V$ , $I_D=3A$                            | ---  | 10   | ---       | nC        |
| $Q_{gs}$     | Gate-Source Charge                    |                                                                   | ---  | 1.7  | ---       |           |
| $Q_{gd}$     | Gate-Drain Charge                     |                                                                   | ---  | 2.1  | ---       |           |
| $T_{d(on)}$  | Turn-On Delay Time                    | $V_{GS}=10V$ , $R_{GEN}=3\Omega$<br>$V_{DS}=30V$ , $R_L=20\Omega$ | ---  | 3.6  | ---       | ns        |
| $T_r$        | Rise Time                             |                                                                   | ---  | 17.6 | ---       |           |
| $T_{d(off)}$ | Turn-Off Delay Time                   |                                                                   | ---  | 13   | ---       |           |
| $T_f$        | Fall Time                             |                                                                   | ---  | 23   | ---       |           |
| $t_{rr}$     | Body Diode Reverse Recovery Time      | $I_F=3A$ , $T_J=25^{\circ}\text{C}$<br>$dI/dt=100A/\mu s$         | ---  | 7    | ---       | ns        |
| $Q_{rr}$     | Body Diode Reverse Recovery Charge    |                                                                   | ---  | 33   | ---       | nC        |
| $C_{iss}$    | Input Capacitance                     | $V_{DS}=30V$ , $V_{GS}=0V$ , $f=1\text{MHz}$                      | ---  | 500  | ---       | pF        |
| $C_{oss}$    | Output Capacitance                    |                                                                   | ---  | 28   | ---       |           |
| $C_{rss}$    | Reverse Transfer Capacitance          |                                                                   | ---  | 22   | ---       |           |
| $R_g$        | Gate Resistance                       | $f=1\text{MHz}$ , open drain                                      | ---  | 2    | ---       | $\Omega$  |
| $I_s$        | Continuous Source Current(Body Diode) | $T_c=25^{\circ}\text{C}$                                          | ---  | ---  | 5         | A         |
| $V_{SD}$     | Drain to Source Diode Forward Voltage | $V_{GS}=0V$ , $I_s=3A$                                            | ---  | 0.85 | 1.2       | V         |

- A. Repetitive rating; pulse width limited by max. junction temperature.  
B.  $P_d$  is based on max. junction temperature, using junction-case thermal resistance.  
C. The value of  $R_{\theta JA}$  is measured with the device mounted on the minimum recommend pad size, in the still air environment with  $T_A=25^{\circ}\text{C}$ .  
The maximum allowed junction temperature of  $150^{\circ}\text{C}$ . The value in any given application depends on the user's specific board design.



### Typical Characteristics

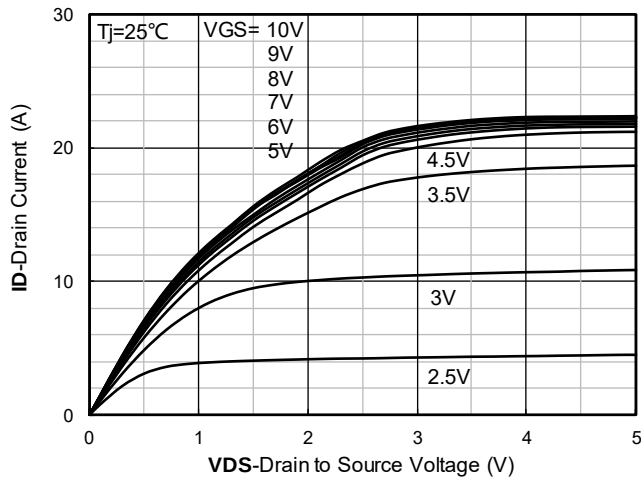


Figure 1. Output Characteristics

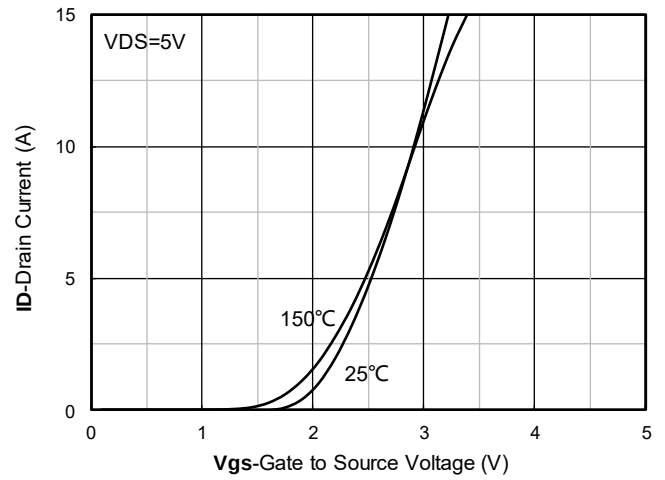


Figure 2. Transfer Characteristics

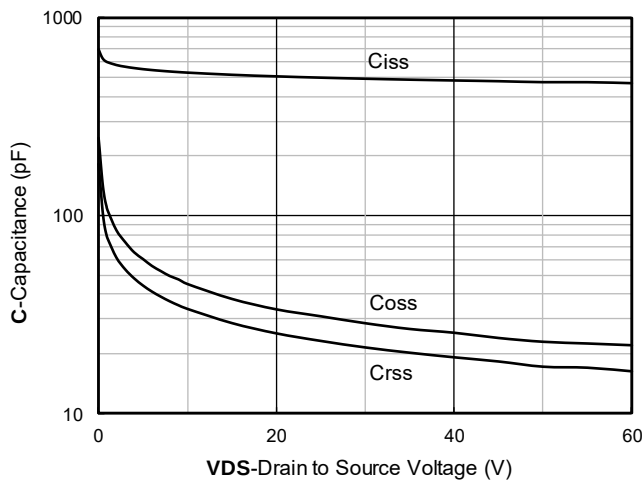


Figure 3. Capacitance Characteristics

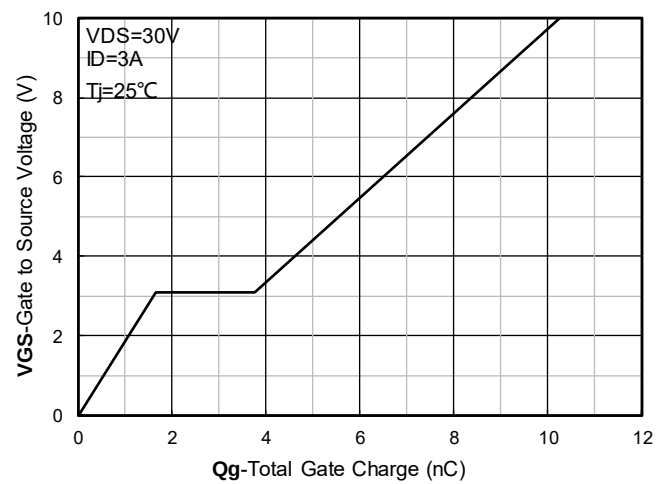


Figure 4. Gate Charge

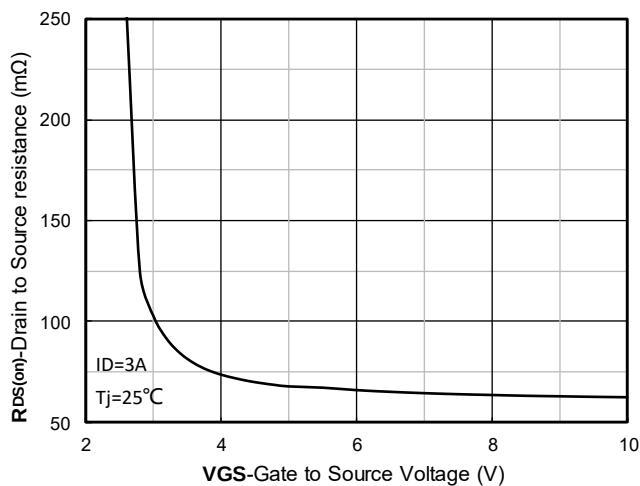


Figure 5. On-Resistance vs Gate to Source Voltage

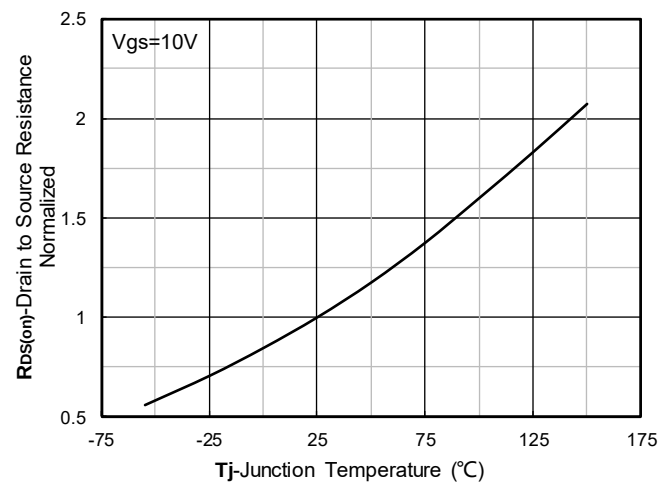


Figure 6. Normalized On-Resistance

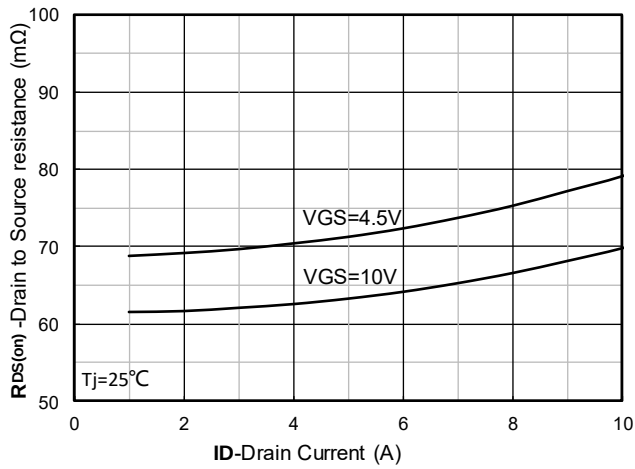


Figure 7.  $R_{DS(on)}$  VS Drain Current

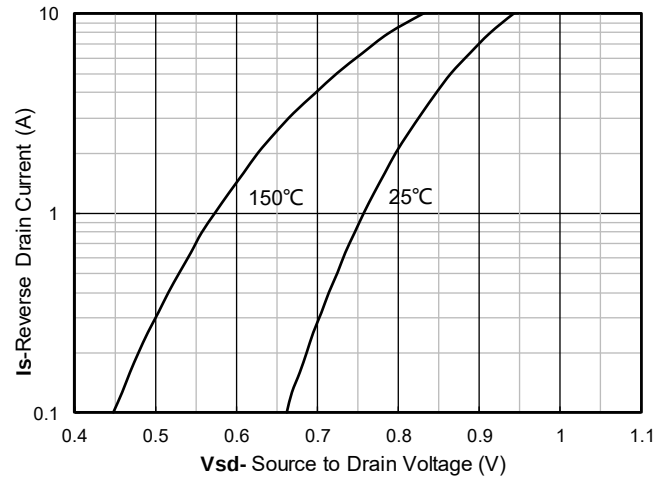


Figure 8. Forward characteristics of reverse diode

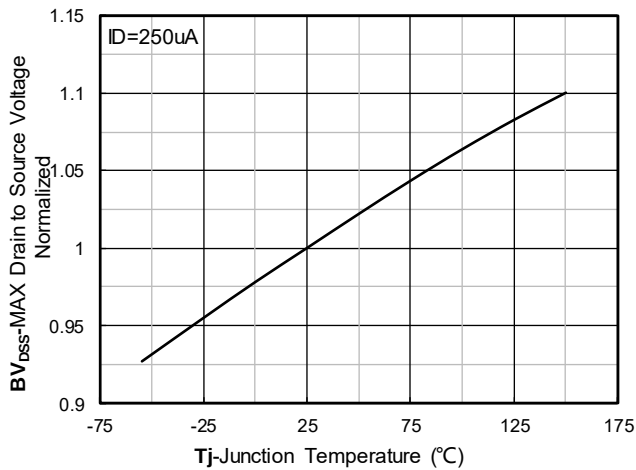


Figure 9. Normalized breakdown voltage

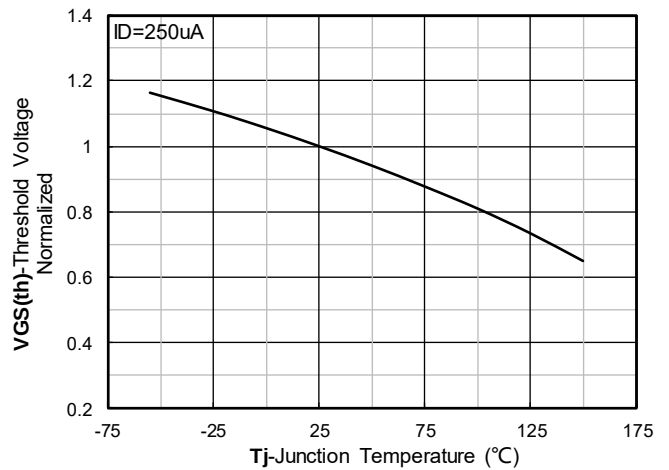


Figure 10. Normalized Threshold voltage

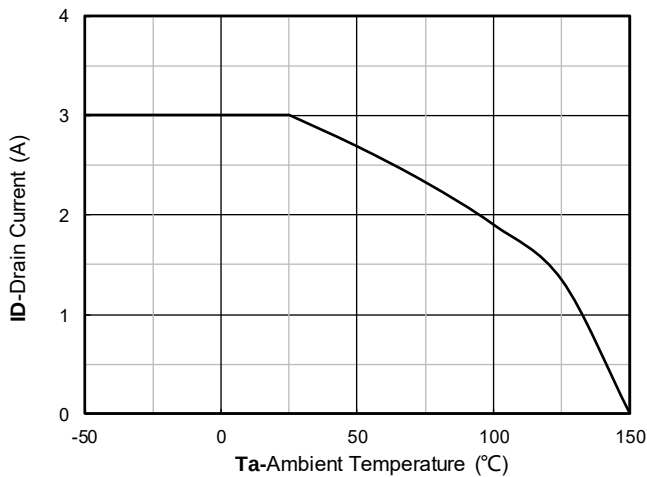


Figure 11. Current dissipation

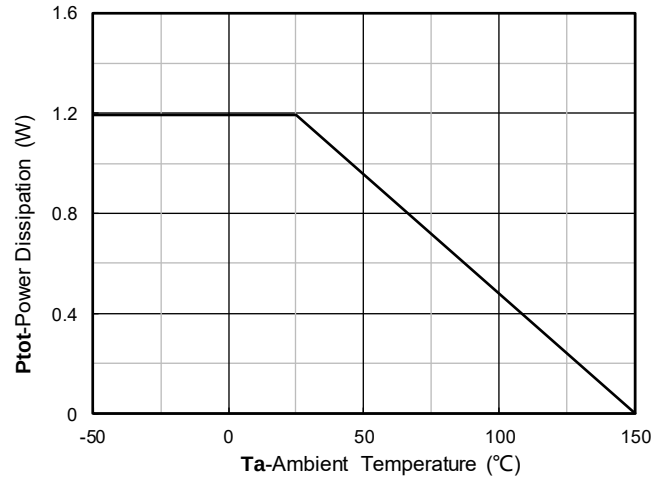


Figure 12. Power dissipation

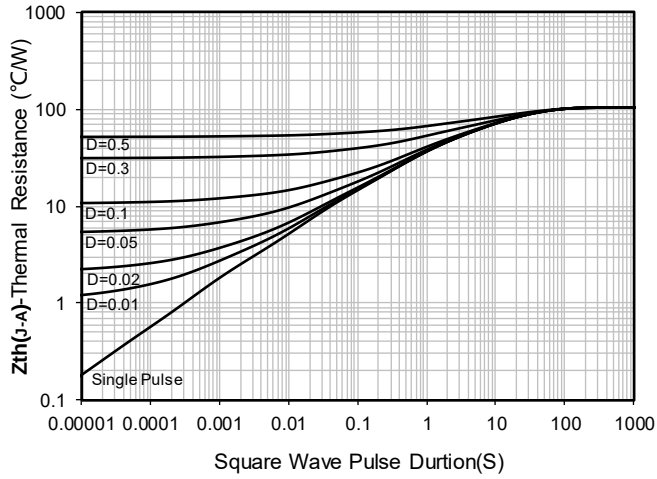


Figure 13. Maximum Transient Thermal Impedance

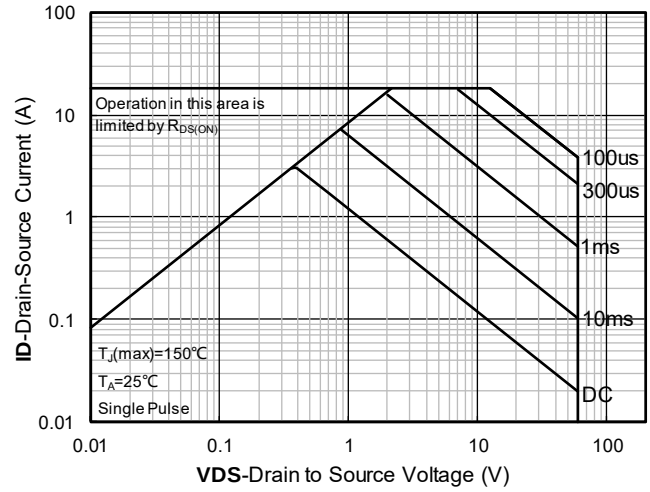


Figure 14. Safe Operation Area

## Test Circuits & Waveforms

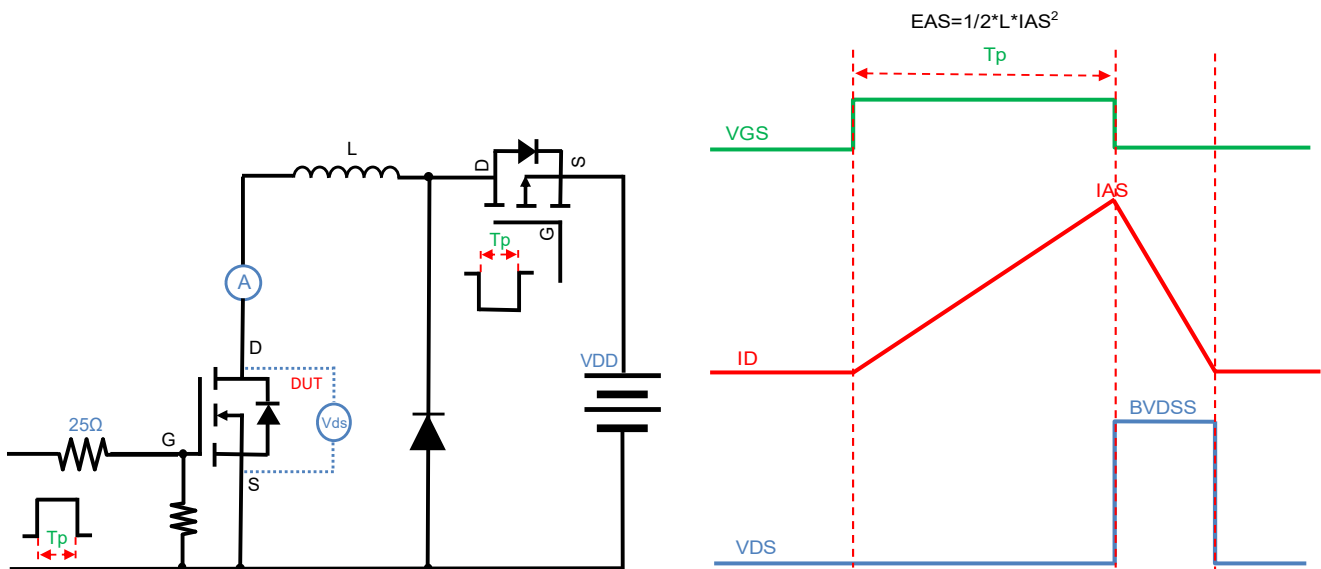


Figure A. Unclamped Inductive Switching (UIS) Test Circuit & Waveform

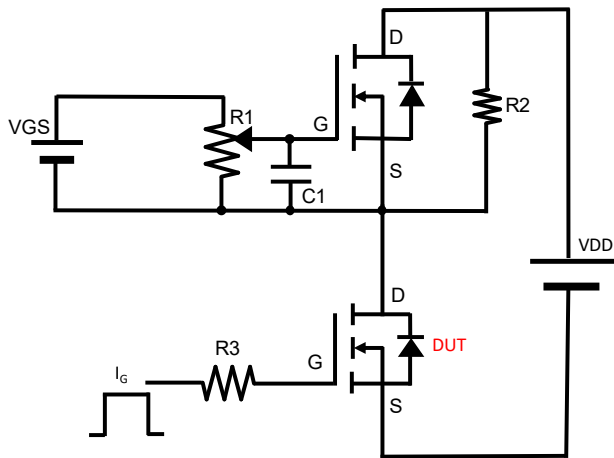


Figure B. Gate Charge Test Circuit & Waveform

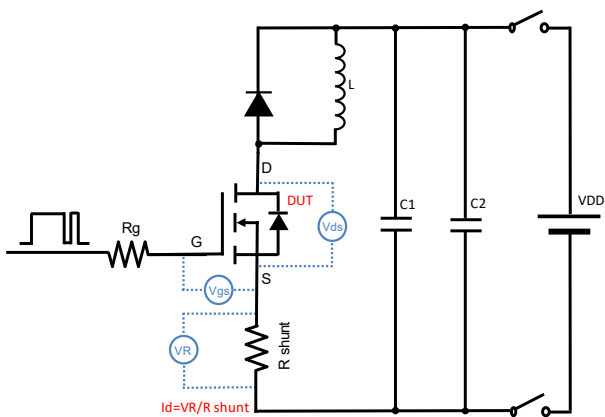
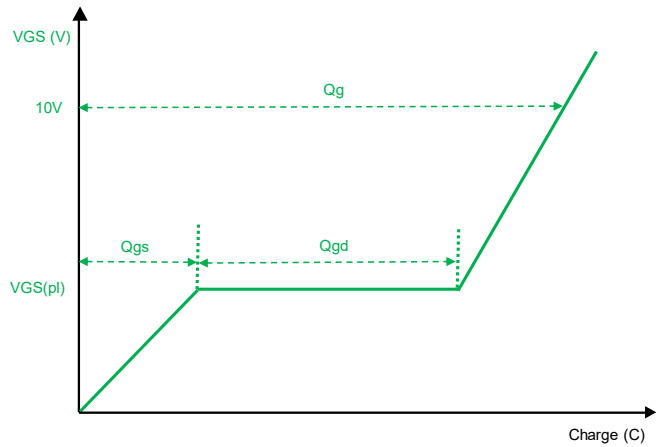


Figure C. Resistive Switching Test Circuit & Waveform

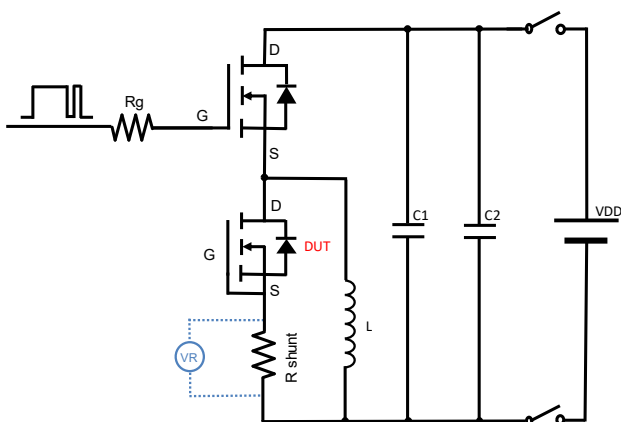
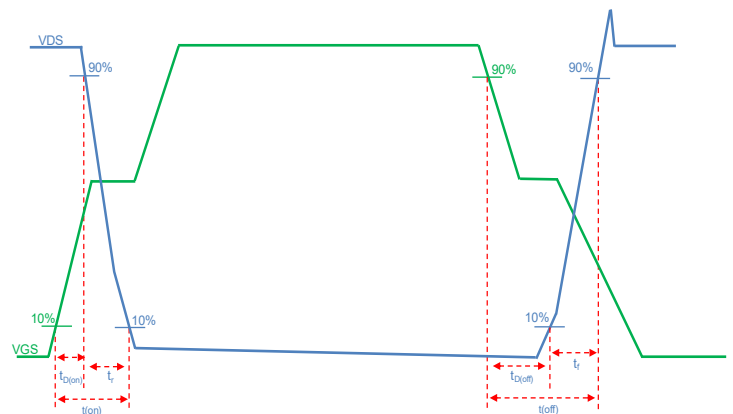
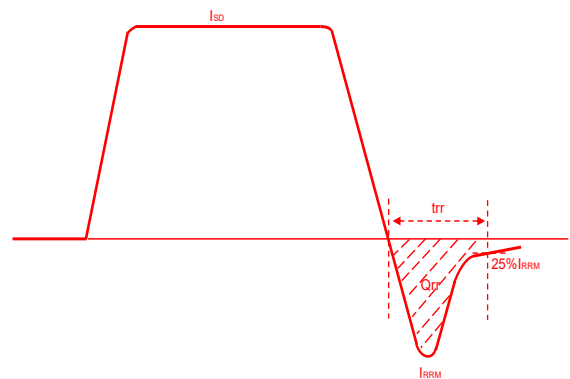
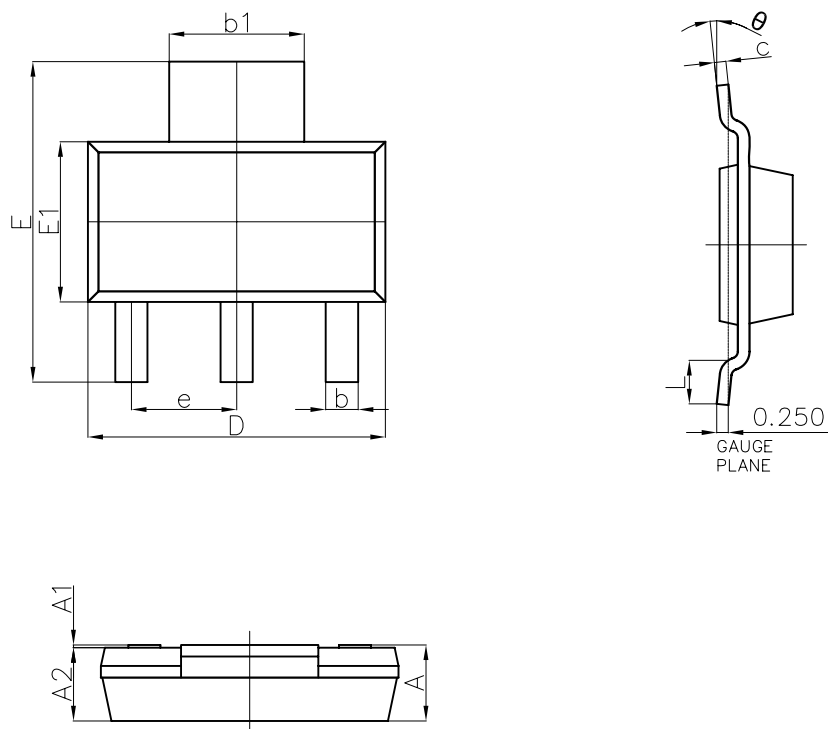


Figure D. Diode Recovery Test Circuit & Waveform





### SOT-223 (SOT-223-4) Package Outline Dimensions



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min.                      | Max.  | Min.                 | Max.  |
| A      | —                         | 1.800 | —                    | 0.071 |
| A1     | 0.020                     | 0.100 | 0.001                | 0.004 |
| A2     | 1.500                     | 1.700 | 0.059                | 0.067 |
| b      | 0.660                     | 0.840 | 0.026                | 0.033 |
| b1     | 2.900                     | 3.100 | 0.114                | 0.122 |
| c      | 0.230                     | 0.350 | 0.009                | 0.014 |
| D      | 6.300                     | 6.700 | 0.248                | 0.264 |
| E      | 6.700                     | 7.300 | 0.264                | 0.287 |
| E1     | 3.300                     | 3.700 | 0.130                | 0.146 |
| e      | 2.300(BSC)                |       | 0.091(BSC)           |       |
| L      | 0.750                     | —     | 0.030                | —     |
| θ      | 0°                        | 10°   | 0°                   | 10°   |



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