# 20V P-Channel Trench MOSFET(Preliminary)

## General Description

- Trench Power technology
- Low $R_{DS(ON)}$
- Low Gate Charge
- Optimized for fast-switching applications

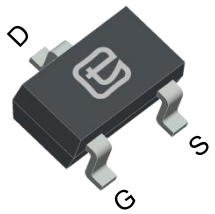
## Applications

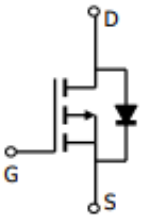
- Synchronous Rectification in DC/DC and AC/DC Converters
- Isolated DC/DC Converters in Telecom and Industrial

## Product Summary

| | |
|---|---|
| $V_{DS}$ | -20V |
| $I_D$ (at $V_{GS}$=-10V) | -4.5A |
| $R_{DS(ON)}$ (at $V_{GS}$=-10V) | < 40mΩ |
| $R_{DS(ON)}$ (at $V_{GS}$=-4.5V) | < 48mΩ |
| $R_{DS(ON)}$ (at $V_{GS}$=-2.5V) | < 62mΩ |

RoHS




| Part Number | Package Type | Form | Marking |
|---|---|---|---|
| TTX2305A | SOT-23 | Tape &Reel | 2305A |

## Absolute Maximum Ratings ($T_A$ =25°C, unless otherwise noted)

| Parameter | | Symbol | Maximum | Units |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | -20 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±12 | V |
| Continuous Drain Current [B] | $T_C$ =25°C | $I_D$ | -4.5 | A |
| | $T_C$ =70°C | | -3.6 | |
| Pulsed Drain Current [A] | | $I_{DM}$ | -13.5 | A |
| Avalanche Current [A] | | $I_{AS}$ | 27 | A |
| Single Pulse Avalanche Energy L =0.3mH [A] | | $E_{AS}$ | 109 | mJ |
| Power Dissipation [C] | $T_C$ =25°C | $P_D$ | 1.66 | W |
| | $T_C$ =70°C | | 1.06 | W |
| Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 150 | °C |

**Thermal Characteristics**

| Parameter | | Symbol | Maximum | Units |
|---|---|---|---|---|
| Maximum Junction-to-Lead | Steady-State | $R_{\theta JL}$ | 60 | °C/W |
| Maximum Junction-to-Ambient | Steady-State | $R_{\theta JA}$ | 100 | |

## Electrical Characteristics($T_J$ =25ºC, unless otherwise noted)

| Symbol | Parameter | Conditions | | Value | | | Units |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | |
| **STATIC PARAMETERS** | | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $I_D$ =-250μA,$V_{GS}$ =0V | | -20 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ =-20V, $V_{GS}$ =0V | $T_J$ =25ºC | | | -1 | μA |
| | | | $T_J$ =100ºC | | | -25 | |
| $I_{GSS}$ | Gate-Body Leakage Current | $V_{DS}$ =0V, $V_{GS}$ =±12V | | | | ±100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ =$V_{GS}$, $I_D$ =250μA | | -0.45 | -0.7 | -0.95 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$ =-10V, $I_D$ =-4.5A | | | 31 | 40 | mΩ |
| | | $V_{GS}$ =-4.5V, $I_D$ =-4.5A | | | 36 | 48 | mΩ |
| | | $V_{GS}$ =-2.5V, $I_D$ =-4.5A | | | 45 | 62 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ =-5V, $I_D$ =-4.5A | | | 5 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$ =-4.5A, $V_{GS}$ =0V | | | | -1.2 | V |
| $I_S$ | Maximum Body-Diode Continuous Current [B] | | | | | -4.5 | A |
| **DYNAMIC PARAMETERS** | | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$ =0V, $V_{DS}$ =-10V, f =1$MH_Z$ | | | 1053 | | pF |
| $C_{oss}$ | Output Capacitance | | | | 128 | | |
| $C_{rss}$ | Reverse Transfer Capacitance | | | | 124 | | |
| $R_g$ | Gate Resistance | f =1$MH_Z$ | | | 6.9 | | Ω |
| **SWITCHING PARAMETERS** | | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{GS}$ =-4.5V,$V_{DS}$ =-10V, $I_D$ =-4A | | | 11.2 | | nC |
| $Q_{gs}$ | Gate Source Charge | | | | 1.8 | | |
| $Q_{gd}$ | Gate Drain Charge | | | | 2.1 | | |
| $t_{D(on)}$ | Turn-On Delay Time | $V_{GS}$ =-4.5V,$V_{DS}$ =-10V, $I_D$ =-4A, $R_G$ =3.3Ω | | | 13 | | ns |
| $t_r$ | Turn-On Rise Time | | | | 32 | | |
| $T_{D(off)}$ | Turn-Off Delay Time | | | | 28 | | |
| $t_f$ | Turn-Off Fall Time | | | | 11 | | |

A. Single pulse width limited by maximum junction temperature.

B. The maximum current rating is package limited.

C. The power dissipation $P_D$ is based on $T_{J(MAX)}$ =150ºC, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

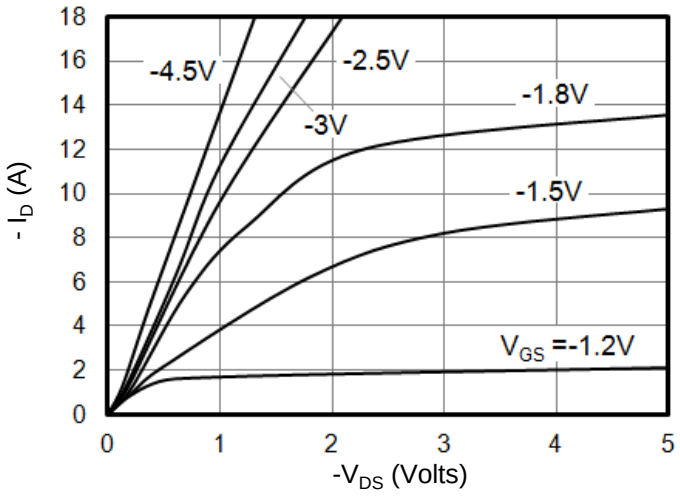



**Figure 1: On-Region Characteristics**

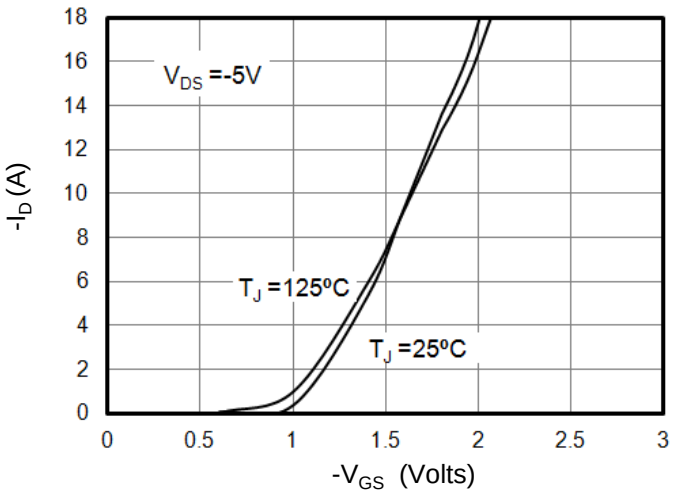



**Figure 2: Transfer Characteristics**

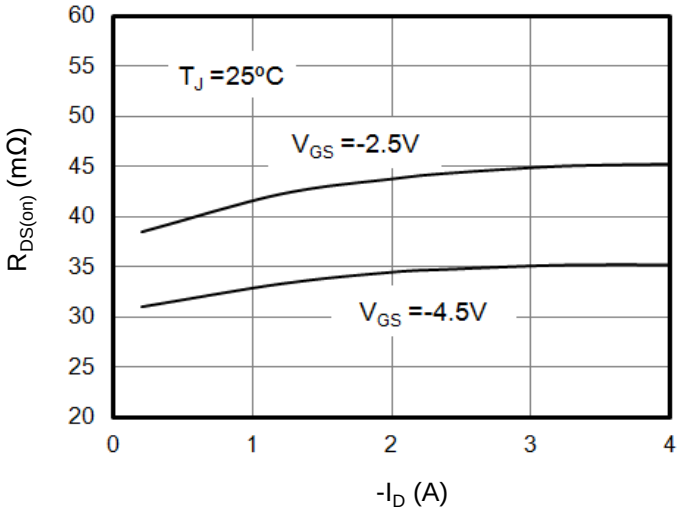



**Figure 3: On-Resistance vs. Drain Current**

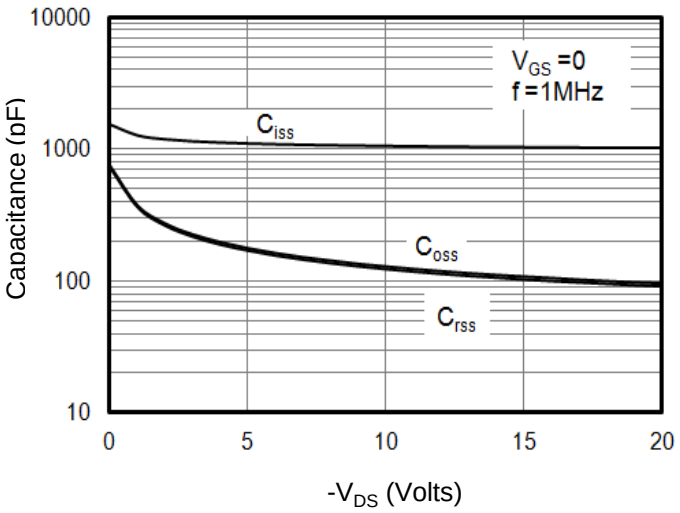



**Figure 4: Capacitance Characteristics**

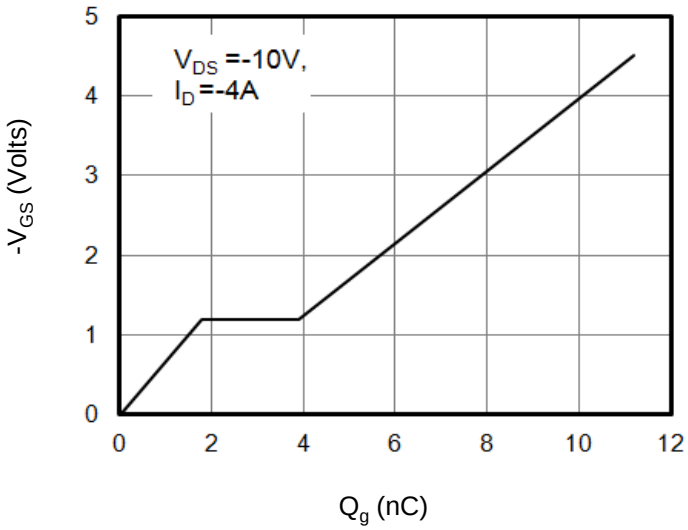



**Figure 5: Gate Charge Characteristics**

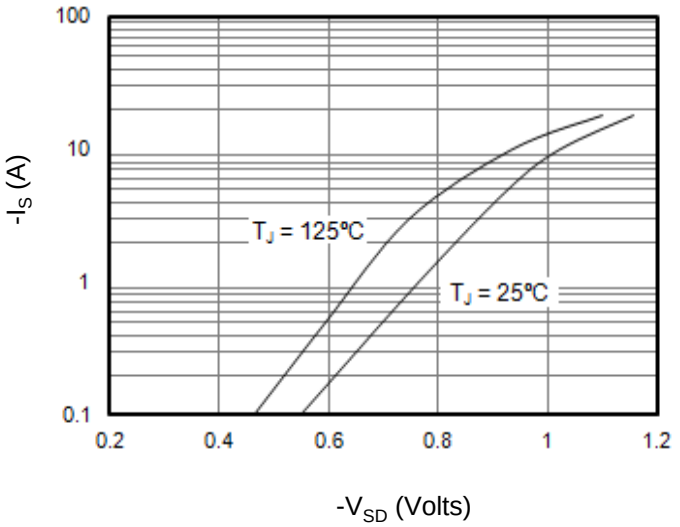



**Figure 6: Body Diode Forward Voltage**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

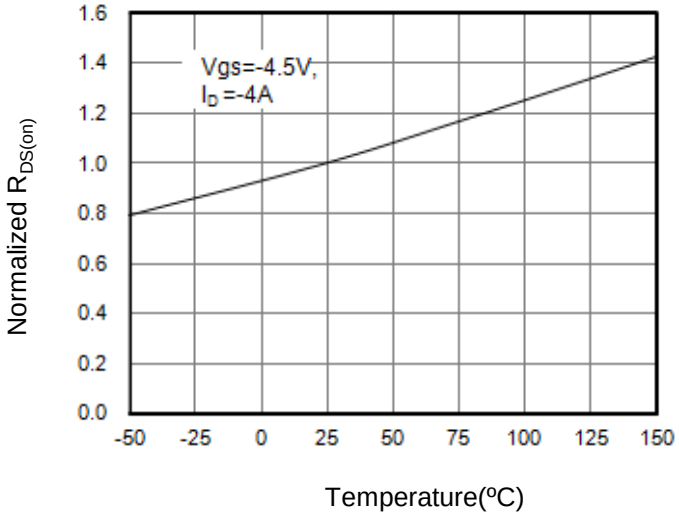



**Figure 7: On-Resistance vs. Junction Temperature**

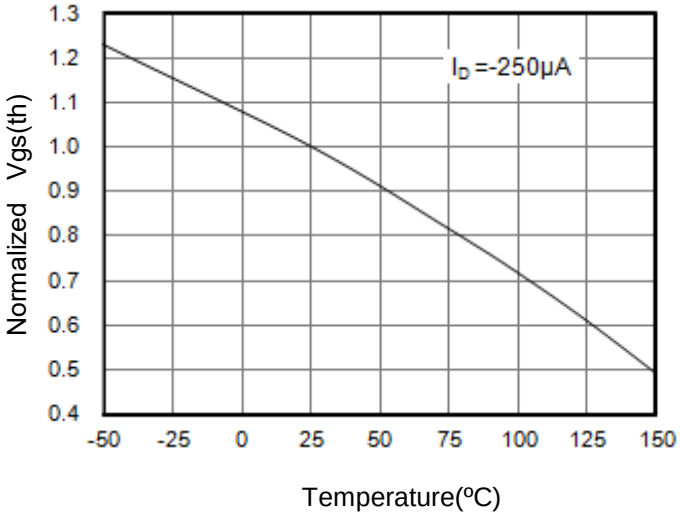



**Figure 8: Vgs(th) vs. Junction Temperature**

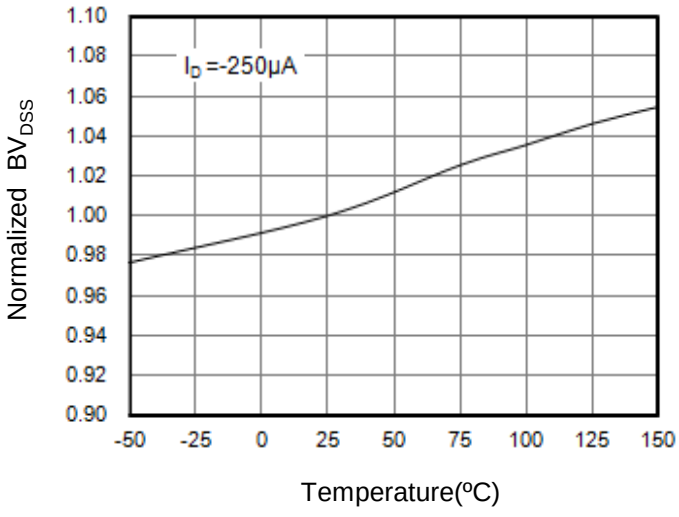



**Figure 9: $BV_{DSS}$ vs. Junction Temperature**

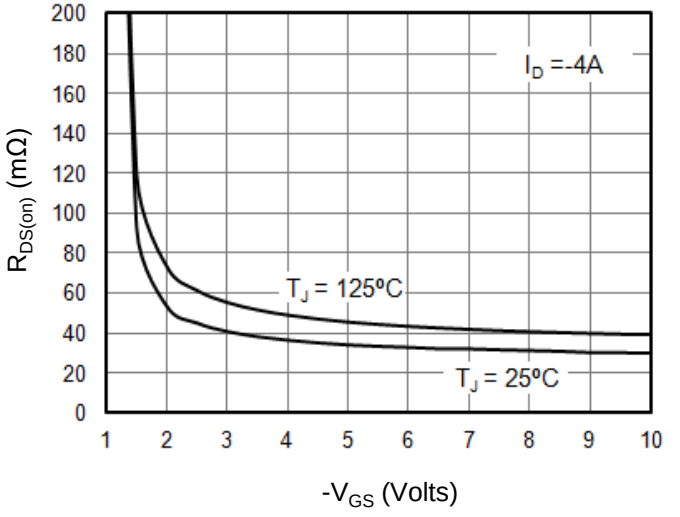



**Figure 10: On-Resistance vs. Gate-Source Voltage**

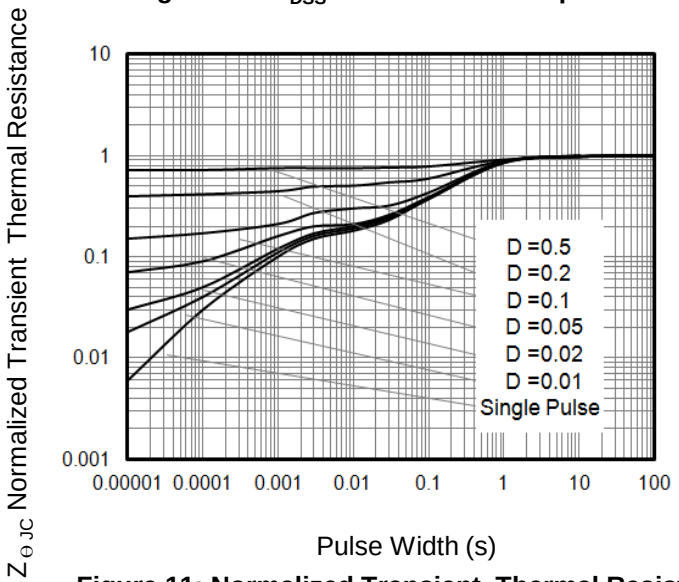



**Figure 11: Normalized Transient Thermal Resistance**

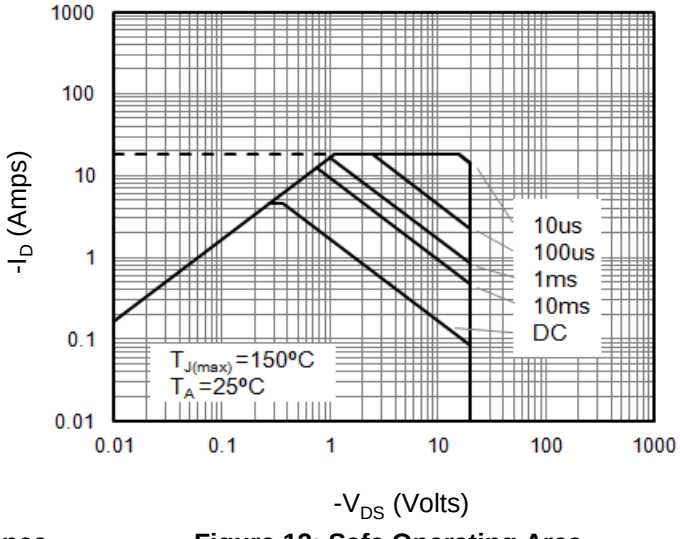



**Figure 12: Safe Operating Area**

**Figure A： Gate Charge Test Circuit and Waveforms**

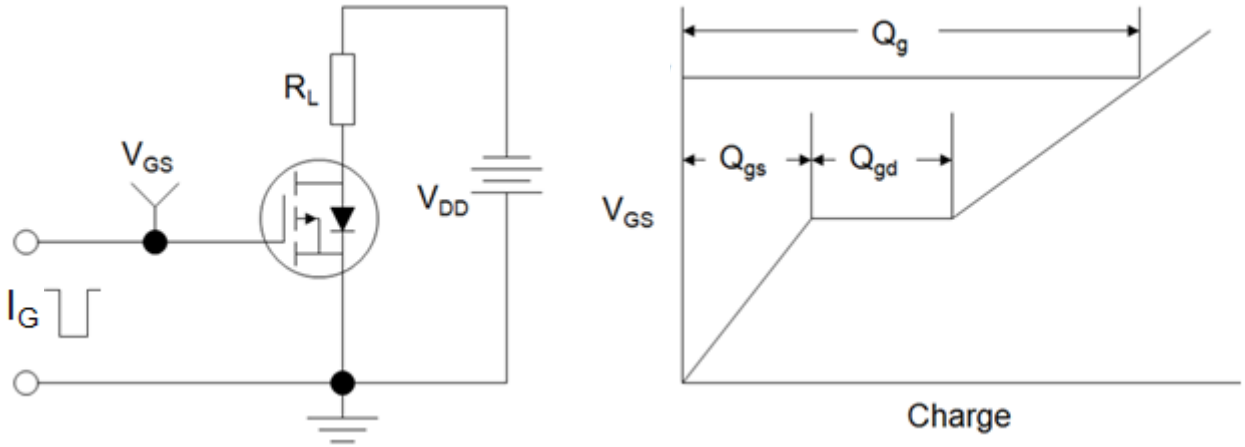



**Figure B：Resistive Switching Test Circuit and Waveforms**

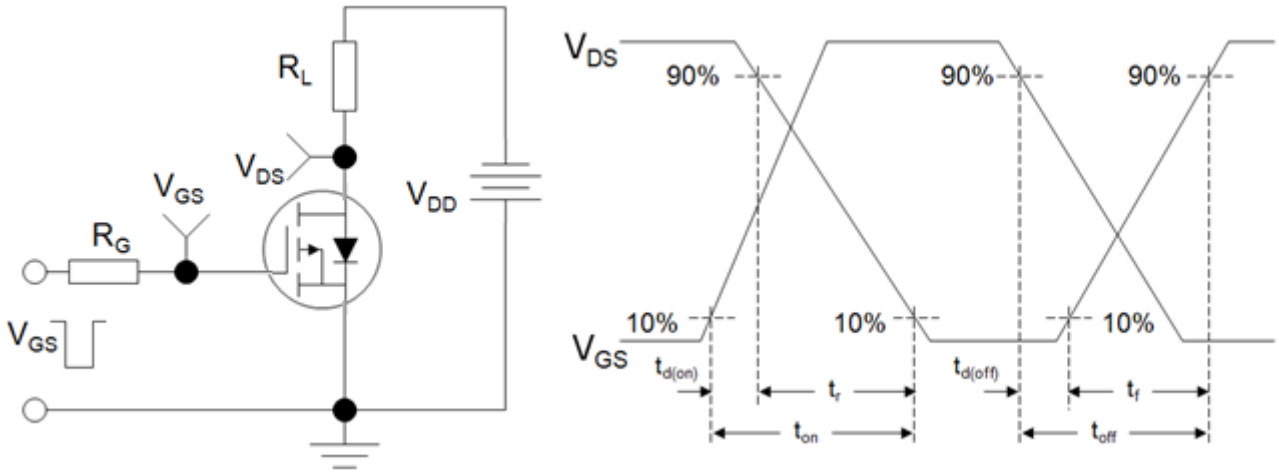
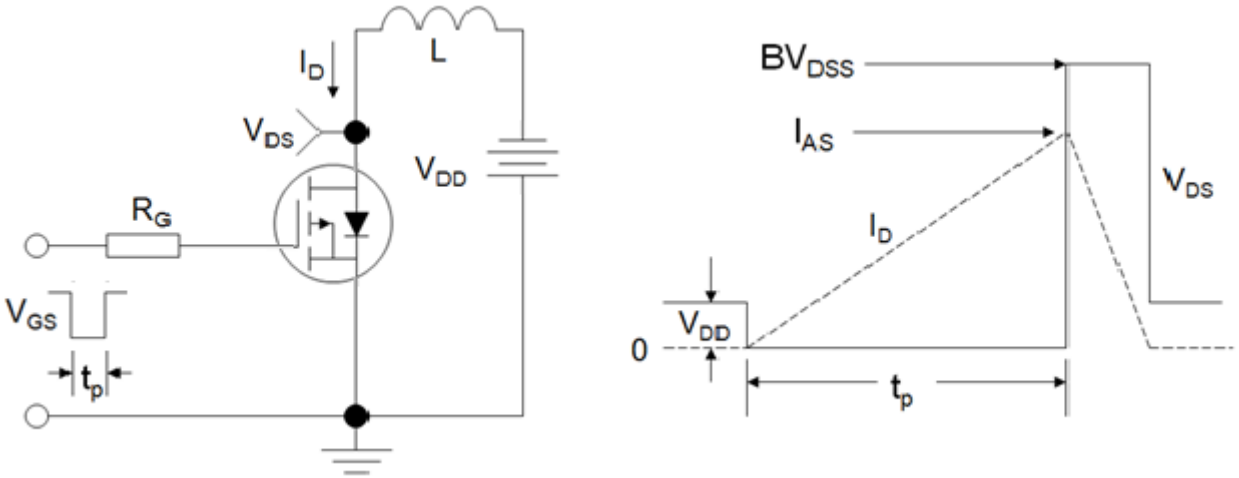
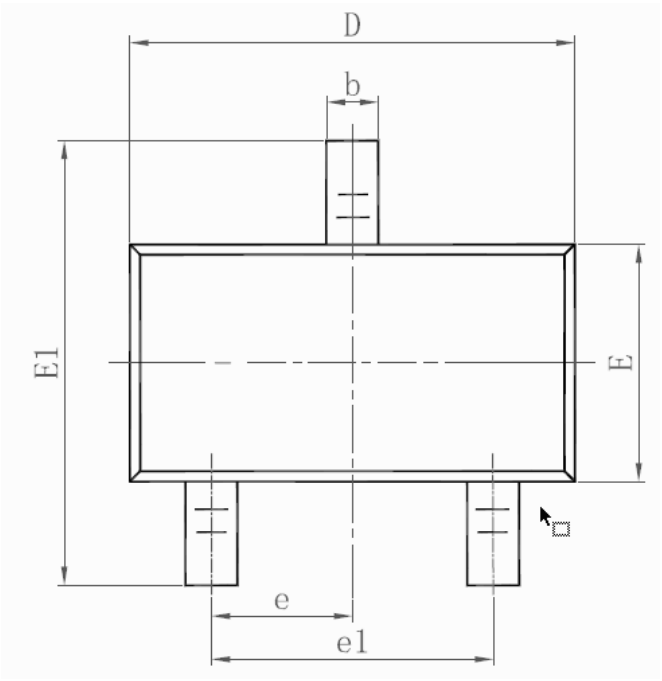
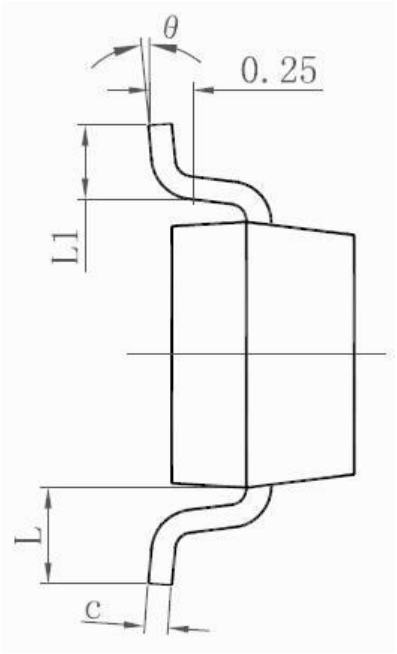


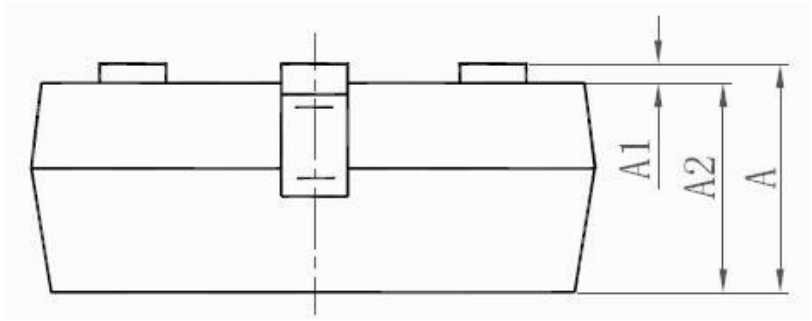

**Figure C：Unclamped Inductive Switching Test Circuit and Waveforms**



# SOT-23(长电)




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 0.900 | 1.150 | 0.035 | 0.045 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 0.900 | 1.050 | 0.035 | 0.041 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.080 | 0.150 | 0.003 | 0.006 |
| D | 2.800 | 3.000 | 0.110 | 0.118 |
| E | 1.200 | 1.400 | 0.047 | 0.055 |
| E1 | 2.250 | 2.550 | 0.089 | 0.100 |
| e | 0.950 TYP. | | 0.037 TYP. | |
| e1 | 1.800 | 2.000 | 0.071 | 0.079 |
| L | 0.550 REF. | | 0.022 REF. | |
| L1 | 0.300 | 0.500 | 0.012 | 0.020 |
| θ | 0° | 8° | 0° | 8° |

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