Dec 2015

SemiHow
Know-How for Semiconductor

# HCD70R950T / HCU70R950T

## 700V N-Channel Super Junction MOSFET

### Features

- Very Low FOM ($R_{DS(on)}$ X $Q_g$)
- Extremely low switching loss
- Excellent stability and uniformity
- 100% Avalanche Tested

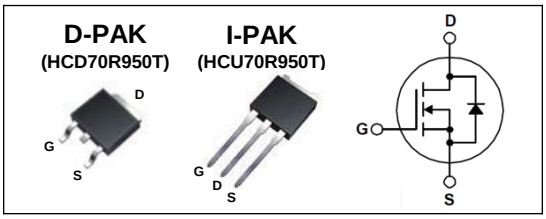
### Key Parameters

| Parameter | Value | Unit |
|---|---|---|
| $BV_{DSS}$ @$T_{j,max}$ | 750 | V |
| $I_D$ | 4.5 | A |
| $R_{DS(on),\ max}$ | 0.95 | Ω |
| $Qg_{,\ Typ}$ | 10 | nC |

### Application

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)
- TV power & LED Lighting Power

### Package & Internal Circuit




### Absolute Maximum Ratings

$T_C$=25℃ unless otherwise specified

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | 700 | V |
| $V_{GS}$ | Gate-Source Voltage | ±30 | V |
| $I_D$ | Drain Current – Continuous ($T_C$ = 25℃) | 4.5 | A |
| | Drain Current – Continuous ($T_C$ = 100℃) | 2.9 | A |
| $I_{DM}$ | Drain Current – Pulsed (Note 1) | 13 | A |
| $E_{AS}$ | Single Pulsed Avalanche Energy (Note 2) | 85 | mJ |
| $P_D$ | Power Dissipation ($T_A$ = 25℃) * | 2.5 | W |
| | Power Dissipation ($T_C$ = 25℃) | 37 | W |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | -55 to +150 | ℃ |
| $T_L$ | Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds | 300 | ℃ |

### Thermal Resistance Characteristics

| Symbol | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | -- | 3.4 | ℃/W |
| $R_{\theta JA}$ | Junction-to-Ambient * | -- | 50 | |
| $R_{\theta JA}$ | Junction-to-Ambient | -- | 110 | |

* When mounted on the minimum pad size recommended (PCB Mount)

## Electrical Characteristics $T_J$=25 °C unless otherwise specified

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **On Characteristics** | | | | | | |
| $V_{GS}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 μA | 2.0 | -- | 4.0 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$ = 10 V, $I_D$ = 1.5 A | -- | 0.86 | 0.95 | Ω |
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$ = 0 V, $I_D$ = 250 μA | 700 | -- | -- | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 700 V, $V_{GS}$ = 0 V | -- | -- | 10 | μA |
| | | $V_{DS}$ = 560 V, $T_J$ = 125℃ | -- | -- | 100 | μA |
| $I_{GSS}$ | Gate-Body Leakage Current | $V_{GS}$ = ±30 V, $V_{DS}$ = 0 V | -- | -- | ±100 | nA |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 50 V, $V_{GS}$ = 0 V, f = 1.0 MHz | -- | 470 | 485 | pF |
| $C_{oss}$ | Output Capacitance | | -- | 32 | 42 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | -- | 6.5 | 8.5 | pF |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Time | $V_{DS}$ = 350 V, $I_D$ = 4.5 A, $R_G$ = 25 Ω | -- | 22 | 54 | ns |
| $t_r$ | Turn-On Rise Time | | -- | 18 | 46 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 40 | 90 | ns |
| $t_f$ | Turn-Off Fall Time | | -- | 20 | 50 | ns |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = 560 V, $I_D$ = 4.5 A $V_{GS}$ = 10 V | -- | 10.0 | 13.0 | nC |
| $Q_{gs}$ | Gate-Source Charge | | -- | 3.0 | -- | nC |
| $Q_{gd}$ | Gate-Drain Charge | | -- | 2.5 | -- | nC |
| **Source-Drain Diode Maximum Ratings and Characteristics** | | | | | | |
| $I_S$ | Continuous Source-Drain Diode Forward Current | | -- | -- | 4.5 | A |
| $I_{SM}$ | Pulsed Source-Drain Diode Forward Current | | -- | -- | 13 | |
| $V_{SD}$ | Source-Drain Diode Forward Voltage | $I_S$ = 4.5 A, $V_{GS}$ = 0 V | -- | -- | 1.4 | V |
| trr | Reverse Recovery Time | $I_S$ = 4.5 A, $V_{GS}$ = 0 V $di_F/dt$ = 100 A/μs | -- | 290 | -- | ns |
| Qrr | Reverse Recovery Charge | | -- | 2.0 | -- | μC |

**Notes ;**

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $I_{AS}$=2.0A, $V_{DD}$=50V, $R_G$=25Ω, Starting $T_J$=25°C
3. Pulse Test : Pulse Width ≤ 300μs, Duty Cycle ≤ 2%

## Typical Characteristics

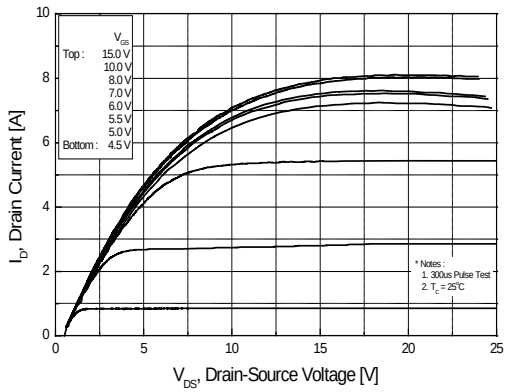



**Figure 1. On Region Characteristics**

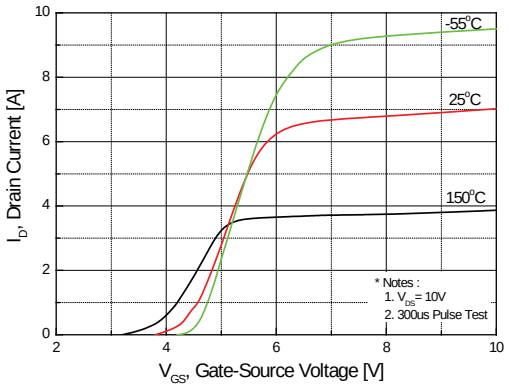



**Figure 2. Transfer Characteristics**

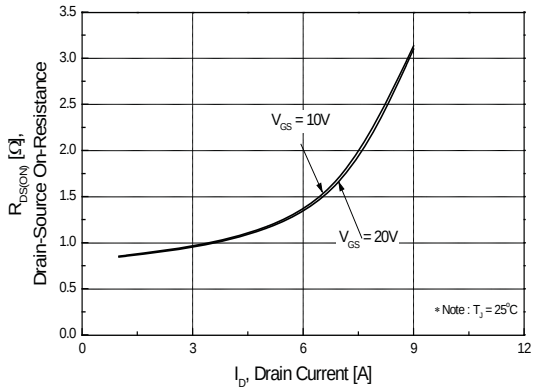



**Figure 3. On Resistance Variation vs Drain Current and Gate Voltage**

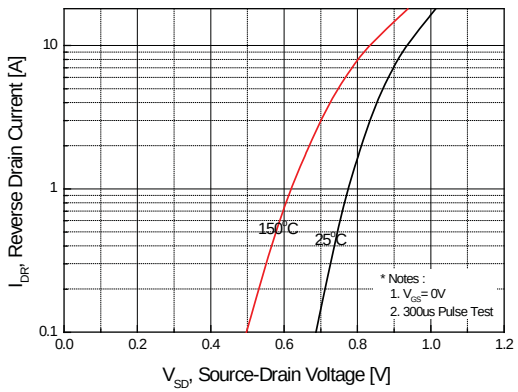



**Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature**

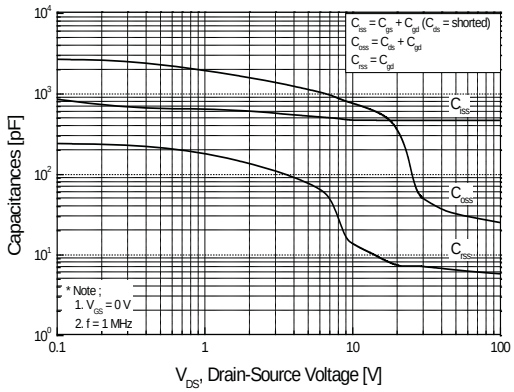



**Figure 5. Capacitance Characteristics**

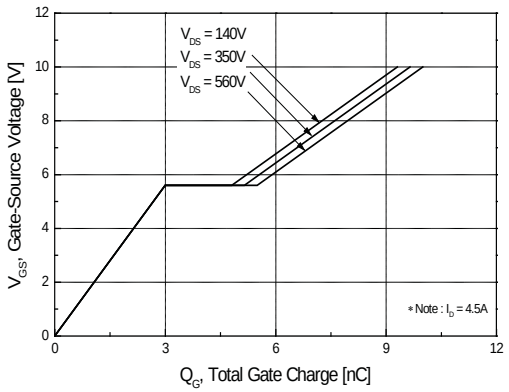



**Figure 6. Gate Charge Characteristics**

## Typical Characteristics (continued)

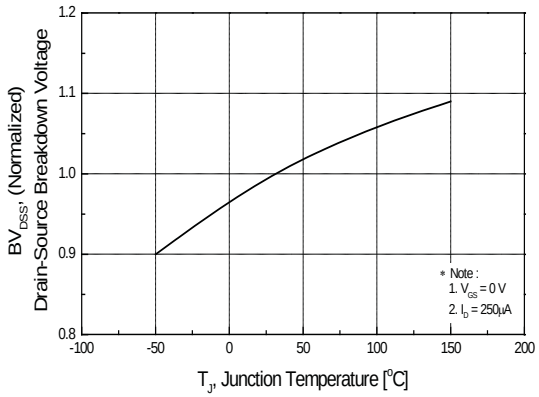



**Figure 7. Breakdown Voltage Variation vs Temperature**

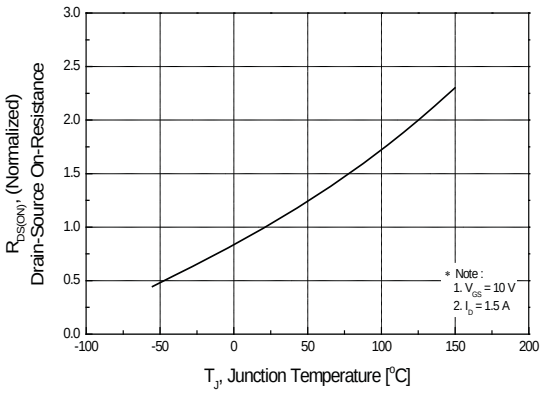



**Figure 8. On-Resistance Variation vs Temperature**

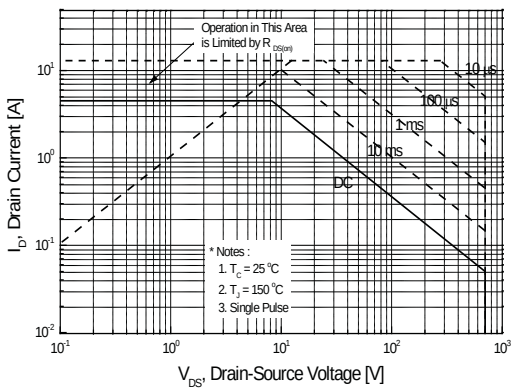



**Figure 9. Maximum Safe Operating Area**

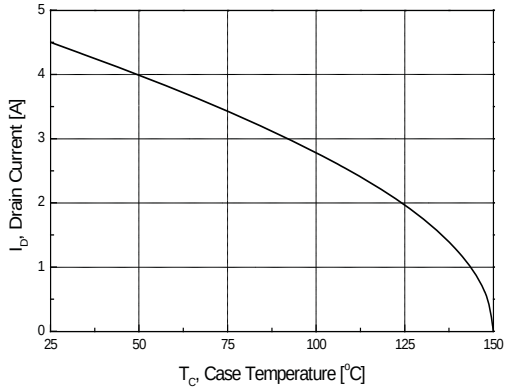



**Figure 10. Maximum Drain Current vs Case Temperature**

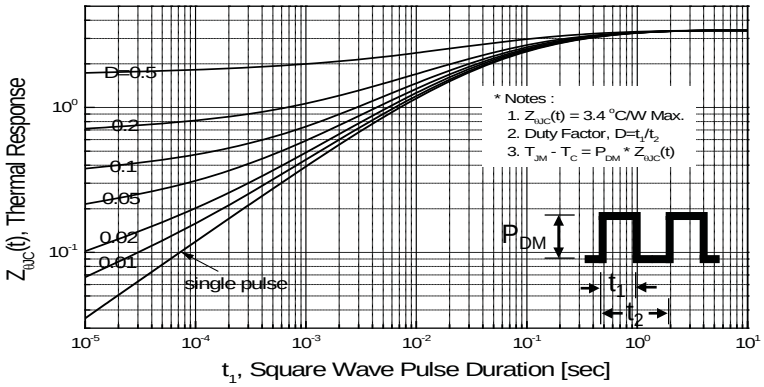



**Figure 11. Transient Thermal Response Curve**

**Fig 12. Gate Charge Test Circuit & Waveform**

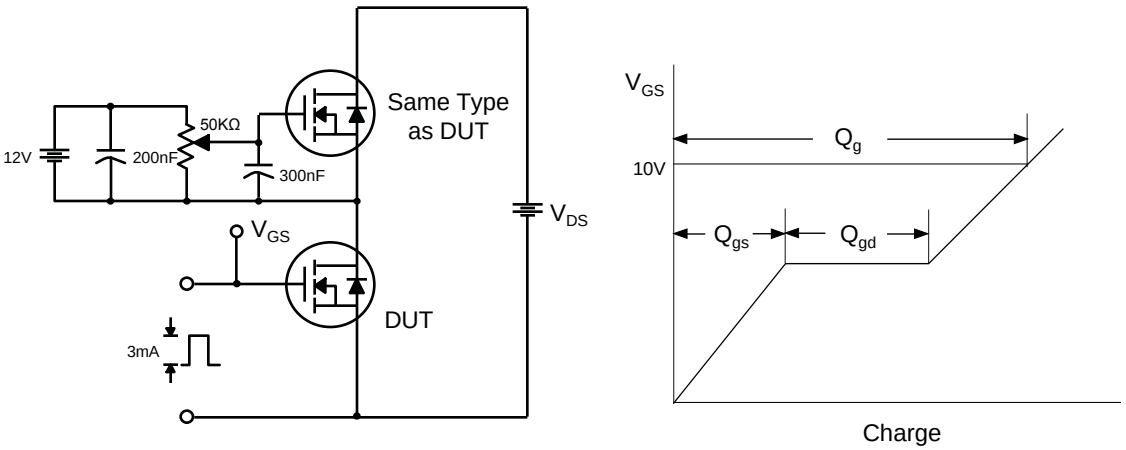



**Fig 13. Resistive Switching Test Circuit & Waveforms**

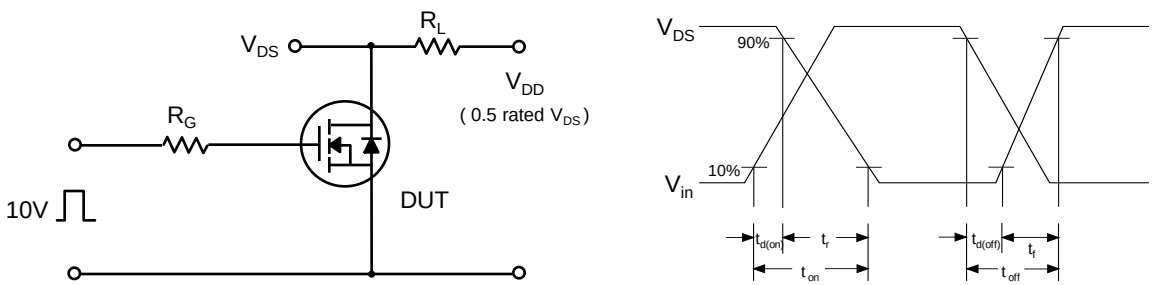



**Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms**

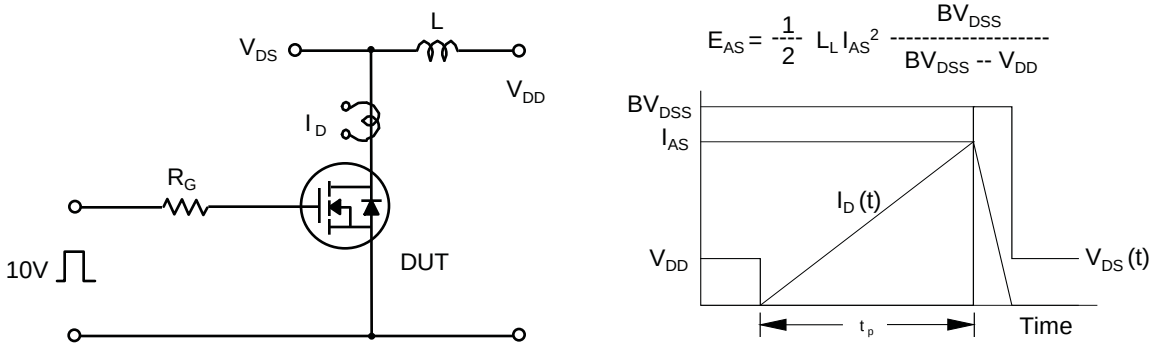
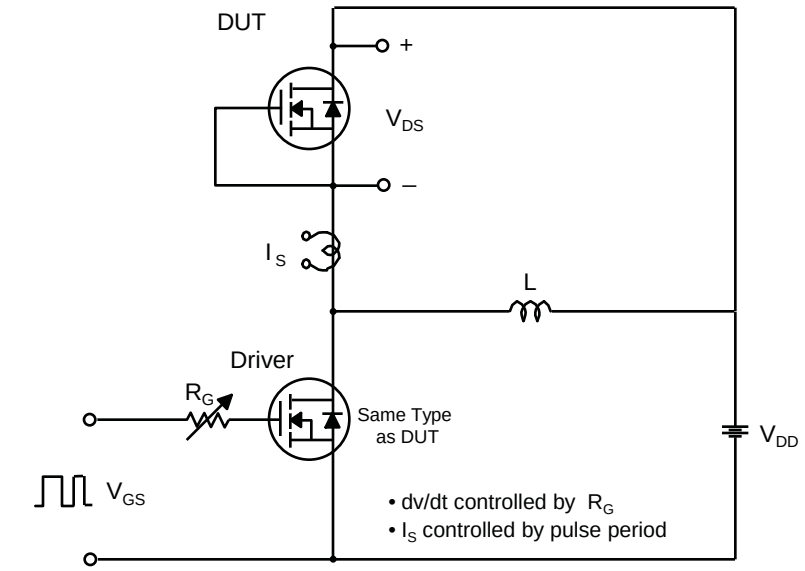
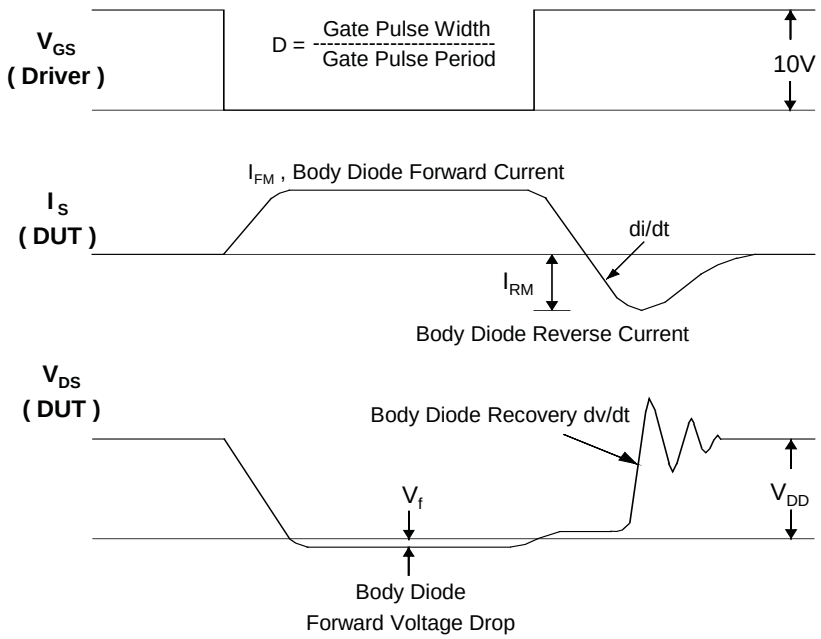


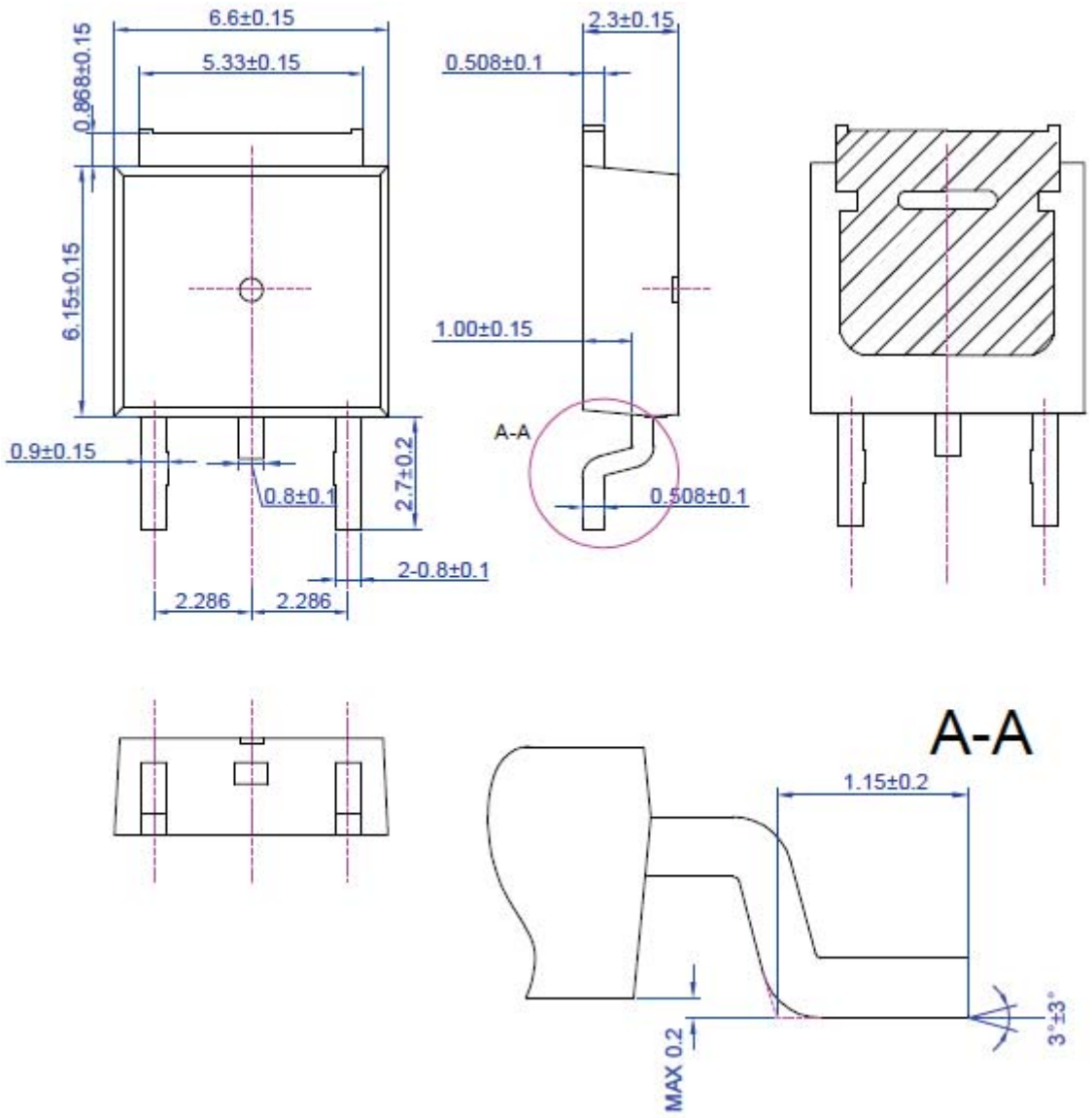
**Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms**



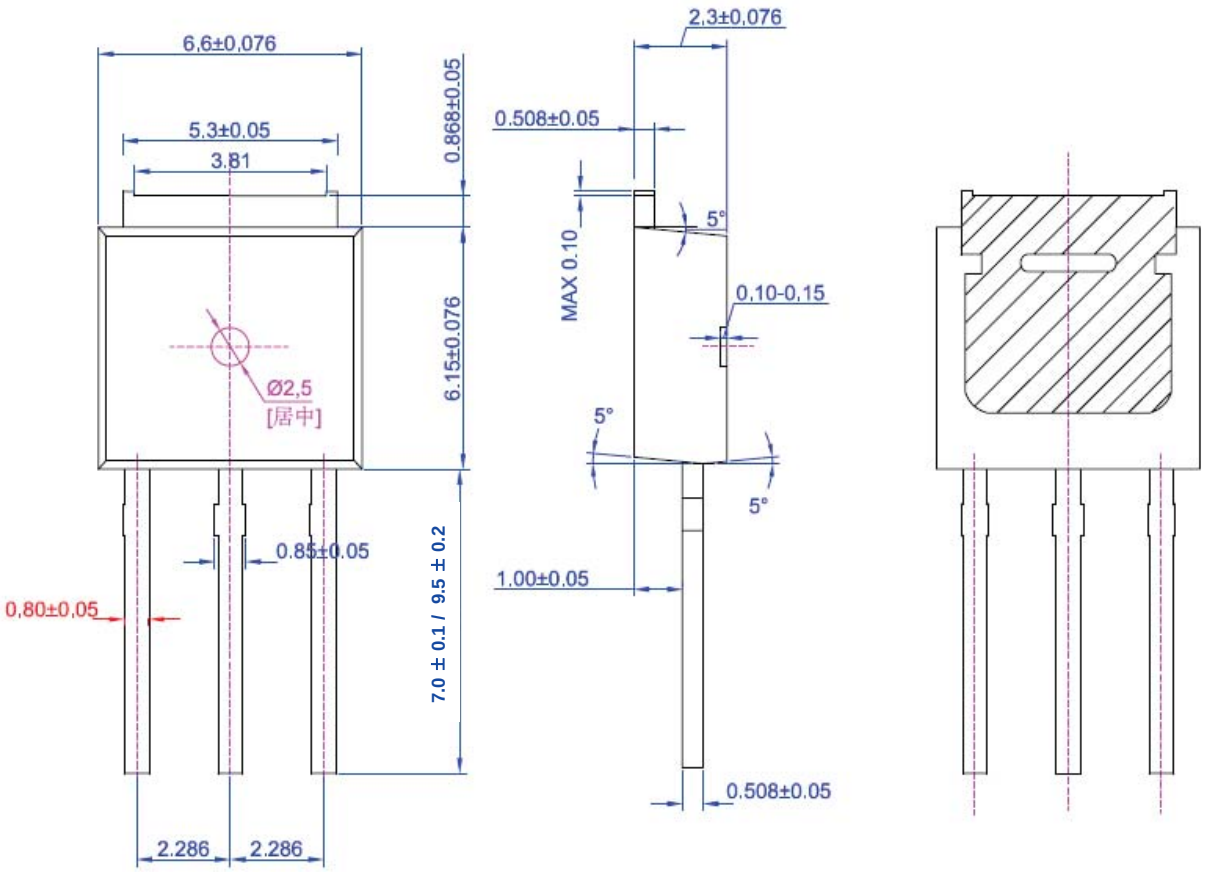
**Package Dimension**

# D-PAK
# (TO-252A)



## Package Dimension

# I-PAK
# (TO-251A)



**Package Dimension**

# I-PAK
# (TO-251B 2.5mm Short Lead)