Green Package

# PFU3N95G

## 950V N-Channel MOSFET

### FEATURES

- Originative New Design
- 100% EAS Test
- Rugged Gate Oxide Technology
- Extremely Low Intrinsic Capacitances
- Remarkable Switching Characteristics
- Unequalled Gate Charge : 15 nC (Typ.)
- Extended Safe Operating Area
- Lower $R_{DS(ON)}$ : 5.5 Ω (Typ.) @$V_{GS}$=10V
- Halogen Free

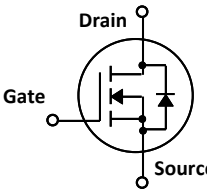
### APPLICATION

- Low power battery chargers
- Switch mode power supply (SMPS)
- AC adaptors

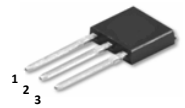
$BV_{DSS}$ = 950 V

$R_{DS(on)}$ = 5.5 Ω

$I_D$ = 2.0 A




**I-PAK(TO-251)**




1.Gate 2. Drain 3. Source

### Absolute Maximum Ratings

$T_C$=25℃ unless otherwise specified

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | 950 | V |
| $I_D$ | Drain Current – Continuous ($T_C$ = 25℃) | 2.0 | A |
| | Drain Current – Continuous ($T_C$ = 100℃) | 1.3 | A |
| $I_{DM}$ | Drain Current – Pulsed (Note 1) | 8.2 | A |
| $V_{GS}$ | Gate-Source Voltage | ±30 | V |
| $E_{AS}$ | Single Pulsed Avalanche Energy (Note 2) | 320 | mJ |
| $I_{AR}$ | Avalanche Current (Note 1) | 2.0 | A |
| $E_{AR}$ | Repetitive Avalanche Energy (Note 1) | 6.25 | mJ |
| dv/dt | Peak Diode Recovery dv/dt (Note 3) | 4.5 | V/ns |
| $P_D$ | Total Power Dissipation (TA=25 °C) * | 2.5 | W |
| | Power Dissipation ($T_C$ = 25℃) | 62.5 | W |
| | - Derate above 25℃ | 0.5 | 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 | -- | 2.0 | ℃/W |
| $R_{\theta JA}$ | Junction-to-Ambient* | -- | 62 | |
| $R_{\theta JA}$ | Junction-to-Ambient | -- | 110 | |

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

## Electrical Characteristics $T_C$=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 uA | 3.0 | -- | 5.0 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$ = 10 V, $I_D$ = 1.5 A | -- | 5.5 | 6.8 | Ω |
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$ = 0 V, $I_D$ = 250 uA | 950 | -- | -- | V |
| $\Delta BV_{DSS}$ /$\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250 uA, Referenced to25℃ | -- | 1.0 | -- | V/℃ |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 950 V, $V_{GS}$ = 0 V | -- | -- | 10 | uA |
| | | $V_{DS}$ = 760 V, $T_C$ = 125℃ | -- | -- | 100 | uA |
| $I_{GSSF}$ | Gate-Body Leakage Current, Forward | $V_{GS}$ = 30 V, $V_{DS}$ = 0 V | -- | -- | 100 | nA |
| $I_{GSSR}$ | Gate-Body Leakage Current, Reverse | $V_{GS}$ = -30 V, $V_{DS}$ = 0 V | -- | -- | -100 | nA |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 25 V, $V_{GS}$ = 0 V, f = 1.0 MHz | -- | 650 | 800 | pF |
| $C_{oss}$ | Output Capacitance | | -- | 60 | 80 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | -- | 8 | 10 | pF |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Time | $V_{DS}$ = 475 V, $I_D$ = 3.0 A, $R_G$ = 25 Ω (Note 4,5) | -- | 20 | 50 | ns |
| $t_r$ | Turn-On Rise Time | | -- | 50 | 110 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 40 | 90 | ns |
| $t_f$ | Turn-Off Fall Time | | -- | 40 | 90 | ns |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = 760 V, $I_D$ = 3.0 A, $V_{GS}$ = 10 V (Note 4,5) | -- | 16 | 20 | nC |
| $Q_{gs}$ | Gate-Source Charge | | -- | 3.5 | -- | nC |
| $Q_{gd}$ | Gate-Drain Charge | | -- | 8.5 | -- | nC |
| **Source-Drain Diode Maximum Ratings and Characteristics** | | | | | | |
| $I_S$ | Continuous Source-Drain Diode Forward Current | | -- | -- | 2.0 | A |
| $I_{SM}$ | Pulsed Source-Drain Diode Forward Current | | -- | -- | 8.2 | |
| $V_{SD}$ | Source-Drain Diode Forward Voltage | $I_S$ = 3.0 A, $V_{GS}$ = 0 V | -- | -- | 1.5 | V |
| trr | Reverse Recovery Time | $I_S$ = 3.0 A, $V_{GS}$ = 0 V $di_F/dt$ = 100 A/us (Note 4) | -- | 550 | -- | ns |
| Qrr | Reverse Recovery Charge | | -- | 0.3 | -- | uC |

**Notes ;**

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $I_{AS}$=3.0A, $V_{DD}$=50V, $R_G$=25Ω, Starting $T_J$=25°C
3. $I_{SD}$≤3.0A, di/dt≤300A/μs, $V_{DD}$≤$BV_{DSS}$ , Starting $T_J$=25 °C
4. Pulse Test : Pulse Width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature

## Typical Characteristics

**Figure1. On Region Characteristics**

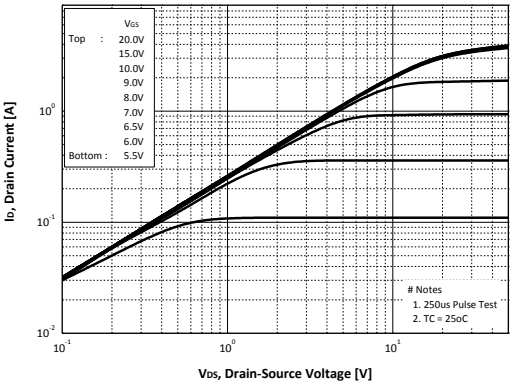



**Figure 2. Transfer Characteristics**

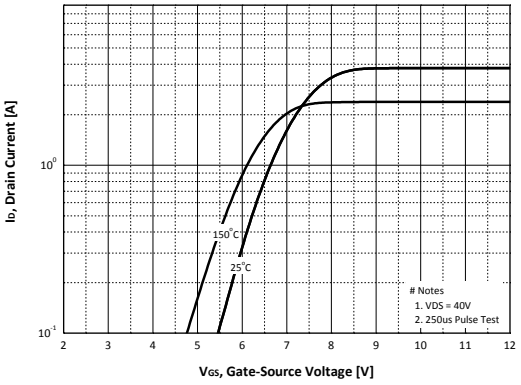



**Figure 3. Static Drain-Source On Resistance**

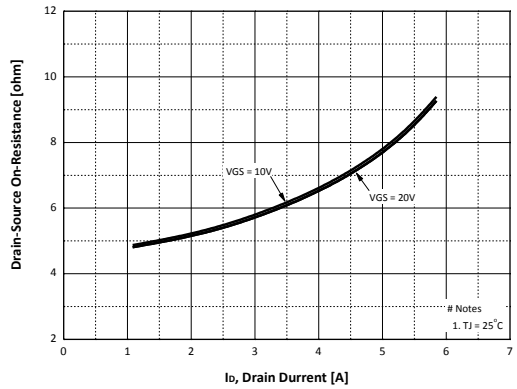



**Figure 4. Body Diode Forward Voltage**

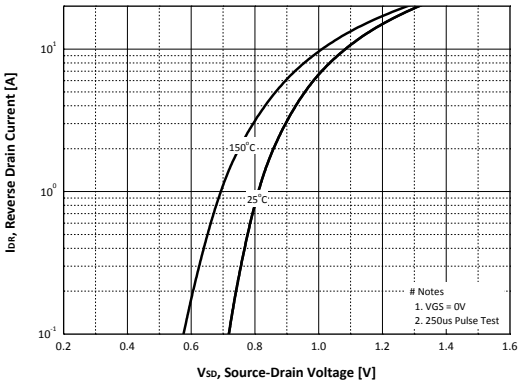



**Figure 5. Capacitance Charateristics**

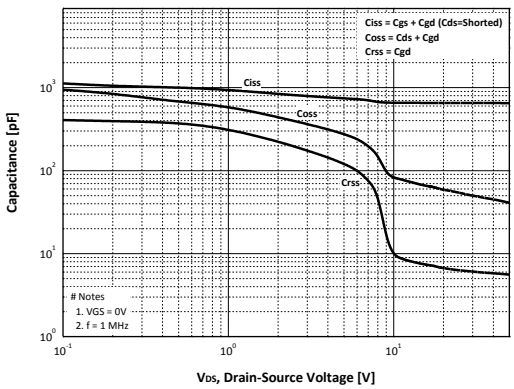
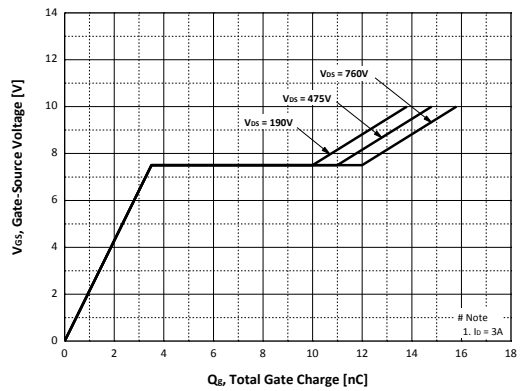



**Figure 6. Gate Charge Characteristics**



## Typical Characteristics

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

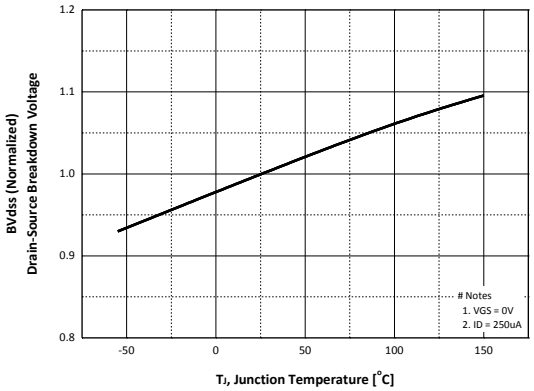



**Figure 8. On-Resistance Variation vs. Temperature**

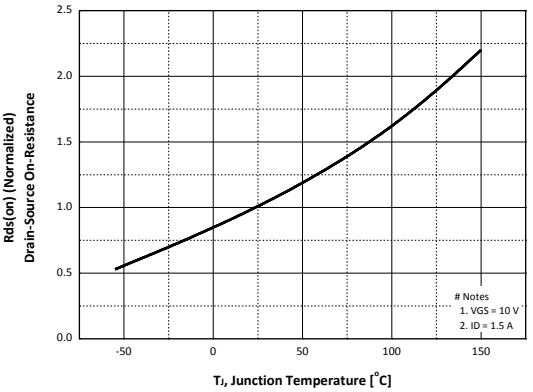



**Figure 9. Safe Operation Area**

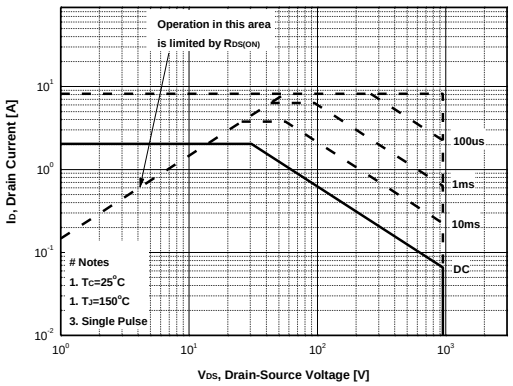



**Figure 10. Maximum Drain Current vs. Case Temperature**

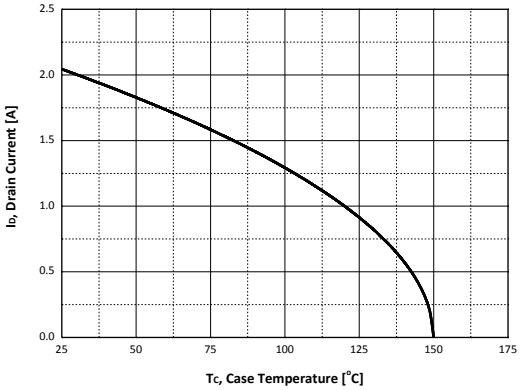
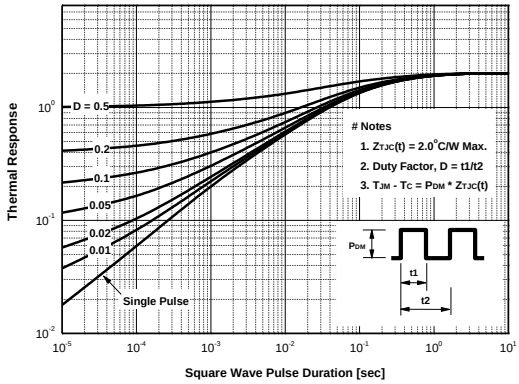



**Figure 11. Transient Thermal Response Curve**



## Characteristics Test Circuit & Waveform

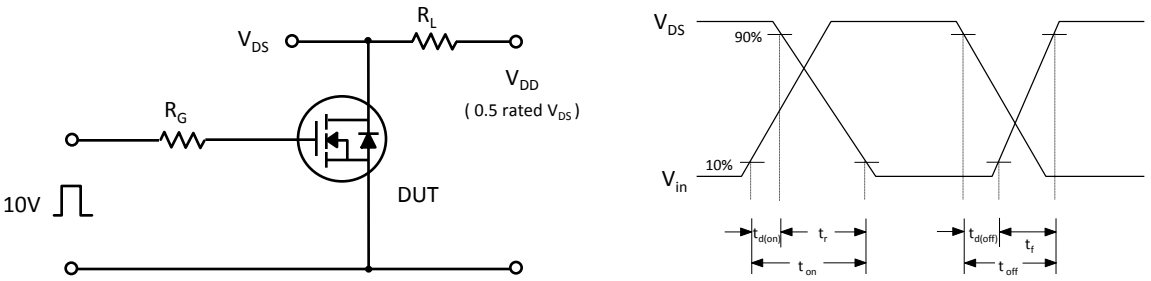



**Fig 14. Resistive Switching Test Circuit & Waveforms**

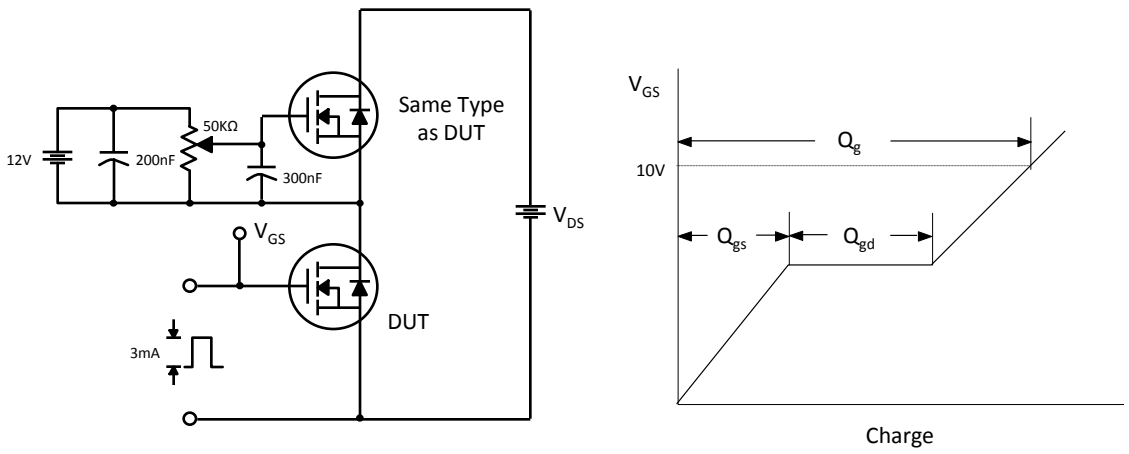



**Fig 15. Gate Charge Test Circuit & Waveform**

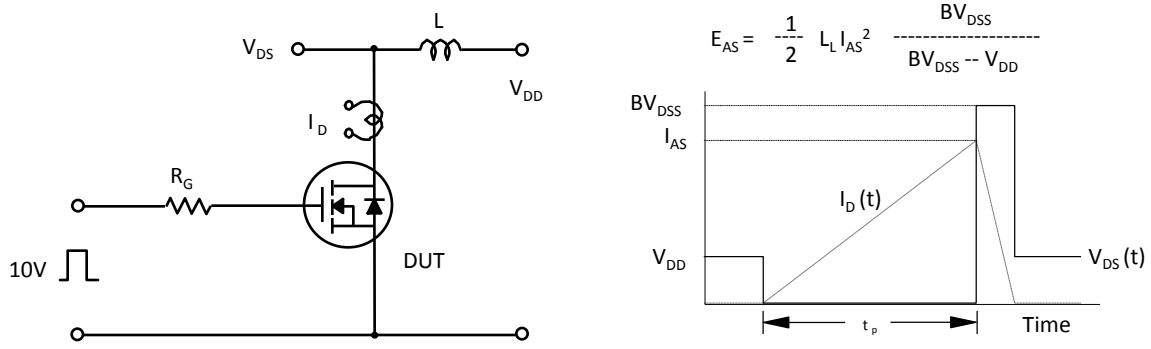
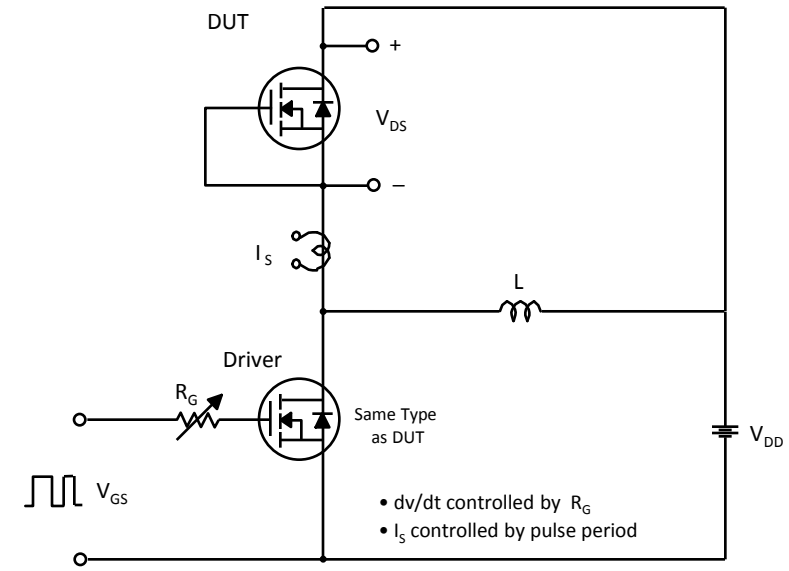



**Fig 16. Unclamped Inductive Switching Test Circuit & Waveforms**

## Characteristics Test Circuit & Waveform (continued)



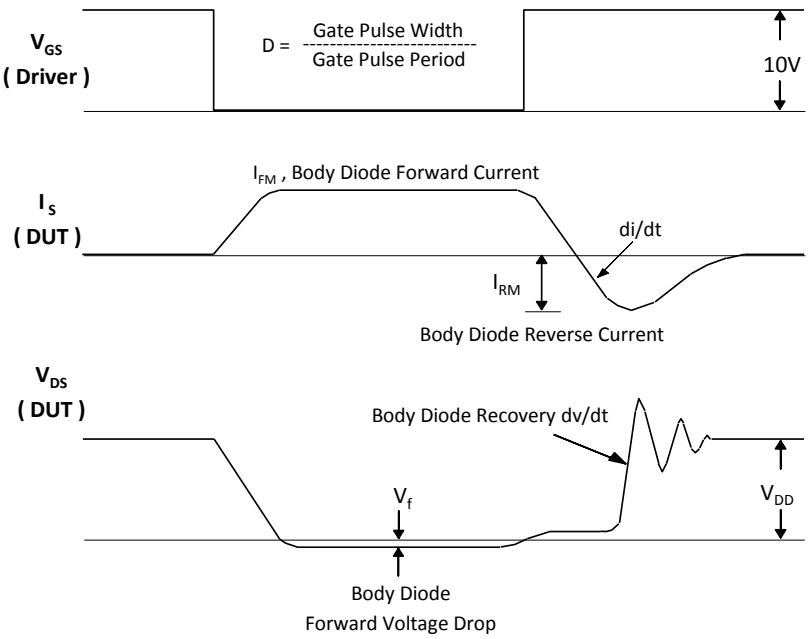
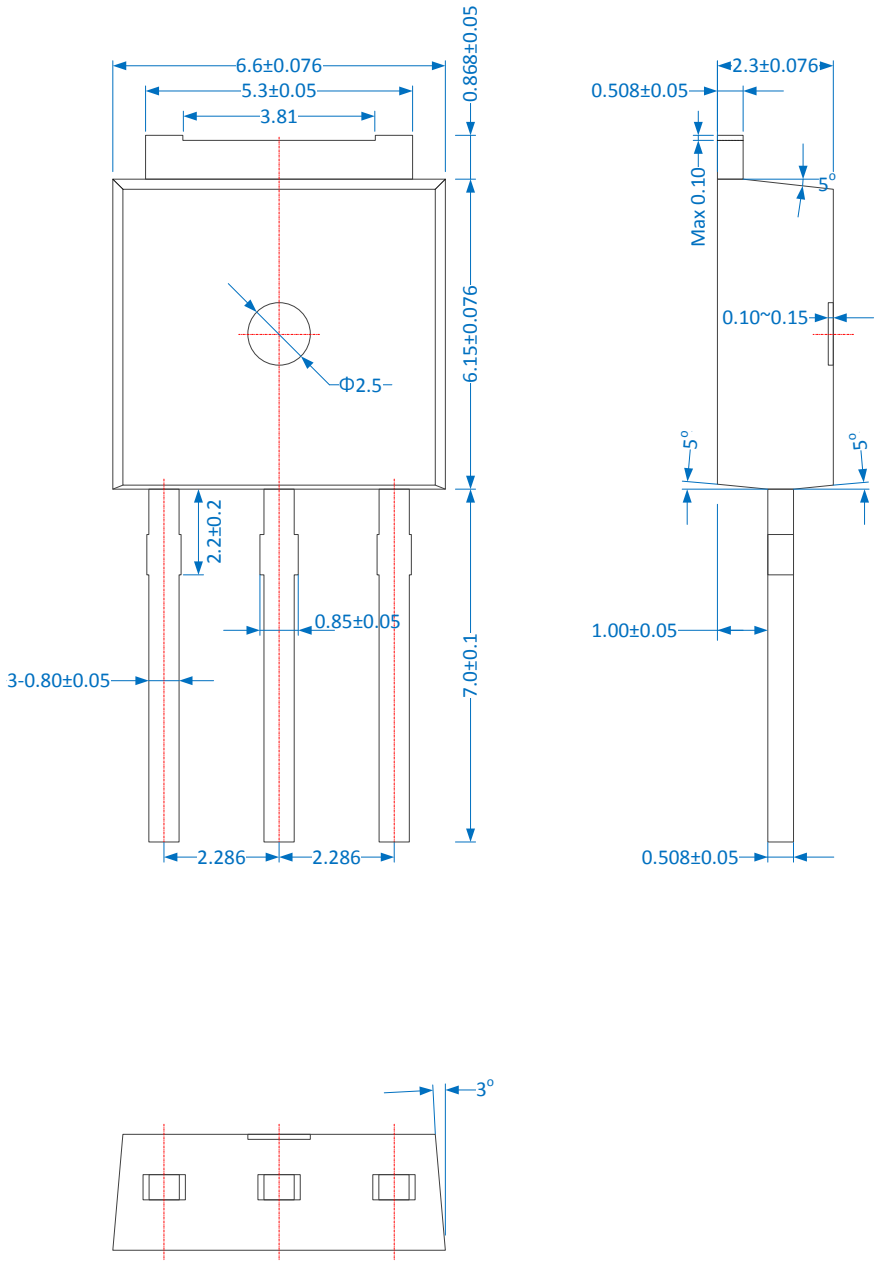




**Fig 17. Peak Diode Recovery dv/dt Test Circuit & Waveforms**

**Package Dimension** **Z**

# I-PAK(TO-251)



## Package Dimension

H

# I-PAK(TO-251)

| Symbol | Millimeters |
|---|---|
| A | 6.40 ~ 6.60 |
| A1 | 5.30 ~ 5.50 |
| B | 5.40 ~ 5.70 |
| C | 1.35 ~ 1.65 |
| D | 7.40 ~ 8.00 |
| D1 | 0.60 ~ 0.75 |
| D2 | 2.30 |
| D3 | 0.49 ~ 0.59 |
| D4 | 1.72 ~ 1.82 |
| E | 2.20 ~ 2.40 |
| F | 0.55 ~ 0.65 |
| a1 | 5 deg |
| a2 | 5 deg |
| a3 | 2 deg |