*PRELIMINARY*

# SFP95N03L

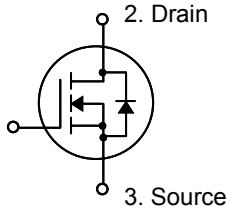
## *Logic N-Channel MOSFET*

### Features

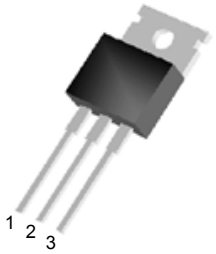
- Low $R_{DS}$(on) (0.0085Ω )@$V_{GS}$=10V
- Low Gate Charge (Typical 39nC)
- Low Crss (Typical 185pF)
- Improved dv/dt Capability
- 100% Avalanche Tested
- Maximum Junction Temperature Range (175°C)



**Symbol**




**TO-220**




### General Description

This Power MOSFET is produced using SemiWell's advanced planar stripe, DMOS technology. This latest technology has been especially designed to minimize on-state resistance, have a low gate charge with superior switching performance, and rugged avalanche characteristics. This Power MOSFET is well suited for synchronous DC-DC Converters and Power Management in portable and battery operated products.

### Absolute Maximum Ratings

| Symbol | Parameter | | Value | Units |
|---|---|---|---|---|
| $V_{DSS}$ | Drain to Source Voltage | | 30 | V |
| $I_D$ | Continuous Drain Current(@$T_C$ = 25°C) | (Note 6) | 95 | A |
| | Continuous Drain Current(@$T_C$ = 100°C) | | 67.3 | A |
| $I_{DM}$ | Drain Current Pulsed | (Note 1) | 380 | A |
| $V_{GS}$ | Gate to Source Voltage | | ±20 | V |
| $E_{AS}$ | Single Pulsed Avalanche Energy | (Note 2) | 450 | mJ |
| dv/dt | Peak Diode Recovery dv/dt | (Note 3) | 7.0 | V/ns |
| $P_D$ | Total Power Dissipation(@$T_C$ = 25 °C) | | 150 | W |
| | Derating Factor above 25 °C | | 1.0 | W/°C |
| $T_{STG}$, $T_J$ | Operating Junction Temperature & Storage Temperature | | - 55 ~ 175 | °C |
| $T_L$ | Maximum Lead Temperature for soldering purpose, 1/8 from Case for 5 seconds. | | 300 | °C |

### Thermal Characteristics

| Symbol | Parameter | Value | | | Units |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case | - | - | 1.0 | °C/W |
| $R_{\theta CS}$ | Thermal Resistance, Case to Sink | - | 0.5 | - | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | - | - | 62.5 | °C/W |

## Electrical Characteristics ( $T_C$ = 25 °C unless otherwise noted )

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$ = 0V, $I_D$ = 250uA | 30 | - | - | V |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temperature coefficient | $I_D$ = 250uA, referenced to 25 °C | - | 0.023 | - | V/°C |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$ = 30V, $V_{GS}$ = 0V | - | - | 1 | uA |
| | | $V_{DS}$ = 24V, $T_C$ = 150 °C | - | - | 10 | uA |
| $I_{GSS}$ | Gate-Source Leakage, Forward | $V_{GS}$ = 20V, $V_{DS}$ = 0V | - | - | 100 | nA |
| | Gate-Source Leakage, Reverse | $V_{GS}$ = -20V, $V_{DS}$ = 0V | - | - | -100 | nA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250uA | 1.0 | - | 3.0 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-state Resistance | $V_{GS}$ =10 V, $I_D$ = 47.5A<br>$V_{GS}$ =5 V, $I_D$ = 47.5A | -<br>- | 0.0065<br>0.0085 | 0.0085<br>0.0115 | Ω |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$ =0 V, $V_{DS}$ =25V, f = 1MHz | - | 1015 | 1320 | pF |
| $C_{oss}$ | Output Capacitance | | - | 845 | 1110 | |
| $C_{rss}$ | Reverse Transfer Capacitance | | - | 185 | 240 | |
| **Dynamic Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD}$ =15V, $I_D$ =95A, $R_G$ =50Ω<br>※ **see fig. 13.** (Note 4, 5) | - | 45 | 100 | ns |
| $t_r$ | Rise Time | | - | 165 | 340 | |
| $t_{d(off)}$ | Turn-off Delay Time | | - | 70 | 150 | |
| $t_f$ | Fall Time | | - | 140 | 290 | |
| $Q_g$ | Total Gate Charge | $V_{DS}$ =24V, $V_{GS}$ =5V, $I_D$ =95A<br>※ **see fig. 12.** (Note 4, 5) | - | 39 | 51 | nC |
| $Q_{gs}$ | Gate-Source Charge | | - | 13 | - | |
| $Q_{gd}$ | Gate-Drain Charge(Miller Charge) | | - | 18 | - | |

## Source-Drain Diode Ratings and Characteristics

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit. |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current | Integral Reverse p-n Junction Diode in the MOSFET | - | - | 95 | A |
| $I_{SM}$ | Pulsed source Current | | - | - | 380 | |
| $V_{SD}$ | Diode Forward Voltage | $I_S$ =95A, $V_{GS}$ =0V | - | - | 1.5 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_S$=95A,$V_{GS}$=0V,$dI_F/dt$=100A/us | - | 55 | - | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | - | 65 | - | nC |

※ NOTES
1. Repeativity rating : pulse width limited by junction temperature
2. L = 50 uH, $I_{AS}$ =95A, $V_{DD}$ = 15V, $R_G$ = 0Ω , Starting $T_J$ = 25°C
3. ISD ≤ 95A, di/dt ≤ 300A/us, $V_{DD}$ ≤ $BV_{DSS}$, Starting $T_J$ = 25°C
4. Pulse Test : Pulse Width ≤ 300us, Duty Cycle ≤ 2%
5. Essentially independent of operating temperature.
6. Continuous Drain current calculated by maximum junction temperature ; limited by package

**Fig 1. On-State Characteristics**

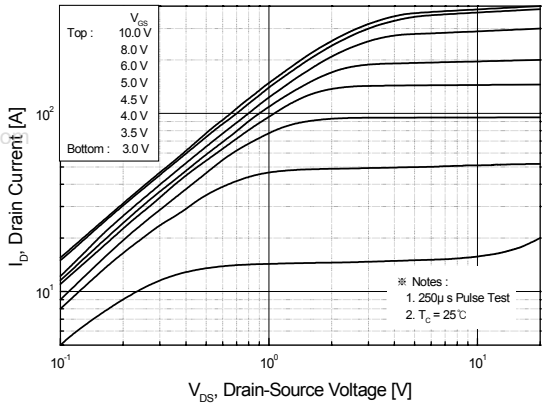



**Fig 2. Transfer Characteristics**

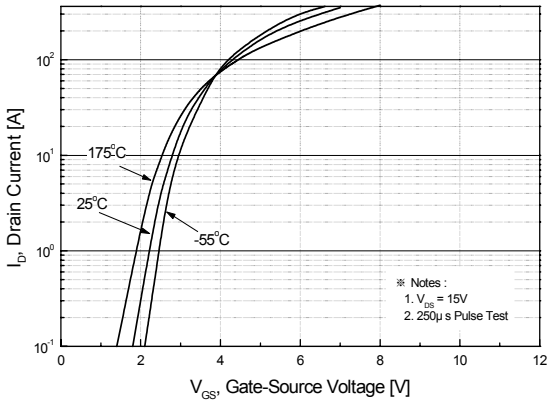



**Fig 3. On Resistance Variation vs. Drain Current and Gate Voltage**

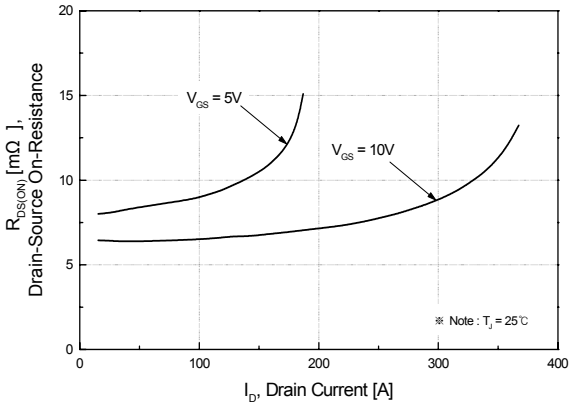



**Fig 4. On State Current vs. Allowable Case Temperature**

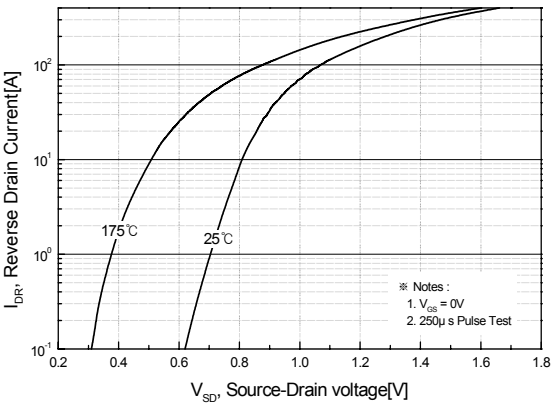



**Fig 5. Capacitance Characteristics**

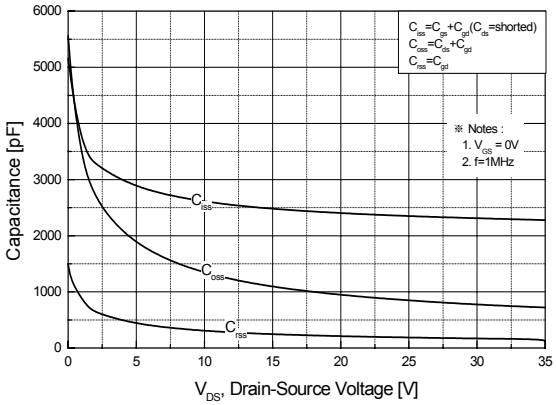



**Fig 6. Gate Charge Characteristics**

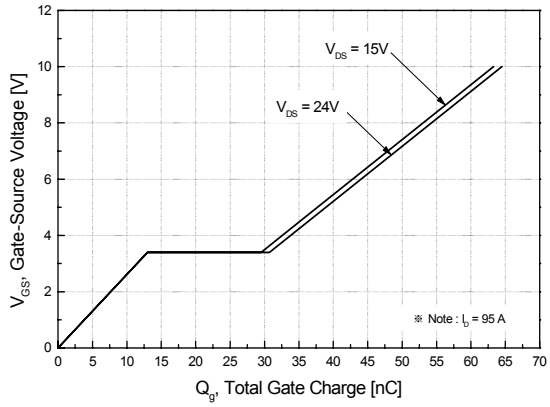


**Fig 7. Breakdown Voltage Variation**

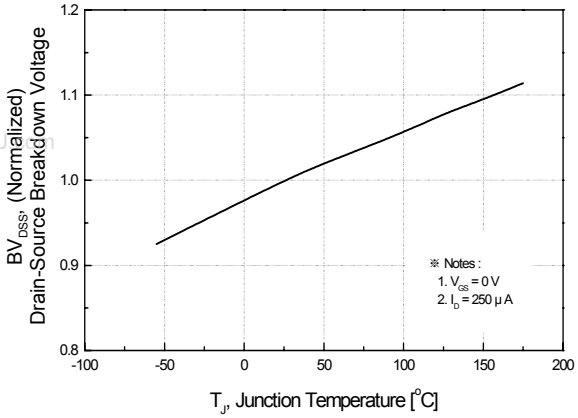



**Fig 8. On-Resistance Variation**

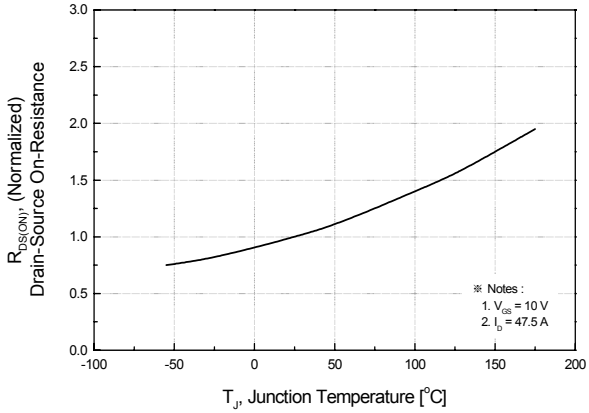



**Fig 9. Maximum Safe Operating Area**

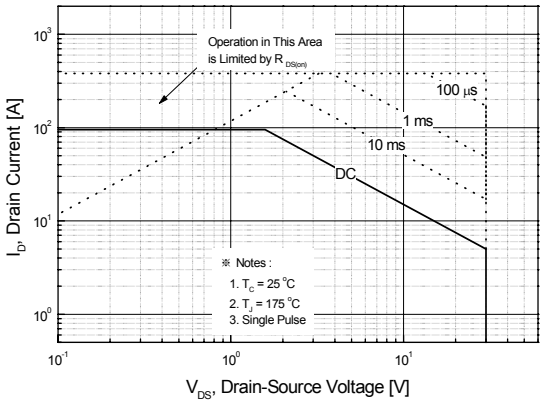



**Fig 10. Maximum Drain Current vs. Case Temperature**

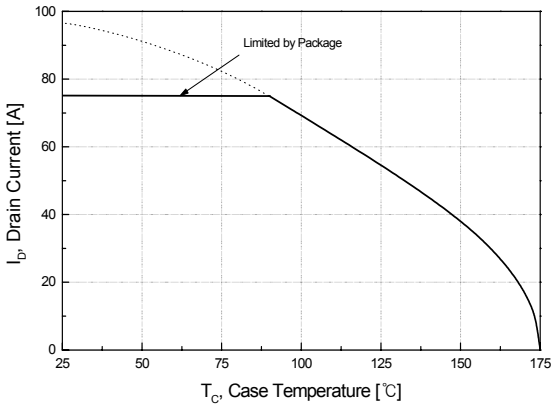



**Fig 11. Transient Thermal Response Curve**

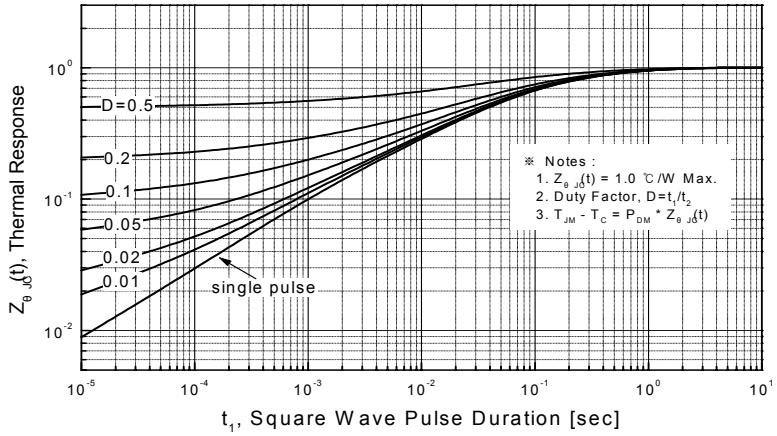


**Fig. 12. Gate Charge Test Circuit & Waveforms**

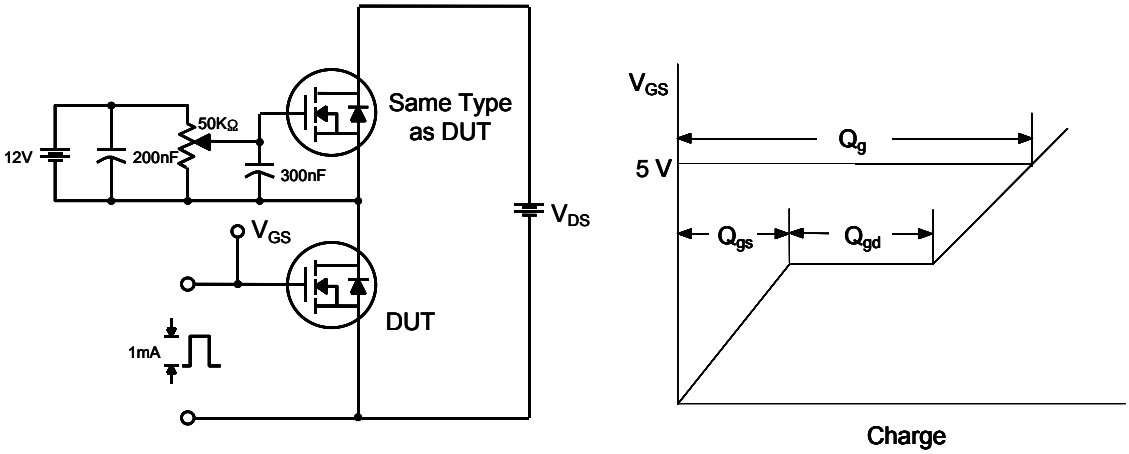





**Fig 13. Switching Time Test Circuit & Waveforms**

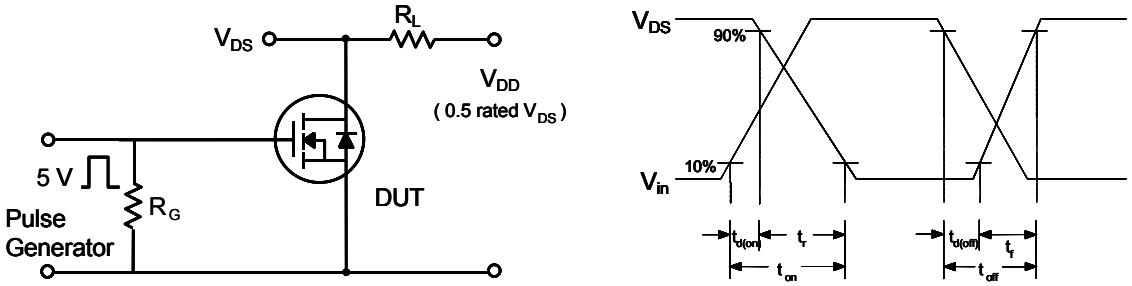



**Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms**

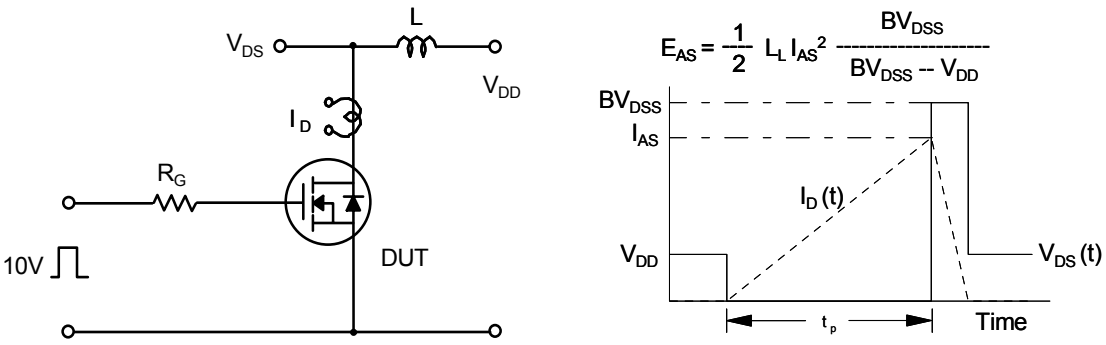
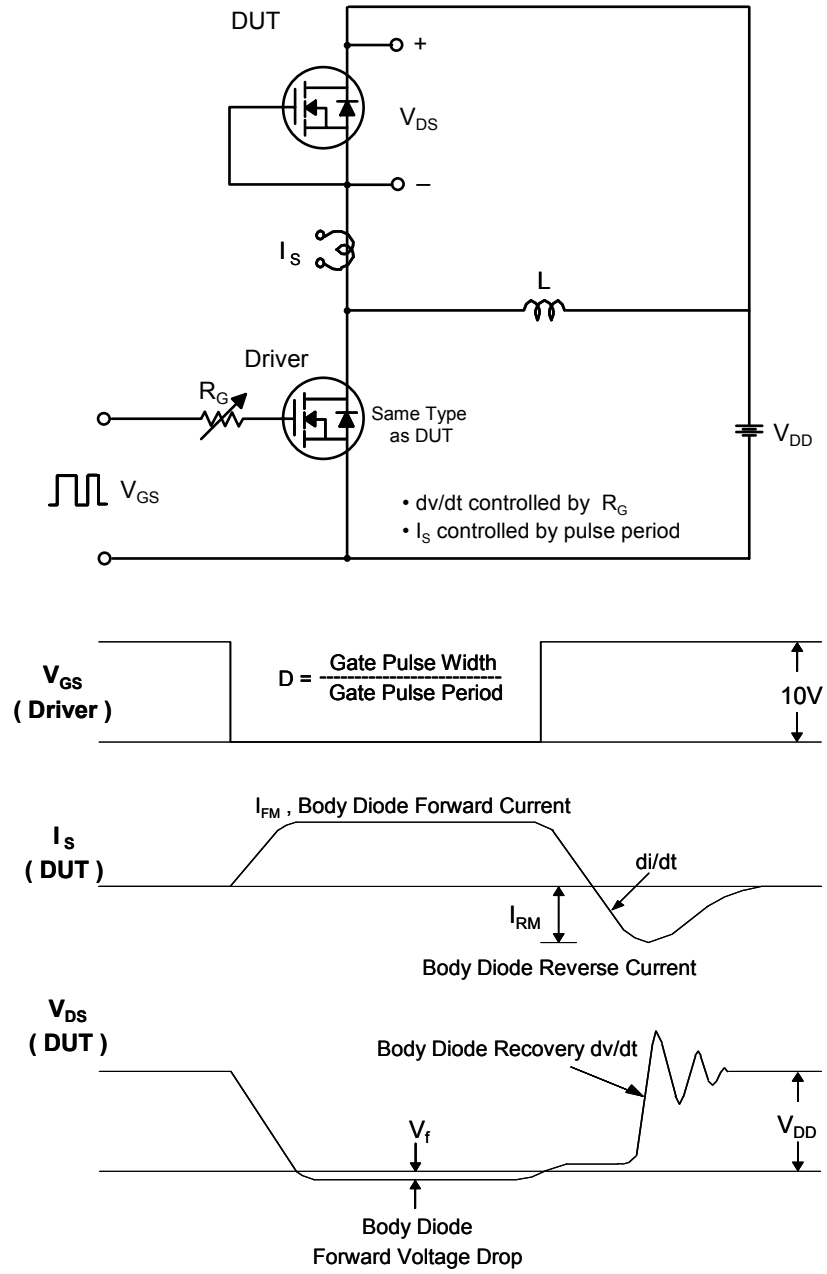


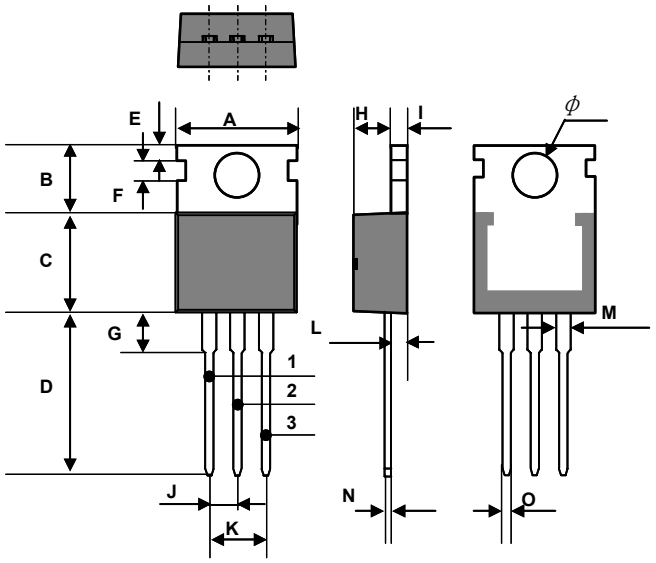
**Fig. 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms**



**TO-220 Package Dimension**



| Dim. | mm | | | Inch | | |
|---|---|---|---|---|---|---|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 9.7 | | 10.1 | 0.382 | | 0.398 |
| B | 6.3 | | 6.7 | 0.248 | | 0.264 |
| C | 9.0 | | 9.47 | 0.354 | | 0.373 |
| D | 12.8 | | 13.3 | 0.504 | | 0.524 |
| E | 1.2 | | 1.4 | 0.047 | | 0.055 |
| F | | 1.7 | | | 0.067 | |
| G | | 2.5 | | | 0.098 | |
| H | 3.0 | | 3.4 | 0.118 | | 0.134 |
| I | 1.25 | | 1.4 | 0.049 | | 0.055 |
| J | 2.4 | | 2.7 | 0.094 | | 0.106 |
| K | 5.0 | | 5.15 | 0.197 | | 0.203 |
| L | 2.2 | | 2.6 | 0.087 | | 0.102 |
| M | 1.42 | | 1.62 | 0.056 | | 0.064 |
| N | 0.45 | | 0.6 | 0.018 | | 0.024 |
| O | 1.17 | | 1.37 | 0.046 | | 0.054 |
| ∅ | | 3.6 | | | 0.142 | |




**1. Gate**
**2. Drain**
**3. Source**