

# FDAF69N25

## 250V N-Channel MOSFET

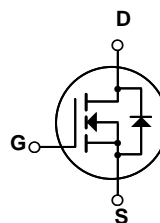
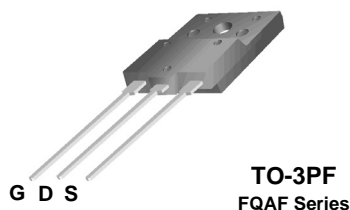
### Features

- 34A, 250V,  $R_{DS(on)} = 0.041\Omega$  @  $V_{GS} = 10V$
- Low gate charge ( typical 77 nC)
- Low  $C_{rss}$  ( typical 84 pF)
- Fast switching
- Improved  $dv/dt$  capability

### Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switching DC/DC converters and switched mode power supplies.



### Absolute Maximum Ratings

| Symbol              | Parameter   | FDAF69N25   | Unit               |
|---------------------|---|-------------|--------------------|
| $V_{DSS}$           | Drain-Source Voltage  | 250         | V                  |
| $V_{DS(Avalanche)}$ | Repetitive Avalanche Voltage (Note 1)<br>(Note 2)   | 300         | V                  |
| $I_D$               | Drain Current - Continuous ( $T_C = 25^\circ C$ )<br>- Continuous ( $T_C = 100^\circ C$ ) | 34<br>21.5  | A<br>A             |
| $I_{DM}$            | Drain Current - Pulsed (Note 1)   | 136         | A                  |
| $V_{GSS}$           | Gate-Source Voltage   | $\pm 30$    | V                  |
| $E_{AS}$            | Single Pulsed Avalanche Energy (Note 2)   | 1894        | mJ                 |
| $I_{AR}$            | Avalanche Current (Note 1)  | 34          | A                  |
| $E_{AR}$            | Repetitive Avalanche Energy (Note 1)  | 11.5        | mJ                 |
| $dv/dt$             | Peak Diode Recovery $dv/dt$ (Note 3)  | 4.5         | V/ns               |
| $P_D$               | Power Dissipation ( $T_C = 25^\circ C$ )<br>- Derate above $25^\circ C$                   | 115<br>0.93 | W<br>W/ $^\circ C$ |
| $T_J, T_{STG}$      | Operating and Storage Temperature Range   | -55 to +150 | $^\circ C$         |
| $T_L$               | Maximum Lead Temperature for Soldering Purpose,<br>1/8" from Case for 5 Seconds           | 300         | $^\circ C$         |

### Thermal Characteristics

| Symbol          | Parameter                               | Min. | Max. | Unit         |
|-----------------|---|------|------|--------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case    | --   | 1.08 | $^\circ C/W$ |
| $R_{\theta CS}$ | Thermal Resistance, Case-to-Sink        | 0.24 | --   | $^\circ C/W$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | --   | 40   | $^\circ C/W$ |

## Package Marking and Ordering Information

| Device Marking | Device    | Package | Reel Size | Tape Width | Quantity |
|----------------|-----------|---------|-----------|------------|----------|
| FDAF69N25      | FDAF69N25 | TO-3PF  | --        | --         | 30       |

## Electrical Characteristics T<sub>C</sub> = 25°C unless otherwise noted

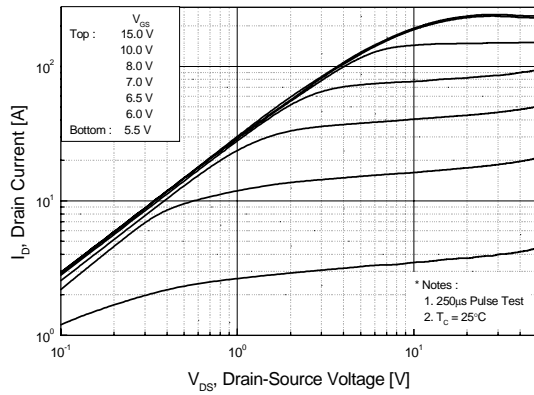
| Symbol  | Parameter   | Conditions   | Min. | Typ.  | Max     | Units    |
|---|---|--|------|-------|---------|----------|
| <b>Off Characteristics</b>                                    |   |  |      |       |         |          |
| BV <sub>DSS</sub>   | Drain-Source Breakdown Voltage                        | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA   | 250  | --    | --      | V        |
| ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>                          | Breakdown Voltage Temperature Coefficient             | I <sub>D</sub> = 250μA, Referenced to 25°C   | --   | 0.25  | --      | V/°C     |
| I <sub>DSS</sub>  | Zero Gate Voltage Drain Current                       | V <sub>DS</sub> = 250V, V <sub>GS</sub> = 0V<br>V <sub>DS</sub> = 200V, T <sub>C</sub> = 125°C | --   | --    | 1<br>10 | μA<br>μA |
| I <sub>GSSF</sub>   | Gate-Body Leakage Current, Forward                    | V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V  | --   | --    | 100     | nA       |
| I <sub>GSSR</sub>   | Gate-Body Leakage Current, Reverse                    | V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V   | --   | --    | -100    | nA       |
| <b>On Characteristics</b>                                     |   |  |      |       |         |          |
| V <sub>GS(th)</sub>   | Gate Threshold Voltage                                | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                                     | 3.0  | --    | 5.0     | V        |
| R <sub>DS(on)</sub>   | Static Drain-Source On-Resistance                     | V <sub>GS</sub> = 10V, I <sub>D</sub> = 17A  | --   | 0.034 | 0.041   | Ω        |
| g <sub>FS</sub>   | Forward Transconductance                              | V <sub>DS</sub> = 40V, I <sub>D</sub> = 17A (Note 4)   | --   | 25    | --      | S        |
| <b>Dynamic Characteristics</b>                                |   |  |      |       |         |          |
| C <sub>iss</sub>  | Input Capacitance                                     | V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V,<br>f = 1.0MHz                                     | --   | 3570  | 4640    | pF       |
| C <sub>oss</sub>  | Output Capacitance                                    |  | --   | 750   | 980     | pF       |
| C <sub>rss</sub>  | Reverse Transfer Capacitance                          |  | --   | 84    | 130     | pF       |
| <b>Switching Characteristics</b>                              |   |  |      |       |         |          |
| t <sub>d(on)</sub>  | Turn-On Delay Time                                    | V <sub>DD</sub> = 125V, I <sub>D</sub> = 69A<br>R <sub>G</sub> = 25Ω (Note 4, 5)               | --   | 95    | 200     | ns       |
| t <sub>r</sub>  | Turn-On Rise Time                                     |  | --   | 855   | 1720    | ns       |
| t <sub>d(off)</sub>   | Turn-Off Delay Time                                   |  | --   | 130   | 270     | ns       |
| t <sub>f</sub>  | Turn-Off Fall Time                                    |  | --   | 220   | 450     | ns       |
| Q <sub>g</sub>  | Total Gate Charge                                     | V <sub>DS</sub> = 200V, I <sub>D</sub> = 69A<br>V <sub>GS</sub> = 10V (Note 4, 5)              | --   | 77    | 100     | nC       |
| Q <sub>gs</sub>   | Gate-Source Charge                                    |  | --   | 24    | --      | nC       |
| Q <sub>gd</sub>   | Gate-Drain Charge                                     |  | --   | 37    | --      | nC       |
| <b>Drain-Source Diode Characteristics and Maximum Ratings</b> |   |  |      |       |         |          |
| I <sub>S</sub>  | Maximum Continuous Drain-Source Diode Forward Current |  | --   | --    | 34      | A        |
| I <sub>SM</sub>   | Maximum Pulsed Drain-Source Diode Forward Current     |  | --   | --    | 136     | A        |
| V <sub>SD</sub>   | Drain-Source Diode Forward Voltage                    | V <sub>GS</sub> = 0V, I <sub>S</sub> = 34A   | --   | --    | 1.4     | V        |
| t <sub>rr</sub>   | Reverse Recovery Time                                 | V <sub>GS</sub> = 0V, I <sub>S</sub> = 69A   | --   | 210   | --      | ns       |
| Q <sub>rr</sub>   | Reverse Recovery Charge                               | dI <sub>F</sub> /dt = 100A/μs (Note 4)   | --   | 5.7   | --      | μC       |

### NOTES:

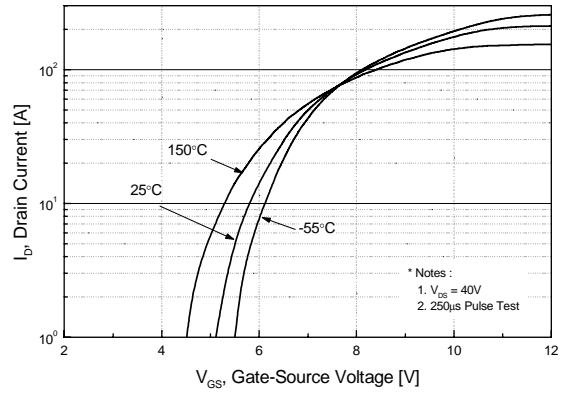
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 0.64mH, I<sub>AS</sub> = 69A, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25Ω, Starting T<sub>J</sub> = 25°C
3. I<sub>SD</sub> ≤ 34A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

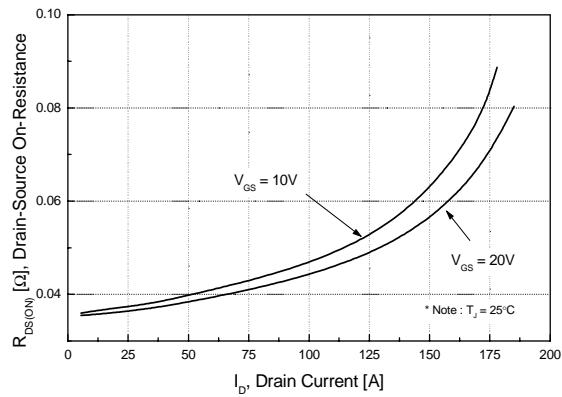
**Figure 1. On-Region Characteristics**



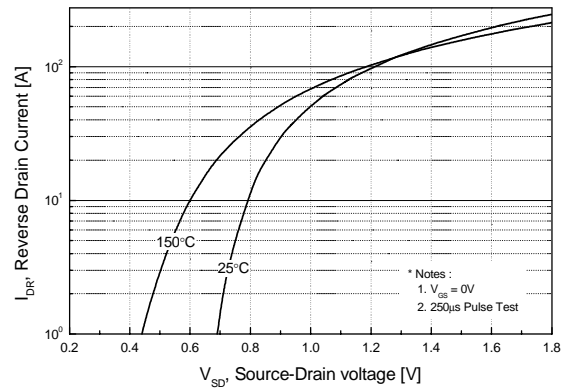
**Figure 2. Transfer Characteristics**



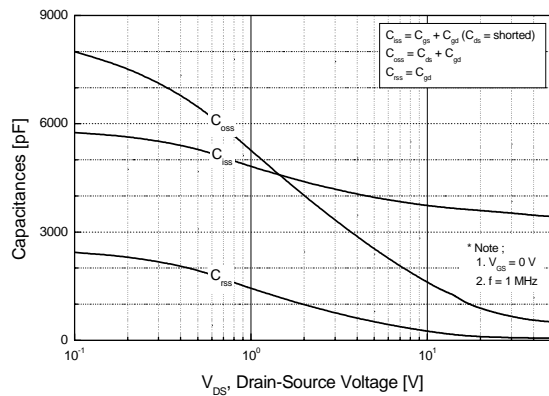
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



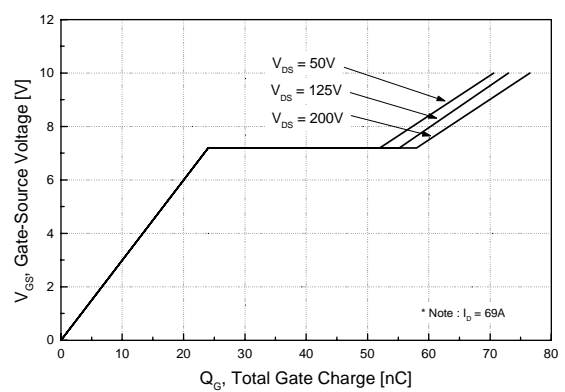
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

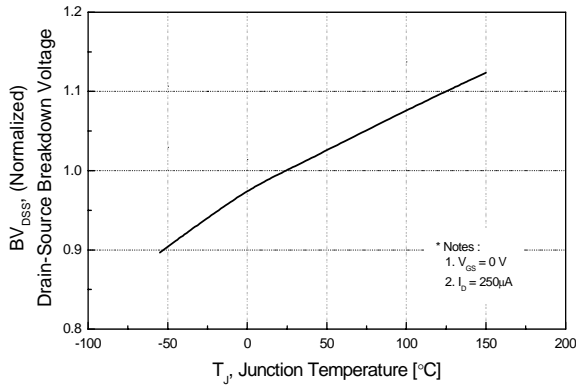


**Figure 6. Gate Charge Characteristics**

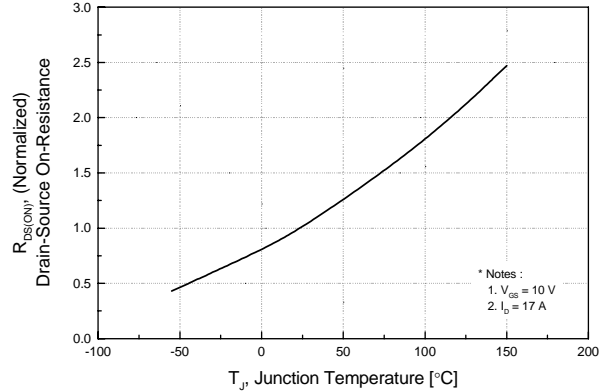


**Typical Performance Characteristics** (Continued)

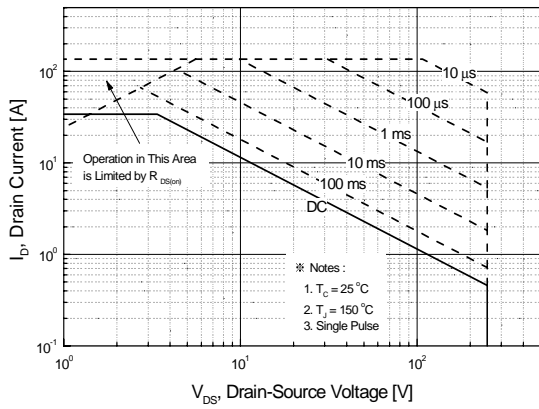
**Figure 7. Breakdown Voltage Variation vs. Temperature**



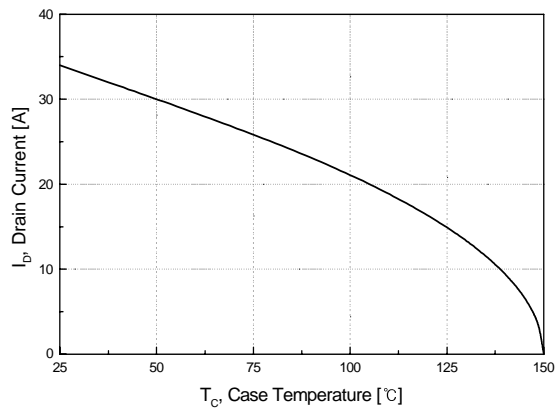
**Figure 8. On-Resistance Variation vs. Temperature**



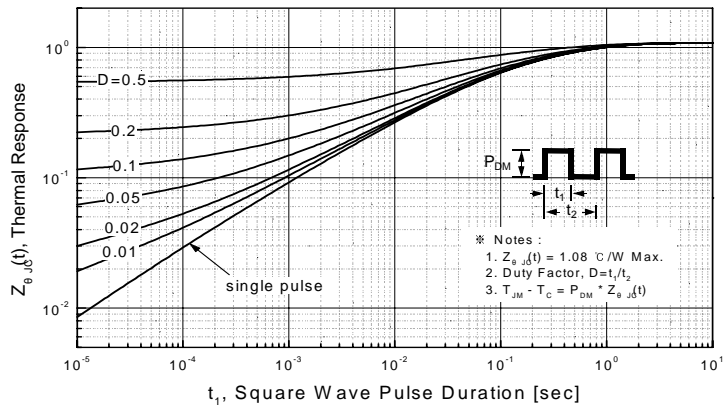
**Figure 9. Maximum Safe Operating Area**



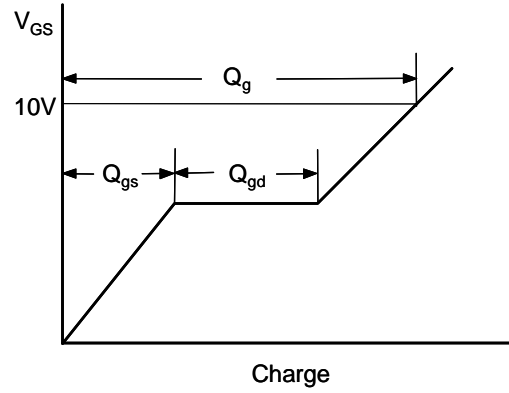
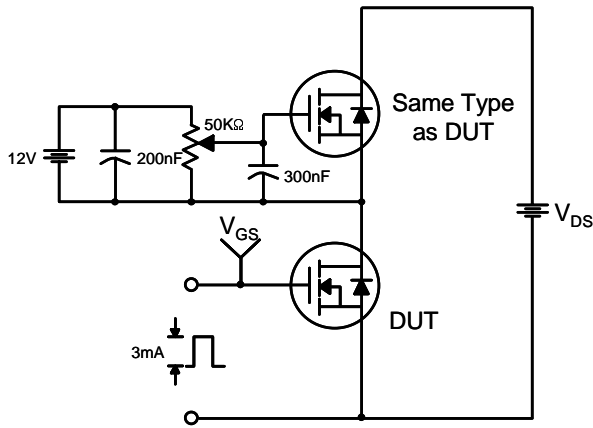
**Figure 10. Maximum Drain Current vs. Case Temperature**



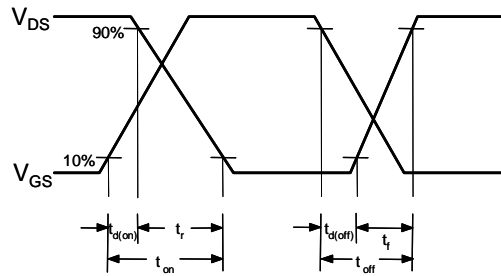
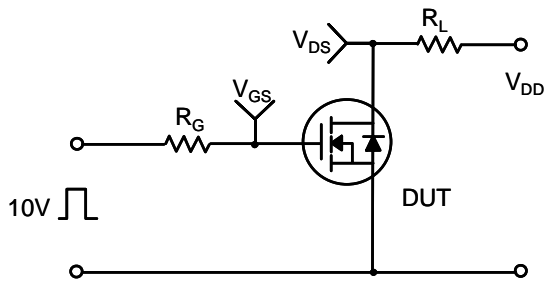
**Figure 11. Transient Thermal Response Curve**



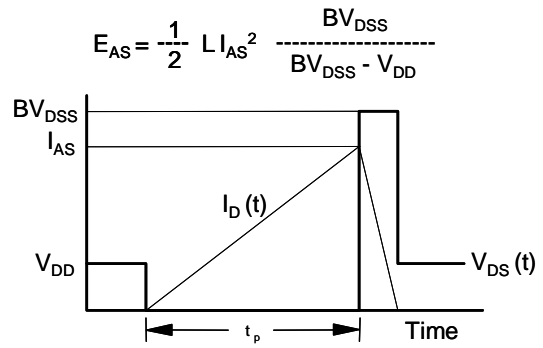
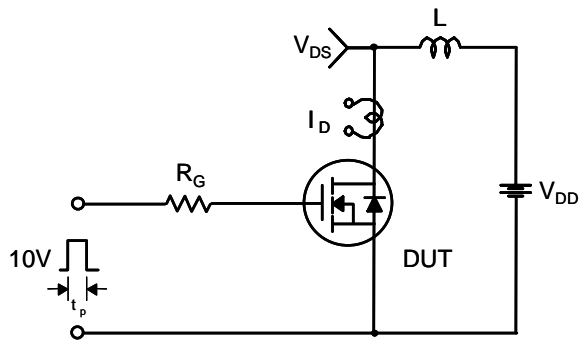
**Gate Charge Test Circuit & Waveform**



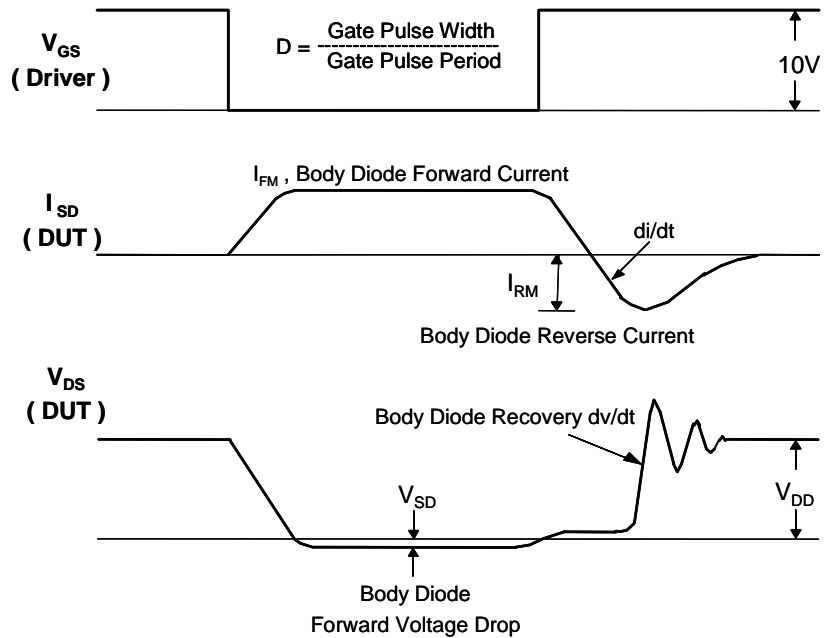
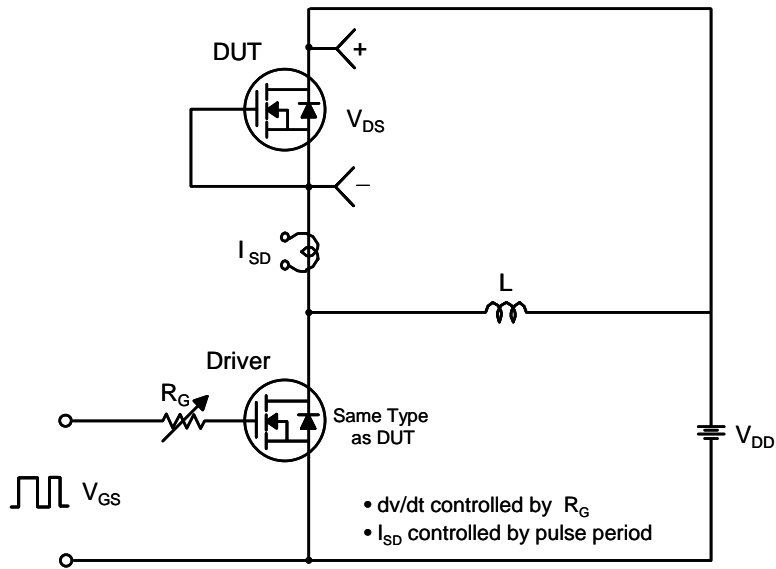
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

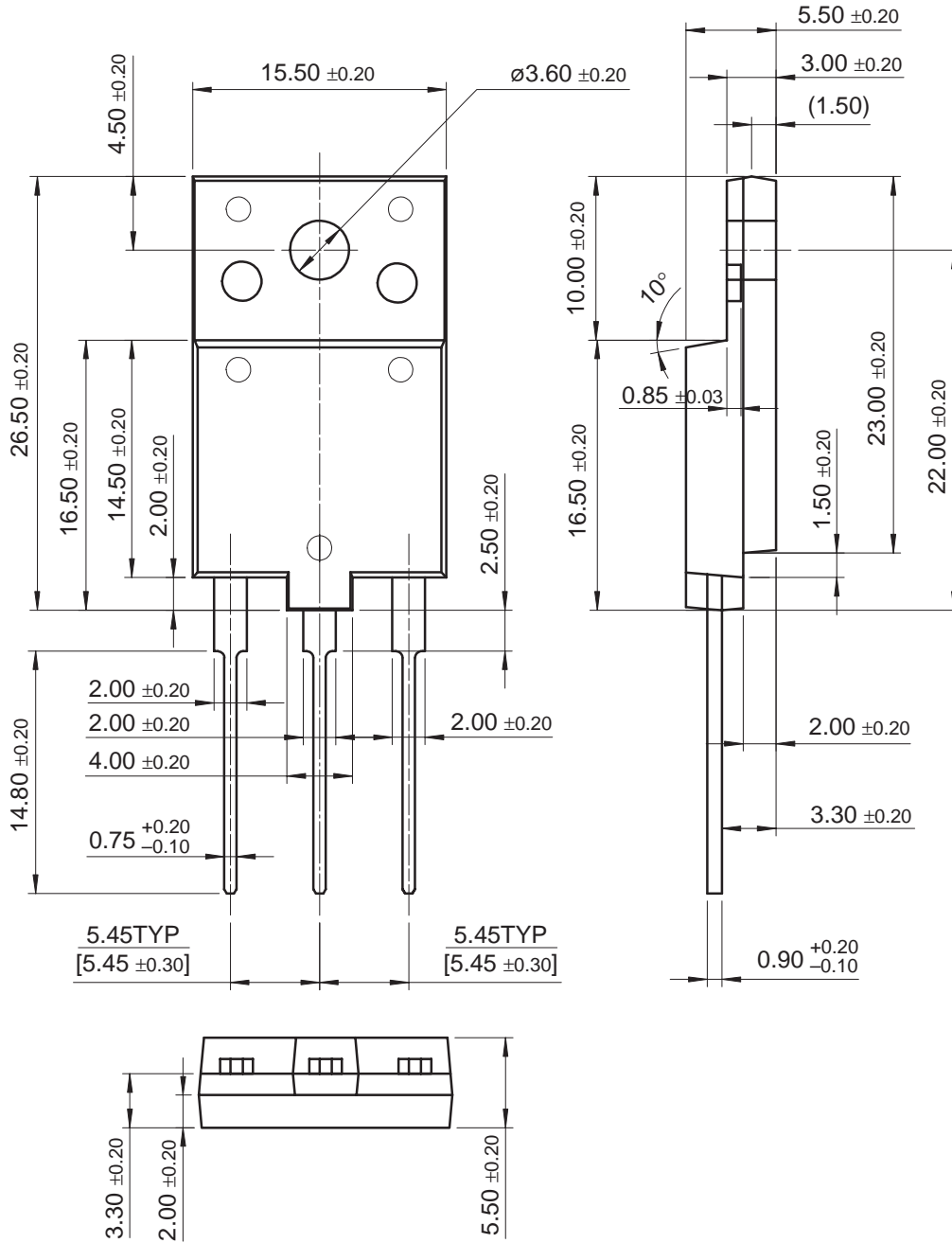


Peak Diode Recovery dv/dt Test Circuit & Waveforms



# Mechanical Dimensions

## TO-3PF



Dimensions in Millimeters

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| Programmable Active Droop <sup>TM</sup>           |                                  | Power247 <sup>TM</sup>     | SuperSOT <sup>TM</sup> -3        |                              |
|   |                                  | PowerEdge <sup>TM</sup>    | SuperSOT <sup>TM</sup> -6        |                              |

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|--------------------------|------------------------|---|
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