

# MOSFET – N-Channel, POWER trench®

100 V, 40 A, 8.5 mΩ

## FDPF085N10A

### Description

This N-Channel MOSFET is Produced using onsemi's advanced PowerTrench Process that has been tailored to minimize the on-state resistance while maintaining superior switching performance.

### Features

- $R_{DS(on)} = 6.5 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 40 \text{ A}$
- Fast Switching Speed
- Low Gate Charge,  $Q_g = 31 \text{ nC}$  (Typ.)
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- High Power and Current Handling Capability
- This Device is Pb-Free Halide, Free and RoHS Compliant

### Applications

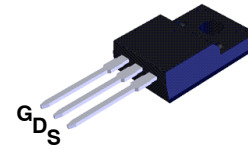
- Consumer Appliances
- LED TV
- Synchronous Rectification for ATX / Server / Telecom PSU
- Motor Drives and Uninterruptible Power Supplies
- Micro Solar Inverter

### ABSOLUTE MAXIMUM RATINGS

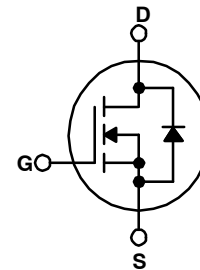
( $T_C = 25^\circ\text{C}$  unless otherwise noted.)

| Symbol         | Parameter                                                                                                | Value           | Unit                     |
|----------------|----------------------------------------------------------------------------------------------------------|-----------------|--------------------------|
| $V_{DSS}$      | Drain to Source Voltage                                                                                  | 100             | V                        |
| $V_{GSS}$      | Gate to Source Voltage                                                                                   | $\pm 20$        | V                        |
| $I_D$          | Drain Current<br>– Continuous ( $T_C = 25^\circ\text{C}$ )<br>– Continuous ( $T_C = 100^\circ\text{C}$ ) | 40<br>28        | A                        |
| $I_{DM}$       | Drain Current – Pulsed (Note 1)                                                                          | 200             | A                        |
| $E_{AS}$       | Single Pulsed Avalanche Energy (Note 2)                                                                  | 269             | mJ                       |
| $dv/dt$        | Peak Diode Recovery $dv/dt$ (Note 3)                                                                     | 6.0             | V/ns                     |
| $P_D$          | Power Dissipation<br>– ( $T_C = 25^\circ\text{C}$ )<br>– Derate Above $25^\circ\text{C}$                 | 33.3<br>0.22    | W<br>W/ $^\circ\text{C}$ |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range                                                                  | $-55$ to $+150$ | $^\circ\text{C}$         |
| $T_L$          | Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds                             | 300             | $^\circ\text{C}$         |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



TO-220F  
CASE 221AT



### MARKING DIAGRAM

|        |
|--------|
| FDPF08 |
| 5N10A  |
| AYWWZZ |

FDPF085N10A = Specific Device Code  
A = Assembly Location  
YWW = Date Code (Year and Week)  
ZZ = Assembly Lot Code

### ORDERING INFORMATION

| Device      | Package              | Shipping             |
|-------------|----------------------|----------------------|
| FDPF085N10A | TO-220-3<br>FullPack | 1000<br>Units / Tube |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](#).

# THERMAL CHARACTERISTICS

| Symbol          | Parameter                                     | Value | Unit                 |
|-----------------|-----------------------------------------------|-------|----------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max.    | 4.5   | $^{\circ}\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient, Max. | 62.5  |                      |

# ELECTRICAL CHARACTERISTICS ( $T_C = 25^{\circ}\text{C}$ unless otherwise noted)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|--------|-----------|-----------------|-----|-----|-----|------|
|--------|-----------|-----------------|-----|-----|-----|------|

## Off Characteristics

|                                      |                                           |                                                               |     |      |           |                             |
|--------------------------------------|-------------------------------------------|---------------------------------------------------------------|-----|------|-----------|-----------------------------|
| $BV_{DSS}$                           | Drain to Source Breakdown Voltage         | $I_D = 250\ \mu\text{A}$ , $V_{GS} = 0\ \text{V}$             | 100 | –    | –         | V                           |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , Referenced to $25^{\circ}\text{C}$ | –   | 0.07 | –         | $\text{V}/^{\circ}\text{C}$ |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{DS} = 80\ \text{V}$ , $V_{GS} = 0\ \text{V}$              | –   | –    | 1         | $\mu\text{A}$               |
|                                      |                                           | $V_{DS} = 80\ \text{V}$ , $T_C = 150^{\circ}\text{C}$         | –   | –    | 500       |                             |
| $I_{GSS}$                            | Gate to Body Leakage Current              | $V_{GS} = \pm 20\ \text{V}$ , $V_{DS} = 0\ \text{V}$          | –   | –    | $\pm 100$ | nA                          |

## On Characteristics

|              |                                      |                                                |     |     |     |                  |
|--------------|--------------------------------------|------------------------------------------------|-----|-----|-----|------------------|
| $V_{GS(th)}$ | Gate Threshold Voltage               | $V_{GS} = V_{DS}$ , $I_D = 250\ \mu\text{A}$   | 2.0 | –   | 4.0 | V                |
| $R_{DS(on)}$ | Static Drain to Source On-Resistance | $V_{GS} = 10\ \text{V}$ , $I_D = 96\ \text{A}$ | –   | 6.5 | 8.5 | $\text{m}\Omega$ |
| $g_{FS}$     | Forward Transconductance             | $V_{DS} = 10\ \text{V}$ , $I_D = 96\ \text{A}$ | –   | 76  | –   | S                |

## Dynamic Characteristics

|               |                                    |                                                                                      |   |      |      |          |
|---------------|------------------------------------|--------------------------------------------------------------------------------------|---|------|------|----------|
| $C_{iss}$     | Input Capacitance                  | $V_{DS} = 50\ \text{V}$ , $V_{GS} = 0\ \text{V}$ , $f = 1\ \text{MHz}$               | – | 2025 | 2695 | pF       |
| $C_{oss}$     | Output Capacitance                 |                                                                                      | – | 468  | 620  | pF       |
| $C_{rss}$     | Reverse Transfer Capacitance       |                                                                                      | – | 20   | –    | pF       |
| $C_{oss(er)}$ | Engry Related Output Capacitance   | $V_{DS} = 50\ \text{V}$ , $V_{GS} = 0\ \text{V}$                                     | – | 752  | –    | pF       |
| $Q_{g(tot)}$  | Total Gate Charge at 10 V          | $V_{GS} = 10\ \text{V}$ , $V_{DS} = 50\ \text{V}$ , $I_D = 96\ \text{A}$<br>(Note 4) | – | 31   | 40   | nC       |
| $Q_{gs}$      | Gate to Source Gate Charge         |                                                                                      | – | 9.7  | –    | nC       |
| $Q_{gs2}$     | Gate Charge Threshold to Plateau   |                                                                                      | – | 5.0  | –    | nC       |
| $Q_{gd}$      | Gate to Drain “Miller” Charge      |                                                                                      | – | 7.5  | –    | nC       |
| ESR           | Equivalent Series Resistance (G–S) | $f = 1\ \text{MHz}$                                                                  | – | 0.97 | –    | $\Omega$ |

## Switching Characteristics

|              |                     |                                                                                                            |   |    |    |    |
|--------------|---------------------|------------------------------------------------------------------------------------------------------------|---|----|----|----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = 50\ \text{V}$ , $I_D = 96\ \text{A}$ ,<br>$V_{GS} = 10\ \text{V}$ , $R_G = 4.7\ \Omega$ (Note 4) | – | 18 | 46 | ns |
| $t_r$        | Turn-On Rise Time   |                                                                                                            | – | 22 | 54 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time |                                                                                                            | – | 29 | 68 | ns |
| $t_f$        | Turn-Off Fall Time  |                                                                                                            | – | 8  | 26 | ns |

## Drain–Source Diode Characteristics and Maximum Ratings

|                 |                                                          |                                                                                                       |   |    |     |    |
|-----------------|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------|---|----|-----|----|
| I <sub>S</sub>  | Maximum Continuous Drain to Source Diode Forward Current |                                                                                                       | – | –  | 40  | A  |
| I <sub>SM</sub> | Maximum Pulsed Drain to Source Diode Forward Current     |                                                                                                       | – | –  | 160 | A  |
| V <sub>SD</sub> | Drain to Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 96 A                                                         | – | –  | 1.3 | V  |
| t <sub>rr</sub> | Reverse Recovery Time                                    | V <sub>DD</sub> = 50 V, V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 96 A, dI <sub>F</sub> /dt = 100 A/μs | – | 59 | –   | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge                                  |                                                                                                       | – | 80 | –   | nC |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## NOTES:

1. Repetitive Rating: Pulse-width limited by maximum junction temperature.
2.  $L = 3\ \text{mH}$ ,  $I_{AS} = 13.4\ \text{A}$ ,  $R_G = 25\ \Omega$  starting  $T_J = 25^{\circ}\text{C}$ .
3.  $I_{SD} \leq 40\ \text{A}$ ,  $di/dt \leq 200\ \text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^{\circ}\text{C}$ .
4. Essentially independent of operating temperature.

TYPICAL CHARACTERISTICS

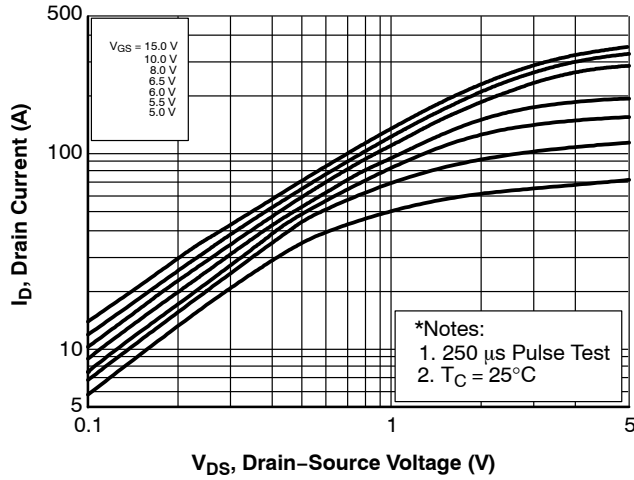


Figure 1. On-Region Characteristics

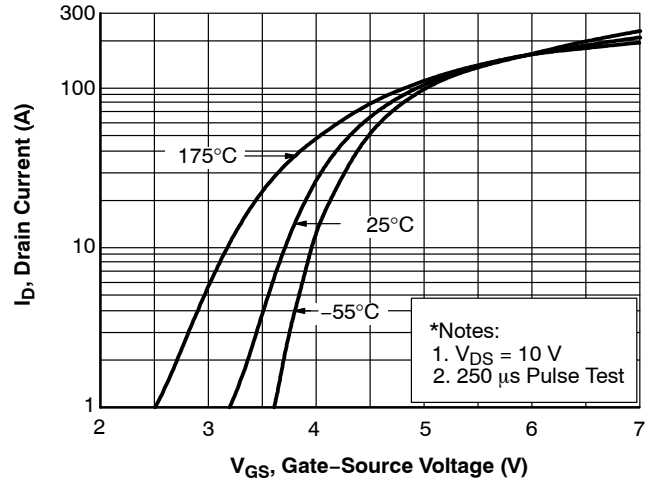


Figure 2. Transfer Characteristics

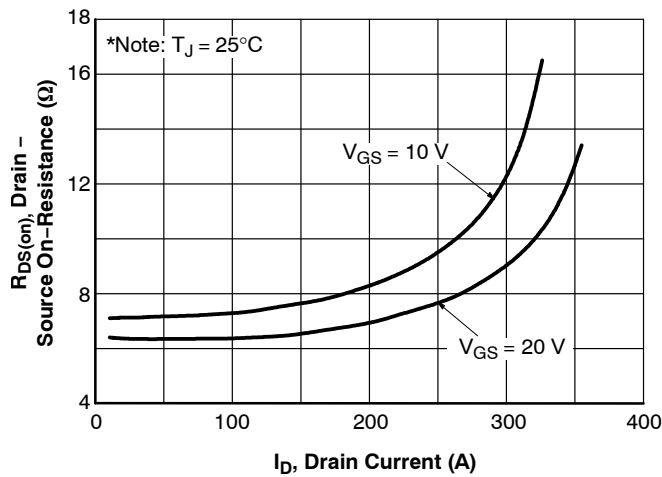


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

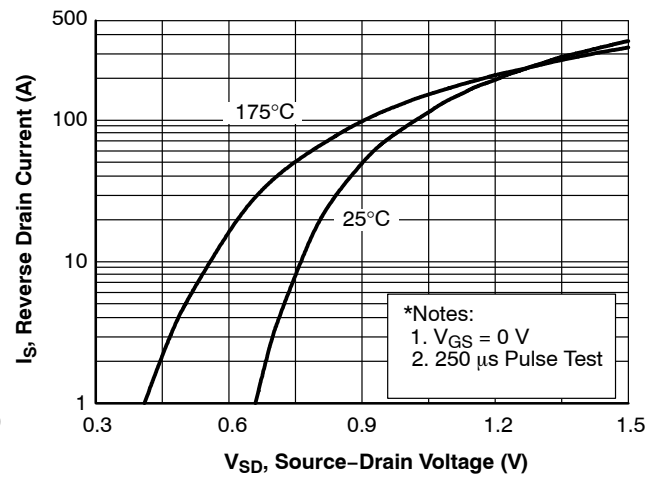


Figure 4. Body Diode Forward Voltage Variation vs Source Current and Temperature

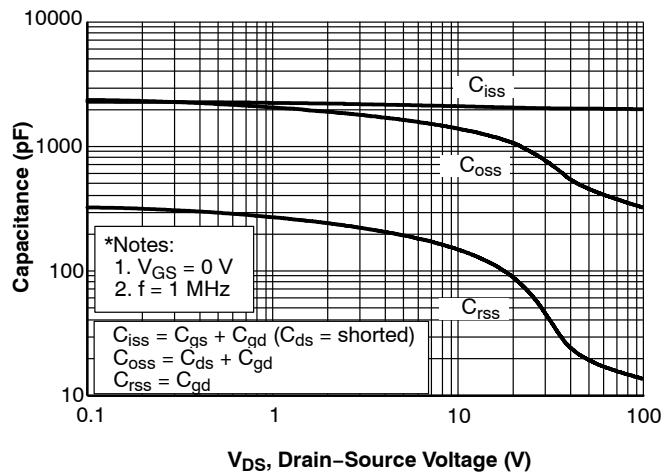


Figure 5. Capacitance Characteristics

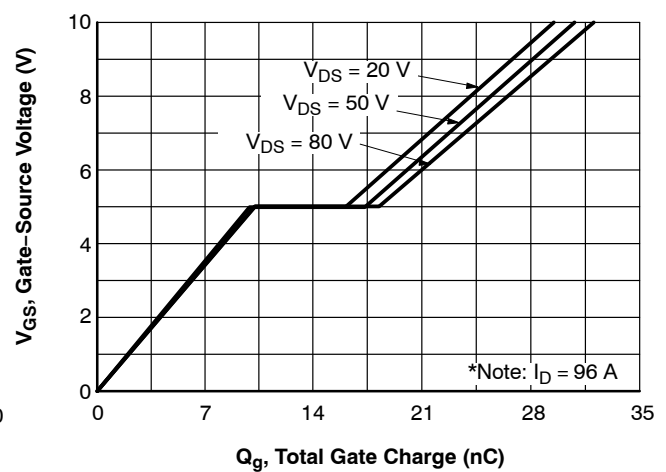
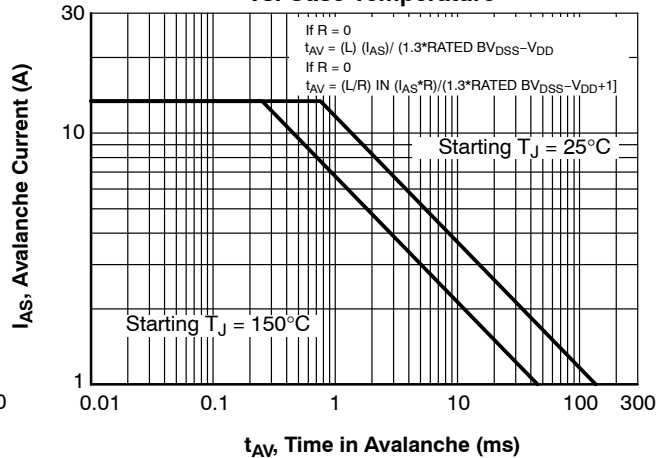
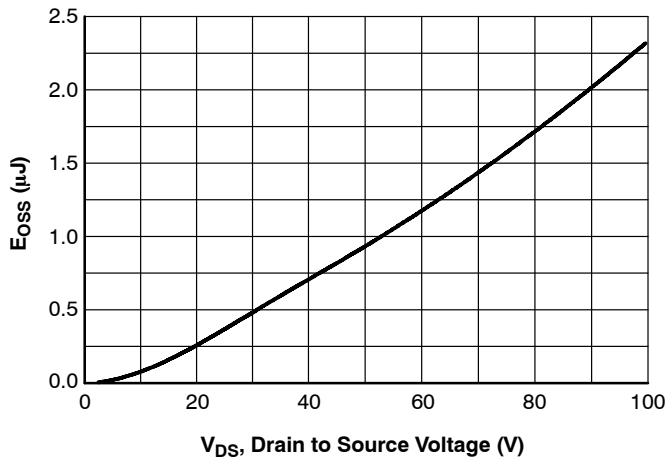
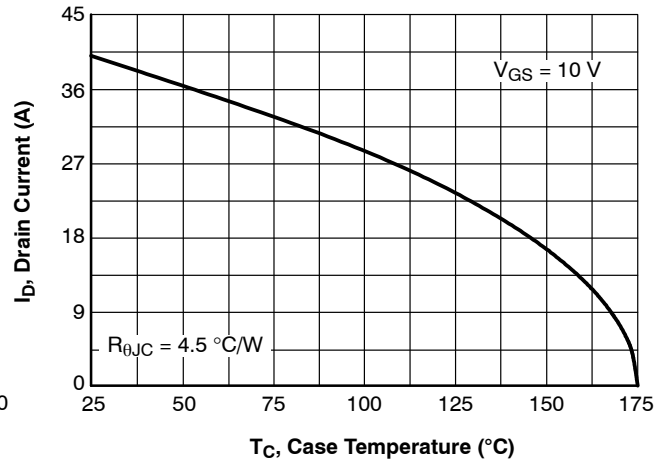
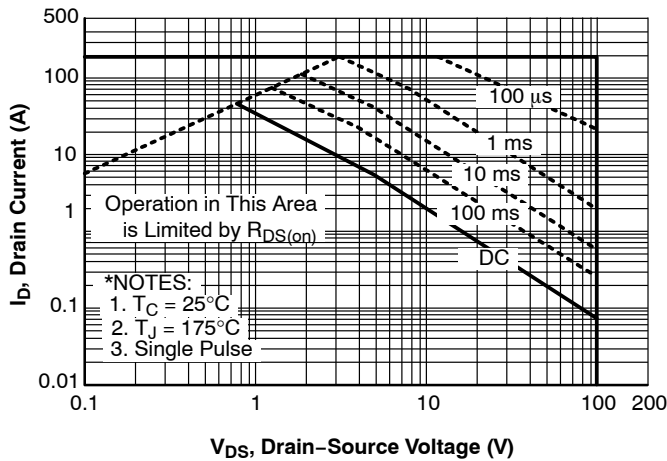
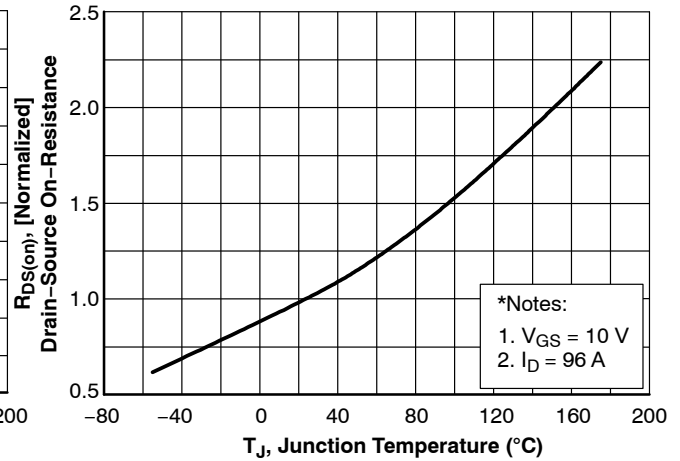
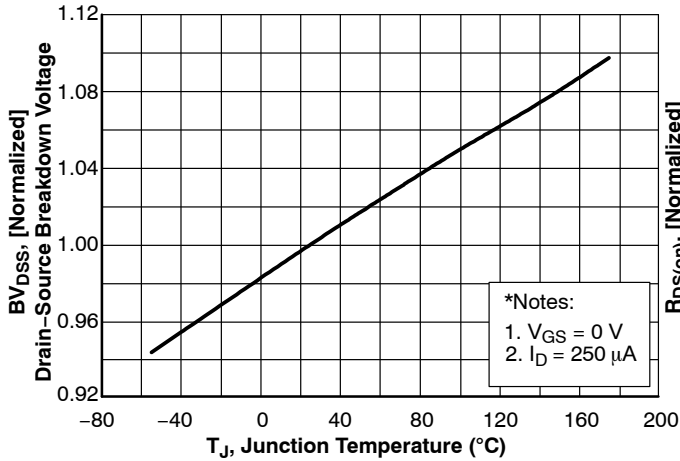


Figure 6. Gate Charge Characteristics

TYPICAL CHARACTERISTICS (CONTINUED)



TYPICAL CHARACTERISTICS (CONTINUED)

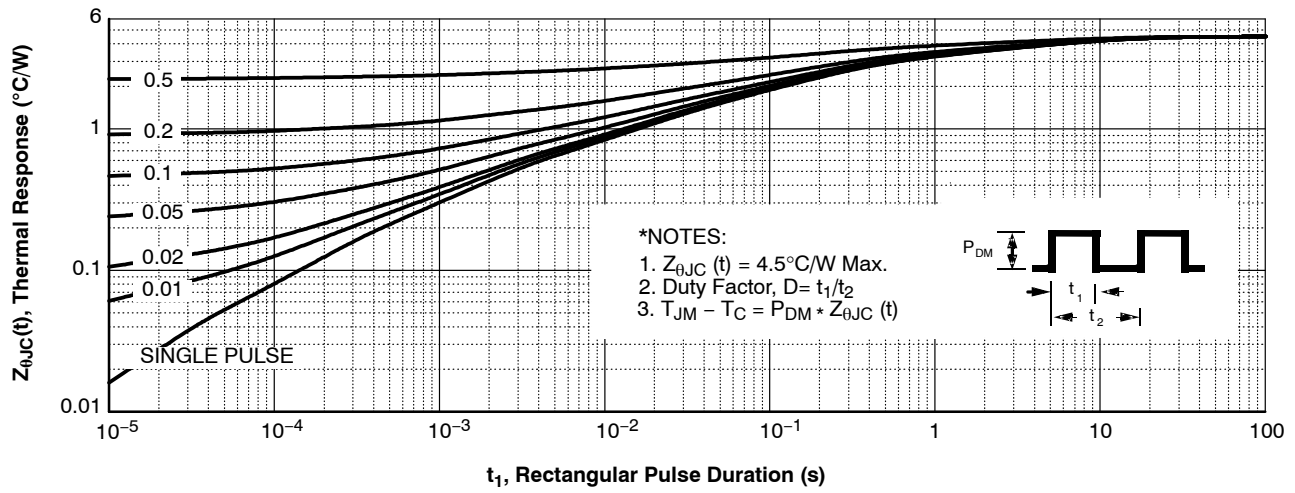


Figure 13. Transient Thermal Response Curve

# FDPF085N10A

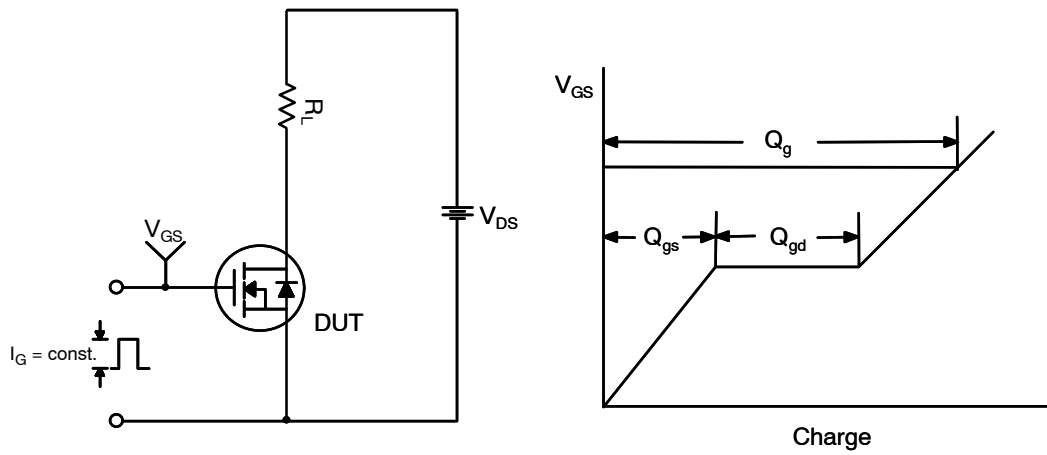


Figure 14. Gate Charge Test Circuit & Waveform

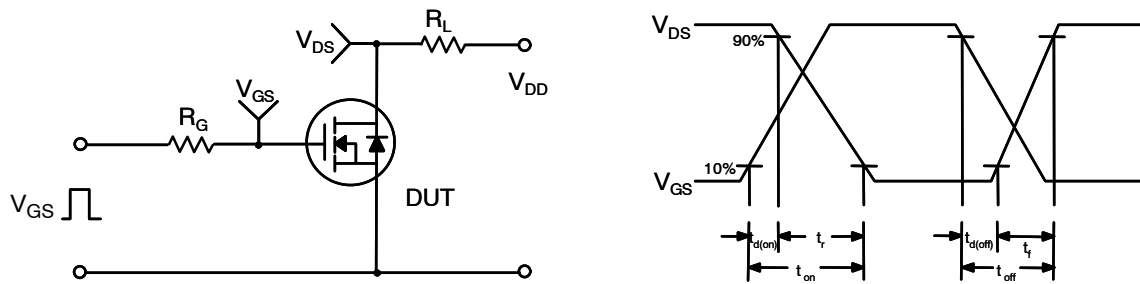


Figure 15. Resistive Switching Test Circuit & Waveforms

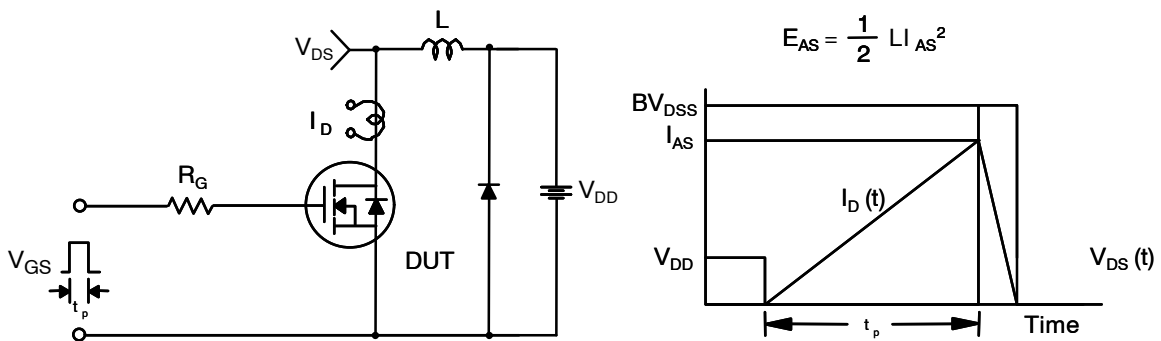


Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms

# FDPF085N10A

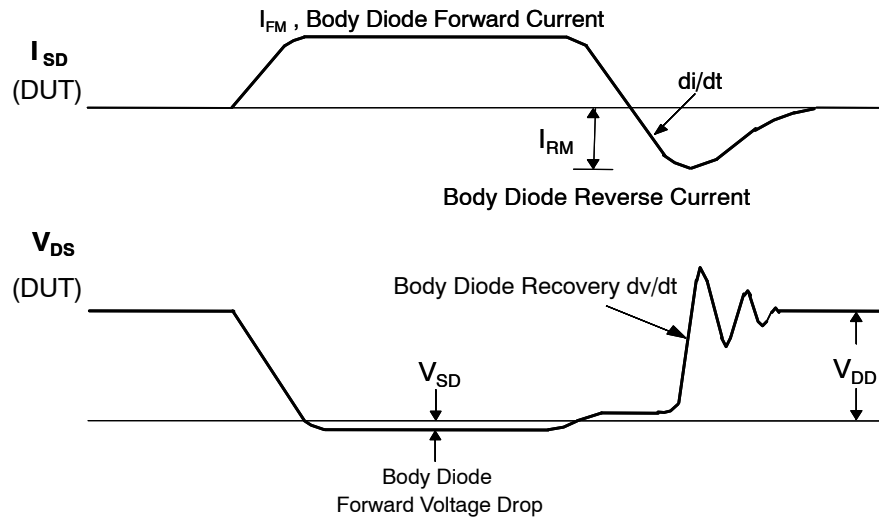
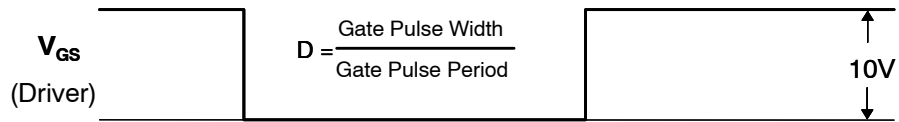
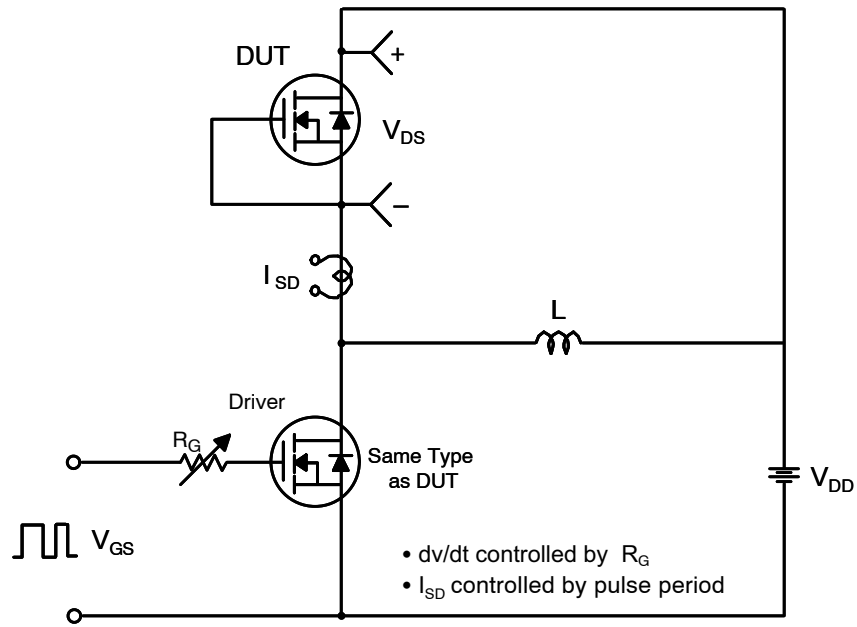
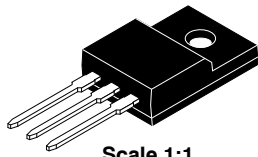


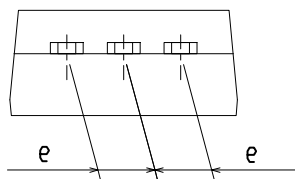
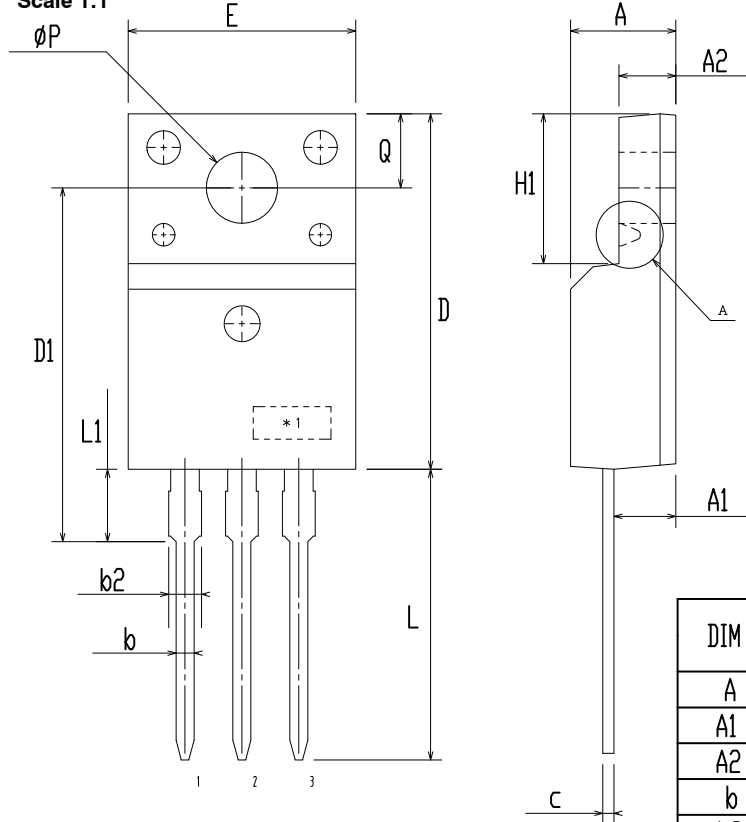
Figure 17. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

**TO-220 Fullpack, 3-Lead / TO-220F-3SG**  
**CASE 221AT**  
**ISSUE B**

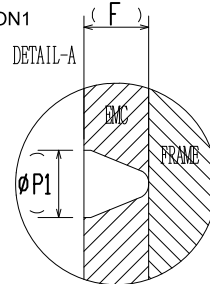
DATE 19 JAN 2021



Scale 1:1



OPTION1



| DIM  | MILLIMETERS |       |       |
|------|-------------|-------|-------|
|      | MIN         | NOM   | MAX   |
| A    | 4.50        | 4.70  | 4.90  |
| A1   | 2.56        | 2.76  | 2.96  |
| A2   | 2.34        | 2.54  | 2.74  |
| b    | 0.70        | 0.80  | 0.90  |
| b2   | ~           | ~     | 1.47  |
| c    | 0.45        | 0.50  | 0.60  |
| D    | 15.67       | 15.87 | 16.07 |
| D1   | 15.60       | 15.80 | 16.00 |
| E    | 9.96        | 10.16 | 10.36 |
| e    | 2.34        | 2.54  | 2.74  |
| F    | ~           | 0.84  | ~     |
| H1   | 6.48        | 6.68  | 6.88  |
| L    | 12.78       | 12.98 | 13.18 |
| L1   | 3.03        | 3.23  | 3.43  |
| Ø P  | 2.98        | 3.18  | 3.38  |
| Ø P1 | ~           | 1.00  | ~     |
| Q    | 3.20        | 3.30  | 3.40  |

**NOTES:**

A. DIMENSION AND TOLERANCE AS ASME Y14.5-2009

B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUCTIONS.

C. OPTION 1 - WITH SUPPORT PIN HOLE

OPTION 2 - NO SUPPORT PIN HOLE

|                         |                                              |                                                                                                                                                                                     |
|-------------------------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| <b>DESCRIPTION:</b>     | <b>TO-220 FULLPACK, 3-LEAD / TO-220F-3SG</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                                  |

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