

# MOSFET – N-Channel, UniFET™

60 V, 55 A, 22 mΩ

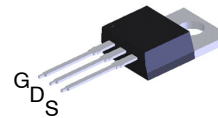
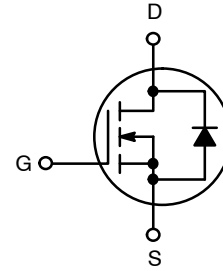
## FDP55N06 / FDPF55N06

### Description

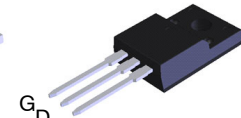
UniFET MOSFET is onsemi's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.

### Features

- $R_{DS(on)} = 22 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 27.5 \text{ A}$
- Low Gate Charge (Typ. 30 nC)
- Low  $C_{rss}$  (Typ. 60 pF)
- 100% Avalanche Tested

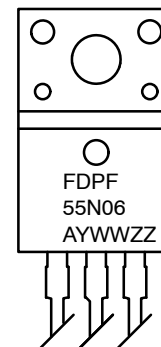


TO-220-3LD  
CASE 340AT



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

### MARKING DIAGRAM



FDP55N06,  
FDPF55N06 = Specific Device Code  
A = Assembly Location  
YWW = Date Code (Year & Week)  
ZZ = Assembly Lot

### ORDERING INFORMATION

| Device    | Package | Shipping          |
|-----------|---------|-------------------|
| FDP55N06  | TO-220  | 1000 Units / Tube |
| FDPF55N06 | TO-220F | 1000 Units / Tube |

# FDP55N06 / FDPF55N06

## ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub> = 25°C unless otherwise noted)

| Symbol                            | Parameter                                                                                        | FDP55N06    | FDPF55N06    | Unit      |
|-----------------------------------|--------------------------------------------------------------------------------------------------|-------------|--------------|-----------|
| V <sub>DSS</sub>                  | Drain to Source Voltage                                                                          | 60          | 60           | V         |
| I <sub>D</sub>                    | Drain Current –<br>– Continuous (T <sub>C</sub> = 25°C)<br>– Continuous (T <sub>C</sub> = 100°C) | 55<br>34.8  | 55*<br>34.8* | A         |
| I <sub>DM</sub>                   | Drain Current – Pulsed (Note 1)                                                                  | 220         | 220*         | A         |
| V <sub>GSS</sub>                  | Gate–Source Voltage                                                                              | ±25         | ±25          | V         |
| E <sub>AS</sub>                   | Single Pulsed Avalanche Energy (Note 2)                                                          | 480         | 480          | mJ        |
| I <sub>AR</sub>                   | Avalanche Current (Note 1)                                                                       | 55          | 55           | A         |
| E <sub>AR</sub>                   | Repetitive Avalanche Energy (Note 1)                                                             | 11.4        | 11.4         | mJ        |
| dv/dt                             | Peak Diode Recovery dv/dt (Note 3)                                                               | 4.5         | 4.5          | V/ns      |
| P <sub>D</sub>                    | Power Dissipation<br>(T <sub>C</sub> = 25°C)<br>– Derate Above 25°C                              | 114<br>0.9  | 48<br>0.4    | W<br>W/°C |
| T <sub>J</sub> , T <sub>STG</sub> | Operating and Storage Temperature Range                                                          | –55 to +150 | –55 to +150  | °C        |
| T <sub>L</sub>                    | Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Second                              | 300         | 300          | °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.

\*Drain current limited by maximum junction temperature

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. L = 5.6 mH, I<sub>AS</sub> = 55 A, V<sub>DD</sub> = 50 V, R<sub>G</sub> = 25 Ω, Starting T<sub>J</sub> = 25°C
3. I<sub>SD</sub> ≤ 55 A, di/dt ≤ 200 A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C

## THERMAL CHARACTERISTICS

| Symbol           | Parameter                                     | FDP55N06 | FDPF55N06 | Unit |
|------------------|-----------------------------------------------|----------|-----------|------|
| R <sub>θJC</sub> | Thermal Resistance, Junction–to–Case, Max.    | 1.1      | 2.58      | °C/W |
| R <sub>θJS</sub> | Thermal Resistance, Junction–to–sink, Typ.    | 0.5      | –         | °C/W |
| R <sub>θJA</sub> | Thermal Resistance, Junction–to–Ambient, Max. | 62.5     | 62.5      | °C/W |

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

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

### OFF CHARACTERISTICS

|                                      |                                           |                                                |    |      |      |      |
|--------------------------------------|-------------------------------------------|------------------------------------------------|----|------|------|------|
| BV <sub>DSS</sub>                    | Drain–Source Breakdown Voltage            | I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0 V | 60 | –    | –    | V    |
| ΔBV <sub>DSS</sub> / ΔT <sub>J</sub> | Breakdown Voltage Temperature Coefficient | I <sub>D</sub> = 250 μA, Referenced to 25°C    | –  | 0.05 | –    | V/°C |
| I <sub>DSS</sub>                     | Zero Gate Voltage Drain Current           | V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V  | –  | –    | 1    | μA   |
|                                      |                                           | V <sub>DS</sub> = 48 V, T <sub>C</sub> = 150°C | –  | –    | 10   |      |
| I <sub>GSSF</sub>                    | Gate–Body Leakage Current, Forward        | V <sub>GS</sub> = 20 V, V <sub>DS</sub> = 0 V  | –  | –    | 100  | nA   |
| I <sub>GSSR</sub>                    | Gate–Body Leakage Current, Reverse        | V <sub>GS</sub> = –20 V, V <sub>DS</sub> = 0 V | –  | –    | –100 | nA   |

### ON CHARACTERISTICS

|                     |                                   |                                                             |     |       |       |   |
|---------------------|-----------------------------------|-------------------------------------------------------------|-----|-------|-------|---|
| V <sub>GS(th)</sub> | Gate Threshold Voltage            | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA | 2.0 | –     | 4.0   | V |
| R <sub>DS(on)</sub> | Static Drain–Source On Resistance | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 27.5 A             | –   | 0.018 | 0.022 | Ω |
| g <sub>FS</sub>     | Forward Transconductance          | V <sub>DS</sub> = 25 V, I <sub>D</sub> = 27.5 A             | –   | 33    | –     | S |

### DYNAMIC CHARACTERISTICS

|                  |                              |                                                             |   |      |      |    |
|------------------|------------------------------|-------------------------------------------------------------|---|------|------|----|
| C <sub>iss</sub> | Input Capacitance            | V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V,<br>f = 1 MHz | – | 1160 | 1510 | pF |
| C <sub>oss</sub> | Output Capacitance           |                                                             | – | 375  | 490  | pF |
| C <sub>rss</sub> | Reverse Transfer Capacitance |                                                             | – | 60   | 90   | pF |

# FDP55N06 / FDPF55N06

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

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

### SWITCHING CHARACTERISTICS

|              |                          |                                                                                      |   |     |     |    |
|--------------|--------------------------|--------------------------------------------------------------------------------------|---|-----|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time       | $V_{DD} = 30\text{ V}$ , $I_D = 55\text{ A}$ ,<br>$R_G = 25\ \Omega$<br>(Note 4)     | – | 30  | 65  | ns |
| $t_r$        | Turn-On Rise Time        |                                                                                      | – | 130 | 265 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time      |                                                                                      | – | 70  | 150 | ns |
| $t_f$        | Turn-Off Fall Time       |                                                                                      | – | 95  | 195 | ns |
| $Q_{g(tot)}$ | Total Gate Charge at 10V | $V_{DD} = 48\text{ V}$ , $I_D = 55\text{ A}$ ,<br>$V_{GS} = 10\text{ V}$<br>(Note 4) | – | 30  | 37  | nC |
| $Q_{gs}$     | Gate-Source Gate Charge  |                                                                                      | – | 6.5 | –   | nC |
| $Q_{gd}$     | Gate-Drain Charge        |                                                                                      | – | 7.5 | –   | nC |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|          |                                                       |                                                                                        |   |    |     |               |
|----------|-------------------------------------------------------|----------------------------------------------------------------------------------------|---|----|-----|---------------|
| $I_S$    | Maximum Continuous Drain-Source Diode Forward Current |                                                                                        | – | –  | 55  | A             |
| $I_{SM}$ | Maximum Pulsed Drain to Source Diode Forward Current  |                                                                                        | – | –  | 220 | A             |
| $V_{SD}$ | Drain to Source Diode Forward Voltage                 | $V_{GS} = 0\text{ V}$ , $I_{SD} = 55\text{ A}$                                         | – | –  | 1.4 | V             |
| $t_{rr}$ | Reverse Recovery Time                                 | $V_{GS} = 0\text{ V}$ , $I_{SD} = 55\text{ A}$<br>$dI_F/dt = 100\text{ A}/\mu\text{s}$ | – | 40 | –   | ns            |
| $Q_{rr}$ | Reverse Recovery Charge                               |                                                                                        | – | 55 | –   | $\mu\text{C}$ |

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.

4. Essentially independent of operating temperature.

TYPICAL CHARACTERISTICS

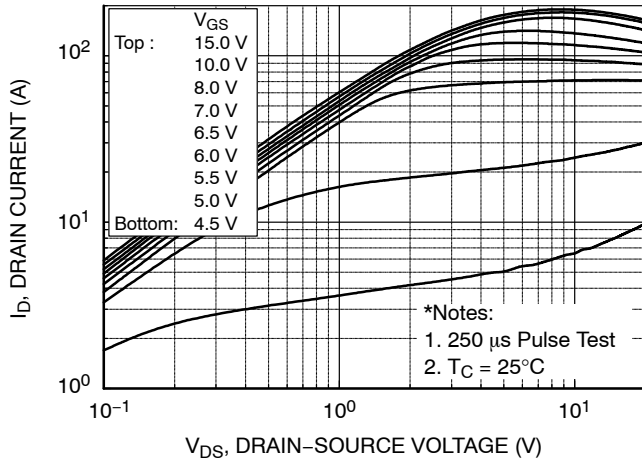


Figure 1. On-Region Characteristics

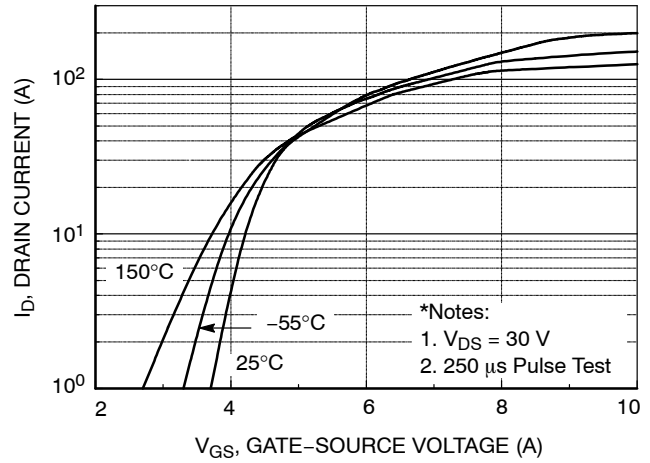


Figure 2. Transfer Characteristics

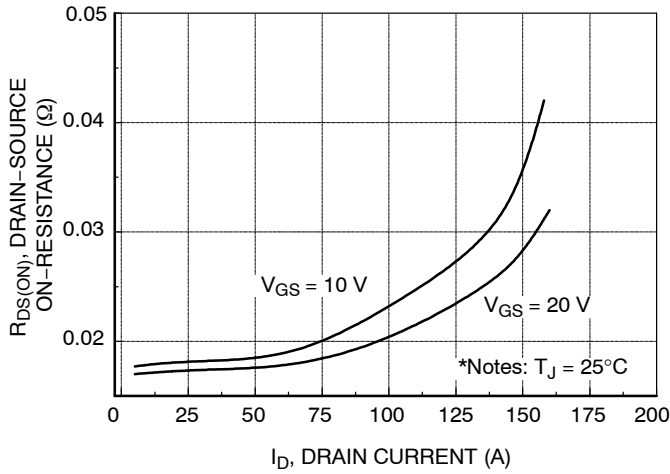


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

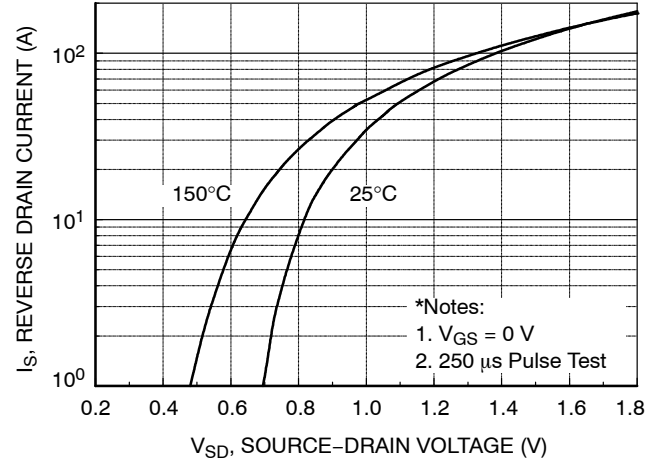


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

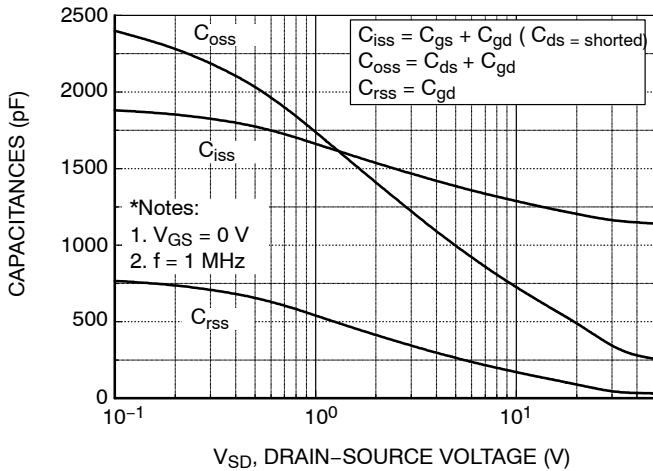


Figure 5. Capacitance Characteristics

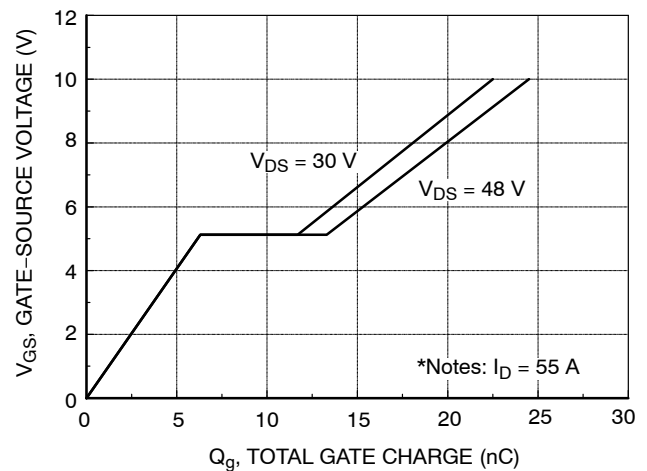


Figure 6. Gate Charge Characteristics

TYPICAL CHARACTERISTICS (continued)

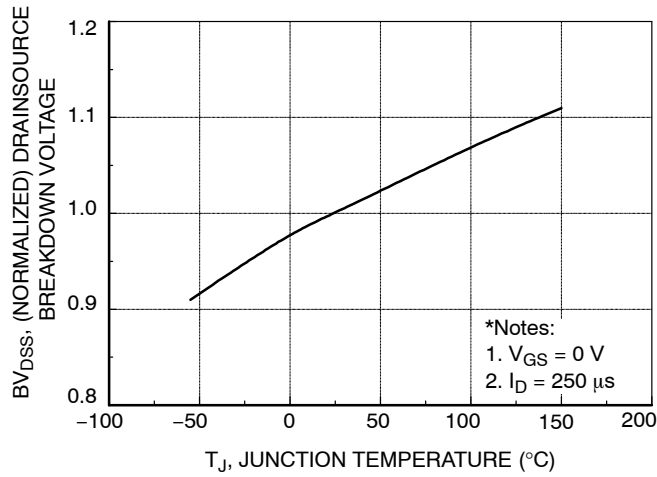


Figure 7. Breakdown Voltage Variation vs. Temperature

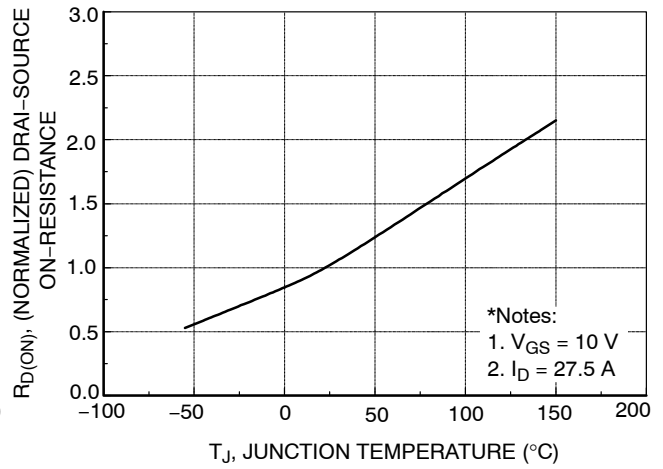


Figure 8. On-Resistance Variation vs. Temperature

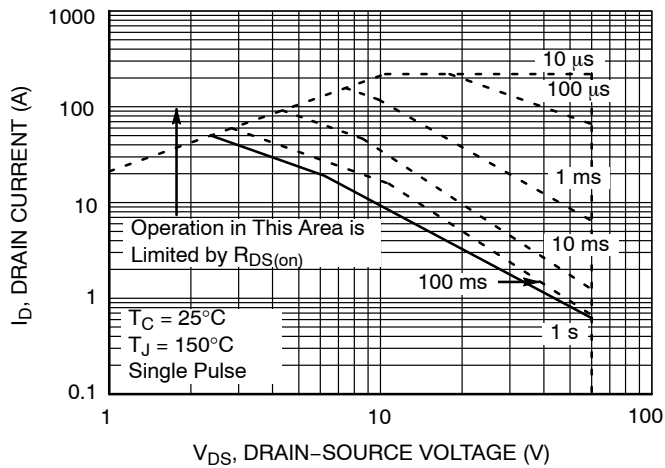


Figure 9-1. Maximum Safe Operating Area for FDP55N06

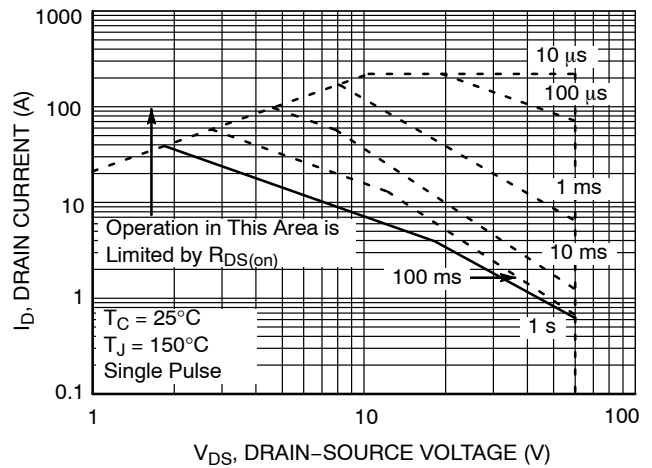


Figure 9-2. Maximum Safe Operating Area for FDPF55N06

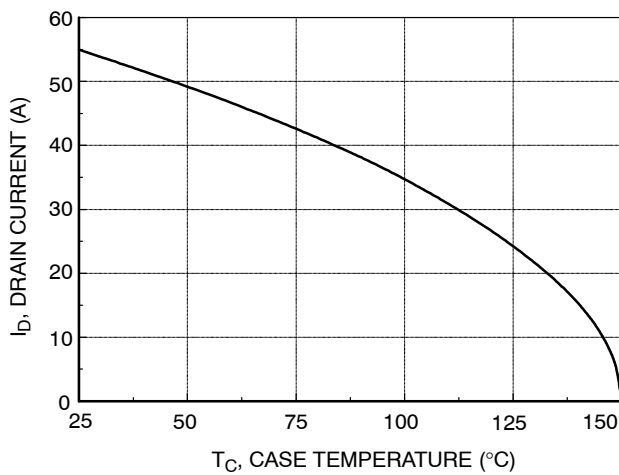


Figure 10. Maximum Drain Current vs. Case Temperature

# FDP55N06 / FDPF55N06

## TYPICAL PERFORMANCE CHARACTERISTICS (CONTINUED)

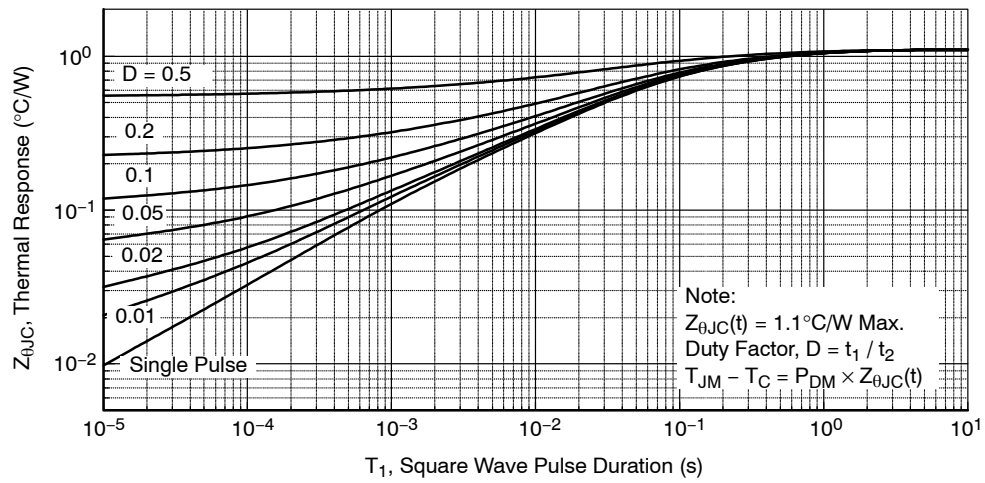


Figure 11-1. Transient Thermal Response Curve for FDP55N06

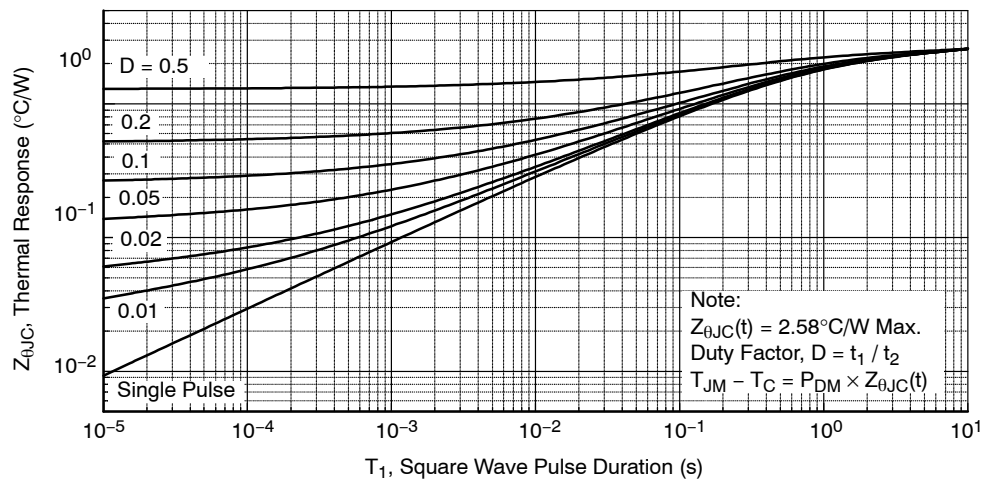


Figure 11-2. Transient Thermal Response Curve for FDPF55N06

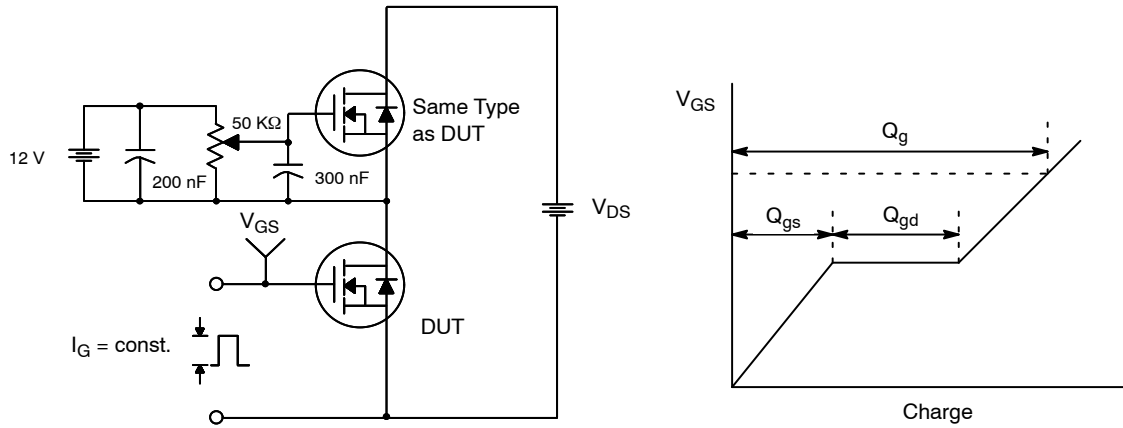


Figure 12. Gate Charge Test Circuit & Waveform

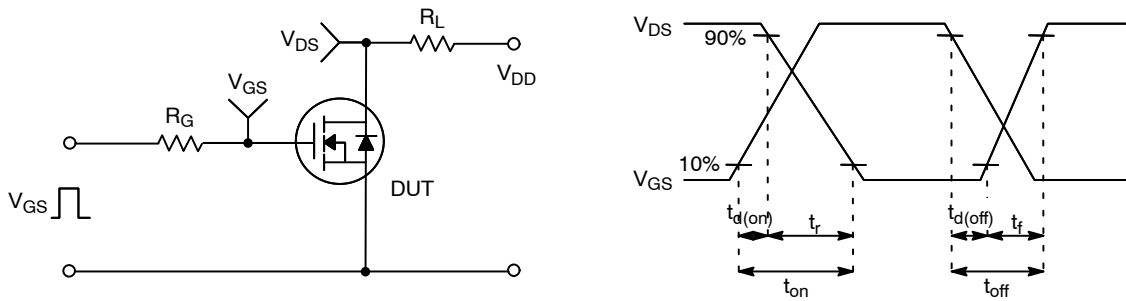


Figure 13. Resistive Switching Test Circuit & Waveforms

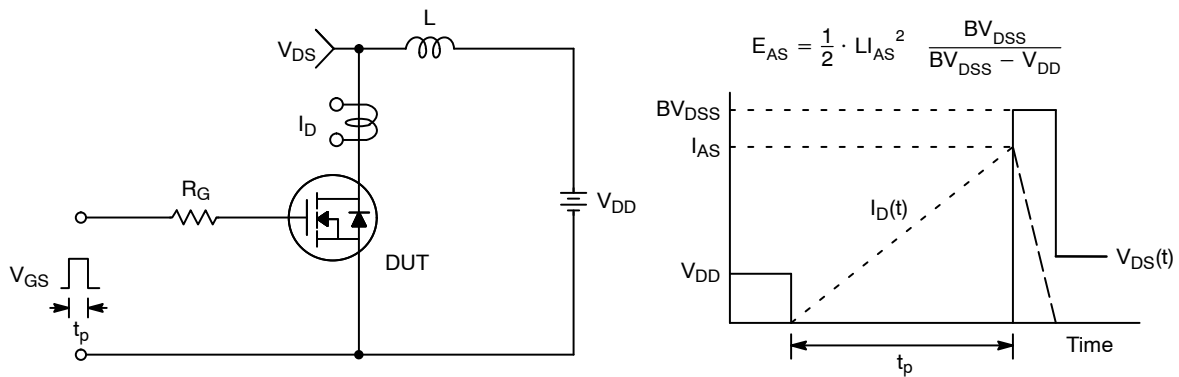
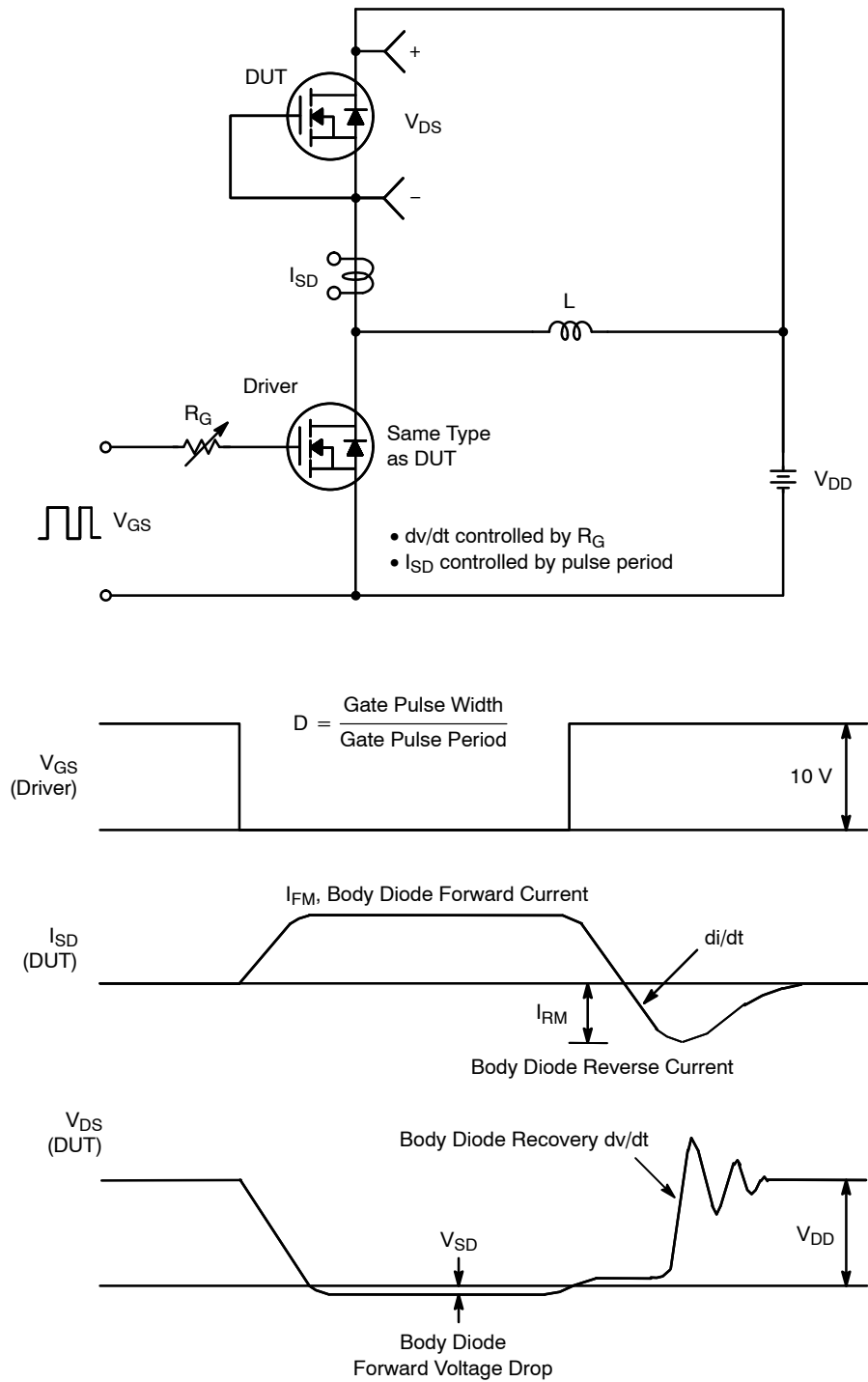


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

# FDP55N06 / FDPF55N06

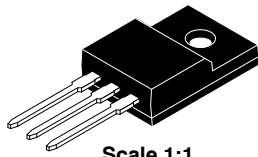


**Figure 15. Peak Recovery  $dv/dt$  Test Circuit & Waveforms**

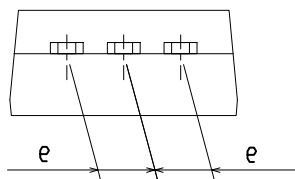
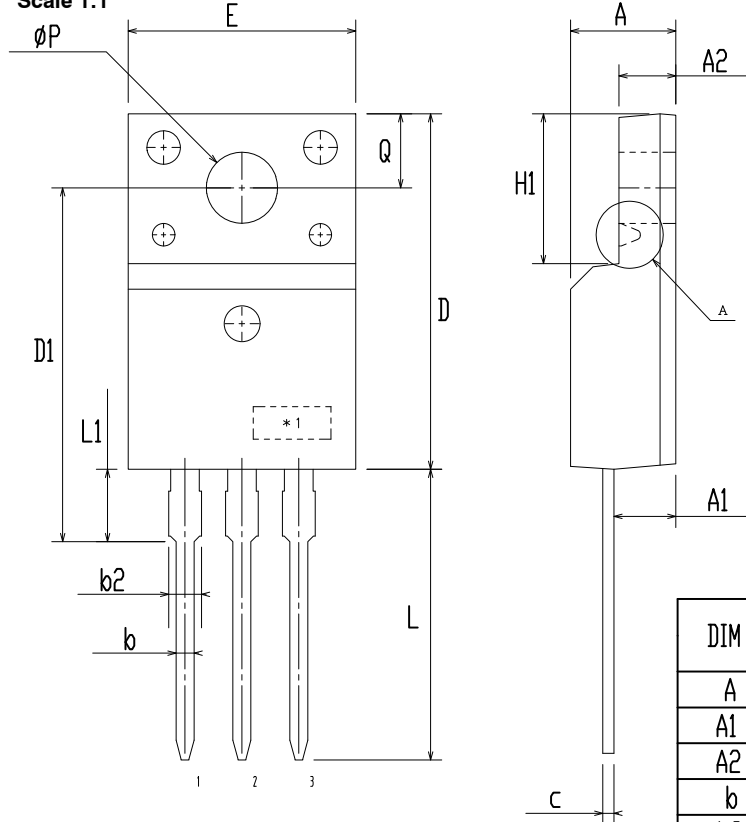


**TO-220 Fullpack, 3-Lead / TO-220F-3SG**  
**CASE 221AT**  
**ISSUE B**

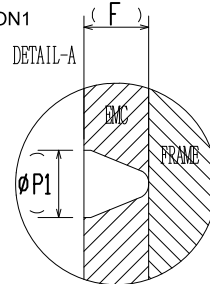
DATE 19 JAN 2021



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

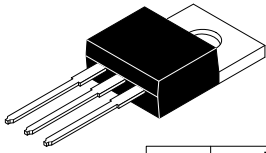
B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUCTIONS.

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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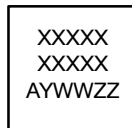
TO-220-3LD  
CASE 340AT  
ISSUE B

DATE 08 AUG 2022

| DIM | MILLIMETERS  |      |       |
|-----|--------------|------|-------|
|     | MIN.         | NOM. | MAX.  |
| A   | 4.00         | --   | 4.70  |
| A1  | SEE NOTE "F" |      |       |
| A2  | 2.10         | --   | 2.85  |
| b   | 0.55         | --   | 1.00  |
| b2  | 1.10         | --   | 1.62  |
| b4  | 1.42         | --   | 1.62  |
| c   | 0.36         | --   | 0.60  |
| D   | 13.90        | --   | 16.30 |
| D1  | 8.13         | --   | 9.40  |
| D2  | 11.50        | --   | 14.30 |
| D3  | 15.42        | --   | 16.51 |
| E   | 9.65         | --   | 10.67 |
| E1  | 7.59         | --   | 8.65  |
| e   | 2.40         | --   | 2.67  |
| H1  | 6.06         | --   | 6.69  |
| L   | 12.70        | --   | 14.04 |
| L1  | 2.70         | --   | 4.10  |
| P   | 3.50         | --   | 4.00  |
| Q   | 2.50         | --   | 3.40  |
| z   | 2.13 REF     |      |       |
| z1  | 2.06 REF     |      |       |
| θ   | 3°           | --   | 5°    |

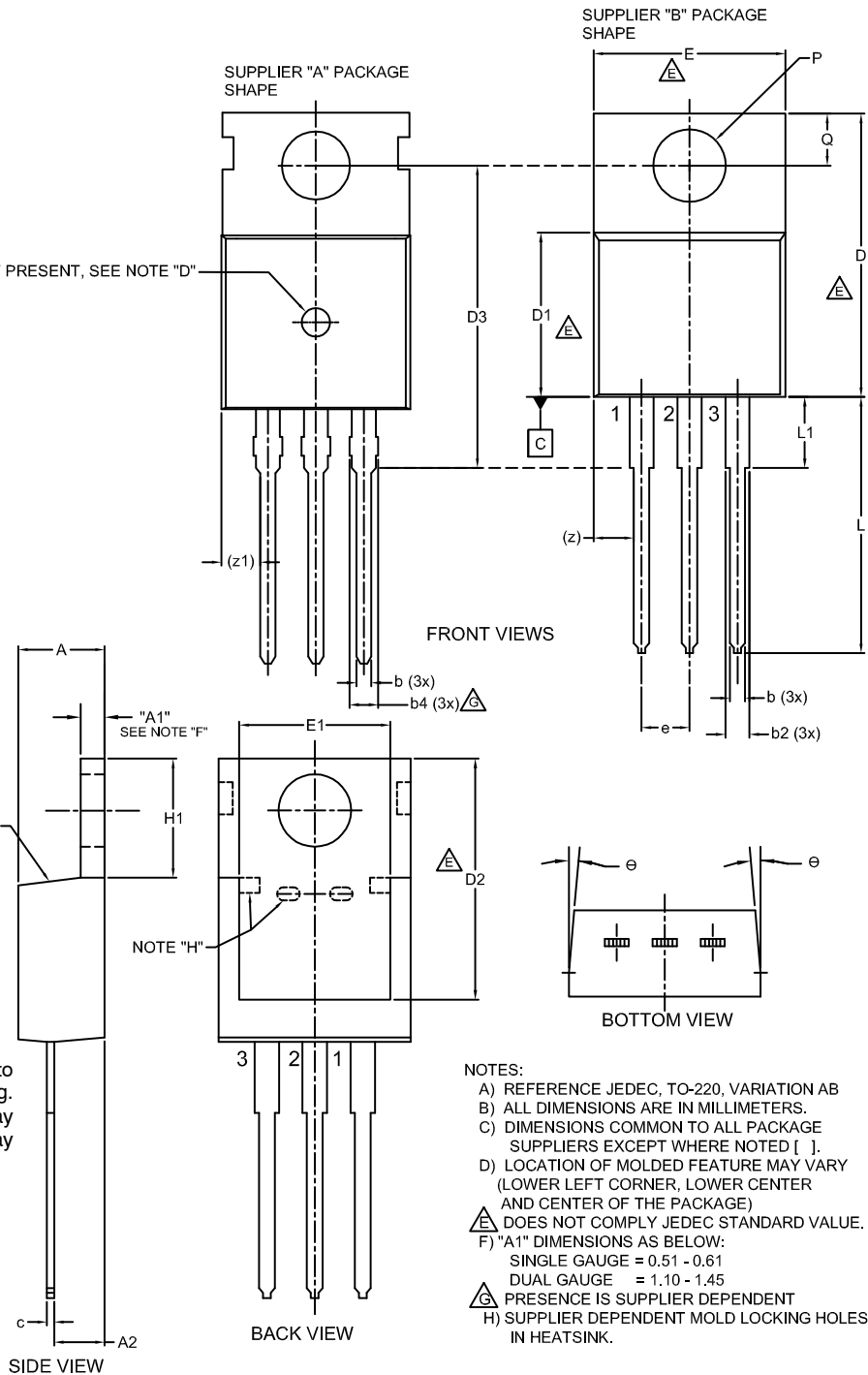
IF PRESENT, SEE NOTE "D"

GENERIC  
MARKING DIAGRAM\*



XXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
ZZ = Assembly Lot Code

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.



NOTES:

- A) REFERENCE JEDEC, TO-220, VARIATION AB
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS COMMON TO ALL PACKAGE SUPPLIERS EXCEPT WHERE NOTED [ ].
- D) LOCATION OF MOLDED FEATURE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)
- E) DOES NOT COMPLY JEDEC STANDARD VALUE.
- F) "A1" DIMENSIONS AS BELOW:  
SINGLE GAUGE = 0.51 - 0.61  
DUAL GAUGE = 1.10 - 1.45
- G) PRESENCE IS SUPPLIER DEPENDENT
- H) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.

|                  |             |                                                                                                                                                                                     |
|------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| DESCRIPTION:     | TO-220-3LD  | PAGE 1 OF 1                                                                                                                                                                         |

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