

# MOSFET – N-Channel, POWERTRENCH®

60 V, 88 A, 3.5 mΩ

## FDPF035N06B-F154

### Description

This N-Channel MOSFET is produced using ON Semiconductor's advanced POWERTRENCH process that has been tailored to minimize the on-state resistance while maintaining superior switching performance.

### Features

- $R_{DS(on)} = 2.91 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 88 \text{ A}$
- Low FOM  $R_{DS(on)} * Q_G$
- Low Reverse Recovery Charge,  $Q_{rr}$
- Soft Reverse Recovery Body Diode
- Enables Highly Efficiency in Synchronous Rectification
- Fast Switching Speed
- 100% UIL Tested
- These Devices are Pb-Free and are RoHS Compliant

### Applications

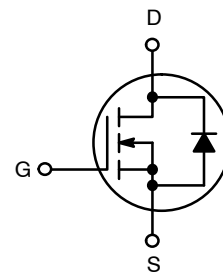
- Synchronous Rectification for ATX / Server / Telecom PSU
- Battery Protection Circuit
- Motor Drives and Uninterruptible Power Supplies
- Renewable System



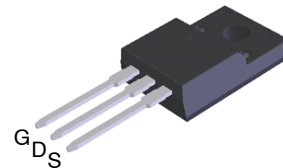
ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)

| $V_{DSS}$ | $R_{DS(on)} \text{ MAX}$ | $I_D \text{ MAX}$ |
|-----------|--------------------------|-------------------|
| 60 V      | 3.5 mΩ @ 10 V            | 88 A              |

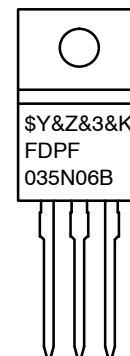


MOSFET



TO-220F Ultra Narrow Lead  
CASE 221BN

### MARKING DIAGRAM



\$Y = ON Semiconductor Logo  
&Z = Assembly Plant Code  
&3 = Data Code (Year & Week)  
&K = Lot  
FDPF035N06B = Specific Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

## FDPF035N06B–F154

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

| Symbol                            | Parameter  | Value  | Unit |
|-----------------------------------|--|--|------|
| V <sub>DSS</sub>                  | Drain to Source Voltage  | 60   | V    |
| V <sub>GSS</sub>                  | Gate to Source Voltage   | ±20  | V    |
| I <sub>D</sub>                    | Drain Current  | – Continuous (T <sub>C</sub> = 25°C, Silicon Limited)  | 88   |
|                                   |  | – Continuous (T <sub>C</sub> = 100°C, Silicon Limited) | 62   |
| I <sub>DM</sub>                   | Drain Current  | – Pulsed (Note 1)                                      | 352  |
| E <sub>AS</sub>                   | Single Pulsed Avalanche Energy (Note 2)                              | 600  | mJ   |
| dv/dt                             | Peak Diode Recovery dv/dt (Note 3)                                   | 6.0  | V/ns |
| P <sub>D</sub>                    | Power Dissipation  | (T <sub>C</sub> = 25°C)                                | 46.3 |
|                                   |  | – Derate Above 25°C                                    | 0.31 |
| T <sub>J</sub> , T <sub>STG</sub> | Operating and Storage Temperature Range                              | –55 to +175  | °C   |
| T <sub>L</sub>                    | Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds | 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.

1. Repetitive rating: pulse-width limited by maximum junction temperature.

2. L = 3 mH, I<sub>AS</sub> = 20 A, starting T<sub>J</sub> = 25°C.

3. I<sub>SD</sub> ≤ 100 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                                     | Value | Unit |
|------------------|---|-------|------|
| R <sub>θJC</sub> | Thermal Resistance, Junction to Case, Max.    | 3.24  | °C/W |
| R <sub>θJA</sub> | Thermal Resistance, Junction to Ambient, Max. | 62.5  | °C/W |

### PACKAGE MARKING AND ORDERING INFORMATION

| Part Number      | Top Marking | Package              | Shipping        |
|------------------|-------------|----------------------|-----------------|
| FDPF035N06B–F154 | FDPF035N06B | TO–220F<br>(Pb–Free) | 50 Units / Tube |

# FDPF035N06B-F154

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

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

### OFF CHARACTERISTICS

|                                      |   |  |    |      |      |      |
|--------------------------------------|---|--|----|------|------|------|
| BV <sub>DSS</sub>                    | Drain to 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    | –  | 0.03 | –    | V/°C |
| I <sub>DSS</sub>                     | Zero Gate Voltage Drain Current           | V <sub>DS</sub> = 48 V, V <sub>GS</sub> = 0 V  | –  | –    | 1    | μA   |
| I <sub>GSS</sub>                     | Gate to Body Leakage Current              | 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>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA | 2 | –    | 4   | V  |
| R <sub>DS(on)</sub> | Static Drain to Source On Resistance | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 88 A               | – | 2.91 | 3.5 | mΩ |
| g <sub>FS</sub>     | Forward Transconductance             | V <sub>DS</sub> = 20 V, I <sub>D</sub> = 88 A               | – | 176  | –   | S  |

### DYNAMIC CHARACTERISTICS

|                      |                                    |  |   |      |      |    |
|----------------------|------------------------------------|--|---|------|------|----|
| C <sub>iss</sub>     | Input Capacitance                  | V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V, f = 1 MHz                           | – | 6035 | 8030 | pF |
| C <sub>oss</sub>     | Output Capacitance                 |  | – | 1685 | 2240 | pF |
| C <sub>rss</sub>     | Reverse Transfer Capacitance       |  | – | 55   | –    | pF |
| C <sub>oss(er)</sub> | Energy Related Output Capacitance  | V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V                                      | – | 2619 | –    |    |
| Q <sub>g(tot)</sub>  | Total Gate Charge at 10 V          | V <sub>DS</sub> = 30 V, I <sub>D</sub> = 100 A, V <sub>GS</sub> = 10 V<br>(Note 4) | – | 76   | 99   | nC |
| Q <sub>gs</sub>      | Gate to Source Gate Charge         |  | – | 29   | –    | nC |
| Q <sub>gd</sub>      | Gate to Drain "Miller" Charge      |  | – | 12   | –    | nC |
| V <sub>plateau</sub> | Gate Plateau Voltage               |  | – | 5.2  | –    | V  |
| Q <sub>sync</sub>    | Total Gate Charge Sync.            | V <sub>DS</sub> = 0 V, I <sub>D</sub> = 50 A                                       | – | 67.3 | –    | nC |
| Q <sub>oss</sub>     | Output Charge                      | V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V                                      | – | 92.4 | –    | nC |
| ESR                  | Equivalent Series Resistance (G–S) | f = 1 MHz  | – | 2.0  | –    | Ω  |

### SWITCHING CHARACTERISTICS

|                     |                     |   |   |    |     |    |
|---------------------|---------------------|---|---|----|-----|----|
| t <sub>d(on)</sub>  | Turn-On Delay Time  | V <sub>DD</sub> = 30 V, I <sub>D</sub> = 100 A, V <sub>GS</sub> = 10 V,<br>R <sub>g</sub> = 4.7 Ω<br>(Note 4) | – | 32 | 74  | ns |
| t <sub>r</sub>      | Turn-On Rise Time   |   | – | 33 | 76  | ns |
| t <sub>d(off)</sub> | Turn-Off Delay Time |   | – | 56 | 122 | ns |
| t <sub>f</sub>      | Turn-Off Fall Time  |   | – | 23 | 56  | ns |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                 |  |   |   |    |      |    |
|-----------------|--|---|---|----|------|----|
| I <sub>S</sub>  | Maximum Continuous Source to Drain Diode Forward Current |   | – | –  | 88   | A  |
| I <sub>SM</sub> | Maximum Pulsed Source to Drain Diode Forward Current     |   | – | –  | 352  | A  |
| V <sub>SD</sub> | Source to Drain Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 88 A                                     | – | –  | 1.25 | V  |
| t <sub>rr</sub> | Reverse Recovery Time                                    | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 100 A,<br>dI <sub>F</sub> /dt = 100 A/μs | – | 71 | –    | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge                                  |   | – | 78 | –    | 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.

4. Essentially independent of operating temperature typical characteristics.

TYPICAL PERFORMANCE CHARACTERISTICS

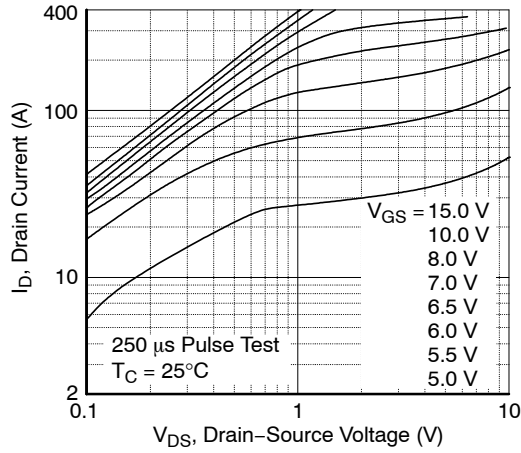


Figure 1. On-Region Characteristics

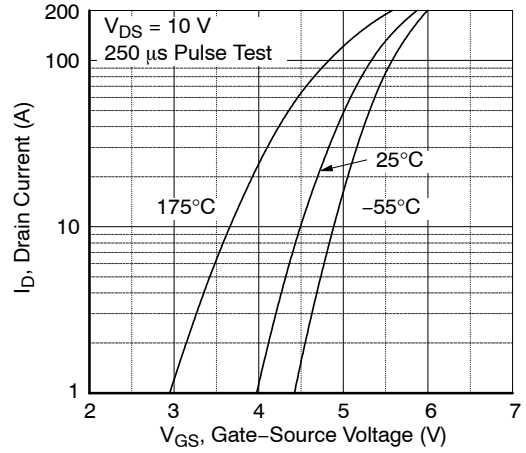


Figure 2. Transfer Characteristics

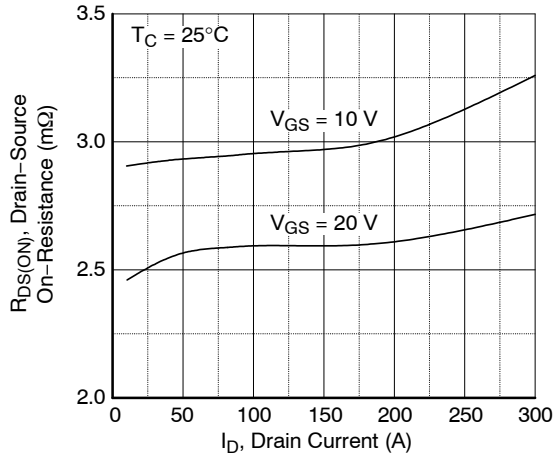


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

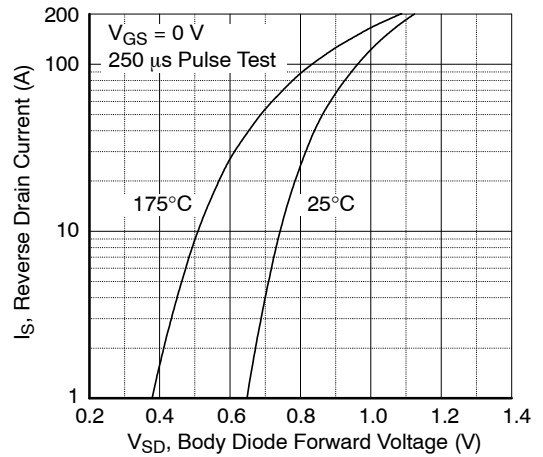


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

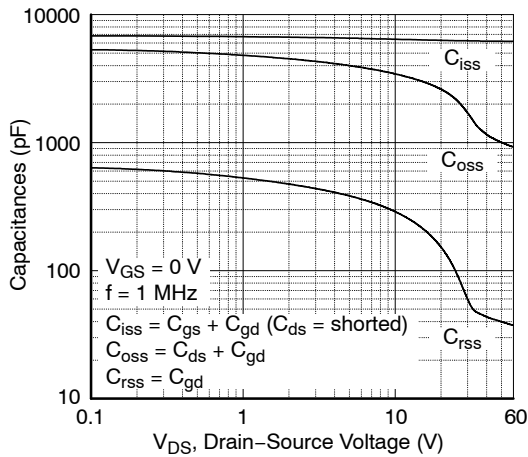


Figure 5. Capacitance Characteristics

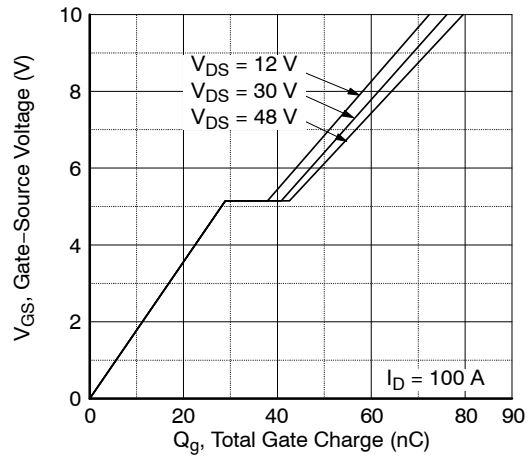


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

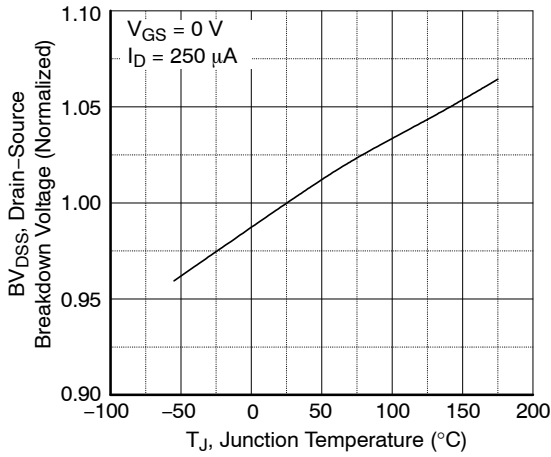


Figure 7. Breakdown Voltage Variation vs. Temperature

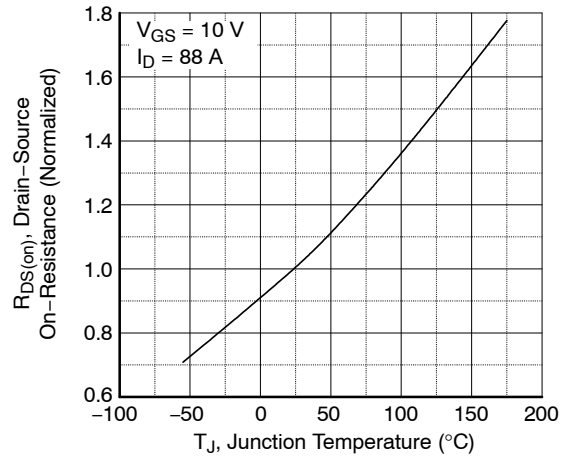


Figure 8. On-Resistance Variation vs. Temperature

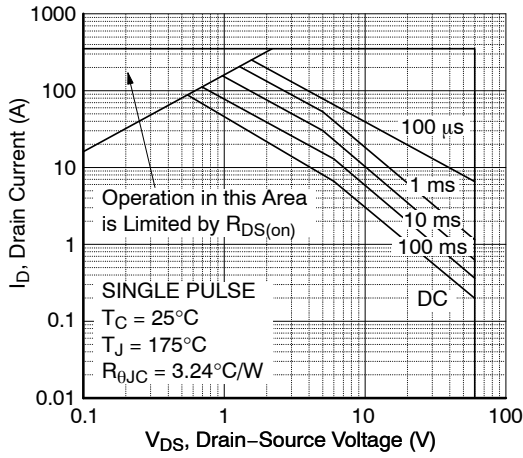


Figure 9. Maximum Safe Operating Area

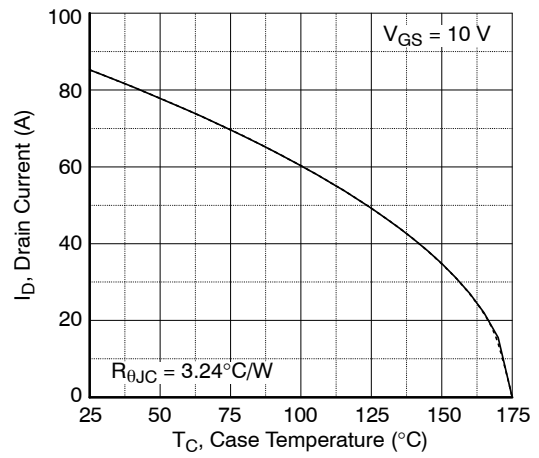


Figure 10. Maximum Drain Current vs. Case Temperature

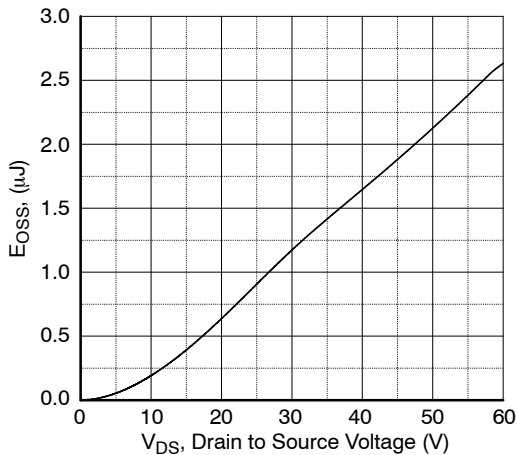


Figure 11.  $E_{OSS}$  vs. Drain to Source Voltage

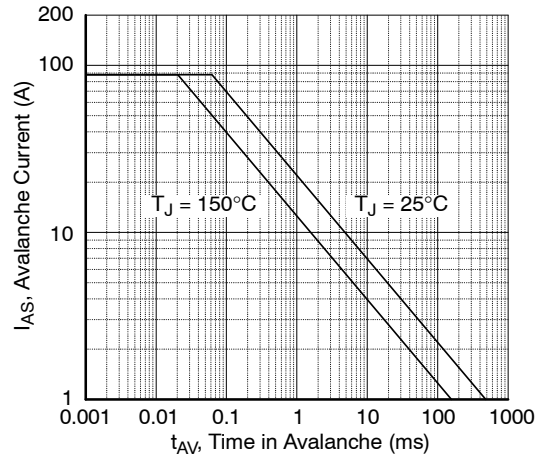


Figure 12. Unclamped Inductive Switching Capability

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

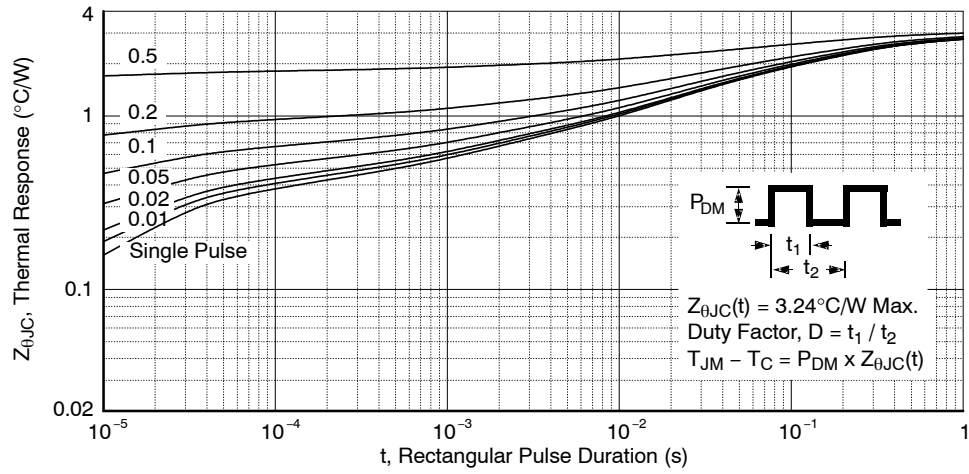


Figure 13. Transient Thermal Response Curve

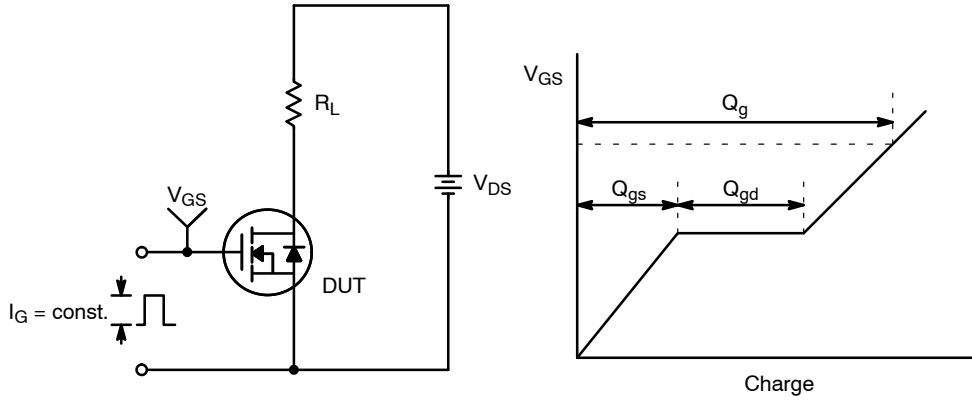


Figure 14. Gate Charge Test Circuit & Waveform

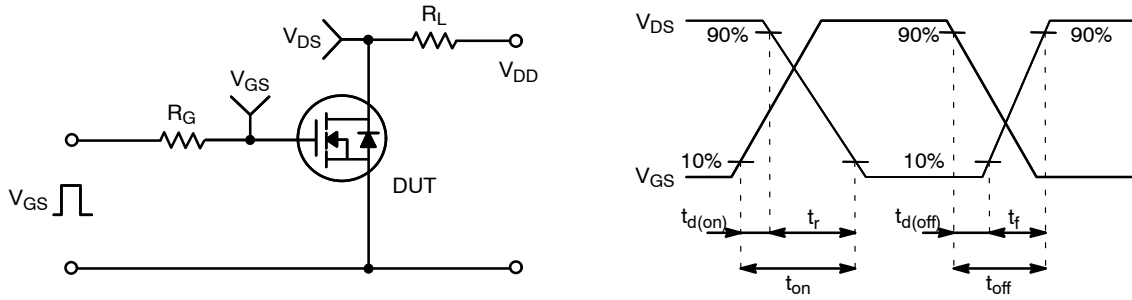


Figure 15. Resistive Switching Test Circuit & Waveforms

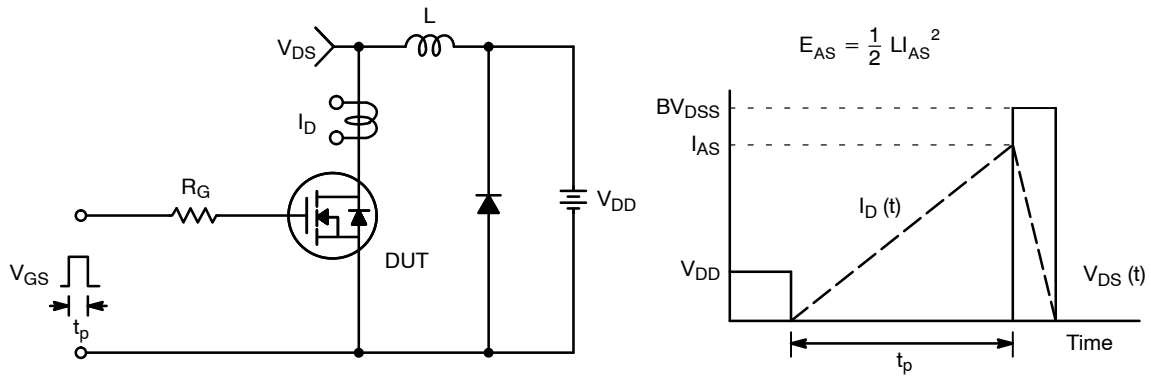
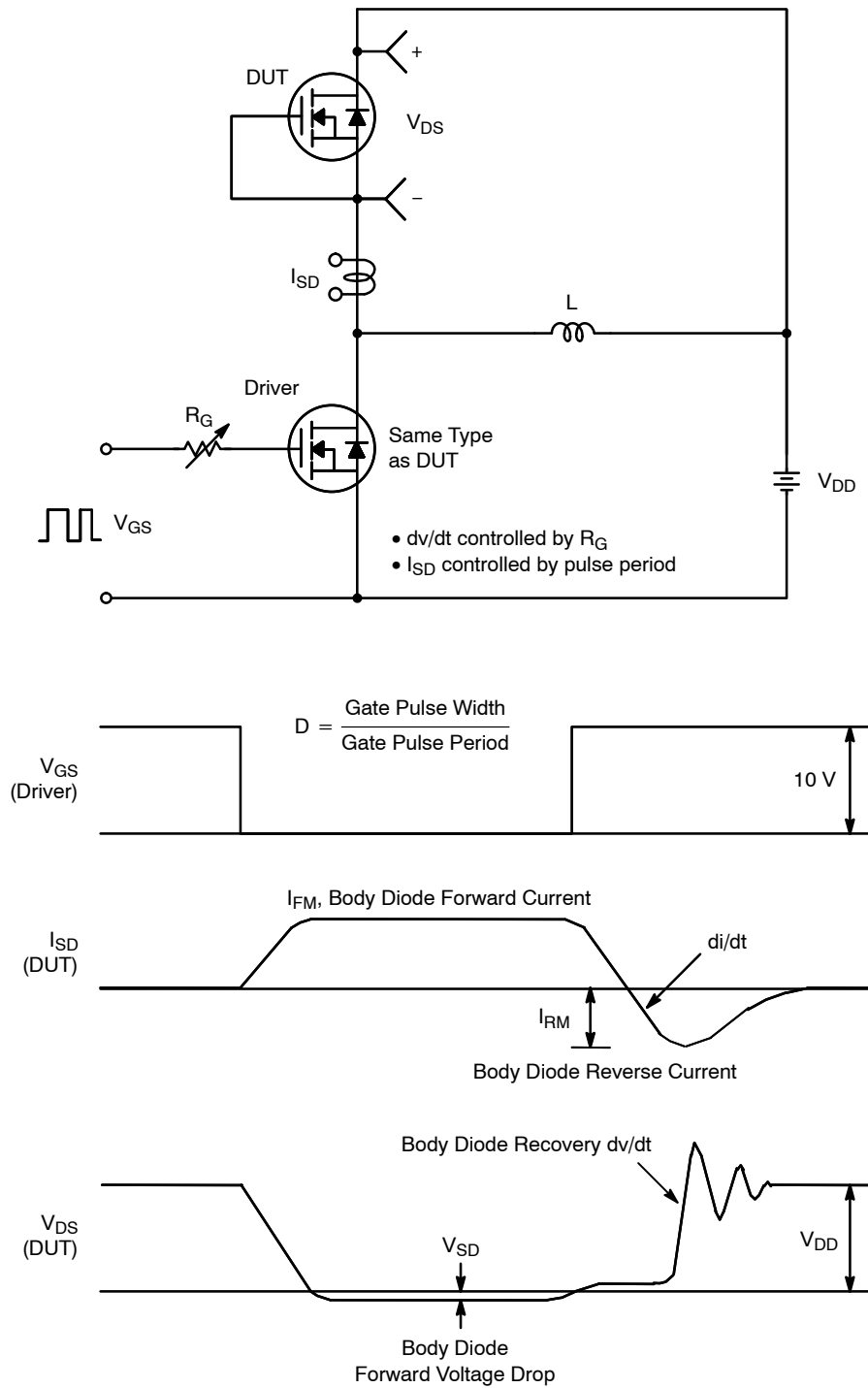


Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms

# FDPF035N06B-F154



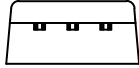
**Figure 17. Peak Recovery  $dv/dt$  Test Circuit & Waveforms**





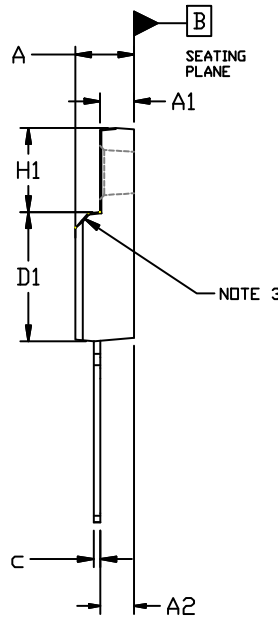
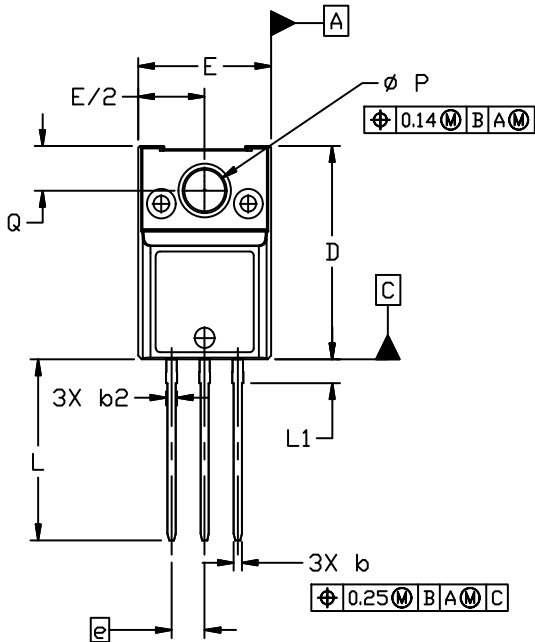
**TO-220 FULLPACK, 3-LEAD (ULTRA NARROW LEAD)**  
 CASE 221BN  
 ISSUE A

DATE 07 MAY 2021



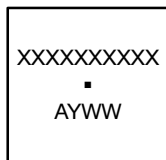
NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. CONTOUR UNCONTROLLED IN THIS AREA.
4. DIMENSIONS EXCLUDE BURRS, MOLD FLASH, AND TIE BAR PROTRUSIONS.



| DIM | MILLIMETERS |       |       |
|-----|-------------|-------|-------|
|     | MIN.        | NOM.  | MAX.  |
| A   | 4.60        | 4.70  | 4.80  |
| A1  | 2.50        | 2.60  | 2.70  |
| A2  | 2.47        | 2.57  | 2.67  |
| b   | 0.56        | 0.63  | 0.69  |
| b2  | ---         | ---   | 0.90  |
| c   | 0.46        | 0.53  | 0.59  |
| D   | 15.80       | 16.00 | 16.20 |
| D1  | 9.58        | 9.68  | 9.78  |
| E   | 10.00       | 10.20 | 10.40 |
| e   | 2.54 BSC    |       |       |
| H1  | 6.32 REF    |       |       |
| L   | 13.45       | 13.60 | 13.75 |
| L1  | 1.70        | 1.80  | 1.90  |
| P   | 3.00        | 3.10  | 3.20  |
| Q   | 3.25        | 3.35  | 3.45  |

**GENERIC MARKING DIAGRAM\***



- XXXX = Specific Device Code
- A = Assembly Location
- Y = Year
- WW = Work Week
- = Pb-Free Package

\*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.

|                         |  |  |
|-------------------------|--|--|
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| <b>DESCRIPTION:</b>     | <b>TO-220 FULLPACK, 3-LEAD (ULTRA NARROW LEAD)</b> | <b>PAGE 1 OF 1</b>   |

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