

# MOSFET – N-Channel, POWER trench®

100 V, 75 A, 9 mΩ

FDP090N10

## Description

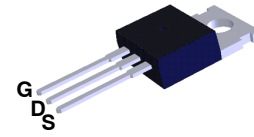
This N-Channel MOSFET is produced using onsemi's advance POWER trench process that has been tailored to minimize the on-state resistance while maintaining superior switching performance.

## Features

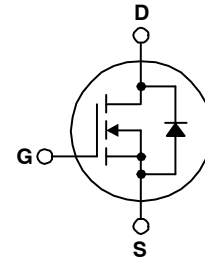
- $R_{DS(on)} = 7.2 \text{ m}\Omega$  (Typ) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 75 \text{ A}$
- Fast Switching Speed
- Low Gate Charge
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

## Applications

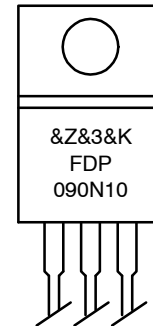
- Synchronous Rectification for ATX / Server / Telecom PSU
- Battery Protection Circuit
- Motor Drives and Uninterruptible Power Supplies
- Micor Solar Inverter



TO-220-3LD  
CASE 340AT



## MARKING DIAGRAM



|           |                                     |
|-----------|-------------------------------------|
| &Z        | = Assembly Plant Code               |
| &3        | = 3-Digit Date Code                 |
| &K        | = 2-Digit Lot Run Traceability Code |
| FDP090N10 | = Specific Device Code              |

## ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

# FDP090N10

## MOSFET MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

| Symbol         | Parameter  |                                       | FDP090N10       | Unit                |
|----------------|--|---------------------------------------|-----------------|---------------------|
| $V_{DSS}$      | Drain to Source Voltage  |                                       | 100             | V                   |
| $V_{GSS}$      | Gate to Source Voltage   |                                       | $\pm 20$        | V                   |
| $I_D$          | Drain Current  | – Continuous $T_C = 85^\circ\text{C}$ | 75              | A                   |
| $I_{DM}$       | Drain Current  | – Pulsed (Note 1)                     | 300             | A                   |
| $E_{AS}$       | Single Pulse Avalanche Energy (Note 2)                               |                                       | 309             | mJ                  |
| $I_{AR}$       | Avalanche Current (Note 1)   |                                       | 75              | A                   |
| $E_{AR}$       | Repetitive Avalanche Energy (Note 1)                                 |                                       | 20.8            | mJ                  |
| $dv/dt$        | Peak Diode Recovery $dv/dt$ (Note 3)                                 |                                       | 5.6             | V/ns                |
| $P_D$          | Power Dissipation  | $T_C = 25^\circ\text{C}$              | 208             | W                   |
|                |  | – Derate Above $25^\circ\text{C}$     | 1.39            | W/ $^\circ\text{C}$ |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range                     |                                       | $-55$ to $+175$ | $^\circ\text{C}$    |
| $T_L$          | Maximum Lead Temperature for Soldering, 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.

## THERMAL CHARACTERISTICS

| Symbol          | Parameter                                    | FDP090N10 | Unit                      |
|-----------------|--|-----------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max    | 0.72      | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient, Max | 62.5      |                           |

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

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

### OFF CHARACTERISTICS

|                                      |   |   |     |     |           |                     |
|--------------------------------------|---|---|-----|-----|-----------|---------------------|
| $BV_{DSS}$                           | Drain to Source Breakdown Voltage         | $I_D = 250 \mu\text{A}, V_{GS} = 0 \text{ V}, T_C = 25^\circ\text{C}$   | 100 | –   | –         | V                   |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$              | –   | 0.1 | –         | V/ $^\circ\text{C}$ |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{DS} = 100 \text{ V}, V_{GS} = 0 \text{ V}$                          | –   | –   | 1         | $\mu\text{A}$       |
|                                      |   | $V_{DS} = 100 \text{ V}, V_{GS} = 0 \text{ V}, T_C = 150^\circ\text{C}$ | –   | –   | 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               | $V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$      | 2.5 | 3.5 | 4.5 | V          |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 10 \text{ V}, I_D = 75 \text{ A}$   | –   | 7.2 | 9   | m $\Omega$ |
| $g_{FS}$     | Forward Transconductance             | $V_{DS} = 10 \text{ V}, I_D = 37.5 \text{ A}$ | –   | 100 | –   | S          |

# FDP090N10

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

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

### DYNAMIC CHARACTERISTICS

|           |                              |   |   |      |      |    |
|-----------|------------------------------|---|---|------|------|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | – | 6185 | 8225 | pF |
| $C_{oss}$ | Output Capacitance           |   | – | 585  | 775  | pF |
| $C_{rss}$ | Reverse Transfer Capacitance |   | – | 235  | 355  | pF |

### SWITCHING CHARACTERISTICS

|              |                               |   |   |     |     |    |
|--------------|-------------------------------|---|---|-----|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = 50\text{ V}, I_D = 75\text{ A},$<br>$V_{GS} = 10\text{ V}, R_G = 25\ \Omega$ (Note 4) | – | 107 | 224 | ns |
| $t_r$        | Turn-On Rise Time             |   | – | 322 | 655 |    |
| $t_{d(off)}$ | Turn-Off Delay Time           |   | – | 166 | 342 |    |
| $t_f$        | Turn-Off Fall Time            |   | – | 149 | 309 |    |
| $Q_{g(TOT)}$ | Total Gate Charge at 10 V     | $V_{DS} = 50\text{ V}, I_D = 75\text{ A}, V_{GS} = 10\text{ V}$ (Note 4)                        | – | 89  | 116 | nC |
| $Q_{gs}$     | Gate to Source Gate Charge    |   | – | 37  | –   |    |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |   | – | 22  | –   |    |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|          |  |   |   |     |      |    |
|----------|--|---|---|-----|------|----|
| $I_S$    | Maximum Continuous Drain to Source Diode Forward Current |   | – | –   | 75   | A  |
| $I_{SM}$ | Maximum Pulsed Drain to Source Diode Forward Current     |   | – | –   | 300  | A  |
| $V_{SD}$ | Drain to Source Diode Forward Voltage                    | $V_{GS} = 0\text{ V}, I_{SD} = 75\text{ A}$                                     | – | –   | 1.25 | V  |
| $t_{rr}$ | Reverse Recovery Time                                    | $V_{GS} = 0\text{ V}, I_{SD} = 75\text{ A}, di_F/dt = 100\text{ A}/\mu\text{s}$ | – | 73  | –    | ns |
| $Q_{rr}$ | Reverse Recovery Charge                                  |   | – | 166 | –    | 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.  $L = 0.11\text{ mH}$ ,  $I_{AS} = 75\text{ A}$ ,  $V_{DD} = 50\text{ V}$ ,  $R_G = 25\ \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 75\text{ A}$ ,  $di/dt \leq 200\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature typical characteristics.

## TYPICAL PERFORMANCE CHARACTERISTICS

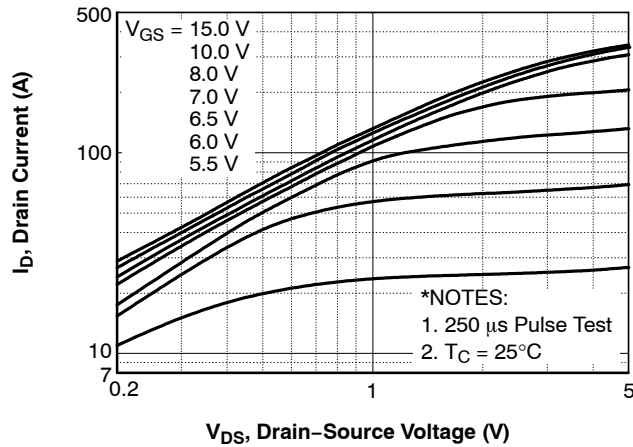


Figure 1. On-Region Characteristics

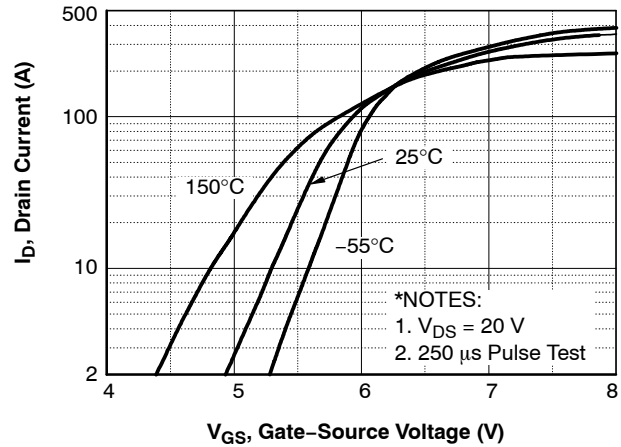


Figure 2. Transfer Characteristics

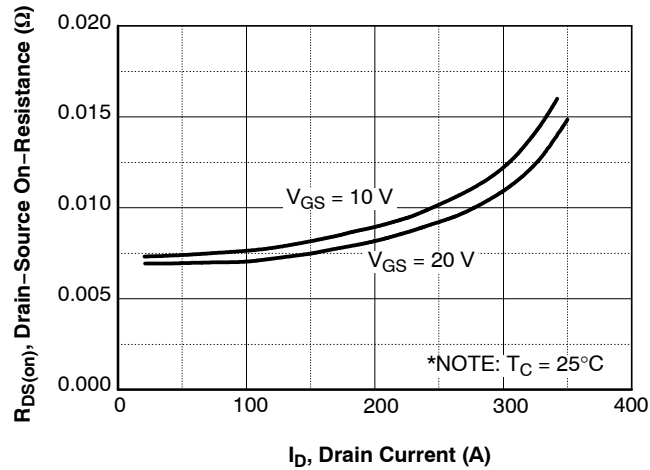


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

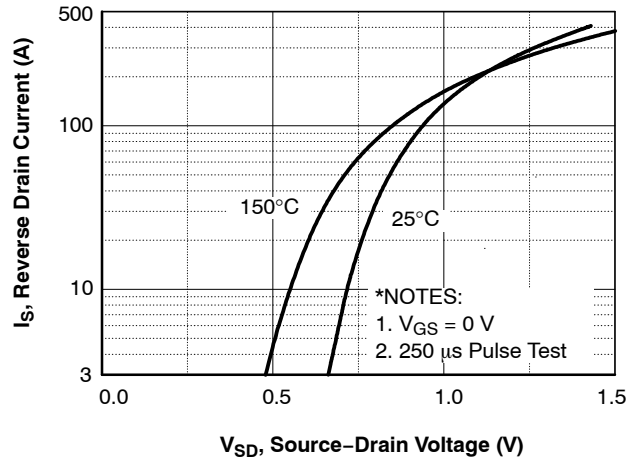


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

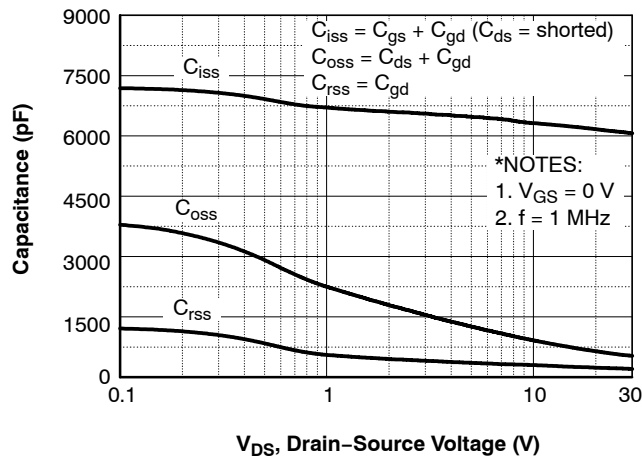


Figure 5. Capacitance Characteristics

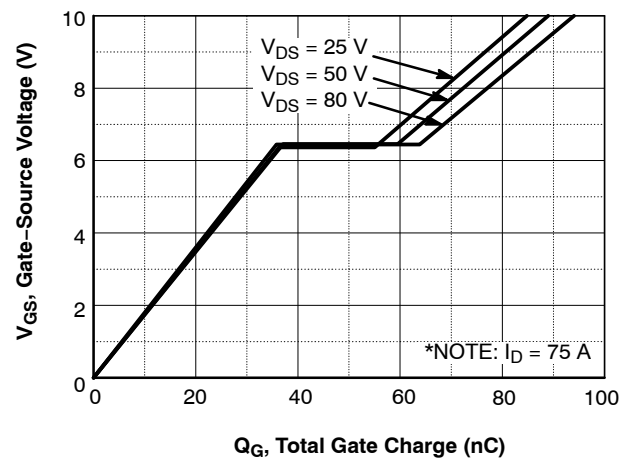
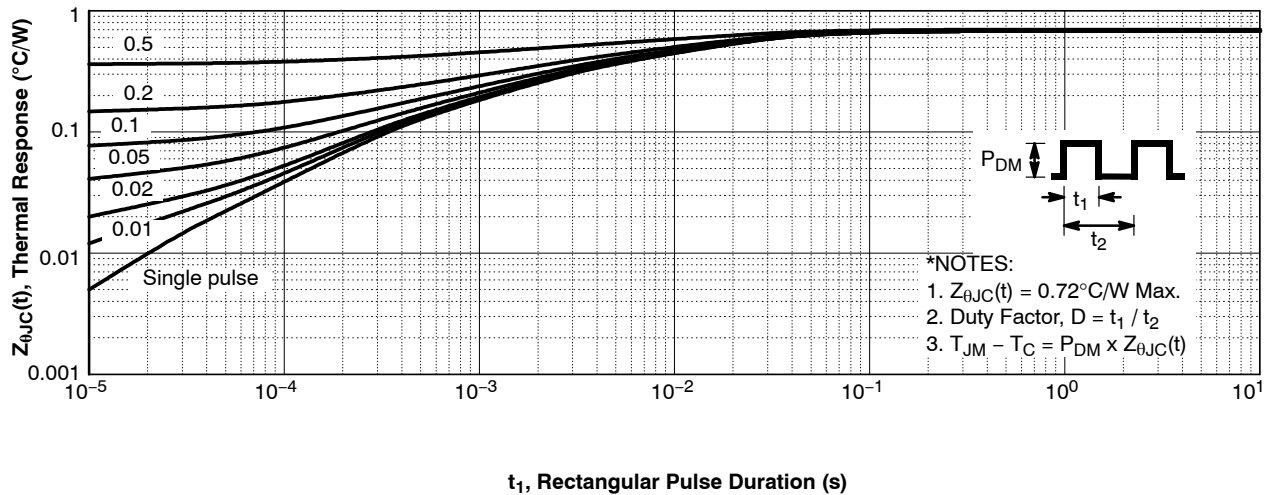
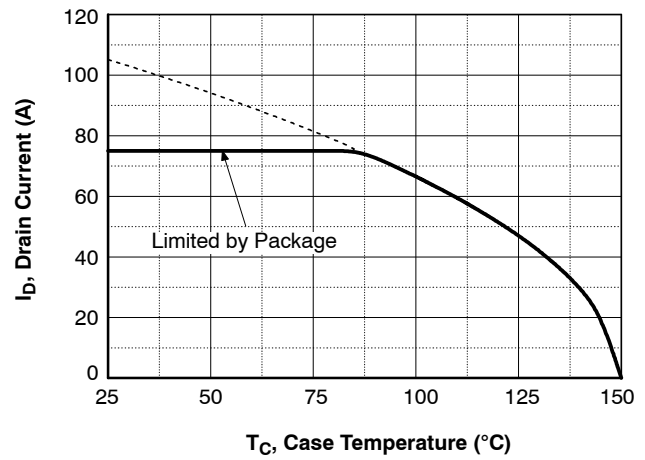
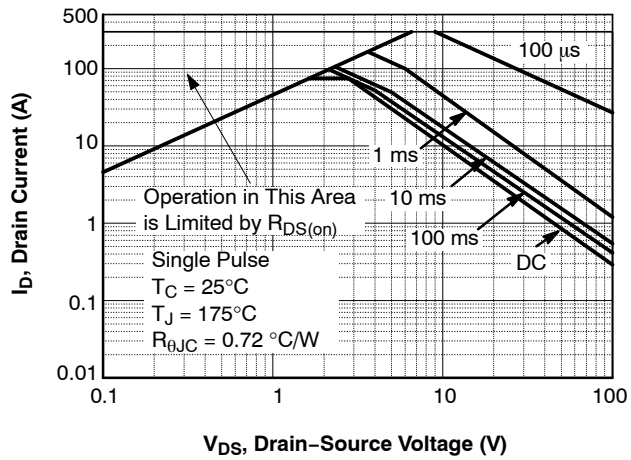
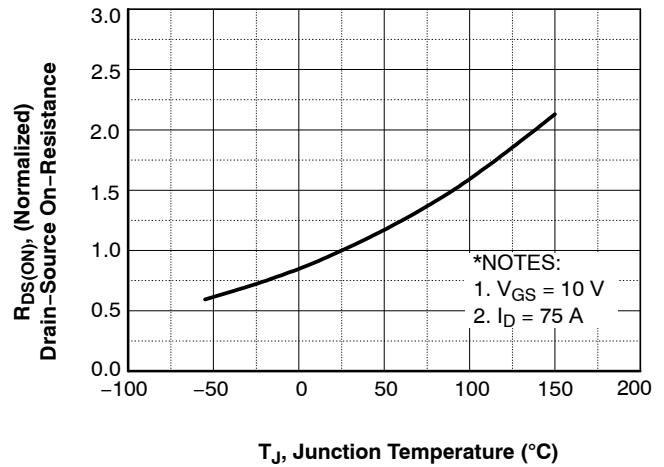
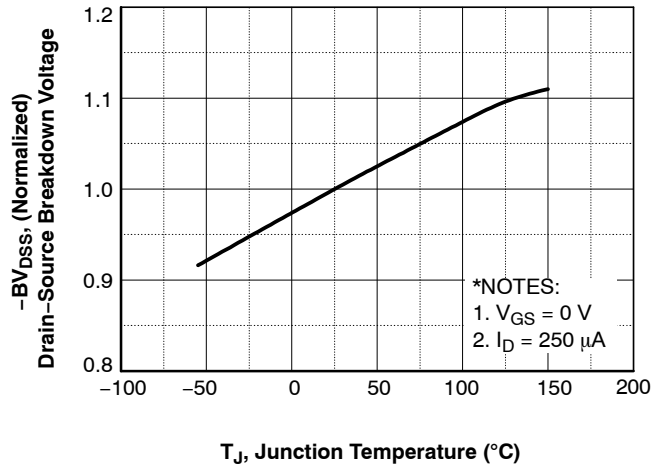


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (continued)



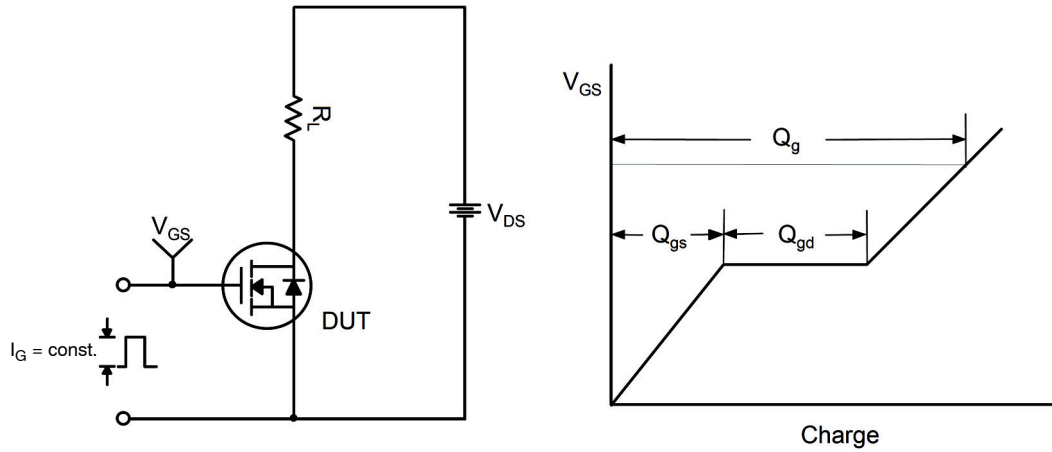


Figure 12. Gate Charge Test Circuit & Waveform

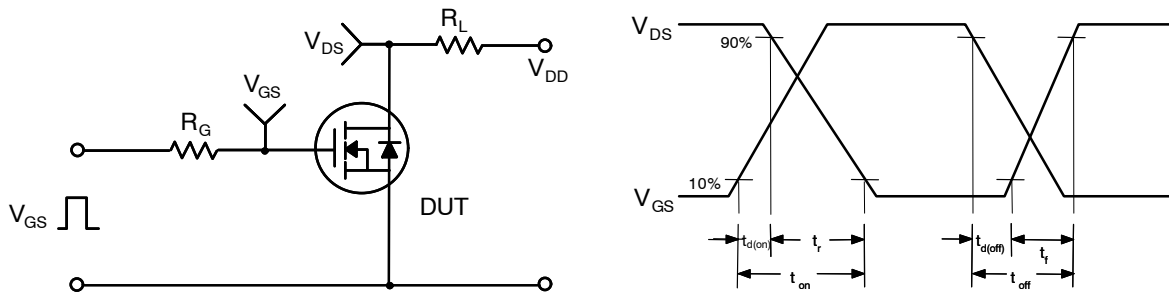


Figure 13. Resistive Switching Test Circuit & Waveforms

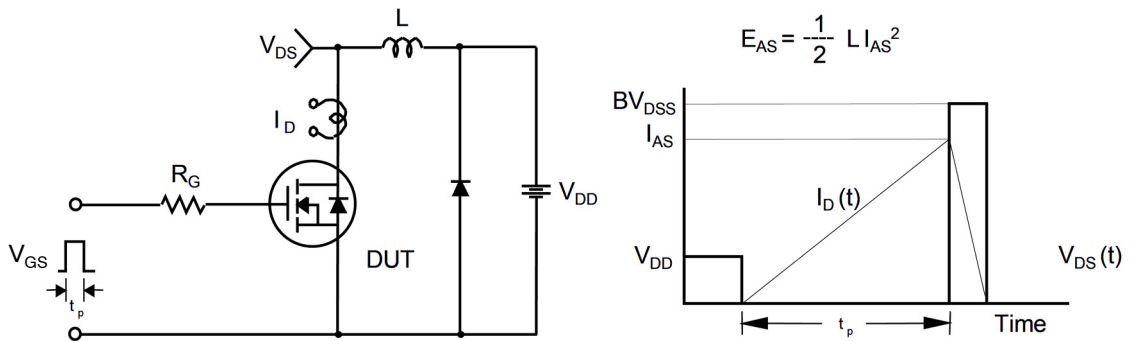


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

## FDP090N10

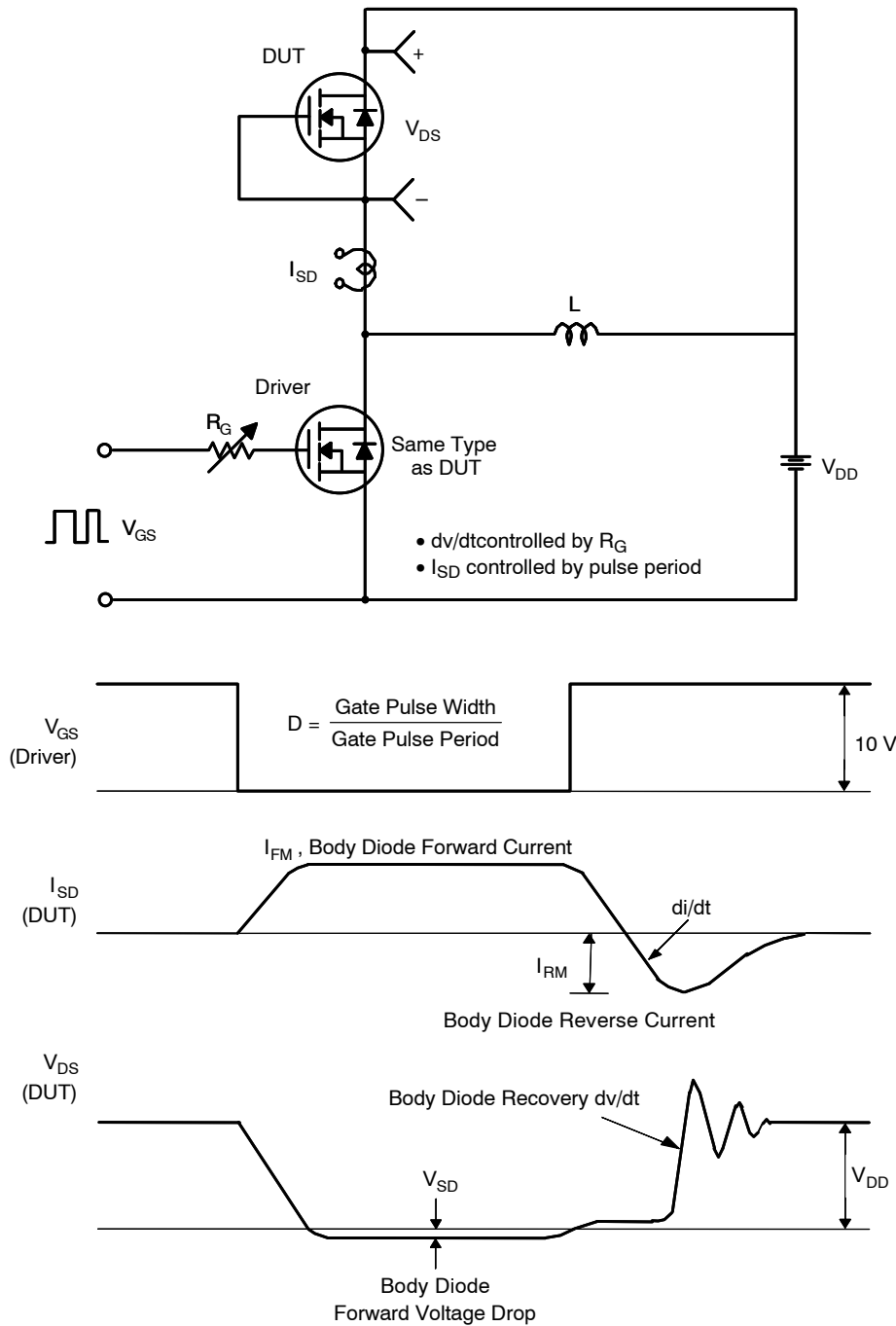
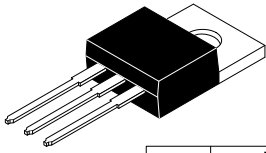


Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

### PACKAGE MARKING AND ORDERING INFORMATION

| Part Number | Top Mark  | Package | Shipping         |
|-------------|-----------|---------|------------------|
| FDP090N10   | FDP090N10 | TO-220  | 800 Units / Tube |

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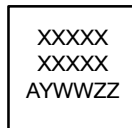
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CASE 340AT  
ISSUE B

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°    |

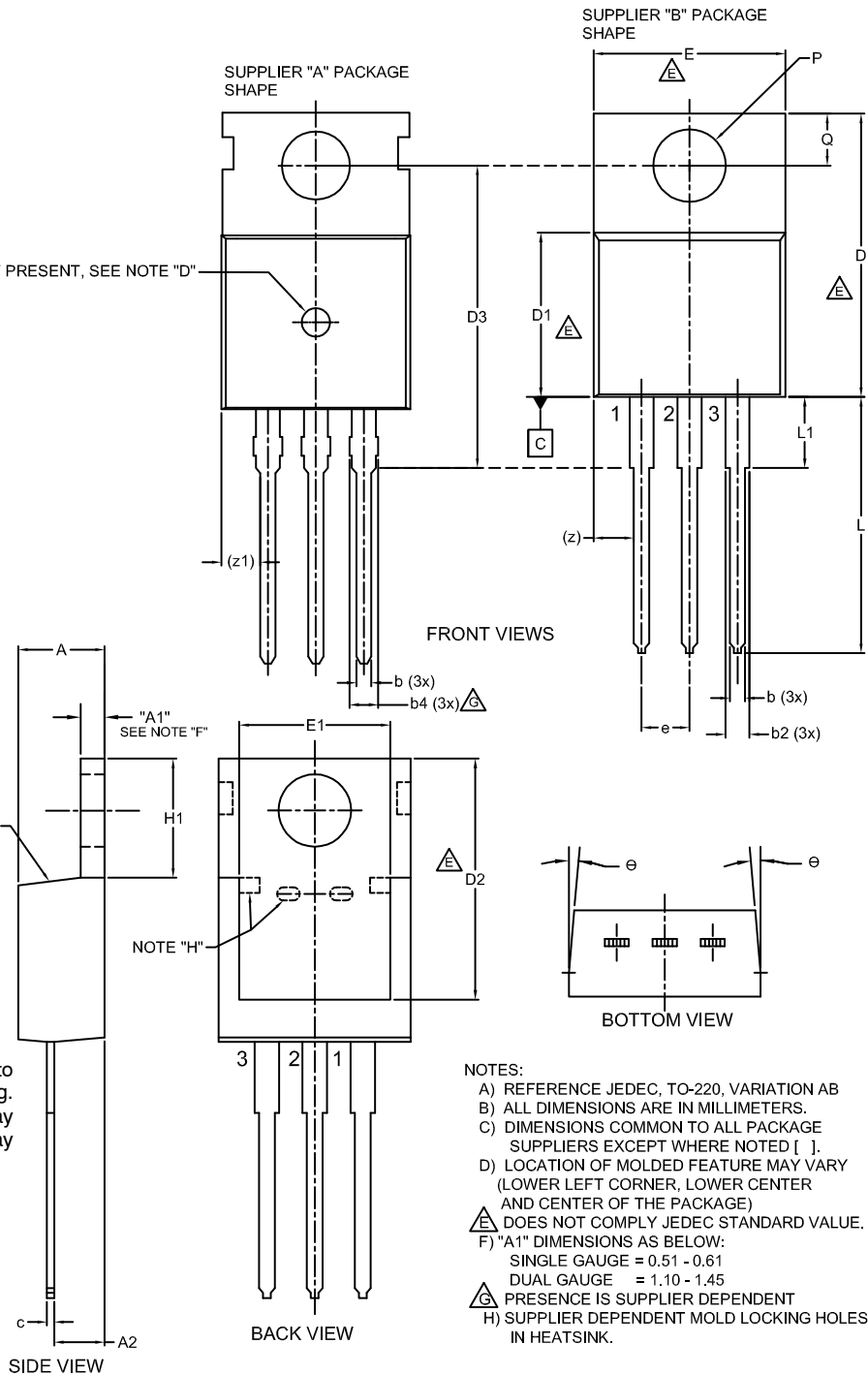
IF PRESENT, SEE NOTE "D"

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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