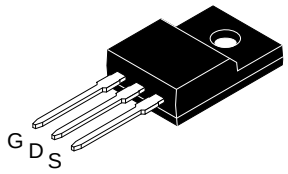
# MOSFET – N-Channel, POWERTRENCH®

## 150 V, 27.4 A, 19 mΩ

# FDPF190N15A

| $V_{DSS}$ | $R_{DS(on)}$ MAX | $I_D$ MAX |
|---|---|---|
| 150 V | 19 mΩ @ 10 V | 27.5 A |




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

### 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.

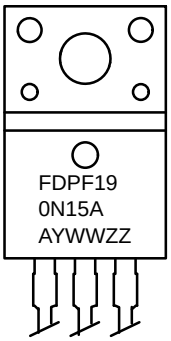
### Features

- $R_{DS(on)}$ = 14.7 mΩ (Typ.) @ $V_{GS}$ = 10 V, $I_D$ = 27.4 A
- Low Gate Charge, $Q_G$ = 31 nC (Typ.)
- Low $C_{rss}$ (Typ. 56 pF)
- Fast Switching Speed
- Improved dv/dt Capability
- RoHS Compliant

### Applications

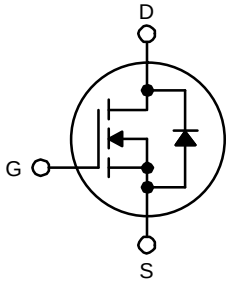
- Consumer Appliances
- LED TV
- Synchronous Rectification for ATX / Sever / Telecom PSU
- Uninterruptible Power Supply
- Micro Solar Inverter

### MARKING DIAGRAM




| | |
|---|---|
| FDPF190N15A | = Specific Device Code |
| A | = Assembly Location |
| YWW | = Date Code (Year & Week) |
| ZZ | = Assembly Lot |

### N−CHANNEL MOSFET




### ORDERING INFORMATION

| Part Number | Package | Shipping |
|---|---|---|
| FDPF190N15A | TO−220F | 1000 Units / Tube |

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**MOSFET MAXIMUM RATINGS** ($T_C$ = 25°C, unless otherwise noted)

| Symbol | Parameter | | FDPF190N15A | Unit |
|---|---|---|---|---|
| $V_{DSS}$ | Drain to Source Voltage | | 150 | V |
| $V_{GSS}$ | Gate to Source Voltage | − DC | ±20 | V |
| | | − AC (f > 1 Hz) | ±30 | |
| $I_D$ | Drain Current | − Continuous ($T_C$ = 25°C) | 27.4 | A |
| | | − Continuous ($T_C$ = 100°C) | 17.4 | |
| $I_{DM}$ | Drain Current | − Pulsed (Note 1) | 110 | A |
| $E_{AS}$ | Single Pulsed Avalanche Energy (Note 2) | | 261 | mJ |
| dv/dt | Peak Diode Recovery dv/dt (Note 3) | | 6.0 | V/ns |
| $P_D$ | Power Dissipation | ($T_C$ = 25°C) | 33 | W |
| | | − Derate Above 25°C | 0.26 | W/°C |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | | −55 to +150 | °C |
| $T_L$ | 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 = 0.33 mH, $I_{AS}$ = 29 A, $R_G$ = 25 Ω, starting $T_J$ = 25°C.
3. $I_{SD}$ ≤ 27.4 A, di/dt ≤ 200 A/μs, $V_{DD}$ ≤ $BV_{DSS}$, starting $T_J$ = 25°C.

**THERMAL CHARACTERISTICS**

| Symbol | Parameter | FDPF190N15A | Unit |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max. | 3.3 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient, Max. | 62.5 | |

**ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C unless otherwise noted)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $I_D$ = 250 μA, $V_{GS}$ = 0 V | 150 | – | – | V |
| $\Delta BV_{DSS}$ / $\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250 μA, Referenced to 25°C | – | 0.14 | – | V/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 120 V, $V_{GS}$ = 0 V | – | – | 1 | μA |
| | | $V_{DS}$ = 120 V, $T_C$ = 150°C | – | – | 500 | |
| $I_{GSS}$ | Gate to Body Leakage Current | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 V | – | – | ±100 | nA |
| **ON CHARACTERISTICS** | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | 2.0 | – | 4.0 | V |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS}$ = 10 V, $I_D$ = 27.4 A | – | 14.7 | 19.0 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 10 V, $I_D$ = 27.4 A | – | 64 | – | S |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 25 V, $V_{GS}$ = 0 V, f = 1 MHz | – | 2020 | 2685 | pF |
| $C_{oss}$ | Output Capacitance | | – | 700 | 930 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | – | 56 | 85 | pF |
| $C_{oss(er)}$ | Energy Related Output Capacitance | $V_{DS}$ = 75 V, $V_{GS}$ = 0 V | – | 252 | – | pF |
| $Q_{g(tot)}$ | Total Gate Charge at 10 V | $V_{DS}$ = 120 V, $I_D$ = 27.4 A, $V_{GS}$ = 10 V (Note 4) | – | 30 | 39 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | | – | 8.8 | – | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | | – | 7.3 | – | nC |
| ESR | Equivalent Series Resistance (G−S) | f = 1 MHz | – | 1.5 | – | Ω |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| $t_{d(on)}$ | Turn−On Delay Time | $V_{DD}$ = 75 V, $I_D$ = 27.4 A, $V_{GS}$ = 10 V, $R_G$ = 4.7 Ω (Note 4) | – | 18 | 46 | ns |
| $t_r$ | Turn−On Rise Time | | – | 16 | 42 | ns |
| $t_{d(off)}$ | Turn−Off Delay Time | | – | 32 | 74 | ns |
| $t_f$ | Turn−Off Fall Time | | – | 8 | 26 | ns |
| **DRAIN−SOURCE DIODE CHARACTERISTICS** | | | | | | |
| $I_S$ | Maximum Continuous Drain to Source Diode Forward Current | | – | – | 27.4 | A |
| $I_{SM}$ | Maximum Pulsed Drain to Source Diode Forward Current | | – | – | 110 | A |
| $V_{SD}$ | Drain to Source Diode Forward Voltage | $V_{GS}$ = 0 V, $I_{SD}$ = 27.4 A | – | – | 1.3 | V |
| $t_{rr}$ | Reverse Recovery Time | $V_{GS}$ = 0 V, $I_{SD}$ = 27.4 A, $dI_F/dt$ = 100 A/μs, $V_{DD}$ = 120 V | – | 76 | – | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | – | 0.18 | – | μC |

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

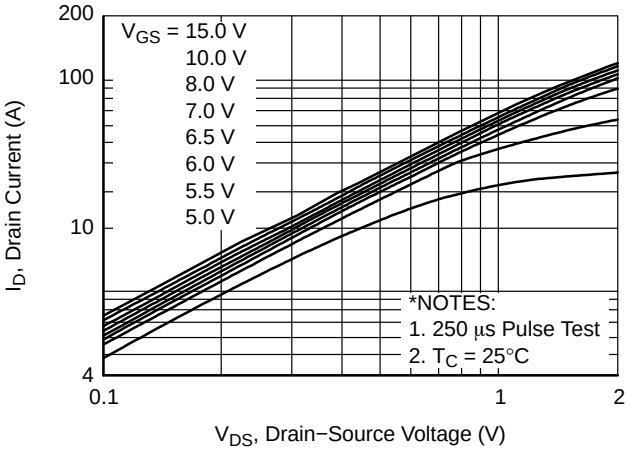


**Figure 1. On−Region Characteristics**

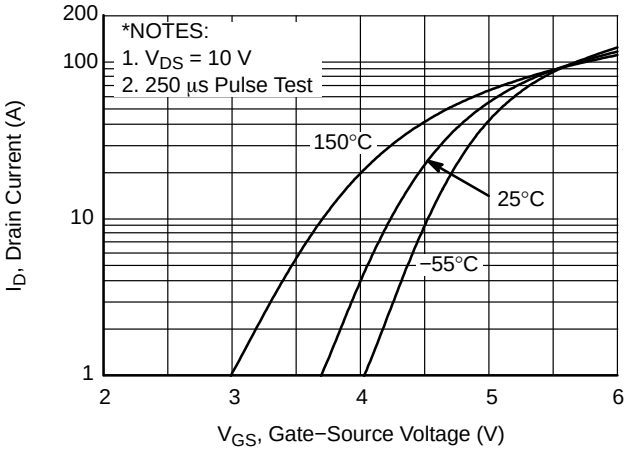


**Figure 2. Transfer Characteristics**

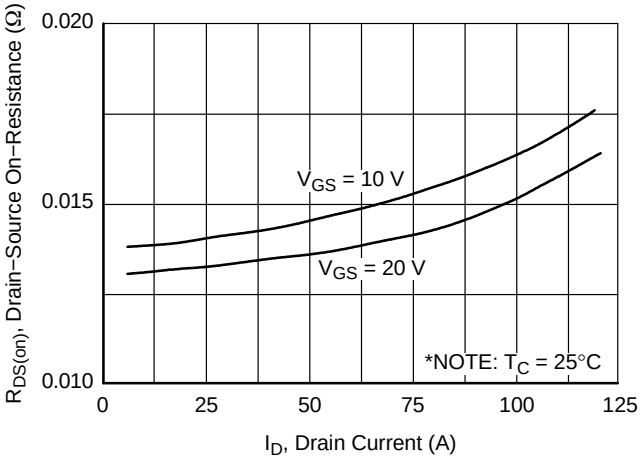


**Figure 3. On−Resistance Variation vs. Drain Current and Gate Voltage**

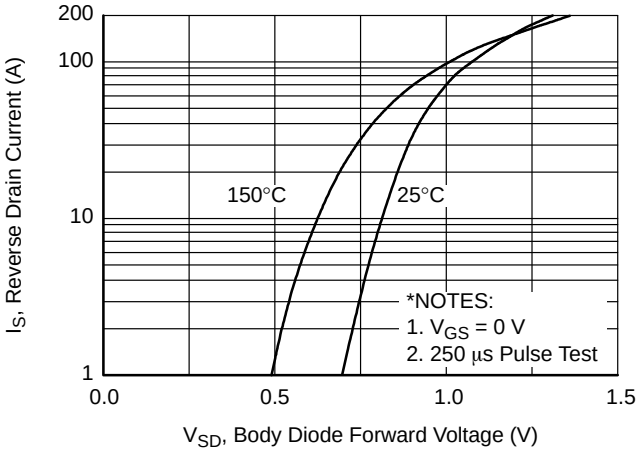


**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**

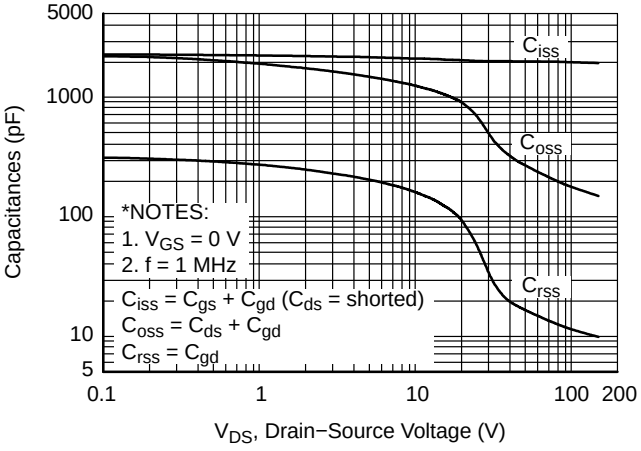


**Figure 5. Capacitance Characteristics**

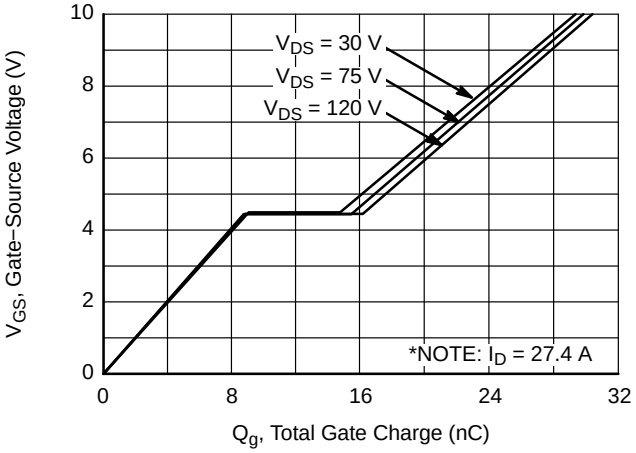


**Figure 6. Gate Charge Characteristics**

## TYPICAL PERFORMANCE CHARACTERISTICS (CONTINUED)

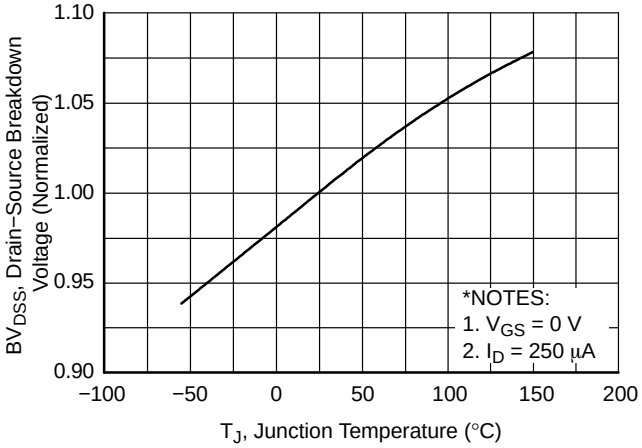


**Figure 7. Breakdown Voltage Variation vs. Temperature**

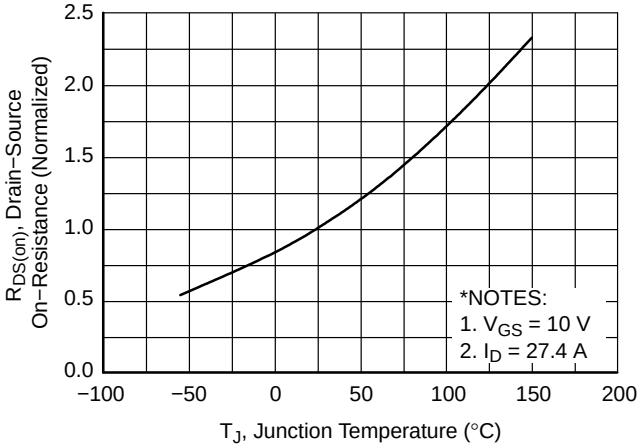


**Figure 8. On−Resistance Variation vs. Temperature**

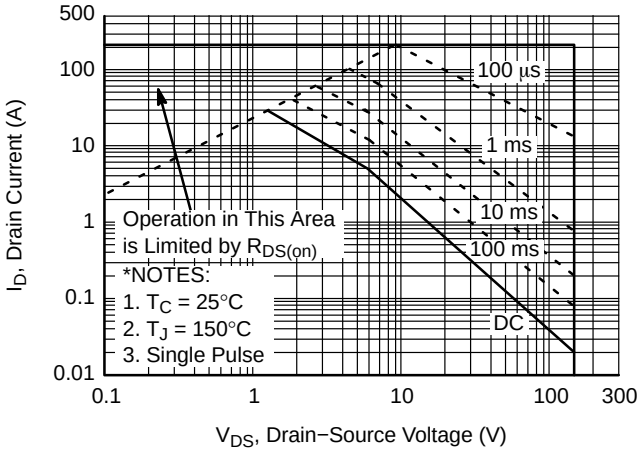


**Figure 9. Maximum Safe Operating Area**

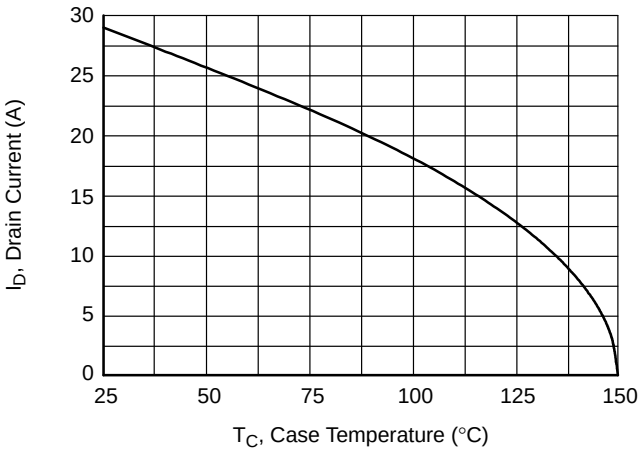


**Figure 10. Maximum Drain Current vs. Case Temperature**

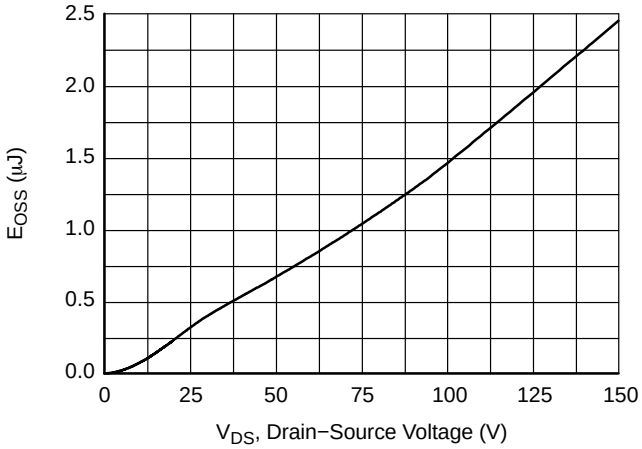


**Figure 11. $E_{OSS}$ vs. Drain to Source Voltage**

## TYPICAL PERFORMANCE CHARACTERISTICS (CONTINUED)

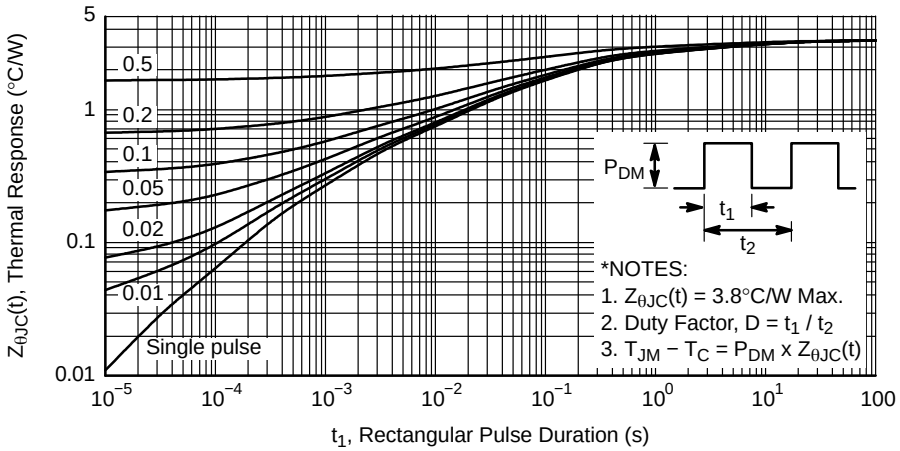


**Figure 12. Transient Thermal Response Curve**

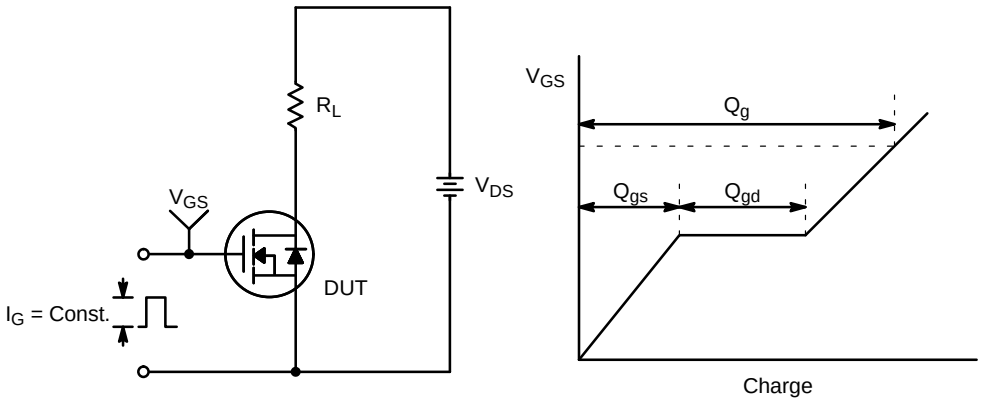


**Figure 13. Gate Charge Test Circuit & Waveform**

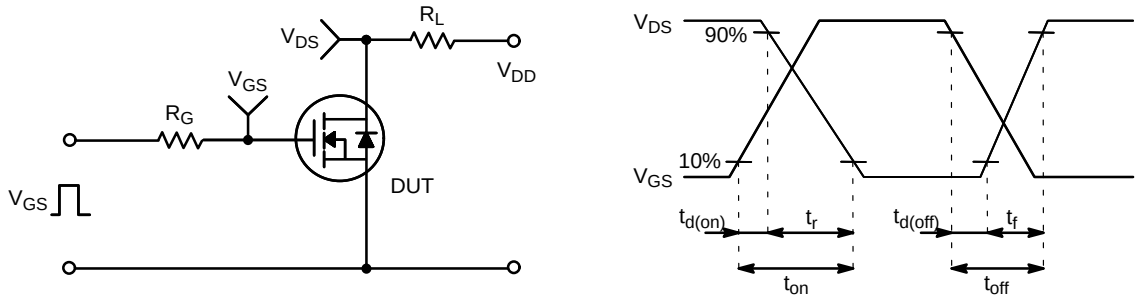


**Figure 14. Resistive Switching Test Circuit & Waveforms**

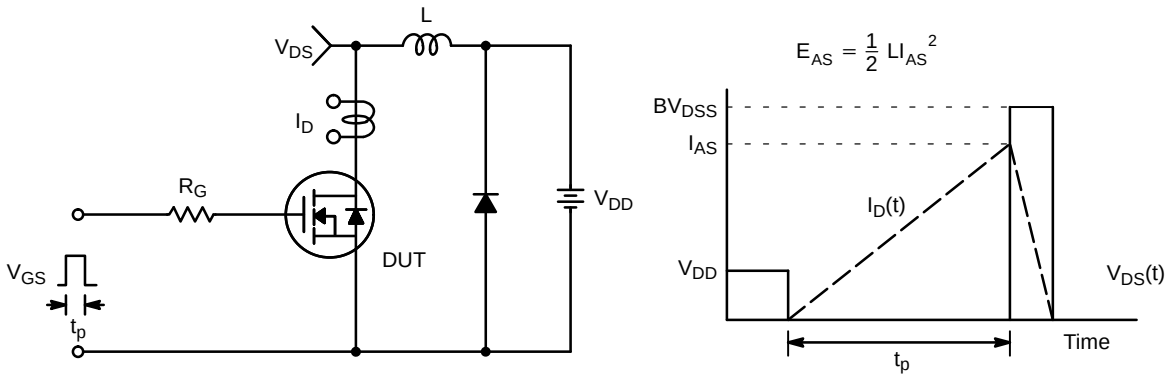


**Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms**

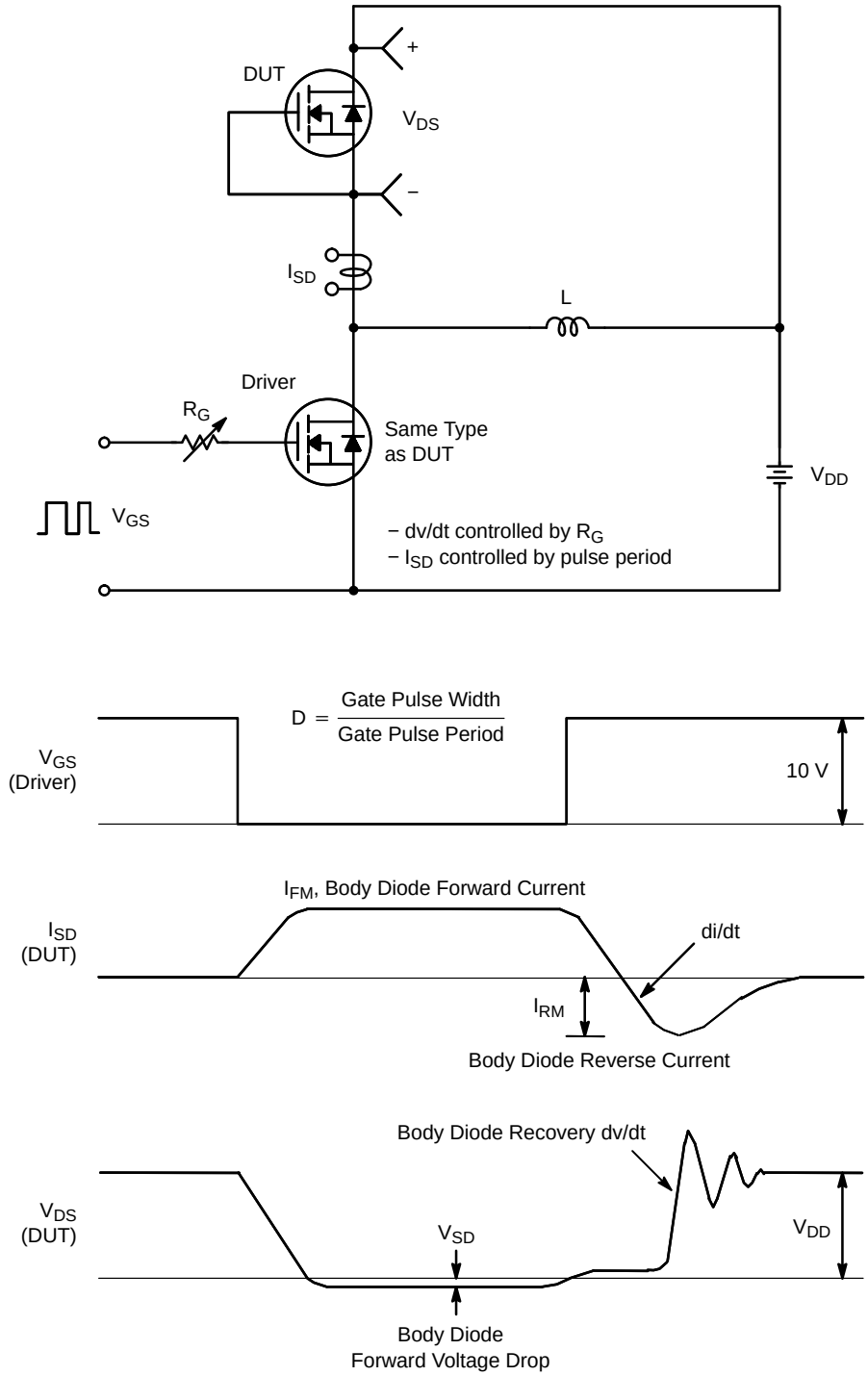


**Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms**

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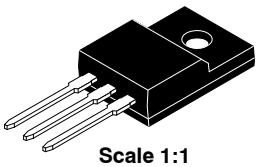
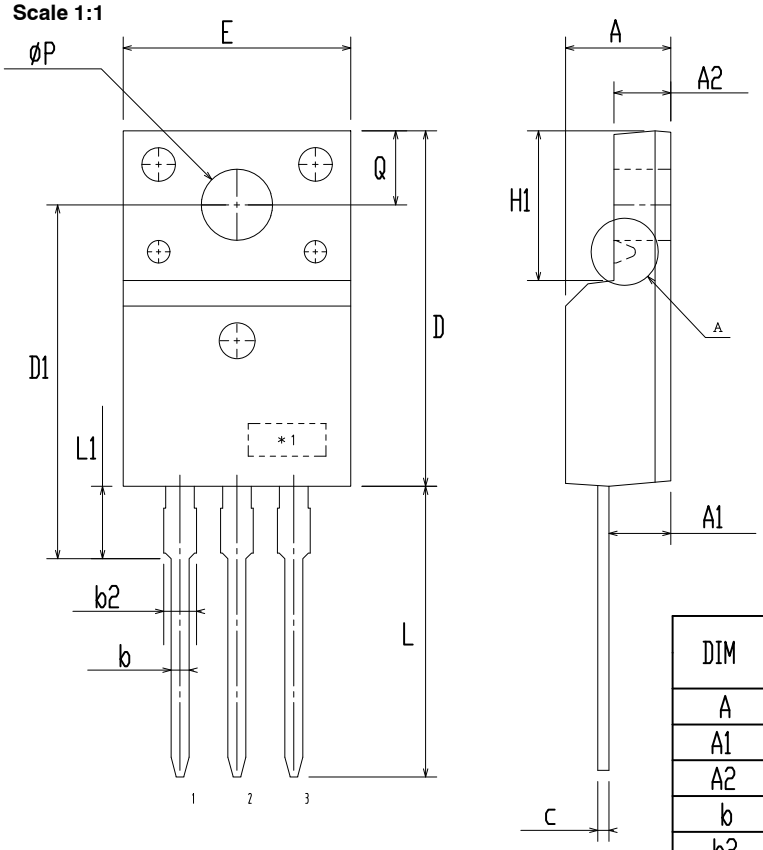
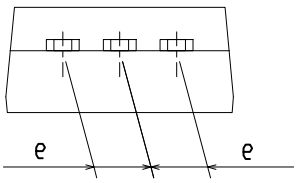
**TO−220 Fullpack, 3−Lead / TO−220F−3SG**
CASE 221AT
ISSUE B

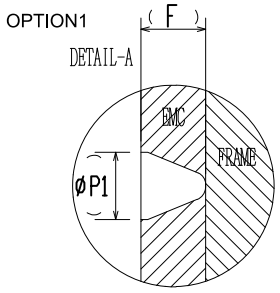
DATE 19 JAN 2021



**Scale 1:1**




| DIM | MILLIMITERS | | |
|---|---|---|---|
| | 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 PROTRUCSIONS.
C. OPTION 1 - WITH SUPPORT PIN HOLE
OPTION 2 - NO SUPPORT PIN HOLE

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