TAVAKOL ELECTRONIC
توکل الکترونیک
مرجع تخصصی تأمین قطعات الکترونیکی اورجینال
این دیتاشیت توسط توکل الکترونیک تهیه و ارائه شده است.
جهت مشاهده قیمت، موجودی و ثبت سفارش این قطعه به وب‌سایت توکل الکترونیک مراجعه فرمایید.
مشاهده قیمت و خرید
برای خرید و مشاهده سایر محصولات کلیک کنید

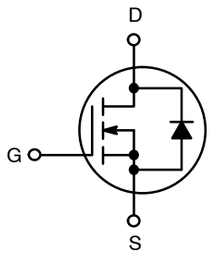
# MOSFET – N-Channel, SUPERFET® II
## 600 V, 20.2 A, 199 mΩ

# FCPF190N60-F154

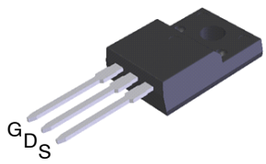
**ON Semiconductor®**

www.onsemi.com

| $V_{DSS}$ | $R_{DS(ON)}$ MAX | $I_D$ MAX |
|---|---|---|
| 600 V | 199 mΩ @ 10 V | 20.2 A |




**MOSFET**




**TO−220F Ultra Narrow Lead**
**CASE 221BN**

### Description

SUPERFET II MOSFET is ON Semiconductor's brand−new high voltage super−junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on−resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy. Consequently, SUPERFET II FAST MOSFET series helps minimize various power systems and improve system efficiency.

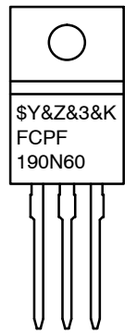
### Features

- 650 V @ $T_J$ = 150°C
- Typ. $R_{DS(on)}$ = 170 mΩ
- Ultra Low Gate Charge (Typ. $Q_g$ = 57 nC)
- Low Effective Output Capacitance (Typ. $C_{oss}$.eff = 160 pF)
- 100% Avalanche Tested
- These Devices are Pb−Free and are RoHS Compliant

### Applications

- Computing / Display Power Supplies
- Telecom / Server Power Supplies
- Industrial Power Supplies
- Lighting / Charger / Adapter

### MARKING DIAGRAM




| | |
|---|---|
| $Y | = ON Semiconductor Logo |
| &Z | = Assembly Plant Code |
| &3 | = Data Code (Year & Week) |
| &K | = Lot |
| FCPF190N60 | = Specific Device Code |

### ORDERING INFORMATION

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

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**ABSOLUTE MAXIMUM RATINGS** ($T_C$ = 25°C, Unless otherwise noted)

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $V_{DSS}$ | Drain to Source Voltage | | 600 | V |
| $V_{GSS}$ | Gate to Source Voltage | − DC | ±20 | V |
| | | − AC (f > 1 Hz) | ±30 | |
| $I_D$ | Drain Current | − Continuous ($T_C$ = 25°C) | 20.2* | A |
| | | − Continuous ($T_C$ = 100°C) | 12.7* | |
| $I_{DM}$ | Drain Current | − Pulsed (Note 1) | 60.6* | A |
| $E_{AS}$ | Single Pulsed Avalanche Energy (Note 2) | | 400 | mJ |
| $I_{AS}$ | Avalanche Current (Note 2) | | 4.0 | A |
| $E_{AR}$ | Repetitive Avalanche Energy (Note 1) | | 2.1 | mJ |
| dv/dt | Peak Diode Recovery dv/dt (Note 3) | | 20 | V/ns |
| | MOSFET dv/dt | | 100 | |
| $P_D$ | Power Dissipation | ($T_C$ = 25°C) | 39 | W |
| | | − Derate Above 25°C | 0.31 | W/°C |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | | −55 to +150 | °C |
| $T_L$ | Maximum Lead Temperature for Soldering Purpose, 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.

*Drain current limited by maximum junction temperature.

1. Repetitive rating: pulse width limited by maximum junction temperature.
2. $I_{AS}$ = 4 A, $V_{DD}$ = 50 V, $R_G$ = 25 Ω, starting $T_J$ = 25°C.
3. $I_{SD}$ ≤ 10 A, di/dt ≤ 200 A/μs, $V_{DD}$ ≤ $BV_{DSS}$, starting $T_J$ = 25°C.

**THERMAL CHARACTERISTICS**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max. | 3.2 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient, Max. | 62.5 | °C/W |

**PACKAGE MARKING AND ORDERING INFORMATION**

| Part Number | Top Marking | Package | Shipping |
|---|---|---|---|
| FCPF190N60−F154 | FCPF190N60 | TO−220F (Pb−Free) | 50 Units / Tube |

**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 | $V_{GS}$ = 0 V, $I_D$ = 10 mA, $T_J$ = 25°C | 600 | – | – | V |
| | | $V_{GS}$ = 0 V, $I_D$ = 10 mA, $T_J$ = 150°C | 650 | – | – | V |
| $\Delta BV_{DSS}$ / $\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 10 mA, Referenced to 25°C | – | 0.67 | – | V/°C |
| $BV_{DS}$ | Drain−Source Avalanche Breakdown Voltage | $V_{GS}$ = 0 V, $I_D$ = 20 A | – | 700 | – | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 480 V, $V_{GS}$ = 0 V | – | – | 10 | μA |
| | | $V_{DS}$ = 480 V, $T_C$ = 125°C | – | – | 10 | |
| $I_{GSS}$ | 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 | 2.5 | – | 3.5 | V |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS}$ = 10 V, $I_D$ = 10 A | – | 0.17 | 0.199 | Ω |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 20 V, $I_D$ = 10 A | – | 21 | – | S |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 25 V, $V_{GS}$ = 0 V, f = 1 MHz | – | 2220 | 2950 | pF |
| $C_{oss}$ | Output Capacitance | | – | 1630 | 2165 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | – | 85 | 128 | pF |
| $C_{oss}$ | Output Capacitance | $V_{DS}$ = 380 V, $V_{GS}$ = 0 V, f = 1 MHz | – | 42 | – | pF |
| $C_{oss\ (eff.)}$ | Effective Output Capacitance | $V_{DS}$ = 0 V to 480 V, $V_{GS}$ = 0 V | – | 160 | – | pF |
| $Q_{g(tot)}$ | Total Gate Charge at 10 V | $V_{DS}$ = 380 V, $I_D$ = 10 A, $V_{GS}$ = 10 V (Note 4) | – | 57 | 74 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | | – | 9 | – | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | | – | 21 | – | nC |
| ESR | Equivalent Series Resistance | f = 1 MHz | – | 1 | – | Ω |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 380 V, $I_D$ = 10 A, $V_{GS}$ = 10 V, $R_g$ = 4.7 Ω (Note 4) | – | 20 | 50 | ns |
| $t_r$ | Turn-On Rise Time | | – | 10 | 30 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | – | 64 | 138 | ns |
| $t_f$ | Turn-Off Fall Time | | – | 5 | 20 | ns |
| **SOURCE−DRAIN DIODE CHARACTERISTICS** | | | | | | |
| $I_S$ | Maximum Continuous Source to Drain Diode Forward Current | | – | – | 20.2 | A |
| $I_{SM}$ | Maximum Pulsed Source to Drain Diode Forward Current | | – | – | 60.6 | A |
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS}$ = 0 V, $I_{SD}$ = 10 A | – | – | 1.2 | V |
| $t_{rr}$ | Reverse Recovery Time | $V_{DD}$ = 400 V, $I_{SD}$ = 10 A, $dI_F/dt$ = 100 A/μs | – | 280 | – | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | – | 3.8 | – | 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

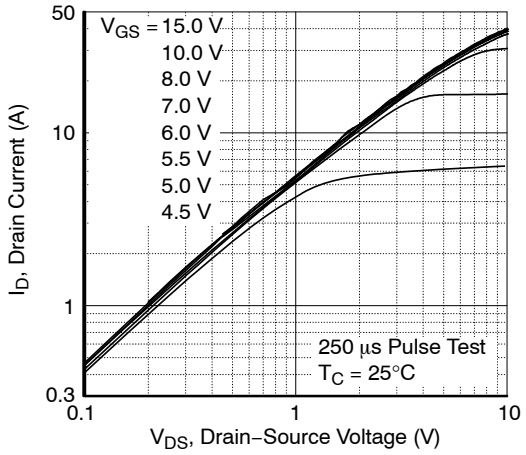


**Figure 1. On−Region Characteristics**

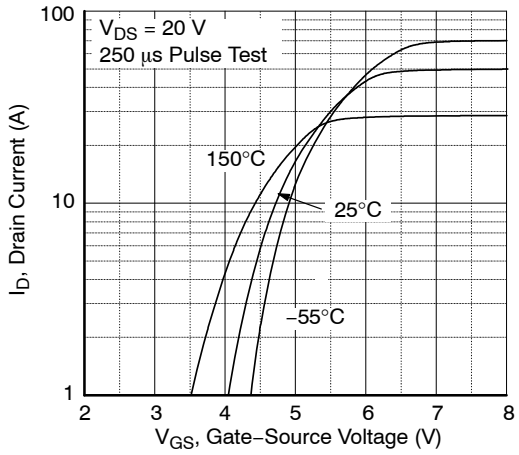


**Figure 2. Transfer Characteristics**

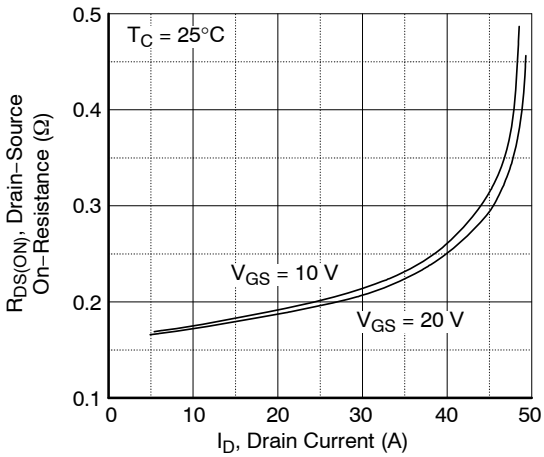


**Figure 3. On−Resistance Variation vs. Drain Current and Gate Voltage**

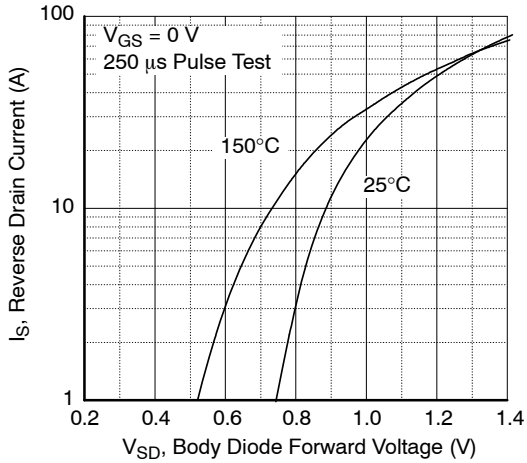


**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**

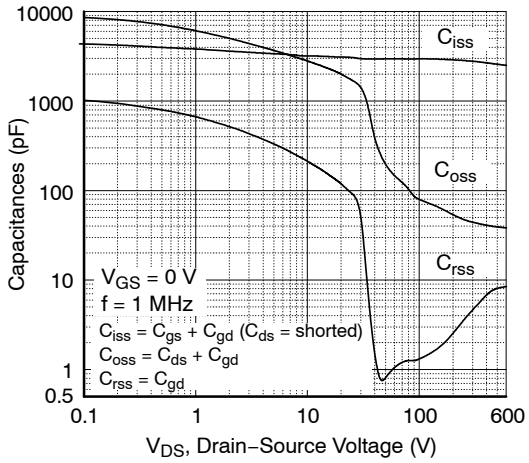


**Figure 5. Capacitance Characteristics**

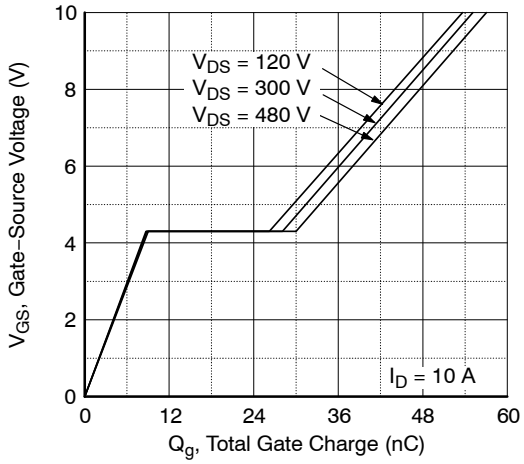


**Figure 6. Gate Charge Characteristics**

## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

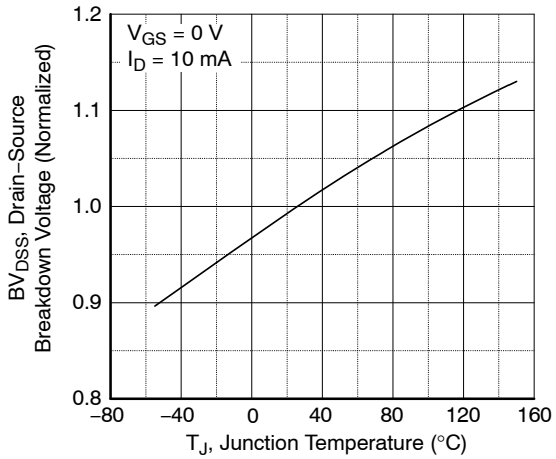


**Figure 7. Breakdown Voltage Variation vs. Temperature**

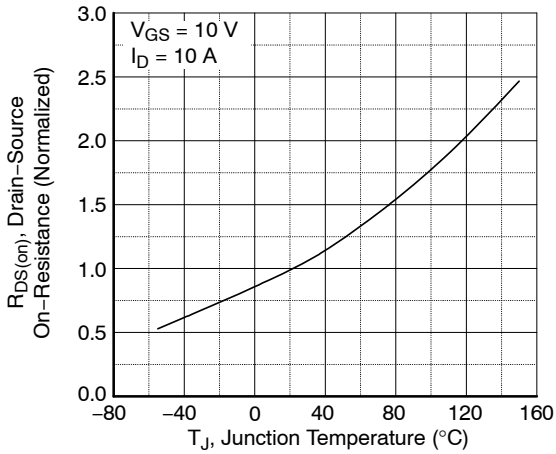


**Figure 8. On−Resistance Variation vs. Temperature**

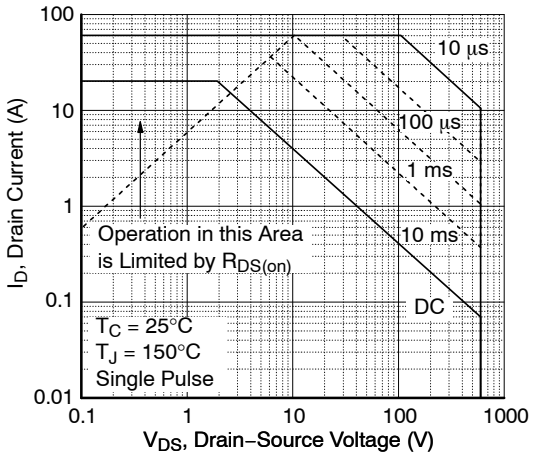


**Figure 9. Maximum Safe Operating Area**

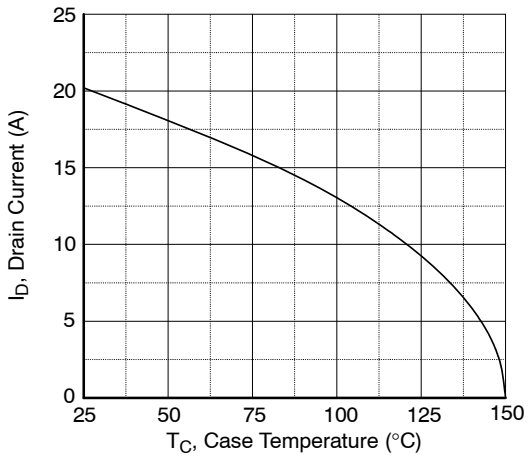


**Figure 10. Maximum Drain Current vs. Case Temperature**

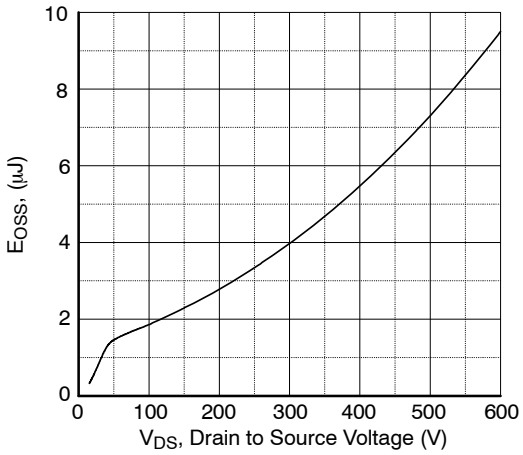


**Figure 11. $E_{OSS}$ vs. Drain−to−Source Voltage**

## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

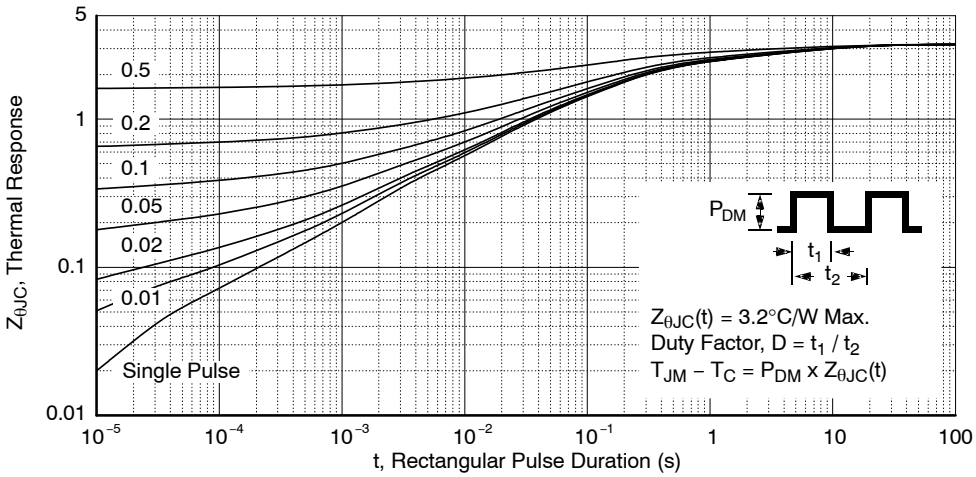


**Figure 12. Transient Thermal Response Curve**

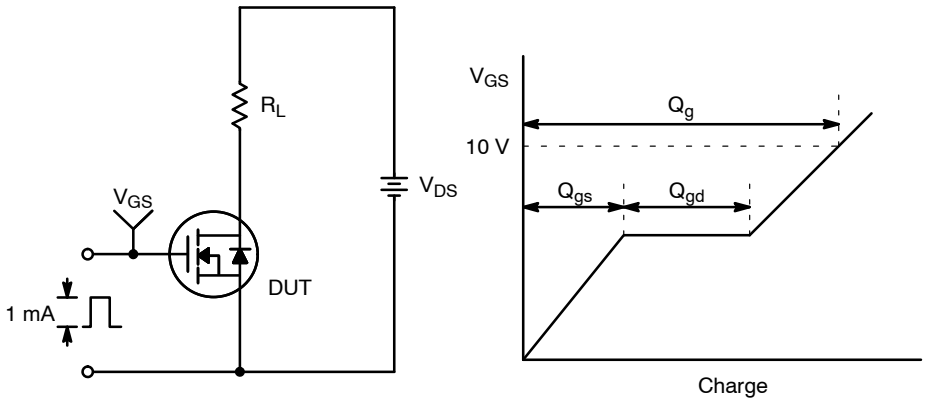


**Figure 13. Gate Charge Test Circuit & Waveform**

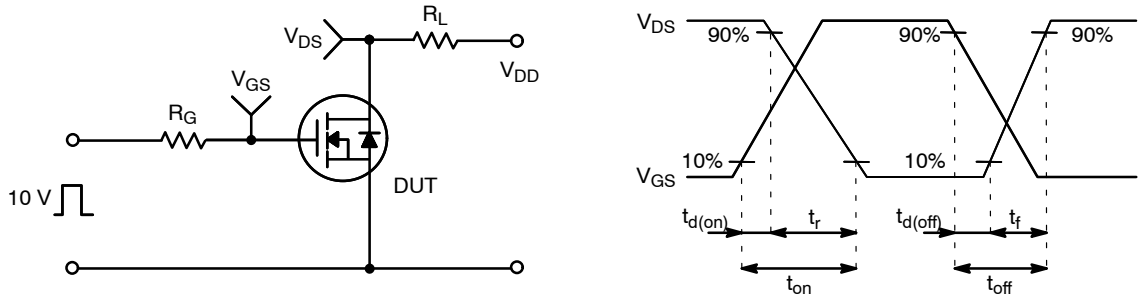


**Figure 14. Resistive Switching Test Circuit & Waveforms**

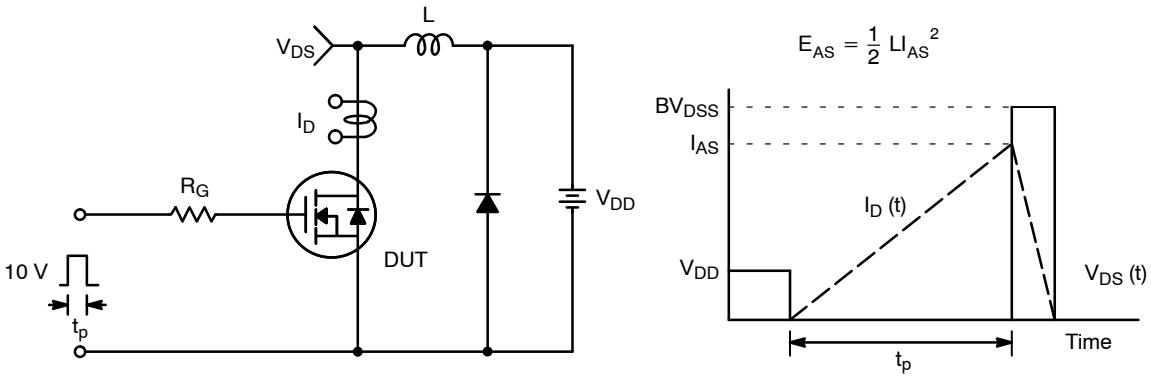


**Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms**

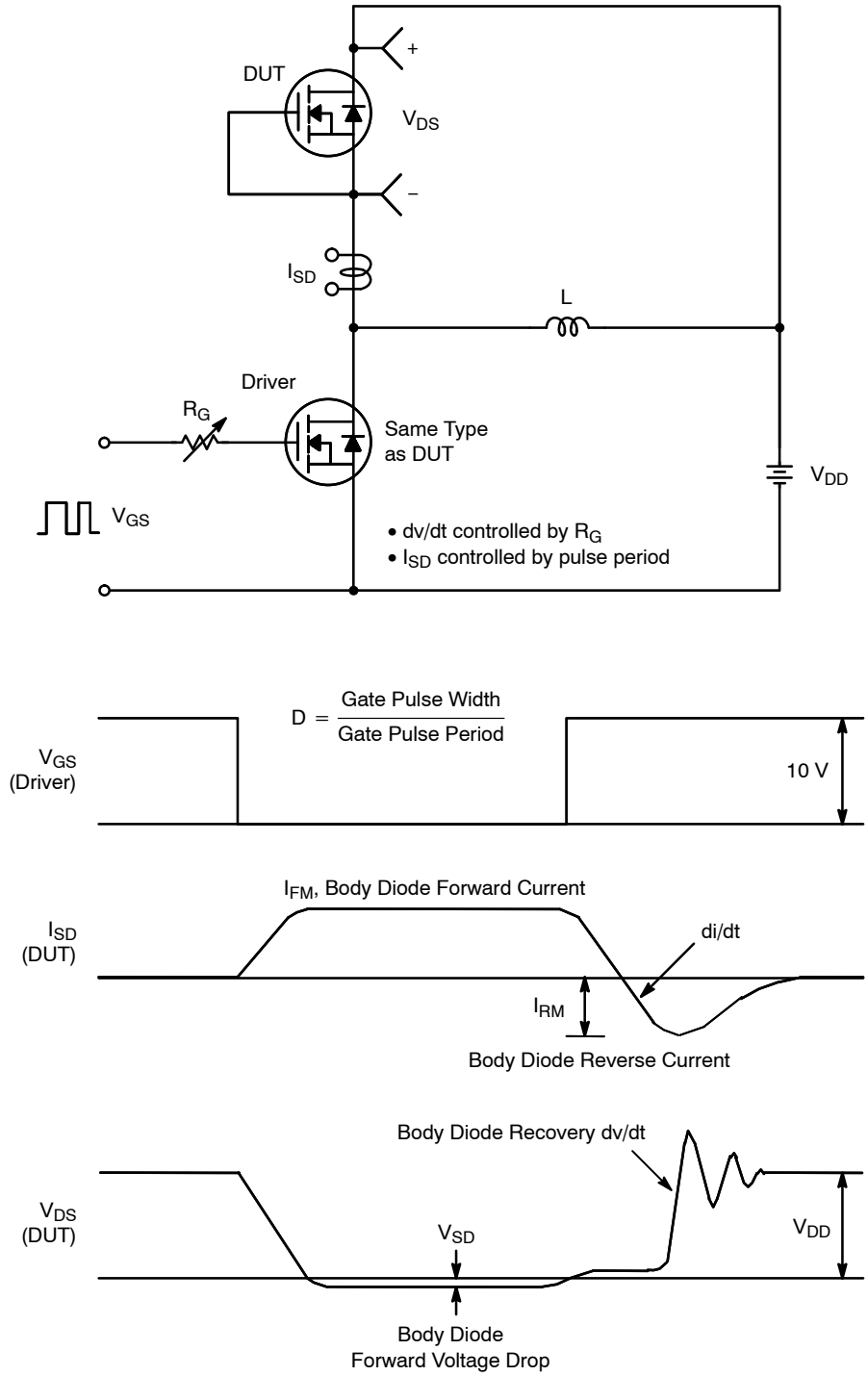


**Figure 16. Peak Recovery dv/dt Test Circuit & Waveforms**

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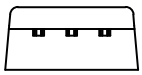
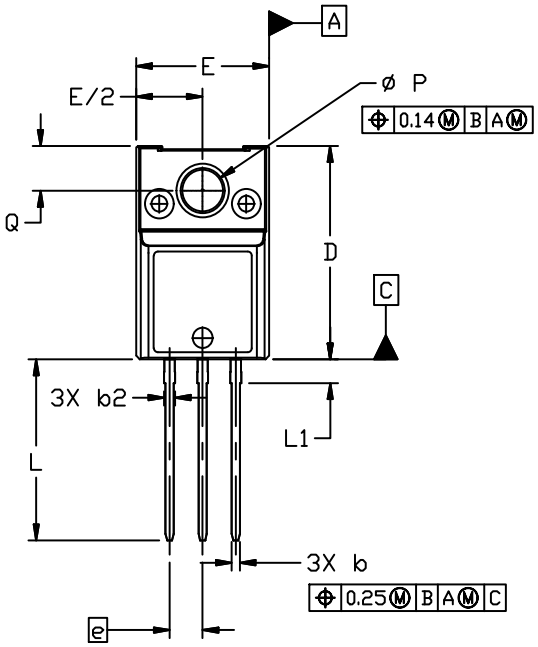
# FCPF190N60−F154

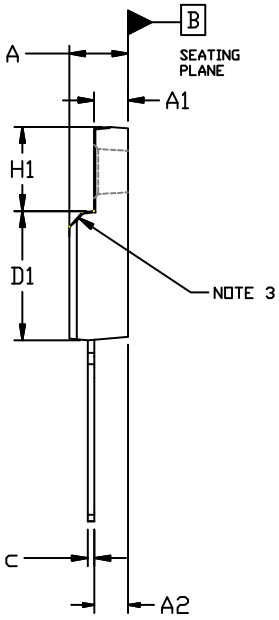
## PACKAGE DIMENSIONS

**TO−220 FULLPACK, 3−LEAD**
CASE 221BN
ISSUE O



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 |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