

MOSFET – N-Channel, UniFET™

500 V, 18 A, 265 mΩ

FDP18N50 / FDPF18N50 / FDPF18N50T

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.

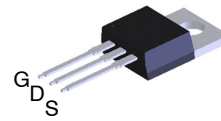
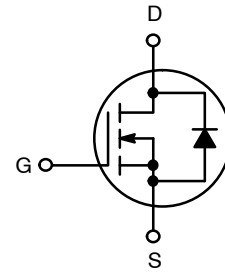
Features

- $R_{DS(on)} = 220 \text{ m}\Omega$ (Typ.) @ $V_{GS} = 10 \text{ V}$, $I_D = 9 \text{ A}$
- Low Gate Charge (Typ. 45 nC)
- Low C_{rss} (Typ. 25 pF)
- 100% Avalanche Tested
- These Devices are Pb-Free and are RoHS Compliant

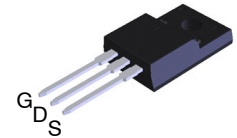
Applications

- LCD/LED/PDP TV
- Lighting
- Uninterruptible Power Supply

| V_{DS} | $R_{DS(on)}$ MAX | I_D MAX |
|----------|------------------|-----------|
| 500 V | 265 mΩ @ 9 V | 18 A |

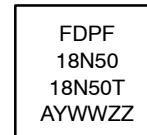
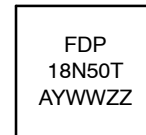


TO-220-3LD
CASE 340AT



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

MARKING DIAGRAM



FDP18N50,
FDPF18N50
FDPF18N50T = Specific Device Code
A = Assembly Location
YWW = Date Code (Year and Week)
ZZ = Assembly Lot Code

ORDERING INFORMATION

| Device | Package | Shipping |
|------------|---------|-------------------|
| FDP18N50 | TO-220 | 1000 Units / Tube |
| FDPF18N50 | TO-220F | 1000 Units / Tube |
| FDPF18N50T | TO-220F | 1000 Units / Tube |

FDP18N50 / FDPF18N50 / FDPF18N50T

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

| Symbol | Parameter | FDP18N50 | FDPF18N50 / FDPF18N50T | Unit |
|----------------|--|-------------|------------------------|--------------------------|
| V_{DSS} | Drain to Source Voltage | 500 | | V |
| I_D | Drain Current – – Continuous ($T_C = 25^\circ\text{C}$) – Continuous ($T_C = 100^\circ\text{C}$) | 18 10.8 | 18* 10.8* | A |
| I_{DM} | Drain Current – Pulsed (Note 1) | 72 | 72* | A |
| V_{GSS} | Gate to Source Voltage | ± 30 | | V |
| E_{AS} | Single Pulsed Avalanche Energy (Note 2) | 945 | | mJ |
| I_{AR} | Avalanche Current (Note 1) | 18 | | A |
| E_{AR} | Repetitive Avalanche Energy (Note 1) | 23.5 | | mJ |
| dv/dt | Peak Diode Recovery dv/dt (Note 3) | 4.5 | | V/ns |
| P_D | Power Dissipation ($T_C = 25^\circ\text{C}$) – Derate Above 25°C | 235 1.88 | 38.5 0.3 | W W/ $^\circ\text{C}$ |
| T_J, T_{STG} | Operating and Storage Temperature Range | –55 to +150 | | $^\circ\text{C}$ |
| T_L | Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Second | 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.

*Drain current limited by maximum junction temperature

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. $L = 5.2\text{ mH}$, $I_{AS} = 18\text{ A}$, $V_{DD} = 50\text{ V}$, $R_G = 25\ \Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 18\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

THERMAL CHARACTERISTICS

| Symbol | Parameter | FDP18N50 | FDPF18N50 / FDPF18N50T | Unit |
|-----------------|---|----------|------------------------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case, Max. | 0.53 | 3.3 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient, Max. | 62.5 | 62.5 | $^\circ\text{C}/\text{W}$ |

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

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

OFF CHARACTERISTICS

| | | | | | | |
|--------------------------------|---|---|-----|-----|------|---------------------|
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS} = 0, I_D = 250\ \mu\text{A}$, | 500 | – | – | V |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$, Referenced to 25°C | – | 0.5 | – | V/ $^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$ | – | – | 1 | μA |
| | | $V_{DS} = 400\text{ V}, T_C = 125^\circ\text{C}$ | – | – | 10 | |
| I_{GSSF} | Gate-Body Leakage Current, Forward | $V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$ | – | – | 100 | nA |
| I_{GSSR} | Gate-Body Leakage Current, Reverse | $V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$ | – | – | -100 | nA |

ON CHARACTERISTICS

| | | | | | | |
|--------------|-----------------------------------|---|-----|-------|-------|----------|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$ | 3.0 | – | 5.0 | V |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = 10\text{ V}, I_D = 9\text{ A}$ | – | 0.220 | 0.265 | Ω |
| g_{FS} | Forward Transconductance | $V_{DS} = 40\text{ V}, I_D = 9\text{ A}$ | – | 25 | – | S |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|-----------|------------------------------|---|---|------|------|----|
| C_{iss} | Input Capacitance | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | – | 2200 | 2860 | pF |
| C_{oss} | Output Capacitance | | – | 330 | 430 | pF |
| C_{rss} | Reverse Transfer Capacitance | | – | 25 | 40 | pF |

FDP18N50 / FDPF18N50 / FDPF18N50T

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted) (continued)

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

SWITCHING CHARACTERISTICS

| | | | | | | |
|---------------------|---------------------|--|---|------|-----|----|
| t _{d(on)} | Turn-On Delay Time | V _{DD} = 250 V, I _D = 18 A, V _{GS} = 10 V, R _G = 25 Ω (Note 4) | – | 55 | 120 | ns |
| t _r | Turn-On Rise Time | | – | 165 | 340 | ns |
| t _{d(off)} | Turn-Off Delay Time | | – | 95 | 200 | ns |
| t _f | Turn-Off Fall Time | | – | 90 | 190 | ns |
| Q _g | Total Gate Charge | V _{DS} = 400 V, I _D = 18 A, V _{GS} = 10 V (Note 4) | – | 45 | 60 | nC |
| Q _{gs} | Gate-Source Charge | | – | 12.5 | – | nC |
| Q _{gd} | Gate-Drain Charge | | – | 19 | – | nC |

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

| | | | | | | |
|-----------------|---|---|---|-----|-----|----|
| I _S | Maximum Continuous Drain-Source Diode Forward Current | | – | – | 18 | A |
| I _{SM} | Maximum Pulsed Drain- Source Diode Forward Current | | – | – | 72 | A |
| V _{SD} | Drain-Source Diode Forward Voltage | V _{GS} = 0 V, I _{SD} = 18 A | – | – | 1.4 | V |
| t _{rr} | Reverse Recovery Time | V _{GS} = 0 V, I _{SD} = 18 A dI _F /dt = 100 A/μs | – | 500 | – | ns |
| Q _{rr} | Reverse Recovery Charge | | – | 5.4 | – | 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

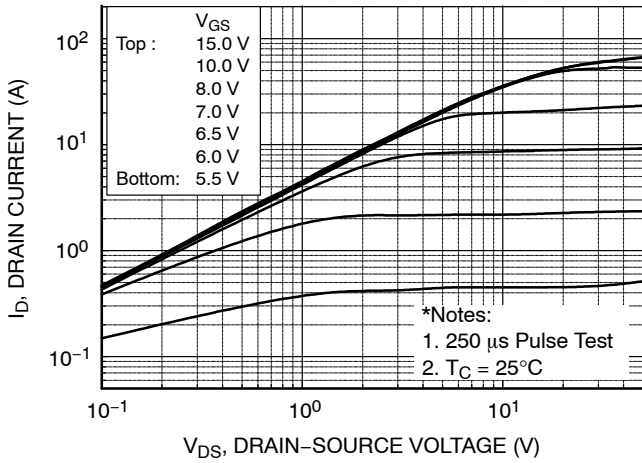


Figure 1. On-Resistance Characteristics

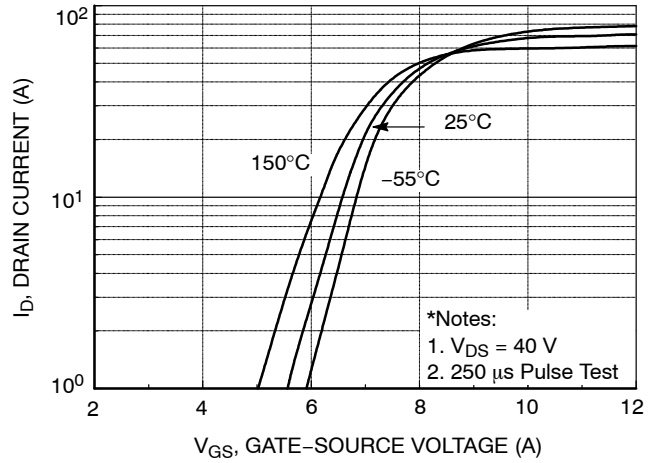


Figure 2. Transfer Characteristics

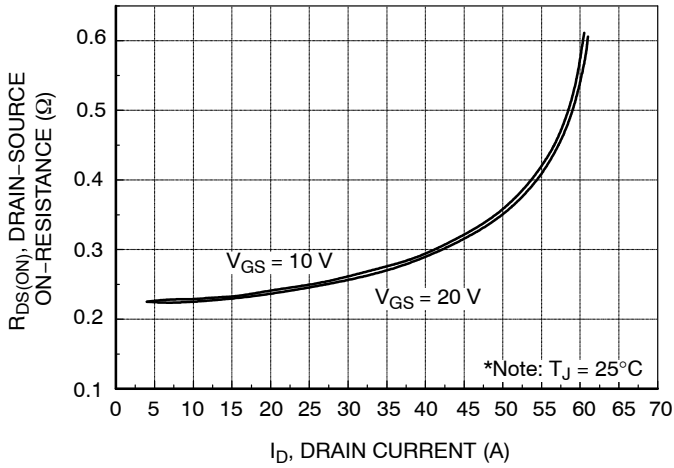


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

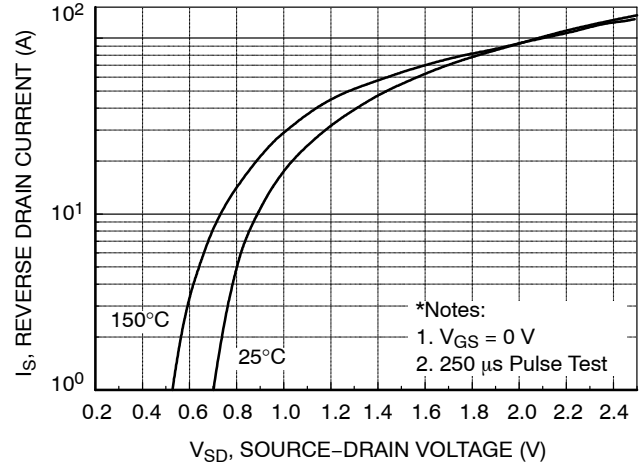


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

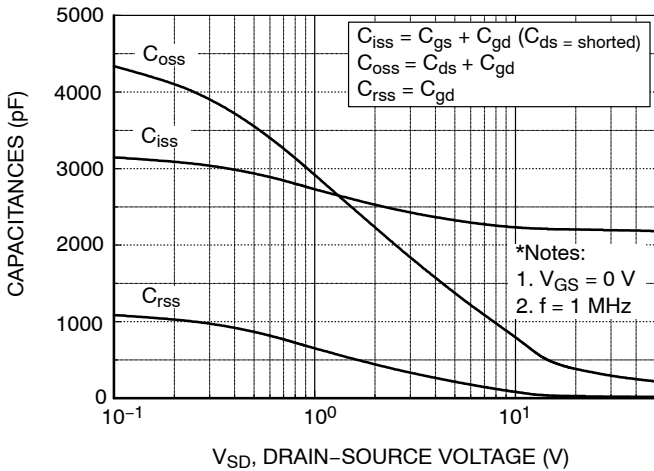


Figure 5. Capacitance Characteristics

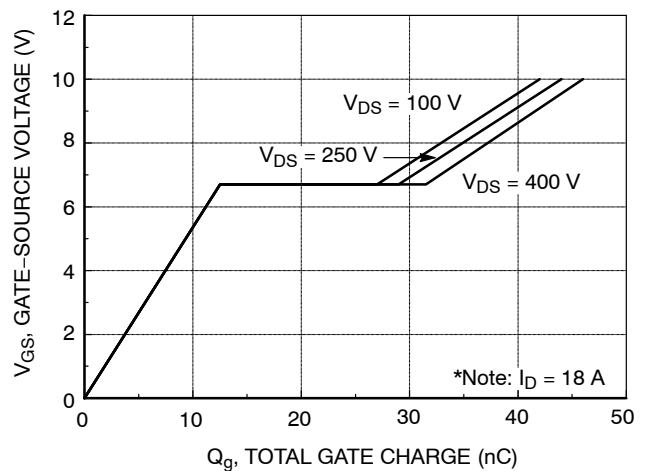


Figure 6. Gate Charge Characteristics

FDP18N50 / FDPF18N50 / FDPF18N50T

TYPICAL CHARACTERISTICS (CONTINUED)

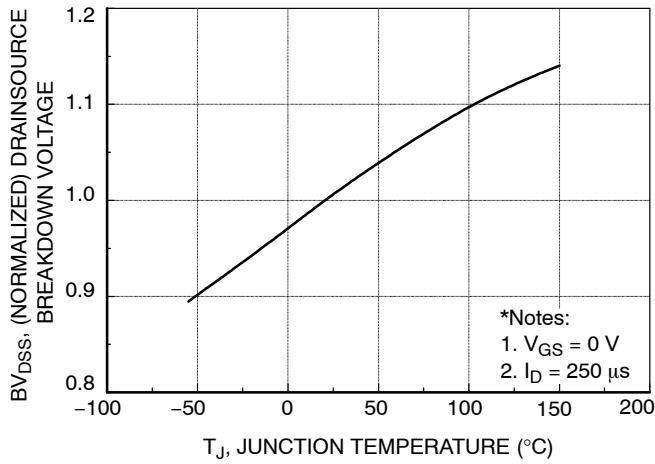


Figure 7. Breakdown Voltage Variation vs. Temperature

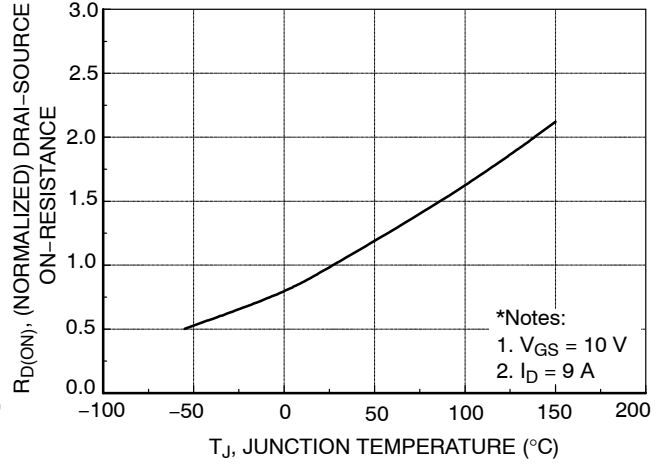


Figure 8. On-Resistance Variation vs. Temperature

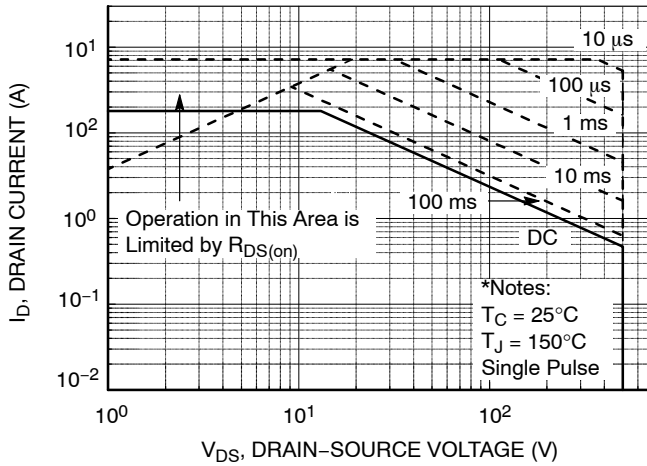


Figure 9-1. Maximum Safe Operating Area for FDP18N50

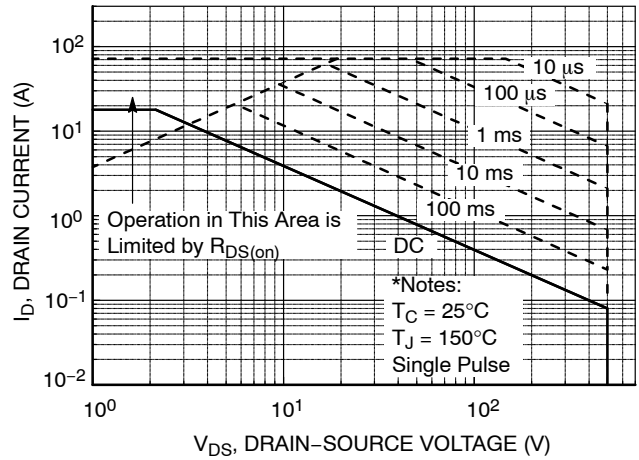


Figure 9-2. Maximum Safe Operating Area for FDPF18N50 / FDPF18N50T

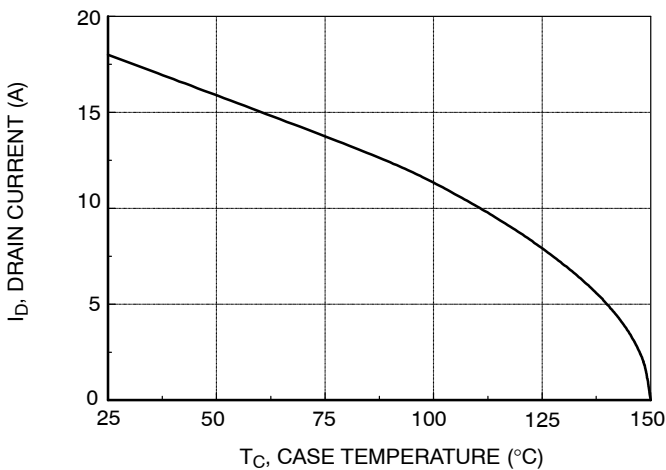


Figure 10. Maximum Drain Current vs. Case Temperature

FDP18N50 / FDPF18N50 / FDPF18N50T

TYPICAL PERFORMANCE CHARACTERISTICS (CONTINUED)

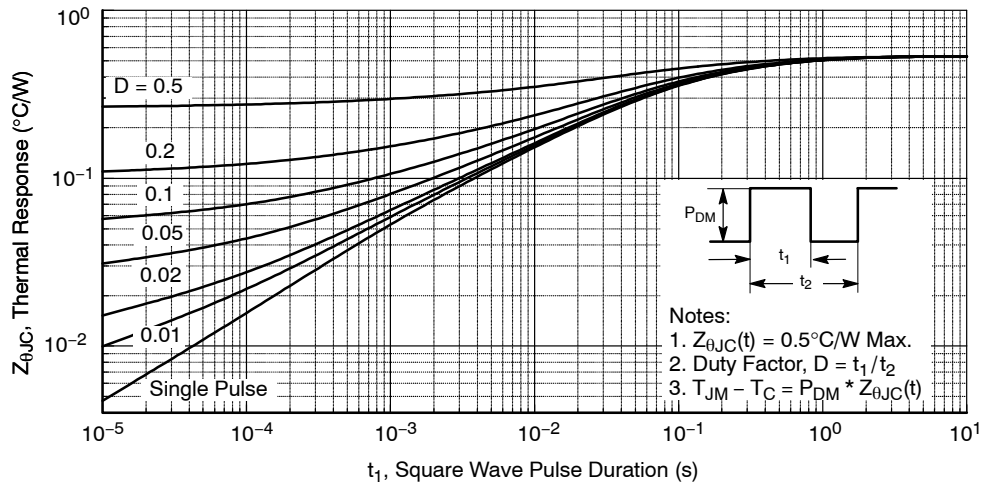


Figure 11 -1. Transient Thermal Response Curve - FDP18N50

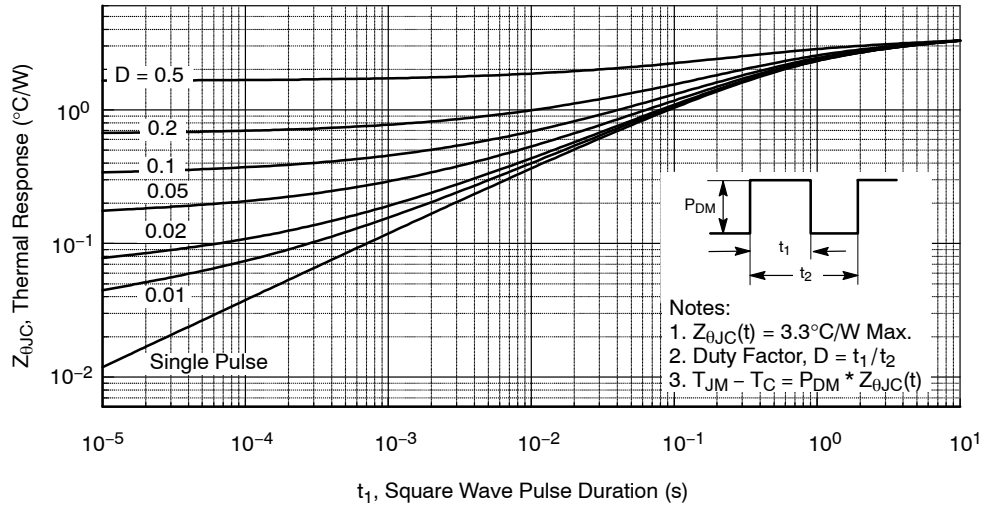


Figure 11 -2. Transient Thermal Response Curve - FDPF18N50 / FDPF18N50T

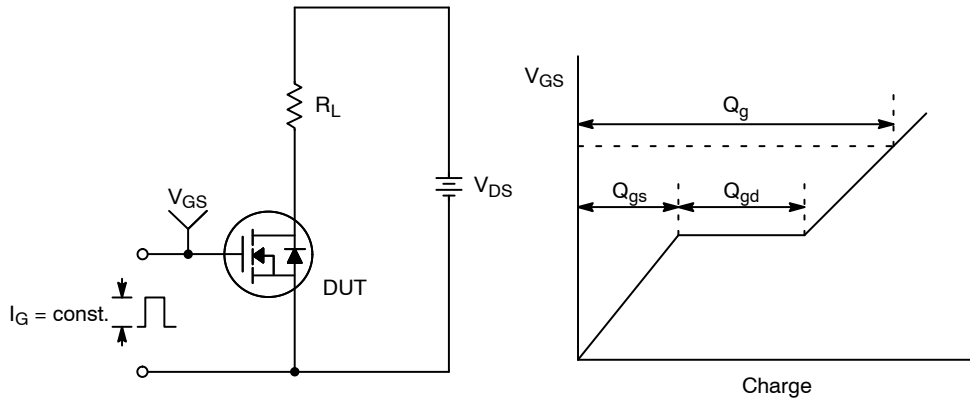


Figure 12. Gate Charge Test Circuit & Waveform

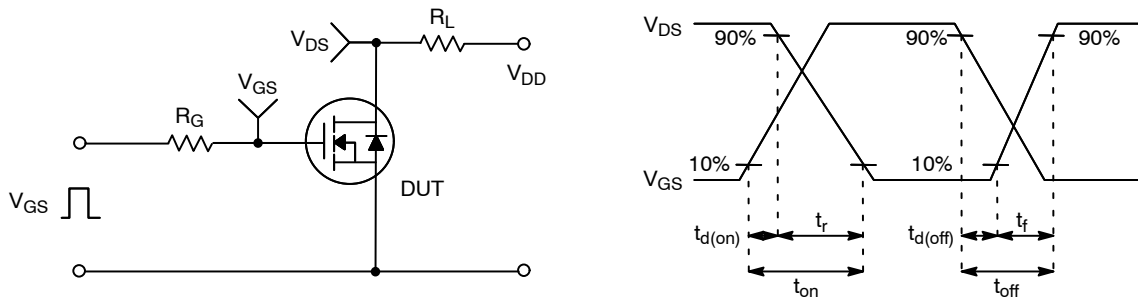


Figure 13. Resistive Switching Test Circuit & Waveforms

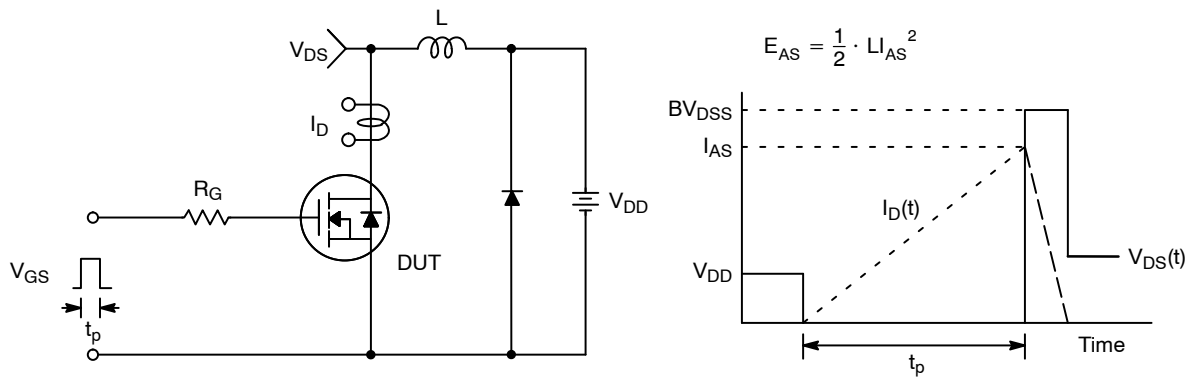


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

FDP18N50 / FDPF18N50 / FDPF18N50T

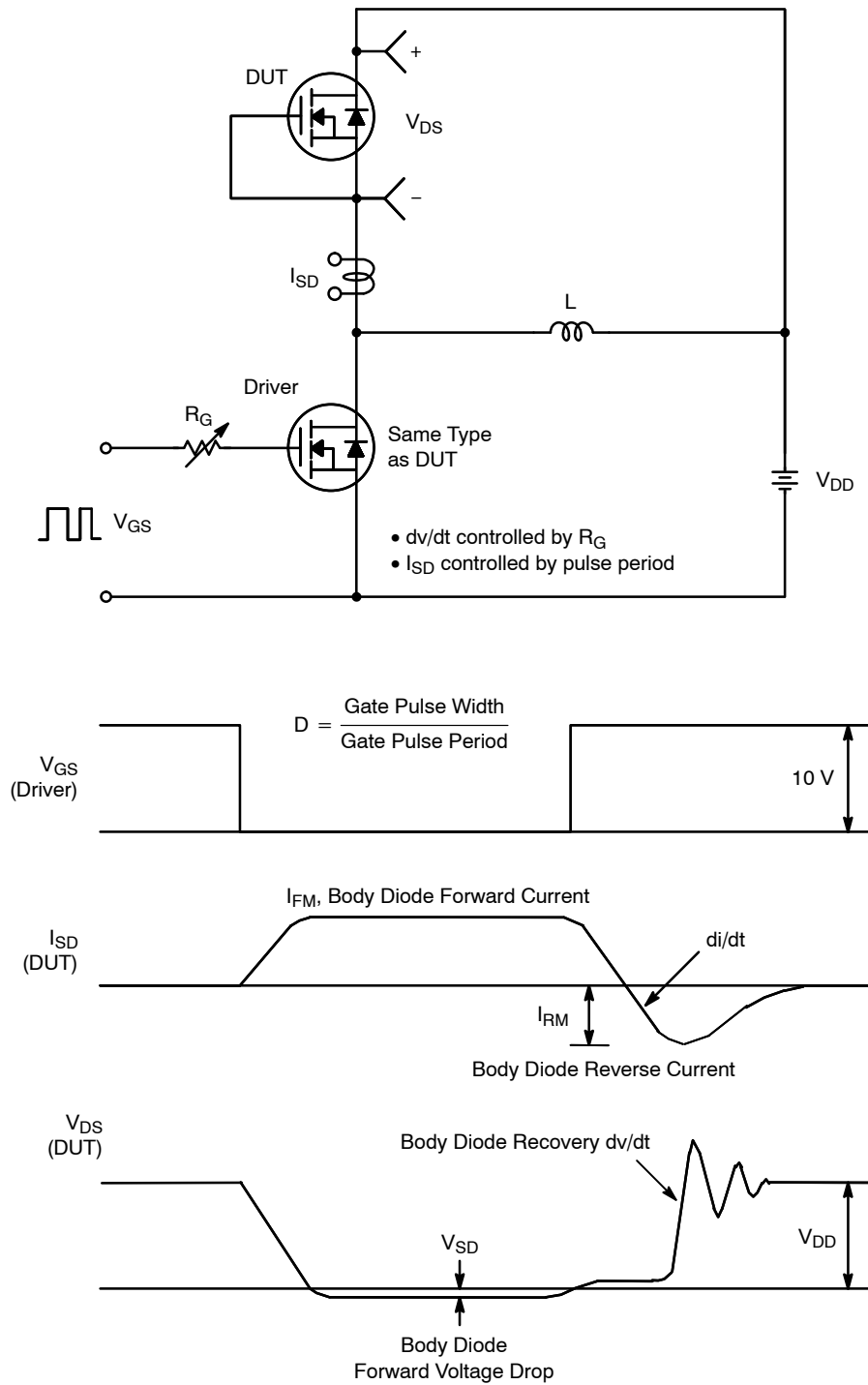


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

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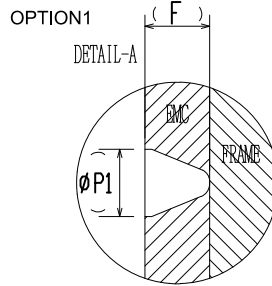
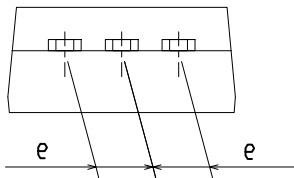


TO-220 Fullpack, 3-Lead / TO-220F-3SG CASE 221AT ISSUE B

DATE 19 JAN 2021



Scale 1:1



| 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 |
| phi P | 2.98 | 3.18 | 3.38 |
| phi 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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| DESCRIPTION: | TO-220 FULLPACK, 3-LEAD / TO-220F-3SG | PAGE 1 OF 1 |

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MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

ON Semiconductor®



Scale 1:1

TO-220-3LD CASE 340AT ISSUE A

DATE 03 OCT 2017



- 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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