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MOSFET – Power, N-Channel, SUPERFET® III 800 V, 450 mΩ, 11 A

NTPF450N80S3Z

Description

800 V SUPERFET III MOSFET is ON Semiconductor's high performance MOSFET family offering 800 V breakdown voltage.

New 800 V SUPERFET III MOSFET which is optimized for primary switch of flyback converter, enables lower switching losses and case temperature without sacrificing EMI performance thanks to its optimized design. In addition, internal Zener Diode significantly improves ESD capability.

This new family of 800 V SUPERFET III MOSFET enables to make more efficient, compact, cooler and more robust applications because of its remarkable performance in switching power applications such as Laptop adapter, Audio, Lighting, ATX power and industrial power supplies.

Features

- Typ. $R_{DS(on)} = 380 \text{ m}\Omega$
- Ultra Low Gate Charge (Typ. $Q_g = 19.3 \text{ nC}$)
- Low Stored Energy in Output Capacitance ($E_{oss} = 2.2 \text{ }\mu\text{J @ 400 V}$)
- 100% Avalanche Tested
- ESD Improved Capability with Zener Diode
- RoHS Compliant

Applications

- Adapters / Chargers
- LED Lighting
- AUX Power
- Audio
- Industrial Power

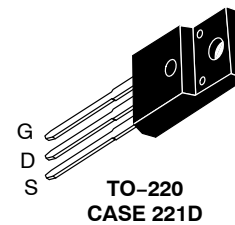
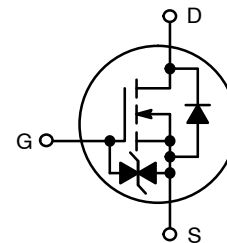


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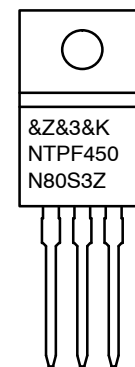
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| $V_{(BR)DSS}$ | $R_{DS(ON)} \text{ MAX}$ | $I_D \text{ MAX}$ |
|---------------|----------------------------------|-------------------|
| 800 V | 450 mΩ @ $V_{GS} = 10 \text{ V}$ | 11 A |

N-CHANNEL MOSFET



MARKING DIAGRAM



- &Z = Assembly Plant Code
- &3 = Data Code (Year & Week)
- &K = Lot
- NTPF450N80S3Z = Specific Device Code

ORDERING INFORMATION

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

NTPF450N80S3Z

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

| Symbol | Parameter | Value | Unit |
|-----------------------------------|--|-------------------------------------|-------|
| V _{DSS} | Drain-to-Source Voltage | 800 | V |
| V _{GS} | Gate-to-Source Voltage | DC | ±20 |
| | | AC (f > 1 Hz) | ±30 |
| I _D | Drain Current | Continuous (T _C = 25°C) | 11* |
| | | Continuous (T _C = 100°C) | 7* |
| I _{DM} | Drain Current | Pulsed (Note 1) | 25* |
| E _{AS} | Single Pulsed Avalanche Energy (Note 2) | 32 | mJ |
| I _{AS} | Avalanche Current (Note 2) | 1.55 | A |
| E _{AR} | Repetitive Avalanche Energy (Note 1) | 0.295 | mJ |
| dv/dt | MOSFET dv/dt | 100 | V/ns |
| | Peak Diode Recovery dv/dt (Note 3) | 10 | V/ns |
| P _D | Power Dissipation | T _C = 25°C | 29.5 |
| | | Derate above 25°C | 0.236 |
| T _J , T _{stg} | Operating Junction and Storage Temperature Range | -55 to +150 | °C |
| T _L | Lead Temperature for Soldering Purposes (1/8" from Case for 10 seconds) | 260 | °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} = 1.55 A, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 2.75 A, di/dt ≤ 200 A/μs, V_{DD} ≤ 400 V, starting T_J = 25°C.

THERMAL CHARACTERISTICS

| Symbol | Parameter | Value | Unit |
|------------------|---|-------|------|
| R _{θJC} | Thermal Resistance, Junction-to-Case, Max. | 4.23 | °C/W |
| R _{θJA} | Thermal Resistance, Junction-to-Ambient, Max. | 62.5 | |

PACKAGE MARKING AND ORDERING INFORMATION

| Part Number | Top Marking | Package | Packing Method | Reel Size | Tape Width | Quantity |
|---------------|---------------|---------|----------------|-----------|------------|----------|
| NTPF450N80S3Z | NTPF450N80S3Z | TO-220F | Tube | N/A | N/A | 50 Units |

NTPF450N80S3Z

ELECTRICAL CHARACTERISTICS

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

OFF CHARACTERISTICS

| | | | | | | |
|-------------------------------------|---|--|-----|-----|----|------|
| BV _{DSS} | Drain-to-Source Breakdown Voltage | V _{GS} = 0 V, I _D = 1 mA, T _J = 25°C | 800 | - | - | V |
| | | V _{GS} = 0 V, I _D = 1 mA, T _J = 150°C | 900 | - | - | V |
| ΔBV _{DSS} /ΔT _J | Drain-to-Source Breakdown Voltage Temperature Coefficient | I _D = 1 mA, Reference to 25°C | - | 1.1 | - | V/°C |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} = 800 V, V _{GS} = 0 V | - | - | 1 | μA |
| | | V _{DS} = 640 V, T _C = 125°C | - | 0.8 | - | |
| I _{GSS} | Gate-to-Source Leakage Current | V _{GS} = ±20 V, V _{DS} = 0 V | - | - | ±1 | μA |

ON CHARACTERISTICS

| | | | | | | |
|---------------------|--------------------------------------|--|-----|------|-----|----|
| V _{GS(th)} | Gate Threshold Voltage | V _{GS} = V _{DS} , I _D = 0.24 mA | 2.2 | - | 3.8 | V |
| R _{DS(on)} | Static Drain-to-Source On Resistance | V _{GS} = 10 V, I _D = 5.5 A | - | 380 | 450 | mΩ |
| g _{FS} | Forward Transconductance | V _{DS} = 20 V, I _D = 5.5 A | - | 11.8 | - | S |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|------------------------|-----------------------------------|---|---|------|---|----|
| C _{iss} | Input Capacitance | V _D = 400 V, V _{GS} = 0 V, f = 250 kHz | - | 885 | - | pF |
| C _{oss} | Output Capacitance | | - | 15 | - | |
| C _{oss(eff.)} | Effective Output Capacitance | V _{DS} = 0 V to 400 V, V _{GS} = 0 V | - | 188 | - | |
| C _{oss(er.)} | Energy Related Output Capacitance | | - | 27 | - | |
| Q _{g(tot)} | Total Gate Charge at 10 V | V _{DS} = 400 V, I _D = 5.5 A, V _{GS} = 10 V (Note 4) | - | 19.3 | - | nC |
| Q _{gs} | Gate-to-Source Charge | | - | 4.2 | - | |
| Q _{gd} | Gate-to-Drain "Miller" Charge | | - | 6.6 | - | |
| ESR | Equivalent Series Resistance | f = 1 MHz | - | 4.0 | - | Ω |

SWITCHING CHARACTERISTICS

| | | | | | | |
|---------------------|---------------------|--|---|------|---|----|
| t _{d(on)} | Turn-On Delay Time | V _{DD} = 400 V, I _D = 5.5 A, V _{GS} = 10 V, R _G = 4.7 Ω (Note 4) | - | 13.3 | - | ns |
| t _r | Turn-On Rise Time | | - | 6.7 | - | |
| t _{d(off)} | Turn-Off Delay Time | | - | 44.3 | - | |
| t _f | Turn-Off Fall Time | | - | 4.6 | - | |

SOURCE-TO-DRAIN DIODE CHARACTERISTICS

| | | | | | | |
|-----------------|--|---|---|-----|-----|----|
| I _S | Maximum Continuous Source-to-Drain Diode Forward Current | | - | - | 11 | A |
| I _{SM} | Maximum Pulsed Source-to-Drain Diode Forward Current | | - | - | 25 | A |
| V _{SD} | Source-to-Drain Diode Forward Voltage | V _{GS} = 0 V, I _{SD} = 5.5 A | - | - | 1.2 | V |
| t _{rr} | Reverse Recovery Time | V _{GS} = 0 V, I _{SD} = 2.75 A, di _F /dt = 100 A/μs | - | 170 | - | ns |
| Q _{rr} | Reverse Recovery Charge | | - | 1.5 | - | 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.

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TYPICAL CHARACTERISTICS

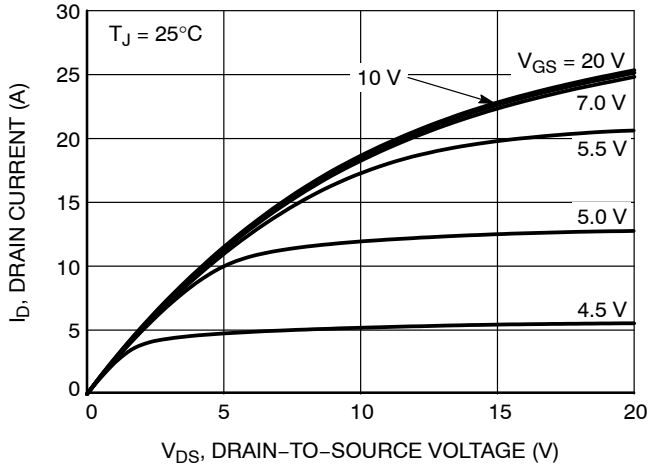


Figure 1. On-Region Characteristics

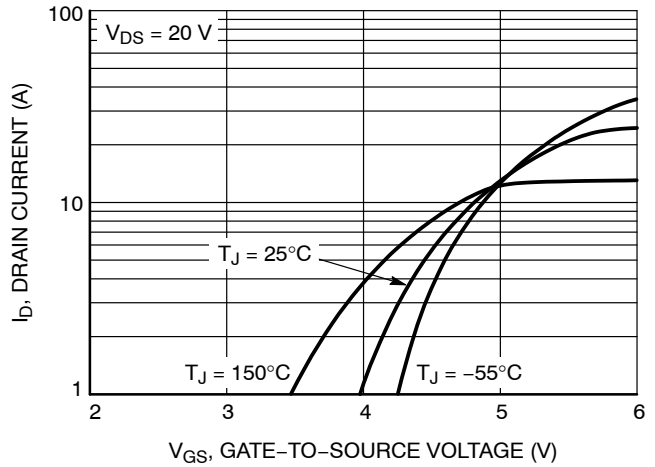


Figure 2. Transfer Characteristics

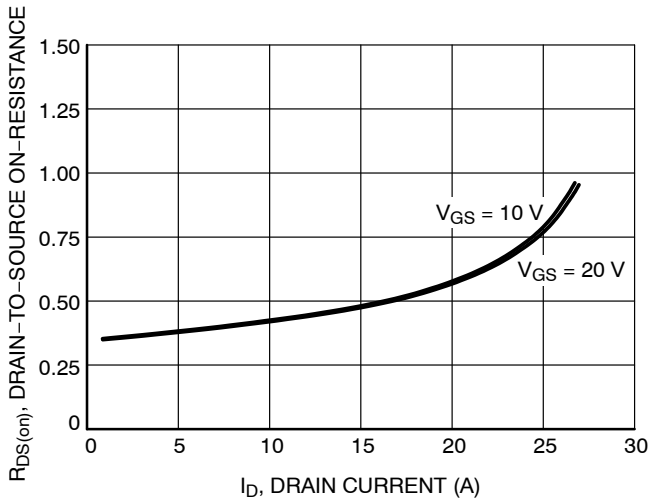


Figure 3. On Resistance vs. Drain Current

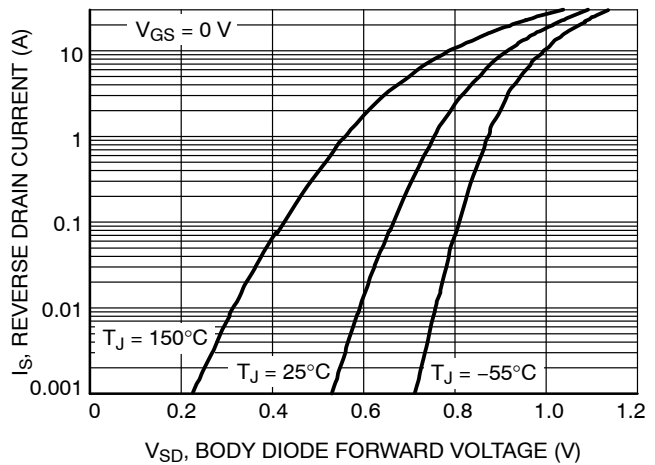


Figure 4. Diode Forward Voltage vs. Current

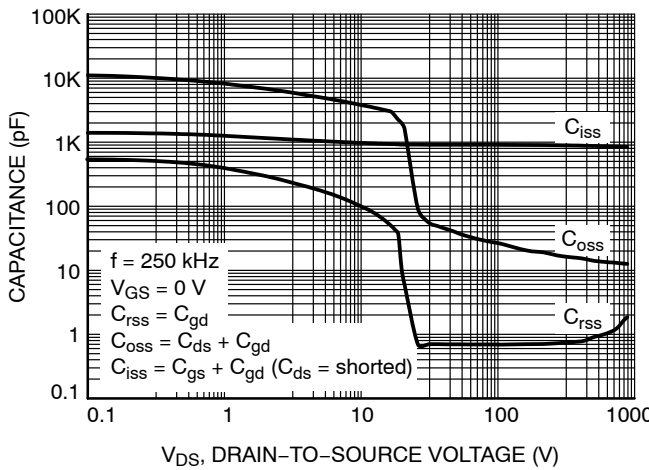


Figure 5. Capacitance Characteristics

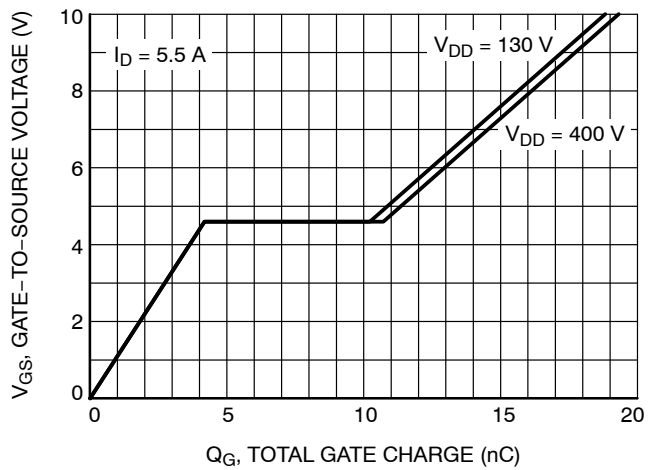


Figure 6. Gate Charge Characteristics

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TYPICAL CHARACTERISTICS

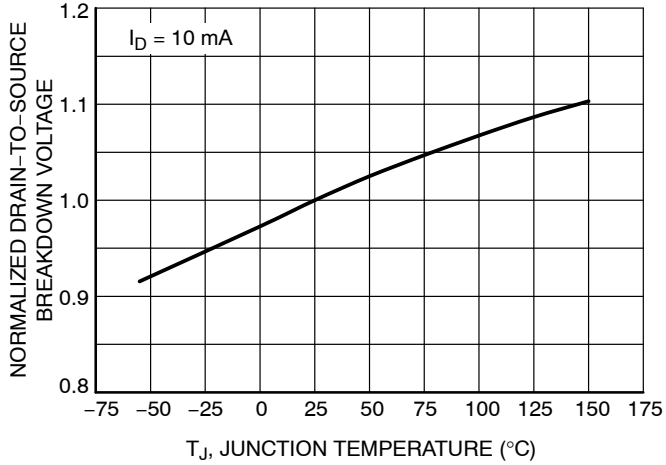


Figure 7. Normalized BV_{DSS} vs. Temperature

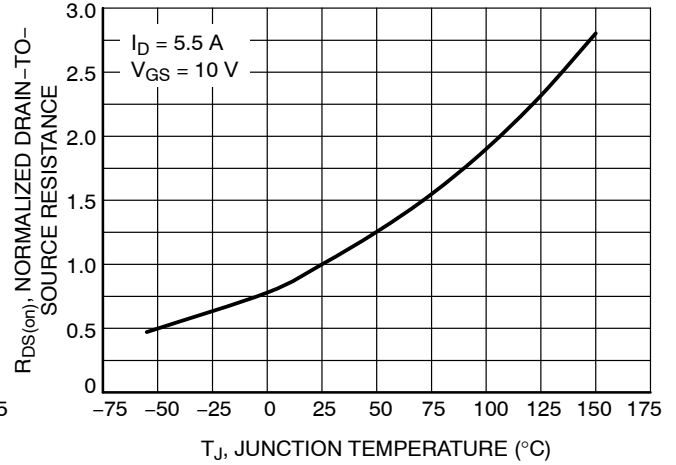


Figure 8. On-Resistance Variation vs. Temperature

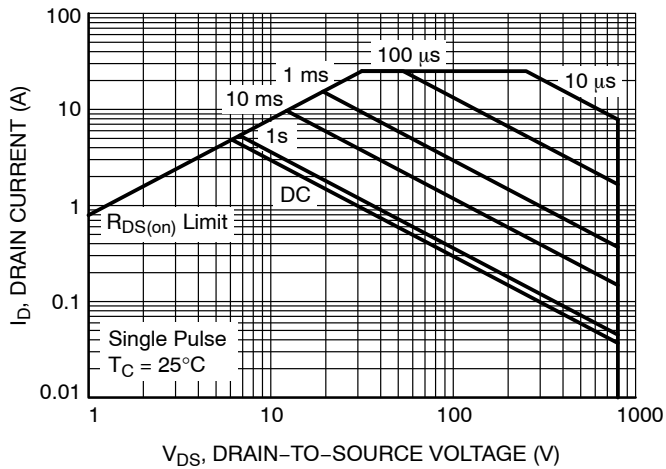


Figure 9. Safe Operating Area

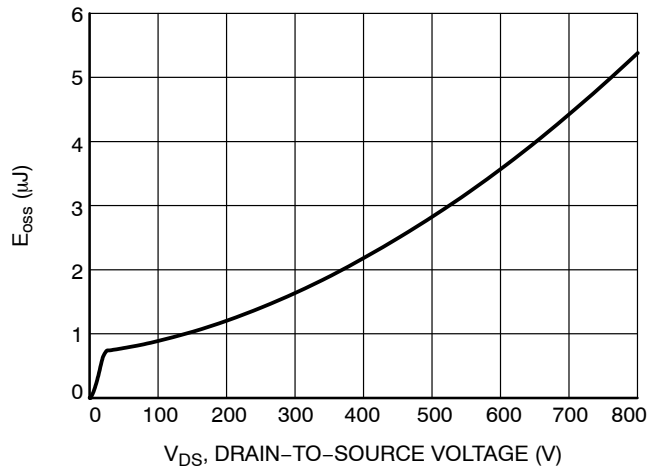


Figure 10. E_{oss} vs. Drain-to-Source Voltage

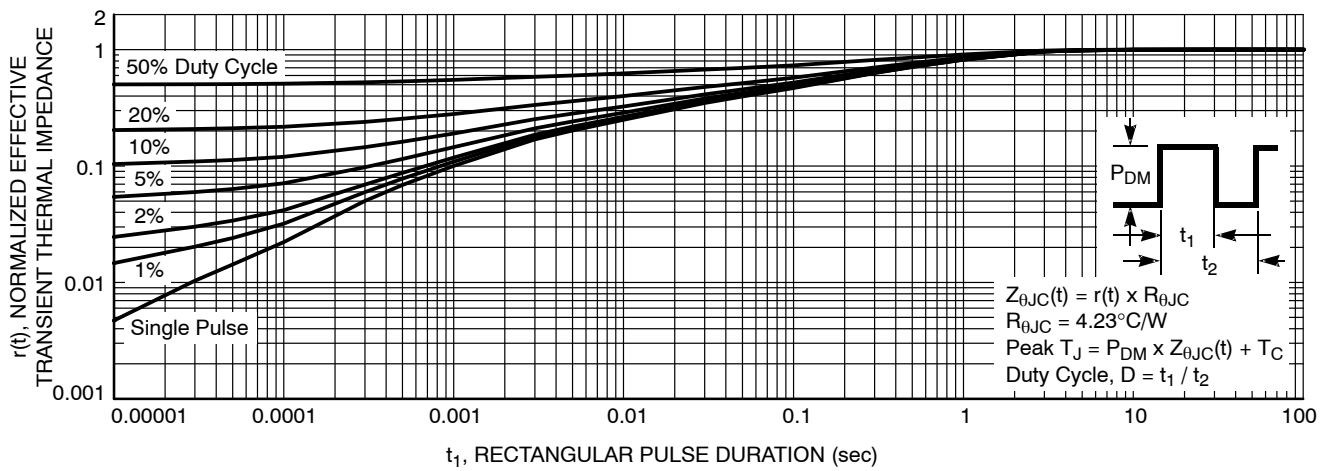


Figure 11. Transient Thermal Impedance

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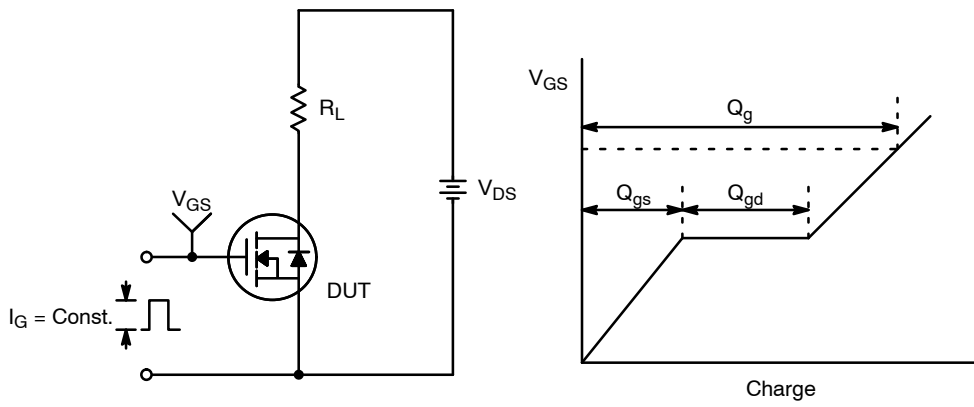


Figure 12. Gate Charge Test Circuit & Waveform

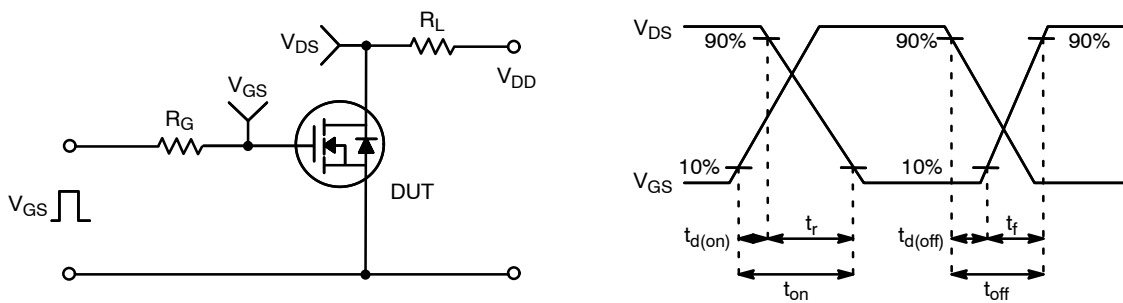


Figure 13. Resistive Switching Test Circuit & Waveforms

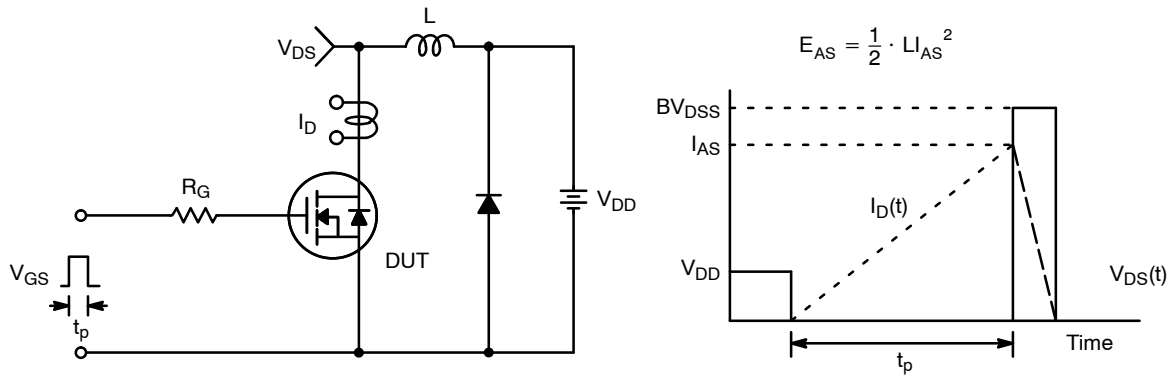


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

NTPF450N80S3Z

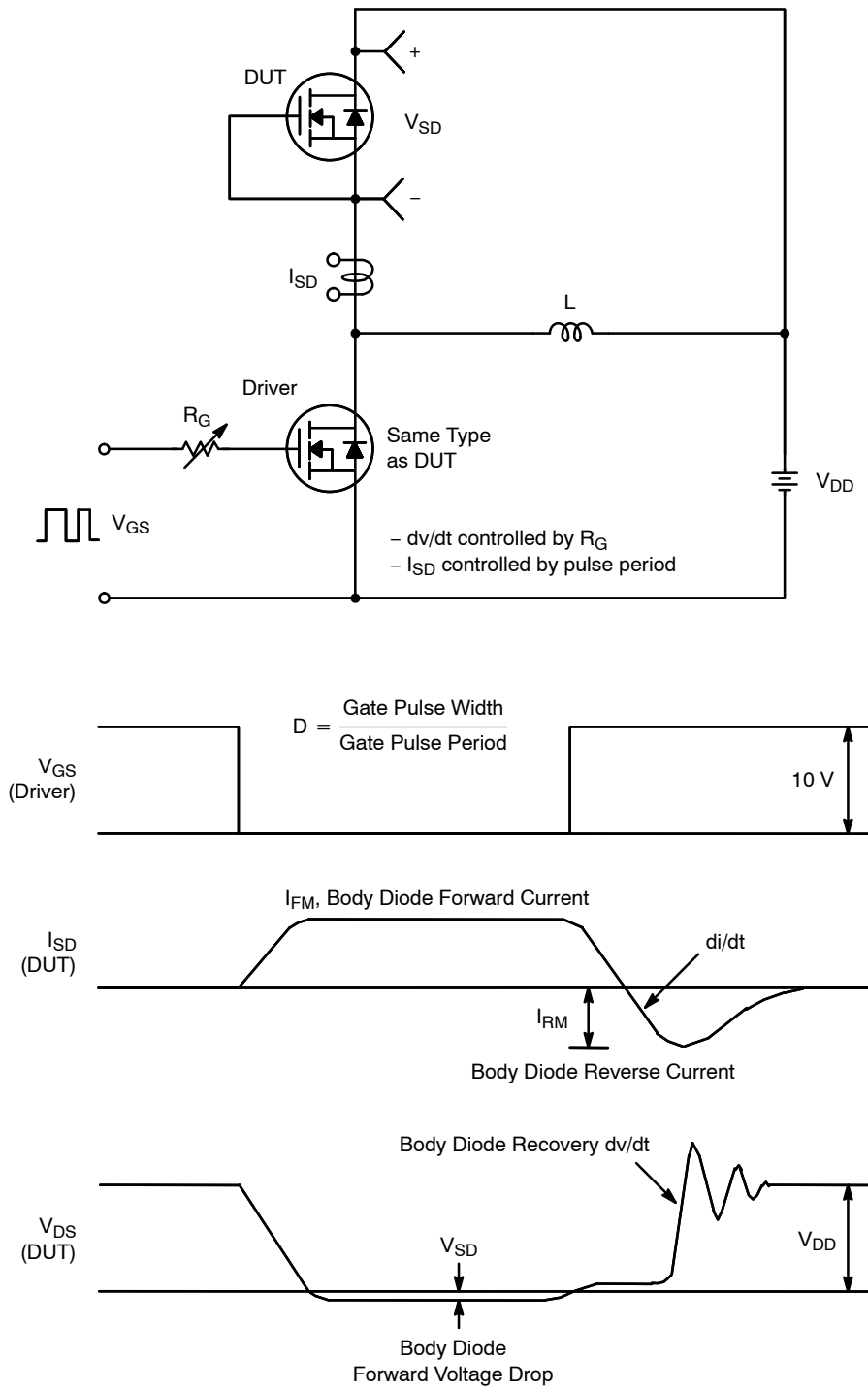
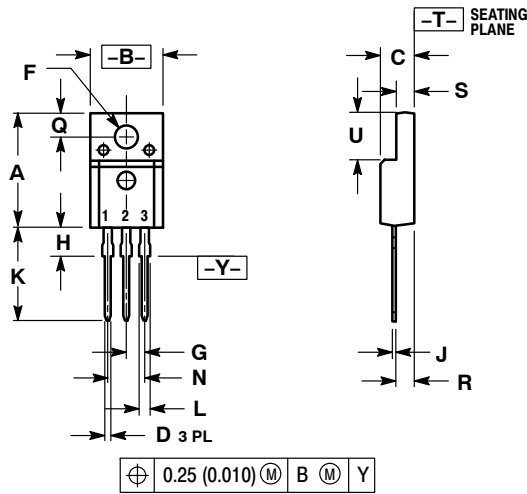


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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PACKAGE DIMENSIONS

TO-220 FULLPAK CASE 221D-03 ISSUE K



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH
 3. 221D-01 THRU 221D-02 OBSOLETE, NEW STANDARD 221D-03.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.617 | 0.635 | 15.67 | 16.12 |
| B | 0.392 | 0.419 | 9.96 | 10.63 |
| C | 0.177 | 0.193 | 4.50 | 4.90 |
| D | 0.024 | 0.039 | 0.60 | 1.00 |
| F | 0.116 | 0.129 | 2.95 | 3.28 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.118 | 0.135 | 3.00 | 3.43 |
| J | 0.018 | 0.025 | 0.45 | 0.63 |
| K | 0.503 | 0.541 | 12.78 | 13.73 |
| L | 0.048 | 0.058 | 1.23 | 1.47 |
| N | 0.200 BSC | | 5.08 BSC | |
| Q | 0.122 | 0.138 | 3.10 | 3.50 |
| R | 0.099 | 0.117 | 2.51 | 2.96 |
| S | 0.092 | 0.113 | 2.34 | 2.87 |
| U | 0.239 | 0.271 | 6.06 | 6.88 |

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