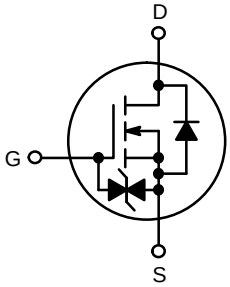
# MOSFET – Power, N-Channel, SUPERFET® III

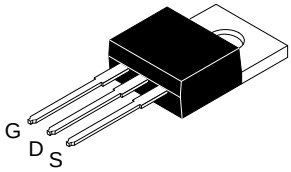
## 800 V, 360 mΩ, 13 A

# NTP360N80S3Z

| $V_{(BR)DSS}$ | $R_{DS(ON)}$ MAX | $I_D$ MAX |
|---|---|---|
| 800 V | 360 mΩ | 13 A |




POWER MOSFET




TO-220
CASE 340AT

### Description

800 V SUPERFET III MOSFET is **onsemi**'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.

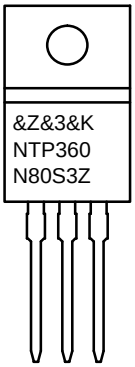
### Features

- Typ. $R_{DS(on)}$ = 300 mΩ
- Ultra Low Gate Charge (Typ. $Q_g$ = 25.3 nC)
- Low Stored Energy in Output Capacitance (Eoss = 2.72 μJ @ 400 V)
- 100% Avalanche Tested
- ESD Improved Capability with Zener Diode
- RoHS Compliant

### Applications

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

### MARKING DIAGRAM




| | |
|---|---|
| &Z | = Assembly Plant Code |
| &3 | = Data Code (Year & Week) |
| &K | = Lot |
| NTP360N80S3Z | = Specific Device Code |

### ORDERING INFORMATION

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

© Semiconductor Components Industries, LLC, 2019


Downloaded from Arrow.com.

**ABSOLUTE 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 | V |
| | | AC (f > 1 Hz) | ±30 | |
| $I_D$ | Drain Current | Continuous ($T_C$ = 25 °C) | 13 | A |
| | | Continuous ($T_C$ = 100 °C) | 8.2 | |
| $I_{DM}$ | Drain Current | Pulsed (Note 1) | 32.5 | A |
| $E_{AS}$ | Single Pulsed Avalanche Energy (Note 2) | | 40 | mJ |
| $I_{AS}$ | Avalanche Current (Note 2) | | 2.0 | A |
| $E_{AR}$ | Repetitive Avalanche Energy (Note 1) | | 0.96 | mJ |
| dv/dt | MOSFET dv/dt | | 100 | V/ns |
| | Peak Diode Recovery dv/dt (Note 3) | | 10 | |
| $P_D$ | Power Dissipation | ($T_C$ = 25 °C) | 96 | W |
| | | Derate Above 25 °C | 0.768 | W/°C |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | | −55 to +150 | °C |
| $T_L$ | Lead Temperature Soldering Reflow 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.

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. $I_{AS}$ = 2.0 A, $R_G$ = 25 Ω, starting $T_J$ = 25 °C.
3. $I_{SD}$ ≤ 3.25 A, di/dt ≤ 200 A/μs, $V_{DD}$ ≤ 400 V, starting $T_J$ = 25 °C.

**THERMAL RESISTANCE RATINGS**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case − Steady State | 1.3 | °C/W |
| $R_{\theta JA}$ | Junction-to-Ambient − Steady State | 62.5 | |

**PACKAGE MARKING AND ORDERING INFORMATION**

| Part Number | Top Marking | Package | Packing Method | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|---|
| NTP360N80S3Z | NTP360N80S3Z | TO-220 | Tube | N/A | N/A | 50 Units |



Downloaded from Arrow.com.

**ELECTRICAL CHARACTERISTICS** ($T_J$ = 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, $I_D$ = 1 mA, $T_J$ = 25 °C | 800 | | | V |
| | | $V_{GS}$ = 0 V, $I_D$ = 1 mA, $T_J$ = 150 °C | 900 | | | V |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 1 mA, Referenced 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-Body Leakage Current | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 V | | | 1 | μA |
| **ON CHARACTERISTICS** | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 0.3 mA | 2.2 | | 3.8 | V |
| $R_{DS(on)}$ | Static Drain-to-Source On Resistance | $V_{GS}$ = 10 V, $I_D$ = 6.5 A | | 300 | 360 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 20 V, $I_D$ = 6.5 A | | 13.8 | | S |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 400 V, $V_{GS}$ = 0 V, f = 250 kHz | | 1143 | | pF |
| $C_{oss}$ | Output Capacitance | | | 18.1 | | pF |
| $C_{oss(eff.)}$ | Effective Output Capacitance | $V_{DS}$ = 0 V to 400 V, $V_{GS}$ = 0 V | | 236.4 | | pF |
| $C_{oss(er.)}$ | Energy Related Output Capacitance | $V_{DS}$ = 0 V to 400 V, $V_{GS}$ = 0 V | | 34 | | pF |
| $Q_{g(tot)}$ | Total Gate Charge at 10 V | $V_{DS}$ = 400 V, $I_D$ = 6.5 A, $V_{GS}$ = 10 V (Note 4) | | 25.3 | | nC |
| $Q_{gs}$ | Gate-to-Source Gate Charge | | | 5.3 | | nC |
| $Q_{gd}$ | Gate-to-Drain “Miller” Charge | | | 8.3 | | nC |
| ESR | Equivalent Series Resistance | f = 1 MHz | | 4 | | Ω |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 400 V, $I_D$ = 6.5 A, $V_{GS}$ = 10 V, $R_g$ = 25 Ω (Note 4) | | 21.2 | | ns |
| $t_r$ | Turn-On Rise Time | | | 18.5 | | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 110 | | ns |
| $t_f$ | Turn-Off Fall Time | | | 17.7 | | ns |
| **SOURCE-DRAIN DIODE CHARACTERISTICS** | | | | | | |
| $I_S$ | Maximum Continuous Source-to-Drain Diode Forward Current | | | | 13 | A |
| $I_{SM}$ | Maximum Pulsed Source-to-Drain Diode Forward Current | | | | 32.5 | A |
| $V_{SD}$ | Source-to-Drain Diode Forward Voltage | $V_{GS}$ = 0 V, $I_{SD}$ = 6.5 A | | | 1.2 | V |
| $t_{rr}$ | Reverse Recovery Time | $V_{GS}$ = 0 V, $I_{SD}$ = 3.25 A, $dI_F/dt$ = 100 A/μs | | 370 | | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 3.0 | | 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.



Downloaded from Arrow.com.

## TYPICAL CHARACTERISTICS

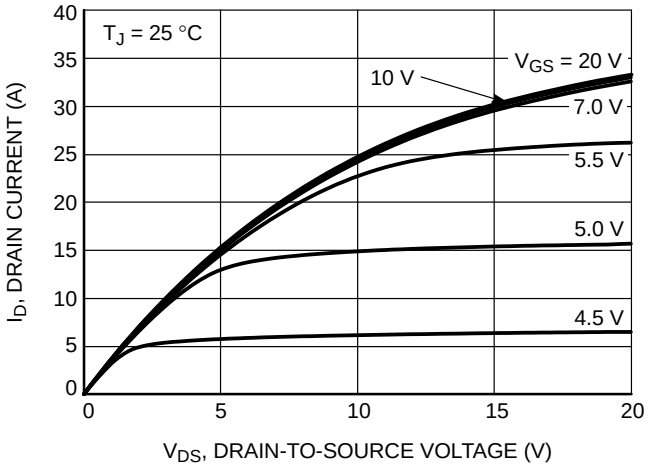



**Figure 1. On-Region Characteristics**

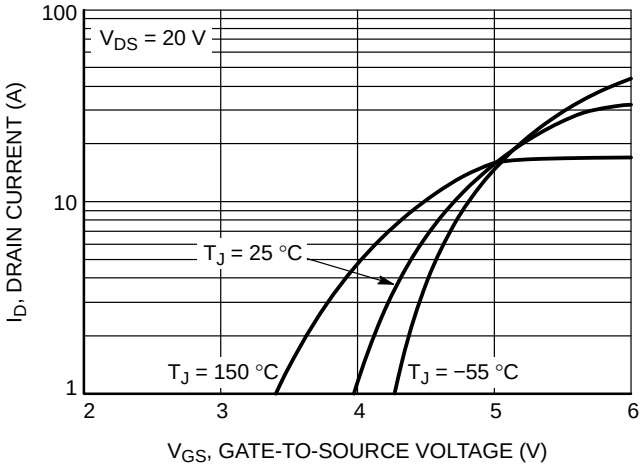



**Figure 2. Transfer Characteristics**

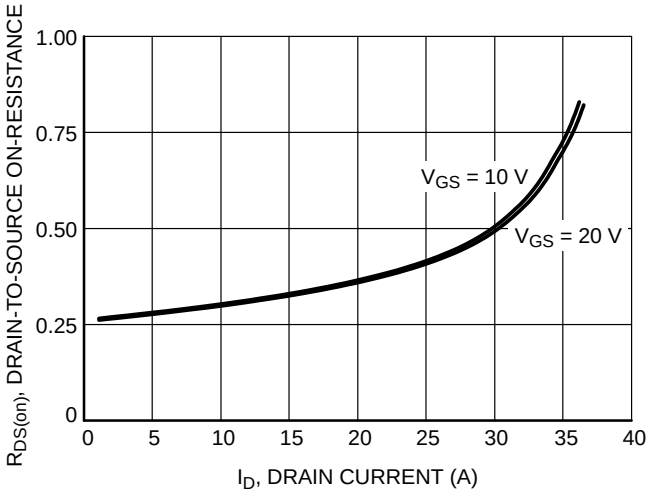



**Figure 3. On Resistance vs. Drain Current**

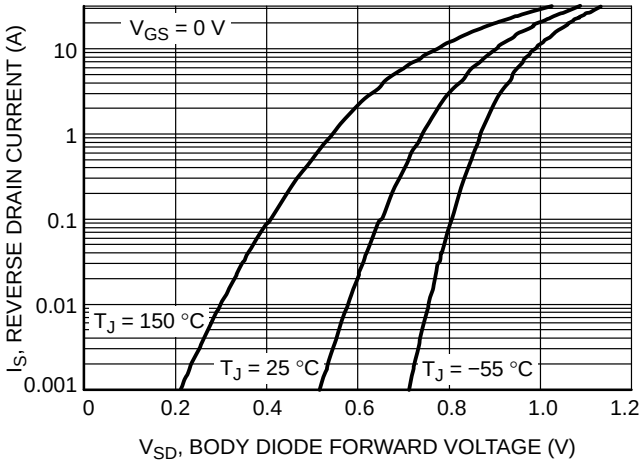



**Figure 4. Diode Forward Voltage vs. Current**

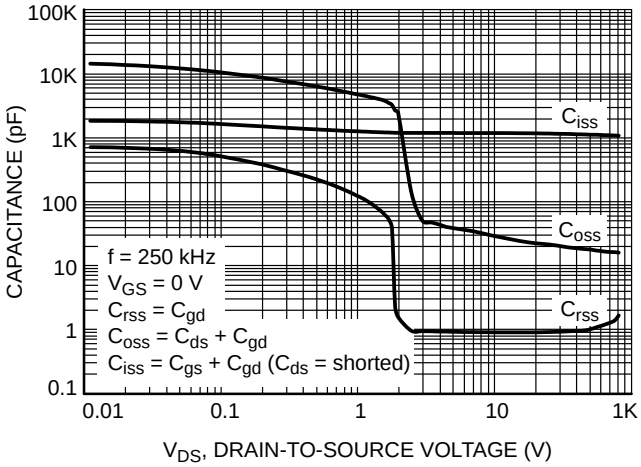



**Figure 5. Capacitance Characteristics**

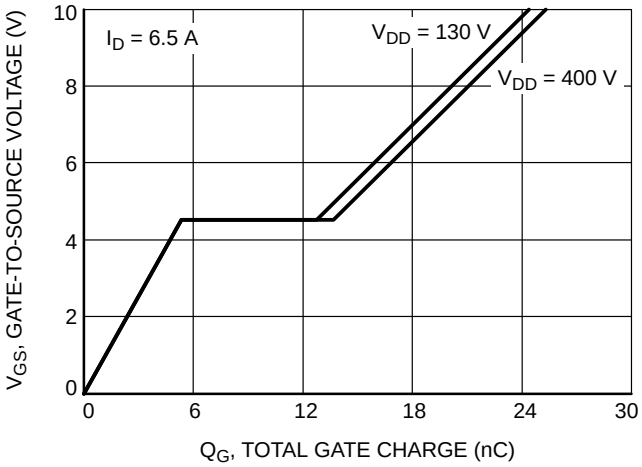



**Figure 6. Gate Charge Characteristics**



Downloaded from Arrow.com.

## TYPICAL CHARACTERISTICS

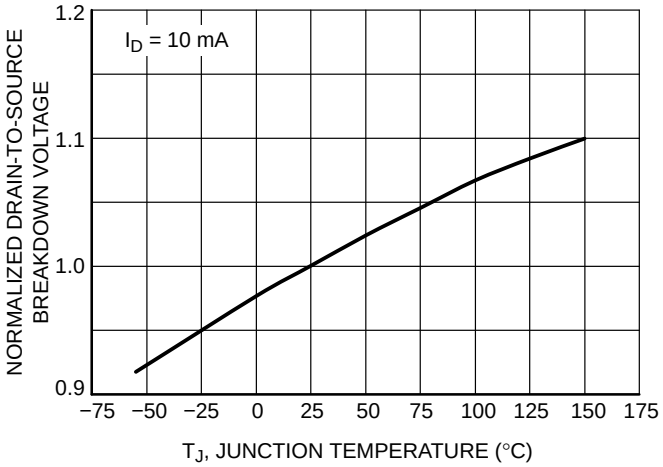



**Figure 7. Normalized $BV_{DSS}$ vs. Temperature**

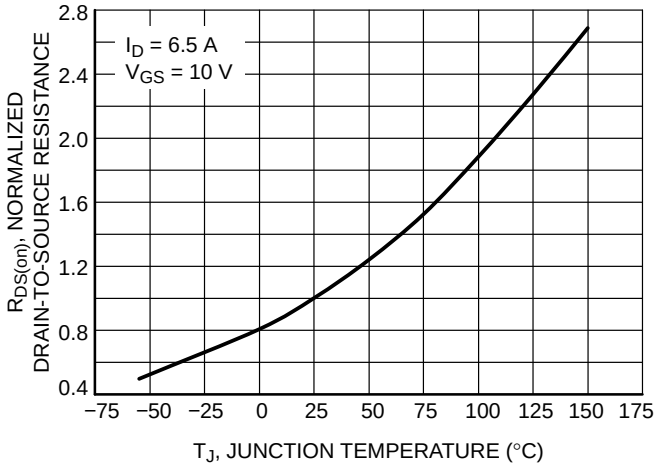



**Figure 8. On-Resistance Variation vs. Temperature**

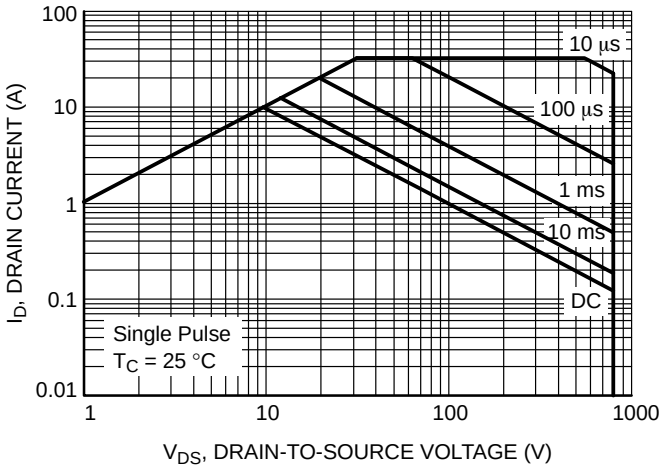



**Figure 9. Safe Operating Area**

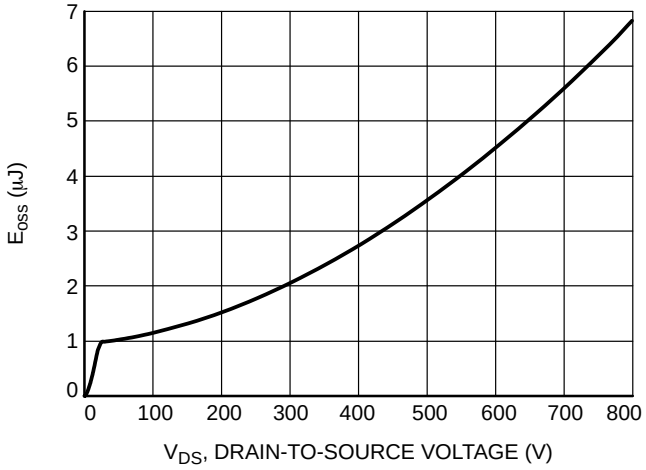



**Figure 10. $E_{oss}$ vs. Drain-to-Source Voltage**

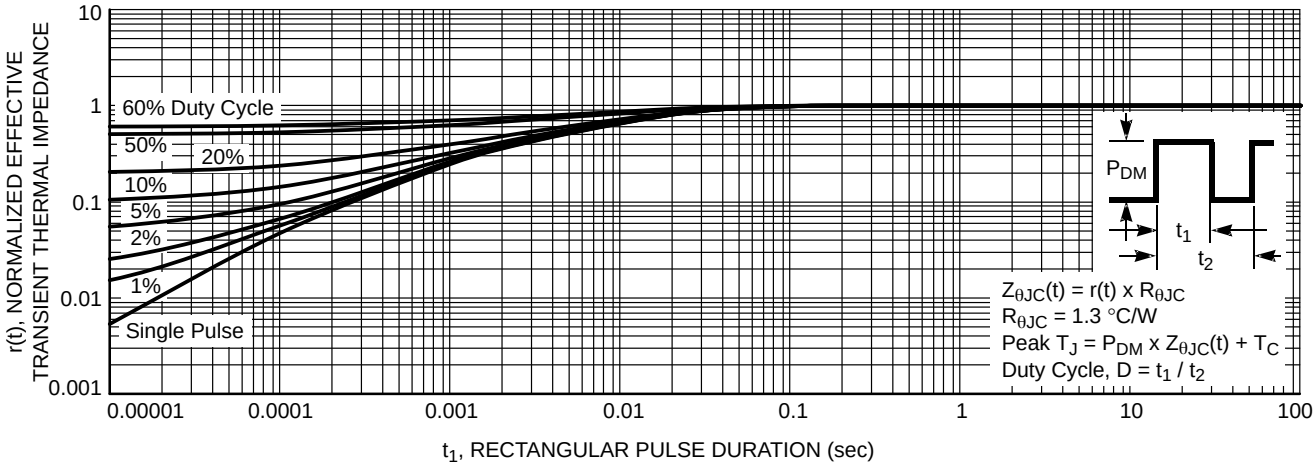



**Figure 11. Transient Thermal Impedance**



Downloaded from Arrow.com.

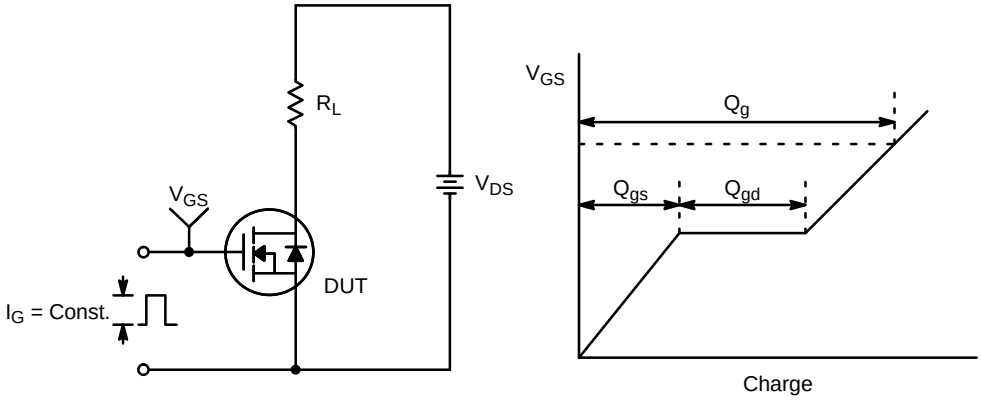



**Figure 12. Gate Charge Test Circuit & Waveform**

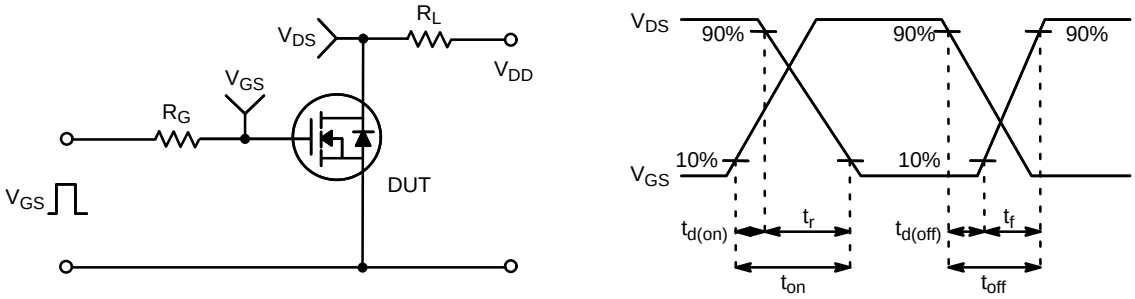



**Figure 13. Resistive Switching Test Circuit & Waveforms**

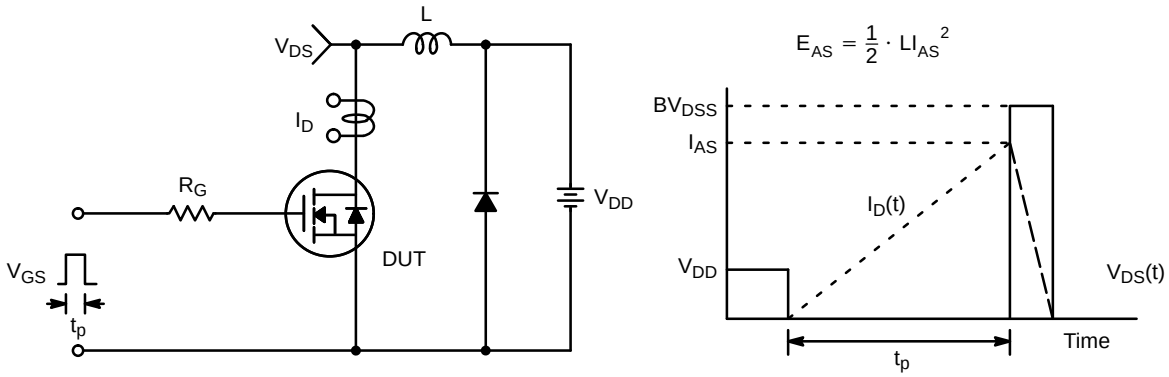



**Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms**



Downloaded from Arrow.com.

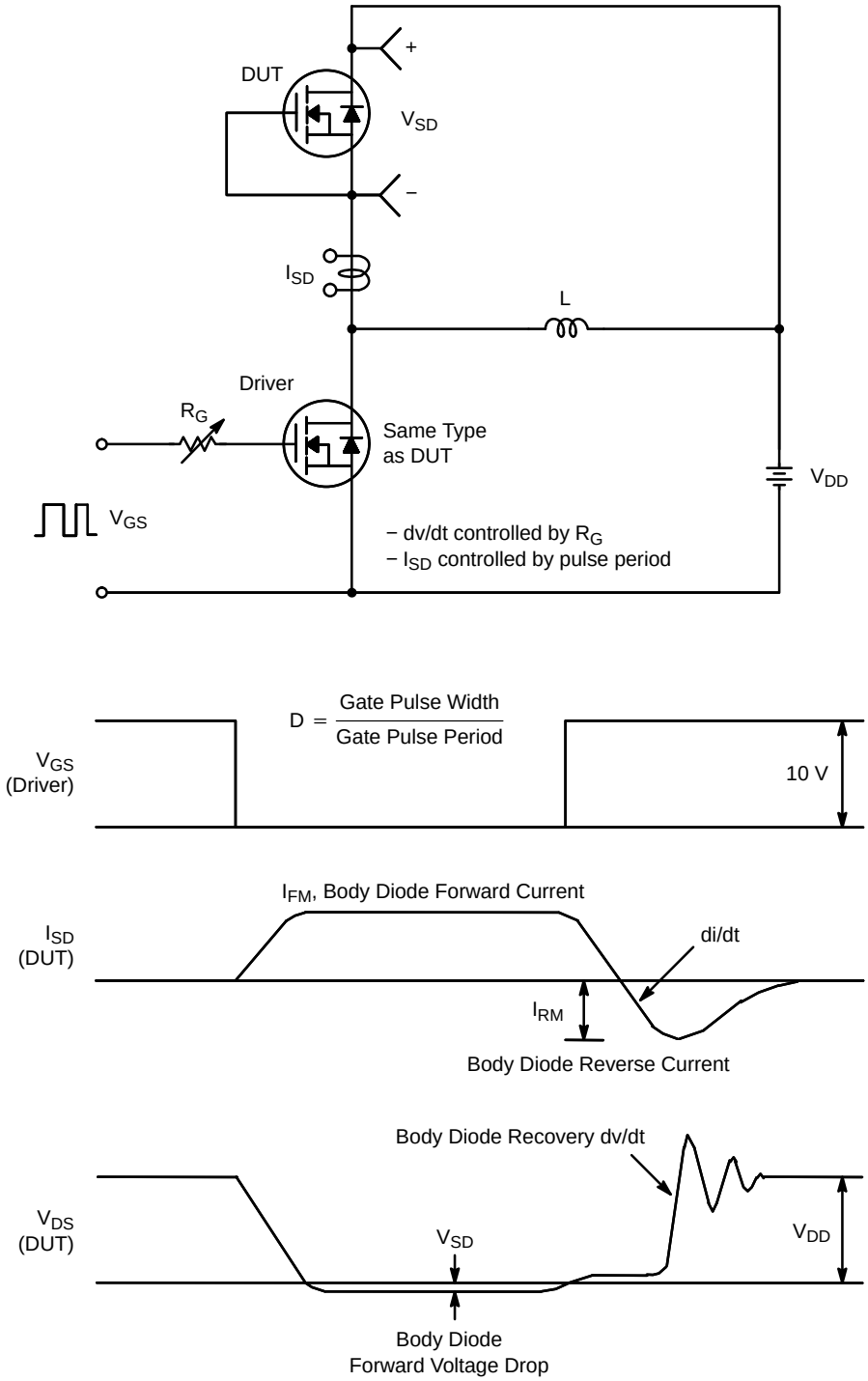



**Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms**

SUPERFET is registered trademark of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries.



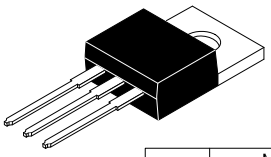
Downloaded from Arrow.com.

## REVISION HISTORY

| Revision | Description of Changes | Date |
|---|---|---|
| 0 | Initial Production Data Sheet release. | 4/1/2020 |
| 1 | Rebranded the Data Sheet to **onsemi** format. | 11/4/2025 |



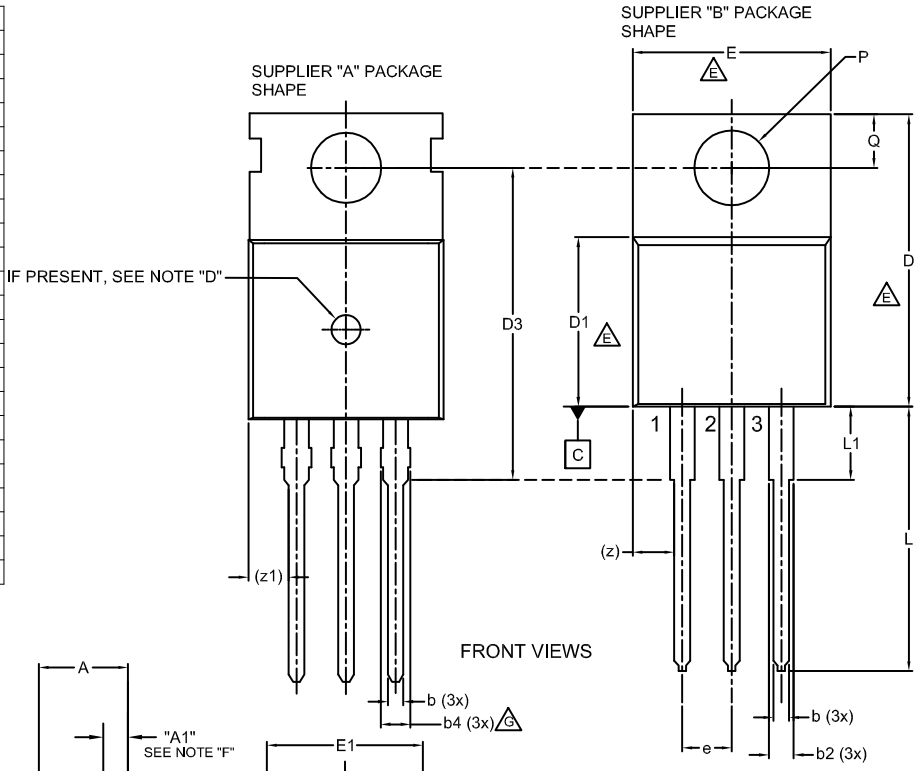
Downloaded from Arrow.com.

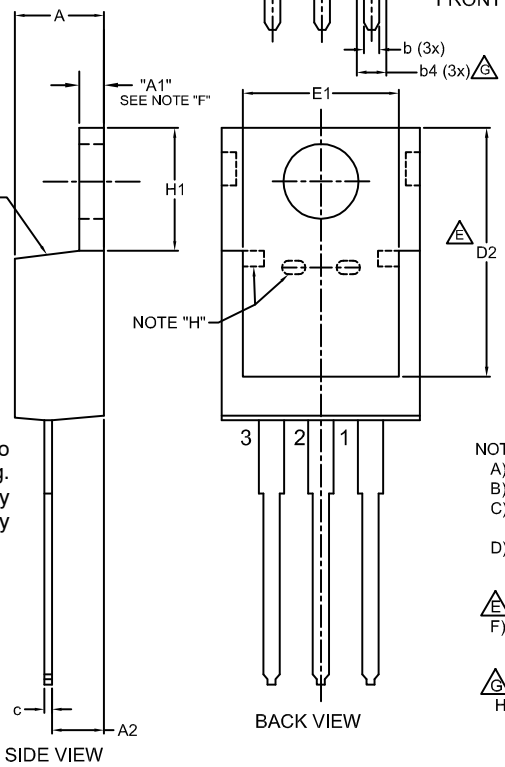


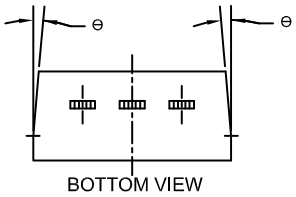
**TO−220−3LD**
CASE 340AT
ISSUE B

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° |




**GENERIC MARKING DIAGRAM***

XXXXX
XXXXX
AYWWZZ

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.

| DOCUMENT NUMBER: | 98AON13818G | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
|---|---|---|
| DESCRIPTION: | TO−220−3LD | PAGE 1 OF 1 |

**onsemi** and onsemi are trademarks of Semiconductor Components Industries, LLC dba **onsemi** or its subsidiaries in the United States and/or other countries. **onsemi** reserves the right to make changes without further notice to any products herein. **onsemi** makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. **onsemi** does not convey any license under its patent rights nor the rights of others.



Downloaded from Arrow.com.

**onsemi**, onsemi, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent−Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as−is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

**TECHNICAL PUBLICATIONS**:
**Technical Library:** www.onsemi.com/design/resources/technical−documentation
**onsemi Website:** www.onsemi.com

**ONLINE SUPPORT**: www.onsemi.com/support
**For additional information, please contact your local Sales Representative at** www.onsemi.com/support/sales

Downloaded from Arrow.com.