

MOSFET – Power, Single N-Channel, D2PAK 650 V, 110 mΩ, 30 A

NVB110N65S3F

Description

SUPERFET[®] III 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 advanced technology is tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate.

Consequently, SUPERFET III MOSFET is very suitable for the various power system for miniaturization and higher efficiency. SUPERFET III FRFET[®] MOSFET's optimized reverse recovery performance of body diode can remove additional component and improve system reliability.

Features

- 700 V @ T_J = 150°C
- Typ. R_{DS(on)} = 93 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 58 nC)
- Low Effective Output Capacitance (Typ. C_{oss(eff.)} = 533 pF)
- 100% Avalanche Tested
- Qualified with AEC-Q101
- These Devices are Pb-Free and are RoHS Compliant

Typical Applications

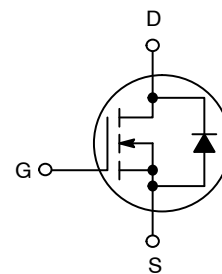
- Automotive On Board Charger
- Automotive DC/DC Converter for HEV



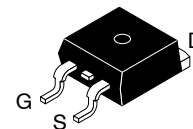
ON Semiconductor[®]

www.onsemi.com

| V _{(BR)DSS} | R _{DS(ON)} MAX | I _D MAX |
|----------------------|-------------------------|--------------------|
| 650 V | 110 mΩ @ 10 V | 30 A |

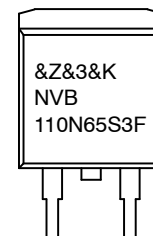


N-CHANNEL MOSFET



D2PAK-3
TO-263
CASE 418AJ

MARKING DIAGRAM



&Z = Assembly Plant Code
 &3 = Data Code (Year & Week)
 &K = Lot
 NVB110N65S3F = Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

NVB110N65S3F

Table 1. ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$ unless otherwise stated)

| Symbol | Parameter | Value | Unit |
|----------------|--|--|------------------|
| V_{DSS} | Drain-to-Source Voltage | 650 | V |
| V_{GS} | Gate-to-Source Voltage | - DC | ± 30 |
| | | - AC ($f > 1$ Hz) | ± 30 |
| I_D | Drain Current | - Continuous ($T_C = 25^\circ\text{C}$) | 30 |
| | | - Continuous ($T_C = 100^\circ\text{C}$) | 19.5 |
| I_{DM} | Drain Current | - Pulsed (Note 1) | 69 |
| E_{AS} | Single Pulse Avalanche Energy (Note 2) | 380 | mJ |
| I_{AS} | Avalanche Current | 3.5 | A |
| E_{AR} | Repeated Avalanche Energy (Note 1) | 2.4 | mJ |
| dv/dt | MOSFET dv/dt | 100 | V/ns |
| | Peak Diode Recovery dv/dt (Note 3) | 50 | |
| P_D | Power Dissipation | $T_C = 25^\circ\text{C}$ | 240 |
| | | - Derate Above 25°C | 1.92 |
| T_J, T_{stg} | Operating Junction and Storage Temperature | -55 to 150 | $^\circ\text{C}$ |
| T_L | Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds | 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.

1. Repetitive rating: pulse – width limited by maximum junction temperature.
2. $I_{AS} = 3.5$ A, $R_G = 25 \Omega$, starting $T_J = 25^\circ\text{C}$.
3. $ISD \leq 15$ A, $di/dt \leq 200$ A/_s, $V_{DD} \leq 400$ V, starting $T_C = 25^\circ\text{C}$.

Table 2. THERMAL RESISTANCE RATINGS

| Symbol | Parameter | Max | Unit |
|-----------------|---|------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case, Max. | 0.52 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient, Max. | 40 | |

NVB110N65S3F

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

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

OFF CHARACTERISTICS

| | | | | | | |
|------------------------------|---|--|-----|------|-----------|---------------------|
| BV_{DSS} | Drain-to-Source Breakdown Voltage | $V_{GS} = 0\text{ V}, I_D = 1\text{ mA}, T_J = 25^\circ\text{C}$ | 650 | - | - | V |
| | | $V_{GS} = 0\text{ V}, I_D = 10\text{ mA}, T_J = 150^\circ\text{C}$ | 700 | - | - | V |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 20\text{ mA}$, Referenced to 25°C | - | 0.61 | - | V/ $^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$ | - | - | 10 | μA |
| | | $V_{DS} = 520\text{ V}, T_C = 125^\circ\text{C}$ | - | 128 | - | μA |
| I_{GSS} | Gate-to-Body Leakage Current | $V_{GS} = 0\text{ V}, I_D = 1\text{ mA}, T_J = 25^\circ\text{C}$ | - | - | ± 100 | nA |

ON CHARACTERISTICS

| | | | | | | |
|--------------|--------------------------------------|---|-----|----|-----|------------|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS} = V_{DS}, I_D = 0.74\text{ mA}$ | 3.0 | - | 5.0 | V |
| $R_{DS(on)}$ | Static Drain-to-Source On Resistance | $V_{GS} = 10\text{ V}, I_D = 15\text{ A}$ | - | 93 | 110 | m Ω |
| g_{FS} | Forward Transconductance | $V_{GS} = 20\text{ V}, I_D = 15\text{ A}$ | - | 17 | - | S |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|-----------------|-----------------------------------|--|---|------|---|----------|
| C_{iss} | Input Capacitance | $V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | - | 2560 | - | pF |
| C_{oss} | Output Capacitance | | - | 50 | - | pF |
| $C_{oss(eff.)}$ | Effective Output Capacitance | $V_{DS} = 0\text{ to }400\text{ V}, V_{GS} = 0\text{ V}$ | - | 553 | - | pF |
| $C_{oss(er.)}$ | Energy Related Output Capacitance | $V_{DS} = 0\text{ to }400\text{ V}, V_{GS} = 0\text{ V}$ | - | 83 | - | pF |
| $Q_{g(total)}$ | Total Gate Charge at 10 V | $V_{DS} = 400\text{ V}, I_D = 15\text{ A},$ $V_{GS} = 10\text{ V}$ (Note 4) | - | 58 | - | nC |
| Q_{gs} | Gate-to-Source Gate Charge | | - | 19 | - | nC |
| Q_{gd} | Gate-to-Drain "Miller" Charge | | - | 23 | - | nC |
| ESR | Equivalent Series Resistance | $F = 1\text{ MHz}$ | - | 2 | - | Ω |

SWITCHING CHARACTERISTICS, $V_{GS} = 10\text{ V}$

| | | | | | | |
|--------------|---------------------|--|---|----|---|----|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = 400\text{ V}, I_D = 15\text{ A},$ $V_{GS} = 10\text{ V}, R_G = 4.7\text{ }\Omega$ (Note 4) | - | 29 | - | ns |
| t_r | Rise Time | | - | 32 | - | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 61 | - | ns |
| t_f | Fall Time | | - | 16 | - | ns |

SOURCE-DRAIN DIODE CHARACTERISTICS

| | | | | | | |
|----------|--|--|---|-----|-----|----|
| I_S | Maximum Continuous Source-to-Drain Diode Forward Current | - | - | 30 | A | |
| I_{SM} | Maximum Pulsed Source-to-Drain Diode Forward Current | - | - | 69 | A | |
| V_{SD} | Source-to-Drain Diode Forward Voltage | $V_{GS} = 0\text{ V}, I_{SD} = 15\text{ A}$ | - | - | 1.3 | V |
| t_{rr} | Reverse-Recovery Time | $V_{GS} = 0\text{ V}, I_{SD} = 15\text{ A},$ $di_F/dt = 100\text{ A}/\mu\text{s}$ | - | 94 | - | ns |
| Q_{rr} | Reverse-Recovery Charge | | - | 343 | - | nC |

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 CHARACTERISTICS

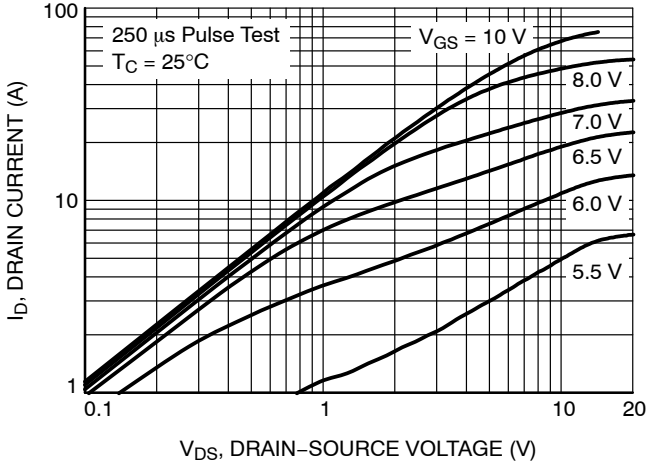


Figure 1. On-Region Characteristics
25°C

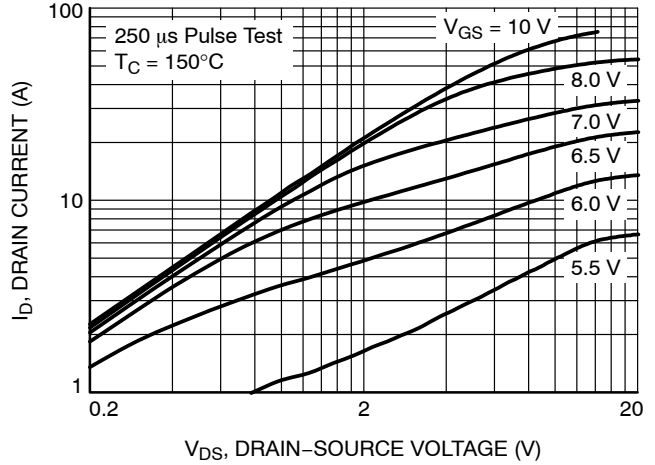


Figure 2. On-Region Characteristics
150°C

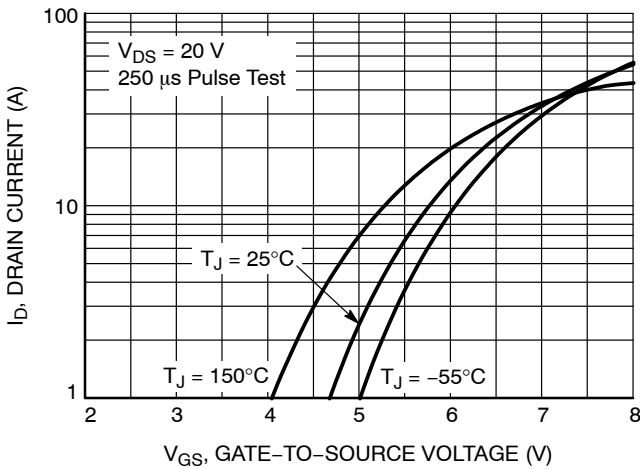


Figure 3. Transfer Characteristics

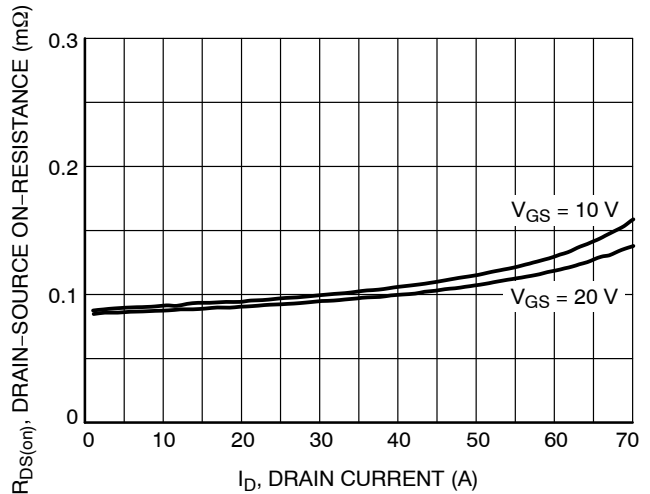


Figure 4. On-Resistance Variation vs. Drain Current and Gate Voltage

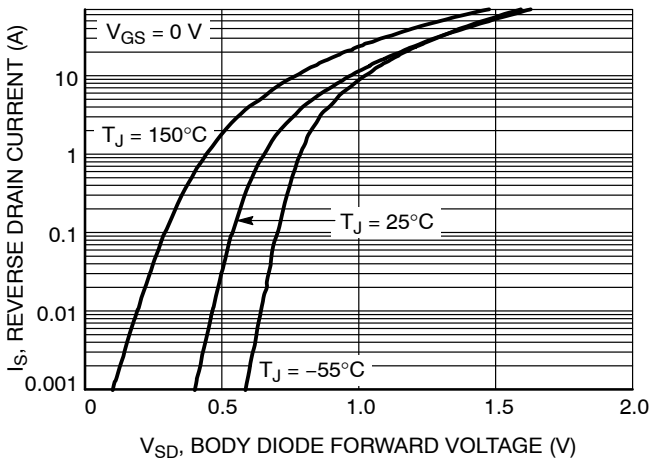


Figure 5. Body Diode Forward Voltage Variation vs. Source Current and Temperature

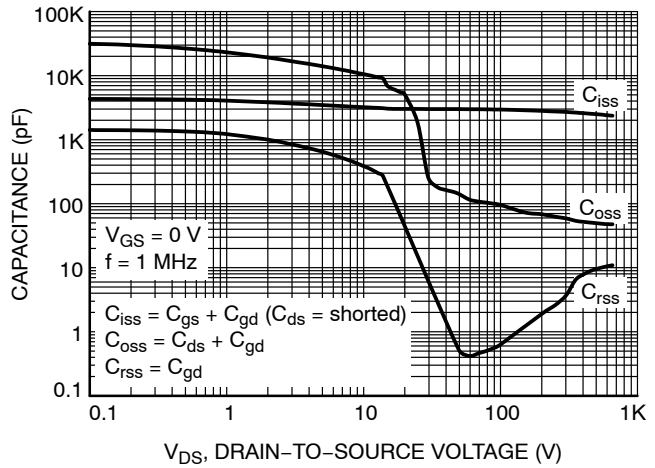


Figure 6. Capacitance Characteristics

TYPICAL CHARACTERISTICS

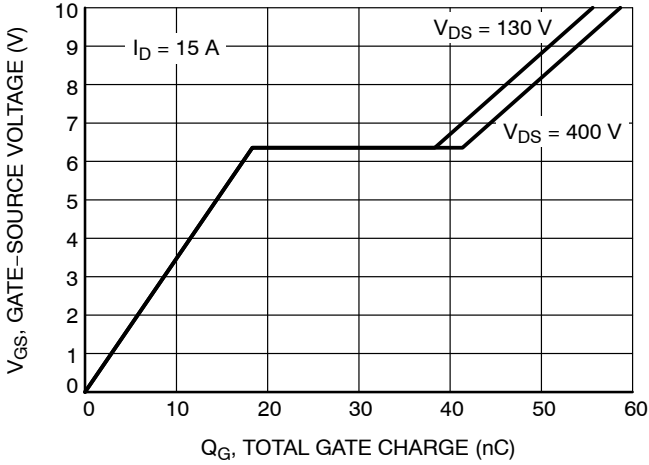


Figure 7. Gate Charge Characteristics

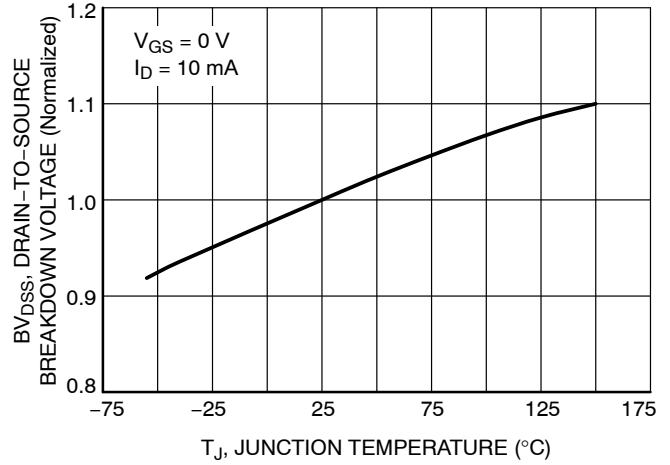


Figure 8. Breakdown Voltage Variation vs. Temperature

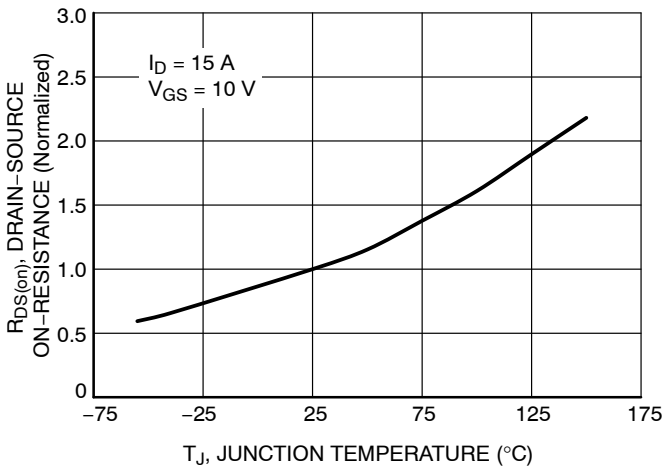


Figure 9. On-Resistance Variation vs. Temperature

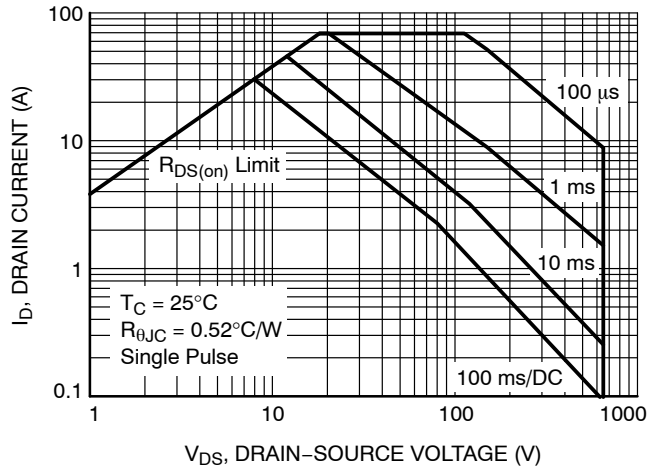


Figure 10. Maximum Safe Operating Area

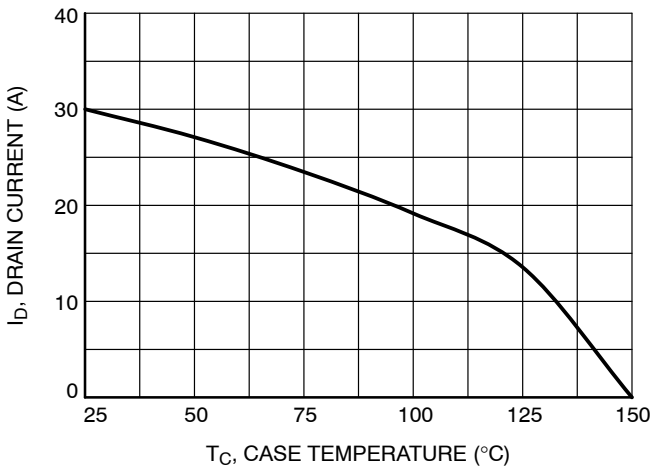


Figure 11. Maximum Drain Current vs. Case Temperature

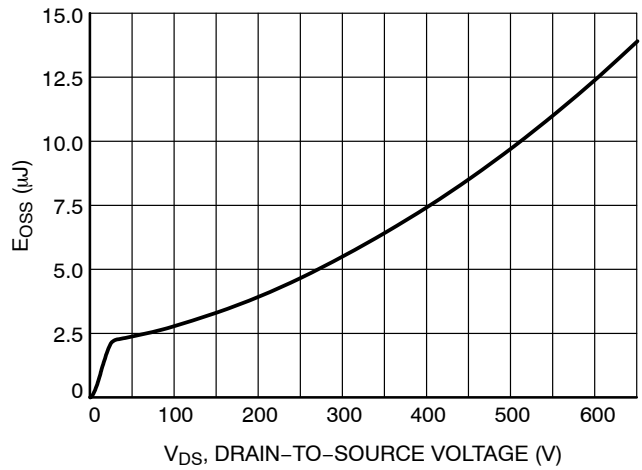


Figure 12. E_{OSS} vs. Drain-to-Source Voltage

NVB110N65S3F

TYPICAL CHARACTERISTICS

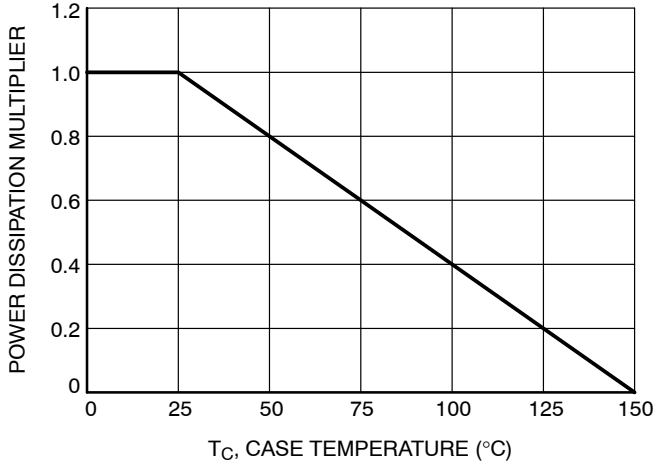


Figure 13. Normalized Power Dissipation vs. Case Temperature

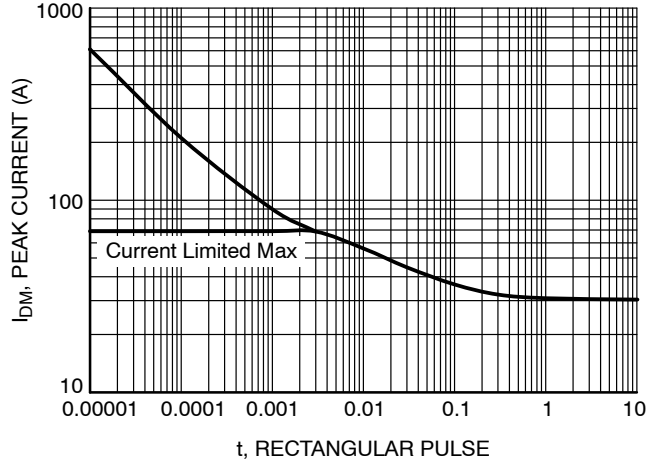


Figure 14. Peak Current Capability

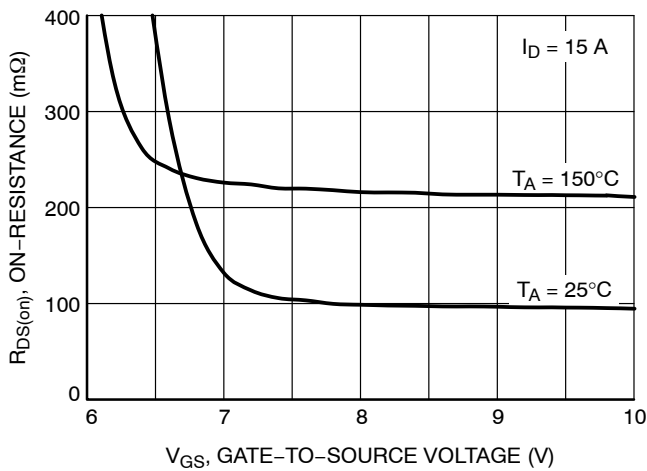


Figure 15. $R_{DS(on)}$ vs. Gate Voltage

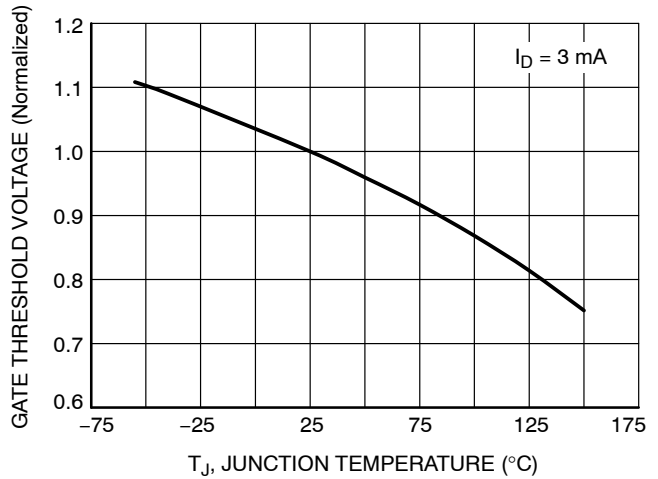


Figure 16. Normalized Gate Threshold Voltage vs. Temperature

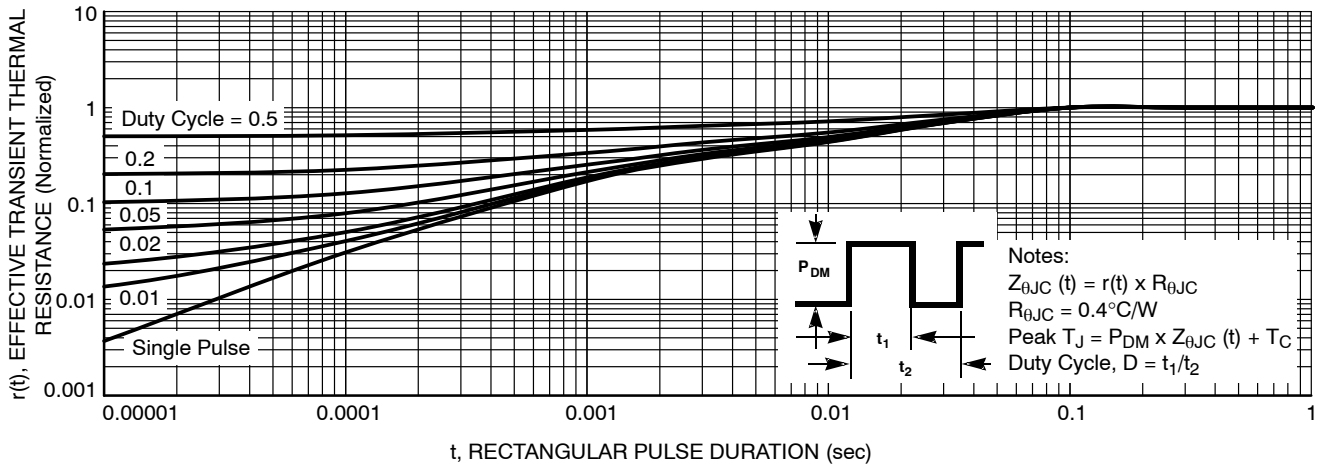


Figure 17. Transient Thermal Response

NVB110N65S3F

PACKAGE MARKING AND ORDERING INFORMATION

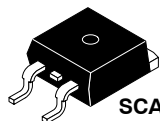
| Part Number | Top Marking | Package | Packing Method | Reel Size | Tape Width | Quantity |
|--------------|--------------|--------------------|----------------|-----------|------------|-----------|
| NVB110N65S3F | NVB110N65S3F | D ² PAK | Tape & Reel† | 330 mm | 24 mm | 800 Units |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](#).

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

ON Semiconductor®



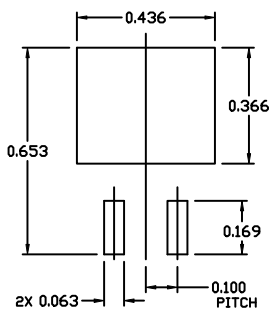
SCALE 1:1

D²PAK-3 (TO-263, 3-LEAD)

CASE 418AJ

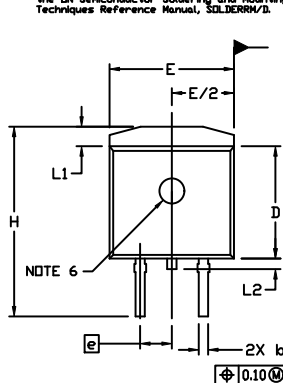
ISSUE F

DATE 11 MAR 2021



RECOMMENDED MOUNTING FOOTPRINT

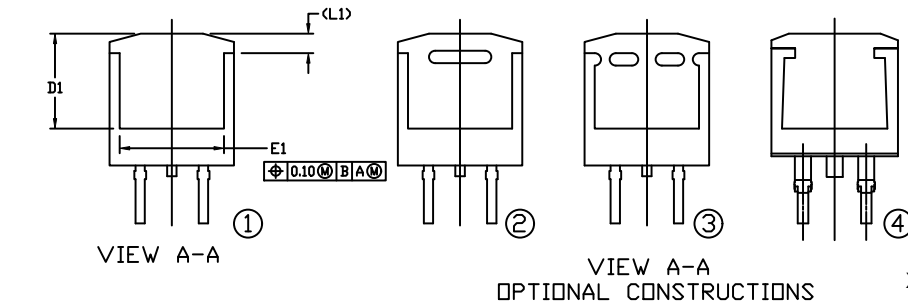
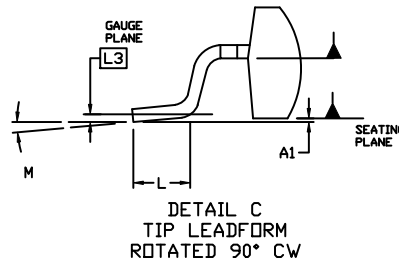
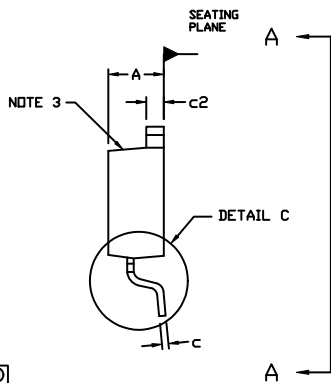
For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



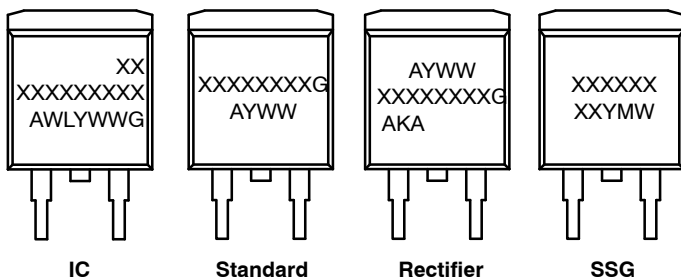
NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
- CONTROLLING DIMENSION: INCHES
- CHAMFER OPTIONAL.
- DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005 PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
- THERMAL PAD CONTOUR IS OPTIONAL WITHIN DIMENSIONS E, L1, D1, AND E1.
- OPTIONAL MOLD FEATURE.
- ①, ② ... OPTIONAL CONSTRUCTION FEATURE CALL OUTS.

| DIM | INCHES | | MILLIMETERS | |
|-----|--------|-------|-------------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 0.160 | 0.190 | 4.06 | 4.83 |
| A1 | 0.000 | 0.010 | 0.00 | 0.25 |
| b | 0.020 | 0.039 | 0.51 | 0.99 |
| c | 0.012 | 0.029 | 0.30 | 0.74 |
| c2 | 0.045 | 0.065 | 1.14 | 1.65 |
| D | 0.330 | 0.380 | 8.38 | 9.65 |
| D1 | 0.260 | --- | 6.60 | --- |
| E | 0.380 | 0.420 | 9.65 | 10.67 |
| E1 | 0.245 | --- | 6.22 | --- |
| e | 0.100 | BSC | 2.54 | BSC |
| H | 0.575 | 0.625 | 14.60 | 15.88 |
| L | 0.070 | 0.110 | 1.78 | 2.79 |
| L1 | --- | 0.066 | --- | 1.68 |
| L2 | --- | 0.070 | --- | 1.78 |
| L3 | 0.010 | BSC | 0.25 | BSC |
| M | 0* | 8* | 0* | 8* |



GENERIC MARKING DIAGRAMS*



- XXXXXX = Specific Device Code
- A = Assembly Location
- WL = Wafer Lot
- Y = Year
- WW = Work Week
- W = Week Code (SSG)
- M = Month Code (SSG)
- G = Pb-Free Package
- AKA = Polarity Indicator

*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.

| | | |
|-------------------------|--|--|
| DOCUMENT NUMBER: | 98AON56370E | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION: | D²PAK-3 (TO-263, 3-LEAD) | PAGE 1 OF 1 |

ON Semiconductor and ON are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

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.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Email Requests to: orderlit@onsemi.com

onsemi Website: www.onsemi.com

TECHNICAL SUPPORT

North American Technical Support:

Voice Mail: 1 800-282-9855 Toll Free USA/Canada

Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[onsemi:](#)

[NVB110N65S3F](#)