

NTF5P03, NVF5P03

Power MOSFET -5.2 A, -30 V

P-Channel SOT-223

Features

- Ultra Low $R_{DS(on)}$
- Higher Efficiency Extending Battery Life
- Logic Level Gate Drive
- Miniature SOT-223 Surface Mount Package
- Avalanche Energy Specified
- AEC-Q101 Qualified and PPAP Capable – NVF5P03T3G
- These Devices are Pb-Free and are RoHS Compliant

Applications

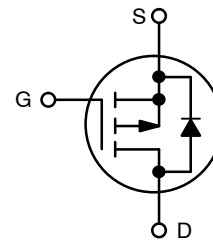
- DC-DC Converters
- Power Management
- Motor Controls
- Inductive Loads
- Replaces MMFT5P03HD



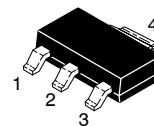
ON Semiconductor[®]

<http://onsemi.com>

-5.2 AMPERES, -30 VOLTS
 $R_{DS(on)} = 100 \text{ m}\Omega$

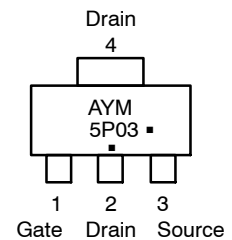


P-Channel MOSFET



**SOT-223
CASE 318E
STYLE 3**

MARKING DIAGRAM & PIN ASSIGNMENT



- A = Assembly Location
- Y = Year
- M = Date Code
- 5P03 = Specific Device Code
- = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

| Device | Package | Shipping [†] |
|------------|----------------------|-----------------------|
| NTF5P03T3G | SOT-223 (Pb-Free) | 4000 / Tape & Reel |
| NVF5P03T3G | SOT-223 (Pb-Free) | 4000 / Tape & Reel |

[†]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.

NTF5P03, NVF5P03

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

Negative sign for P-Channel devices omitted for clarity

| Rating | | Symbol | Max | Unit |
|---|---|----------------|-------------|----------------------------|
| Drain-to-Source Voltage | | V_{DSS} | -30 | V |
| Drain-to-Gate Voltage ($R_{GS} = 1.0\text{ M}\Omega$) | | V_{DGR} | -30 | V |
| Gate-to-Source Voltage - Continuous | | V_{GS} | ± 20 | V |
| 1 sq in FR-4 or G-10 PCB 10 seconds | Thermal Resistance - Junction to Ambient | R_{THJA} | 40 | $^\circ\text{C}/\text{W}$ |
| | Total Power Dissipation @ $T_A = 25^\circ\text{C}$ | P_D | 3.13 | Watts |
| | Linear Derating Factor | | 25 | $\text{mW}/^\circ\text{C}$ |
| | Drain Current - Continuous @ $T_A = 25^\circ\text{C}$ | I_D | -5.2 | A |
| Minimum FR-4 or G-10 PCB 10 seconds | Continuous @ $T_A = 70^\circ\text{C}$ | I_D | -4.1 | A |
| | Pulsed Drain Current (Note 1) | I_{DM} | -26 | A |
| | Thermal Resistance - Junction to Ambient | R_{THJA} | 80 | $^\circ\text{C}/\text{W}$ |
| | Total Power Dissipation @ $T_A = 25^\circ\text{C}$ | P_D | 1.56 | Watts |
| | Linear Derating Factor | | 12.5 | $\text{mW}/^\circ\text{C}$ |
| | Drain Current - Continuous @ $T_A = 25^\circ\text{C}$ | I_D | -3.7 | A |
| | Continuous @ $T_A = 70^\circ\text{C}$ | I_D | -2.9 | A |
| | Pulsed Drain Current (Note 1) | I_{DM} | -19 | A |
| Operating and Storage Temperature Range | | T_J, T_{stg} | - 55 to 150 | $^\circ\text{C}$ |
| Single Pulse Drain-to-Source Avalanche Energy - Starting $T_J = 25^\circ\text{C}$ ($V_{DD} = -30\text{ Vdc}$, $V_{GS} = -10\text{ Vdc}$, Peak $I_L = -12\text{ Apk}$, $L = 3.5\text{ mH}$, $R_G = 25\ \Omega$) | | E_{AS} | 250 | mJ |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Repetitive rating; pulse width limited by maximum junction temperature.

NTF5P03, NVF5P03

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | |
|---|----------------------|----------|----------|-------------|--------------|
| Drain-to-Source Breakdown Voltage (Cpk ≥ 2.0) (Notes 2 and 4) (V _{GS} = 0 Vdc, I _D = -250 μAdc) Temperature Coefficient (Positive) | V _{(BR)DSS} | -30 - | - -28 | - - | Vdc mV/°C |
| Zero Gate Voltage Drain Current (V _{DS} = -24 Vdc, V _{GS} = 0 Vdc) (V _{DS} = -24 Vdc, V _{GS} = 0 Vdc, T _J = 125°C) | I _{DSS} | - - | - - | -1.0 -25 | μAdc |
| Gate-Body Leakage Current (V _{GS} = ± 20 Vdc, V _{DS} = 0 Vdc) | I _{GSS} | - | - | ± 100 | nAdc |

ON CHARACTERISTICS (Note 2)

| | | | | | |
|---|---------------------|-----------|--------------|------------|--------------|
| Gate Threshold Voltage (Cpk ≥ 2.0) (Notes 2 and 4) (V _{DS} = V _{GS} , I _D = -250 μAdc) Threshold Temperature Coefficient (Negative) | V _{GS(th)} | -1.0 - | -1.75 3.5 | -3.0 - | Vdc mV/°C |
| Static Drain-to-Source On-Resistance (Cpk ≥ 2.0) (Notes 2 and 4) (V _{GS} = -10 Vdc, I _D = -5.2 Adc) (V _{GS} = -4.5 Vdc, I _D = -2.6 Adc) | R _{DS(on)} | - | 76 107 | 100 150 | mΩ |
| Forward Transconductance (Note 2) (V _{DS} = -15 Vdc, I _D = -2.0 Adc) | g _{fs} | 2.0 | 3.9 | - | Mhos |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|----------------------|--|------------------|---|-----|-----|----|
| Input Capacitance | (V _{DS} = -25 Vdc, V _{GS} = 0 V, f = 1.0 MHz) | C _{iss} | - | 500 | 950 | pF |
| Output Capacitance | | C _{oss} | - | 153 | 440 | |
| Transfer Capacitance | | C _{rss} | - | 58 | 140 | |

SWITCHING CHARACTERISTICS (Note 3)

| | | | | | | |
|---------------------|--|---------------------|---|-----|-----|----|
| Turn-On Delay Time | (V _{DD} = -15 Vdc, I _D = -4.0 Adc, V _{GS} = -10 Vdc, R _G = 6.0 Ω) (Note 2) | t _{d(on)} | - | 10 | 24 | ns |
| Rise Time | | t _r | - | 33 | 48 | |
| Turn-Off Delay Time | | t _{d(off)} | - | 38 | 94 | |
| Fall Time | | t _f | - | 20 | 92 | |
| Turn-On Delay Time | (V _{DD} = -15 Vdc, I _D = -2.0 Adc, V _{GS} = -10 Vdc, R _G = 6.0 Ω) (Note 2) | t _{d(on)} | - | 16 | 38 | ns |
| Rise Time | | t _r | - | 45 | 110 | |
| Turn-Off Delay Time | | t _{d(off)} | - | 23 | 60 | |
| Fall Time | | t _f | - | 24 | 80 | |
| Gate Charge | (V _{DS} = -24 Vdc, I _D = -4.0 Adc, V _{GS} = -10 Vdc) (Note 2) | Q _T | - | 15 | 38 | nC |
| | | Q ₁ | - | 1.6 | - | |
| | | Q ₂ | - | 3.5 | - | |
| | | Q ₃ | - | 2.6 | - | |

SOURCE-DRAIN DIODE CHARACTERISTICS

| | | | | | | |
|--------------------------------|--|-----------------|--------|---------------|-----------|-----|
| Forward On-Voltage | (I _S = -4.0 Adc, V _{GS} = 0 Vdc) (I _S = -4.0 Adc, V _{GS} = 0 Vdc, T _J = 125°C) (Note 2) | V _{SD} | - - | -1.1 -0.89 | -1.5 - | Vdc |
| Reverse Recovery Time | (I _S = -4.0 Adc, V _{GS} = 0 Vdc, dI _S /dt = 100 A/μs) (Note 2) | t _{rr} | - | 34 | - | ns |
| | | t _a | - | 20 | - | |
| | | t _b | - | 14 | - | |
| Reverse Recovery Stored Charge | | Q _{RR} | - | 0.036 | - | μC |

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.
3. Switching characteristics are independent of operating junction temperatures.
4. Reflects typical values.

$$Cpk = \left| \frac{\text{Max limit} - \text{Typ}}{3 \times \text{SIGMA}} \right|$$

TYPICAL ELECTRICAL CHARACTERISTICS

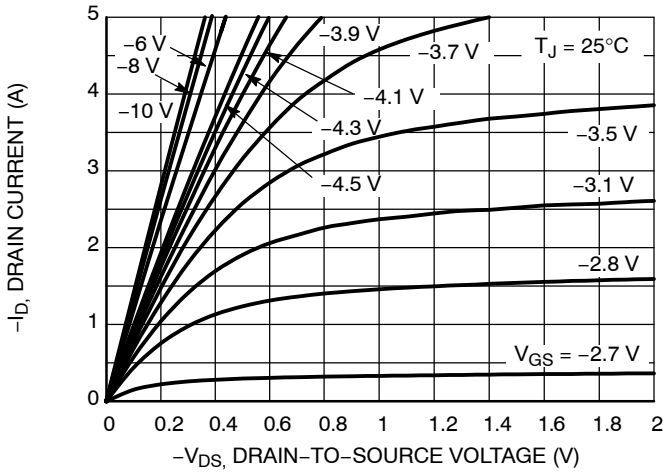


Figure 1. On-Region Characteristics

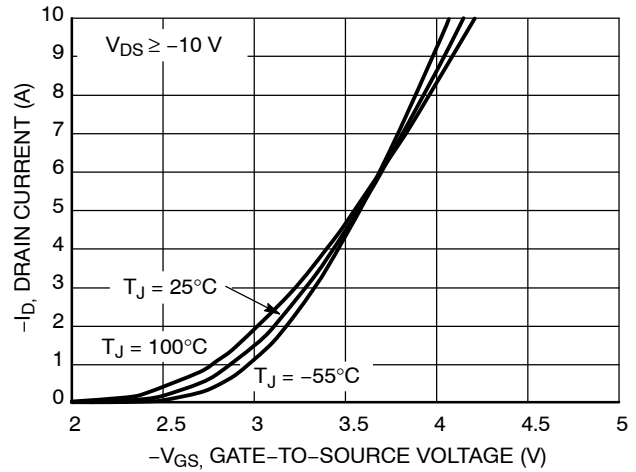


Figure 2. Transfer Characteristics

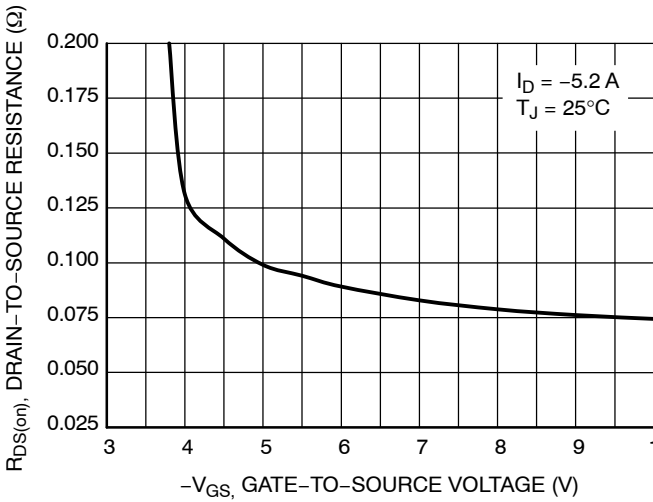


Figure 3. On-Resistance versus Gate-to-Source Voltage

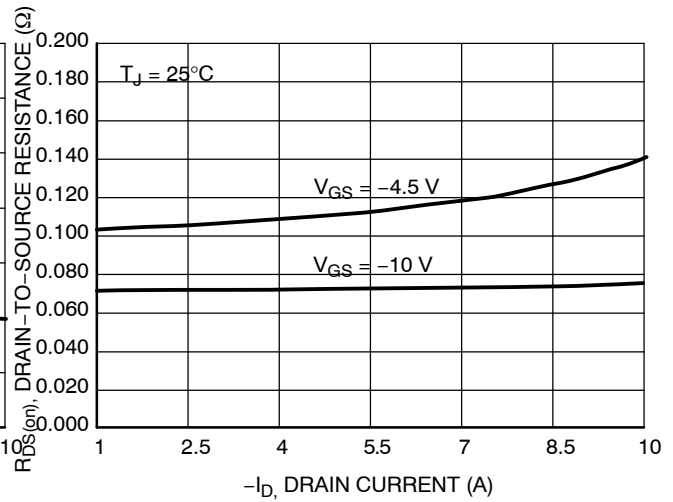


Figure 4. On-Resistance versus Drain Current and Gate Voltage

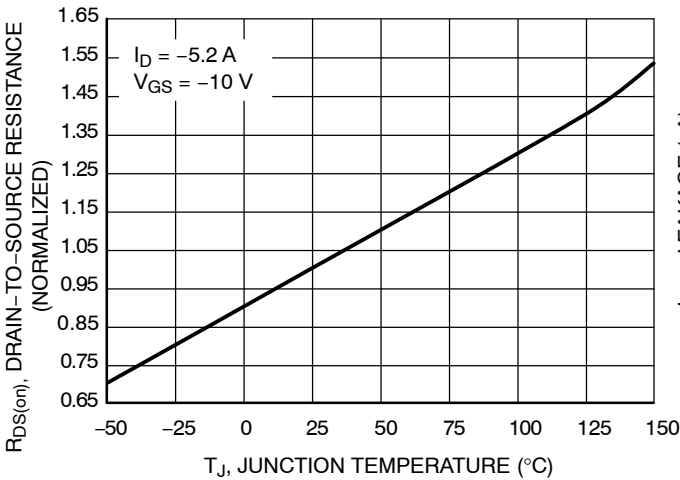


Figure 5. On-Resistance Variation with Temperature

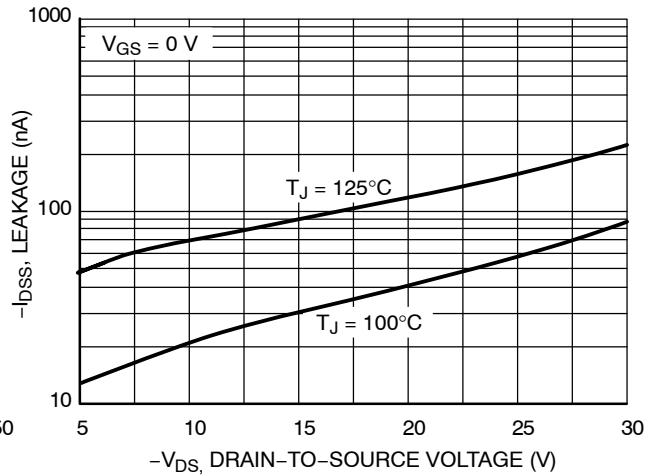


Figure 6. Drain-to-Source Leakage Current versus Voltage

NTF5P03, NVF5P03

TYPICAL ELECTRICAL CHARACTERISTICS

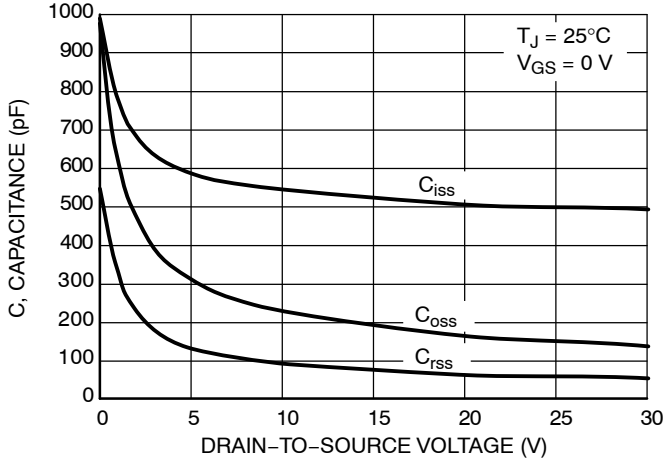


Figure 7. Capacitance Variation

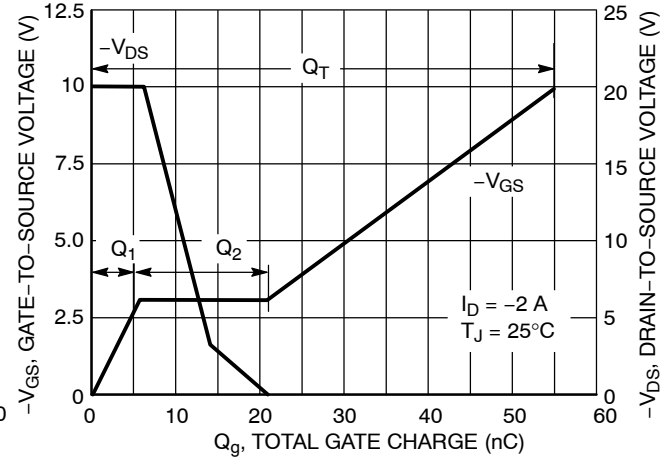


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

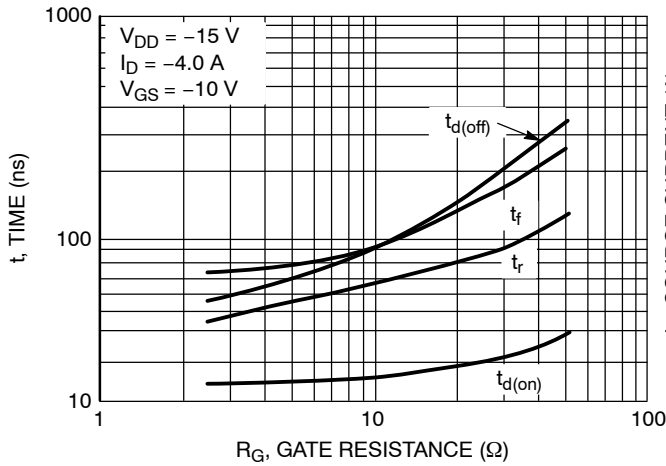


Figure 9. Resistive Switching Time Variation versus Gate Resistance

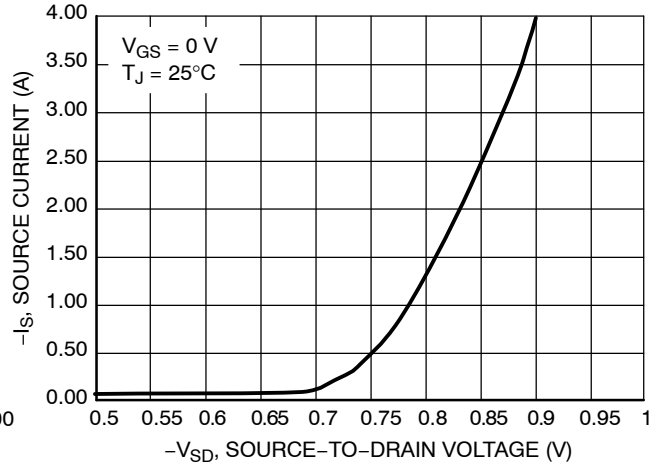
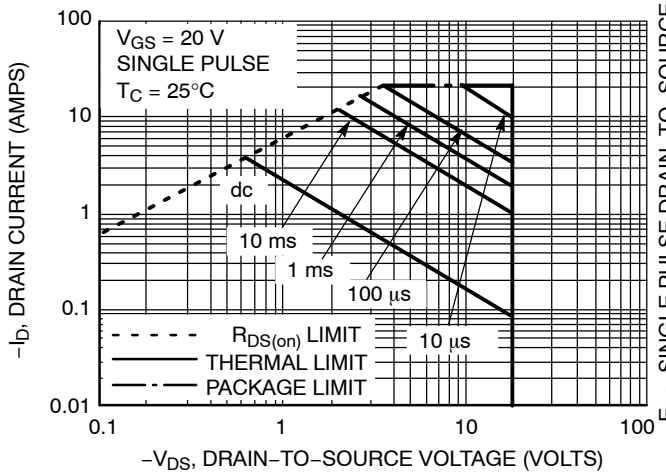


Figure 10. Diode Forward Voltage versus Current



Mounted on 2"sq. FR4 board (1"sq. 2 oz. Cu 0.06" thick single sided) with on die operating, 10 s max.

Figure 11. Maximum Rated Forward Biased Safe Operating Area

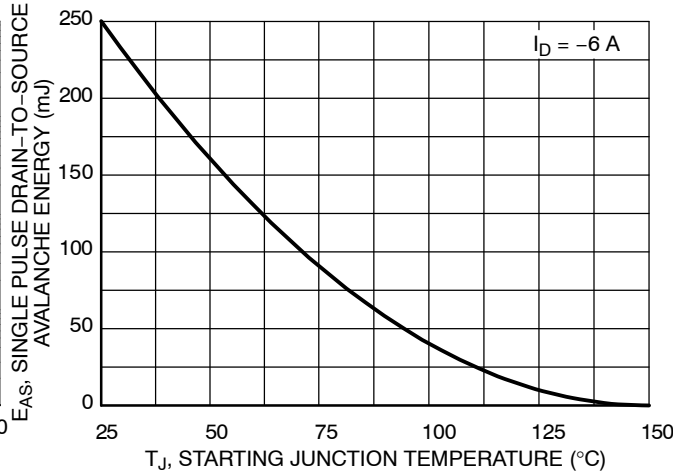


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

NTF5P03, NVF5P03

TYPICAL ELECTRICAL CHARACTERISTICS

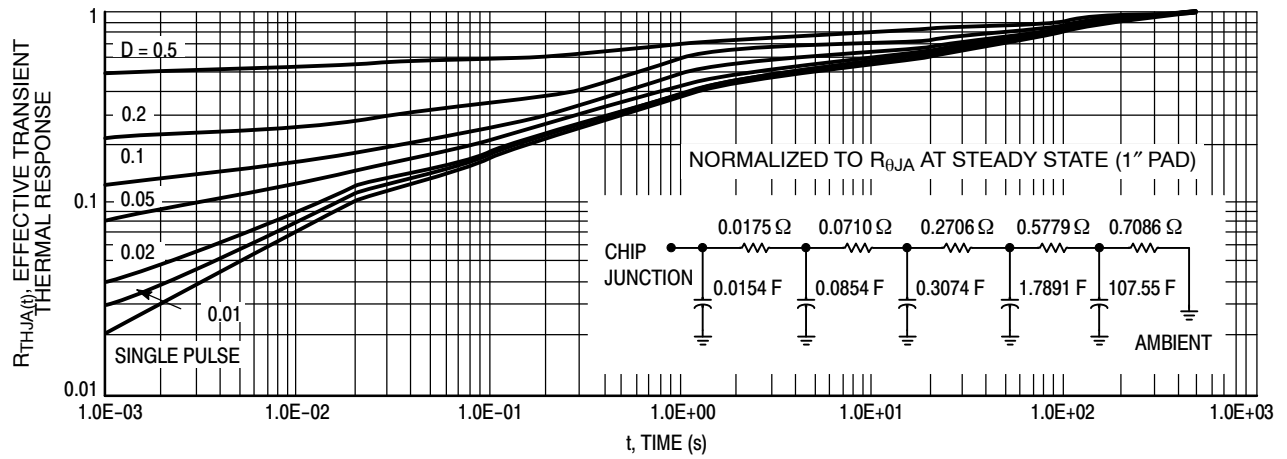
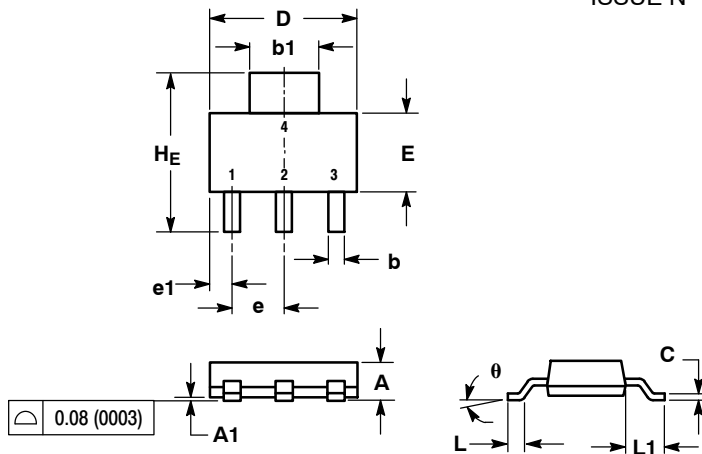


Figure 13. FET Thermal Response

NTF5P03, NVF5P03

PACKAGE DIMENSIONS

SOT-223 (TO-261)
CASE 318E-04
ISSUE N

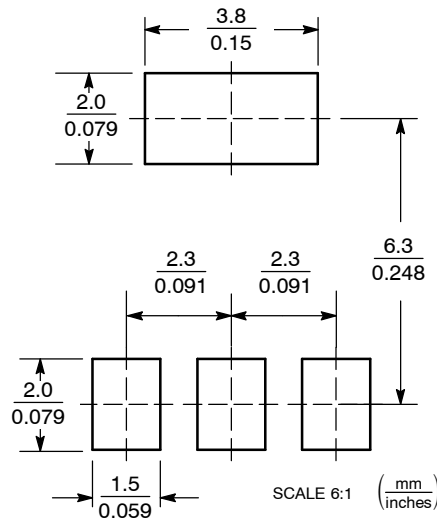


NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCH.

| DIM | MILLIMETERS | | | INCHES | | |
|-------|-------------|------|------|--------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 1.50 | 1.63 | 1.75 | 0.060 | 0.064 | 0.068 |
| A1 | 0.02 | 0.06 | 0.10 | 0.001 | 0.002 | 0.004 |
| b | 0.60 | 0.75 | 0.89 | 0.024 | 0.030 | 0.035 |
| b1 | 2.90 | 3.06 | 3.20 | 0.115 | 0.121 | 0.126 |
| c | 0.24 | 0.29 | 0.35 | 0.009 | 0.012 | 0.014 |
| D | 6.30 | 6.50 | 6.70 | 0.249 | 0.256 | 0.263 |
| E | 3.30 | 3.50 | 3.70 | 0.130 | 0.138 | 0.145 |
| e | 2.20 | 2.30 | 2.40 | 0.087 | 0.091 | 0.094 |
| e1 | 0.85 | 0.94 | 1.05 | 0.033 | 0.037 | 0.041 |
| L | 0.20 | --- | --- | 0.008 | --- | --- |
| L1 | 1.50 | 1.75 | 2.00 | 0.060 | 0.069 | 0.078 |
| HE | 6.70 | 7.00 | 7.30 | 0.264 | 0.276 | 0.287 |
| theta | 0° | - | 10° | 0° | - | 10° |

STYLE 3:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

SOLDERING FOOTPRINT



ON Semiconductor and are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC 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. "Typical" parameters which may be provided in SCILLC 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. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC 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 SCILLC was negligent regarding the design or manufacture of the part. SCILLC 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:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com
Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative

Mouser Electronics

Authorized Distributor

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

[ON Semiconductor:](#)

[NTF5P03T3G](#) [NVF5P03T3G](#)