

# Power MOSFET

## 300 mAmps, 20 Volts

### N-Channel SC-70/SOT-323

### MMBF2201N, NVF2201N

These miniature surface mount MOSFETs low  $R_{DS(on)}$  assure minimal power loss and conserve energy, making these devices ideal for use in small power management circuitry. Typical applications are dc-dc converters, power management in portable and battery-powered products such as computers, printers, PCMCIA cards, cellular and cordless telephones.

#### Features

- Low  $R_{DS(on)}$  Provides Higher Efficiency and Extends Battery Life
- Miniature SC-70/SOT-323 Surface Mount Package Saves Board Space
- NVF Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable\*
- These Devices are Pb-Free and are RoHS Compliant

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

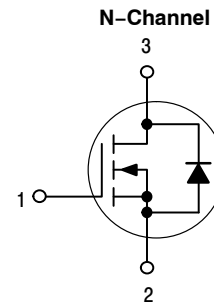
| Rating                                                                                            | Symbol          | Value          | Unit                       |
|---------------------------------------------------------------------------------------------------|-----------------|----------------|----------------------------|
| Drain-to-Source Voltage                                                                           | $V_{DSS}$       | 20             | Vdc                        |
| Gate-to-Source Voltage – Continuous                                                               | $V_{GS}$        | $\pm 20$       | Vdc                        |
| Drain Current                                                                                     |                 |                | mAdc                       |
| – Continuous @ $T_A = 25^\circ\text{C}$                                                           | $I_D$           | 300            |                            |
| – Continuous @ $T_A = 70^\circ\text{C}$                                                           | $I_D$           | 240            |                            |
| – Pulsed Drain Current ( $t_p \leq 10 \mu\text{s}$ )                                              | $I_{DM}$        | 750            |                            |
| Total Power Dissipation @ $T_A = 25^\circ\text{C}$<br>(Note 1)<br>Derate above $25^\circ\text{C}$ | $P_D$           | 150<br>1.2     | mW<br>mW/ $^\circ\text{C}$ |
| Operating and Storage Temperature Range                                                           | $T_J, T_{stg}$  | $-55$ to $150$ | $^\circ\text{C}$           |
| Thermal Resistance, Junction-to-Ambient                                                           | $R_{\theta JA}$ | 833            | $^\circ\text{C/W}$         |
| Maximum Lead Temperature for Soldering Purposes, for 10 seconds                                   | $T_L$           | 260            | $^\circ\text{C}$           |

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.

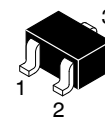
1. Mounted on G10/FR4 glass epoxy board using minimum recommended footprint.

300 mAMPS, 20 VOLTS

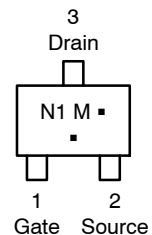
$$R_{DS(on)} = 1 \Omega$$



#### MARKING DIAGRAM AND PIN ASSIGNMENT



SC-70/SOT-323  
CASE 419  
STYLE 8



N1 = Device Code  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation may vary depending upon manufacturing location.

#### ORDERING INFORMATION

| Device       | Package              | Shipping†          |
|--------------|----------------------|--------------------|
| MMBF2201NT1G | SOT-323<br>(Pb-Free) | 3000 / Tape & Reel |
| NVF2201NT1G* | SOT-323<br>(Pb-Free) | 3000 / 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.

# MMBF2201N, NVF2201N

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

| Characteristic                                                                                                                                                        | Symbol                                                                          | Min                 | Typ         | Max        | Unit  |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------------|-------------|------------|-------|----|
| OFF CHARACTERISTICS                                                                                                                                                   |                                                                                 |                     |             |            |       |    |
| Drain-to-Source Breakdown Voltage<br>(V <sub>GS</sub> = 0 Vdc, I <sub>D</sub> = 10 μA)                                                                                | V <sub>(BR)DSS</sub>                                                            | 20                  | –           | –          | Vdc   |    |
| Zero Gate Voltage Drain Current<br>(V <sub>DS</sub> = 16 Vdc, V <sub>GS</sub> = 0 Vdc)<br>(V <sub>DS</sub> = 16 Vdc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 125°C) | I <sub>DSS</sub>                                                                | –<br>–              | –<br>–      | 1.0<br>10  | μAdc  |    |
| Gate-Body Leakage Current (V <sub>GS</sub> = ± 20 Vdc, V <sub>DS</sub> = 0)                                                                                           | I <sub>GSS</sub>                                                                | –                   | –           | ±100       | nAdc  |    |
| ON CHARACTERISTICS (Note 2)                                                                                                                                           |                                                                                 |                     |             |            |       |    |
| Gate Threshold Voltage<br>(V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μAdc)                                                                             | V <sub>GS(th)</sub>                                                             | 1.0                 | 1.7         | 2.4        | Vdc   |    |
| Static Drain-to-Source On-Resistance<br>(V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 300 mAdc)<br>(V <sub>GS</sub> = 4.5 Vdc, I <sub>D</sub> = 100 mAdc)               | r <sub>DS(on)</sub>                                                             | –<br>–              | 0.75<br>1.0 | 1.0<br>1.4 | Ω     |    |
| Forward Transconductance (V <sub>DS</sub> = 10 Vdc, I <sub>D</sub> = 200 mAdc)                                                                                        | g <sub>FS</sub>                                                                 | –                   | 450         | –          | mMhos |    |
| DYNAMIC CHARACTERISTICS                                                                                                                                               |                                                                                 |                     |             |            |       |    |
| Input Capacitance                                                                                                                                                     | (V <sub>DS</sub> = 5.0 V)                                                       | C <sub>iss</sub>    | –           | 45         | –     | pF |
| Output Capacitance                                                                                                                                                    | (V <sub>DS</sub> = 5.0 V)                                                       | C <sub>oss</sub>    | –           | 25         | –     |    |
| Transfer Capacitance                                                                                                                                                  | (V <sub>DG</sub> = 5.0 V)                                                       | C <sub>rss</sub>    | –           | 5.0        | –     |    |
| SWITCHING CHARACTERISTICS (Note 3)                                                                                                                                    |                                                                                 |                     |             |            |       |    |
| Turn-On Delay Time                                                                                                                                                    | (V <sub>DD</sub> = 15 Vdc, I <sub>D</sub> = 300 mAdc,<br>R <sub>L</sub> = 50 Ω) | t <sub>d(on)</sub>  | –           | 2.5        | –     | ns |
| Rise Time                                                                                                                                                             |                                                                                 | t <sub>r</sub>      | –           | 2.5        | –     |    |
| Turn-Off Delay Time                                                                                                                                                   |                                                                                 | t <sub>d(off)</sub> | –           | 15         | –     |    |
| Fall Time                                                                                                                                                             |                                                                                 | t <sub>f</sub>      | –           | 0.8        | –     |    |
| Gate Charge (See Figure 5)                                                                                                                                            |                                                                                 | Q <sub>T</sub>      | –           | 1400       | –     | pC |
| SOURCE-DRAIN DIODE CHARACTERISTICS                                                                                                                                    |                                                                                 |                     |             |            |       |    |
| Continuous Current                                                                                                                                                    | I <sub>S</sub>                                                                  | –                   | –           | 0.3        | A     |    |
| Pulsed Current                                                                                                                                                        | I <sub>SM</sub>                                                                 | –                   | –           | 0.75       |       |    |
| Forward Voltage (Note 3)                                                                                                                                              | V <sub>SD</sub>                                                                 | –                   | 0.85        | –          | V     |    |

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
3. Switching characteristics are independent of operating junction temperature.

## TYPICAL CHARACTERISTICS

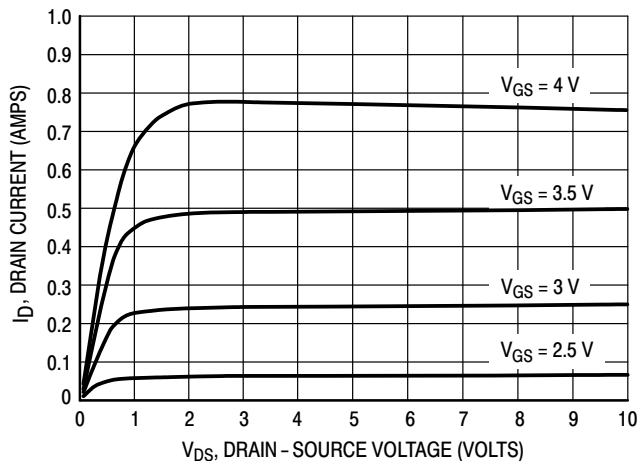


Figure 1. Typical Drain Characteristics

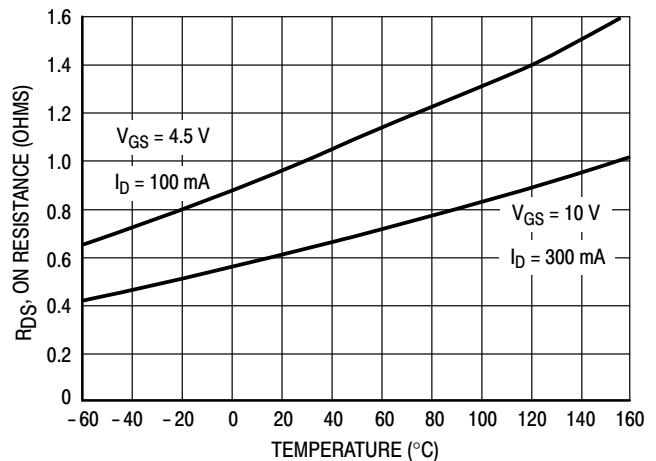


Figure 2. On Resistance versus Temperature

TYPICAL CHARACTERISTICS

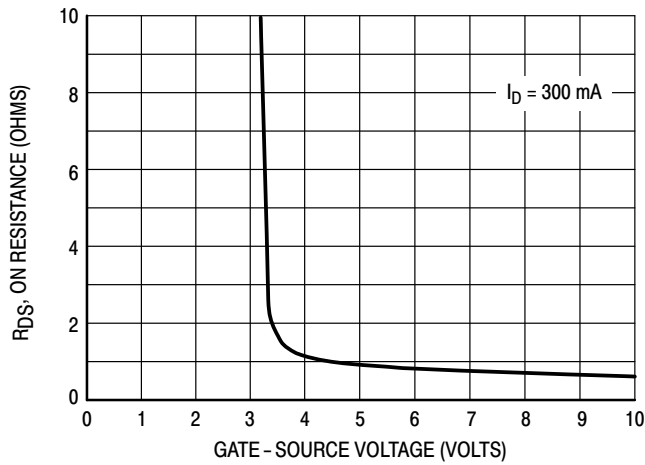


Figure 3. On Resistance versus Gate-Source Voltage

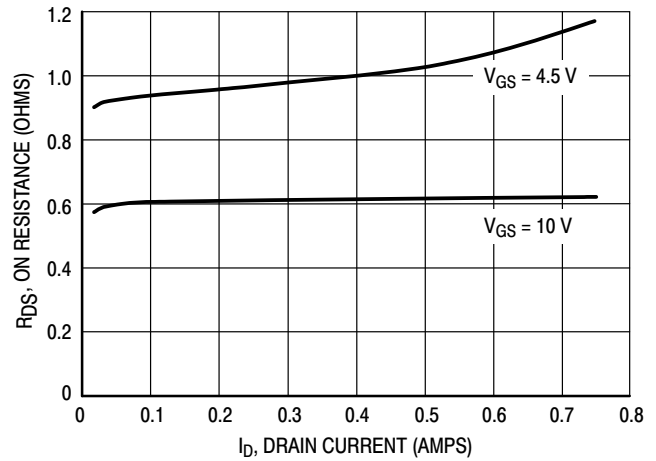


Figure 4. On Resistance versus Drain Current

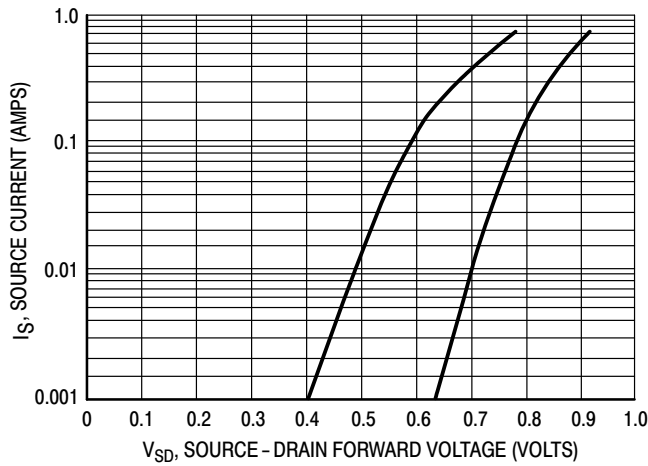


Figure 5. Source-Drain Forward Voltage

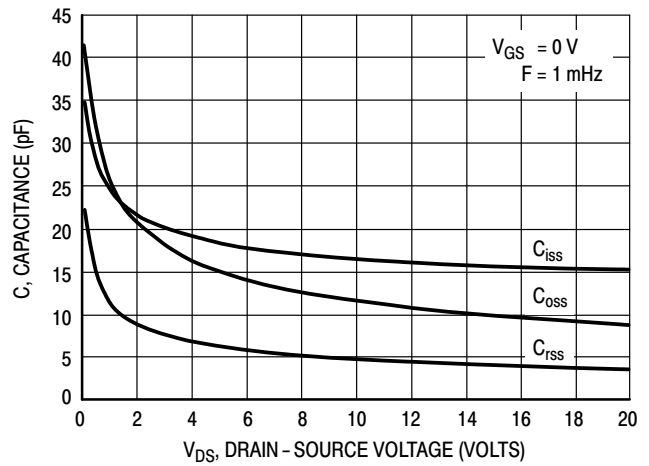


Figure 6. Capacitance Variation

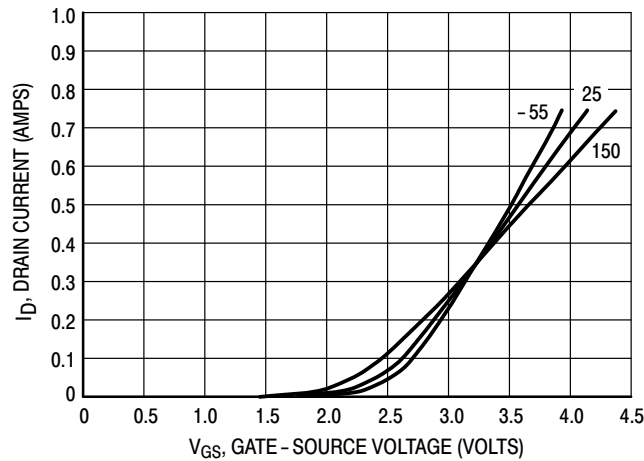
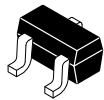


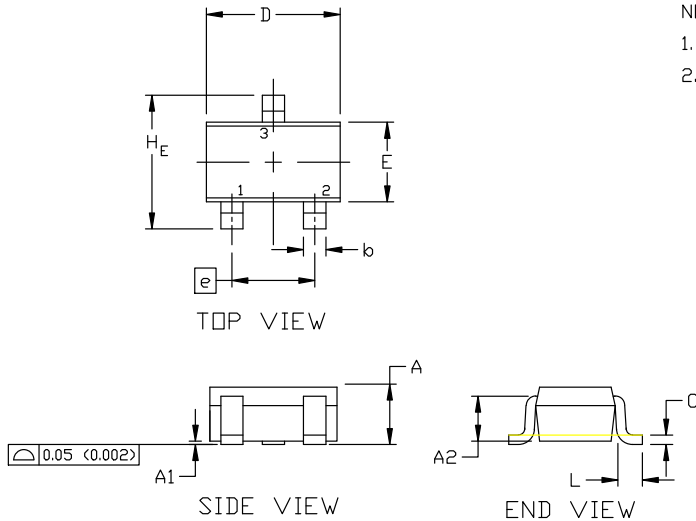
Figure 7. Transfer Characteristics



SCALE 4:1

SC-70 (SOT-323)  
CASE 419  
ISSUE R

DATE 11 OCT 2022

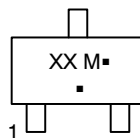


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH

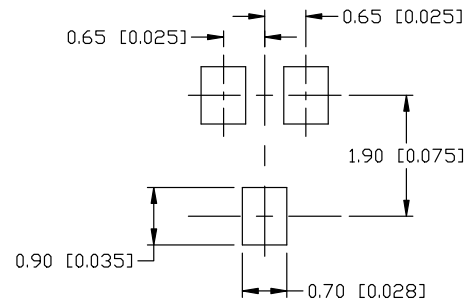
| DIM            | MILLIMETERS |      |      | INCHES    |       |       |
|----------------|-------------|------|------|-----------|-------|-------|
|                | MIN.        | NOM. | MAX. | MIN.      | NOM.  | MAX.  |
| A              | 0.80        | 0.90 | 1.00 | 0.032     | 0.035 | 0.040 |
| A1             | 0.00        | 0.05 | 0.10 | 0.000     | 0.002 | 0.004 |
| A2             | 0.70 REF    |      |      | 0.028 BSC |       |       |
| b              | 0.30        | 0.35 | 0.40 | 0.012     | 0.014 | 0.016 |
| c              | 0.10        | 0.18 | 0.25 | 0.004     | 0.007 | 0.010 |
| D              | 1.80        | 2.00 | 2.20 | 0.071     | 0.080 | 0.087 |
| E              | 1.15        | 1.24 | 1.35 | 0.045     | 0.049 | 0.053 |
| e              | 1.20        | 1.30 | 1.40 | 0.047     | 0.051 | 0.055 |
| e1             | 0.65 BSC    |      |      | 0.026 BSC |       |       |
| L              | 0.20        | 0.38 | 0.56 | 0.008     | 0.015 | 0.022 |
| H <sub>E</sub> | 2.00        | 2.10 | 2.40 | 0.079     | 0.083 | 0.095 |

GENERIC  
MARKING DIAGRAM



XX = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

\*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.



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

SOLDERING FOOTPRINT

STYLE 1:  
CANCELLED

STYLE 2:  
PIN 1. ANODE  
2. N.C.  
3. CATHODE

STYLE 3:  
PIN 1. BASE  
2. EMITTER  
3. COLLECTOR

STYLE 4:  
PIN 1. CATHODE  
2. CATHODE  
3. ANODE

STYLE 5:  
PIN 1. ANODE  
2. ANODE  
3. CATHODE

STYLE 6:  
PIN 1. EMITTER  
2. BASE  
3. COLLECTOR

STYLE 7:  
PIN 1. BASE  
2. EMITTER  
3. COLLECTOR

STYLE 8:  
PIN 1. GATE  
2. SOURCE  
3. DRAIN

STYLE 9:  
PIN 1. ANODE  
2. CATHODE  
3. CATHODE-ANODE

STYLE 10:  
PIN 1. CATHODE  
2. ANODE  
3. ANODE-CATHODE

STYLE 11:  
PIN 1. CATHODE  
2. CATHODE  
3. CATHODE

|                  |                 |                                                                                                                                                                                  |
|------------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| DESCRIPTION:     | SC-70 (SOT-323) | PAGE 1 OF 1                                                                                                                                                                      |

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