

# MMBF170L, NVBF170L

## MOSFET – N-Channel, SOT-23 500 mA, 60 V

### Features

- NVBF 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

| Rating                                   | Symbol    | Value    | Unit |
|--|-----------|----------|------|
| Drain-Source Voltage                     | $V_{DSS}$ | 60       | Vdc  |
| Drain-Gate Voltage                       | $V_{DGS}$ | 60       | Vdc  |
| Gate-Source Voltage                      | $V_{GS}$  | $\pm 20$ | Vdc  |
| – Continuous                             | $V_{GSM}$ | $\pm 40$ | Vpk  |
| – Non-repetitive ( $t_p \leq 50 \mu s$ ) |           |          |      |
| Drain Current – Continuous               | $I_D$     | 0.5      | Adc  |
| – Pulsed                                 | $I_{DM}$  | 0.8      |      |

### THERMAL CHARACTERISTICS

| Characteristic   | Symbol          | Max            | Unit                 |
|--|-----------------|----------------|----------------------|
| Total Device Dissipation FR-5 Board<br>(Note 1.) $T_A = 25^\circ C$<br>Derate above $25^\circ C$ | $P_D$           | 225<br>1.8     | mW<br>mW/ $^\circ C$ |
| Thermal Resistance, Junction-to-Ambient  | $R_{\theta JA}$ | 556            | $^\circ C/W$         |
| Junction and Storage Temperature   | $T_J, T_{stg}$  | -55 to<br>+150 | $^\circ C$           |

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. FR-5 =  $1.0 \times 0.75 \times 0.062$  in.

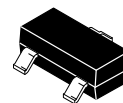


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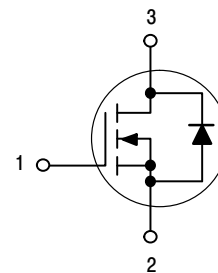
500 mA, 60 V

$R_{DS(on)} = 5 \Omega$

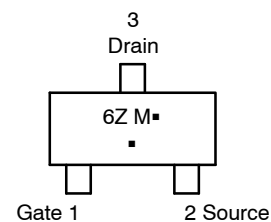


SOT-23  
CASE 318  
STYLE 21

### N-Channel



### MARKING DIAGRAM & PIN ASSIGNMENT



6Z = Specific Device Code

M = Date Code

▪ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

# MMBF170L, NVBF170L

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

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

### OFF CHARACTERISTICS

|   |                      |    |    |      |
|---|----------------------|----|----|------|
| Drain-Source Breakdown Voltage (V <sub>GS</sub> = 0, I <sub>D</sub> = 100 μA)       | V <sub>(BR)DSS</sub> | 60 | -  | Vdc  |
| Gate-Body Leakage Current, Forward (V <sub>GSF</sub> = 15 Vdc, V <sub>DS</sub> = 0) | I <sub>GSS</sub>     | -  | 10 | nAdc |

### ON CHARACTERISTICS (Note 1)

|   |                     |     |     |     |
|---|---------------------|-----|-----|-----|
| Gate Threshold Voltage (V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 1.0 mA)  | V <sub>GS(th)</sub> | 0.8 | 3.0 | Vdc |
| Static Drain-Source On-Resistance (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 200 mA) | r <sub>DS(on)</sub> | -   | 5.0 | Ω   |
| On-State Drain Current (V <sub>DS</sub> = 25 Vdc, V <sub>GS</sub> = 0)                | I <sub>D(off)</sub> | -   | 0.5 | μA  |

### DYNAMIC CHARACTERISTICS

|   |                  |   |    |    |
|---|------------------|---|----|----|
| Input Capacitance<br>(V <sub>DS</sub> = 10 Vdc, V <sub>GS</sub> = 0 V, f = 1.0 MHz) | C <sub>iss</sub> | - | 60 | pF |
|---|------------------|---|----|----|

### SWITCHING CHARACTERISTICS (Note 1)

|                     |  |                     |   |    |    |
|---------------------|--|---------------------|---|----|----|
| Turn-On Delay Time  | (V <sub>DD</sub> = 25 Vdc, I <sub>D</sub> = 500 mA, R <sub>gen</sub> = 50 Ω)<br>Figure 1 | t <sub>d(on)</sub>  | - | 10 | ns |
| Turn-Off Delay Time |  | t <sub>d(off)</sub> | - | 10 |    |

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.

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

## ORDERING INFORMATION

| Device       | Package                      | Shipping†           |
|--------------|------------------------------|---------------------|
| MMBF170LT1G  | SOT-23 (TO-236)<br>(Pb-Free) | 3000 / Tape & Reel  |
| MMBF170LT3G  | SOT-23 (TO-236)<br>(Pb-Free) | 10000 / Tape & Reel |
| NVBF170LT1G* | SOT-23 (TO-236)<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.

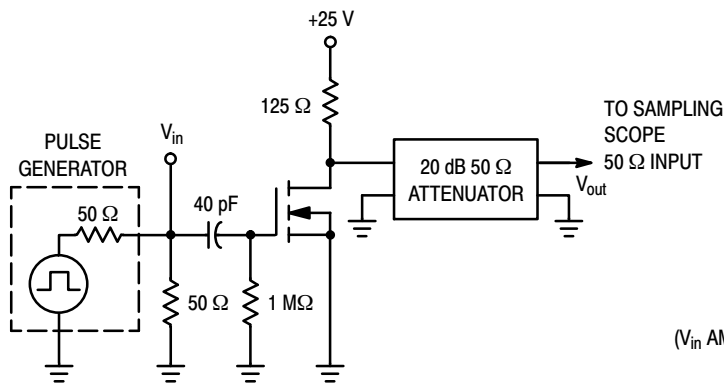


Figure 1. Switching Test Circuit

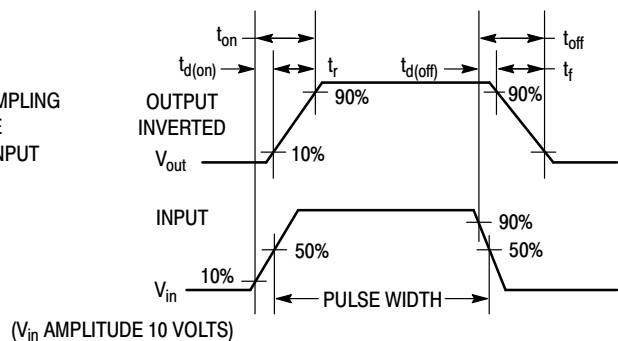
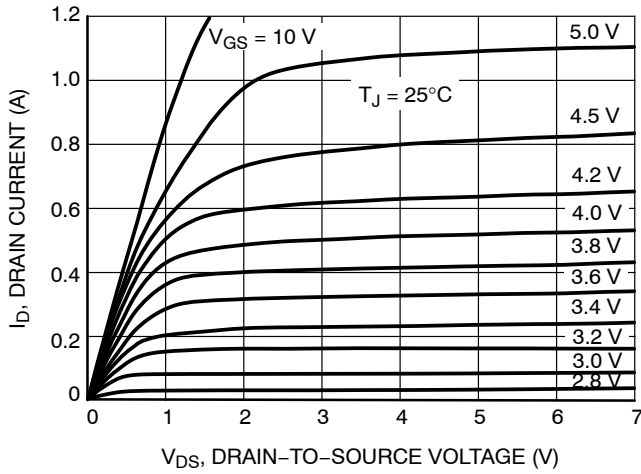


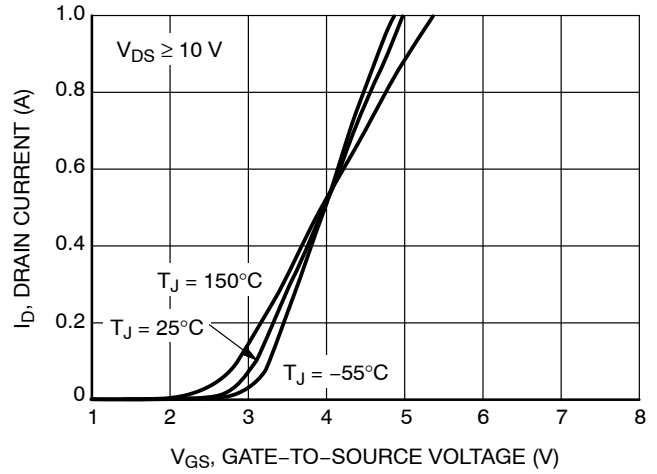
Figure 2. Switching Waveform

# MMBF170L, NVBF170L

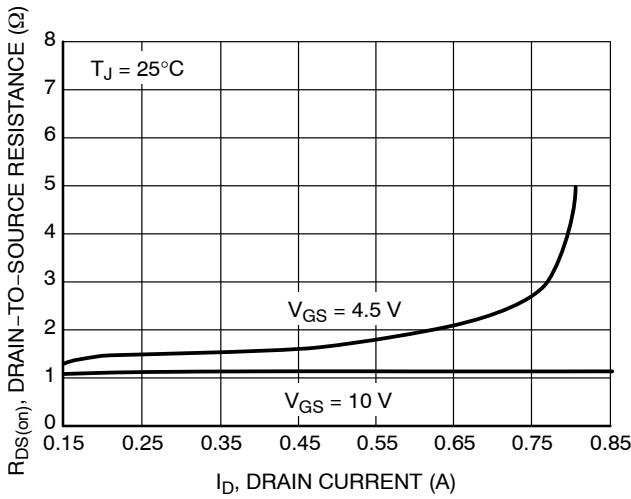
## TYPICAL ELECTRICAL CHARACTERISTICS



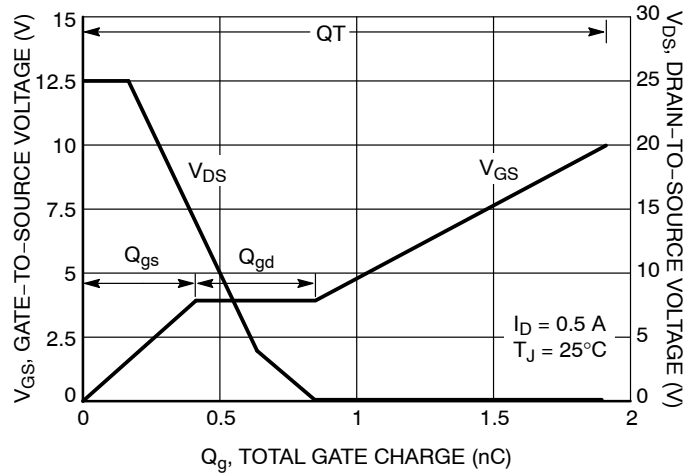
**Figure 3. On-Region Characteristics**



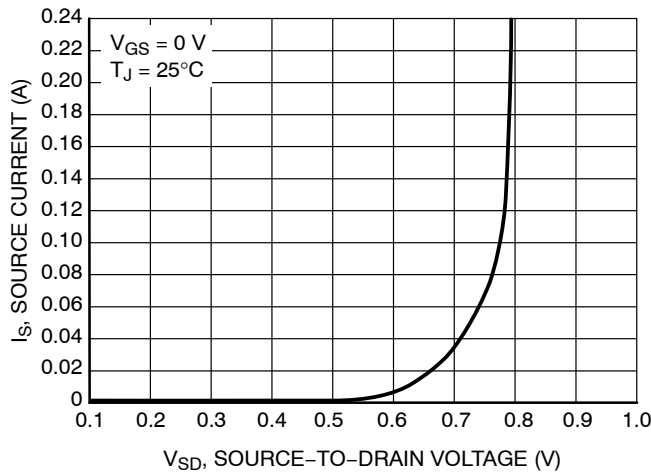
**Figure 4. Transfer Characteristics**



**Figure 5. On-Resistance vs. Drain Current and Gate Voltage**



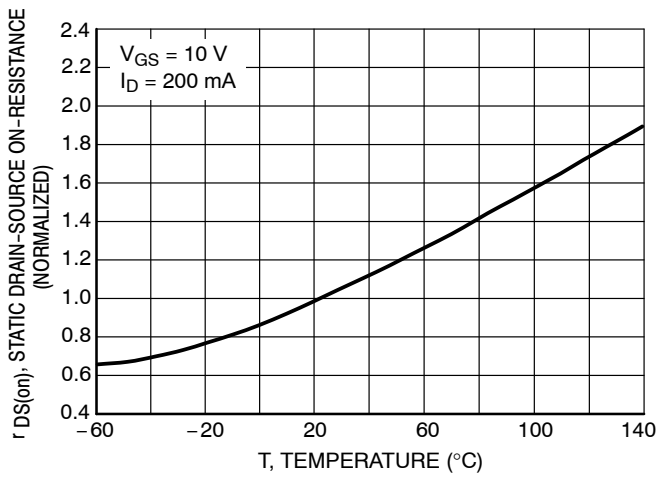
**Figure 6. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge**



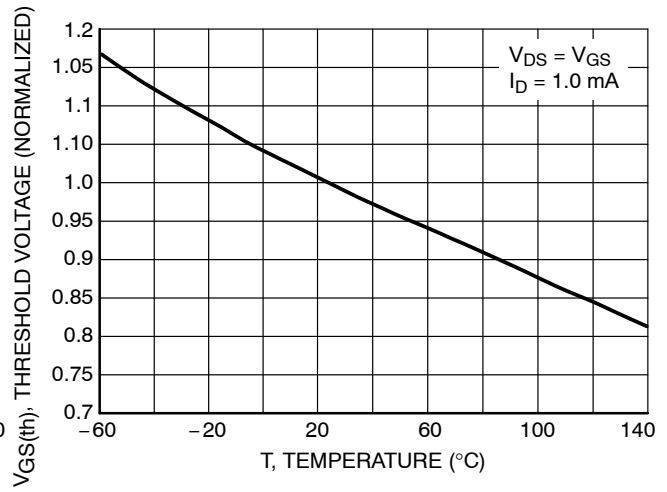
**Figure 7. Diode Forward Voltage vs. Current**

# MMBF170L, NVBF170L

## TYPICAL ELECTRICAL CHARACTERISTICS



**Figure 8. Temperature versus Static Drain-Source On-Resistance**



**Figure 9. Temperature versus Gate Threshold Voltage**

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



**SOT-23 (TO-236)**  
**CASE 318-08**  
**ISSUE AS**

DATE 30 JAN 2018

SCALE 4:1

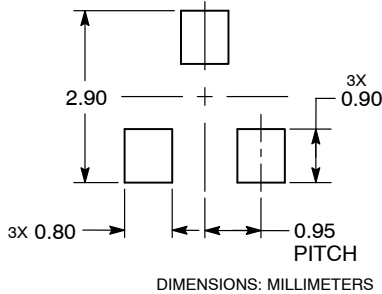


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM | MILLIMETERS |      |      | INCHES |       |       |
|-----|-------------|------|------|--------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN    | NOM   | MAX   |
| A   | 0.89        | 1.00 | 1.11 | 0.035  | 0.039 | 0.044 |
| A1  | 0.01        | 0.06 | 0.10 | 0.000  | 0.002 | 0.004 |
| b   | 0.37        | 0.44 | 0.50 | 0.015  | 0.017 | 0.020 |
| c   | 0.08        | 0.14 | 0.20 | 0.003  | 0.006 | 0.008 |
| D   | 2.80        | 2.90 | 3.04 | 0.110  | 0.114 | 0.120 |
| E   | 1.20        | 1.30 | 1.40 | 0.047  | 0.051 | 0.055 |
| e   | 1.78        | 1.90 | 2.04 | 0.070  | 0.075 | 0.080 |
| L   | 0.30        | 0.43 | 0.55 | 0.012  | 0.017 | 0.022 |
| L1  | 0.35        | 0.54 | 0.69 | 0.014  | 0.021 | 0.027 |
| HE  | 2.10        | 2.40 | 2.64 | 0.083  | 0.094 | 0.104 |
| T   | 0°          | ---  | 10°  | 0°     | ---   | 10°   |

**RECOMMENDED SOLDERING FOOTPRINT**



**GENERIC MARKING DIAGRAM\***



XXX = 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.

STYLE 1 THRU 5:  
CANCELLED

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

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

STYLE 8:  
PIN 1. ANODE  
2. NO CONNECTION  
3. CATHODE

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

STYLE 10:  
PIN 1. DRAIN  
2. SOURCE  
3. GATE

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

STYLE 12:  
PIN 1. CATHODE  
2. CATHODE  
3. ANODE

STYLE 13:  
PIN 1. SOURCE  
2. DRAIN  
3. GATE

STYLE 14:  
PIN 1. CATHODE  
2. GATE  
3. ANODE

STYLE 15:  
PIN 1. GATE  
2. CATHODE  
3. ANODE

STYLE 16:  
PIN 1. ANODE  
2. CATHODE  
3. CATHODE

STYLE 17:  
PIN 1. NO CONNECTION  
2. ANODE  
3. CATHODE

STYLE 18:  
PIN 1. NO CONNECTION  
2. CATHODE  
3. ANODE

STYLE 19:  
PIN 1. CATHODE  
2. ANODE  
3. CATHODE-ANODE

STYLE 20:  
PIN 1. CATHODE  
2. ANODE  
3. GATE

STYLE 21:  
PIN 1. GATE  
2. SOURCE  
3. DRAIN

STYLE 22:  
PIN 1. RETURN  
2. OUTPUT  
3. INPUT

STYLE 23:  
PIN 1. ANODE  
2. ANODE  
3. CATHODE

STYLE 24:  
PIN 1. GATE  
2. DRAIN  
3. SOURCE

STYLE 25:  
PIN 1. ANODE  
2. CATHODE  
3. GATE

STYLE 26:  
PIN 1. CATHODE  
2. ANODE  
3. NO CONNECTION

STYLE 27:  
PIN 1. CATHODE  
2. CATHODE  
3. CATHODE

STYLE 28:  
PIN 1. ANODE  
2. ANODE  
3. ANODE

|                         |                        |  |
|-------------------------|------------------------|--|
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| <b>DESCRIPTION:</b>     | <b>SOT-23 (TO-236)</b> | <b>PAGE 1 OF 1</b>   |

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