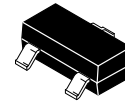


# MOSFET - N-Channel, SOT-23

500 mA, 60 V

MMBF170L, NVBF170L

500 mA, 60 V

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

SOT-23  
CASE 318  
STYLE 21

## 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      |      |

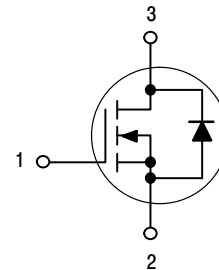
## THERMAL CHARACTERISTICS

| 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 $+150$ | $^\circ C$           |

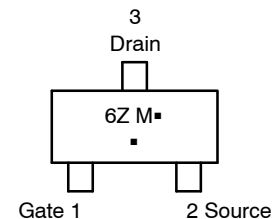
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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

## 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.

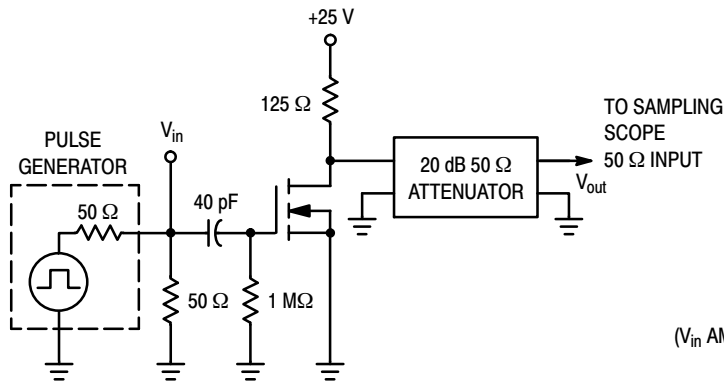


Figure 1. Switching Test Circuit

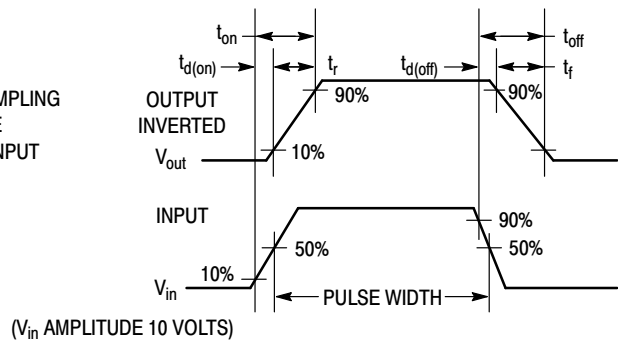


Figure 2. Switching Waveform

TYPICAL ELECTRICAL CHARACTERISTICS

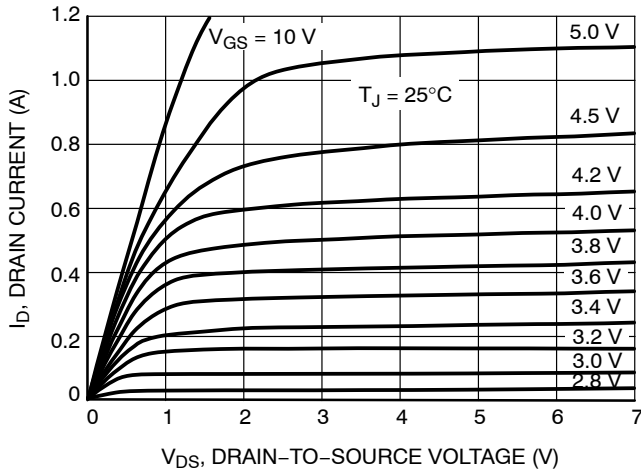


Figure 3. On-Region Characteristics

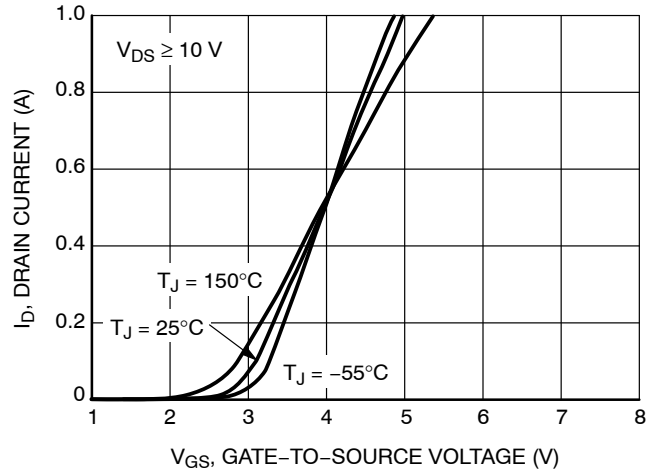


Figure 4. Transfer Characteristics

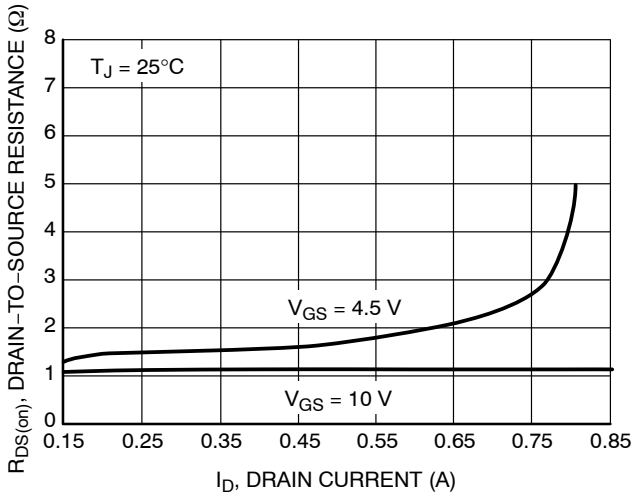


Figure 5. On-Resistance vs. Drain Current and Gate Voltage

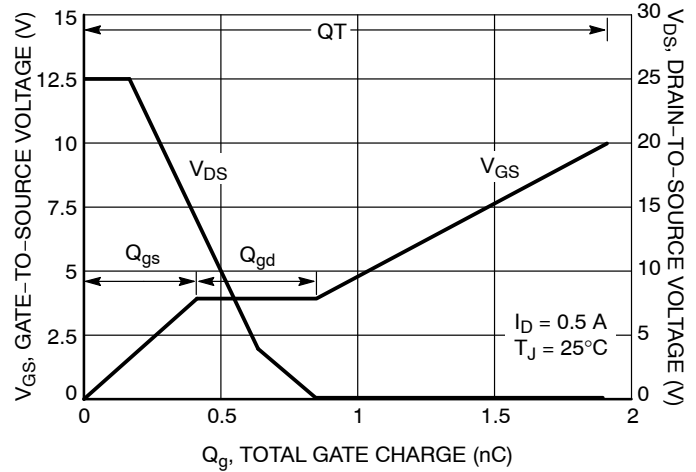


Figure 6. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

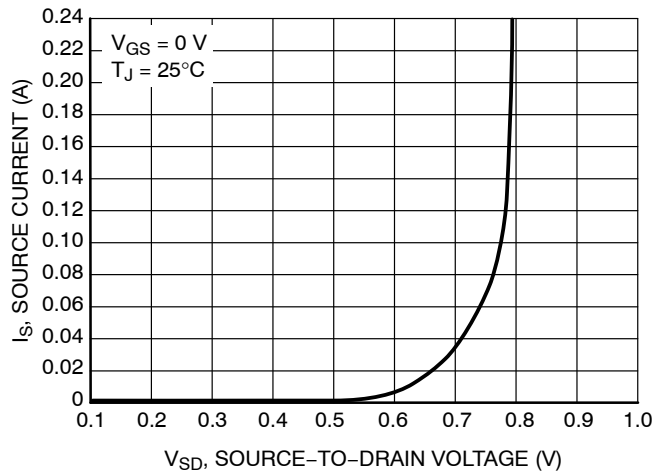
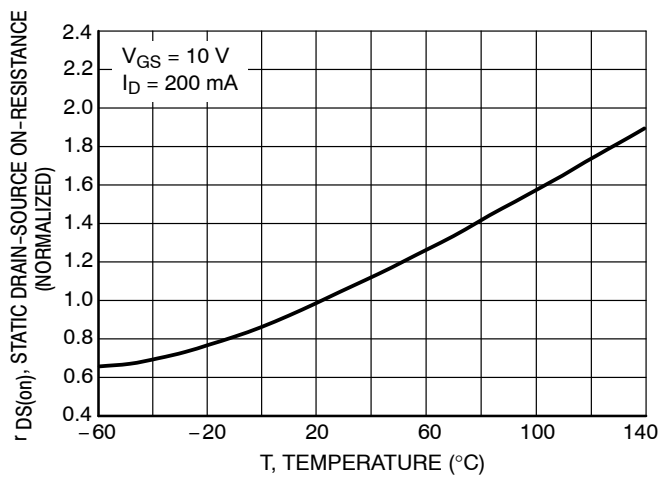


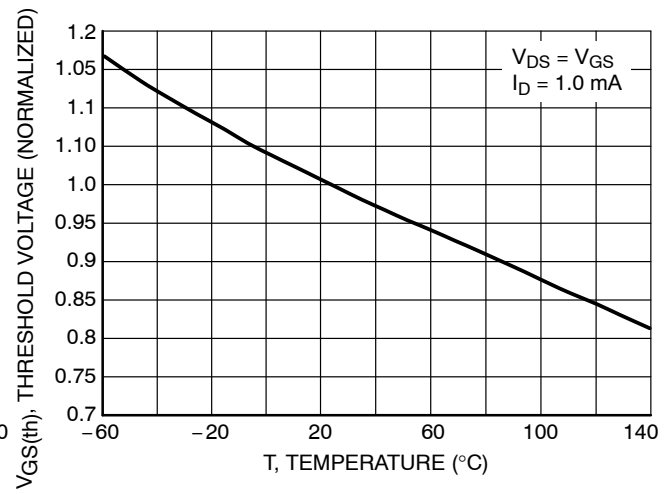
Figure 7. Diode Forward Voltage vs. Current

# MMBF170L, NVBF170L

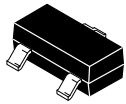
## TYPICAL ELECTRICAL CHARACTERISTICS



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



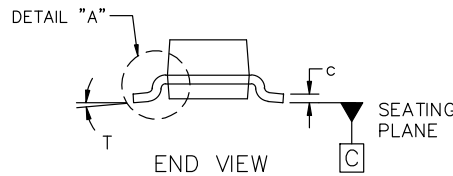
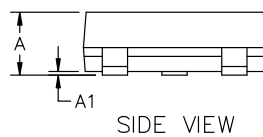
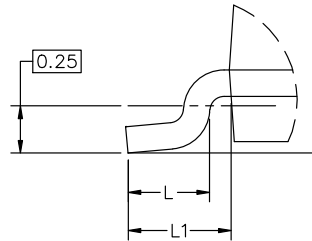
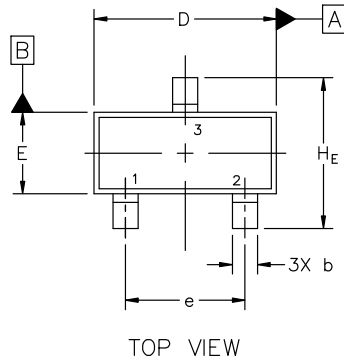
**Figure 9. Temperature versus Gate Threshold Voltage**



SCALE 4:1

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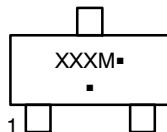


| MILLIMETERS |      |      |      |
|-------------|------|------|------|
| DIM         | MIN  | NOM  | MAX  |
| A           | 0.89 | 1.00 | 1.11 |
| A1          | 0.01 | 0.06 | 0.10 |
| b           | 0.37 | 0.44 | 0.50 |
| c           | 0.08 | 0.14 | 0.20 |
| D           | 2.80 | 2.90 | 3.04 |
| E           | 1.20 | 1.30 | 1.40 |
| e           | 1.78 | 1.90 | 2.04 |
| L           | 0.30 | 0.43 | 0.55 |
| L1          | 0.35 | 0.54 | 0.69 |
| HE          | 2.10 | 2.40 | 2.64 |
| T           | 0°   | ---  | 10°  |

NOTES:

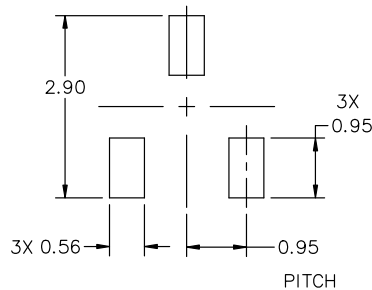
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSIONS: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

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. Some products may not follow the Generic Marking.



RECOMMENDED  
MOUNTING FOOTPRINT

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

STYLES ON PAGE 2

|                  |                                      |                                                                                                                                                                                     |
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**CASE 318**  
**ISSUE AU**

DATE 14 AUG 2024

|                                                         |                                                       |                                                             |                                                             |                                                             |                                                             |
|---------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|
| STYLE 1 THRU 5:<br>CANCELLED                            | STYLE 6:<br>PIN 1. BASE<br>2. EMITTER<br>3. COLLECTOR | STYLE 7:<br>PIN 1. EMITTER<br>2. BASE<br>3. COLLECTOR       | STYLE 8:<br>PIN 1. ANODE<br>2. NO CONNECTION<br>3. CATHODE  |                                                             |                                                             |
| STYLE 9:<br>PIN 1. ANODE<br>2. ANODE<br>3. CATHODE      | STYLE 10:<br>PIN 1. DRAIN<br>2. SOURCE<br>3. GATE     | STYLE 11:<br>PIN 1. ANODE<br>2. CATHODE<br>3. CATHODE-ANODE | STYLE 12:<br>PIN 1. CATHODE<br>2. CATHODE<br>3. ANODE       | STYLE 13:<br>PIN 1. SOURCE<br>2. DRAIN<br>3. GATE           | STYLE 14:<br>PIN 1. CATHODE<br>2. GATE<br>3. ANODE          |
| STYLE 15:<br>PIN 1. GATE<br>2. CATHODE<br>3. ANODE      | STYLE 16:<br>PIN 1. ANODE<br>2. CATHODE<br>3. CATHODE | STYLE 17:<br>PIN 1. NO CONNECTION<br>2. ANODE<br>3. CATHODE | STYLE 18:<br>PIN 1. NO CONNECTION<br>2. CATHODE<br>3. ANODE | STYLE 19:<br>PIN 1. CATHODE<br>2. ANODE<br>3. CATHODE-ANODE | STYLE 20:<br>PIN 1. CATHODE<br>2. ANODE<br>3. GATE          |
| STYLE 21:<br>PIN 1. GATE<br>2. SOURCE<br>3. DRAIN       | STYLE 22:<br>PIN 1. RETURN<br>2. OUTPUT<br>3. INPUT   | STYLE 23:<br>PIN 1. ANODE<br>2. ANODE<br>3. CATHODE         | STYLE 24:<br>PIN 1. GATE<br>2. DRAIN<br>3. SOURCE           | STYLE 25:<br>PIN 1. ANODE<br>2. CATHODE<br>3. GATE          | STYLE 26:<br>PIN 1. CATHODE<br>2. ANODE<br>3. NO CONNECTION |
| STYLE 27:<br>PIN 1. CATHODE<br>2. CATHODE<br>3. CATHODE | STYLE 28:<br>PIN 1. ANODE<br>2. ANODE<br>3. ANODE     |                                                             |                                                             |                                                             |                                                             |

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