

# MMBF170L, NVBF170L

## Power MOSFET

500 mA, 60 V, N-Channel SOT-23

### 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  | $V_{DS}$              | 60                   | Vdc        |
| Drain-Gate Voltage  | $V_{DGS}$             | 60                   | Vdc        |
| Gate-Source Voltage<br>- Continuous<br>- Non-repetitive ( $t_p \leq 50 \mu s$ ) | $V_{GS}$<br>$V_{GSM}$ | $\pm 20$<br>$\pm 40$ | Vdc<br>Vpk |
| Drain Current - Continuous<br>- Pulsed  | $I_D$<br>$I_{DM}$     | 0.5<br>0.8           | Adc        |

### 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.

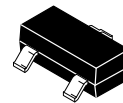


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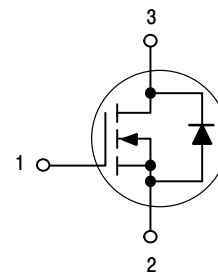
500 mA, 60 V

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

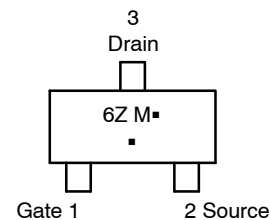


SOT-23  
CASE 318  
STYLE 21

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.

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

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

### OFF CHARACTERISTICS

|  |               |    |    |      |
|--|---------------|----|----|------|
| Drain-Source Breakdown Voltage ( $V_{GS} = 0, I_D = 100 \mu\text{A}$ )       | $V_{(BR)DSS}$ | 60 | -  | Vdc  |
| Gate-Body Leakage Current, Forward ( $V_{GSF} = 15 \text{Vdc}, V_{DS} = 0$ ) | $I_{GSS}$     | -  | 10 | nAdc |

### ON CHARACTERISTICS (Note 1)

|   |              |     |     |               |
|---|--------------|-----|-----|---------------|
| Gate Threshold Voltage ( $V_{DS} = V_{GS}, I_D = 1.0 \text{mA}$ )                   | $V_{GS(th)}$ | 0.8 | 3.0 | Vdc           |
| Static Drain-Source On-Resistance ( $V_{GS} = 10 \text{Vdc}, I_D = 200 \text{mA}$ ) | $r_{DS(on)}$ | -   | 5.0 | $\Omega$      |
| On-State Drain Current ( $V_{DS} = 25 \text{Vdc}, V_{GS} = 0$ )                     | $I_{D(off)}$ | -   | 0.5 | $\mu\text{A}$ |

### DYNAMIC CHARACTERISTICS

|  |           |   |    |    |
|--|-----------|---|----|----|
| Input Capacitance<br>( $V_{DS} = 10 \text{Vdc}, V_{GS} = 0 \text{V}, f = 1.0 \text{MHz}$ ) | $C_{iss}$ | - | 60 | pF |
|--|-----------|---|----|----|

### SWITCHING CHARACTERISTICS (Note 1)

|                     |  |              |   |    |    |
|---------------------|--|--------------|---|----|----|
| Turn-On Delay Time  | $(V_{DD} = 25 \text{Vdc}, I_D = 500 \text{mA}, R_{gen} = 50 \Omega)$<br>Figure 1 | $t_{d(on)}$  | - | 10 | ns |
| Turn-Off Delay Time |  | $t_{d(off)}$ | - | 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  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

## 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.

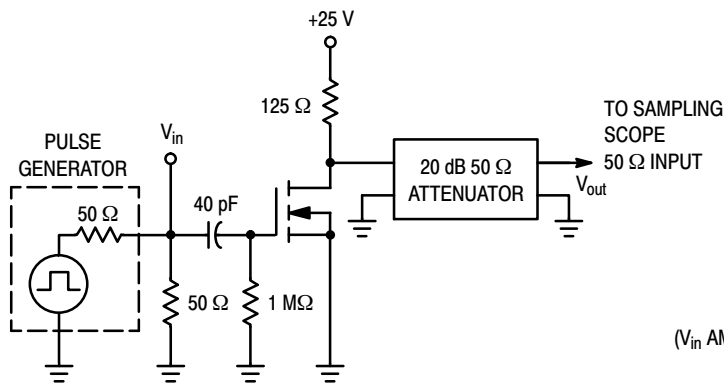


Figure 1. Switching Test Circuit

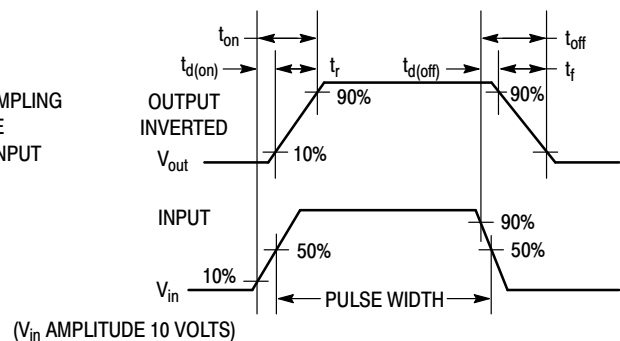


Figure 2. Switching Waveform

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## TYPICAL ELECTRICAL CHARACTERISTICS

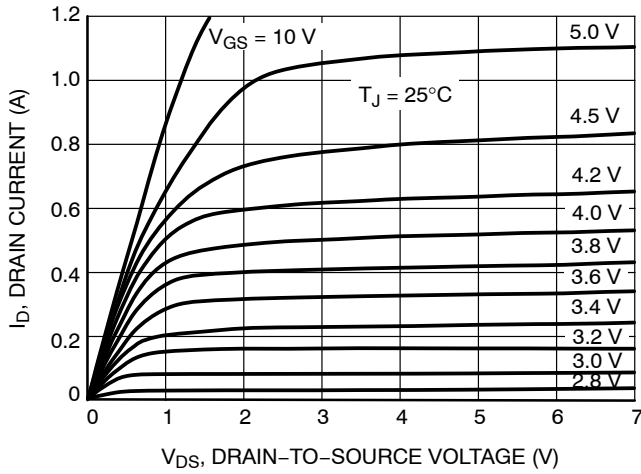


Figure 3. On-Region Characteristics

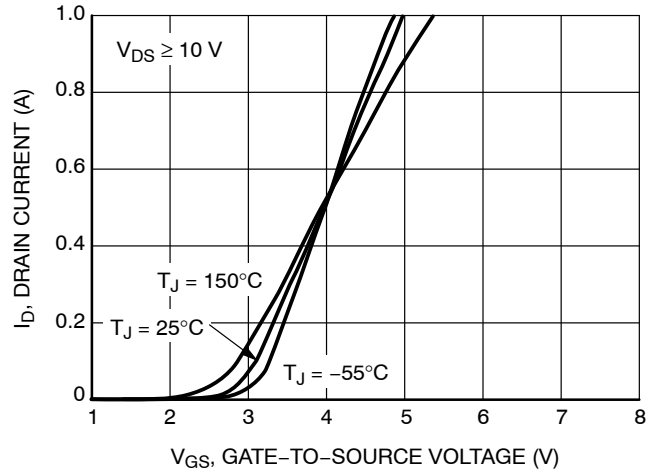


Figure 4. Transfer Characteristics

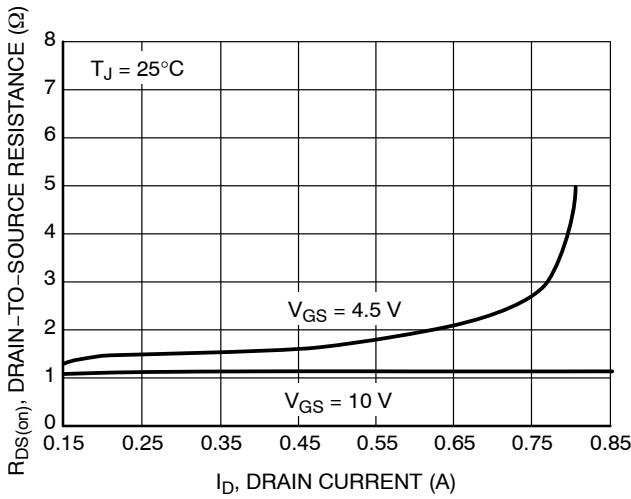


Figure 5. On-Resistance vs. Drain Current and Gate Voltage

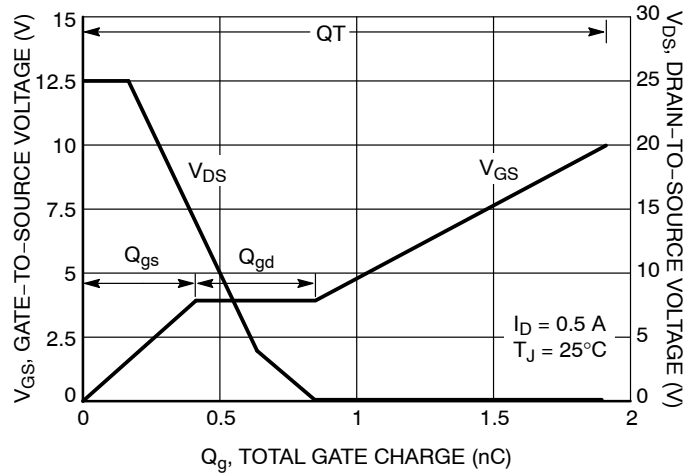


Figure 6. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

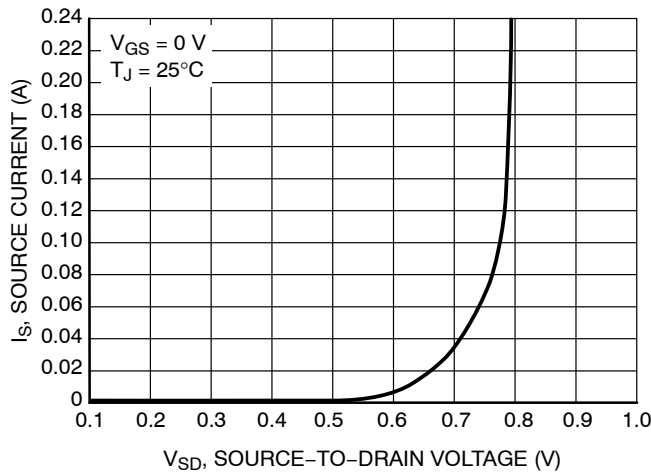
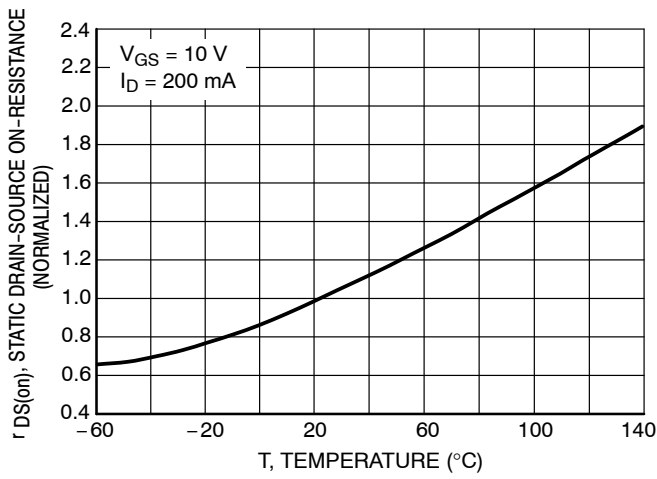


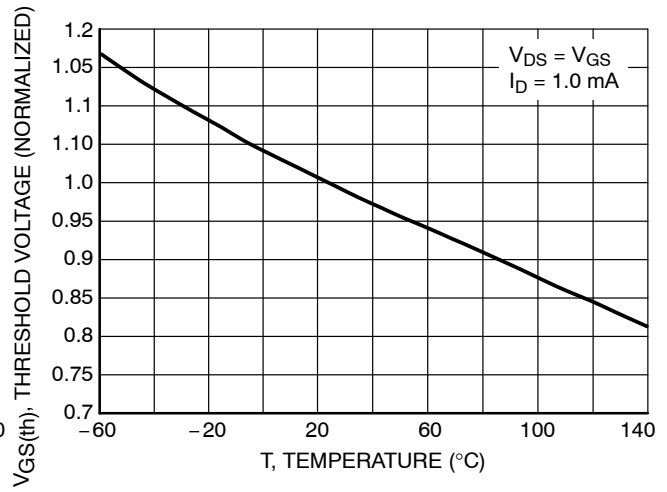
Figure 7. Diode Forward Voltage vs. Current

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## TYPICAL ELECTRICAL CHARACTERISTICS



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

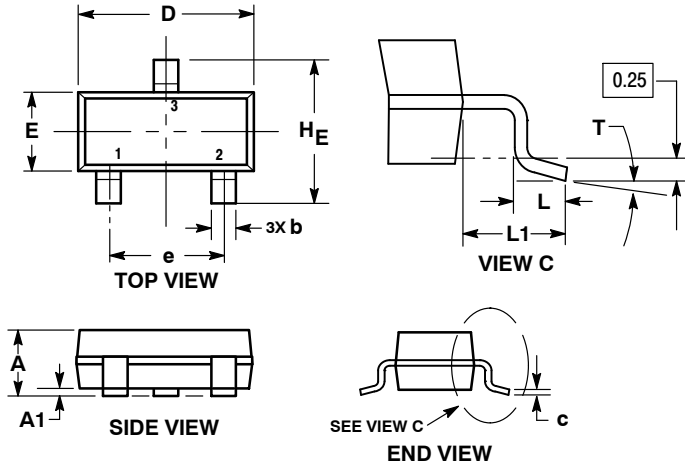


**Figure 9. Temperature versus Gate Threshold Voltage**

# MMBF170L, NVBF170L

## PACKAGE DIMENSIONS

SOT-23 (TO-236)  
CASE 318-08  
ISSUE AR



**NOTES:**

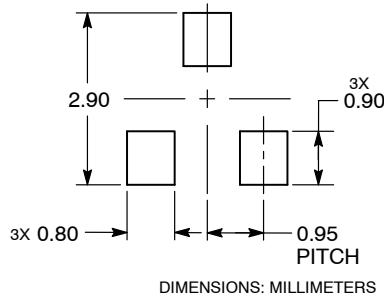
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| 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°   |

**STYLE 21:**

1. GATE
2. SOURCE
3. DRAIN

### RECOMMENDED SOLDERING 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.

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