

# NPN - MPS8099; PNP - MPS8599



ON Semiconductor®

<http://onsemi.com>

## Amplifier Transistors

Voltage and Current are Negative for PNP Transistors

### Features

- These are Pb-Free Devices\*

### MAXIMUM RATINGS

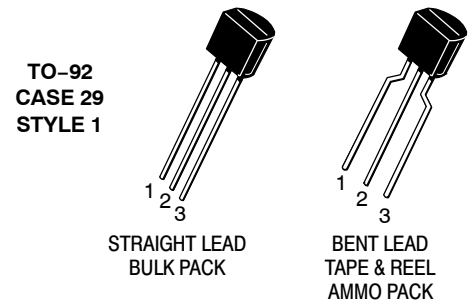
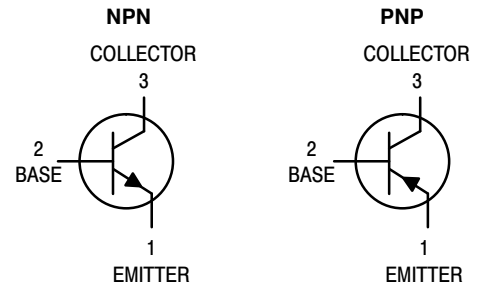
| Rating                                                                                 | Symbol         | Value       | Unit                       |
|----------------------------------------------------------------------------------------|----------------|-------------|----------------------------|
| Collector - Emitter Voltage                                                            | $V_{CEO}$      | 80          | Vdc                        |
| Collector - Base Voltage                                                               | $V_{CBO}$      | 80          | Vdc                        |
| Emitter - Base Voltage                                                                 | $V_{EBO}$      | 6.0         | Vdc                        |
| Collector Current - Continuous                                                         | $I_C$          | 500         | mAdc                       |
| Total Device Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 625<br>5.0  | mW<br>mW/ $^\circ\text{C}$ |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 1.5<br>12   | W<br>mW/ $^\circ\text{C}$  |
| Operating and Storage Junction<br>Temperature Range                                    | $T_J, T_{stg}$ | -55 to +150 | $^\circ\text{C}$           |

### THERMAL CHARACTERISTICS

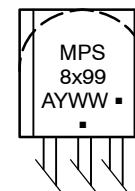
| Characteristic                                      | Symbol          | Max  | Unit                      |
|-----------------------------------------------------|-----------------|------|---------------------------|
| Thermal Resistance, Junction-to-Ambient<br>(Note 1) | $R_{\theta JA}$ | 200  | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-Case                | $R_{\theta JC}$ | 83.3 | $^\circ\text{C}/\text{W}$ |

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.  $R_{\theta JA}$  is measured with the device soldered into a typical printed circuit board.



### MARKING DIAGRAM



- x = 0 or 5
- A = Assembly Location
- Y = Year
- WW = Work Week
- = 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 3 of this data sheet.

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

## NPN – MPS8099; PNP – MPS8599

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

| Characteristic                                                                                                                                                                                                                                                             | Symbol               | Min              | Max           | Unit             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------|---------------|------------------|
| <b>OFF CHARACTERISTICS</b>                                                                                                                                                                                                                                                 |                      |                  |               |                  |
| Collector – Emitter Breakdown Voltage (Note 2)<br>(I <sub>C</sub> = 10 mA <sub>dc</sub> , I <sub>B</sub> = 0)                                                                                                                                                              | V <sub>(BR)CEO</sub> | 80               | –             | V <sub>dc</sub>  |
| Collector – Base Breakdown Voltage<br>(I <sub>C</sub> = 100 μA <sub>dc</sub> , I <sub>E</sub> = 0)                                                                                                                                                                         | V <sub>(BR)CBO</sub> | 80               | –             | V <sub>dc</sub>  |
| Emitter – Base Breakdown Voltage<br>(I <sub>E</sub> = 10 μA <sub>dc</sub> , I <sub>C</sub> = 0)                                                                                                                                                                            | V <sub>(BR)EBO</sub> | 6.0              | –             | V <sub>dc</sub>  |
| Collector Cutoff Current<br>(V <sub>CE</sub> = 60 V <sub>dc</sub> , I <sub>B</sub> = 0)                                                                                                                                                                                    | I <sub>CES</sub>     | –                | 0.1           | μA <sub>dc</sub> |
| Collector Cutoff Current<br>(V <sub>CB</sub> = 80 V <sub>dc</sub> , I <sub>E</sub> = 0)                                                                                                                                                                                    | I <sub>CBO</sub>     | –                | 0.1           | μA <sub>dc</sub> |
| Emitter Cutoff Current<br>(V <sub>EB</sub> = 6.0 V <sub>dc</sub> , I <sub>C</sub> = 0)                                                                                                                                                                                     | I <sub>EBO</sub>     | –                | 0.1           | μA <sub>dc</sub> |
| <b>ON CHARACTERISTICS (Note 2)</b>                                                                                                                                                                                                                                         |                      |                  |               |                  |
| DC Current Gain<br>(I <sub>C</sub> = 1.0 mA <sub>dc</sub> , V <sub>CE</sub> = 5.0 V <sub>dc</sub> )<br>(I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 5.0 V <sub>dc</sub> )<br>(I <sub>C</sub> = 100 mA <sub>dc</sub> , V <sub>CE</sub> = 5.0 V <sub>dc</sub> ) | h <sub>FE</sub>      | 100<br>100<br>75 | 300<br>–<br>– | –                |
| Collector – Emitter Saturation Voltage<br>(I <sub>C</sub> = 100 mA <sub>dc</sub> , I <sub>B</sub> = 5.0 mA <sub>dc</sub> )<br>(I <sub>C</sub> = 100 mA <sub>dc</sub> , I <sub>B</sub> = 10 mA <sub>dc</sub> )                                                              | V <sub>CE(sat)</sub> | –<br>–           | 0.4<br>0.3    | V <sub>dc</sub>  |
| Base – Emitter On Voltage<br>(I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 5.0 V <sub>dc</sub> )                                                                                                                                                               | V <sub>BE(on)</sub>  | 0.6              | 0.8           | V <sub>dc</sub>  |
| <b>SMALL – SIGNAL CHARACTERISTICS</b>                                                                                                                                                                                                                                      |                      |                  |               |                  |
| Current – Gain – Bandwidth Product<br>(I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 5.0 V <sub>dc</sub> , f = 100 MHz)                                                                                                                                         | f <sub>T</sub>       | 150              | –             | MHz              |
| Output Capacitance<br>(V <sub>CB</sub> = 5.0 V <sub>dc</sub> , I <sub>E</sub> = 0, f = 1.0 MHz)                                                                                                                                                                            | C <sub>obo</sub>     | –                | 8.0           | pF               |
| Input Capacitance<br>(V <sub>EB</sub> = 0.5 V <sub>dc</sub> , I <sub>C</sub> = 0, f = 1.0 MHz)                                                                                                                                                                             | C <sub>ibo</sub>     | –                | 30            | pF               |

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

# NPN – MPS8099; PNP – MPS8599

## ORDERING INFORMATION

| Device       | Package            | Shipping†          |
|--------------|--------------------|--------------------|
| MPS8099G     | TO-92<br>(Pb-Free) | 5000 Units / Bulk  |
| MPS8099RLRAG | TO-92<br>(Pb-Free) | 2000 / Tape & Reel |
| MPS8099RLRPG | TO-92<br>(Pb-Free) | 2000 / Ammo Pack   |
| MPS8599RLRAG | TO-92<br>(Pb-Free) | 2000 / Tape & Reel |
| MPS8599RLRMG | TO-92<br>(Pb-Free) | 2000 / Ammo Pack   |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

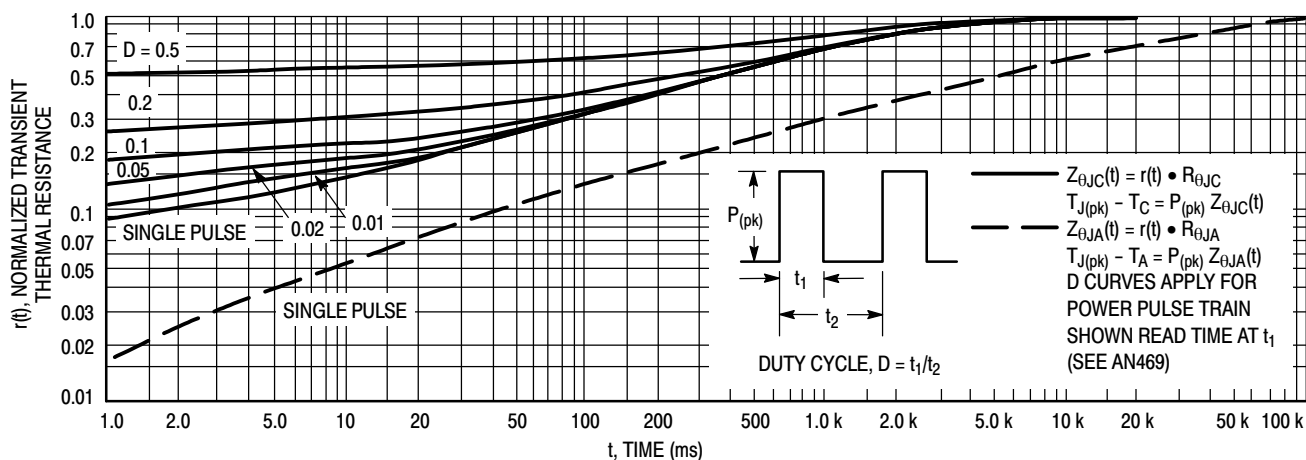
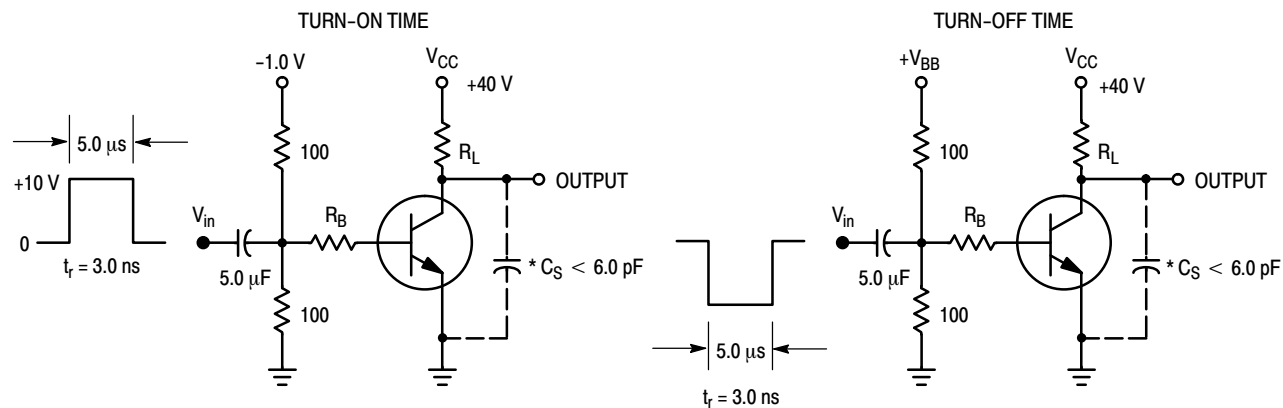


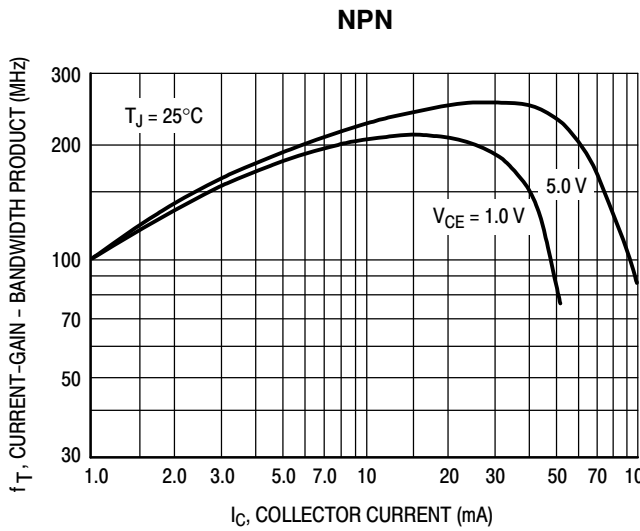
Figure 1. Thermal Response



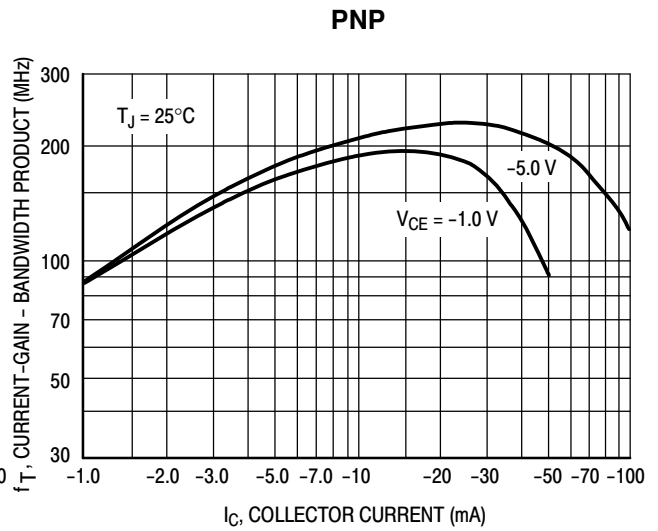
\*Total Shunt Capacitance of Test Jig and Connectors For PNP Test Circuits, Reverse All Voltage Polarities

Figure 2. Switching Time Test Circuits

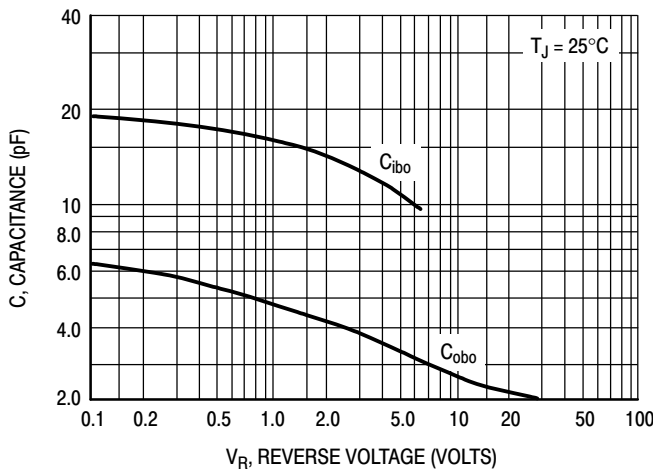
# NPN – MPS8099; PNP – MPS8599



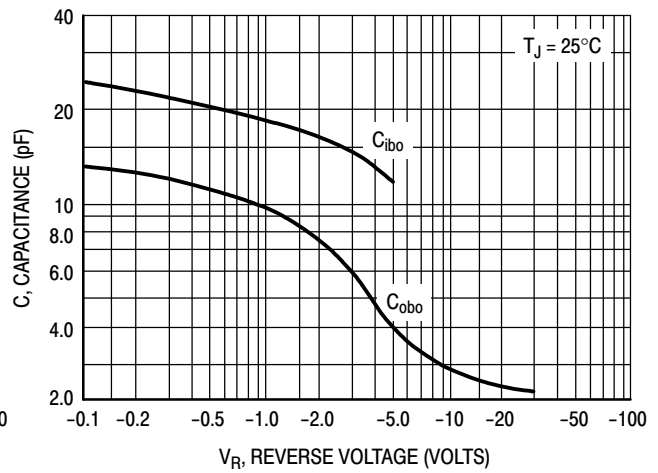
**Figure 3. Current-Gain – Bandwidth Product**



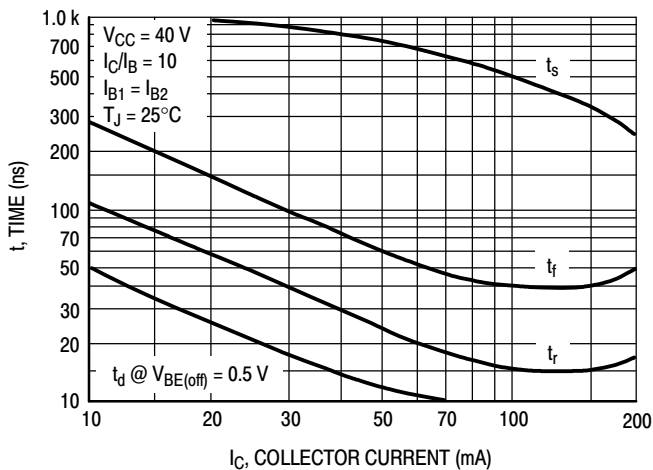
**Figure 4. Current-Gain – Bandwidth Product**



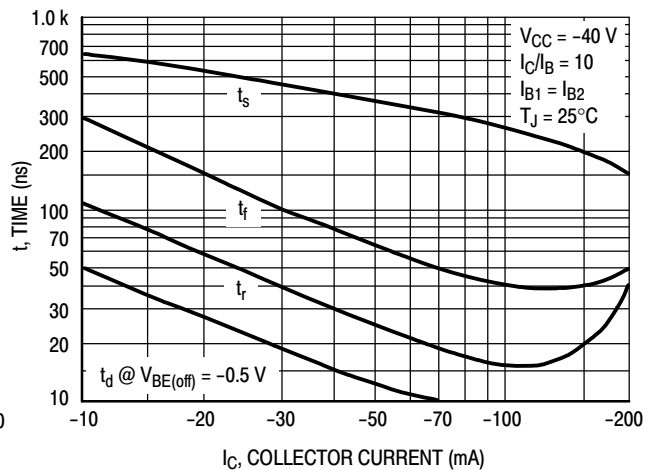
**Figure 5. Capacitance**



**Figure 6. Capacitance**



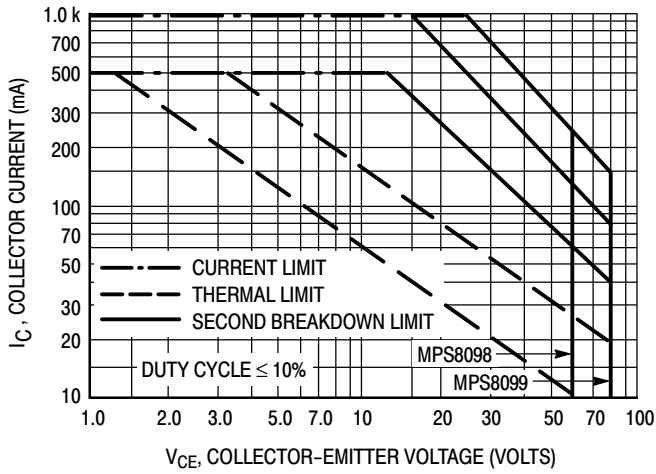
**Figure 7. Switching Times**



**Figure 8. Switching Times**

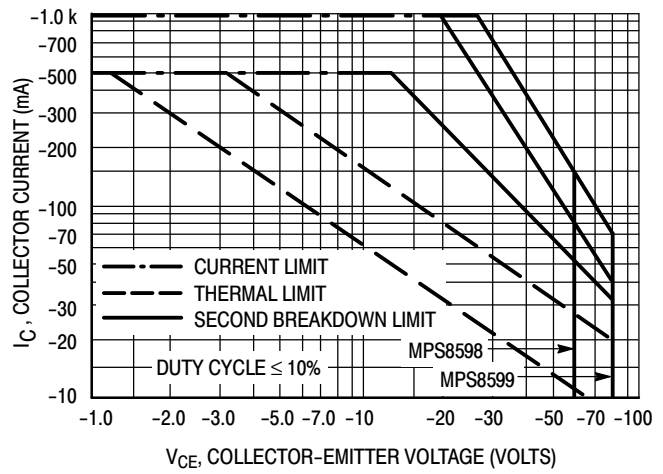
# NPN – MPS8099; PNP – MPS8599

## NPN

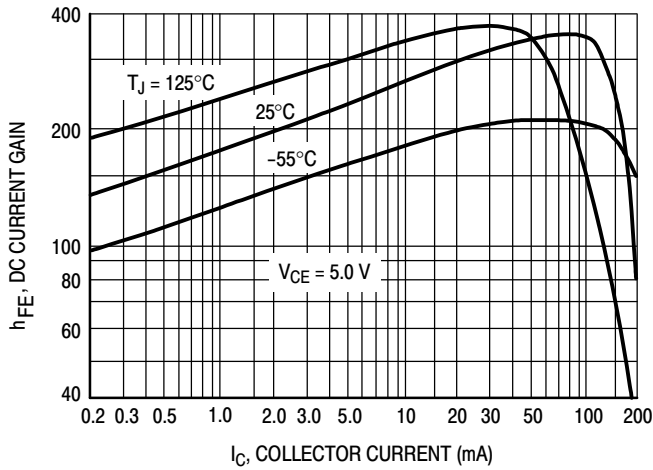


**Figure 9. Active-Region Safe Operating Area**

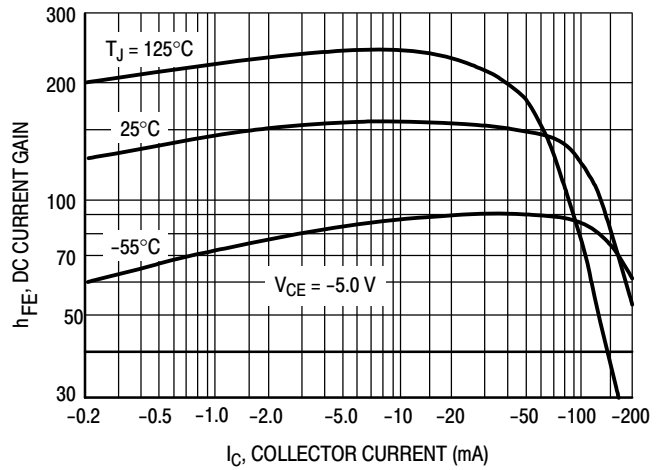
## PNP



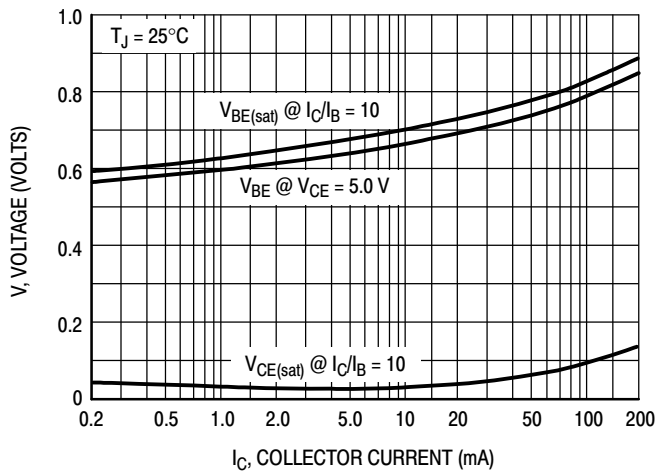
**Figure 10. Active-Region Safe Operating Area**



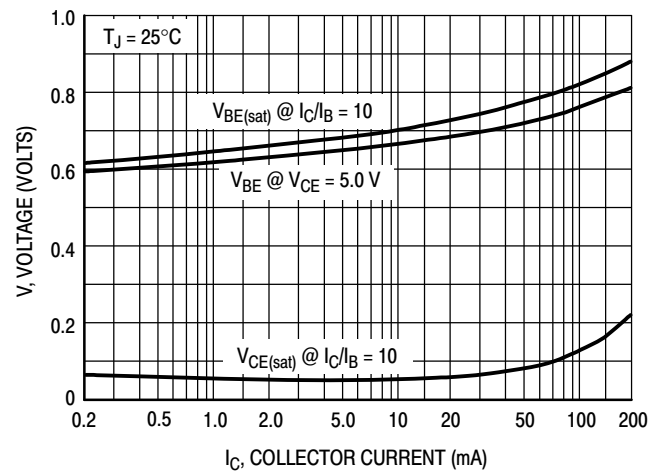
**Figure 11. DC Current Gain**



**Figure 12. DC Current Gain**



**Figure 13. "ON" Voltages**



**Figure 14. "ON" Voltages**

NPN – MPS8099; PNP – MPS8599

NPN

PNP

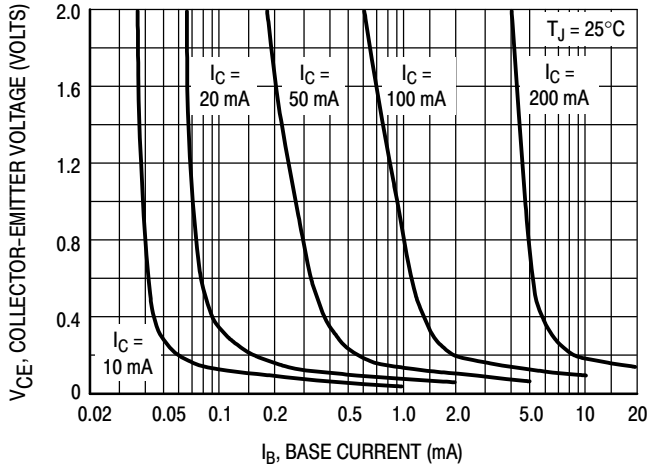


Figure 15. Collector Saturation Region

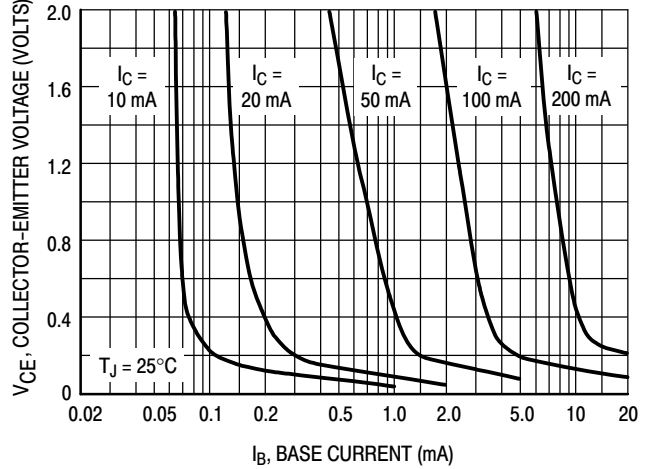


Figure 16. Collector Saturation Region

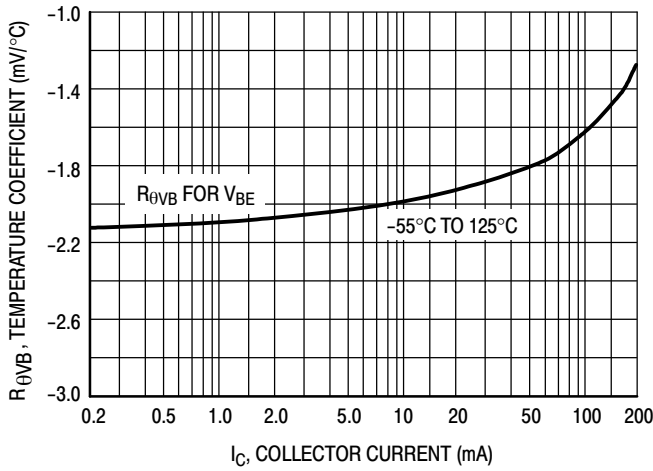


Figure 17. Base-Emitter Temperature Coefficient

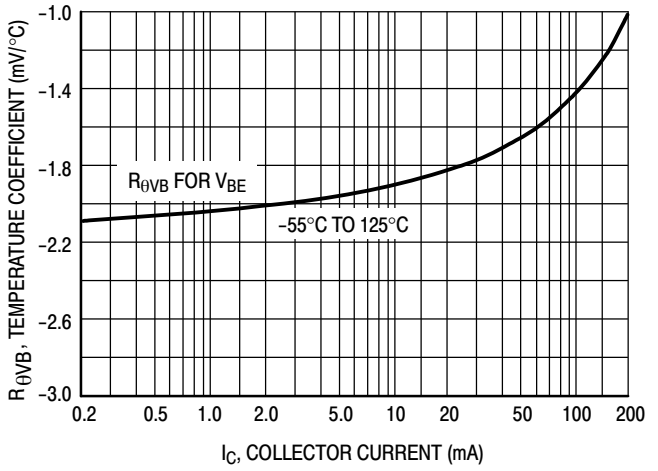
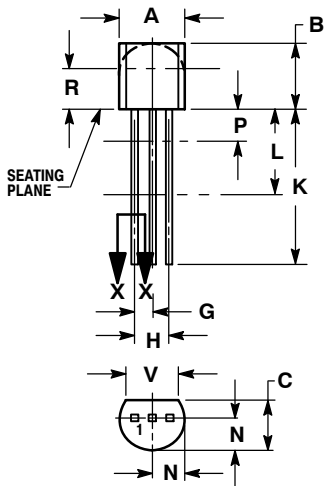


Figure 18. Base-Emitter Temperature Coefficient

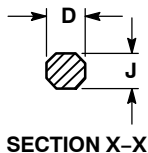
# NPN – MPS8099; PNP – MPS8599

## PACKAGE DIMENSIONS

TO-92 (TO-226)  
CASE 29-11  
ISSUE AM



STRAIGHT LEAD  
BULK PACK

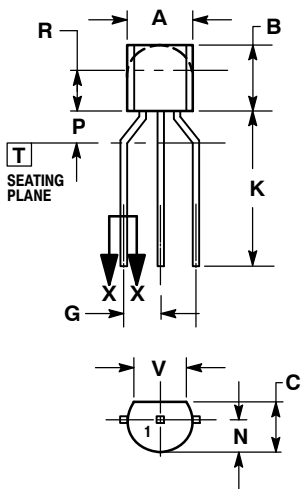


SECTION X-X

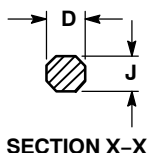
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.175  | 0.205 | 4.45        | 5.20  |
| B   | 0.170  | 0.210 | 4.32        | 5.33  |
| C   | 0.125  | 0.165 | 3.18        | 4.19  |
| D   | 0.016  | 0.021 | 0.407       | 0.533 |
| G   | 0.045  | 0.055 | 1.15        | 1.39  |
| H   | 0.095  | 0.105 | 2.42        | 2.66  |
| J   | 0.015  | 0.020 | 0.39        | 0.50  |
| K   | 0.500  | ---   | 12.70       | ---   |
| L   | 0.250  | ---   | 6.35        | ---   |
| N   | 0.080  | 0.105 | 2.04        | 2.66  |
| P   | ---    | 0.100 | ---         | 2.54  |
| R   | 0.115  | ---   | 2.93        | ---   |
| V   | 0.135  | ---   | 3.43        | ---   |



BENT LEAD  
TAPE & REEL  
AMMO PACK



SECTION X-X

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 4.45        | 5.20 |
| B   | 4.32        | 5.33 |
| C   | 3.18        | 4.19 |
| D   | 0.40        | 0.54 |
| G   | 2.40        | 2.80 |
| J   | 0.39        | 0.50 |
| K   | 12.70       | ---  |
| N   | 2.04        | 2.66 |
| P   | 1.50        | 4.00 |
| R   | 2.93        | ---  |
| V   | 3.43        | ---  |

STYLE 1:

1. EMITTER
2. BASE
3. COLLECTOR

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