

# MPSA13, MPSA14

MPSA14 is a Preferred Device

## Darlington Transistors

### NPN Silicon

#### Features

- Pb-Free Packages are Available\*

#### MAXIMUM RATINGS

| Rating                                                                                 | Symbol         | Value       | Unit                       |
|----------------------------------------------------------------------------------------|----------------|-------------|----------------------------|
| Collector – Emitter Voltage                                                            | $V_{CES}$      | 30          | Vdc                        |
| Collector – Base Voltage                                                               | $V_{CBO}$      | 30          | Vdc                        |
| Emitter – Base Voltage                                                                 | $V_{EBO}$      | 10          | 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

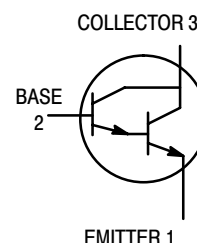
| Characteristic                          | Symbol          | Max  | Unit                       |
|-----------------------------------------|-----------------|------|----------------------------|
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 200  | $^\circ\text{C}/\text{mW}$ |
| Thermal Resistance, Junction-to-Case    | $R_{\theta JC}$ | 83.3 | $^\circ\text{C}/\text{mW}$ |

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.

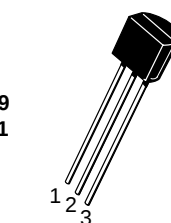


ON Semiconductor®

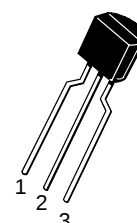
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TO-92  
CASE 29  
STYLE 1

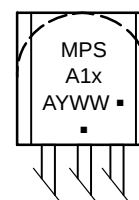


STRAIGHT LEAD  
BULK PACK



BENT LEAD  
TAPE & REEL  
AMMO PACK

#### MARKING DIAGRAM



- x = 3 or 4
- 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 2 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.

Preferred devices are recommended choices for future use and best overall value.

# MPSA13, MPSA14

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

| Characteristic                                                                                                                               | Symbol        | Min                                 | Max              | Unit |
|----------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------------------------|------------------|------|
| <b>OFF CHARACTERISTICS</b>                                                                                                                   |               |                                     |                  |      |
| Collector–Emitter Breakdown Voltage<br>( $I_C = 100\ \mu\text{Adc}$ , $I_B = 0$ )                                                            | $V_{(BR)CES}$ | 30                                  | –                | Vdc  |
| Collector Cutoff Current<br>( $V_{CB} = 30\ \text{Vdc}$ , $I_E = 0$ )                                                                        | $I_{CBO}$     | –                                   | 100              | nAdc |
| Emitter Cutoff Current<br>( $V_{EB} = 10\ \text{Vdc}$ , $I_C = 0$ )                                                                          | $I_{EBO}$     | –                                   | 100              | nAdc |
| <b>ON CHARACTERISTICS (Note 1)</b>                                                                                                           |               |                                     |                  |      |
| DC Current Gain<br>( $I_C = 10\ \text{mAdc}$ , $V_{CE} = 5.0\ \text{Vdc}$ )<br><br>( $I_C = 100\ \text{mAdc}$ , $V_{CE} = 5.0\ \text{Vdc}$ ) | $h_{FE}$      | 5,000<br>10,000<br>10,000<br>20,000 | –<br>–<br>–<br>– | –    |
| Collector–Emitter Saturation Voltage<br>( $I_C = 100\ \text{mAdc}$ , $I_B = 0.1\ \text{mAdc}$ )                                              | $V_{CE(sat)}$ | –                                   | 1.5              | Vdc  |
| Base–Emitter On Voltage<br>( $I_C = 100\ \text{mAdc}$ , $V_{CE} = 5.0\ \text{Vdc}$ )                                                         | $V_{BE(on)}$  | –                                   | 2.0              | Vdc  |
| <b>SMALL–SIGNAL CHARACTERISTICS</b>                                                                                                          |               |                                     |                  |      |
| Current–Gain – Bandwidth Product (Note 2)<br>( $I_C = 10\ \text{mAdc}$ , $V_{CE} = 5.0\ \text{Vdc}$ , $f = 100\ \text{MHz}$ )                | $f_T$         | 125                                 | –                | MHz  |

1. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ ; Duty Cycle  $\leq 2.0\%$ .

2.  $f_T = |h_{fe}| \cdot f_{test}$ .

## ORDERING INFORMATION

| Device      | Package            | Shipping <sup>†</sup> |
|-------------|--------------------|-----------------------|
| MPSA13      | TO–92              | 5000 Units / Bulk     |
| MPSA13G     | TO–92<br>(Pb–Free) | 5000 Units / Bulk     |
| MPSA13RLRA  | TO–92              | 2000 / Tape & Reel    |
| MPSA13RLRAG | TO–92<br>(Pb–Free) | 2000 / Tape & Reel    |
| MPSA13RLRMG | TO–92<br>(Pb–Free) | 2000 / Ammo Pack      |
| MPSA13RLRPG | TO–92<br>(Pb–Free) | 2000 / Ammo Pack      |
| MPSA13ZL1G  | TO–92<br>(Pb–Free) | 2000 / Ammo Pack      |
| MPSA14G     | TO–92<br>(Pb–Free) | 5000 Units / Bulk     |
| MPSA14RLRAG | TO–92<br>(Pb–Free) | 2000 / Tape & Reel    |
| MPSA14RLRPG | TO–92<br>(Pb–Free) | 2000 / Ammo Pack      |

<sup>†</sup>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.

## MPSA13, MPSA14

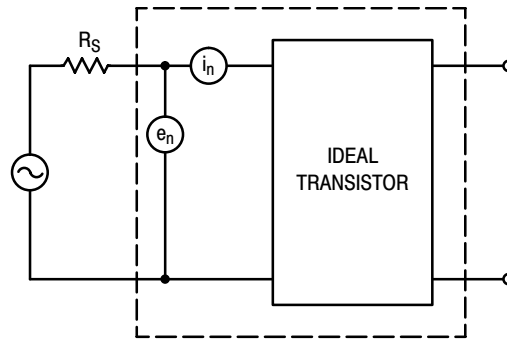


Figure 1. Transistor Noise Model

### NOISE CHARACTERISTICS

( $V_{CE} = 5.0$  Vdc,  $T_A = 25^\circ\text{C}$ )

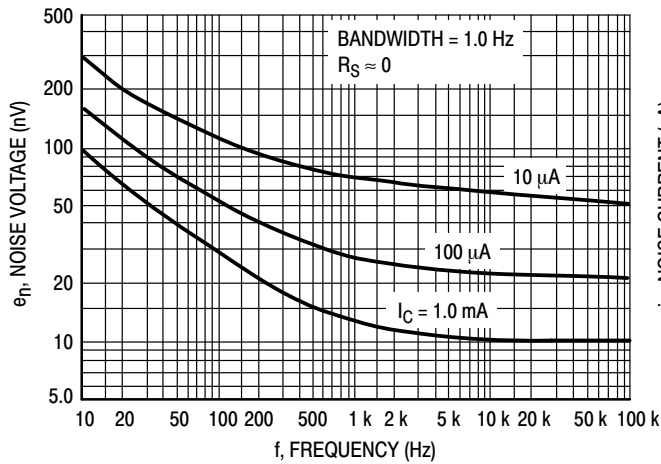


Figure 2. Noise Voltage

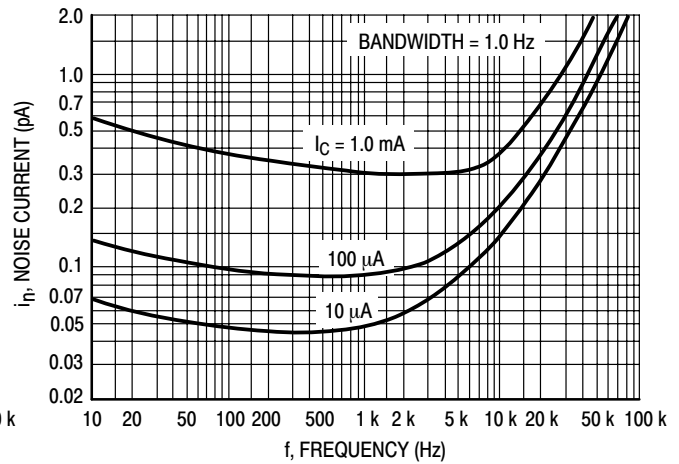


Figure 3. Noise Current

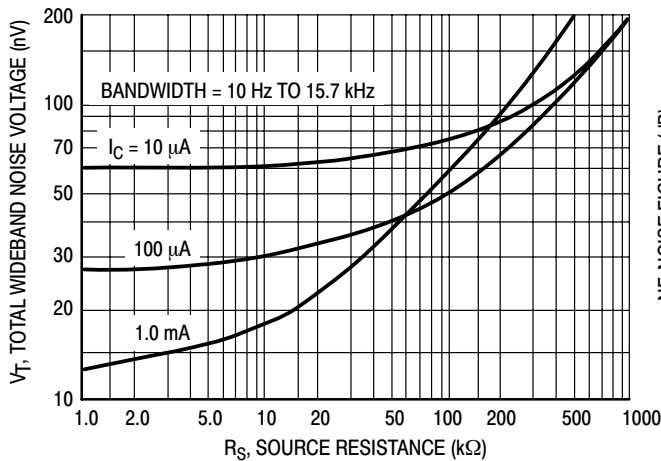


Figure 4. Total Wideband Noise Voltage

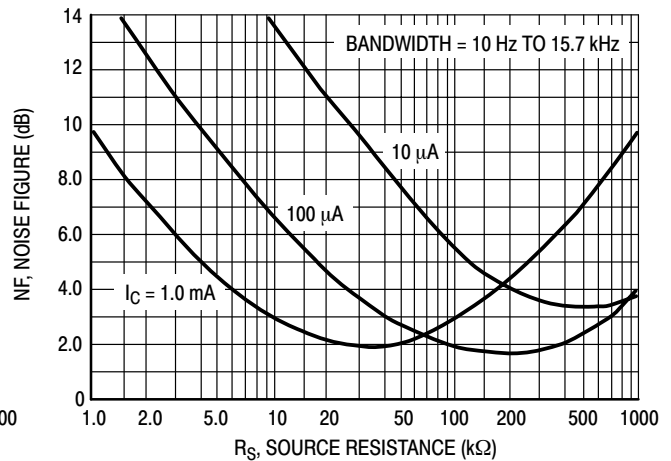


Figure 5. Wideband Noise Figure

# MPSA13, MPSA14

## SMALL-SIGNAL CHARACTERISTICS

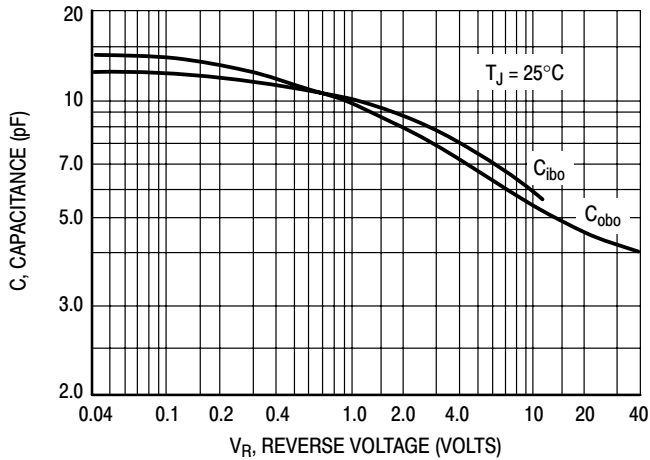


Figure 6. Capacitance

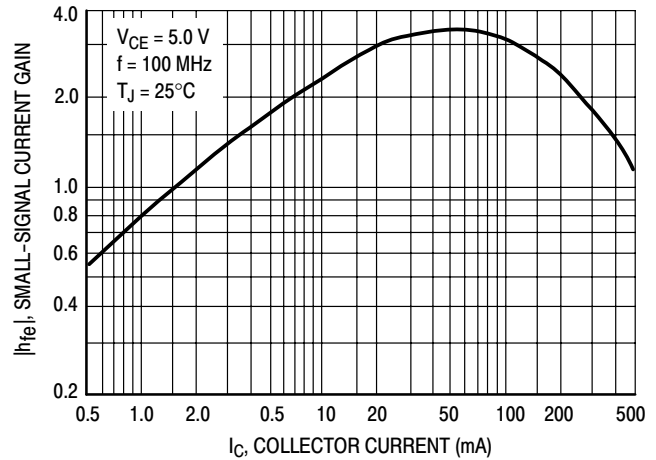


Figure 7. High Frequency Current Gain

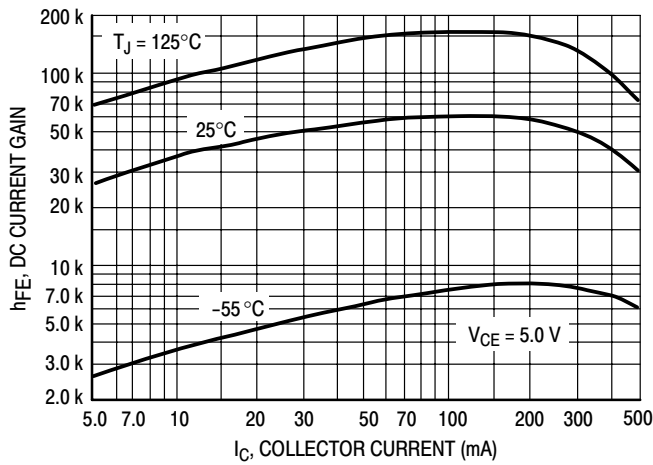


Figure 8. DC Current Gain

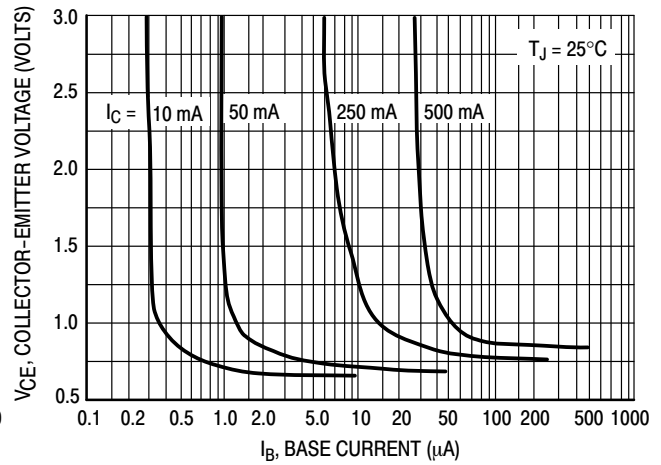


Figure 9. Collector Saturation Region

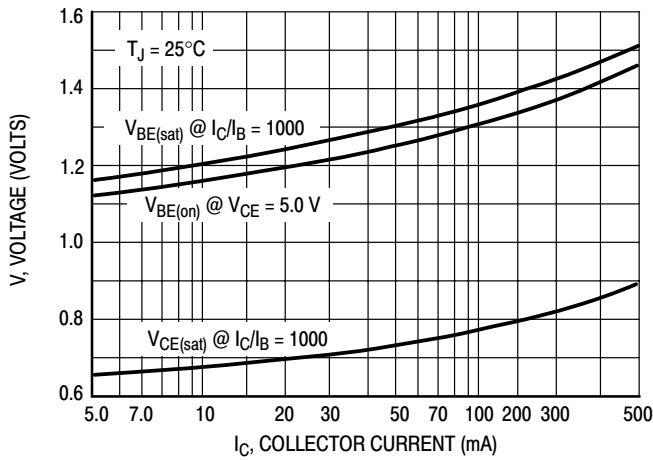


Figure 10. "On" Voltages

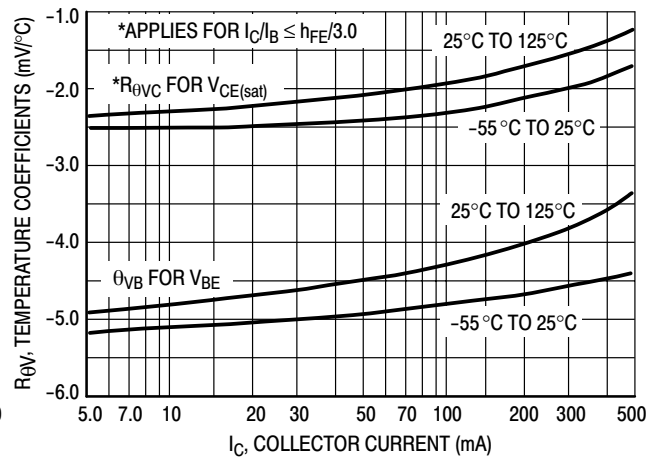


Figure 11. Temperature Coefficients

## MPSA13, MPSA14

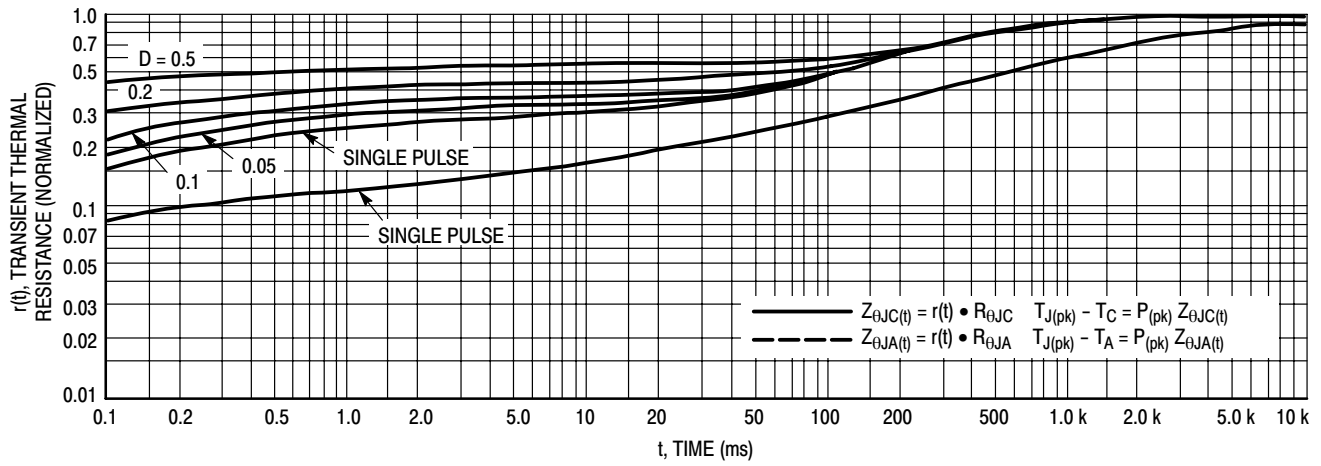


Figure 12. Thermal Response

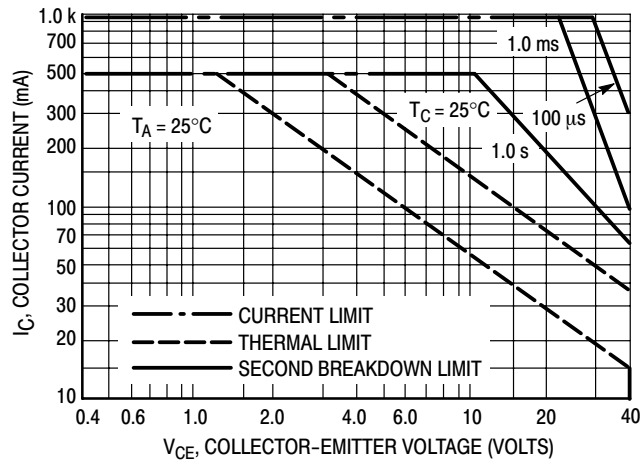
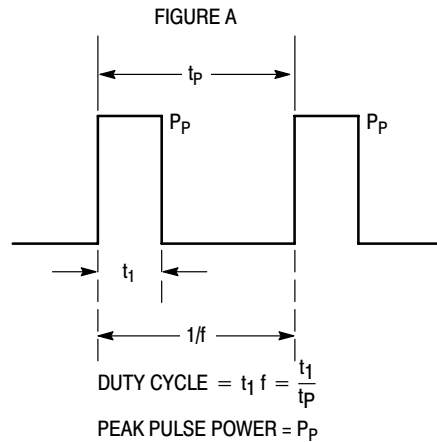
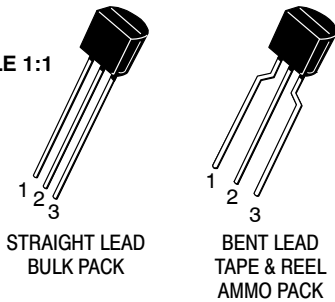


Figure 13. Active Region Safe Operating Area



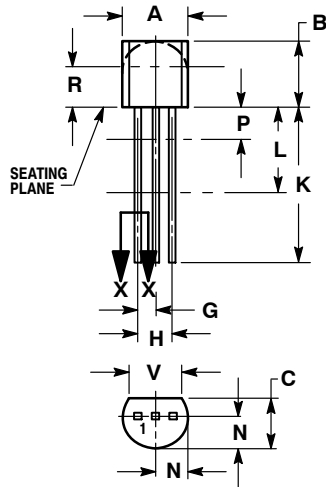
Design Note: Use of Transient Thermal Resistance Data

SCALE 1:1

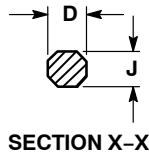


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DATE 09 MAR 2007



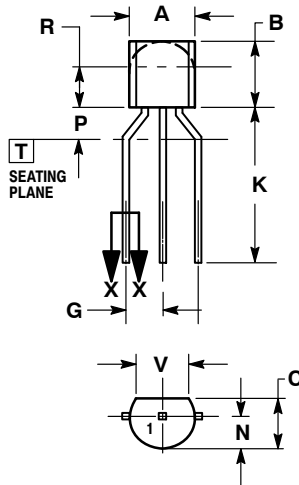
STRAIGHT LEAD  
BULK PACK



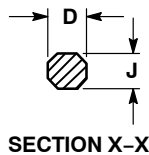
NOTES:

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



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        | ---  |

STYLES ON PAGE 2

|                  |                |                                                                                                                                                                                     |
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|                                                               |                                                                      |                                                              |                                                                 |                                                             |
|---------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------|
| STYLE 1:<br>PIN 1. EMITTER<br>2. BASE<br>3. COLLECTOR         | STYLE 2:<br>PIN 1. BASE<br>2. EMITTER<br>3. COLLECTOR                | STYLE 3:<br>PIN 1. ANODE<br>2. ANODE<br>3. CATHODE           | STYLE 4:<br>PIN 1. CATHODE<br>2. CATHODE<br>3. ANODE            | STYLE 5:<br>PIN 1. DRAIN<br>2. SOURCE<br>3. GATE            |
| STYLE 6:<br>PIN 1. GATE<br>2. SOURCE & SUBSTRATE<br>3. DRAIN  | STYLE 7:<br>PIN 1. SOURCE<br>2. DRAIN<br>3. GATE                     | STYLE 8:<br>PIN 1. DRAIN<br>2. GATE<br>3. SOURCE & SUBSTRATE | STYLE 9:<br>PIN 1. BASE 1<br>2. EMITTER<br>3. BASE 2            | STYLE 10:<br>PIN 1. CATHODE<br>2. GATE<br>3. ANODE          |
| STYLE 11:<br>PIN 1. ANODE<br>2. CATHODE & ANODE<br>3. CATHODE | STYLE 12:<br>PIN 1. MAIN TERMINAL 1<br>2. GATE<br>3. MAIN TERMINAL 2 | STYLE 13:<br>PIN 1. ANODE 1<br>2. GATE<br>3. CATHODE 2       | STYLE 14:<br>PIN 1. EMITTER<br>2. COLLECTOR<br>3. BASE          | STYLE 15:<br>PIN 1. ANODE 1<br>2. CATHODE<br>3. ANODE 2     |
| STYLE 16:<br>PIN 1. ANODE<br>2. GATE<br>3. CATHODE            | STYLE 17:<br>PIN 1. COLLECTOR<br>2. BASE<br>3. EMITTER               | STYLE 18:<br>PIN 1. ANODE<br>2. CATHODE<br>3. NOT CONNECTED  | STYLE 19:<br>PIN 1. GATE<br>2. ANODE<br>3. CATHODE              | STYLE 20:<br>PIN 1. NOT CONNECTED<br>2. CATHODE<br>3. ANODE |
| STYLE 21:<br>PIN 1. COLLECTOR<br>2. EMITTER<br>3. BASE        | STYLE 22:<br>PIN 1. SOURCE<br>2. GATE<br>3. DRAIN                    | STYLE 23:<br>PIN 1. GATE<br>2. SOURCE<br>3. DRAIN            | STYLE 24:<br>PIN 1. EMITTER<br>2. COLLECTOR/ANODE<br>3. CATHODE | STYLE 25:<br>PIN 1. MT 1<br>2. GATE<br>3. MT 2              |
| STYLE 26:<br>PIN 1. $V_{CC}$<br>2. GROUND 2<br>3. OUTPUT      | STYLE 27:<br>PIN 1. MT<br>2. SUBSTRATE<br>3. MT                      | STYLE 28:<br>PIN 1. CATHODE<br>2. ANODE<br>3. GATE           | STYLE 29:<br>PIN 1. NOT CONNECTED<br>2. ANODE<br>3. CATHODE     | STYLE 30:<br>PIN 1. DRAIN<br>2. GATE<br>3. SOURCE           |
| STYLE 31:<br>PIN 1. GATE<br>2. DRAIN<br>3. SOURCE             | STYLE 32:<br>PIN 1. BASE<br>2. COLLECTOR<br>3. EMITTER               | STYLE 33:<br>PIN 1. RETURN<br>2. INPUT<br>3. OUTPUT          | STYLE 34:<br>PIN 1. INPUT<br>2. GROUND<br>3. LOGIC              | STYLE 35:<br>PIN 1. GATE<br>2. COLLECTOR<br>3. EMITTER      |

|                         |                       |                                                                                                                                                                                     |
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