

# 2N4123, 2N4124

## General Purpose Transistors

### NPN Silicon

#### Features

- Pb-Free Packages are Available\*

#### MAXIMUM RATINGS

| Rating   | Symbol         | Value       | Unit                       |
|--|----------------|-------------|----------------------------|
| Collector-Emitter Voltage<br>2N4123<br>2N4124  | $V_{CEO}$      | 30<br>25    | Vdc                        |
| Collector-Base Voltage<br>2N4123<br>2N4124   | $V_{CBO}$      | 40<br>30    | Vdc                        |
| Emitter-Base Voltage   | $V_{EBO}$      | 5.0         | Vdc                        |
| Collector Current - Continuous   | $I_C$          | 200         | 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

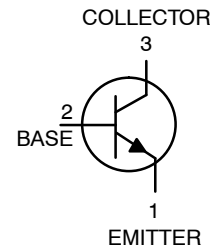
| Characteristic                          | Symbol          | Max  | Unit                      |
|---|-----------------|------|---------------------------|
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 200  | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-Case    | $R_{\theta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

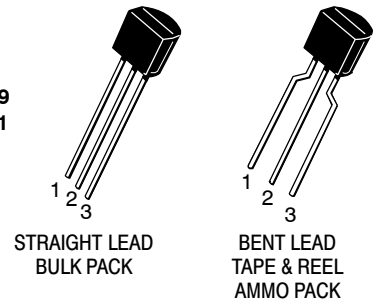


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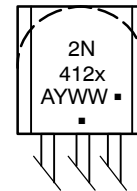
<http://onsemi.com>



TO-92  
CASE 29  
STYLE 1



#### 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

| Device     | Package            | Shipping†          |
|------------|--------------------|--------------------|
| 2N4123RLRM | TO-92              | 2000 / Tape & Ammo |
| 2N4124G    | TO-92<br>(Pb-Free) | 5000 Units / Bulk  |

†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.

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

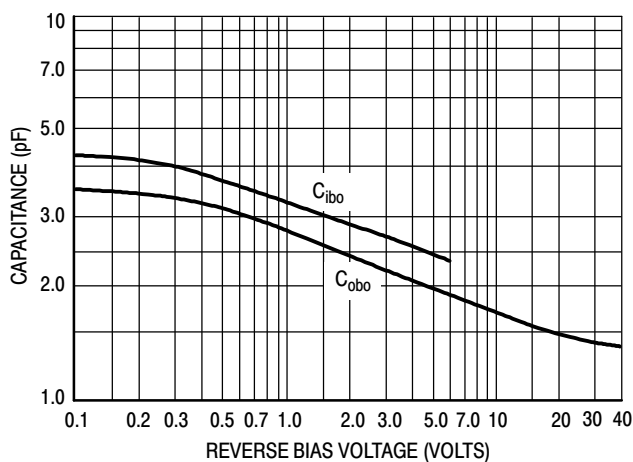
## 2N4123, 2N4124

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

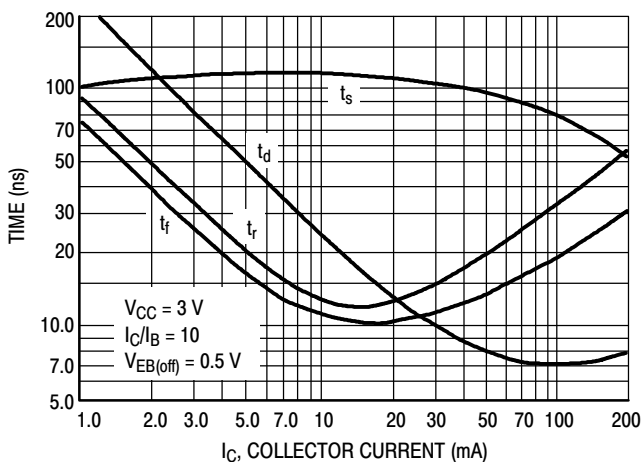
| Characteristic   | Symbol           | Min                  | Max        | Unit       |                  |
|--|------------------|----------------------|------------|------------|------------------|
| <b>OFF CHARACTERISTICS</b>   |                  |                      |            |            |                  |
| Collector–Emitter Breakdown Voltage (Note 1)<br>(I <sub>C</sub> = 1.0 mA <sub>dc</sub> , I <sub>E</sub> = 0)                                       | 2N4123<br>2N4124 | V <sub>(BR)CEO</sub> | 30<br>25   | –<br>–     | V <sub>dc</sub>  |
| Collector–Base Breakdown Voltage<br>(I <sub>C</sub> = 10 μA <sub>dc</sub> , I <sub>E</sub> = 0)  | 2N4123<br>2N4124 | V <sub>(BR)CBO</sub> | 40<br>30   | –<br>–     | 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> | 5.0        | –          | V <sub>dc</sub>  |
| Collector Cutoff Current<br>(V <sub>CB</sub> = 20 V <sub>dc</sub> , I <sub>E</sub> = 0)  |                  | I <sub>CBO</sub>     | –          | 50         | nA <sub>dc</sub> |
| Emitter Cutoff Current<br>(V <sub>EB</sub> = 3.0 V <sub>dc</sub> , I <sub>C</sub> = 0)   |                  | I <sub>EBO</sub>     | –          | 50         | nA <sub>dc</sub> |
| <b>ON CHARACTERISTICS</b>  |                  |                      |            |            |                  |
| DC Current Gain (Note 1)<br>(I <sub>C</sub> = 2.0 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> )                                       | 2N4123<br>2N4124 | h <sub>FE</sub>      | 50<br>120  | 150<br>360 | –                |
| (I <sub>C</sub> = 50 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> )  | 2N4123<br>2N4124 |                      | 25<br>60   | –<br>–     |                  |
| Collector–Emitter Saturation Voltage (Note 1)<br>(I <sub>C</sub> = 50 mA <sub>dc</sub> , I <sub>B</sub> = 5.0 mA <sub>dc</sub> )                   |                  | V <sub>CE(sat)</sub> | –          | 0.3        | V <sub>dc</sub>  |
| Base–Emitter Saturation Voltage (Note 1)<br>(I <sub>C</sub> = 50 mA <sub>dc</sub> , I <sub>B</sub> = 5.0 mA <sub>dc</sub> )                        |                  | V <sub>BE(sat)</sub> | –          | 0.95       | 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> = 20 V <sub>dc</sub> , f = 100 MHz)                    | 2N4123<br>2N4124 | f <sub>T</sub>       | 250<br>300 | –<br>–     | MHz              |
| 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>     | –          | 8.0        | pF               |
| Collector–Base Capacitance<br>(I <sub>E</sub> = 0, V <sub>CB</sub> = 5.0 V, f = 1.0 MHz)   |                  | C <sub>cb</sub>      | –          | 4.0        | pF               |
| Small–Signal Current Gain<br>(I <sub>C</sub> = 2.0 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , R <sub>S</sub> = 10 k Ω, f = 1.0 kHz) | 2N4123<br>2N4124 | h <sub>fe</sub>      | 50<br>120  | 200<br>480 | –                |
| Current Gain – High Frequency<br>(I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 20 V <sub>dc</sub> , f = 100 MHz)                       | 2N4123<br>2N4124 | h <sub>fe</sub>      | 2.5<br>3.0 | –<br>–     | –                |
| (I <sub>C</sub> = 2.0 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V, f = 1.0 kHz)  | 2N4123           |                      | 50         | 200        |                  |
| (I <sub>C</sub> = 2.0 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V, f = 1.0 kHz)  | 2N4124           |                      | 120        | 480        |                  |
| Noise Figure<br>(I <sub>C</sub> = 100 μA <sub>dc</sub> , V <sub>CE</sub> = 5.0 V <sub>dc</sub> , R <sub>S</sub> = 1.0 k Ω, f = 1.0 kHz)            | 2N4123<br>2N4124 | NF                   | –<br>–     | 6.0<br>5.0 | dB               |

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

## 2N4123, 2N4124



**Figure 1. Capacitance**



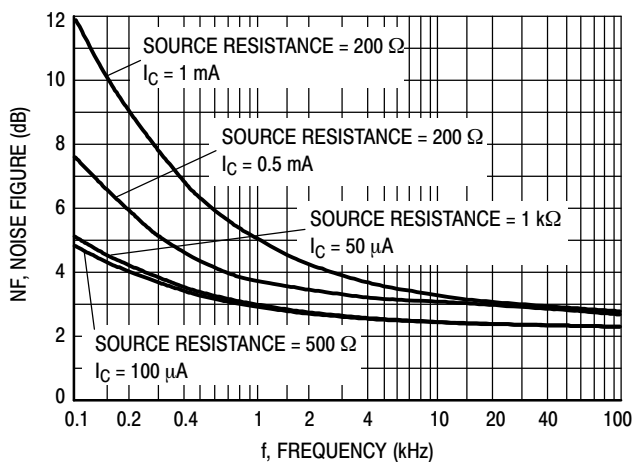
**Figure 2. Switching Times**

### AUDIO SMALL-SIGNAL CHARACTERISTICS

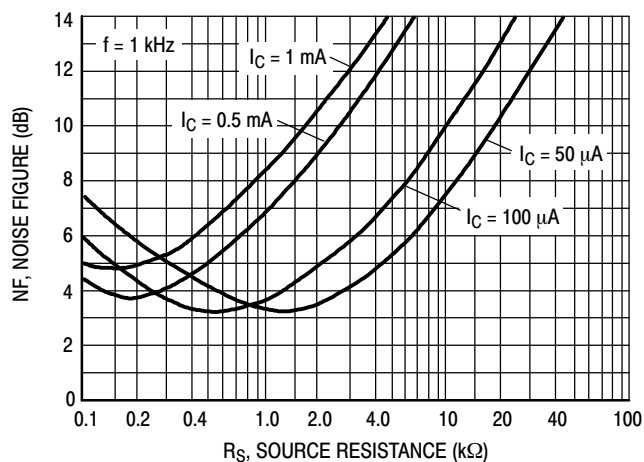
#### NOISE FIGURE

( $V_{CE} = 5 \text{ Vdc}$ ,  $T_A = 25^\circ\text{C}$ )

Bandwidth = 1.0 Hz



**Figure 3. Frequency Variations**



**Figure 4. Source Resistance**

# 2N4123, 2N4124

## h PARAMETERS

( $V_{CE} = 10\text{ V}$ ,  $f = 1\text{ kHz}$ ,  $T_A = 25^\circ\text{C}$ )

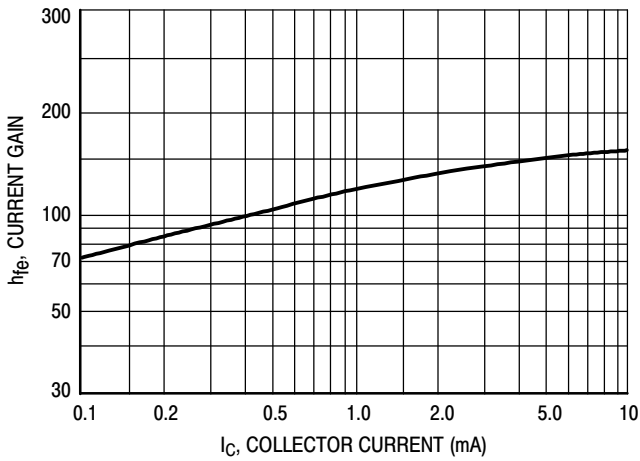


Figure 5. Current Gain

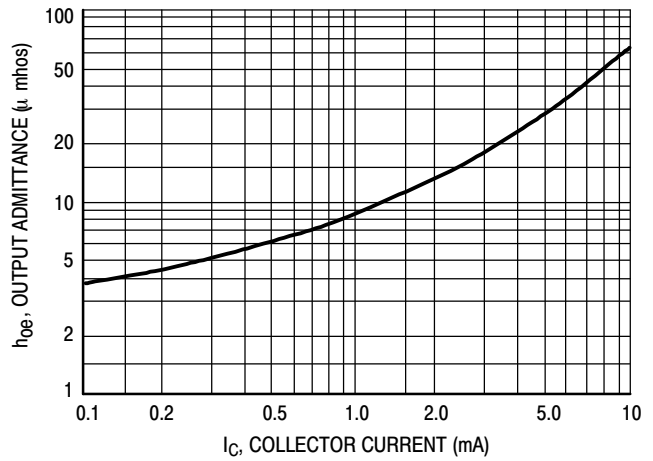


Figure 6. Output Admittance

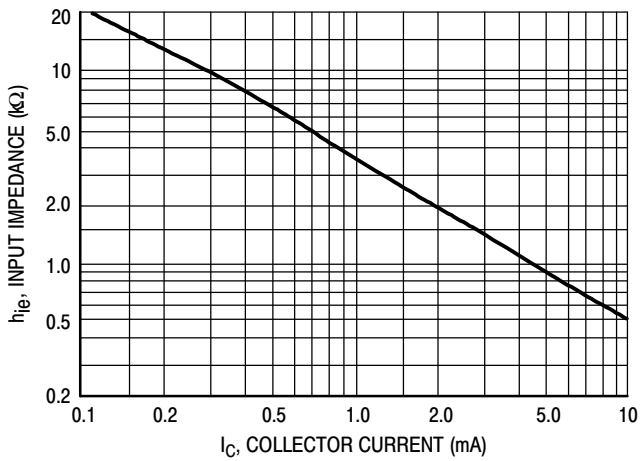


Figure 7. Input Impedance

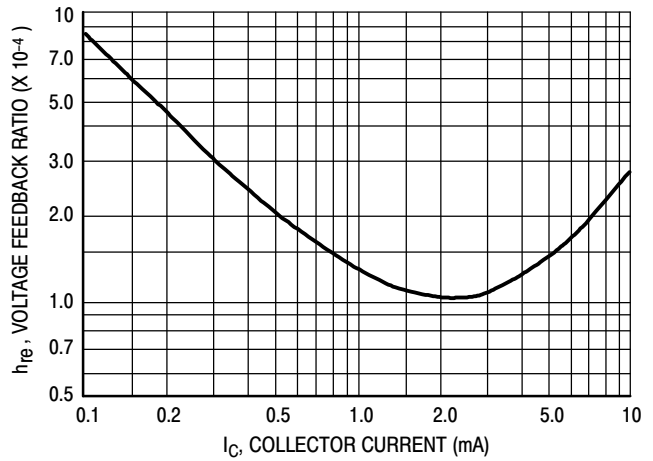


Figure 8. Voltage Feedback Ratio

## STATIC CHARACTERISTICS

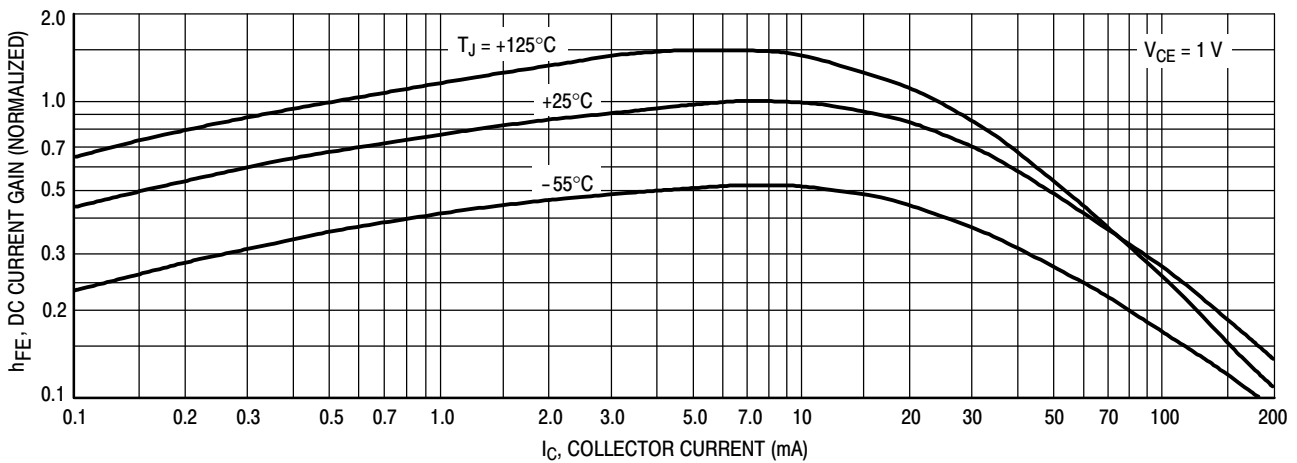
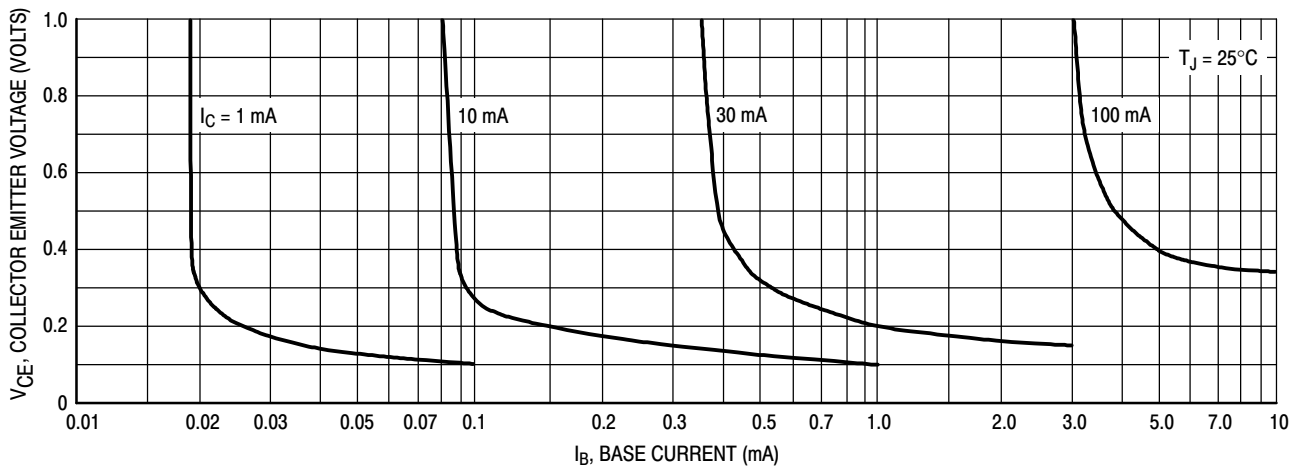
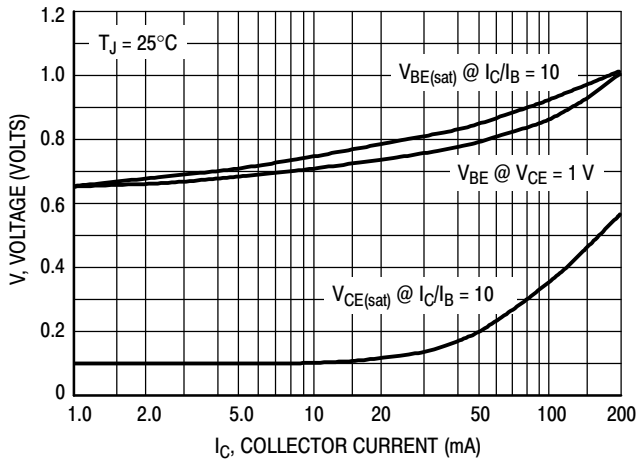


Figure 9. DC Current Gain

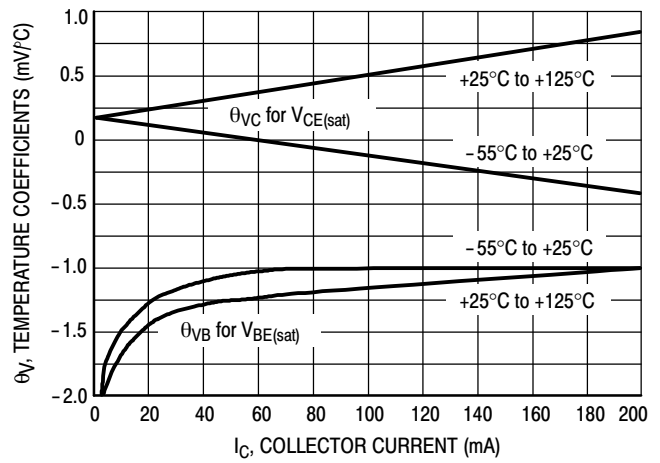
## 2N4123, 2N4124



**Figure 10. Collector Saturation Region**



**Figure 11. "On" Voltages**

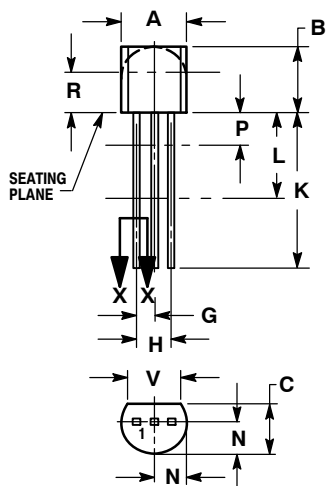


**Figure 12. Temperature Coefficients**

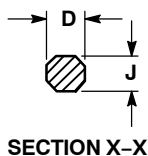
# 2N4123, 2N4124

## PACKAGE DIMENSIONS

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



STRAIGHT LEAD  
BULK PACK

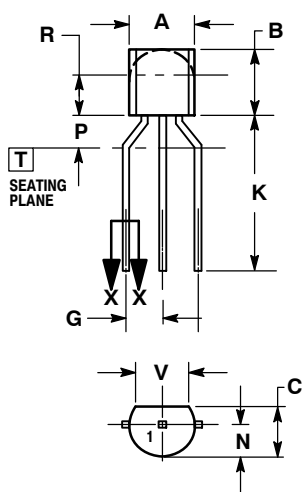


SECTION X-X

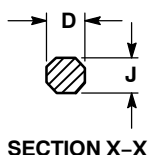
NOTES:

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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