

# 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 | $^\circ\text{C}/\text{mW}$ |

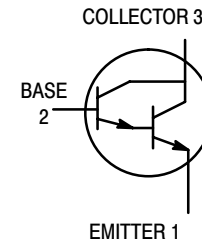
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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

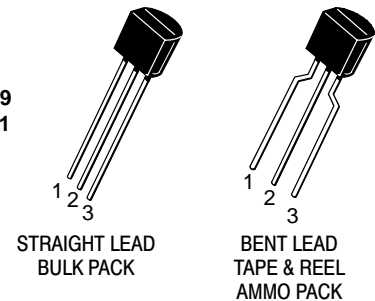


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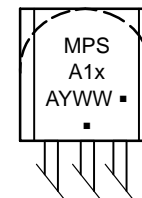
<http://onsemi.com>



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

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

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

# MPSA13, MPSA14

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

| Characteristic   | Symbol               | Min                                 | Max              | Unit |
|--|----------------------|-------------------------------------|------------------|------|
| <b>OFF CHARACTERISTICS</b>   |                      |                                     |                  |      |
| Collector–Emitter Breakdown Voltage<br>(I <sub>C</sub> = 100 μAdc, I <sub>B</sub> = 0)   | V <sub>(BR)CES</sub> | 30                                  | –                | Vdc  |
| Collector Cutoff Current<br>(V <sub>CB</sub> = 30 Vdc, I <sub>E</sub> = 0)   | I <sub>CBO</sub>     | –                                   | 100              | nAdc |
| Emitter Cutoff Current<br>(V <sub>EB</sub> = 10 Vdc, I <sub>C</sub> = 0)   | I <sub>EBO</sub>     | –                                   | 100              | nAdc |
| <b>ON CHARACTERISTICS (Note 1)</b>   |                      |                                     |                  |      |
| DC Current Gain<br>(I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 5.0 Vdc)<br><br>(I <sub>C</sub> = 100 mAdc, V <sub>CE</sub> = 5.0 Vdc) | h <sub>FE</sub>      | 5,000<br>10,000<br>10,000<br>20,000 | –<br>–<br>–<br>– | –    |
| Collector–Emitter Saturation Voltage<br>(I <sub>C</sub> = 100 mAdc, I <sub>B</sub> = 0.1 mAdc)   | V <sub>CE(sat)</sub> | –                                   | 1.5              | Vdc  |
| Base–Emitter On Voltage<br>(I <sub>C</sub> = 100 mAdc, V <sub>CE</sub> = 5.0 Vdc)  | V <sub>BE(on)</sub>  | –                                   | 2.0              | Vdc  |
| <b>SMALL–SIGNAL CHARACTERISTICS</b>  |                      |                                     |                  |      |
| Current–Gain – Bandwidth Product (Note 2)<br>(I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 5.0 Vdc, f = 100 MHz)                        | f <sub>T</sub>       | 125                                 | –                | MHz  |

1. Pulse Test: Pulse Width ≤ 300 μs; Duty Cycle ≤ 2.0%.
2. f<sub>T</sub> = |h<sub>fe</sub>| • f<sub>test</sub>.

## 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

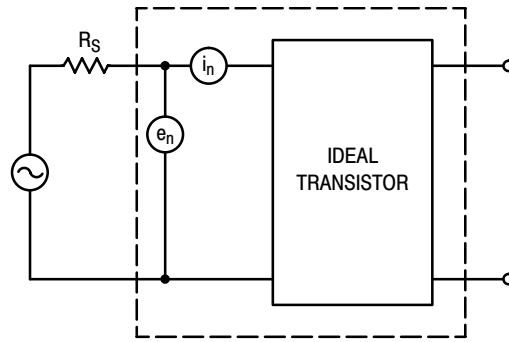


Figure 1. Transistor Noise Model

## NOISE CHARACTERISTICS

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

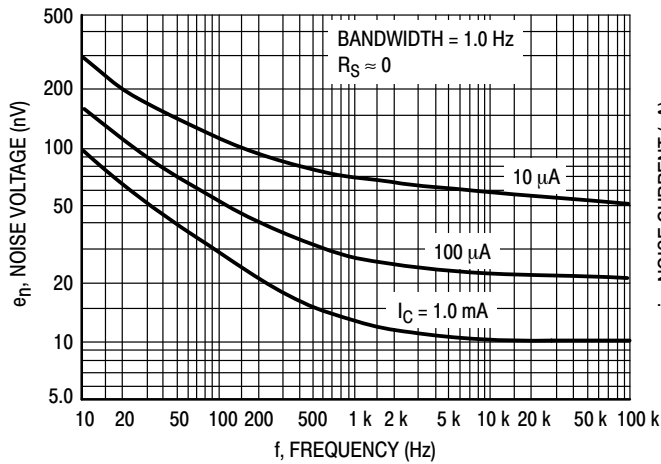


Figure 2. Noise Voltage

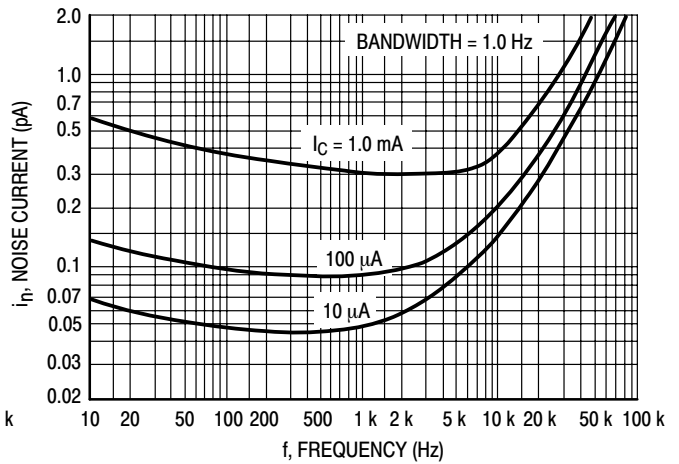


Figure 3. Noise Current

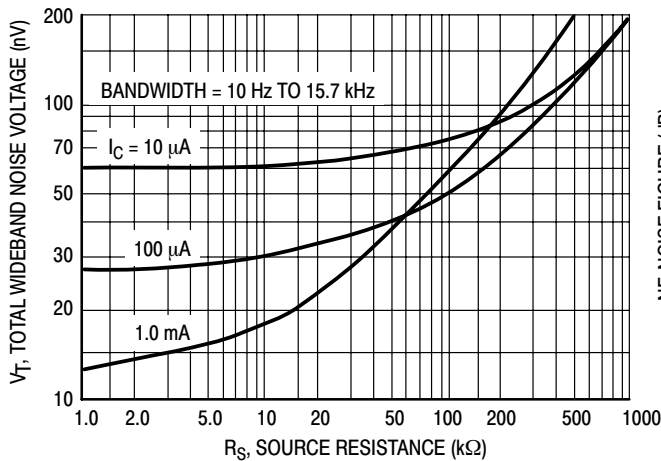


Figure 4. Total Wideband Noise Voltage

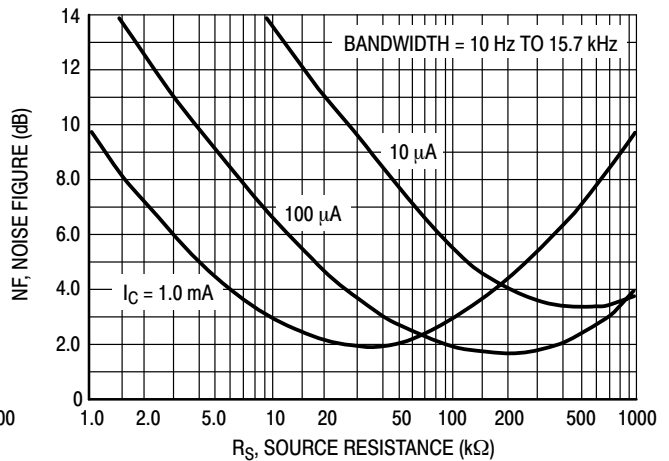


Figure 5. Wideband Noise Figure

# MPSA13, MPSA14

## SMALL-SIGNAL CHARACTERISTICS

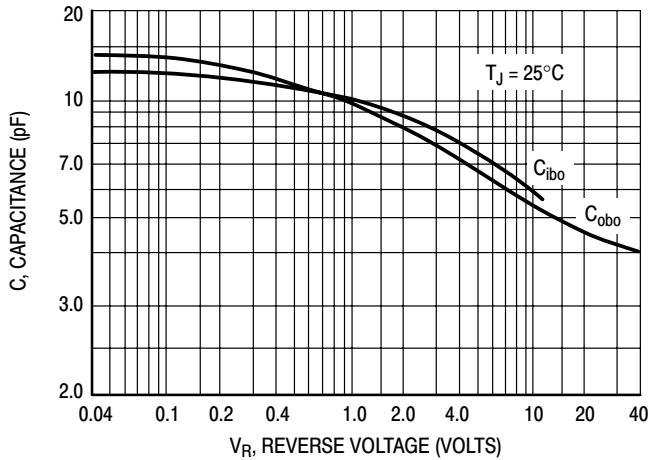


Figure 6. Capacitance

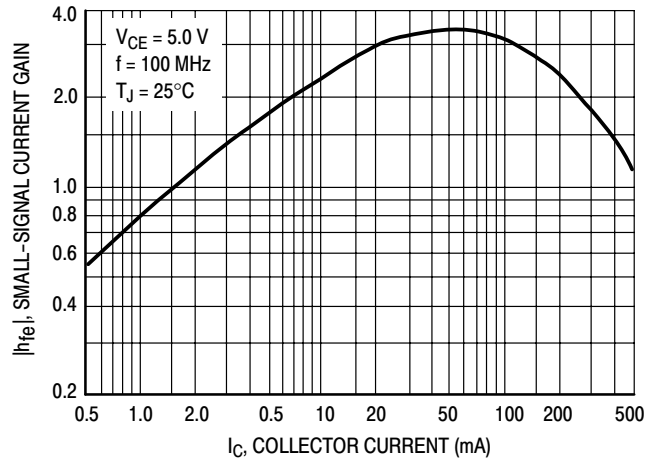


Figure 7. High Frequency Current Gain

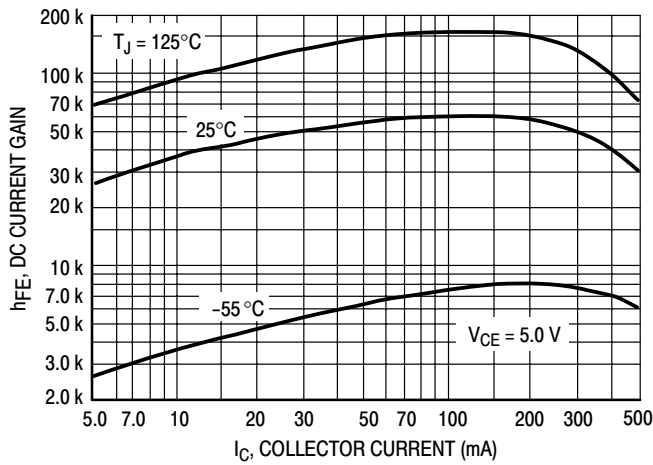


Figure 8. DC Current Gain

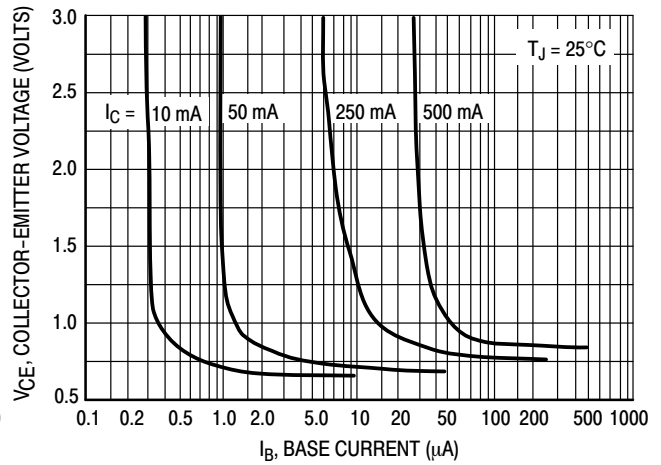


Figure 9. Collector Saturation Region

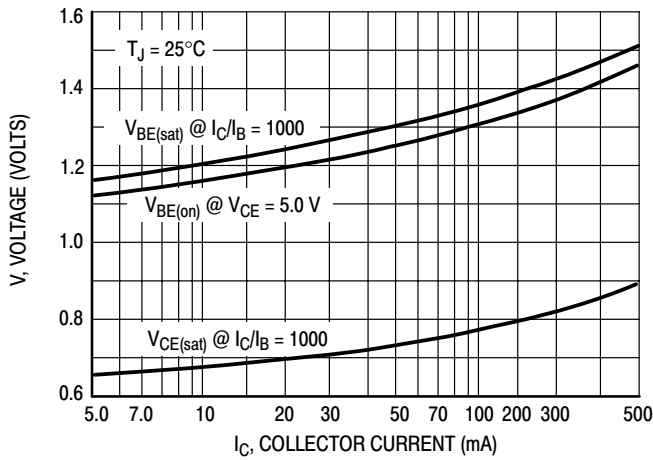


Figure 10. "On" Voltages

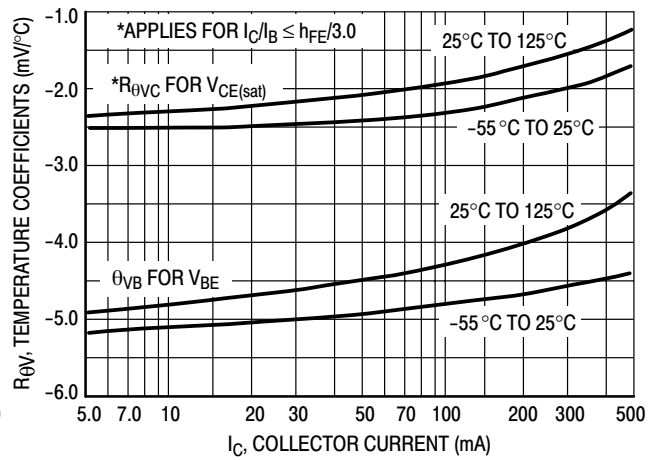


Figure 11. Temperature Coefficients

# MPSA13, MPSA14

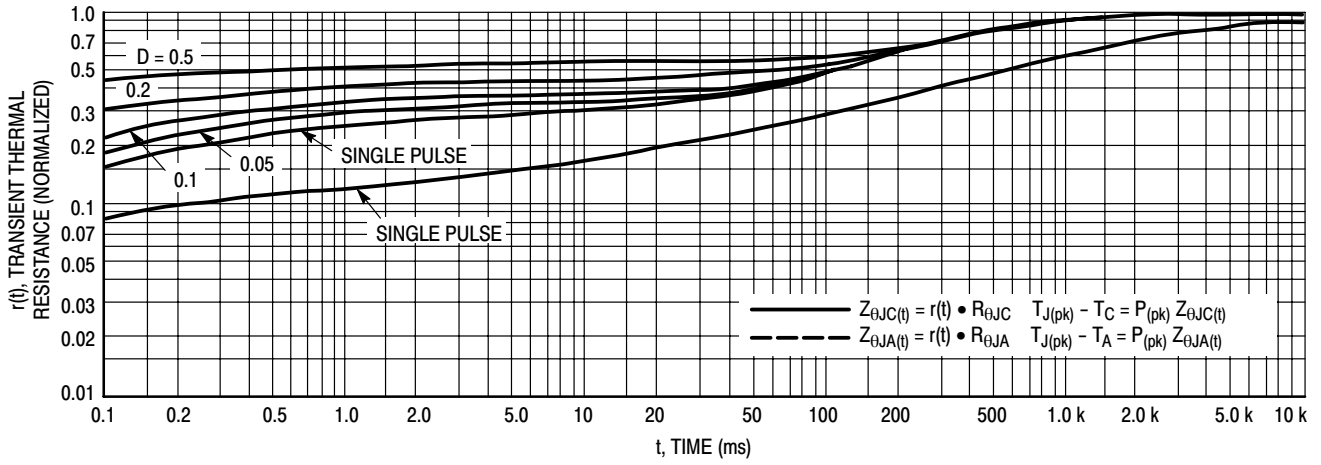


Figure 12. Thermal Response

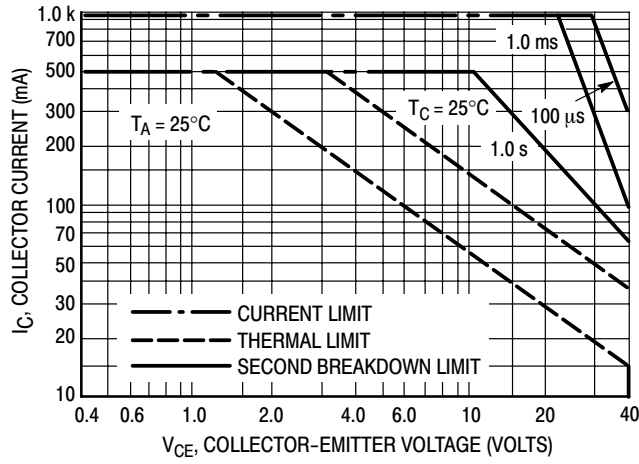
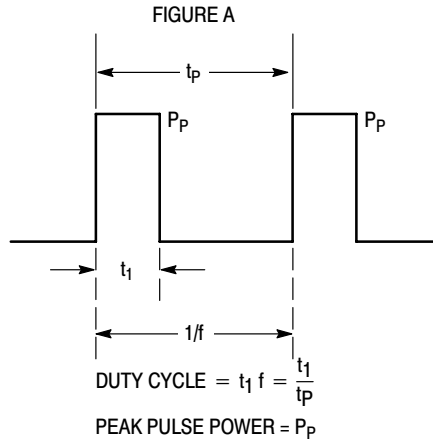


Figure 13. Active Region Safe Operating Area



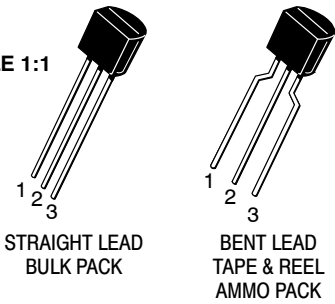
Design Note: Use of Transient Thermal Resistance Data

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

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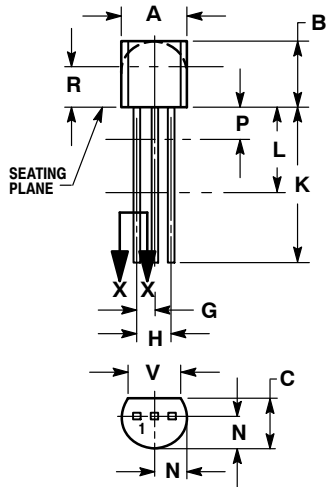


SCALE 1:1

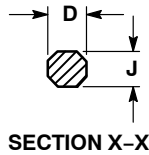


TO-92 (TO-226)  
CASE 29-11  
ISSUE AM

DATE 09 MAR 2007



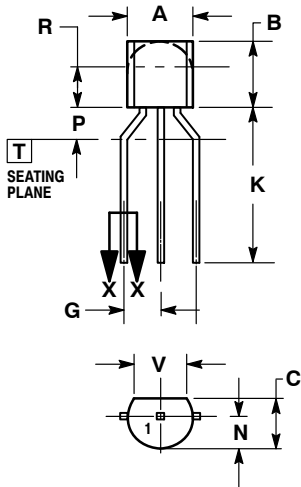
STRAIGHT LEAD  
BULK PACK



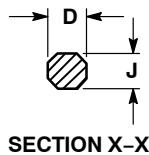
NOTES:

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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| DESCRIPTION:     | TO-92 (TO-226)            | PAGE 1 OF 3  |

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

DATE 09 MAR 2007

STYLE 1:  
 PIN 1. EMITTER  
 2. BASE  
 3. COLLECTOR

STYLE 2:  
 PIN 1. BASE  
 2. EMITTER  
 3. COLLECTOR

STYLE 3:  
 PIN 1. ANODE  
 2. ANODE  
 3. CATHODE

STYLE 4:  
 PIN 1. CATHODE  
 2. CATHODE  
 3. ANODE

STYLE 5:  
 PIN 1. DRAIN  
 2. SOURCE  
 3. GATE

STYLE 6:  
 PIN 1. GATE  
 2. SOURCE & SUBSTRATE  
 3. DRAIN

STYLE 7:  
 PIN 1. SOURCE  
 2. DRAIN  
 3. GATE

STYLE 8:  
 PIN 1. DRAIN  
 2. GATE  
 3. SOURCE & SUBSTRATE

STYLE 9:  
 PIN 1. BASE 1  
 2. EMITTER  
 3. BASE 2

STYLE 10:  
 PIN 1. CATHODE  
 2. GATE  
 3. ANODE

STYLE 11:  
 PIN 1. ANODE  
 2. CATHODE & ANODE  
 3. CATHODE

STYLE 12:  
 PIN 1. MAIN TERMINAL 1  
 2. GATE  
 3. MAIN TERMINAL 2

STYLE 13:  
 PIN 1. ANODE 1  
 2. GATE  
 3. CATHODE 2

STYLE 14:  
 PIN 1. EMITTER  
 2. COLLECTOR  
 3. BASE

STYLE 15:  
 PIN 1. ANODE 1  
 2. CATHODE  
 3. ANODE 2

STYLE 16:  
 PIN 1. ANODE  
 2. GATE  
 3. CATHODE

STYLE 17:  
 PIN 1. COLLECTOR  
 2. BASE  
 3. EMITTER

STYLE 18:  
 PIN 1. ANODE  
 2. CATHODE  
 3. NOT CONNECTED

STYLE 19:  
 PIN 1. GATE  
 2. ANODE  
 3. CATHODE

STYLE 20:  
 PIN 1. NOT CONNECTED  
 2. CATHODE  
 3. ANODE

STYLE 21:  
 PIN 1. COLLECTOR  
 2. EMITTER  
 3. BASE

STYLE 22:  
 PIN 1. SOURCE  
 2. GATE  
 3. DRAIN

STYLE 23:  
 PIN 1. GATE  
 2. SOURCE  
 3. DRAIN

STYLE 24:  
 PIN 1. EMITTER  
 2. COLLECTOR/ANODE  
 3. CATHODE

STYLE 25:  
 PIN 1. MT 1  
 2. GATE  
 3. MT 2

STYLE 26:  
 PIN 1. V<sub>CC</sub>  
 2. GROUND 2  
 3. OUTPUT

STYLE 27:  
 PIN 1. MT  
 2. SUBSTRATE  
 3. MT

STYLE 28:  
 PIN 1. CATHODE  
 2. ANODE  
 3. GATE

STYLE 29:  
 PIN 1. NOT CONNECTED  
 2. ANODE  
 3. CATHODE

STYLE 30:  
 PIN 1. DRAIN  
 2. GATE  
 3. SOURCE

STYLE 31:  
 PIN 1. GATE  
 2. DRAIN  
 3. SOURCE

STYLE 32:  
 PIN 1. BASE  
 2. COLLECTOR  
 3. EMITTER

STYLE 33:  
 PIN 1. RETURN  
 2. INPUT  
 3. OUTPUT

STYLE 34:  
 PIN 1. INPUT  
 2. GROUND  
 3. LOGIC

STYLE 35:  
 PIN 1. GATE  
 2. COLLECTOR  
 3. EMITTER

|                         |                                  |  |
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| <b>NEW STANDARD:</b>    |                                  |  |
| <b>DESCRIPTION:</b>     | <b>TO-92 (TO-226)</b>            | <b>PAGE 2 OF 3</b>   |



| ISSUE | REVISION  | DATE        |
|-------|---|-------------|
| AM    | ADDED BENT-LEAD TAPE & REEL VERSION. REQ. BY J. SUPINA. | 09 MAR 2007 |
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