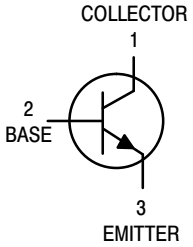
# Amplifier Transistors

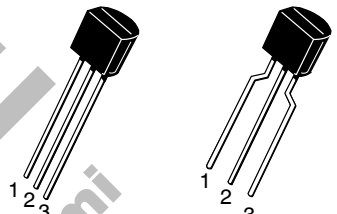
## NPN Silicon

# BC546B, BC547A, B, C, BC548B, C




### Features

- Pb−Free Packages are Available*




### MAXIMUM RATINGS

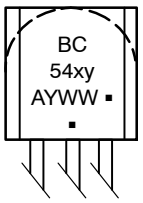
| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector - Emitter Voltage<br>BC546<br>BC547<br>BC548 | $V_{CEO}$ | <br>65<br>45<br>30 | Vdc |
| Collector - Base Voltage<br>BC546<br>BC547<br>BC548 | $V_{CBO}$ | <br>80<br>50<br>30 | Vdc |
| Emitter - Base Voltage | $V_{EBO}$ | 6.0 | Vdc |
| Collector Current − Continuous | $I_C$ | 100 | mAdc |
| Total Device Dissipation @ $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 625<br>5.0 | mW<br>mW/°C |
| Total Device Dissipation @ $T_C$ = 25°C<br>Derate above 25°C | $P_D$ | 1.5<br>12 | W<br>mW/°C |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{stg}$ | −55 to +150 | °C |

### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction−to−Ambient | $R_{\theta JA}$ | 200 | °C/W |
| Thermal Resistance, Junction−to−Case | $R_{\theta JC}$ | 83.3 | °C/W |

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.

### MARKING DIAGRAM




x = 6, 7, or 8
y = A, B or C
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 5 of this data sheet.



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

**ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C unless otherwise noted)

| Characteristic | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Collector – Emitter Breakdown Voltage | | $V_{(BR)CEO}$ | | | | V |
| ($I_C$ = 1.0 mA, $I_B$ = 0) | BC546 | | 65 | – | – | |
| | BC547 | | 45 | – | – | |
| | BC548 | | 30 | – | – | |
| Collector – Base Breakdown Voltage | | $V_{(BR)CBO}$ | | | | V |
| ($I_C$ = 100 μAdc) | BC546 | | 80 | – | – | |
| | BC547 | | 50 | – | – | |
| | BC548 | | 30 | – | – | |
| Emitter – Base Breakdown Voltage | | $V_{(BR)EBO}$ | | | | V |
| ($I_E$ = 10 μA, $I_C$ = 0) | BC546 | | 6.0 | – | – | |
| | BC547 | | 6.0 | – | – | |
| | BC548 | | 6.0 | – | – | |
| Collector Cutoff Current | | $I_{CES}$ | | | | |
| ($V_{CE}$ = 70 V, $V_{BE}$ = 0) | BC546 | | – | 0.2 | 15 | nA |
| ($V_{CE}$ = 50 V, $V_{BE}$ = 0) | BC547 | | – | 0.2 | 15 | |
| ($V_{CE}$ = 35 V, $V_{BE}$ = 0) | BC548 | | – | 0.2 | 15 | |
| ($V_{CE}$ = 30 V, $T_A$ = 125°C) | BC546/547/548 | | – | – | 4.0 | μA |
| **ON CHARACTERISTICS** | | | | | | |
| DC Current Gain | | $h_{FE}$ | | | | – |
| ($I_C$ = 10 μA, $V_{CE}$ = 5.0 V) | BC547A | | – | 90 | – | |
| | BC546B/547B/548B | | – | 150 | – | |
| | BC548C | | – | 270 | – | |
| ($I_C$ = 2.0 mA, $V_{CE}$ = 5.0 V) | BC546 | | 110 | – | 450 | |
| | BC547 | | 110 | – | 800 | |
| | BC548 | | 110 | – | 800 | |
| | BC547A | | 110 | 180 | 220 | |
| | BC546B/547B/548B | | 200 | 290 | 450 | |
| | BC547C/BC548C | | 420 | 520 | 800 | |
| ($I_C$ = 100 mA, $V_{CE}$ = 5.0 V) | BC547A/548A | | – | 120 | – | |
| | BC546B/547B/548B | | – | 180 | – | |
| | BC548C | | – | 300 | – | |
| Collector – Emitter Saturation Voltage | | $V_{CE(sat)}$ | | | | V |
| ($I_C$ = 10 mA, $I_B$ = 0.5 mA) | | | – | 0.09 | 0.25 | |
| ($I_C$ = 100 mA, $I_B$ = 5.0 mA) | | | – | 0.2 | 0.6 | |
| ($I_C$ = 10 mA, $I_B$ = See Note 1) | | | – | 0.3 | 0.6 | |
| Base – Emitter Saturation Voltage | | $V_{BE(sat)}$ | – | 0.7 | – | V |
| ($I_C$ = 10 mA, $I_B$ = 0.5 mA) | | | | | | |
| Base – Emitter On Voltage | | $V_{BE(on)}$ | | | | V |
| ($I_C$ = 2.0 mA, $V_{CE}$ = 5.0 V) | | | 0.55 | – | 0.7 | |
| ($I_C$ = 10 mA, $V_{CE}$ = 5.0 V) | | | – | – | 0.77 | |
| **SMALL–SIGNAL CHARACTERISTICS** | | | | | | |
| Current – Gain – Bandwidth Product | | $f_T$ | | | | MHz |
| ($I_C$ = 10 mA, $V_{CE}$ = 5.0 V, f = 100 MHz) | BC546 | | 150 | 300 | – | |
| | BC547 | | 150 | 300 | – | |
| | BC548 | | 150 | 300 | – | |
| Output Capacitance | | $C_{obo}$ | – | 1.7 | 4.5 | pF |
| ($V_{CB}$ = 10 V, $I_C$ = 0, f = 1.0 MHz) | | | | | | |
| Input Capacitance | | $C_{ibo}$ | – | 10 | – | pF |
| ($V_{EB}$ = 0.5 V, $I_C$ = 0, f = 1.0 MHz) | | | | | | |
| Small – Signal Current Gain | | $h_{fe}$ | | | | – |
| ($I_C$ = 2.0 mA, $V_{CE}$ = 5.0 V, f = 1.0 kHz) | BC546 | | 125 | – | 500 | |
| | BC547/548 | | 125 | – | 900 | |
| | BC547A | | 125 | 220 | 260 | |
| | BC546B/547B/548B | | 240 | 330 | 500 | |
| | BC547C/548C | | 450 | 600 | 900 | |
| Noise Figure ($I_C$ = 0.2 mA, $V_{CE}$ = 5.0 V, $R_S$ = 2 kΩ, f = 1.0 kHz, Δf = 200 Hz) | | NF | | | | dB |
| | BC546 | | – | 2.0 | 10 | |
| | BC547 | | – | 2.0 | 10 | |
| | BC548 | | – | 2.0 | 10 | |

1. $I_B$ is value for which $I_C$ = 11 mA at $V_{CE}$ = 1.0 V.

## BC547/BC548

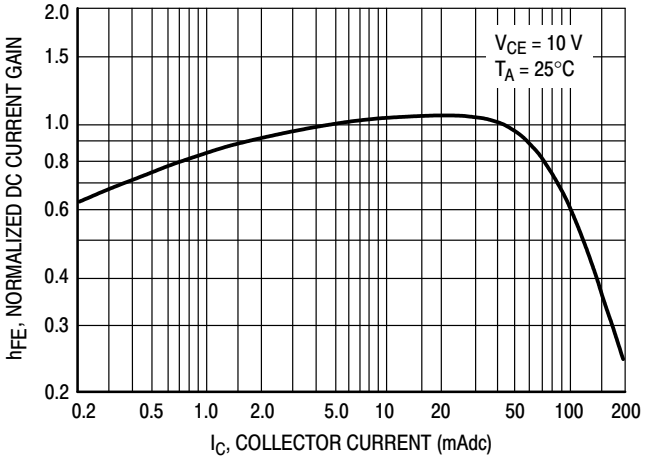



**Figure 1. Normalized DC Current Gain**

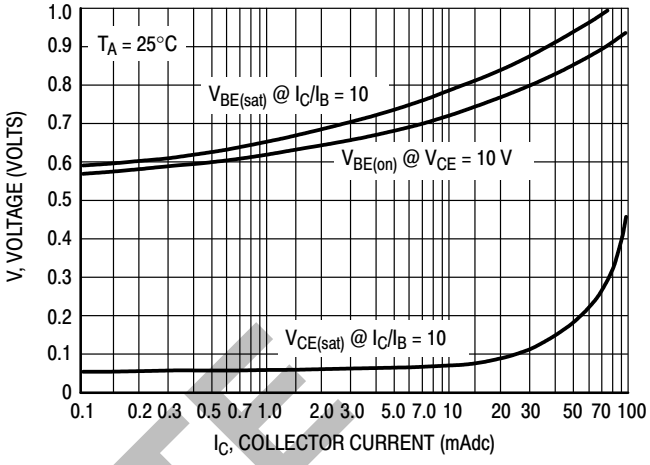



**Figure 2. "Saturation" and "On" Voltages**

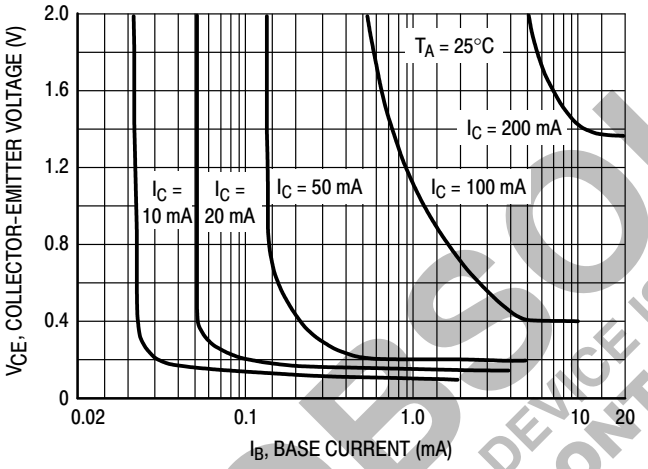



**Figure 3. Collector Saturation Region**

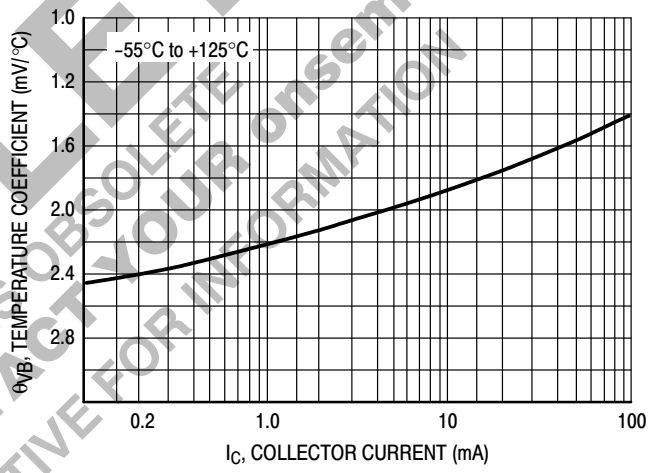



**Figure 4. Base−Emitter Temperature Coefficient**

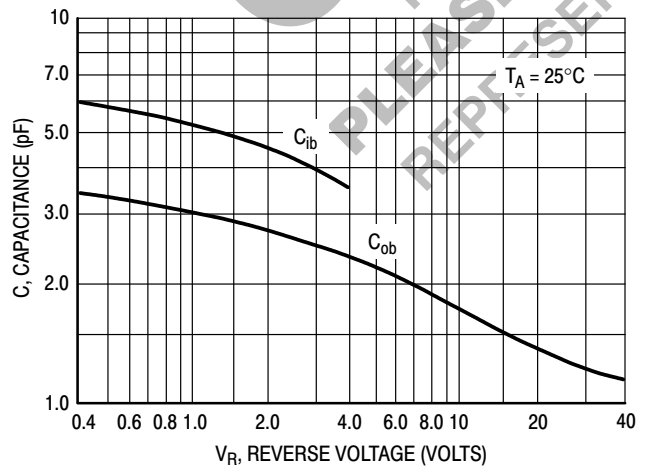



**Figure 5. Capacitances**

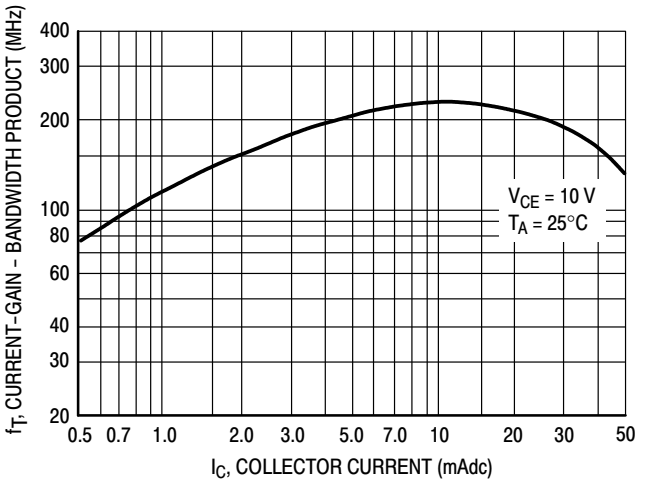



**Figure 6. Current−Gain − Bandwidth Product**

## BC546

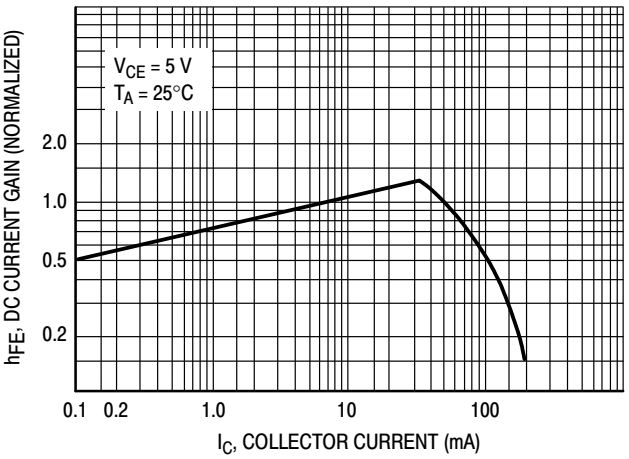



**Figure 7. DC Current Gain**

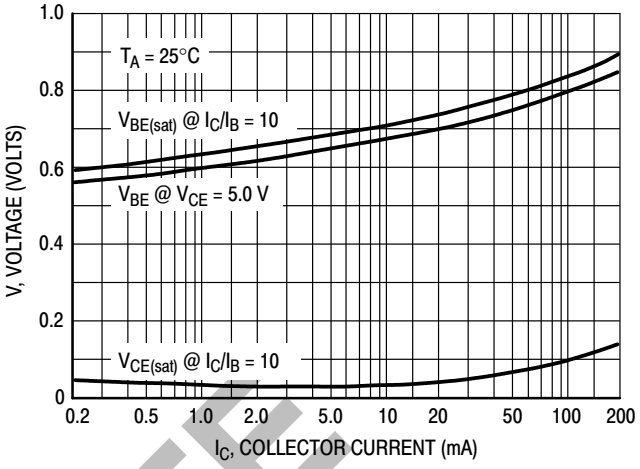



**Figure 8. "On" Voltage**

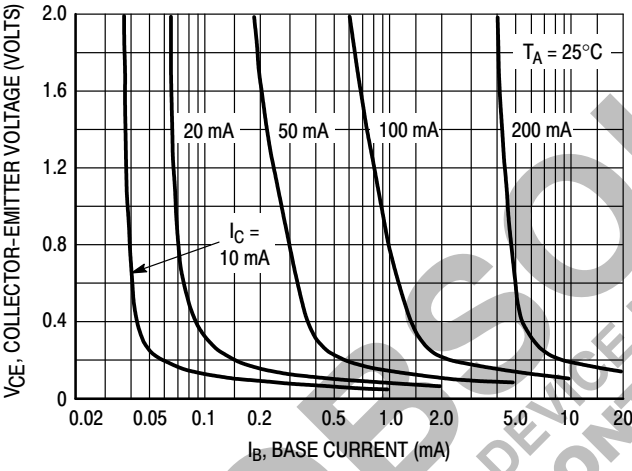



**Figure 9. Collector Saturation Region**

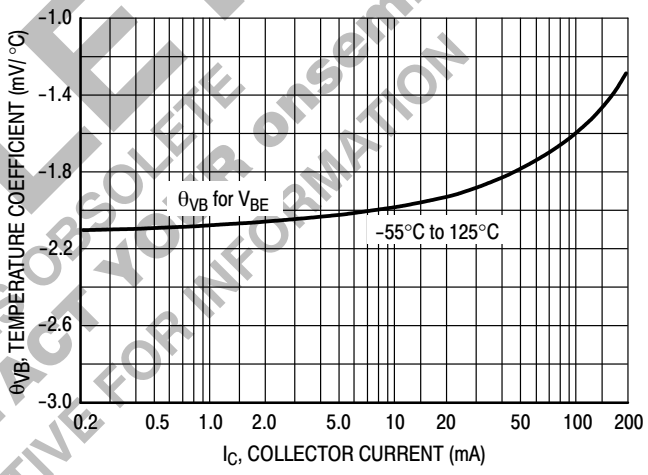



**Figure 10. Base−Emitter Temperature Coefficient**

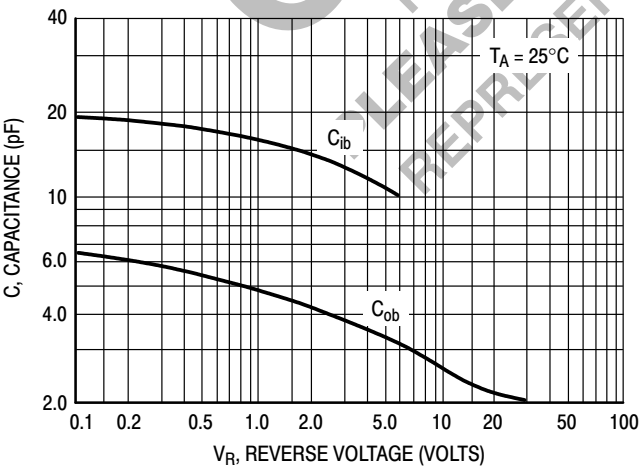



**Figure 11. Capacitance**

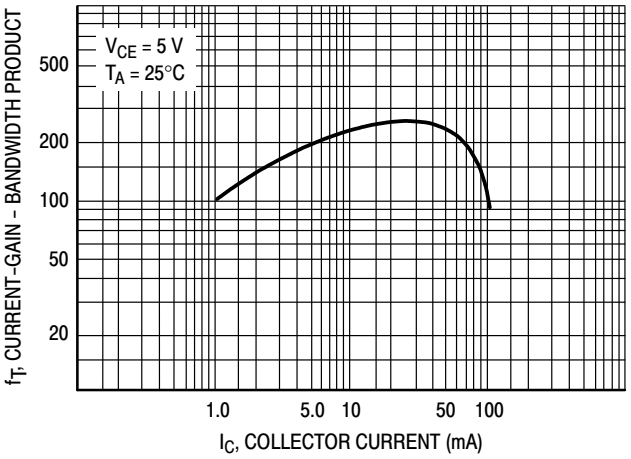



**Figure 12. Current−Gain − Bandwidth Product**

## ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| BC546B | TO−92 | 5000 Units / Bulk |
| BC546BG | TO−92 (Pb−Free) | 5000 Units / Bulk |
| BC546BRL1 | TO−92 | 2000 / Tape & Reel |
| BC546BRL1G | TO−92 (Pb−Free) | 2000 / Tape & Reel |
| BC546BZL1G | TO−92 (Pb−Free) | 2000 / Ammo Box |
| BC547ARL | TO−92 | 2000 / Tape & Reel |
| BC547ARLG | TO−92 (Pb−Free) | 2000 / Tape & Reel |
| BC547AZL1G | TO−92 (Pb−Free) | 2000 / Ammo Box |
| BC547BG | TO−92 (Pb−Free) | 5000 Units / Bulk |
| BC547BRL1G | TO−92 (Pb−Free) | 2000 / Tape & Reel |
| BC547BZL1G | TO−92 (Pb−Free) | 2000 / Ammo Box |
| BC547CG | TO−92 (Pb−Free) | 5000 Units / Bulk |
| BC547CZL1G | TO−92 (Pb−Free) | 2000 / Ammo Box |
| BC548BG | TO−92 (Pb−Free) | 5000 Units / Bulk |
| BC548BRL1G | TO−92 (Pb−Free) | 2000 / Tape & Reel |
| BC548BZL1G | TO−92 (Pb−Free) | 2000 / Ammo Box |
| BC548CG | TO−92 (Pb−Free) | 5000 Units / Bulk |
| BC548CZL1G | TO−92 (Pb−Free) | 2000 / Ammo Box |

†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.

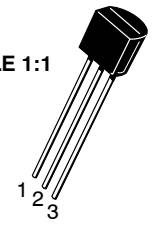
# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

ON Semiconductor®

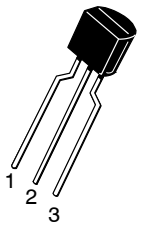
**TO−92 (TO−226)**
CASE 29−11
ISSUE AM

DATE 09 MAR 2007

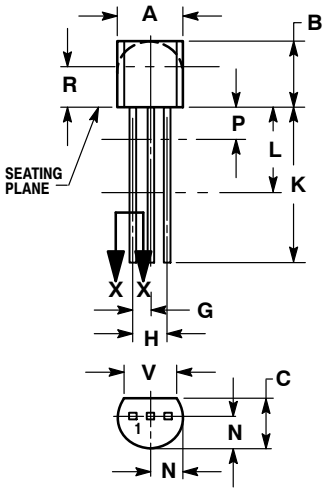
SCALE 1:1



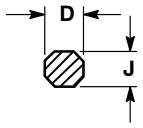

STRAIGHT LEAD
BULK PACK




BENT LEAD
TAPE & REEL
AMMO PACK



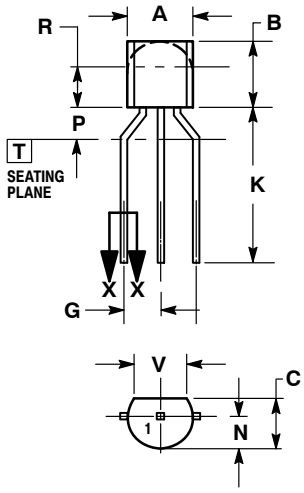

STRAIGHT LEAD
BULK PACK



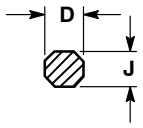

**SECTION X−X**

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.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | 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.

| | MILLIMETERS | |
|---|---|---|
| DIM | 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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| **STATUS:** | **ON SEMICONDUCTOR STANDARD** | |
| **NEW STANDARD:** | | |
| **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. $V_{CC}$
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

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

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