

# BDX33B, BDX33C\* (NPN) BDX34B, BDX34C\* (PNP)

BDX33C and BDX34C are Preferred Devices

## Darlington Complementary Silicon Power Transistors

These devices are designed for general purpose and low speed switching applications.

### Features

- High DC Current Gain –  $h_{FE} = 2500$  (typ.) at  $I_C = 4.0$
- Collector–Emitter Sustaining Voltage at 100 mAdc  
 $V_{CE(sus)} = 80$  Vdc (min) – BDX33B, BDX334B  
 $= 100$  Vdc (min) – BDX33C, BDX334C
- Low Collector–Emitter Saturation Voltage  
 $V_{CE(sat)} = 2.5$  Vdc (max) at  $I_C = 3.0$  Adc  
– BDX33B, 33C/34B, 34C
- Monolithic Construction with Build–In Base–Emitter Shunt Resistors
- Pb–Free Packages are Available\*

### MAXIMUM RATINGS

| Rating                                                                                 | Symbol         | Value       | Unit                     |
|----------------------------------------------------------------------------------------|----------------|-------------|--------------------------|
| Collector–Emitter Voltage<br>BDX33B, BDX34B<br>BDX33C, BDX34C                          | $V_{CEO}$      | 80<br>100   | Vdc                      |
| Collector–Base Voltage<br>BDX33B, BDX34B<br>BDX33C, BDX34C                             | $V_{CB}$       | 80<br>100   | Vdc                      |
| Emitter–Base Voltage                                                                   | $V_{EB}$       | 5.0         | Vdc                      |
| Collector Current – Continuous<br>– Peak                                               | $I_C$          | 10<br>15    | A                        |
| Base Current                                                                           | $I_B$          | 0.25        | A                        |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 70<br>0.56  | W<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                    | $T_J, T_{stg}$ | –65 to +150 | $^\circ\text{C}$         |

### THERMAL CHARACTERISTICS

| Characteristics                      | Symbol          | Max  | Unit               |
|--------------------------------------|-----------------|------|--------------------|
| Thermal Resistance, Junction–to–Case | $R_{\theta JC}$ | 1.78 | $^\circ\text{C/W}$ |

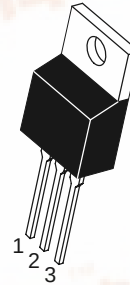
Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.



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**DARLINGTON  
10 AMPERE  
COMPLEMENTARY SILICON  
POWER TRANSISTORS  
80–100 VOLTS, 65 WATTS**



TO-220AB  
CASE 221A-09  
STYLE 1

### MARKING DIAGRAM



BDX3xy = Device Code  
x = 3 or 4  
y = B or C  
A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb–Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

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

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



## BDX33B, BDX33C\* (NPN) BDX34B, BDX34C\* (PNP)

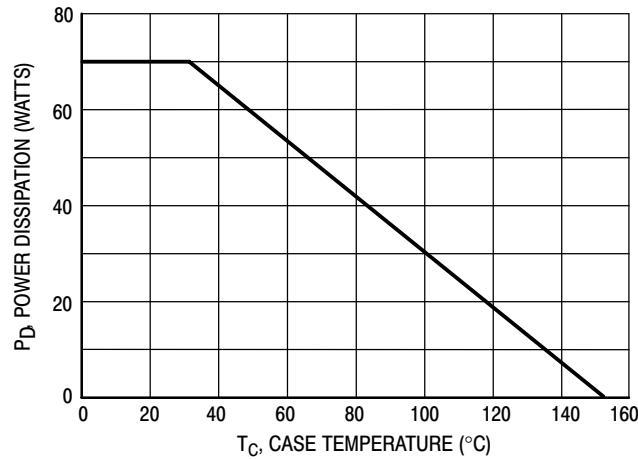


Figure 1. Power Derating

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

| Characteristic                                                                                                                                        |                                                 | Symbol                | Min       | Max        | Unit             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|-----------------------|-----------|------------|------------------|
| OFF CHARACTERISTICS                                                                                                                                   |                                                 |                       |           |            |                  |
| Collector-Emitter Sustaining Voltage (Note 1)<br>(I <sub>C</sub> = 100 mA <sub>dc</sub> , I <sub>B</sub> = 0)                                         | BDX33B/BDX34B<br>BDX33C/BDX34C                  | V <sub>CEO(sus)</sub> | 80<br>100 | –<br>–     | V <sub>dc</sub>  |
| Collector-Emitter Sustaining Voltage (Note 1)<br>(I <sub>C</sub> = 100 mA <sub>dc</sub> , I <sub>B</sub> = 0, R <sub>BE</sub> = 100)                  | BDX33B/BDX34B<br>BDX33C/BDX33C                  | V <sub>CER(sus)</sub> | 80<br>100 | –<br>–     | V <sub>dc</sub>  |
| Collector-Emitter Sustaining Voltage (Note 1)<br>(I <sub>C</sub> = 100 mA <sub>dc</sub> , I <sub>B</sub> = 0, V <sub>BE</sub> = 1.5 V <sub>dc</sub> ) | BDX33B/BDX34B<br>BDX33C/BDX34C                  | V <sub>CEX(sus)</sub> | 80<br>100 | –<br>–     | V <sub>dc</sub>  |
| Collector Cutoff Current<br>(V <sub>CE</sub> = 1/2 rated V <sub>CEO</sub> , I <sub>B</sub> = 0)                                                       | T <sub>C</sub> = 25°C<br>T <sub>C</sub> = 100°C | I <sub>CEO</sub>      | –<br>–    | 0.5<br>10  | mA <sub>dc</sub> |
| Collector Cutoff Current<br>(V <sub>CB</sub> = rated V <sub>CBO</sub> , I <sub>E</sub> = 0)                                                           | T <sub>C</sub> = 25°C<br>T <sub>C</sub> = 100°C | I <sub>CBO</sub>      | –<br>–    | 1.0<br>5.0 | mA <sub>dc</sub> |
| Emitter Cutoff Current<br>(V <sub>BE</sub> = 5.0 V <sub>dc</sub> , I <sub>C</sub> = 0)                                                                |                                                 | I <sub>EBO</sub>      | –         | 10         | mA <sub>dc</sub> |
| ON CHARACTERISTICS                                                                                                                                    |                                                 |                       |           |            |                  |
| DC Current Gain (Note 1)<br>(I <sub>C</sub> = 3.0 A <sub>dc</sub> , V <sub>CE</sub> = 3.0 V <sub>dc</sub> )                                           | BDX33B, 33C/34B, 34C                            | h <sub>FE</sub>       | 750       | –          | –                |
| Collector-Emitter Saturation Voltage<br>(I <sub>C</sub> = 3.0 A <sub>dc</sub> , I <sub>B</sub> = 6.0 mA <sub>dc</sub> )                               | BDX33B, 33C/34B, 34C                            | V <sub>CE(sat)</sub>  | –         | 2.5        | V <sub>dc</sub>  |
| Base-Emitter On Voltage<br>(I <sub>C</sub> = 3.0 A <sub>dc</sub> , V <sub>CE</sub> = 3.0 V <sub>dc</sub> )                                            | BDX33B, 33C/34B, 34C                            | V <sub>BE(on)</sub>   | –         | 2.5        | V <sub>dc</sub>  |
| Diode Forward Voltage<br>(I <sub>C</sub> = 8.0 A <sub>dc</sub> )                                                                                      |                                                 | V <sub>F</sub>        | –         | 4.0        | V <sub>dc</sub>  |

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.
2. Pulse Test non repetitive: Pulse Width = 0.25 seconds.

## BDX33B, BDX33C\* (NPN) BDX34B, BDX34C\* (PNP)

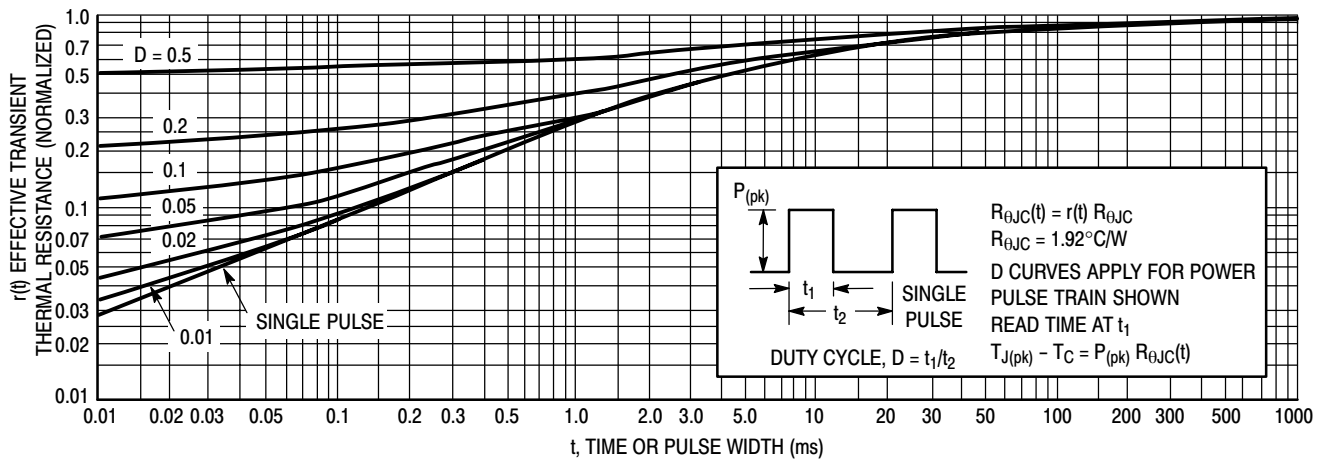


Figure 1. Thermal Response

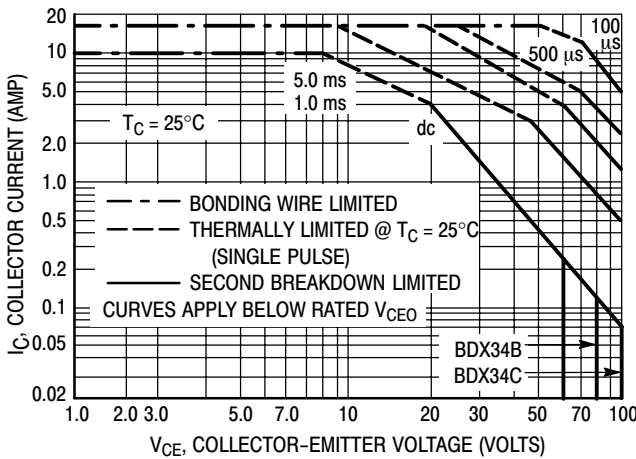
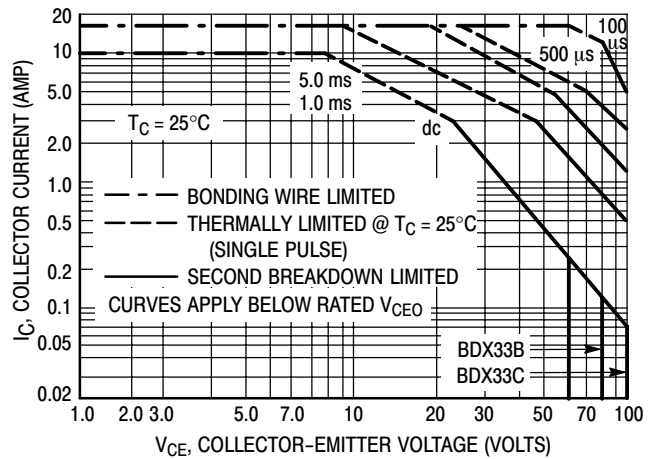


Figure 2. Active-Region Safe Operating Area



There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  limits of the transistor that must be observed for reliable operation, i.e., the transistor must not be subjected to greater dissipation than the curves indicate. The data of Figure 3 is based on  $T_{J(pk)}$

$= 150^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} = 150^\circ\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

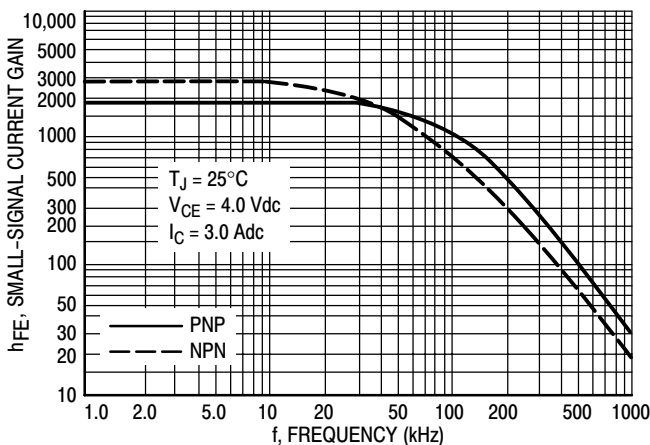


Figure 3. Small-Signal Current Gain

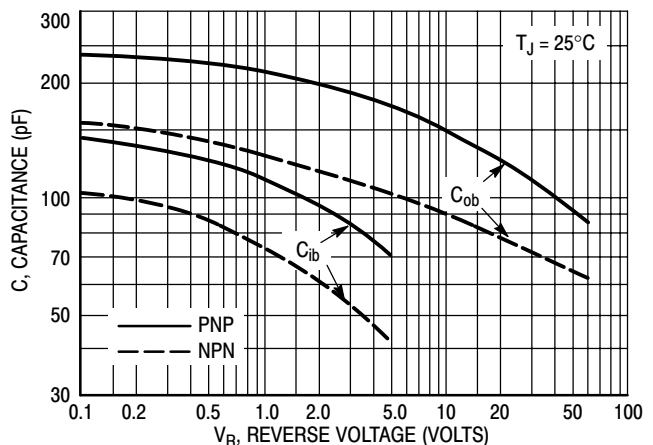
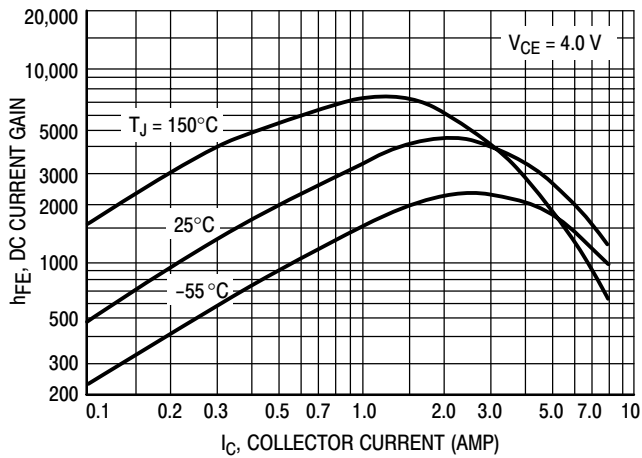


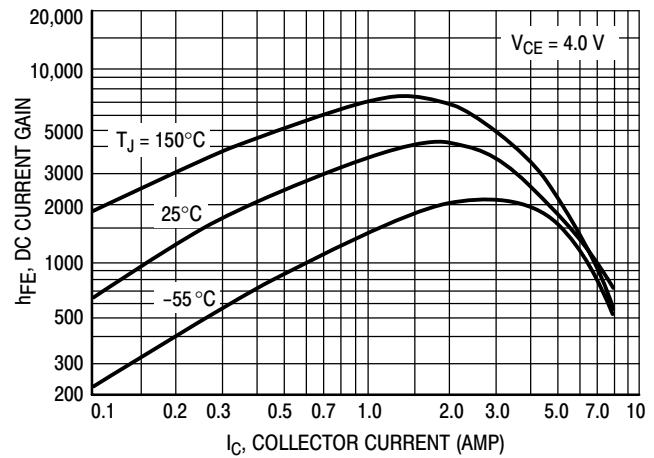
Figure 4. Capacitance

## BDX33B, BDX33C\* (NPN) BDX34B, BDX34C\* (PNP)

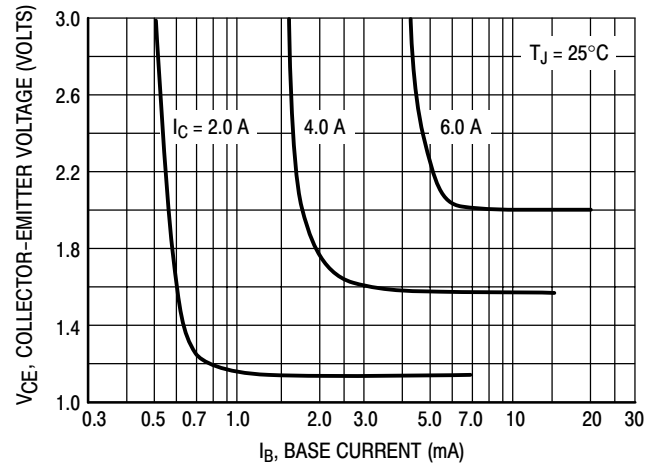
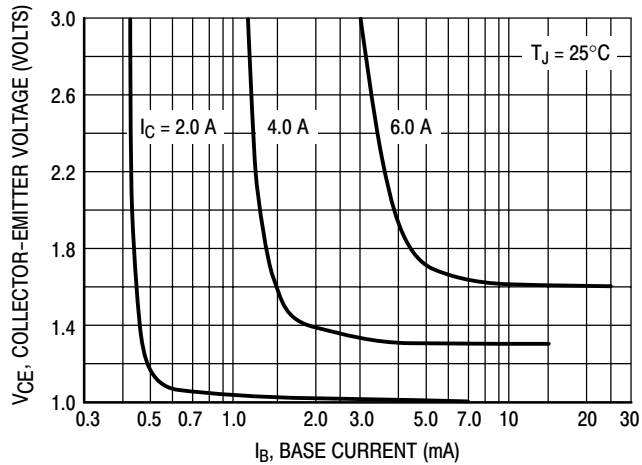
**NPN**  
**BDX33B, 33C**



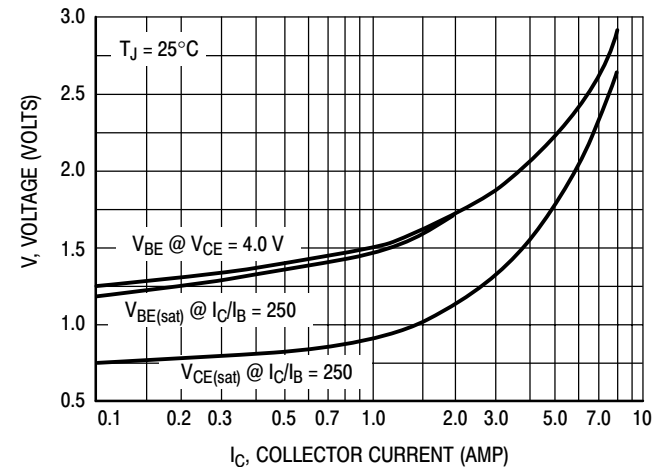
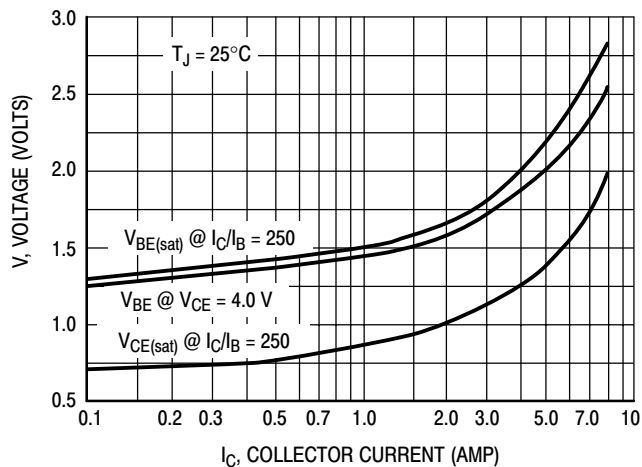
**PNP**  
**BDX34B, 34C**



**Figure 5. DC Current Gain**



**Figure 6. Collector Saturation Region**



**Figure 7. "On" Voltages**

## BDX33B, BDX33C\* (NPN) BDX34B, BDX34C\* (PNP)

### ORDERING INFORMATION

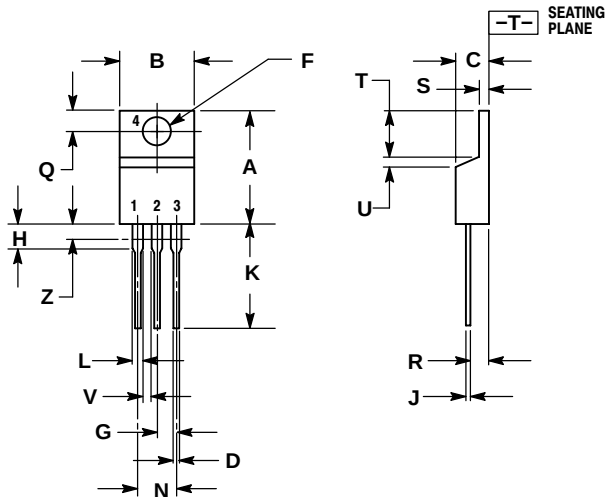
| Device  | Package             | Shipping <sup>†</sup> |
|---------|---------------------|-----------------------|
| BDX33B  | TO-220              | 50 Units / Rail       |
| BDX33BG | TO-220<br>(Pb-Free) |                       |
| BDX33C  | TO-220              | 50 Units / Rail       |
| BDX33CG | TO-220<br>(Pb-Free) |                       |
| BDX34B  | TO-220              | 50 Units / Rail       |
| BDX34BG | TO-220<br>(Pb-Free) |                       |
| BDX34C  | TO-220              | 50 Units / Rail       |
| BDX34CG | TO-220<br>(Pb-Free) |                       |

<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.

# BDX33B, BDX33C\* (NPN) BDX34B, BDX34C\* (PNP)

## PACKAGE DIMENSIONS

TO-220AB  
CASE 221A-09  
ISSUE AA



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.570  | 0.620 | 14.48       | 15.75 |
| B   | 0.380  | 0.405 | 9.66        | 10.28 |
| C   | 0.160  | 0.190 | 4.07        | 4.82  |
| D   | 0.025  | 0.035 | 0.64        | 0.88  |
| F   | 0.142  | 0.147 | 3.61        | 3.73  |
| G   | 0.095  | 0.105 | 2.42        | 2.66  |
| H   | 0.110  | 0.155 | 2.80        | 3.93  |
| J   | 0.018  | 0.025 | 0.46        | 0.64  |
| K   | 0.500  | 0.562 | 12.70       | 14.27 |
| L   | 0.045  | 0.060 | 1.15        | 1.52  |
| N   | 0.190  | 0.210 | 4.83        | 5.33  |
| Q   | 0.100  | 0.120 | 2.54        | 3.04  |
| R   | 0.080  | 0.110 | 2.04        | 2.79  |
| S   | 0.045  | 0.055 | 1.15        | 1.39  |
| T   | 0.235  | 0.255 | 5.97        | 6.47  |
| U   | 0.000  | 0.050 | 0.00        | 1.27  |
| V   | 0.045  | ---   | 1.15        | ---   |
| Z   | ---    | 0.080 | ---         | 2.04  |

### STYLE 1:

- PIN 1. BASE  
2. COLLECTOR  
3. EMITTER  
4. COLLECTOR

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