

# MJE15028, MJE15030 (NPN) MJE15029, MJE15031 (PNP)

## Complementary Silicon Plastic Power Transistors

These devices are designed for use as high-frequency drivers in audio amplifiers.

### Features

- DC Current Gain Specified to 4.0 A  
 $h_{FE} = 40 \text{ (Min) @ } I_C = 3.0 \text{ Adc}$   
 $= 20 \text{ (Min) @ } I_C = 4.0 \text{ Adc}$
- Collector-Emitter Sustaining Voltage –  
 $V_{CEO(sus)} = 120 \text{ Vdc (Min); MJE15028, MJE15029}$   
 $= 150 \text{ Vdc (Min); MJE15030, MJE15031}$
- High Current Gain – Bandwidth Product  
 $f_T = 30 \text{ MHz (Min) @ } I_C = 500 \text{ mAdc}$
- TO-220AB Compact Package
- Pb-Free Packages are Available\*

### MAXIMUM RATINGS

| Rating                                                                                 | Symbol            | Value          | Unit                     |
|----------------------------------------------------------------------------------------|-------------------|----------------|--------------------------|
| Collector-Emitter Voltage<br>MJE15028, MJE15029<br>MJE15030, MJE15031                  | $V_{CEO}$         | 120<br>150     | Vdc                      |
| Collector-Base Voltage<br>MJE15028, MJE15029<br>MJE15030, MJE15031                     | $V_{CB}$          | 120<br>150     | Vdc                      |
| Emitter-Base Voltage                                                                   | $V_{EB}$          | 5.0            | Vdc                      |
| Collector Current – Continuous<br>– Peak                                               | $I_C$<br>$I_{CM}$ | 8.0<br>16      | Adc                      |
| Base Current                                                                           | $I_B$             | 2.0            | Adc                      |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$             | 50<br>0.40     | W<br>W/ $^\circ\text{C}$ |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$             | 2.0<br>0.016   | W<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                    | $T_J, T_{stg}$    | -65 to<br>+150 | $^\circ\text{C}$         |

### THERMAL CHARACTERISTICS

| Characteristics                         | Symbol          | Max  | Unit               |
|-----------------------------------------|-----------------|------|--------------------|
| Thermal Resistance, Junction-to-Case    | $R_{\theta JC}$ | 2.5  | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 62.5 | $^\circ\text{C/W}$ |

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.

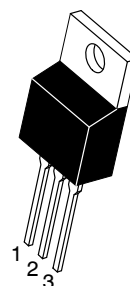
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



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## 8 AMPERE POWER TRANSISTORS COMPLEMENTARY SILICON 120-150 VOLTS, 50 WATTS



TO-220AB  
CASE 221A-09  
STYLE 1

### MARKING DIAGRAM



MJE150xx = Device Code  
 x = 28, 29, 30, or 31  
 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.

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

| Characteristic                                                                                                                                                                                                                                          | Symbol         | Min                  | Max              | Unit            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------|------------------|-----------------|
| <b>OFF CHARACTERISTICS</b>                                                                                                                                                                                                                              |                |                      |                  |                 |
| Collector-Emitter Sustaining Voltage (Note 1)<br>( $I_C = 10\text{ mAdc}$ , $I_B = 0$ )                                                                                                                                                                 | $V_{CEO(sus)}$ | 120<br>150           | –<br>–           | Vdc             |
| Collector Cutoff Current<br>( $V_{CE} = 120\text{ Vdc}$ , $I_B = 0$ )<br>( $V_{CE} = 150\text{ Vdc}$ , $I_B = 0$ )                                                                                                                                      | $I_{CEO}$      | –<br>–               | 0.1<br>0.1       | mAdc            |
| Collector Cutoff Current<br>( $V_{CB} = 120\text{ Vdc}$ , $I_E = 0$ )<br>( $V_{CB} = 150\text{ Vdc}$ , $I_E = 0$ )                                                                                                                                      | $I_{CBO}$      | –<br>–               | 10<br>10         | $\mu\text{Adc}$ |
| Emitter Cutoff Current<br>( $V_{BE} = 5.0\text{ Vdc}$ , $I_C = 0$ )                                                                                                                                                                                     | $I_{EBO}$      | –                    | 10               | $\mu\text{Adc}$ |
| <b>ON CHARACTERISTICS (Note 1)</b>                                                                                                                                                                                                                      |                |                      |                  |                 |
| DC Current Gain<br>( $I_C = 0.1\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ )<br>( $I_C = 2.0\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ )<br>( $I_C = 3.0\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ )<br>( $I_C = 4.0\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ ) | $h_{FE}$       | 40<br>40<br>40<br>20 | –<br>–<br>–<br>– | –               |
| DC Current Gain Linearity<br>( $V_{CE}$ From 2.0 V to 20 V, $I_C$ From 0.1 A to 3 A)<br>(NPN to PNP)                                                                                                                                                    | $h_{FE}$       | Typ<br>2<br>3        |                  |                 |
| Collector-Emitter Saturation Voltage<br>( $I_C = 1.0\text{ Adc}$ , $I_B = 0.1\text{ Adc}$ )                                                                                                                                                             | $V_{CE(sat)}$  | –                    | 0.5              | Vdc             |
| Base-Emitter On Voltage<br>( $I_C = 1.0\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ )                                                                                                                                                                       | $V_{BE(on)}$   | –                    | 1.0              | Vdc             |
| <b>DYNAMIC CHARACTERISTICS</b>                                                                                                                                                                                                                          |                |                      |                  |                 |
| Current Gain – Bandwidth Product (Note 2)<br>( $I_C = 500\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f_{test} = 10\text{ MHz}$ )                                                                                                                        | $f_T$          | 30                   | –                | MHz             |

1. Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .
2.  $f_T = |h_{fe}| \cdot f_{test}$ .

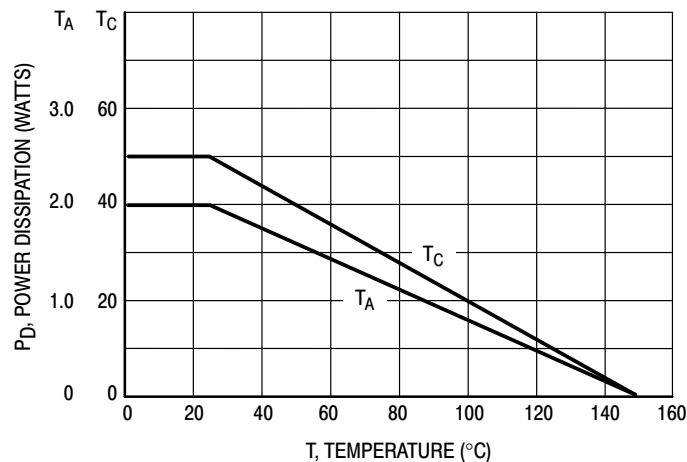


Figure 1. Power Derating

# MJE15028, MJE15030 (NPN) MJE15029, MJE15031 (PNP)

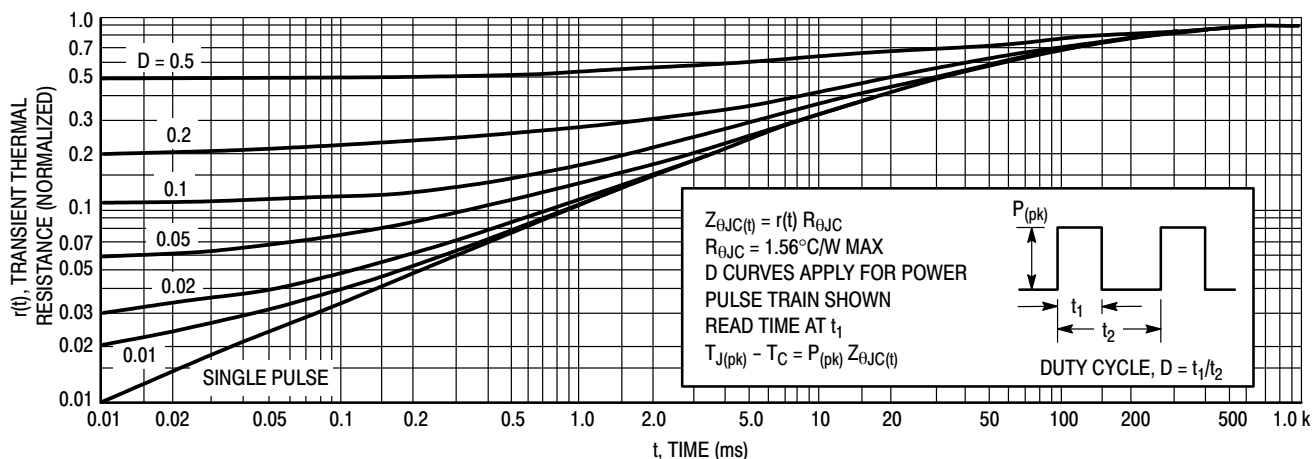


Figure 2. Thermal Response

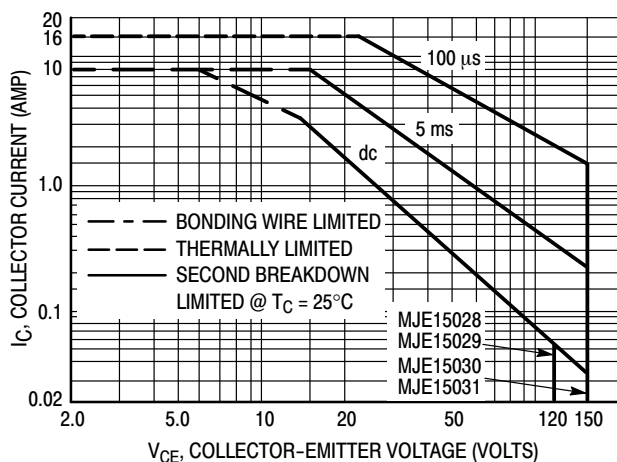


Figure 3. Forward Bias Safe Operating Area

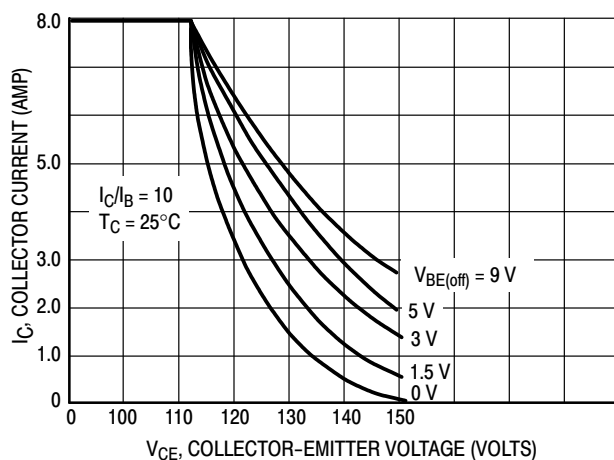


Figure 4. Reverse-Bias Switching Safe Operating Area

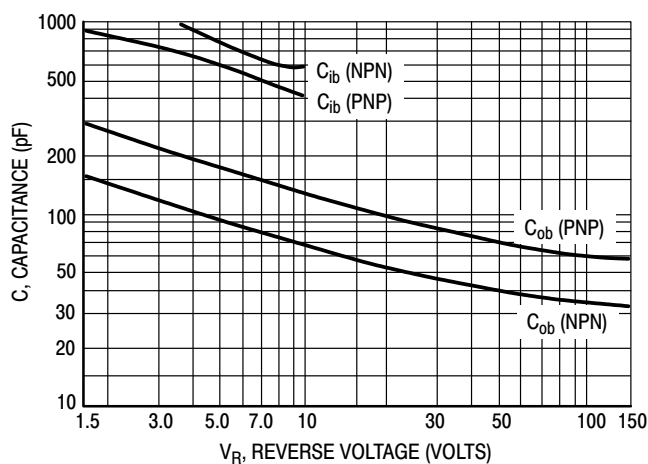


Figure 5. Capacitances

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 Figures 3 and 4 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 2. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

# MJE15028, MJE15030 (NPN) MJE15029, MJE15031 (PNP)

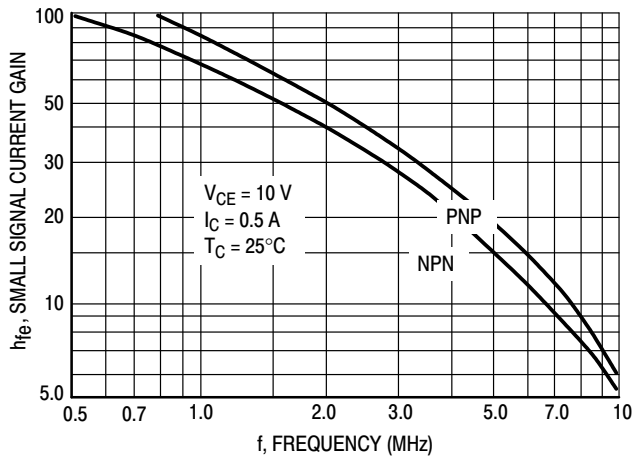


Figure 6. Small-Signal Current Gain

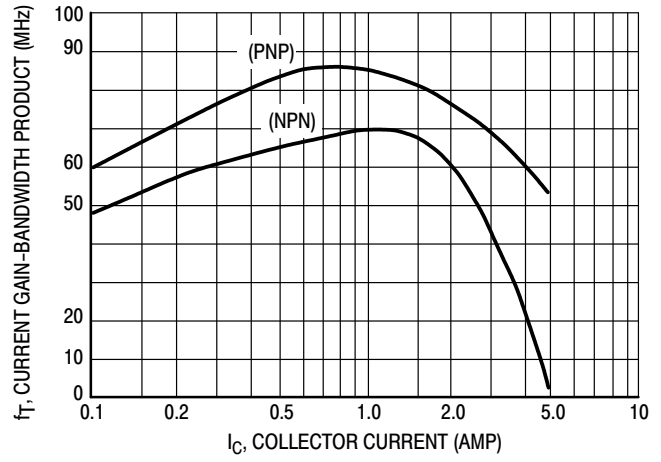
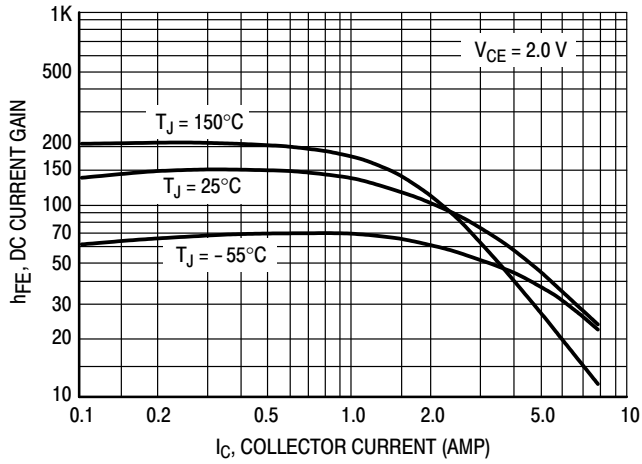


Figure 7. Current Gain-Bandwidth Product

## NPN — MJE15028 MJE15030



## PNP — MJE15029 MJE15031

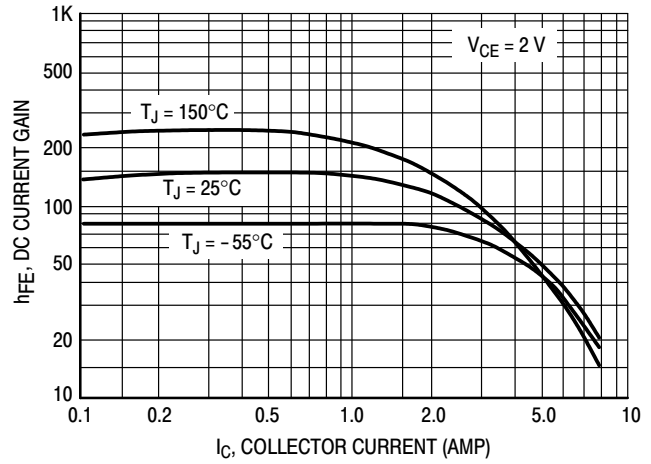
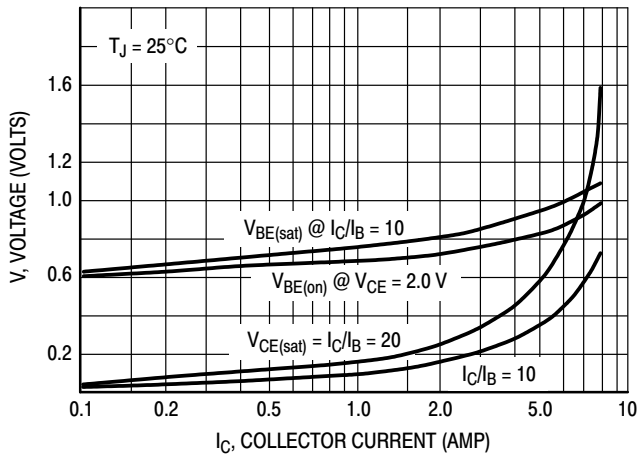


Figure 8. DC Current Gain

## NPN



## PNP

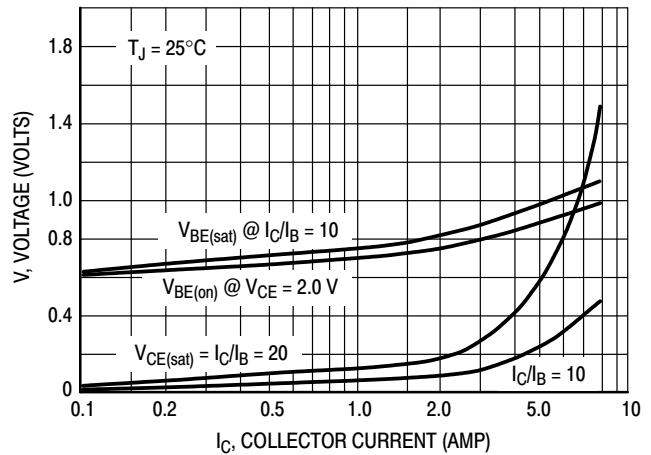


Figure 9. "On" Voltage

## MJE15028, MJE15030 (NPN) MJE15029, MJE15031 (PNP)

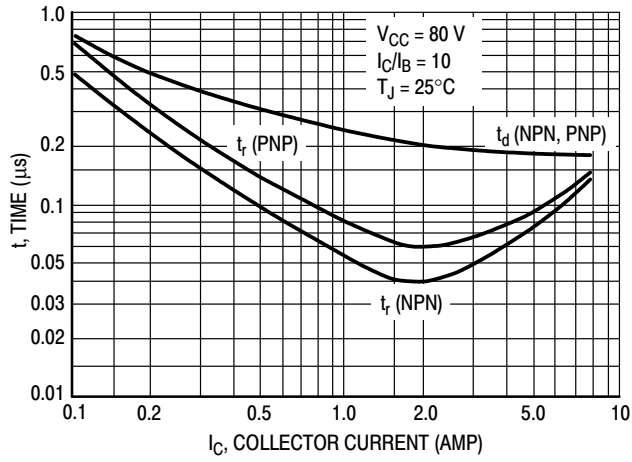


Figure 10. Turn-On Times

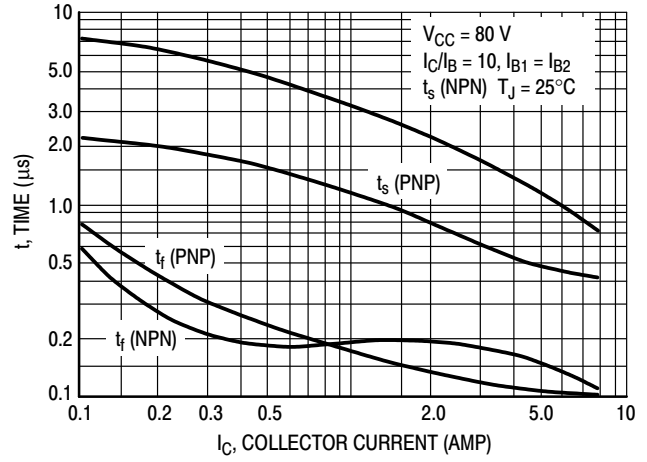


Figure 11. Turn-Off Times

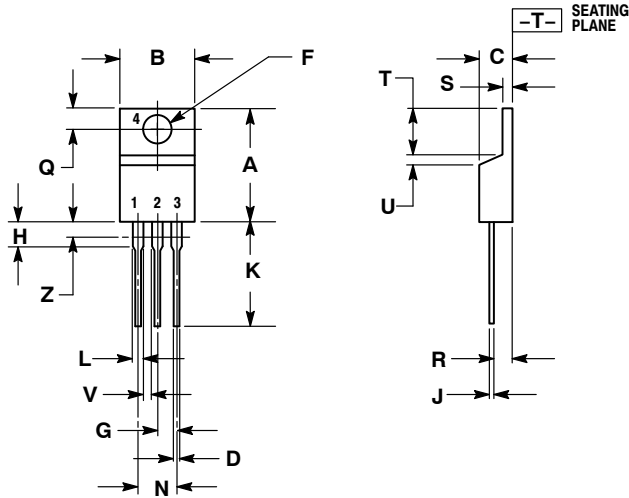
### ORDERING INFORMATION

| Device    | Package             | Shipping        |
|-----------|---------------------|-----------------|
| MJE15028  | TO-220              | 50 Units / Rail |
| MJE15028G | TO-220<br>(Pb-Free) | 50 Units / Rail |
| MJE15029  | TO-220              | 50 Units / Rail |
| MJE15029G | TO-220<br>(Pb-Free) | 50 Units / Rail |
| MJE15030  | TO-220              | 50 Units / Rail |
| MJE15030G | TO-220<br>(Pb-Free) | 50 Units / Rail |
| MJE15031  | TO-220              | 50 Units / Rail |
| MJE15031G | TO-220<br>(Pb-Free) | 50 Units / Rail |

# MJE15028, MJE15030 (NPN) MJE15029, MJE15031 (PNP)

## PACKAGE DIMENSIONS

TO-220  
CASE 221A-09  
ISSUE AG



### 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  | 0.036 | 0.64        | 0.91  |
| F   | 0.142  | 0.161 | 3.61        | 4.09  |
| G   | 0.095  | 0.105 | 2.42        | 2.66  |
| H   | 0.110  | 0.161 | 2.80        | 4.10  |
| J   | 0.014  | 0.025 | 0.36        | 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:

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

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