

## Silicon Power Transistors

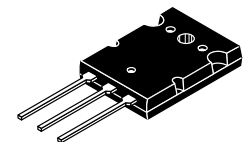
The MJL21193 and MJL21194 utilize Perforated Emitter technology and are specifically designed for high power audio output, disk head positioners and linear applications.

- Total Harmonic Distortion Characterized
- High DC Current Gain –  $h_{FE} = 25$  Min @  $I_C = 8$  Adc
- Excellent Gain Linearity
- High SOA: 2.25 A, 80 V, 1 Second

**PNP**  
**MJL21193\***  
**NPN**  
**MJL21194\***

\*Motorola Preferred Device

**16 AMPERE**  
**COMPLEMENTARY**  
**SILICON POWER**  
**TRANSISTORS**  
**250 VOLTS**  
**200 WATTS**



**CASE 340G-02**  
**TO-3PBL**

### MAXIMUM RATINGS

| Rating  | Symbol         | Value        | Unit                         |
|---|----------------|--------------|------------------------------|
| Collector–Emitter Voltage   | $V_{CEO}$      | 250          | Vdc                          |
| Collector–Base Voltage  | $V_{CBO}$      | 400          | Vdc                          |
| Emitter–Base Voltage  | $V_{EBO}$      | 5            | Vdc                          |
| Collector–Emitter Voltage – 1.5 V   | $V_{CEX}$      | 400          | Vdc                          |
| Collector Current — Continuous<br>Peak (1)  | $I_C$          | 16<br>30     | Adc                          |
| Base Current – Continuous   | $I_B$          | 5            | Adc                          |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate Above $25^\circ\text{C}$ | $P_D$          | 200<br>1.43  | Watts<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction Temperature Range                                      | $T_J, T_{stg}$ | – 65 to +150 | $^\circ\text{C}$             |

### THERMAL CHARACTERISTICS

| Characteristic                       | Symbol          | Max | Unit               |
|--------------------------------------|-----------------|-----|--------------------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 0.7 | $^\circ\text{C/W}$ |

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

| Characteristic | Symbol | Min | Typical | Max | Unit |
|----------------|--------|-----|---------|-----|------|
|----------------|--------|-----|---------|-----|------|

### OFF CHARACTERISTICS

|   |                |     |   |     |                 |
|---|----------------|-----|---|-----|-----------------|
| Collector–Emitter Sustaining Voltage<br>( $I_C = 100$ mAdc, $I_B = 0$ ) | $V_{CEO(sus)}$ | 250 | — | —   | Vdc             |
| Collector Cutoff Current<br>( $V_{CE} = 200$ Vdc, $I_B = 0$ )           | $I_{CEO}$      | —   | — | 100 | $\mu\text{Adc}$ |

(1) Pulse Test: Pulse Width = 5.0  $\mu\text{s}$ , Duty Cycle  $\leq 10\%$ .

(continued)

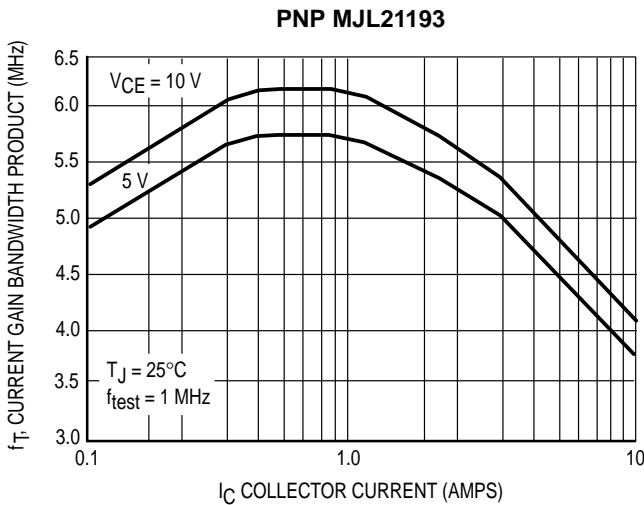
**Preferred** devices are Motorola recommended choices for future use and best overall value.

# MJL21193 MJL21194

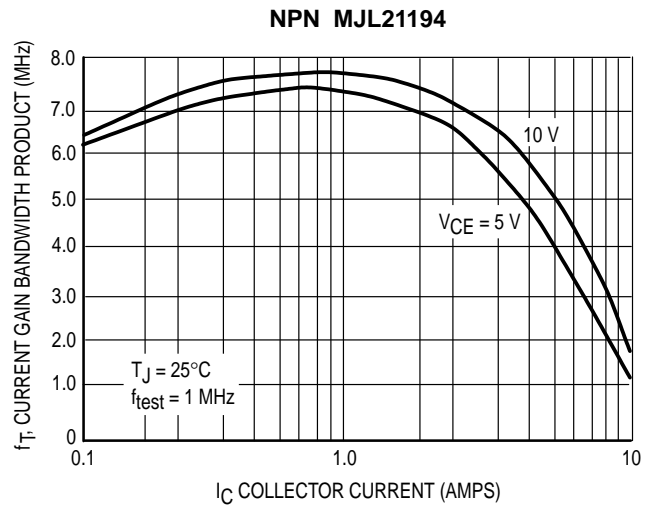
## ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic  | Symbol               | Min         | Typical     | Max      | Unit            |
|---|----------------------|-------------|-------------|----------|-----------------|
| <b>OFF CHARACTERISTICS</b>  |                      |             |             |          |                 |
| Emitter Cutoff Current<br>( $V_{CE} = 5\text{ Vdc}$ , $I_C = 0$ )   | $I_{EBO}$            | —           | —           | 100      | $\mu\text{Adc}$ |
| Collector Cutoff Current<br>( $V_{CE} = 250\text{ Vdc}$ , $V_{BE(\text{off})} = 1.5\text{ Vdc}$ )   | $I_{CEX}$            | —           | —           | 100      | $\mu\text{Adc}$ |
| <b>SECOND BREAKDOWN</b>   |                      |             |             |          |                 |
| Second Breakdown Collector Current with Base Forward Biased<br>( $V_{CE} = 50\text{ Vdc}$ , $t = 1\text{ s}$ (non-repetitive))<br>( $V_{CE} = 80\text{ Vdc}$ , $t = 1\text{ s}$ (non-repetitive)) | $I_{S/b}$            | 4.0<br>2.25 | —<br>—      | —<br>—   | A <sub>dc</sub> |
| <b>ON CHARACTERISTICS</b>   |                      |             |             |          |                 |
| DC Current Gain<br>( $I_C = 8\text{ Adc}$ , $V_{CE} = 5\text{ Vdc}$ )<br>( $I_C = 16\text{ Adc}$ , $I_B = 5\text{ Adc}$ )   | $h_{FE}$             | 25<br>8     | —<br>—      | 75<br>—  |                 |
| Base-Emitter On Voltage<br>( $I_C = 8\text{ Adc}$ , $V_{CE} = 5\text{ Vdc}$ )   | $V_{BE(\text{on})}$  | —           | —           | 2.2      | V <sub>dc</sub> |
| Collector-Emitter Saturation Voltage<br>( $I_C = 8\text{ Adc}$ , $I_B = 0.8\text{ Adc}$ )<br>( $I_C = 16\text{ Adc}$ , $I_B = 3.2\text{ Adc}$ )   | $V_{CE(\text{sat})}$ | —<br>—      | —<br>—      | 1.4<br>4 | V <sub>dc</sub> |
| <b>DYNAMIC CHARACTERISTICS</b>  |                      |             |             |          |                 |
| Total Harmonic Distortion at the Output<br>$V_{RMS} = 28.3\text{ V}$ , $f = 1\text{ kHz}$ , $P_{LOAD} = 100\text{ W}_{RMS}$<br>(Matched pair $h_{FE} = 50 @ 5\text{ A}/5\text{ V}$ )              | $T_{HD}$             | —<br>—      | 0.8<br>0.08 | —<br>—   | %               |
| Current Gain Bandwidth Product<br>( $I_C = 1\text{ Adc}$ , $V_{CE} = 10\text{ Vdc}$ , $f_{\text{test}} = 1\text{ MHz}$ )  | $f_T$                | 4           | —           | —        | MHz             |
| Output Capacitance<br>( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f_{\text{test}} = 1\text{ MHz}$ )   | $C_{ob}$             | —           | —           | 500      | pF              |

(1) Pulse Test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle  $\leq 2\%$



**Figure 1. Typical Current Gain Bandwidth Product**



**Figure 2. Typical Current Gain Bandwidth Product**

TYPICAL CHARACTERISTICS

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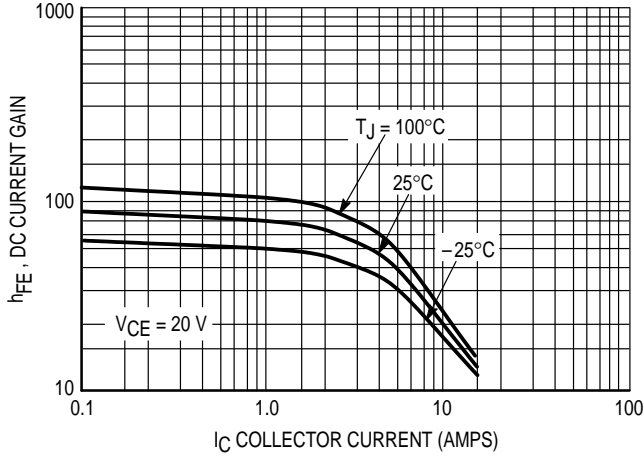


Figure 3. DC Current Gain,  $V_{CE} = 20\text{ V}$

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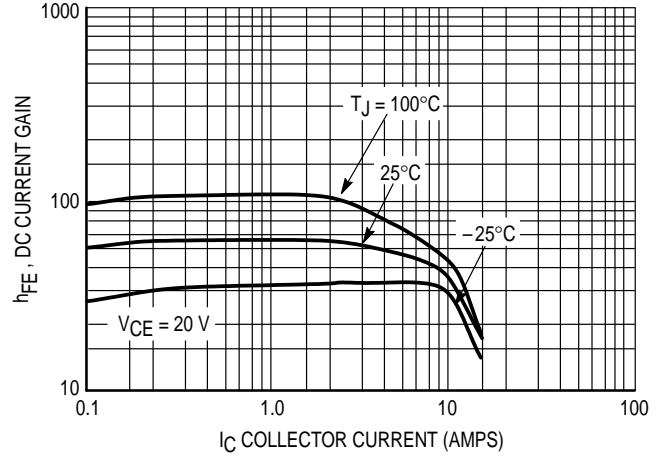


Figure 4. DC Current Gain,  $V_{CE} = 20\text{ V}$

PNP MJL21193

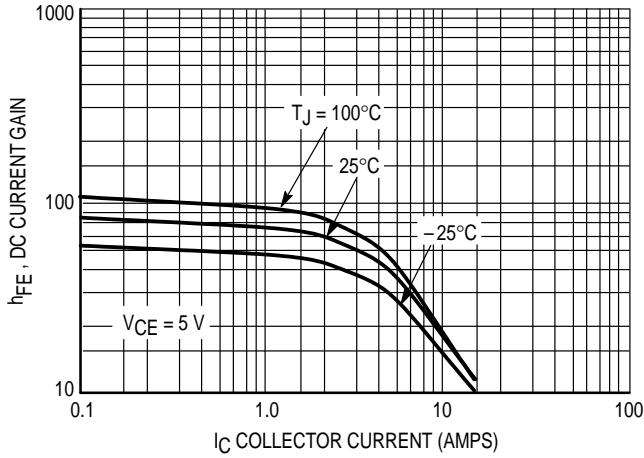


Figure 5. DC Current Gain,  $V_{CE} = 5\text{ V}$

NPN MJL21194

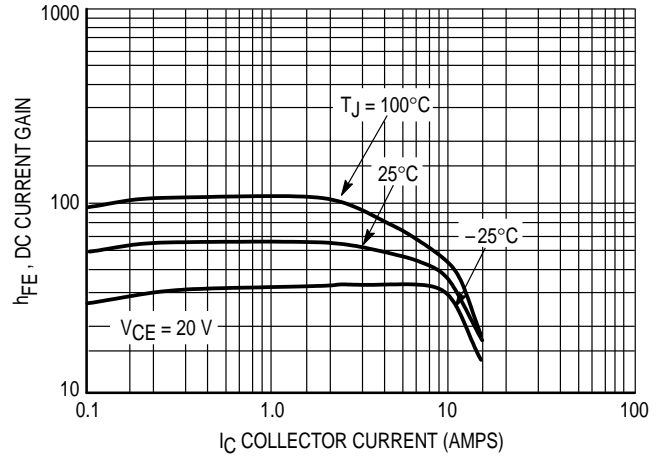


Figure 6. DC Current Gain,  $V_{CE} = 5\text{ V}$

PNP MJL21193

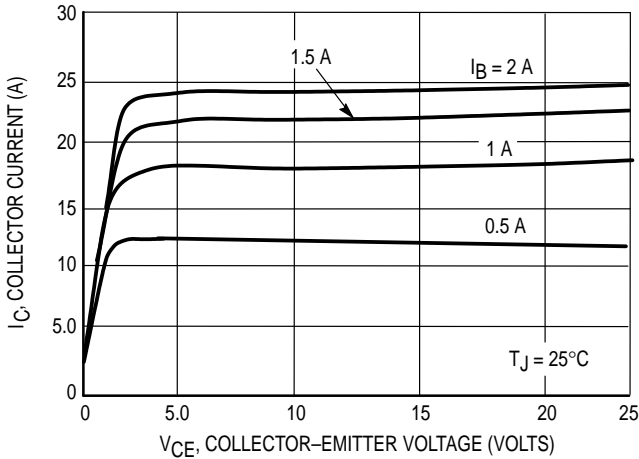


Figure 7. Typical Output Characteristics

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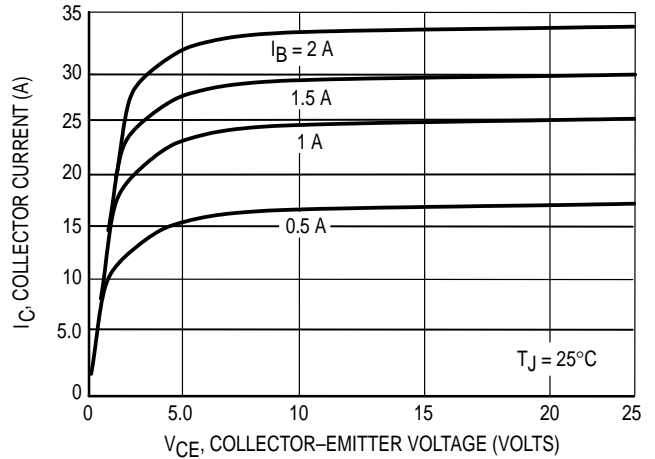


Figure 8. Typical Output Characteristics

TYPICAL CHARACTERISTICS

PNP MJL21193

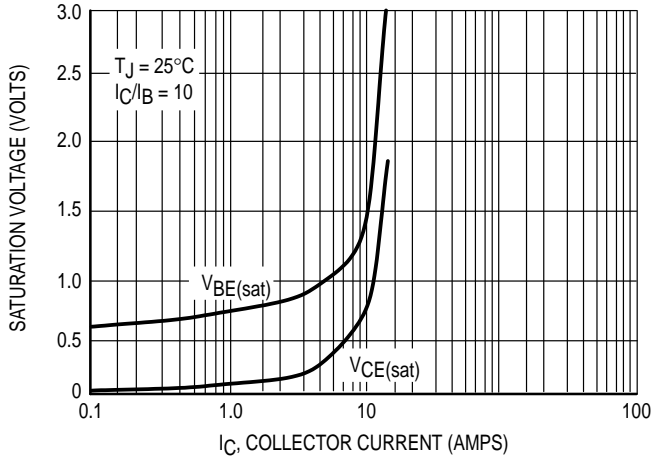


Figure 9. Typical Saturation Voltages

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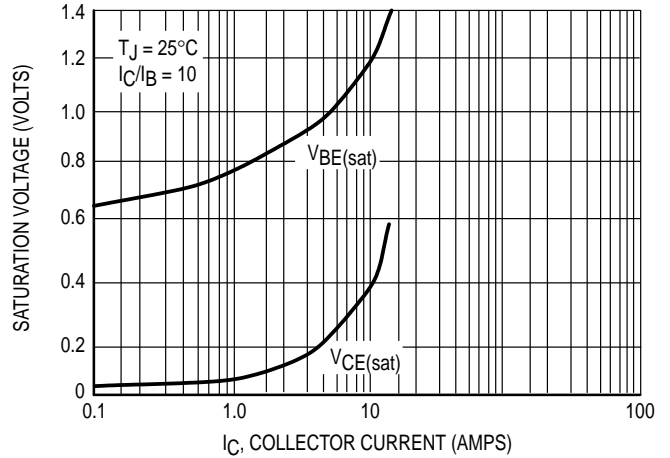


Figure 10. Typical Saturation Voltages

PNP MJL21193

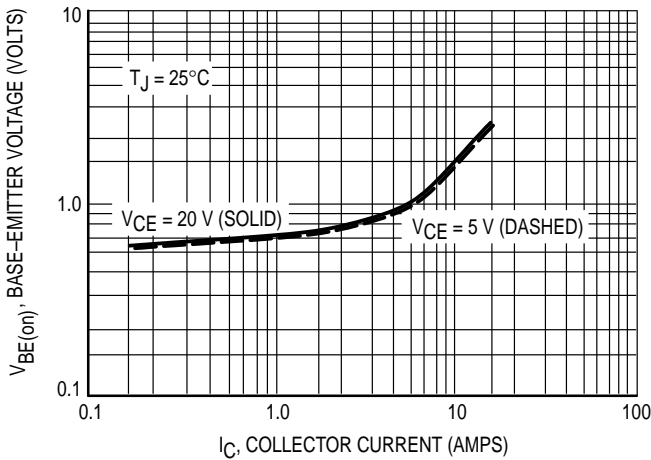


Figure 11. Typical Base-Emitter Voltage

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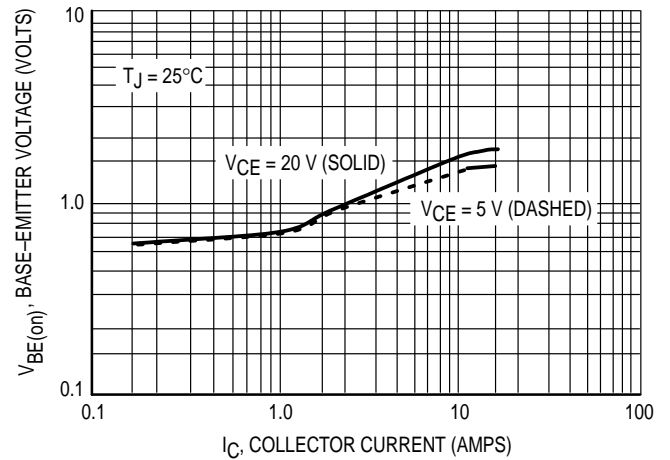


Figure 12. Typical Base-Emitter Voltage

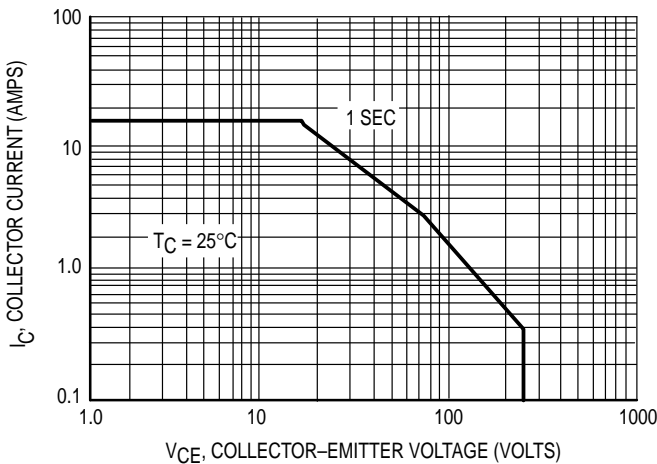


Figure 13. Active Region Safe Operating Area

There are two limitations on the power handling ability of a transistor; average junction temperature and secondary 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 13 is based on  $T_{J(pk)} = 200^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. At high case temperatures, thermal limitations will reduce the power than can be handled to values less than the limitations imposed by second breakdown.

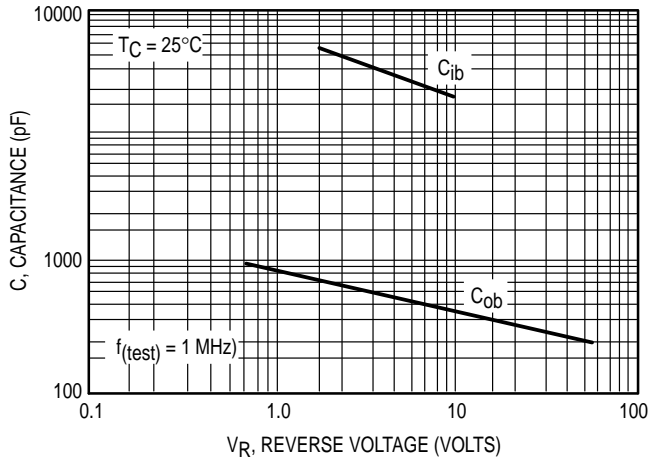


Figure 14. MJL21193 Typical Capacitance

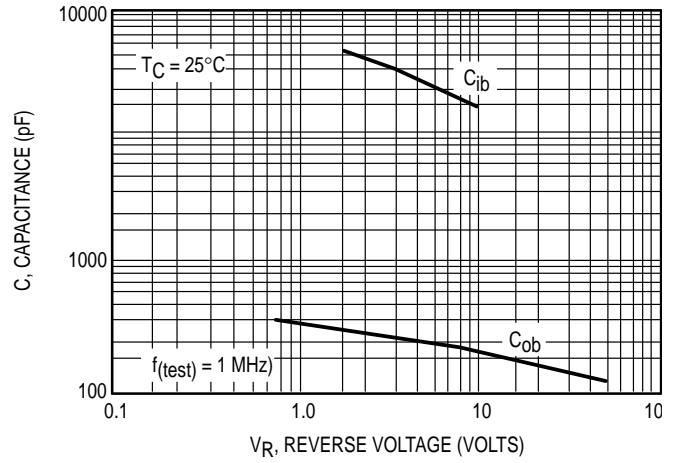


Figure 15. MJL21194 Typical Capacitance

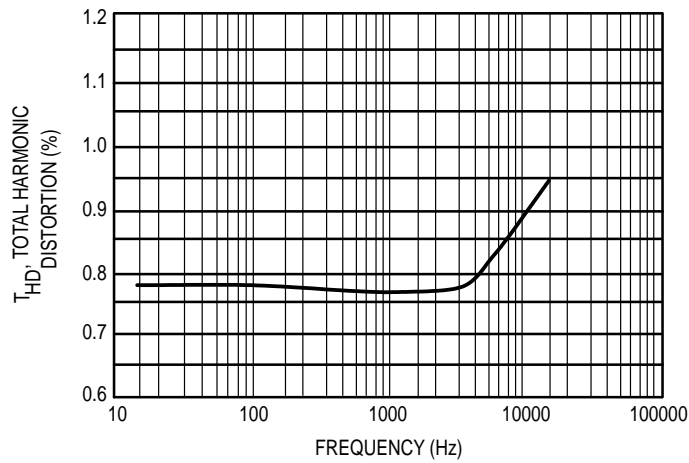


Figure 16. Typical Total Harmonic Distortion

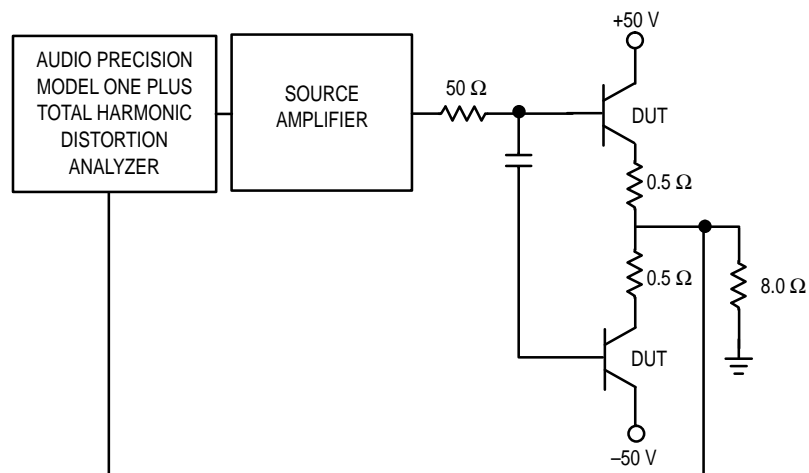
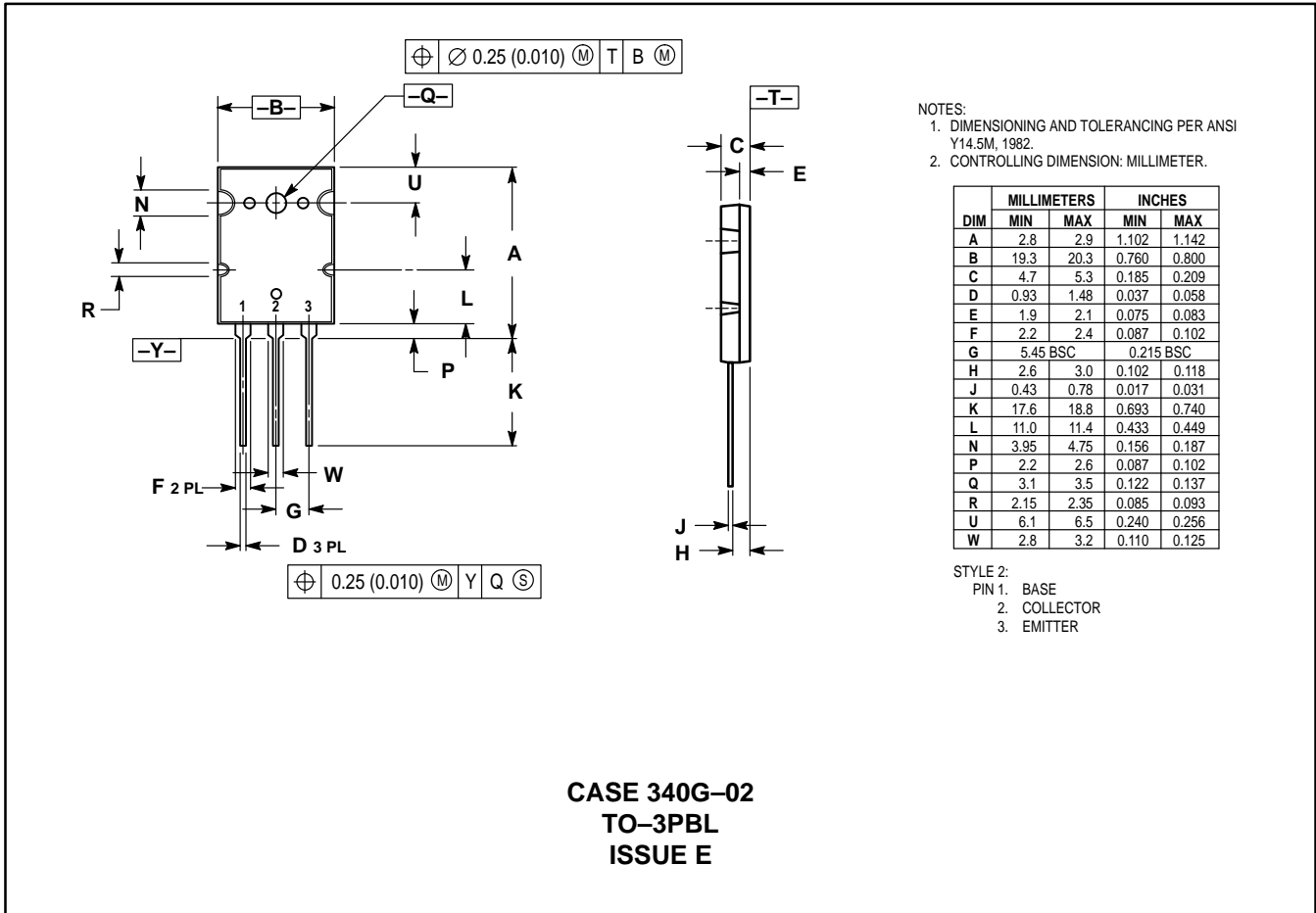


Figure 17. Total Harmonic Distortion Test Circuit

PACKAGE DIMENSIONS



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