

# Silicon Power Transistors

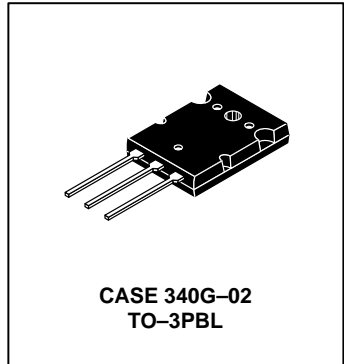
The MJL21193 and MJL21194 utilize Perforated Emitter technology and are specifically designed for high power audio output, disk head positioners and linear applications.

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

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

\*ON Semiconductor Preferred Device

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



## MAXIMUM RATINGS

| Rating   | Symbol                               | Value          | Unit          |
|--|--------------------------------------|----------------|---------------|
| Collector–Emitter Voltage  | V <sub>CEO</sub>                     | 250            | Vdc           |
| Collector–Base Voltage   | V <sub>CBO</sub>                     | 400            | Vdc           |
| Emitter–Base Voltage   | V <sub>EBO</sub>                     | 5              | Vdc           |
| Collector–Emitter Voltage – 1.5 V                                    | V <sub>CEX</sub>                     | 400            | Vdc           |
| Collector Current — Continuous<br>Peak (1)                           | I <sub>C</sub>                       | 16<br>30       | Adc           |
| Base Current – Continuous  | I <sub>B</sub>                       | 5              | Adc           |
| Total Power Dissipation @ T <sub>C</sub> = 25°C<br>Derate Above 25°C | P <sub>D</sub>                       | 200<br>1.43    | Watts<br>W/°C |
| Operating and Storage Junction Temperature Range                     | T <sub>J</sub> ,<br>T <sub>stg</sub> | –65 to<br>+150 | °C            |

## THERMAL CHARACTERISTICS

| Characteristic                       | Symbol           | Max | Unit |
|--------------------------------------|------------------|-----|------|
| Thermal Resistance, Junction to Case | R <sub>θJC</sub> | 0.7 | °C/W |

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

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

## OFF CHARACTERISTICS

|   |                       |     |   |     |      |
|---|-----------------------|-----|---|-----|------|
| Collector–Emitter Sustaining Voltage<br>(I <sub>C</sub> = 100 mAdc, I <sub>B</sub> = 0) | V <sub>CEO(sus)</sub> | 250 | — | —   | Vdc  |
| Collector Cutoff Current<br>(V <sub>CE</sub> = 200 Vdc, I <sub>B</sub> = 0)             | I <sub>CEO</sub>      | —   | — | 100 | μAdc |

(1) Pulse Test: Pulse Width = 5.0 μs, Duty Cycle ≤10%.

(continued)

Preferred devices are ON Semiconductor 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 |
|----------------|--------|-----|---------|-----|------|
|----------------|--------|-----|---------|-----|------|

### OFF CHARACTERISTICS

|   |           |   |   |     |                 |
|---|-----------|---|---|-----|-----------------|
| 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 | $\mu\text{Adc}$ |

### SECOND BREAKDOWN

|   |           |             |        |        |      |
|---|-----------|-------------|--------|--------|------|
| 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 dc |
|---|-----------|-------------|--------|--------|------|

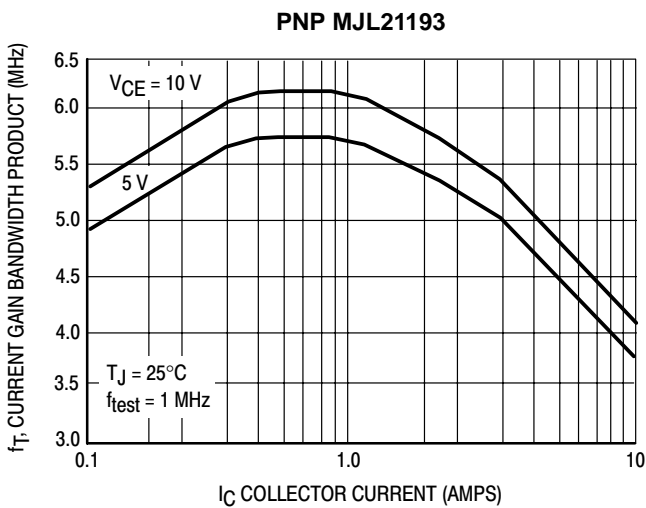
### ON CHARACTERISTICS

|   |                      |         |        |          |      |
|---|----------------------|---------|--------|----------|------|
| 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 dc |
| 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 dc |

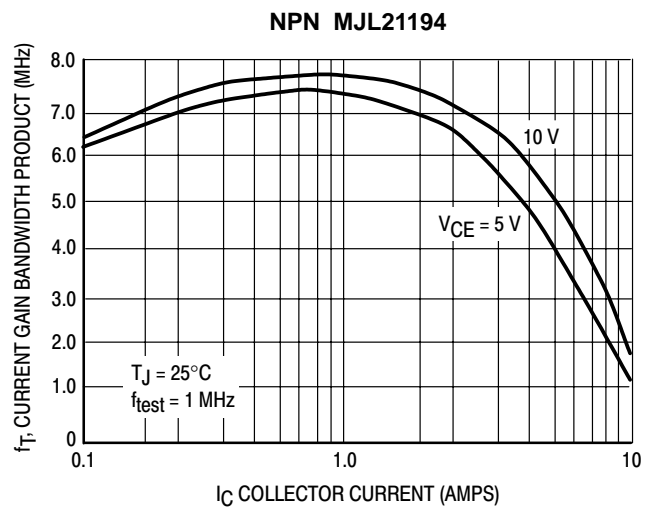
### DYNAMIC CHARACTERISTICS

|   |          |        |             |        |     |
|---|----------|--------|-------------|--------|-----|
| 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**

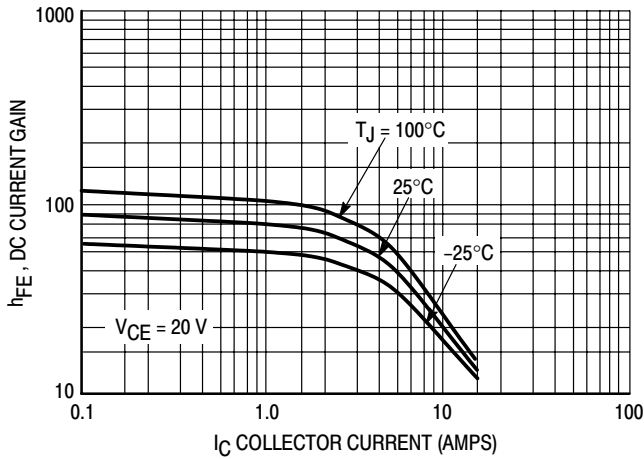


**Figure 2. Typical Current Gain Bandwidth Product**

# MJL21193 MJL21194

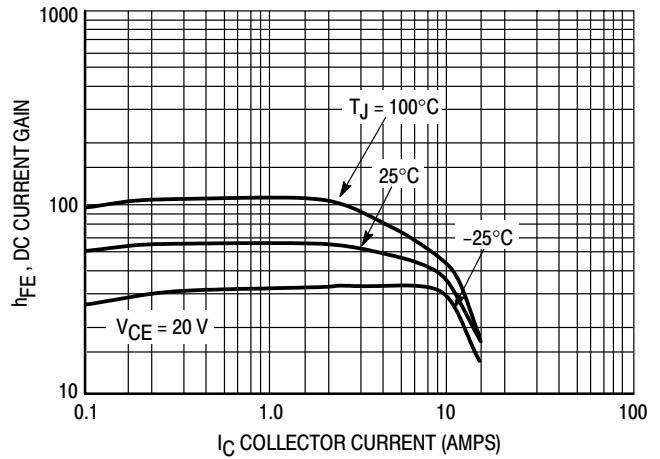
## TYPICAL CHARACTERISTICS

**PNP MJL21193**



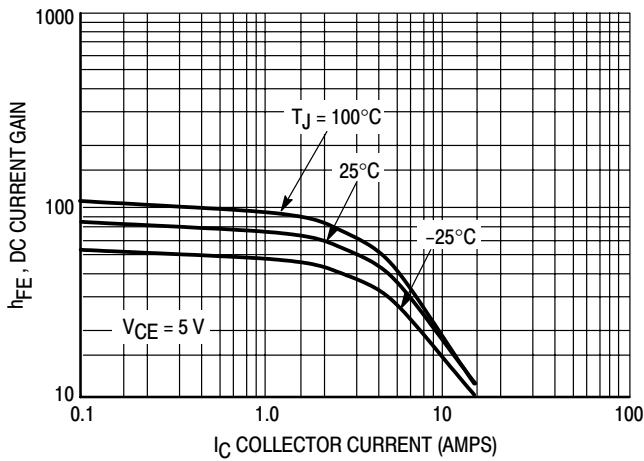
**Figure 3. DC Current Gain,  $V_{CE} = 20\text{ V}$**

**NPN MJL21194**



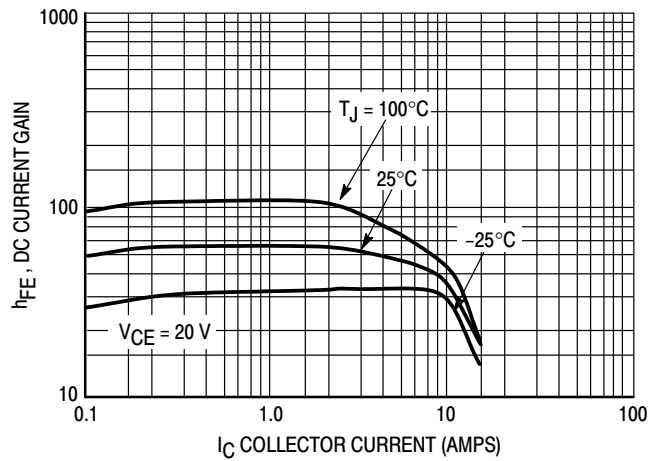
**Figure 4. DC Current Gain,  $V_{CE} = 20\text{ V}$**

**PNP MJL21193**



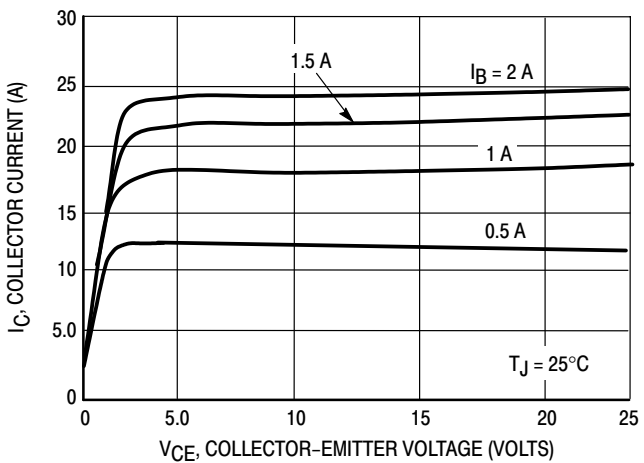
**Figure 5. DC Current Gain,  $V_{CE} = 5\text{ V}$**

**NPN MJL21194**

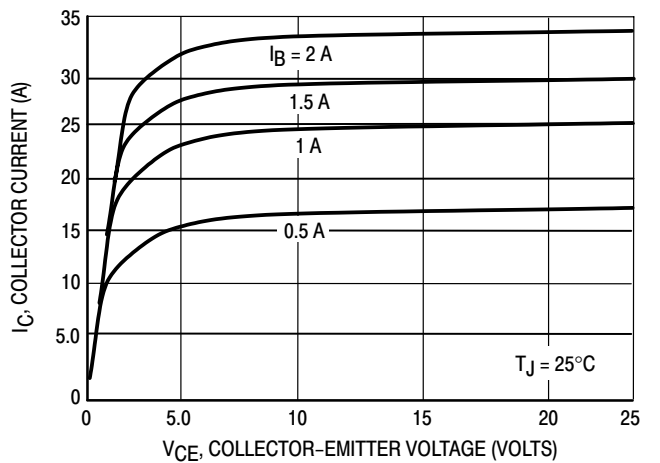


**Figure 6. DC Current Gain,  $V_{CE} = 5\text{ V}$**

**PNP MJL21193**



**NPN MJL21194**



TYPICAL CHARACTERISTICS

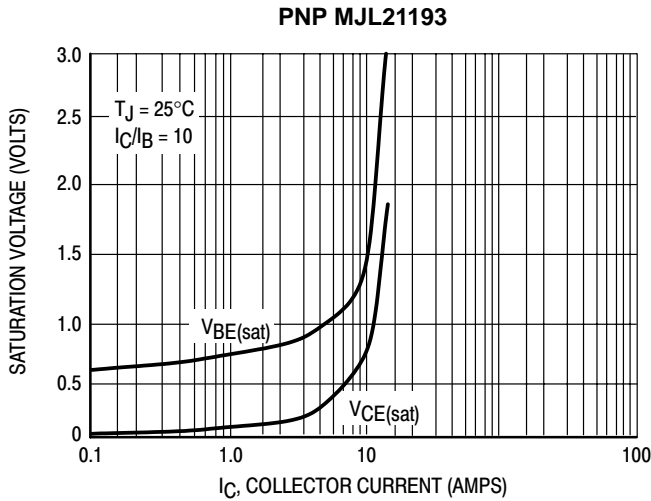


Figure 9. Typical Saturation Voltages

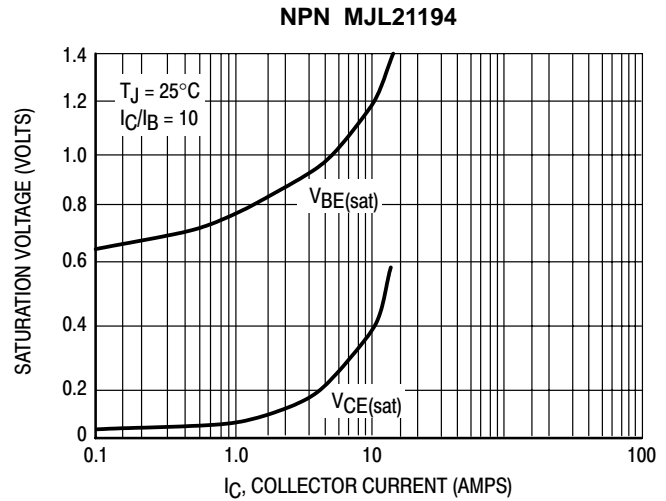


Figure 10. Typical Saturation Voltages

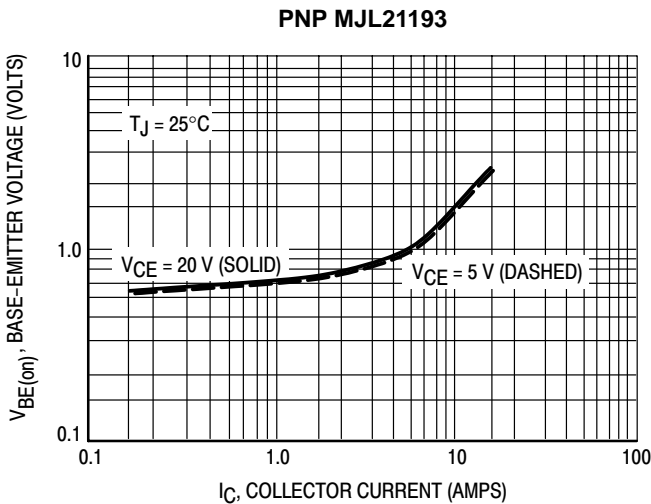


Figure 11. Typical Base-Emitter Voltage

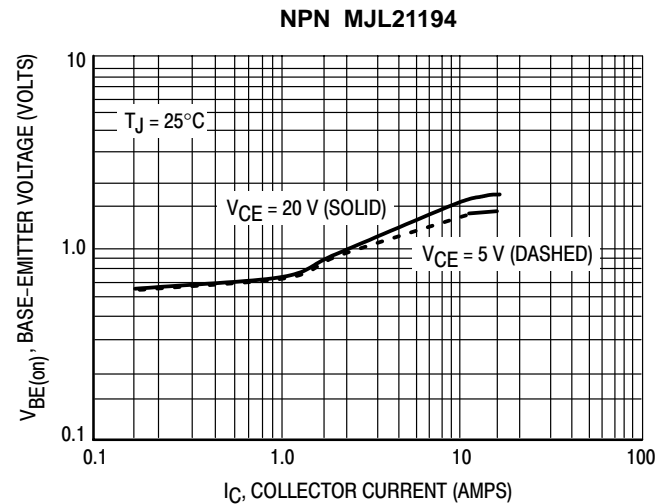


Figure 12. Typical Base-Emitter Voltage

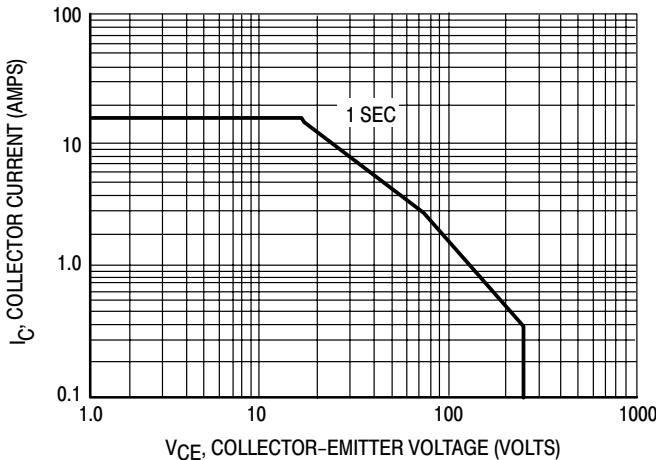


Figure 13. Active Region Safe Operating Area

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  $T_{J(pk)} = 150^\circ\text{C}$ ;  $T_C$  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.

# MJL21193 MJL21194

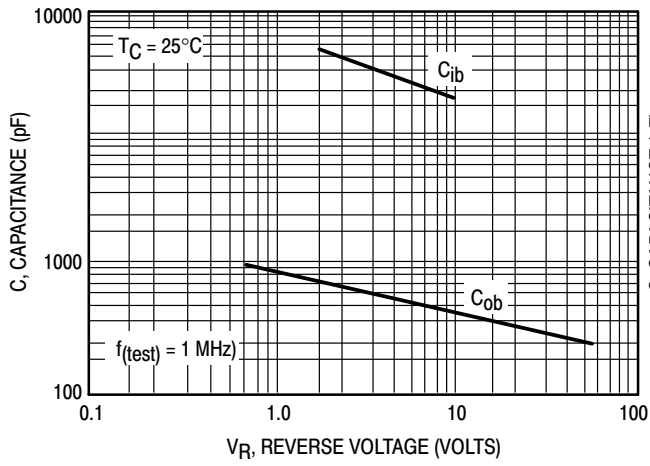


Figure 14. MJL21193 Typical Capacitance

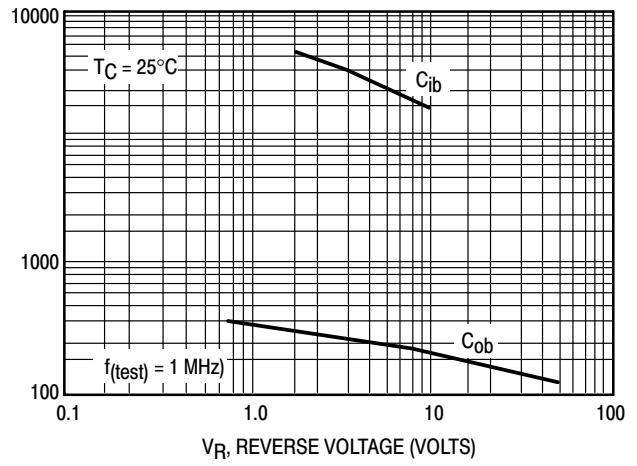


Figure 15. MJL21194 Typical Capacitance

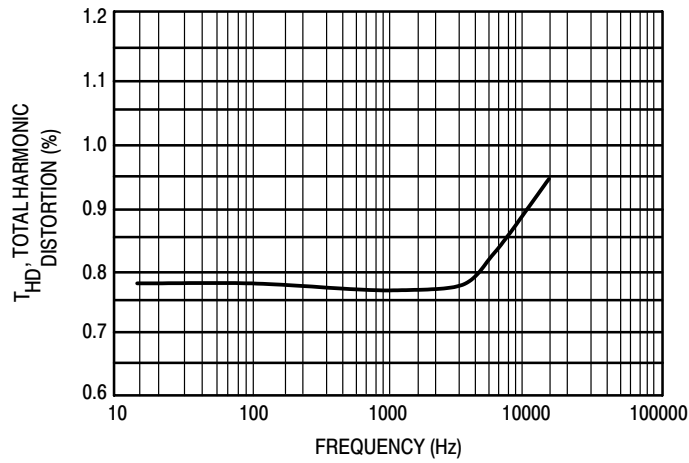


Figure 16. Typical Total Harmonic Distortion

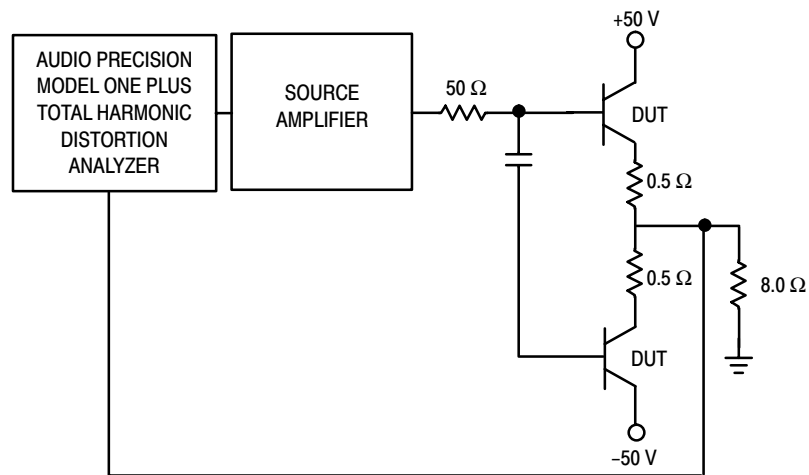


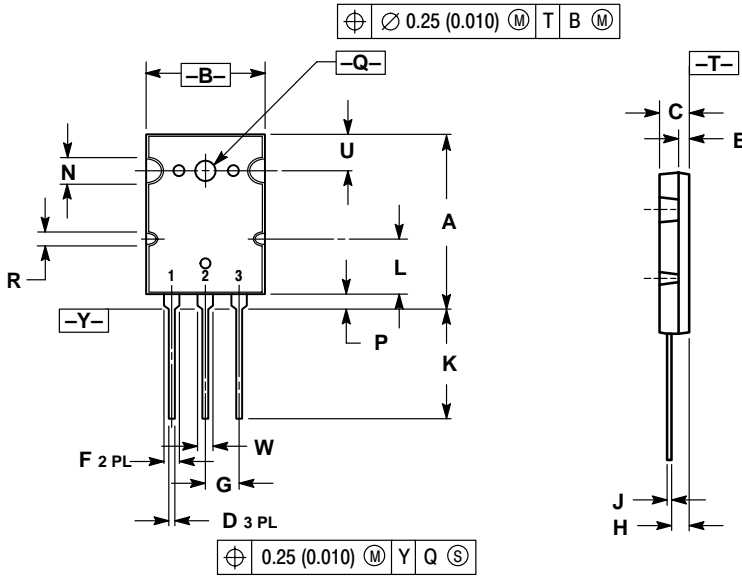
Figure 17. Total Harmonic Distortion Test Circuit

# MJL21193 MJL21194

## PACKAGE DIMENSIONS

TO-3PBL (TO-264)  
CASE 340G-02  
ISSUE H

SCALE 1:2



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 28.0        | 29.0 | 1.102     | 1.142 |
| B   | 19.3        | 20.3 | 0.760     | 0.800 |
| C   | 4.7         | 5.3  | 0.185     | 0.209 |
| D   | 0.93        | 1.48 | 0.037     | 0.058 |
| E   | 1.9         | 2.1  | 0.075     | 0.083 |
| F   | 2.2         | 2.4  | 0.087     | 0.102 |
| G   | 5.45 BSC    |      | 0.215 BSC |       |
| H   | 2.6         | 3.0  | 0.102     | 0.118 |
| J   | 0.43        | 0.78 | 0.017     | 0.031 |
| K   | 17.6        | 18.8 | 0.693     | 0.740 |
| L   | 11.0        | 11.4 | 0.433     | 0.449 |
| N   | 3.95        | 4.75 | 0.156     | 0.187 |
| P   | 2.2         | 2.6  | 0.087     | 0.102 |
| Q   | 3.1         | 3.5  | 0.122     | 0.137 |
| R   | 2.15        | 2.35 | 0.085     | 0.093 |
| U   | 6.1         | 6.5  | 0.240     | 0.256 |
| W   | 2.8         | 3.2  | 0.110     | 0.125 |

## Notes

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