

# Silicon Power Transistors

## MJL21195 (PNP), MJL21196 (NPN)

The MJL21195 and MJL21196 utilize Perforated Emitter technology and are specifically designed for high power audio output, disk head positioners and linear applications.

### Features

- Total Harmonic Distortion Characterized
- High DC Current Gain
- Excellent Gain Linearity
- High SOA
- Epoxy Meets UL 94, V-0 @ 0.125 in
- These Devices are Pb-Free and are RoHS Compliant\*

### 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                                                           | $I_C$          | 16           | Adc                      |
| Collector Current – Peak (Note 1)                                                        | $I_{CM}$       | 30           | Adc                      |
| Base Current – Continuous                                                                | $I_B$          | 5            | Adc                      |
| Total Power Dissipation<br>@ $T_C = 25^\circ\text{C}$<br>Derate Above $25^\circ\text{C}$ | $P_D$          | 200<br>1.43  | W<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                      | $T_J, T_{stg}$ | - 65 to +150 | $^\circ\text{C}$         |
| ESD – Human Body Model                                                                   | HBM            | 3B           | V                        |
| ESD – Machine Model                                                                      | MM             | C            | V                        |

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.

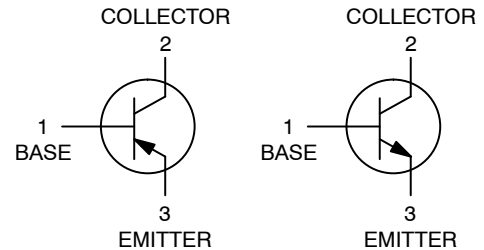
1. Pulse Test: Pulse Width = 5.0  $\mu\text{s}$ , Duty Cycle  $\leq 10\%$ .

### THERMAL CHARACTERISTICS

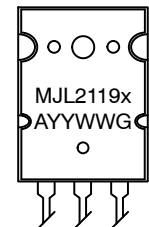
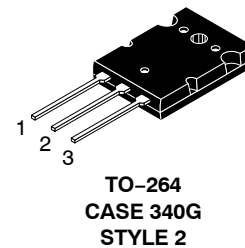
| Characteristic                       | Symbol          | Max | Unit               |
|--------------------------------------|-----------------|-----|--------------------|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 0.7 | $^\circ\text{C/W}$ |

## 16 A COMPLEMENTARY SILICON POWER TRANSISTORS 250 V, 200 W

### COMPLEMENTARY



### MARKING DIAGRAM



x = 5 or 6  
A = Assembly Location  
YY = Year  
WW = Work Week  
G = Pb-Free Package

### ORDERING INFORMATION

| Device    | Package             | Shipping        |
|-----------|---------------------|-----------------|
| MJL21195G | TO-264<br>(Pb-Free) | 25 Units / Rail |
| MJL21196G | TO-264<br>(Pb-Free) | 25 Units / Rail |

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

# MJL21195 (PNP), MJL21196 (NPN)

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

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

### OFF CHARACTERISTICS (Note 2)

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

### OFF CHARACTERISTICS (Note 3)

|                                                                                            |           |   |   |     |                 |
|--------------------------------------------------------------------------------------------|-----------|---|---|-----|-----------------|
| Emitter Cutoff Current<br>( $V_{CE} = 5\text{ Vdc}$ , $I_C = 0$ )                          | $I_{EBO}$ | – | – | 100 | $\mu\text{Adc}$ |
| Collector Cutoff Current<br>( $V_{CE} = 250\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ ) | $I_{CEX}$ | – | – | 100 | $\mu\text{Adc}$ |

### SECOND BREAKDOWN (Note 3)

|                                                                                                                                                                                                 |           |             |        |        |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------|--------|--------|-----|
| Second Breakdown Collector Current with Base Forward Biased<br>( $V_{CE} = 50\text{ Vdc}$ , $t = 1\text{ s}$ (Nonrepetitive))<br>( $V_{CE} = 80\text{ Vdc}$ , $t = 1\text{ s}$ (Nonrepetitive)) | $I_{S/b}$ | 4.0<br>2.25 | –<br>– | –<br>– | Adc |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------|--------|--------|-----|

### ON CHARACTERISTICS (Note 3)

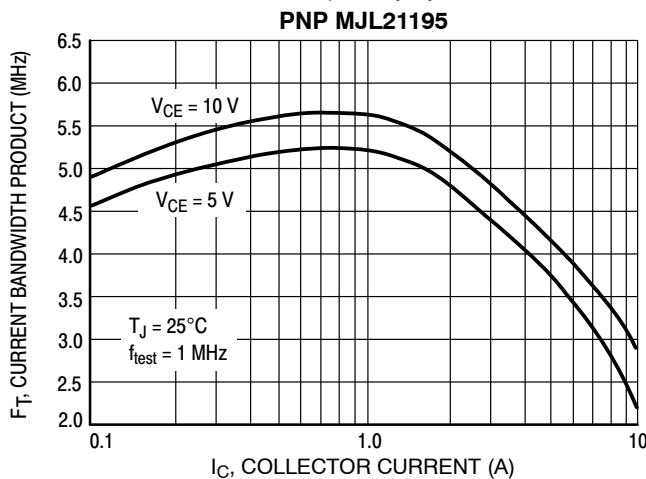
|                                                                                                                                                 |               |           |        |          |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------|--------|----------|-----|
| 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>8.0 | –<br>– | 100<br>– | –   |
| Base-Emitter On Voltage<br>( $I_C = 8\text{ Adc}$ , $V_{CE} = 5\text{ Vdc}$ )                                                                   | $V_{BE(on)}$  | –         | –      | 2.2      | Vdc |
| Collector-Emitter Saturation Voltage<br>( $I_C = 8\text{ Adc}$ , $I_B = 0.8\text{ Adc}$ )<br>( $I_C = 16\text{ Adc}$ , $I_B = 3.2\text{ Adc}$ ) | $V_{CE(sat)}$ | –<br>–    | –<br>– | 1.4<br>4 | Vdc |

### DYNAMIC CHARACTERISTICS (Note 3)

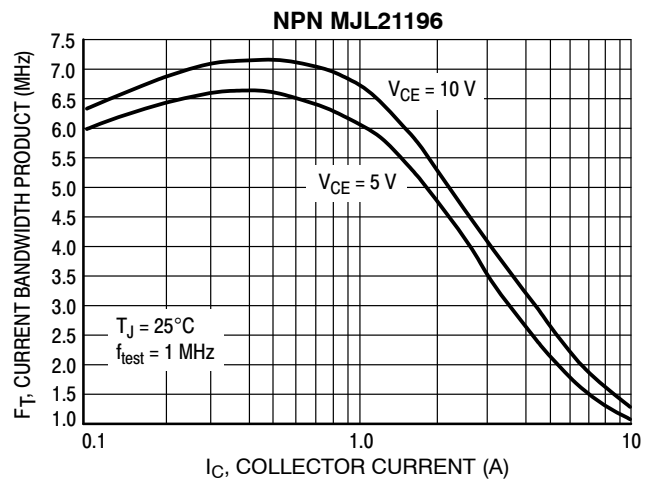
|                                                                                                                                                                                                                                    |          |        |             |        |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------|-------------|--------|-----|
| Total Harmonic Distortion at the Output<br>( $V_{RMS} = 28.3\text{ V}$ , $f = 1\text{ kHz}$ , $P_{LOAD} = 100\text{ W}_{RMS}$ )<br>$h_{FE}$ unmatched<br>(Matched pair $h_{FE} = 50 @ 5\text{ A}/5\text{ V}$ )<br>$h_{FE}$ matched | $T_{HD}$ | –<br>– | 0.8<br>0.08 | –<br>– | %   |
| Current Gain Bandwidth Product<br>( $I_C = 1\text{ Adc}$ , $V_{CE} = 10\text{ Vdc}$ , $f_{test} = 1\text{ MHz}$ )                                                                                                                  | $f_T$    | 4      | –           | –      | MHz |
| Output Capacitance<br>( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f_{test} = 1\text{ MHz}$ )                                                                                                                                         | $C_{ob}$ | –      | –           | 500    | pF  |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

- Pulse Test: Pulse Width =  $5.0\text{ }\mu\text{s}$ , Duty Cycle  $\leq 10\%$ .
- Pulse Test: Pulse Width =  $300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .



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

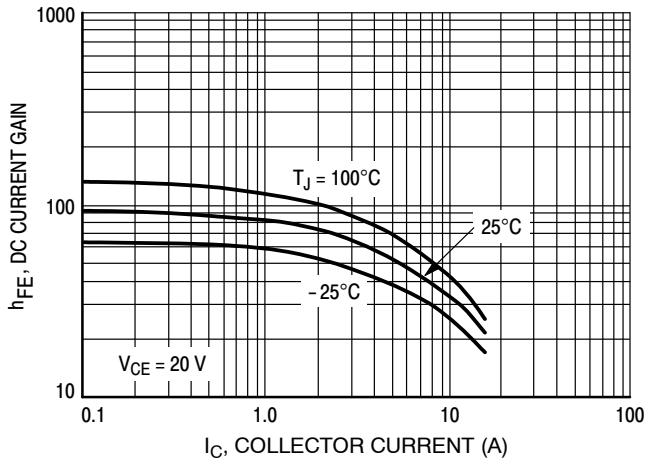


**Figure 2. Typical Current Gain Bandwidth Product**

# MJL21195 (PNP), MJL21196 (NPN)

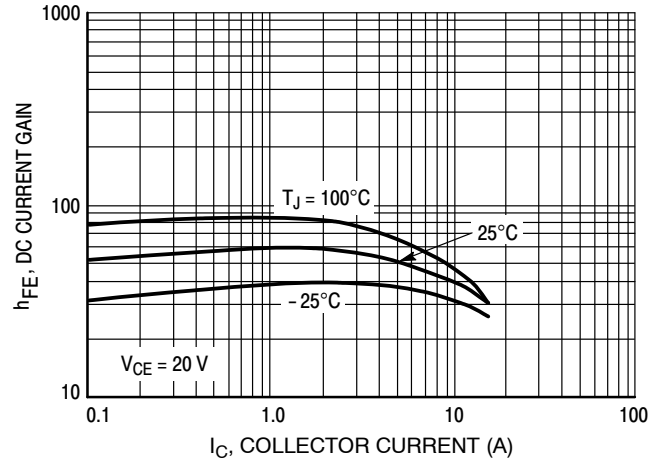
## TYPICAL CHARACTERISTICS

**PNP MJL21195**



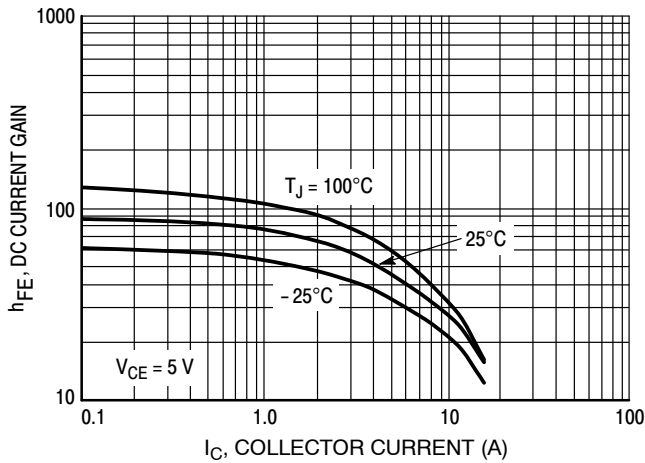
**Figure 3. DC Current Gain,  $V_{CE} = 20\text{ V}$**

**NPN MJL21196**



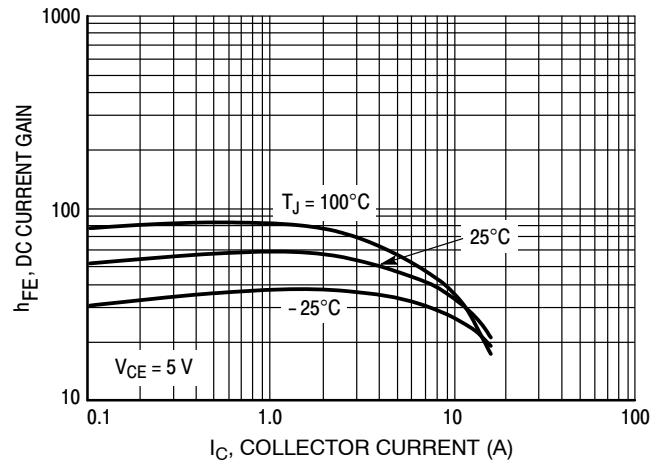
**Figure 4. DC Current Gain,  $V_{CE} = 20\text{ V}$**

**PNP MJL21195**



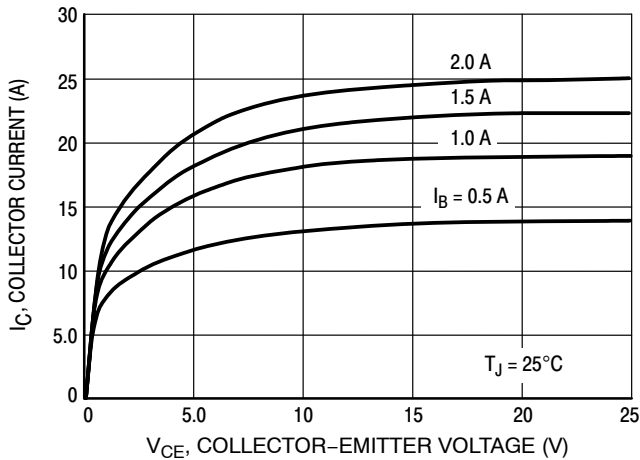
**Figure 5. DC Current Gain,  $V_{CE} = 5\text{ V}$**

**NPN MJL21196**



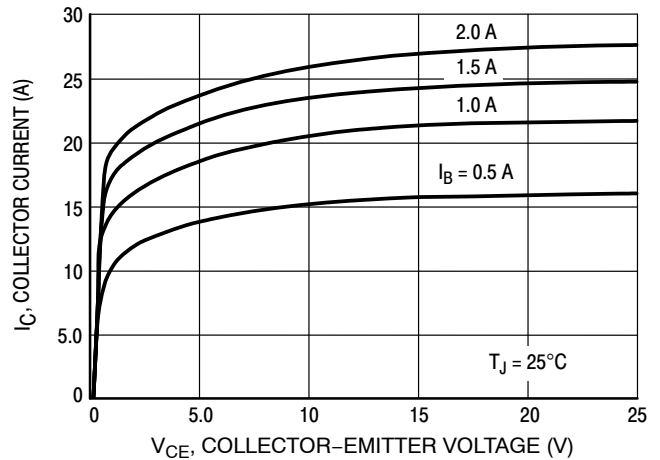
**Figure 6. DC Current Gain,  $V_{CE} = 5\text{ V}$**

**PNP MJL21195**



**Figure 7. Typical Output Characteristics**

**NPN MJL21196**



**Figure 8. Typical Output Characteristics**

# MJL21195 (PNP), MJL21196 (NPN)

## TYPICAL CHARACTERISTICS

PNP MJL21195

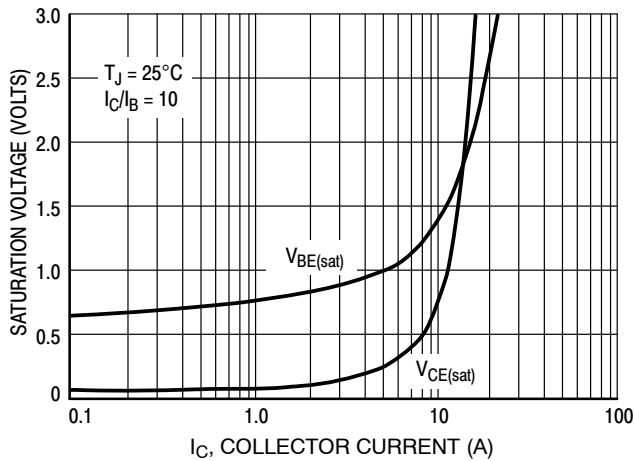


Figure 9. Typical Saturation Voltages

NPN MJL21196

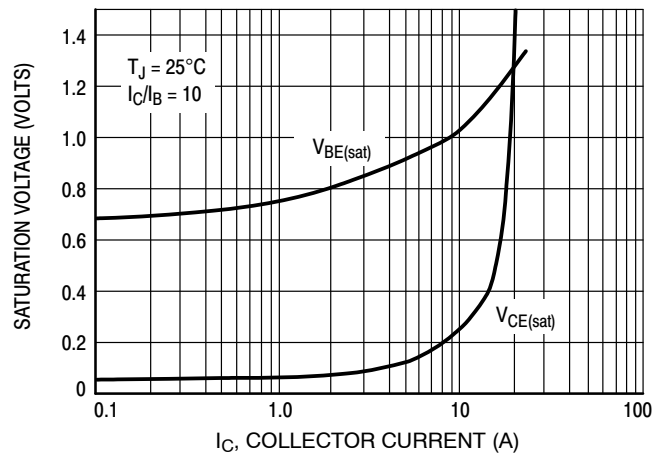


Figure 10. Typical Saturation Voltages

PNP MJL21195

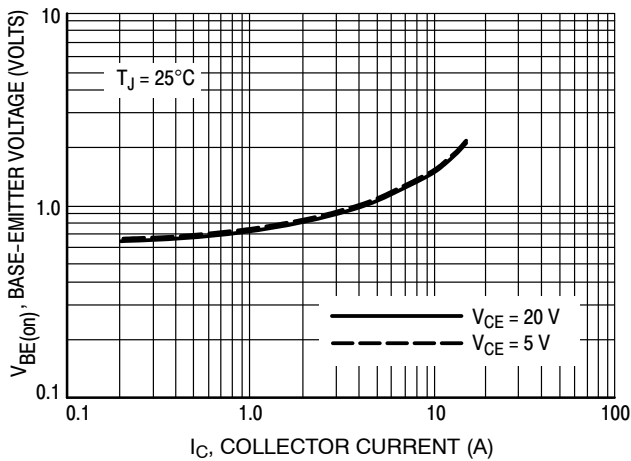


Figure 11. Typical Base-Emitter Voltage

NPN MJL21196

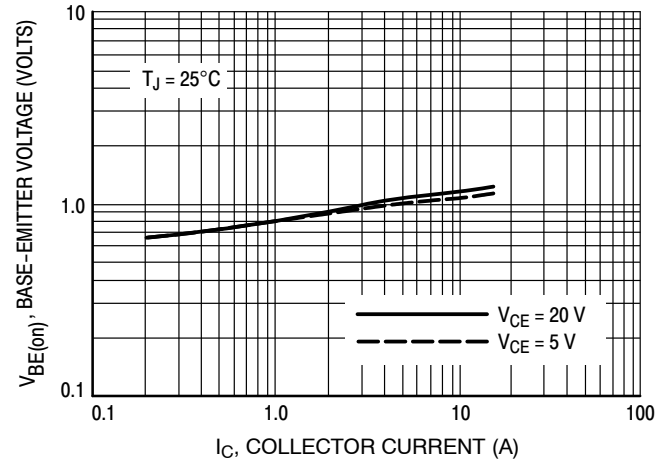


Figure 12. Typical Base-Emitter Voltage

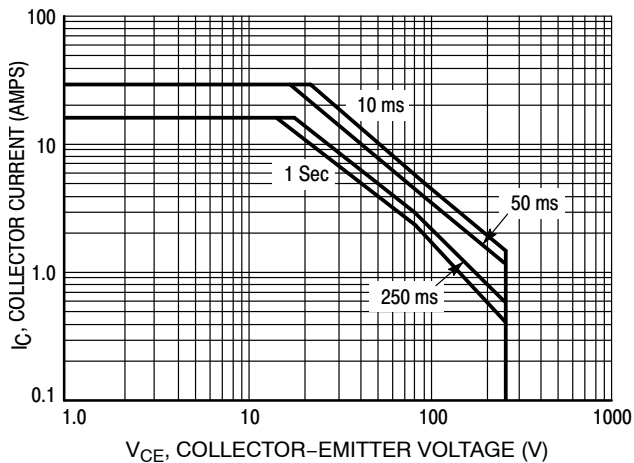


Figure 13. Active Region Safe Operating Area

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.

## MJL21195 (PNP), MJL21196 (NPN)

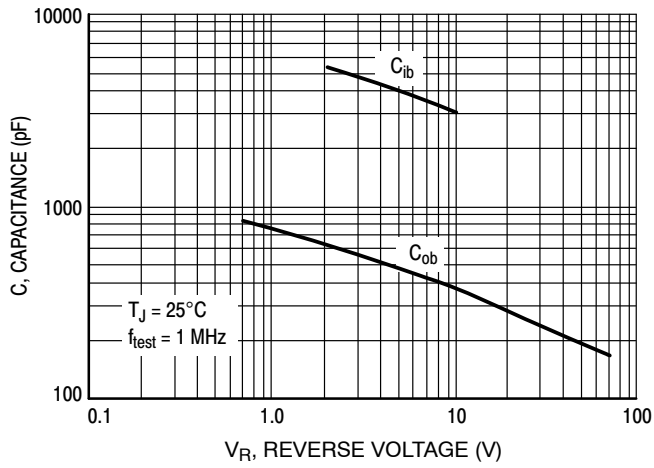


Figure 14. MJL21195 Typical Capacitance

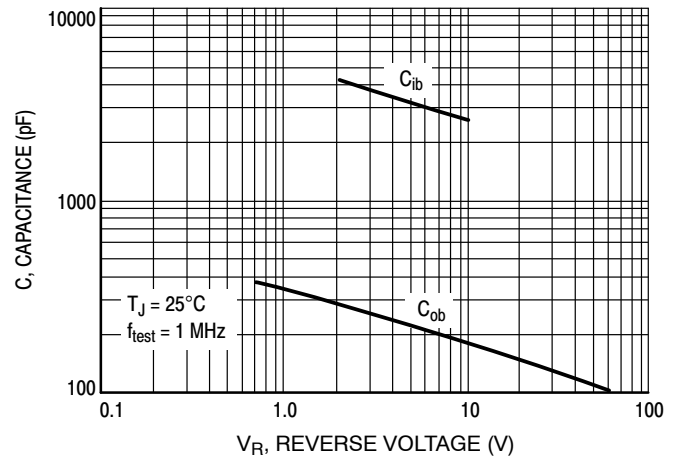


Figure 15. MJL21196 Typical Capacitance

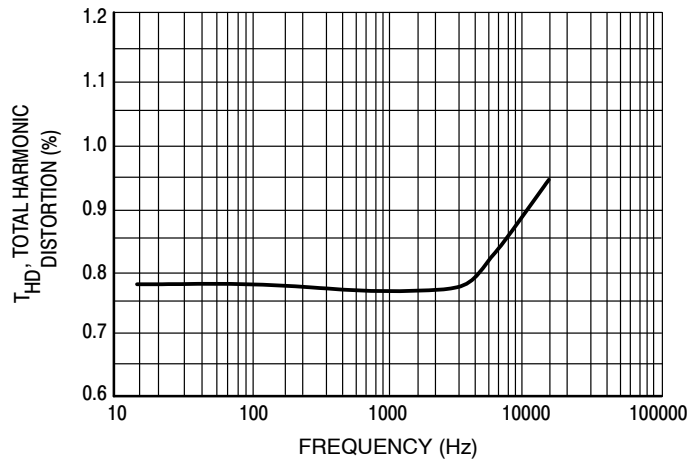


Figure 16. Typical Total Harmonic Distortion

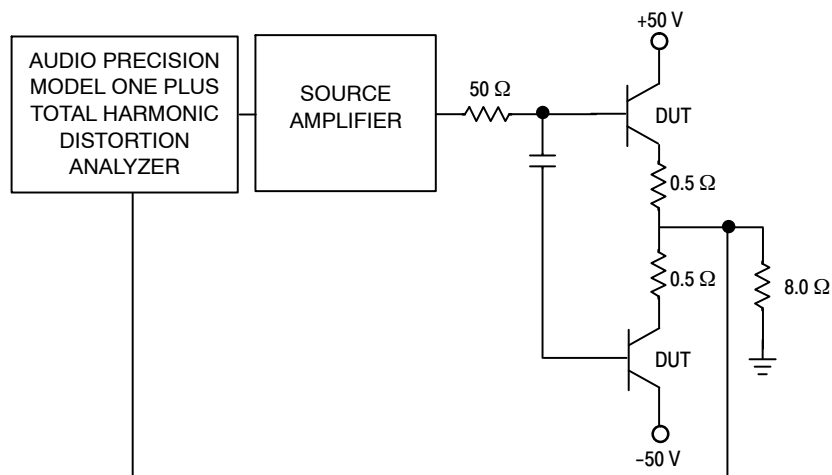
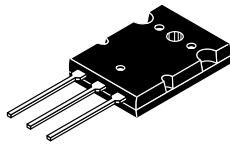


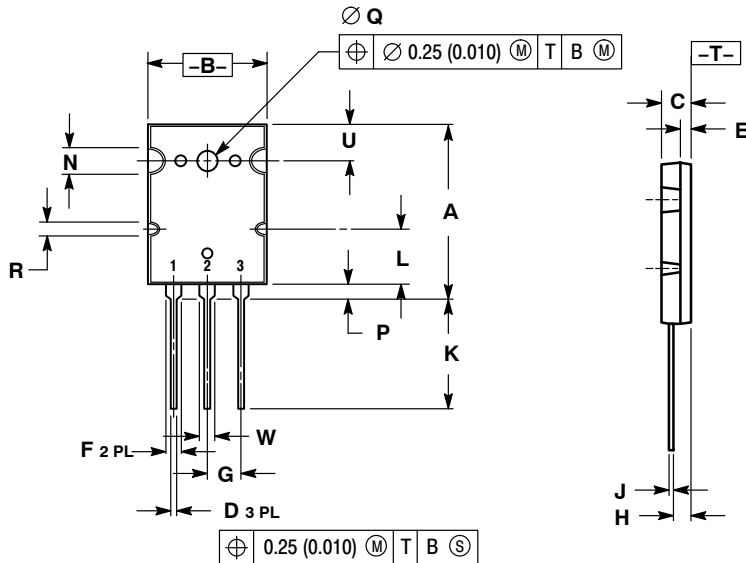
Figure 17. Total Harmonic Distortion Test Circuit



TO-3BPL (TO-264)  
CASE 340G-02  
ISSUE J

DATE 17 DEC 2004

SCALE 1:2



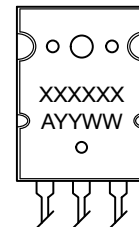
NOTES:

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

| DIM | 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   | 11.2 REF |      | 0.411 REF |       |
| N   | 4.35 REF |      | 0.172 REF |       |
| P   | 2.2      | 2.6  | 0.087     | 0.102 |
| Q   | 3.1      | 3.5  | 0.122     | 0.137 |
| R   | 2.25 REF |      | 0.089 REF |       |
| U   | 6.3 REF  |      | 0.248 REF |       |
| W   | 2.8      | 3.2  | 0.110     | 0.125 |

GENERIC  
MARKING DIAGRAM\*

- STYLE 1:  
PIN 1. GATE  
2. DRAIN  
3. SOURCE
- STYLE 2:  
PIN 1. BASE  
2. COLLECTOR  
3. EMITTER
- STYLE 3:  
PIN 1. GATE  
2. SOURCE  
3. DRAIN
- STYLE 4:  
PIN 1. DRAIN  
2. SOURCE  
3. GATE
- STYLE 5:  
PIN 1. GATE  
2. COLLECTOR  
3. EMITTER



XXXXXX = Specific Device Code  
A = Location Code  
YY = Year  
WW = Work Week

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

|                  |                  |                                                                                                                                                                                  |
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