

# Silicon Power Transistors

## MJW21193 (PNP) MJW21194 (NPN)

The MJW21193 and MJW21194 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
- 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  | $V_{EBO}$      | 5.0             | 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   | $I_B$          | 5.0             | Adc                      |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$<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<br>+150 | $^\circ\text{C}$         |

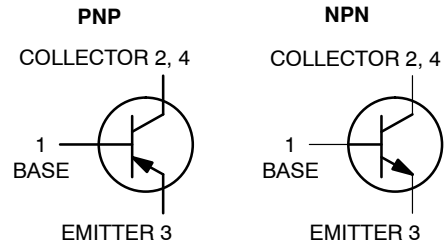
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Pulse Test: Pulse Width = 5  $\mu\text{s}$ , Duty Cycle  $\leq 10\%$ .

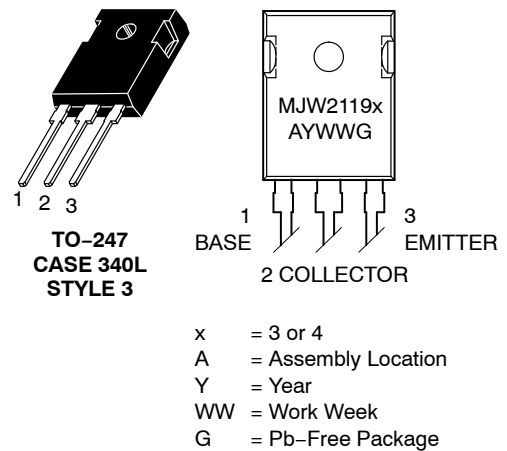
### THERMAL CHARACTERISTICS

| Characteristic                             | Symbol          | Max | Unit               |
|--|-----------------|-----|--------------------|
| Thermal Resistance,<br>Junction-to-Case    | $R_{\theta JC}$ | 0.7 | $^\circ\text{C/W}$ |
| Thermal Resistance,<br>Junction-to-Ambient | $R_{\theta JA}$ | 40  | $^\circ\text{C/W}$ |

## 16 AMPERES COMPLEMENTARY SILICON POWER TRANSISTORS 250 VOLTS, 200 WATTS



### MARKING DIAGRAM



### ORDERING INFORMATION

| Device    | Package             | Shipping      |
|-----------|---------------------|---------------|
| MJW21193G | TO-247<br>(Pb-Free) | 30 Units/Rail |
| MJW21194G | TO-247<br>(Pb-Free) | 30 Units/Rail |

# MJW21193 (PNP) MJW21194 (NPN)

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

### OFF CHARACTERISTICS

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

|   |           |             |        |        |     |
|---|-----------|-------------|--------|--------|-----|
| 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>– | Adc |
|---|-----------|-------------|--------|--------|-----|

### ON CHARACTERISTICS

|   |               |         |        |          |     |
|---|---------------|---------|--------|----------|-----|
| DC Current Gain<br>( $I_C = 8\text{ Adc}$ , $V_{CE} = 5\text{ Vdc}$ )<br>( $I_C = 16\text{ Adc}$ , $I_B = 5\text{ Adc}$ )                       | $h_{FE}$      | 20<br>8 | –<br>– | 80<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

|  |          |        |             |        |     |
|--|----------|--------|-------------|--------|-----|
| 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>( $I_C = 1\text{ Adc}$ , $V_{CE} = 10\text{ Vdc}$ , $f_{test} = 1\text{ MHz}$ )  | $f_T$    | 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.

PNP MJW21193

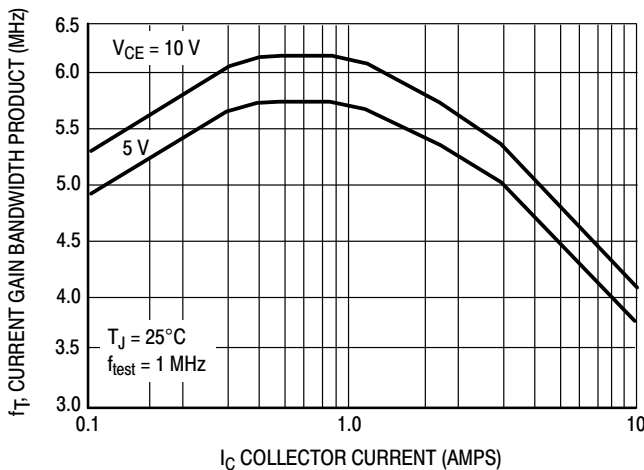


Figure 1. Typical Current Gain Bandwidth Product

NPN MJW21194

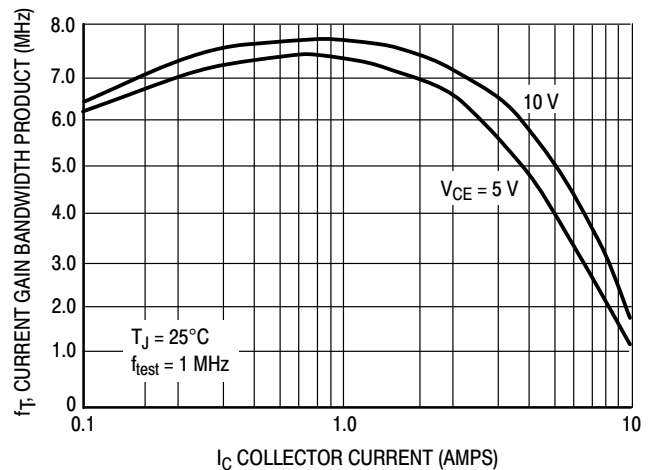


Figure 2. Typical Current Gain Bandwidth Product

# MJW21193 (PNP) MJW21194 (NPN)

## TYPICAL CHARACTERISTICS

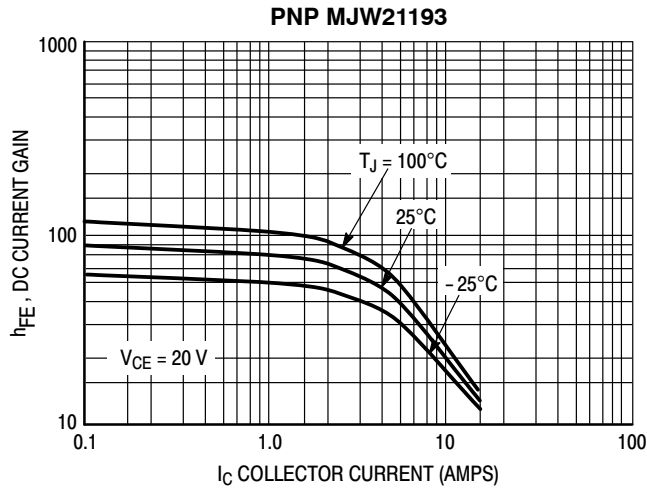


Figure 3. DC Current Gain,  $V_{CE} = 20\text{ V}$

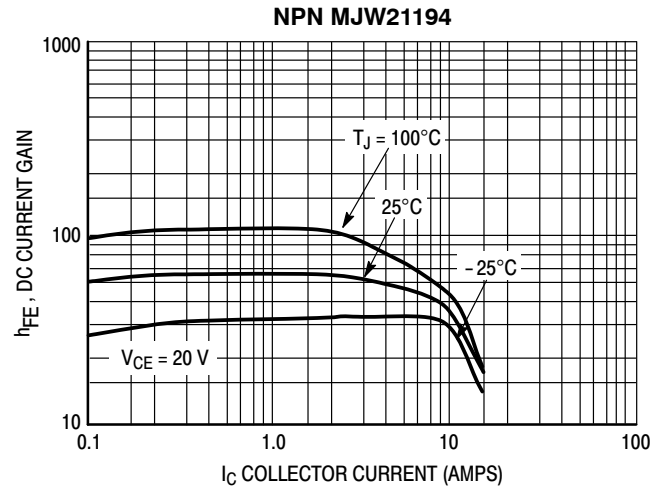


Figure 4. DC Current Gain,  $V_{CE} = 20\text{ V}$

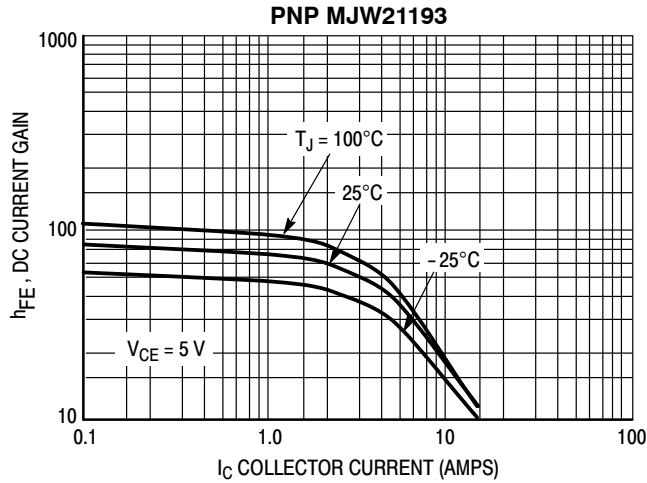


Figure 5. DC Current Gain,  $V_{CE} = 5\text{ V}$

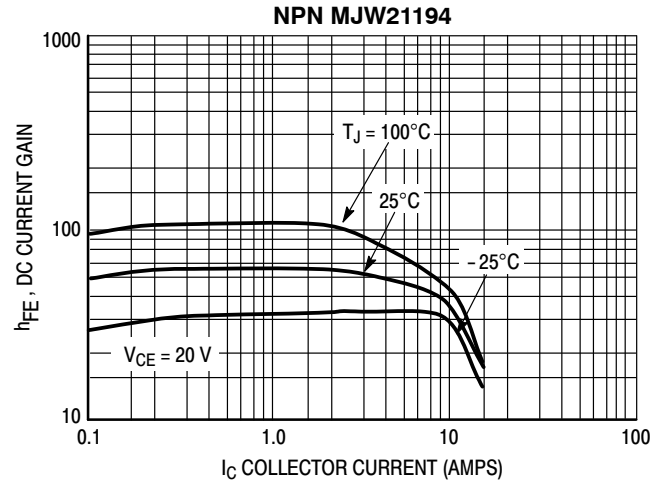


Figure 6. DC Current Gain,  $V_{CE} = 5\text{ V}$

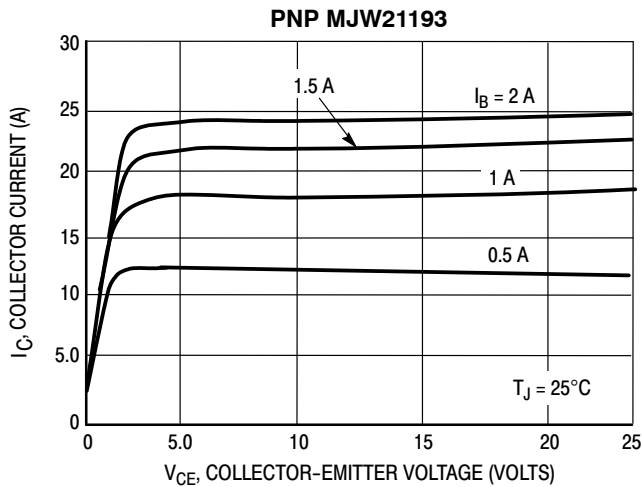


Figure 7. Typical Output Characteristics

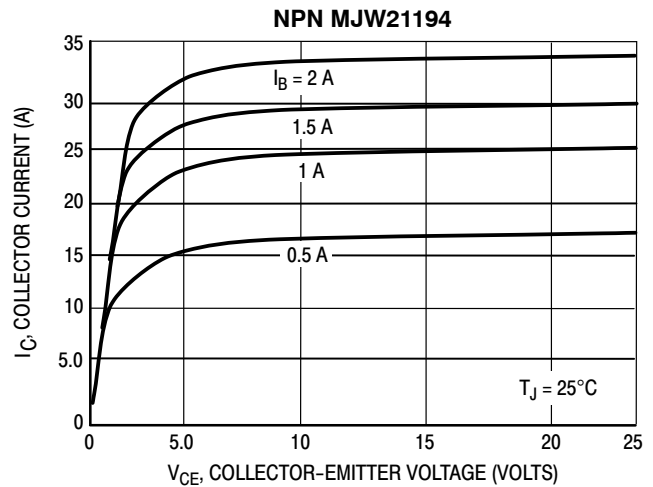


Figure 8. Typical Output Characteristics

# MJW21193 (PNP) MJW21194 (NPN)

## TYPICAL CHARACTERISTICS (continued)

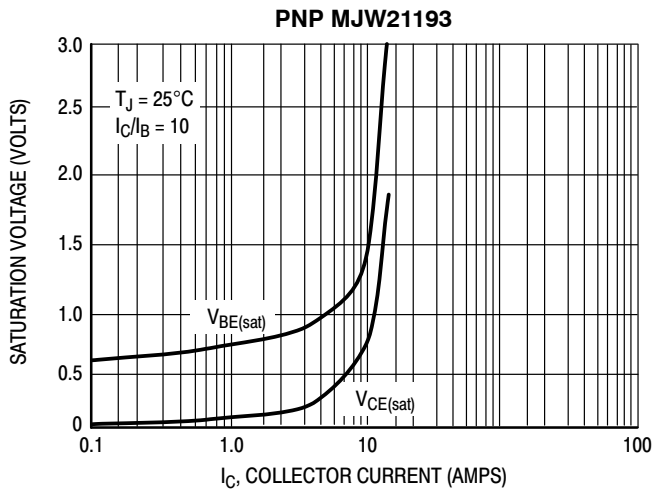


Figure 9. Typical Saturation Voltages

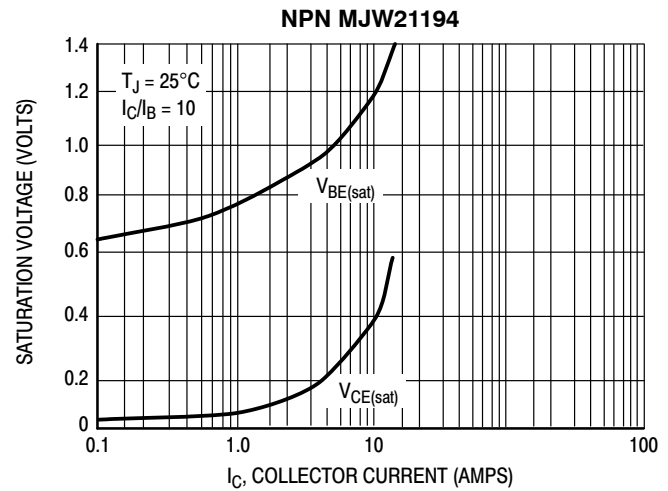


Figure 10. Typical Saturation Voltages

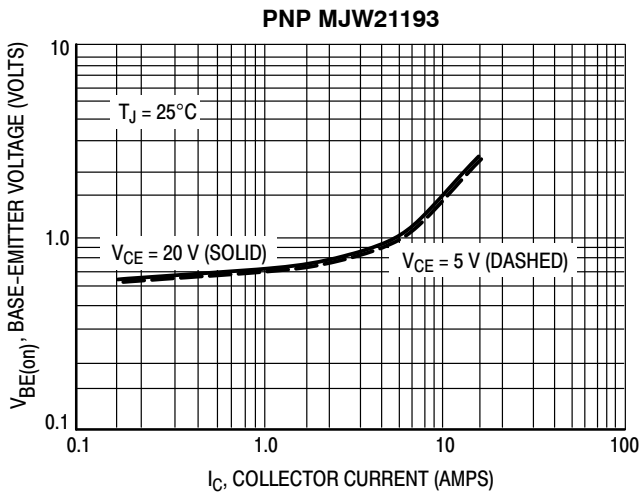


Figure 11. Typical Base-Emitter Voltage

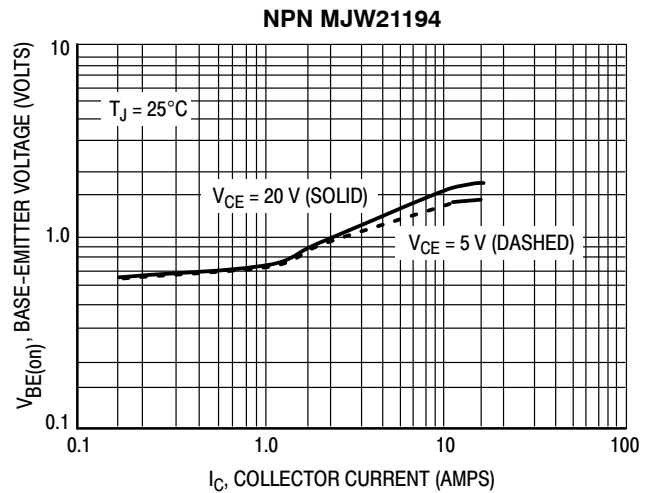


Figure 12. Typical Base-Emitter Voltage

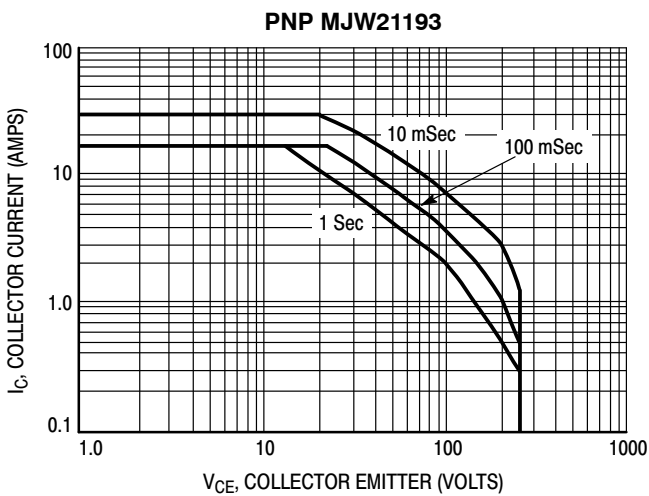


Figure 13. Active Region Safe Operating Area

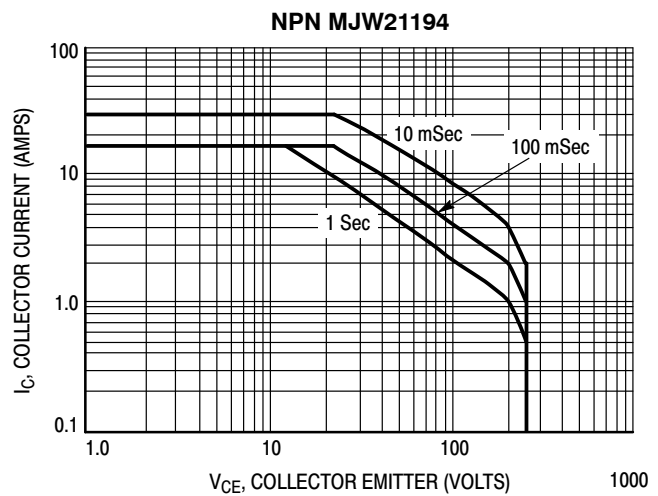


Figure 14. Active Region Safe Operating Area

## MJW21193 (PNP) MJW21194 (NPN)

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.

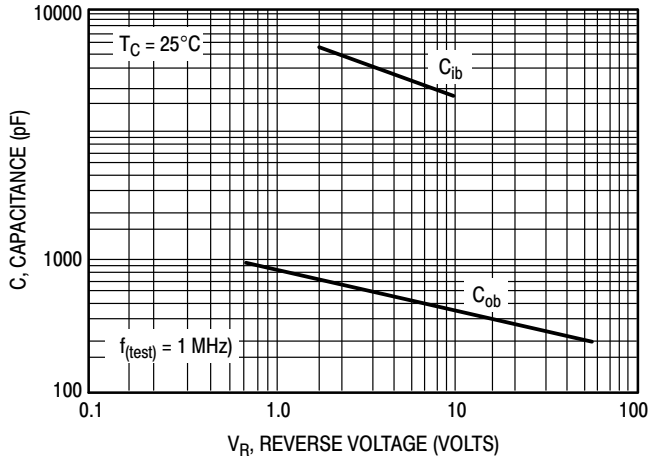


Figure 15. MJW21193 Typical Capacitance

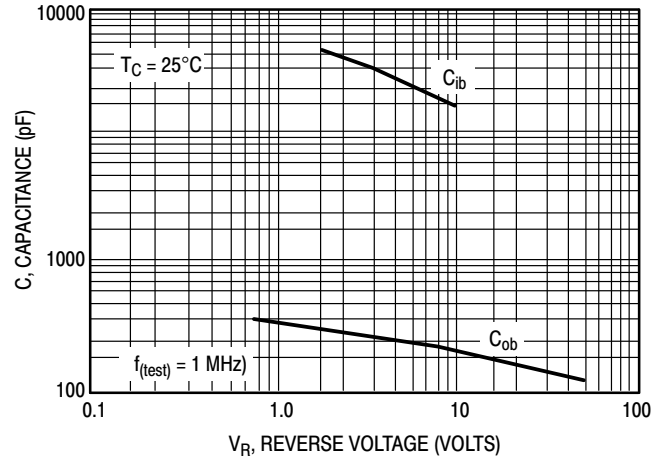


Figure 16. MJW21194 Typical Capacitance

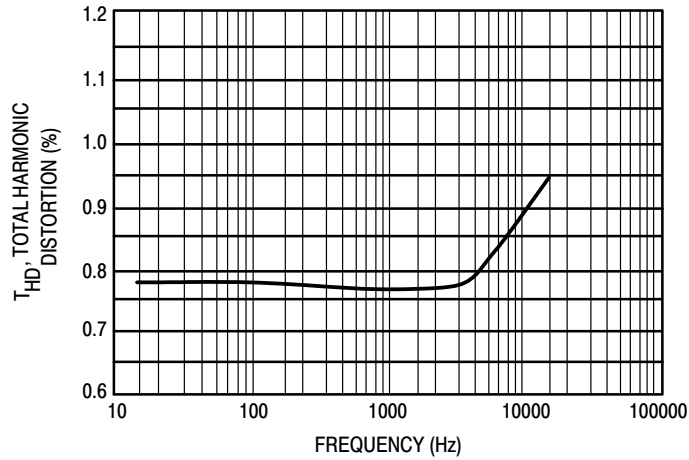


Figure 17. Typical Total Harmonic Distortion

MJW21193 (PNP) MJW21194 (NPN)

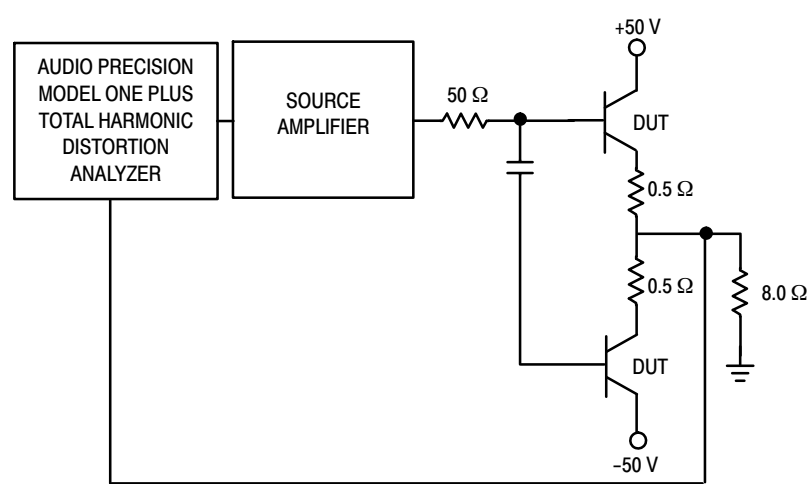
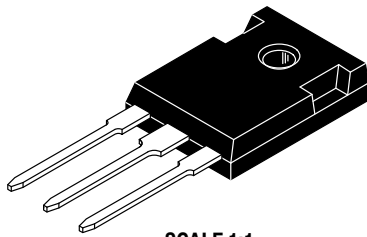


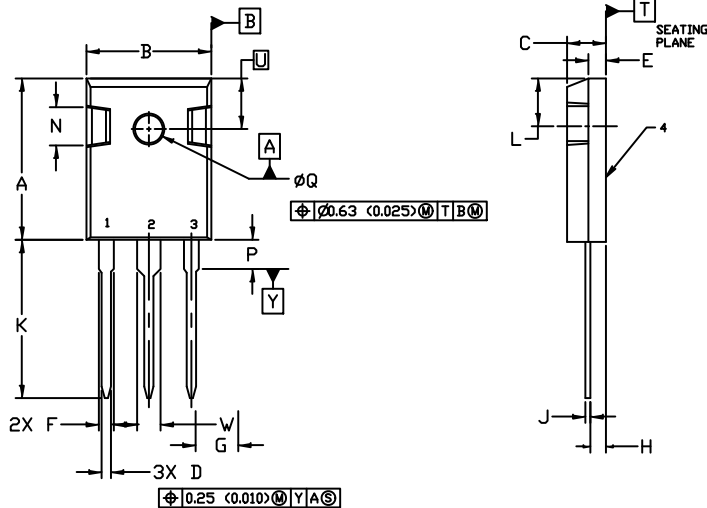
Figure 18. Total Harmonic Distortion Test Circuit



**TO-247**  
**CASE 340L**  
**ISSUE G**

DATE 06 OCT 2021

SCALE 1:1

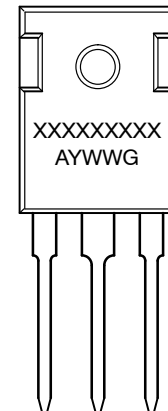


**NOTES:**

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

|     | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
| DIM | MIN.        | MAX.  | MIN.      | MAX.  |
| A   | 20.32       | 21.08 | 0.800     | 0.830 |
| B   | 15.75       | 16.26 | 0.620     | 0.640 |
| C   | 4.70        | 5.30  | 0.185     | 0.209 |
| D   | 1.00        | 1.40  | 0.040     | 0.055 |
| E   | 1.90        | 2.60  | 0.075     | 0.102 |
| F   | 1.65        | 2.13  | 0.065     | 0.084 |
| G   | 5.45 BSC    |       | 0.215 BSC |       |
| H   | 1.50        | 2.49  | 0.059     | 0.098 |
| J   | 0.40        | 0.80  | 0.016     | 0.031 |
| K   | 19.81       | 20.83 | 0.780     | 0.820 |
| L   | 5.40        | 6.20  | 0.212     | 0.244 |
| N   | 4.32        | 5.49  | 0.170     | 0.216 |
| P   | ----        | 4.50  | ----      | 0.177 |
| Q   | 3.55        | 3.65  | 0.140     | 0.144 |
| U   | 6.15 BSC    |       | 0.242 BSC |       |
| W   | 2.87        | 3.12  | 0.113     | 0.123 |

**GENERIC**  
**MARKING DIAGRAM\***



|   |   |   |   |
|---|---|---|---|
| STYLE 1:<br>PIN 1. GATE<br>2. DRAIN<br>3. SOURCE<br>4. DRAIN  | STYLE 2:<br>PIN 1. ANODE<br>2. CATHODE (S)<br>3. ANODE 2<br>4. CATHODE (S)                | STYLE 3:<br>PIN 1. BASE<br>2. COLLECTOR<br>3. EMITTER<br>4. COLLECTOR | STYLE 4:<br>PIN 1. GATE<br>2. COLLECTOR<br>3. EMITTER<br>4. COLLECTOR |
| STYLE 5:<br>PIN 1. CATHODE<br>2. ANODE<br>3. GATE<br>4. ANODE | STYLE 6:<br>PIN 1. MAIN TERMINAL 1<br>2. MAIN TERMINAL 2<br>3. GATE<br>4. MAIN TERMINAL 2 |   |   |

XXXXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb-Free Package

\*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. Some products may not follow the Generic Marking.

|                         |                    |  |
|-------------------------|--------------------|--|
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