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# NJW21193G (PNP) NJW21194G (NPN)

## Silicon Power Transistors

The NJW21193G and NJW21194G 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>1.6      | 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 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.

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

### THERMAL CHARACTERISTICS

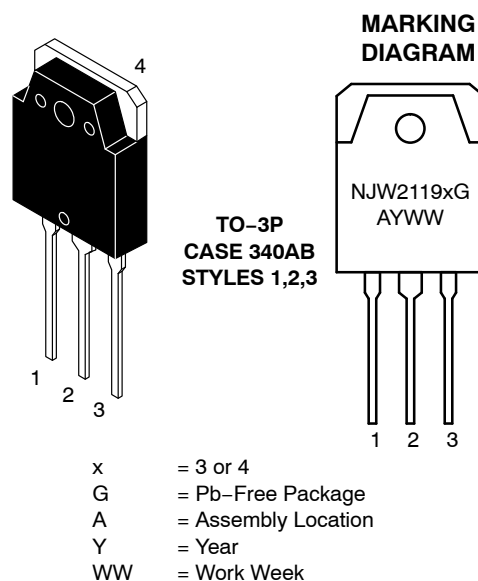
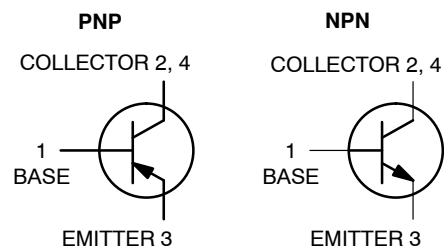
| Characteristic                             | Symbol          | Max   | Unit                      |
|--------------------------------------------|-----------------|-------|---------------------------|
| Thermal Resistance,<br>Junction-to-Case    | $R_{\theta JC}$ | 0.625 | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance,<br>Junction-to-Ambient | $R_{\theta JA}$ | 40    | $^\circ\text{C}/\text{W}$ |



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



### ORDERING INFORMATION

| Device    | Package            | Shipping      |
|-----------|--------------------|---------------|
| NJW21193G | TO-3P<br>(Pb-Free) | 30 Units/Rail |
| NJW21194G | TO-3P<br>(Pb-Free) | 30 Units/Rail |

# NJW21193G (PNP) NJW21194G (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>( $I_C = 100\text{ mAdc}$ , $I_B = 0$ )            | $V_{CEO(sus)}$ | 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

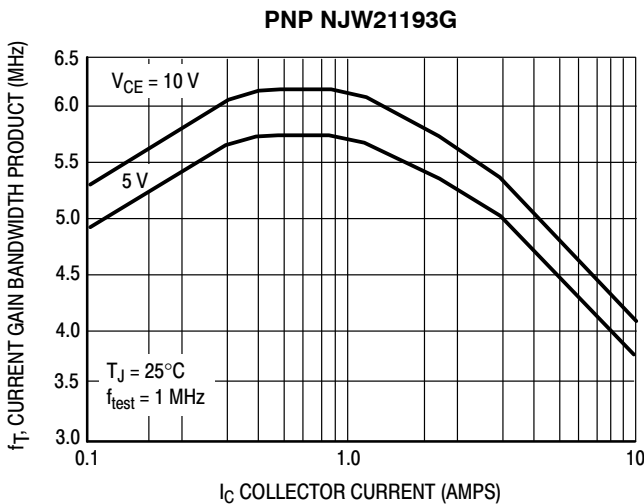
|                                                                                                                                                                                                   |           |             |        |        |     |
|-------------------------------------------------------------------------------------------------------------------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

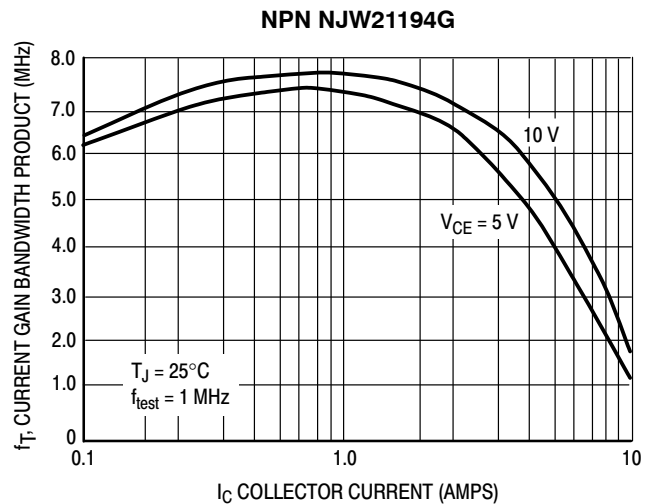
|                                                                                                                                                 |               |         |        |          |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------|--------|----------|-----|
| 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>$V_{RMS} = 28.3\text{ V}$ , $f = 1\text{ kHz}$ , $P_{LOAD} = 100\text{ WRMS}$<br><br>(Matched pair $h_{FE} = 50 @ 5\text{ A/5 V}$ ) | $T_{HD}$ | - | 0.8<br>0.08 | -<br>- | %<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     |



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

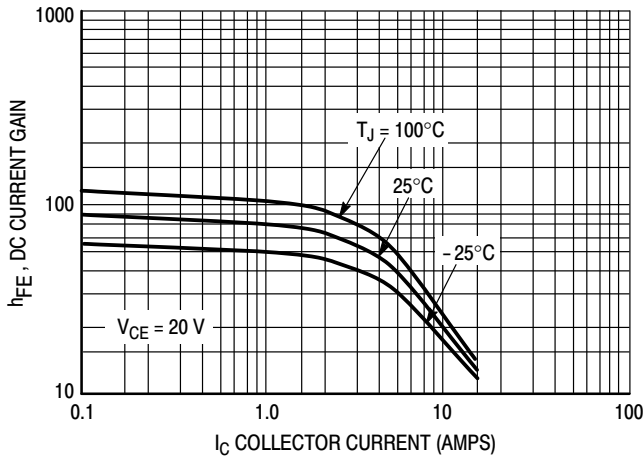


**Figure 2. Typical Current Gain Bandwidth Product**

# NJW21193G (PNP) NJW21194G (NPN)

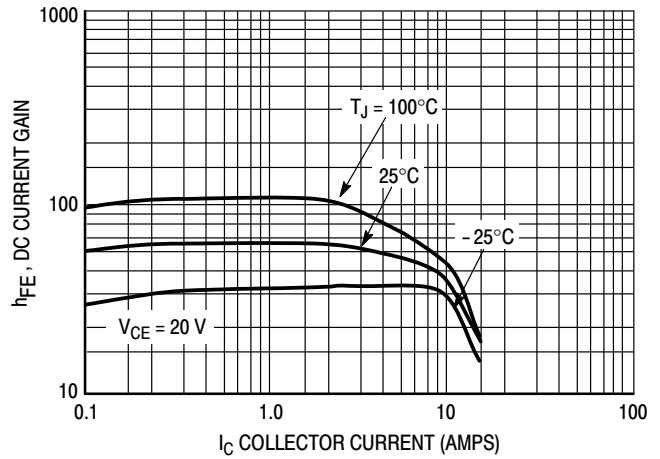
## TYPICAL CHARACTERISTICS

**PNP NJW21193G**



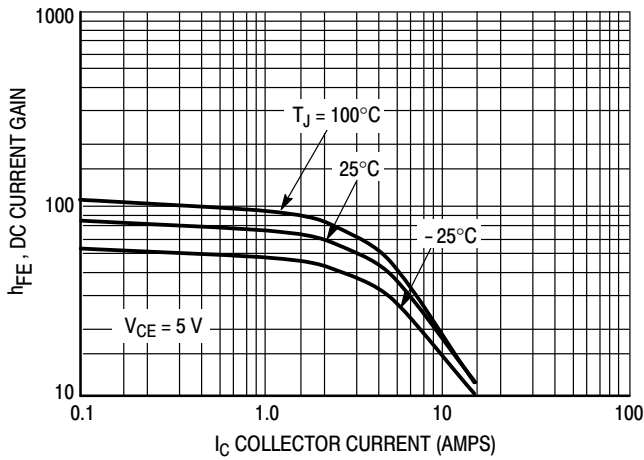
**Figure 3. DC Current Gain,  $V_{CE} = 20\text{ V}$**

**NPN NJW21194G**



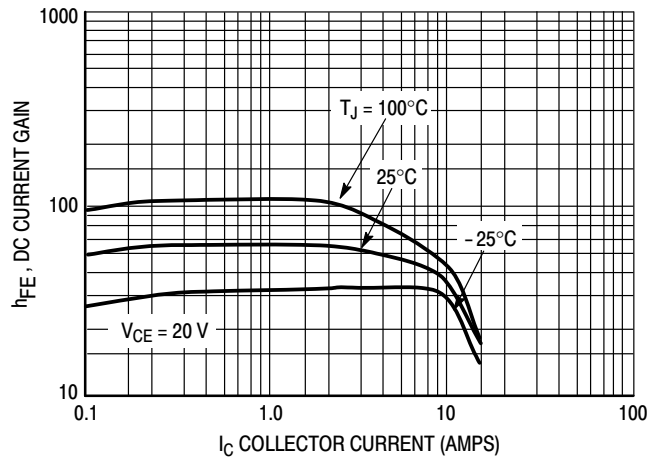
**Figure 4. DC Current Gain,  $V_{CE} = 20\text{ V}$**

**PNP NJW21193G**



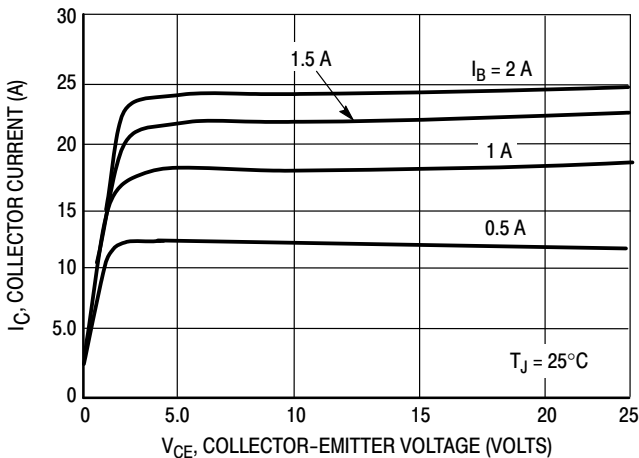
**Figure 5. DC Current Gain,  $V_{CE} = 5\text{ V}$**

**NPN NJW21194G**



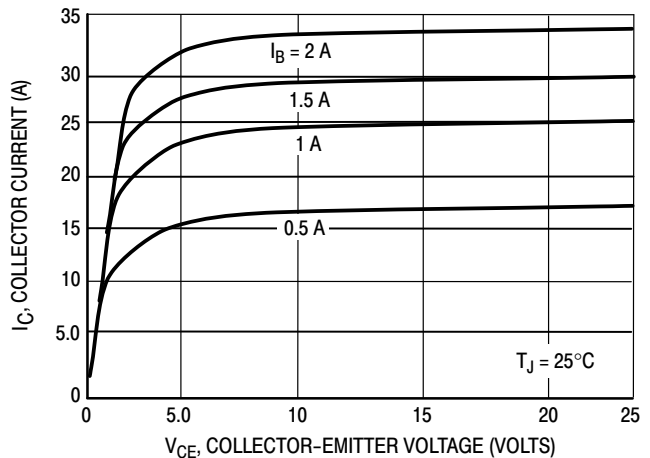
**Figure 6. DC Current Gain,  $V_{CE} = 5\text{ V}$**

**PNP NJW21193G**



**Figure 7. Typical Output Characteristics**

**NPN NJW21194G**



**Figure 8. Typical Output Characteristics**

# NJW21193G (PNP) NJW21194G (NPN)

## TYPICAL CHARACTERISTICS

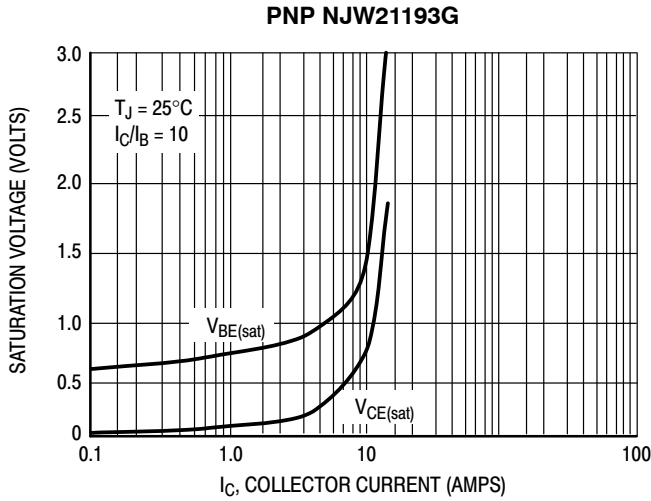


Figure 9. Typical Saturation Voltages

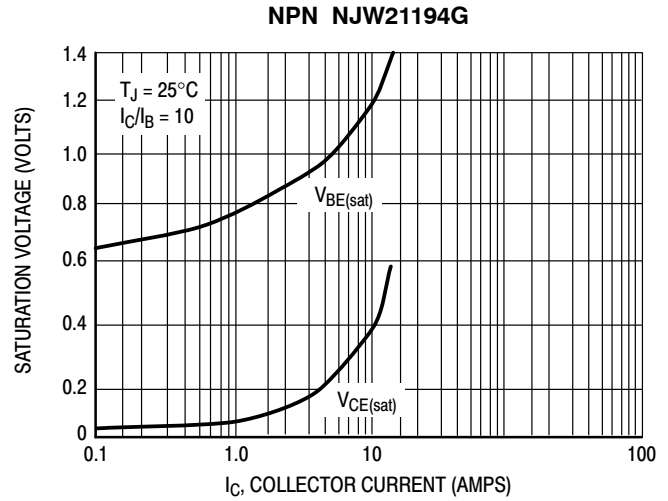


Figure 10. Typical Saturation Voltages

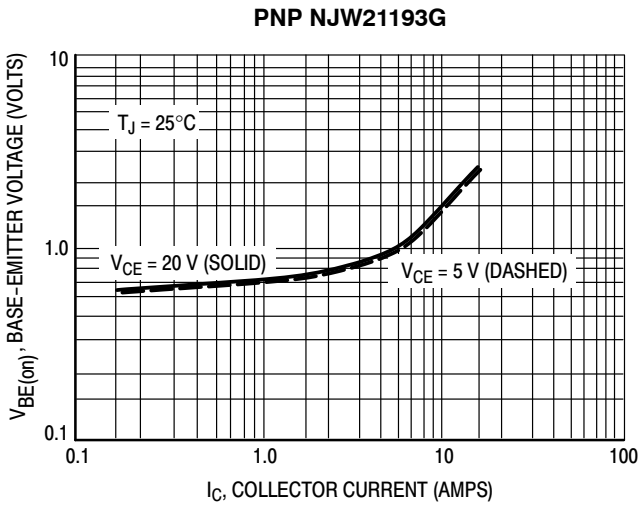


Figure 11. Typical Base-Emitter Voltage

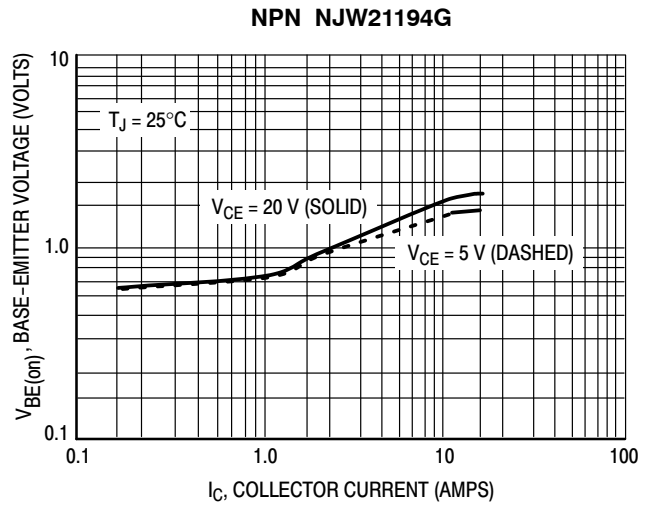


Figure 12. Typical Base-Emitter Voltage

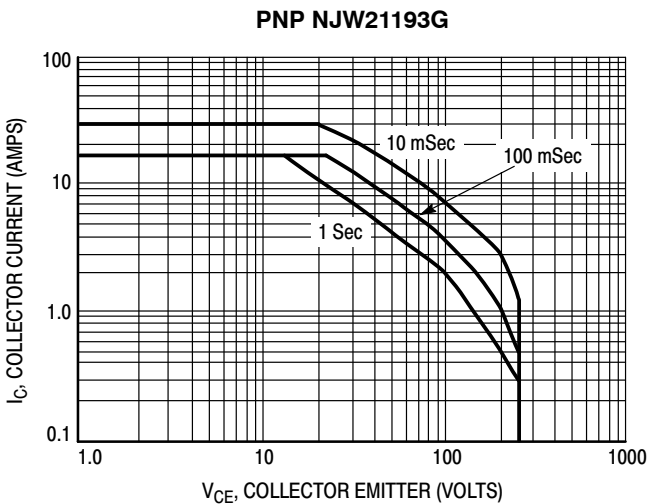


Figure 13. Active Region Safe Operating Area

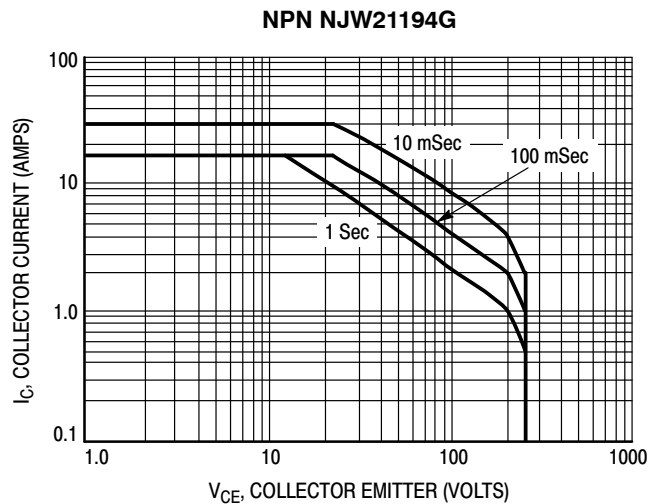


Figure 14. Active Region Safe Operating Area

## NJW21193G (PNP) NJW21194G (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.

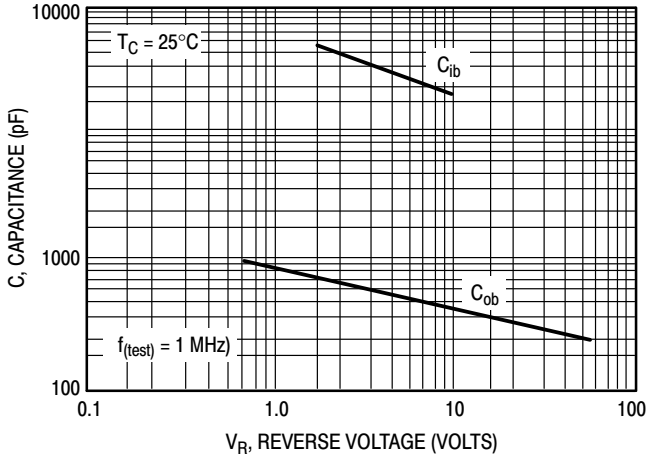


Figure 15. NJW21193G Typical Capacitance

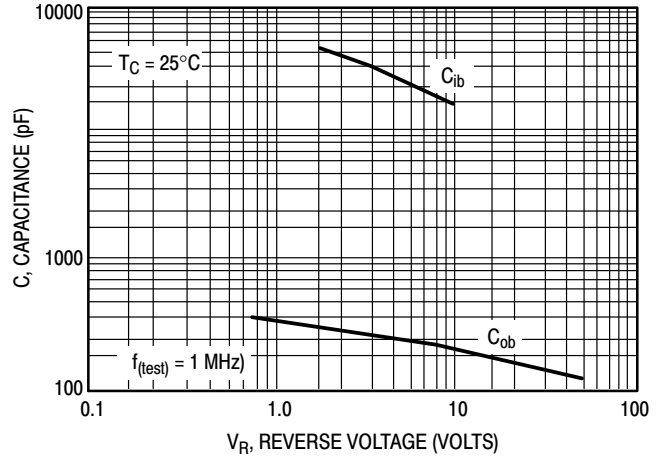


Figure 16. NJW21194G Typical Capacitance

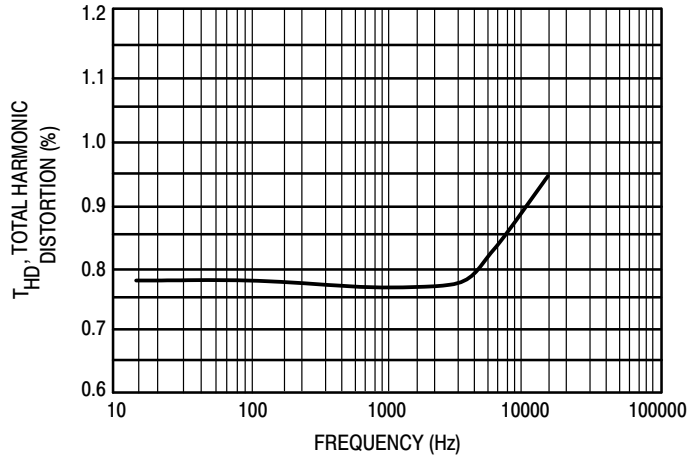
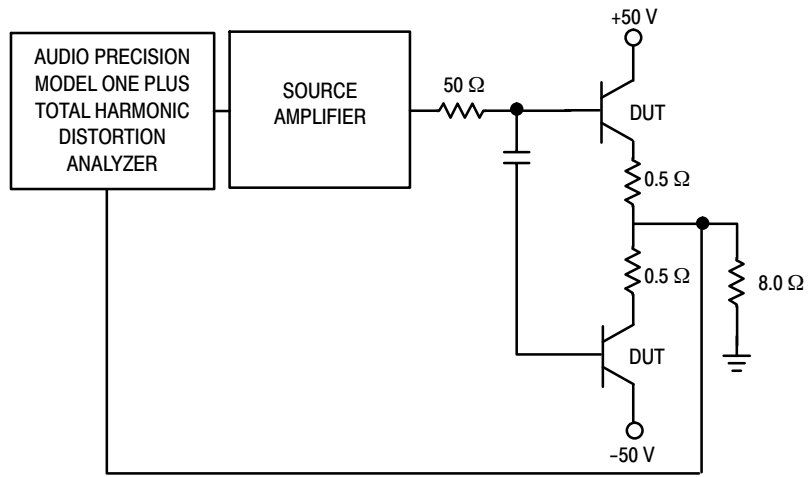


Figure 17. Typical Total Harmonic Distortion

**NJW21193G (PNP) NJW21194G (NPN)**



**Figure 18. Total Harmonic Distortion Test Circuit**

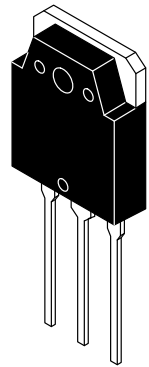
# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

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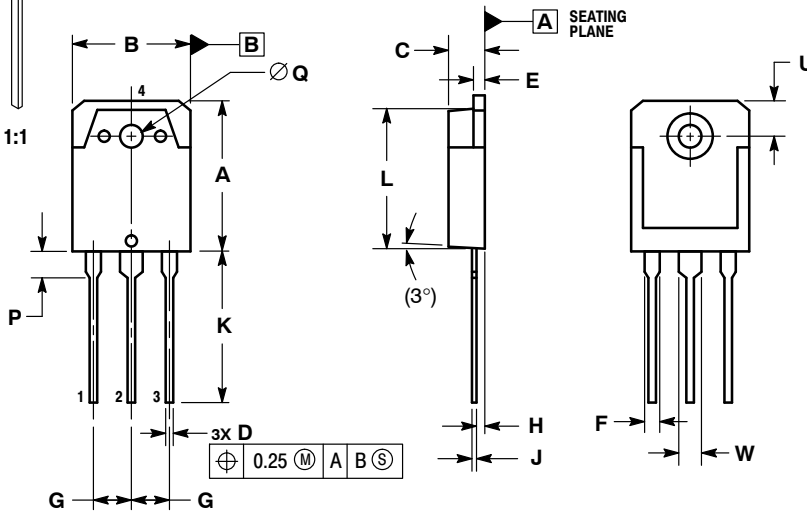


## TO-3P-3LD CASE 340AB-01 ISSUE A

DATE 30 OCT 2007



SCALE 1:1



**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30mm FROM THE TERMINAL TIP.
4. DIMENSION A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM | MILLIMETERS |       |       |
|-----|-------------|-------|-------|
|     | MIN         | NOM   | MAX   |
| A   | 19.70       | 19.90 | 20.10 |
| B   | 15.40       | 15.60 | 15.80 |
| C   | 4.60        | 4.80  | 5.00  |
| D   | 0.80        | 1.00  | 1.20  |
| E   | 1.45        | 1.50  | 1.65  |
| F   | 1.80        | 2.00  | 2.20  |
| G   | 5.45 BSC    |       |       |
| H   | 1.20        | 1.40  | 1.60  |
| J   | 0.55        | 0.60  | 0.75  |
| K   | 19.80       | 20.00 | 20.20 |
| L   | 18.50       | 18.70 | 18.90 |
| P   | 3.30        | 3.50  | 3.70  |
| Q   | 3.10        | 3.20  | 3.50  |
| U   | 5.00 REF    |       |       |
| W   | 2.80        | 3.00  | 3.20  |

**STYLE 1:**

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

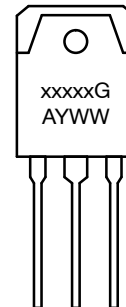
**STYLE 2:**

- PIN 1. ANODE
- 2. CATHODE
- 3. ANODE
- 4. CATHODE

**STYLE 3:**

- PIN 1. GATE
- 2. DRAIN
- 3. SOURCE
- 4. DRAIN

### GENERIC MARKING DIAGRAM\*



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

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

|                         |                    |                                                                                                                                                                                  |
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