

# 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 –  

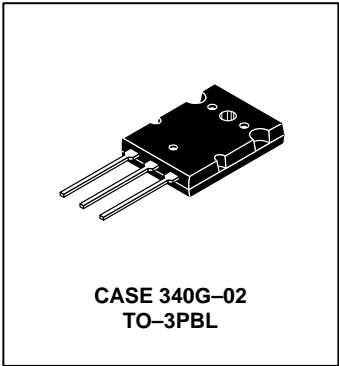
$$h_{FE} = 25 \text{ Min @ } I_C$$

$$= 8 \text{ Adc}$$
- 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 Peak (1)	I <sub>C</sub>	16 30	Adc
Base Current – Continuous	I <sub>B</sub>	5	Adc
Total Power Dissipation @ T <sub>C</sub> = 25°C Derate Above 25°C	P <sub>D</sub>	200 1.43	Watts W/°C
Operating and Storage Junction Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	–65 to +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
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## OFF CHARACTERISTICS

Collector–Emitter Sustaining Voltage (I <sub>C</sub> = 100 mAdc, I <sub>B</sub> = 0)	V <sub>CEO(sus)</sub>	250	—	—	Vdc
Collector Cutoff Current (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
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### OFF CHARACTERISTICS

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

### SECOND BREAKDOWN

Second Breakdown Collector Current with Base Forward Biased ( $V_{CE} = 50\text{ Vdc}$ , $t = 1\text{ s}$ (non-repetitive)) ( $V_{CE} = 80\text{ Vdc}$ , $t = 1\text{ s}$ (non-repetitive))	$I_{S/b}$	4.0 2.25	— —	— —	A <sub>dc</sub>
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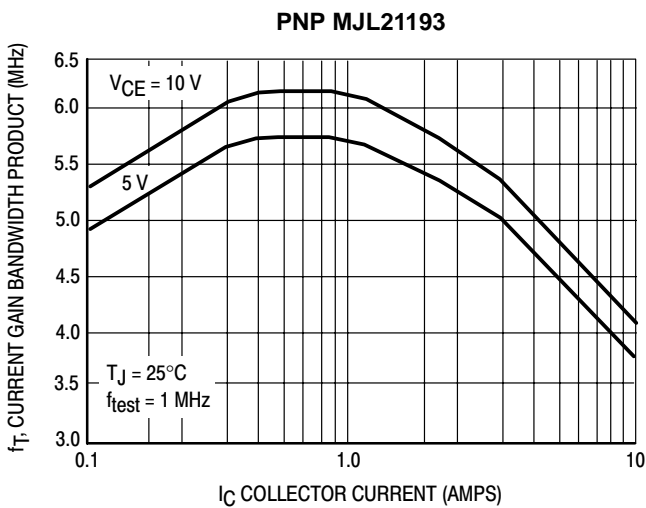
### ON CHARACTERISTICS

DC Current Gain ( $I_C = 8\text{ Adc}$ , $V_{CE} = 5\text{ Vdc}$ ) ( $I_C = 16\text{ Adc}$ , $I_B = 5\text{ Adc}$ )	$h_{FE}$	25 8	— —	75 —	
Base-Emitter On Voltage ( $I_C = 8\text{ Adc}$ , $V_{CE} = 5\text{ Vdc}$ )	$V_{BE(\text{on})}$	—	—	2.2	V <sub>dc</sub>
Collector-Emitter Saturation Voltage ( $I_C = 8\text{ Adc}$ , $I_B = 0.8\text{ Adc}$ ) ( $I_C = 16\text{ Adc}$ , $I_B = 3.2\text{ Adc}$ )	$V_{CE(\text{sat})}$	— —	— —	1.4 4	V <sub>dc</sub>

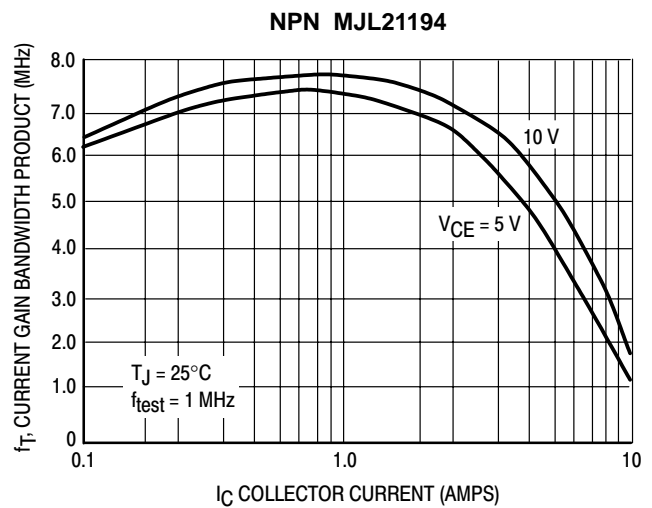
### DYNAMIC CHARACTERISTICS

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

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



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

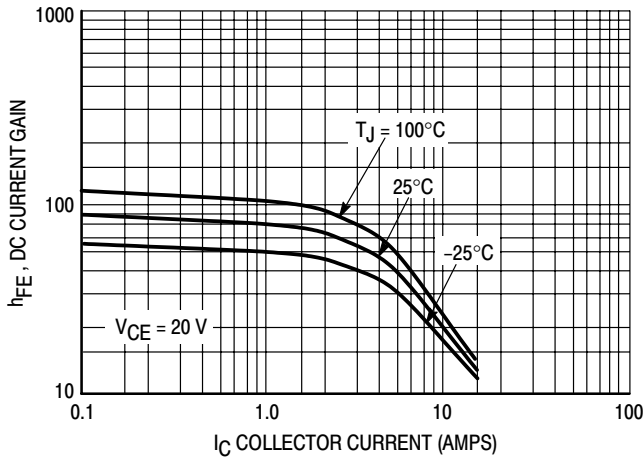


**Figure 2. Typical Current Gain Bandwidth Product**

# MJL21193 MJL21194

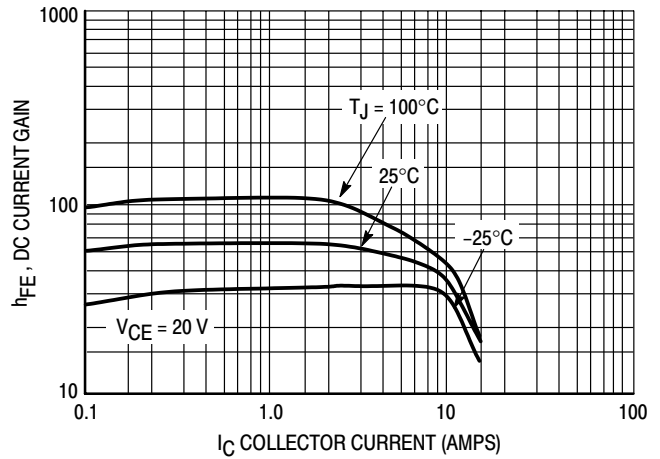
## TYPICAL CHARACTERISTICS

**PNP MJL21193**



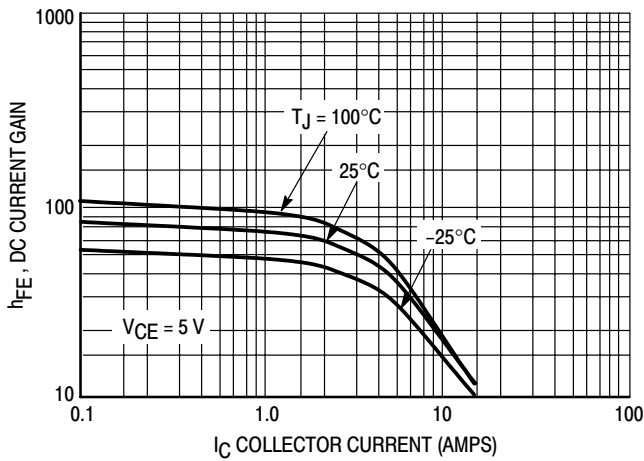
**Figure 3. DC Current Gain,  $V_{CE} = 20$  V**

**NPN MJL21194**



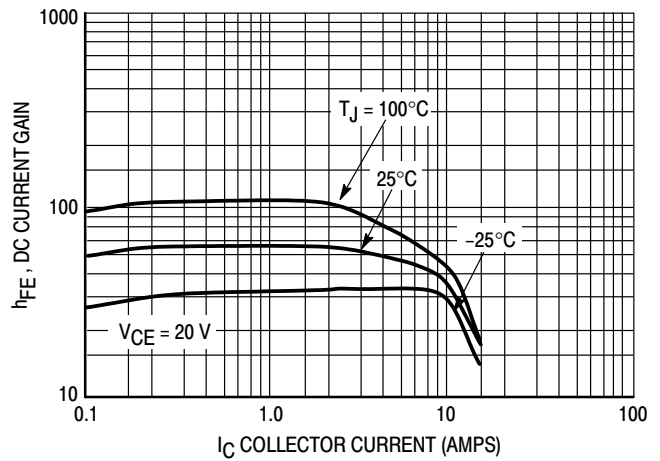
**Figure 4. DC Current Gain,  $V_{CE} = 20$  V**

**PNP MJL21193**



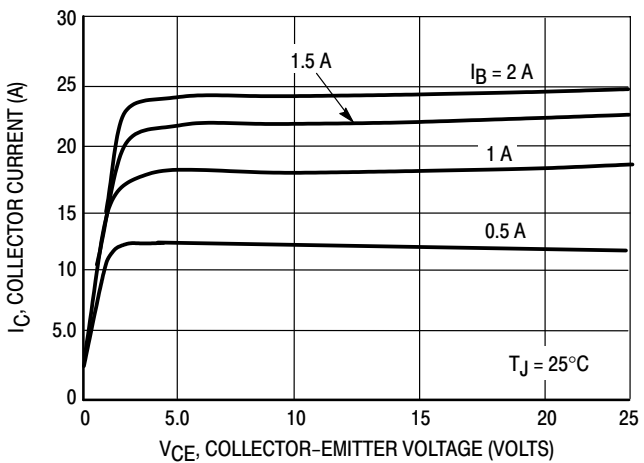
**Figure 5. DC Current Gain,  $V_{CE} = 5$  V**

**NPN MJL21194**

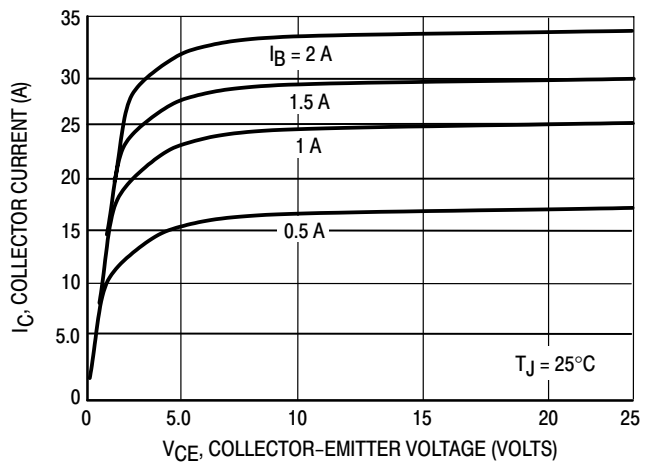


**Figure 6. DC Current Gain,  $V_{CE} = 5$  V**

**PNP MJL21193**



**NPN MJL21194**



TYPICAL CHARACTERISTICS

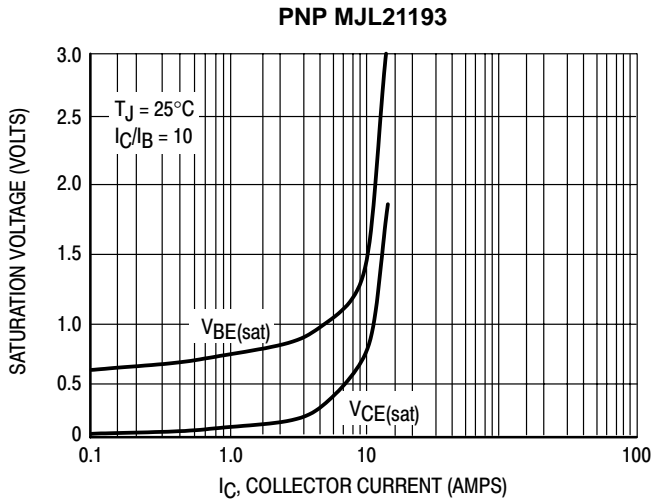


Figure 9. Typical Saturation Voltages

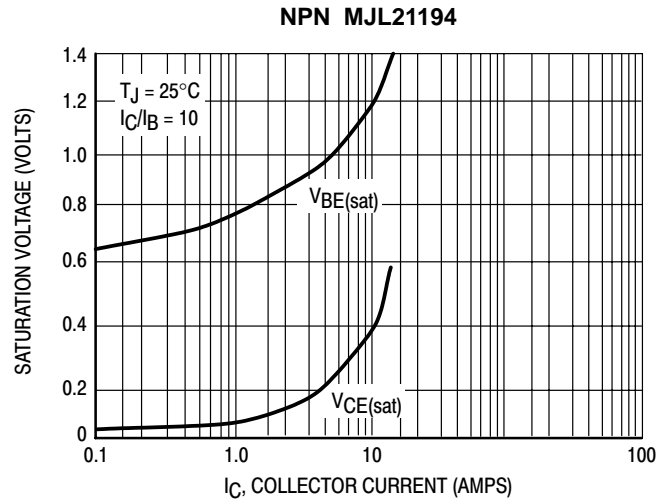


Figure 10. Typical Saturation Voltages

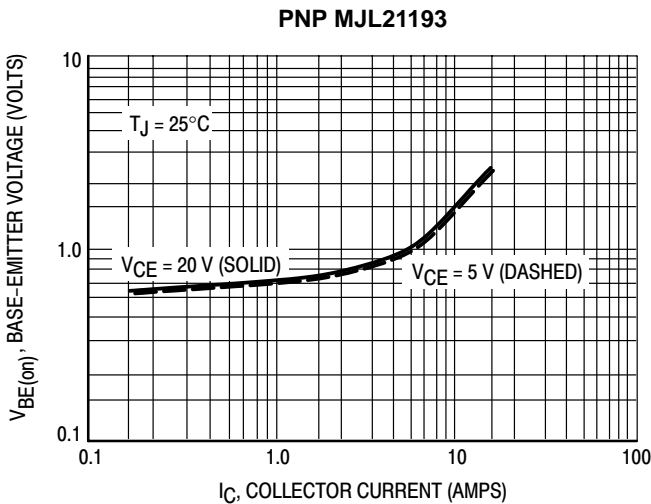


Figure 11. Typical Base-Emitter Voltage

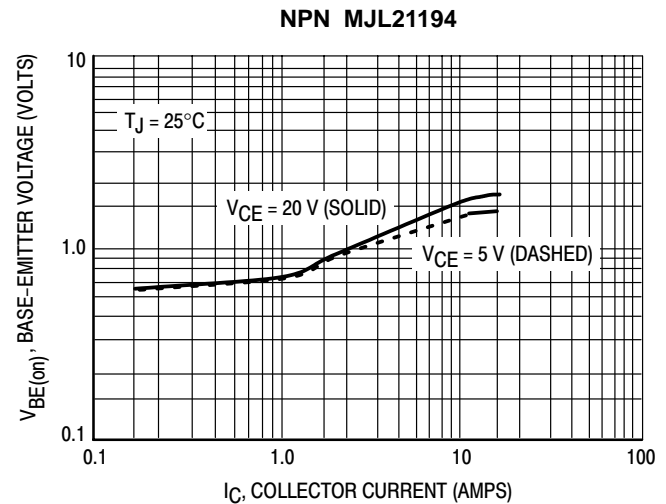


Figure 12. Typical Base-Emitter Voltage

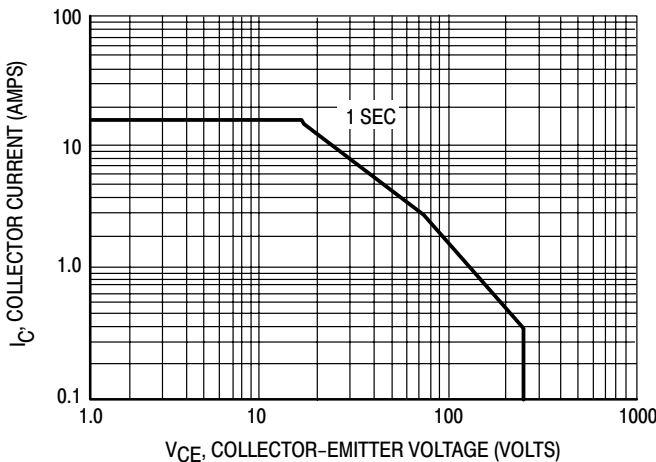


Figure 13. Active Region Safe Operating Area

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

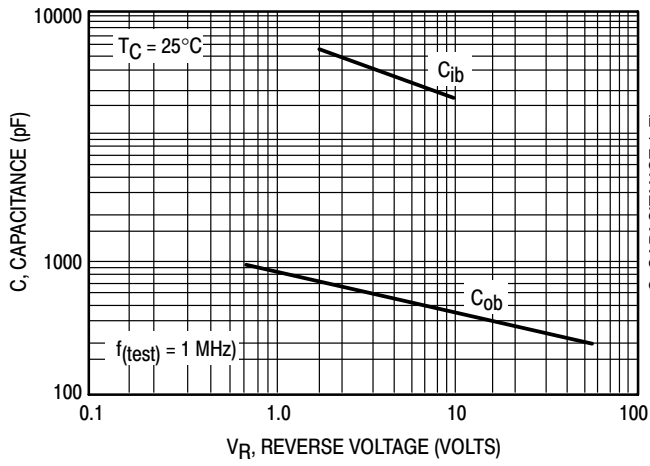


Figure 14. MJL21193 Typical Capacitance

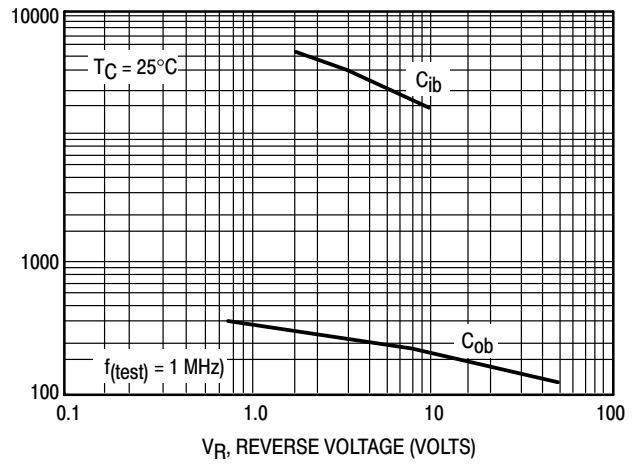


Figure 15. MJL21194 Typical Capacitance

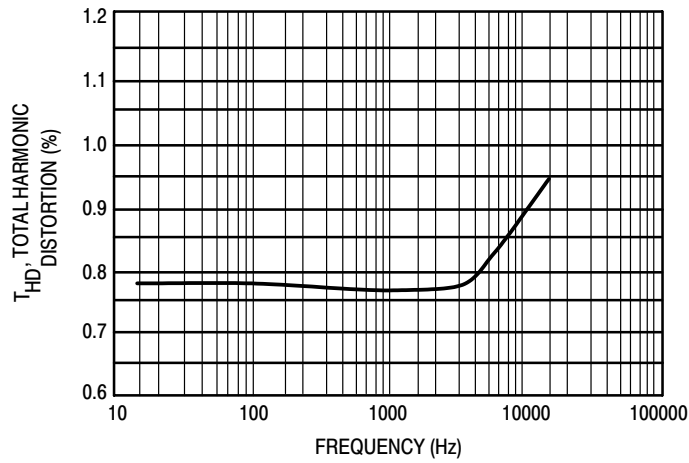


Figure 16. Typical Total Harmonic Distortion

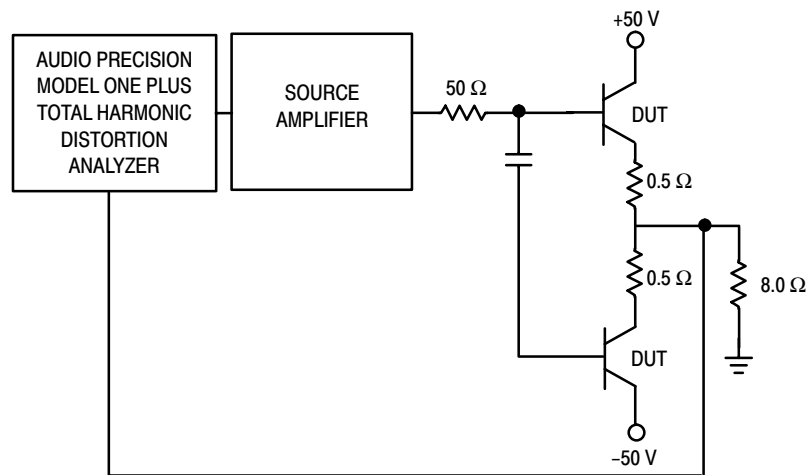


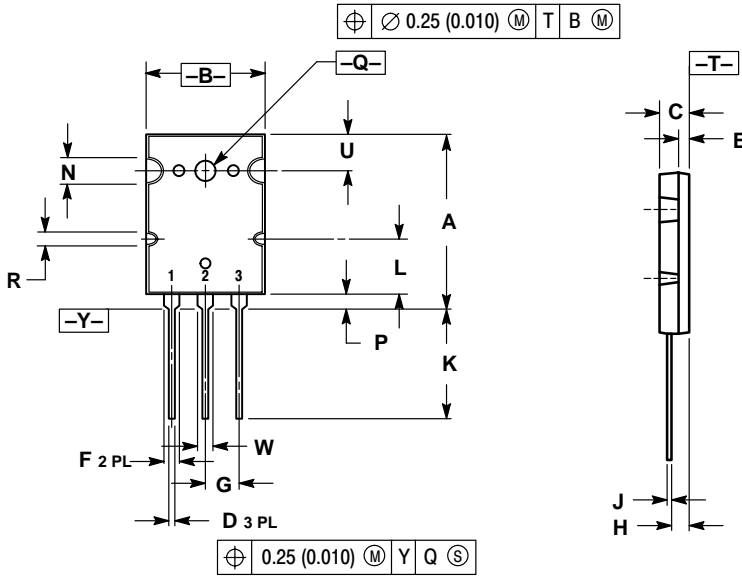
Figure 17. Total Harmonic Distortion Test Circuit

# 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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