

# MJL21193, MJL21194

Preferred Device

## 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.

### Features

- 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
- Pb-Free Packages are Available\*

### 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 Peak (Note 1)	$I_C$	16 30	Adc
Base Current – Continuous	$I_B$	5	Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	200 1.43	W W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +150	$^\circ\text{C}$

### THERMAL CHARACTERISTICS

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

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

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

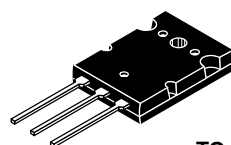


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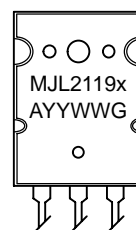
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## 16 AMPERE COMPLEMENTARY SILICON POWER TRANSISTORS 250 VOLTS, 200 WATTS

### MARKING DIAGRAM



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



x = 3 or 4  
A = Assembly Location  
YY = Year  
WW = Work Week  
G = Pb-Free Package

### ORDERING INFORMATION

Device	Package	Shipping†
MJL21193	TO-264	25 Units / Rail
MJL21193G	TO-264 (Pb-Free)	25 Units / Rail
MJL21194	TO-264	25 Units / Rail
MJL21194G	TO-264 (Pb-Free)	25 Units / Rail

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

Preferred devices are recommended choices for future use and best overall value.

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

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
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
Emitter Cutoff Current (V <sub>CE</sub> = 5 Vdc, I <sub>C</sub> = 0)	I <sub>EBO</sub>	–	–	100	μAdc
Collector Cutoff Current (V <sub>CE</sub> = 250 Vdc, V <sub>BE(off)</sub> = 1.5 Vdc)	I <sub>CEX</sub>	–	–	100	μAdc

## SECOND BREAKDOWN

Second Breakdown Collector Current with Base Forward Biased (V <sub>CE</sub> = 50 Vdc, t = 1 s (non-repetitive) (V <sub>CE</sub> = 80 Vdc, t = 1 s (non-repetitive)	I <sub>S/b</sub>	4.0 2.25	– –	– –	Adc
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## ON CHARACTERISTICS

DC Current Gain (I <sub>C</sub> = 8 Adc, V <sub>CE</sub> = 5 Vdc) (I <sub>C</sub> = 16 Adc, I <sub>B</sub> = 5 Adc)	h <sub>FE</sub>	25 8	– –	75 –	
Base–Emitter On Voltage (I <sub>C</sub> = 8 Adc, V <sub>CE</sub> = 5 Vdc)	V <sub>BE(on)</sub>	–	–	2.2	Vdc
Collector–Emitter Saturation Voltage (I <sub>C</sub> = 8 Adc, I <sub>B</sub> = 0.8 Adc) (I <sub>C</sub> = 16 Adc, I <sub>B</sub> = 3.2 Adc)	V <sub>CE(sat)</sub>	– –	– –	1.4 4	Vdc

## DYNAMIC CHARACTERISTICS

Total Harmonic Distortion at the Output V <sub>RMS</sub> = 28.3 V, f = 1 kHz, P <sub>LOAD</sub> = 100 W <sub>RMS</sub> (Matched pair h <sub>FE</sub> = 50 @ 5 A/5 V)	T <sub>HD</sub>	– –	0.8 0.08	– –	%
Current Gain Bandwidth Product (I <sub>C</sub> = 1 Adc, V <sub>CE</sub> = 10 Vdc, f <sub>test</sub> = 1 MHz)	f <sub>T</sub>	4	–	–	MHz
Output Capacitance (V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0, f <sub>test</sub> = 1 MHz)	C <sub>ob</sub>	–	–	500	pF

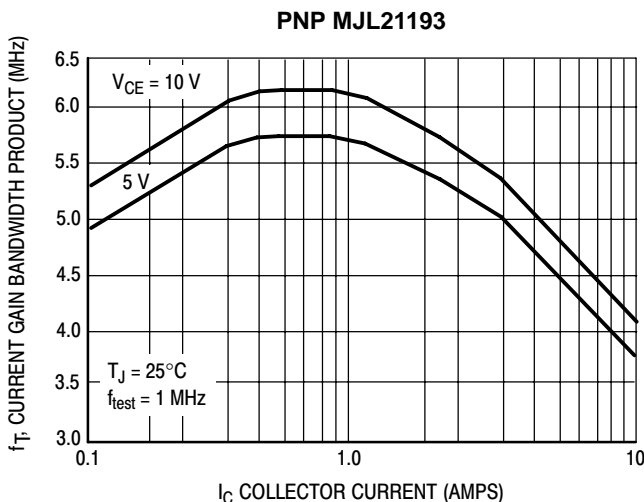


Figure 1. Typical Current Gain Bandwidth Product

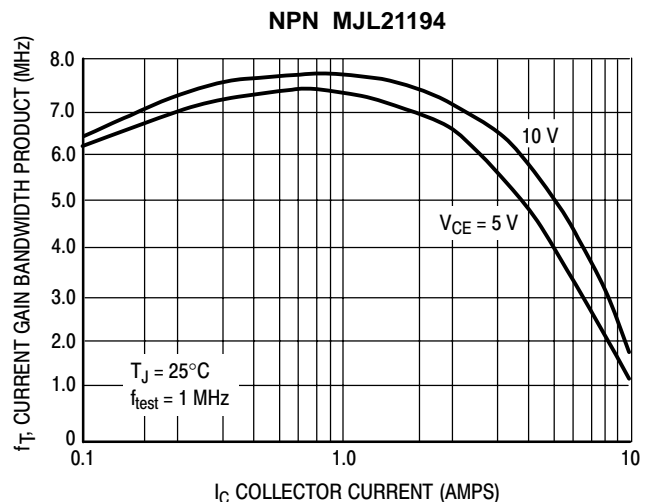


Figure 2. Typical Current Gain Bandwidth Product

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## TYPICAL CHARACTERISTICS

PNP MJL21193

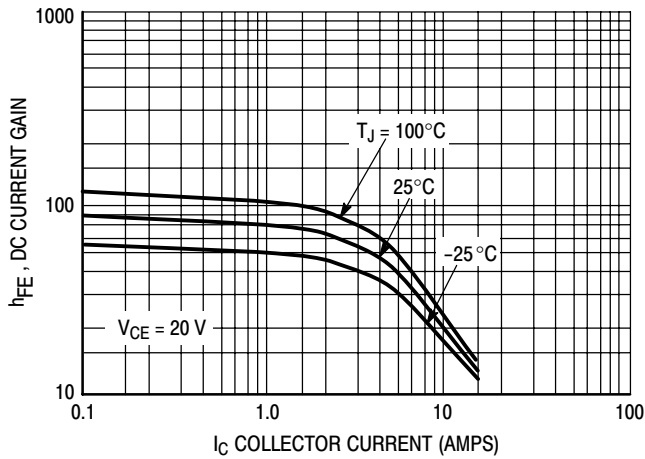


Figure 3. DC Current Gain,  $V_{CE} = 20$  V

NPN MJL21194

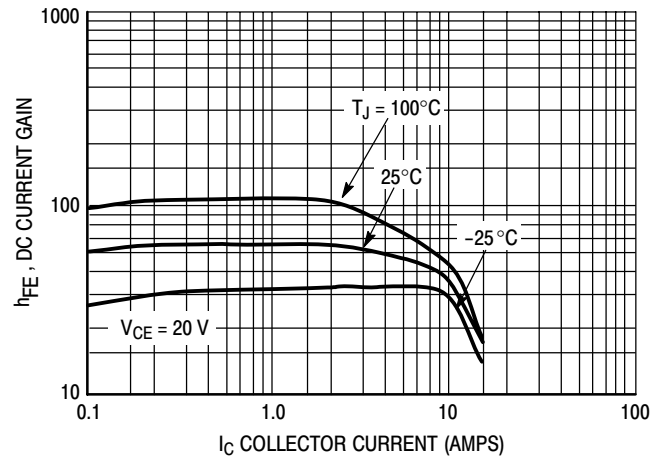


Figure 4. DC Current Gain,  $V_{CE} = 20$  V

PNP MJL21193

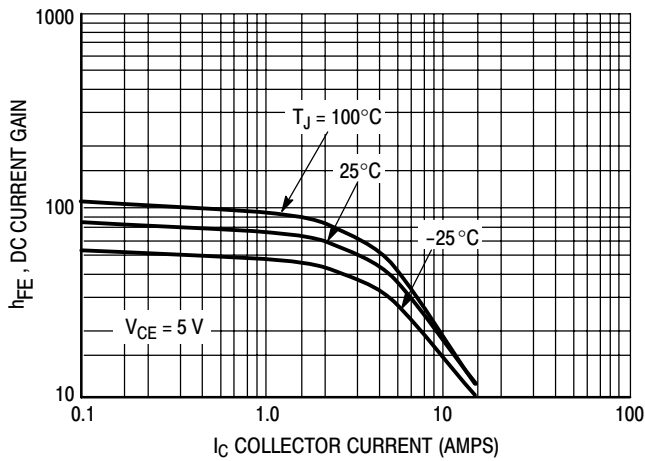


Figure 5. DC Current Gain,  $V_{CE} = 5$  V

NPN MJL21194

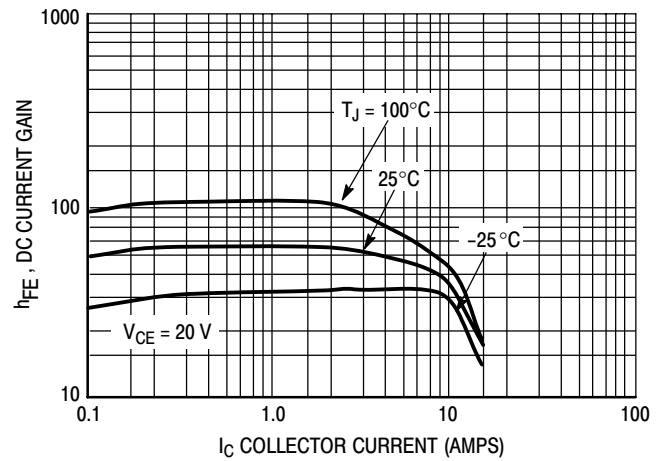
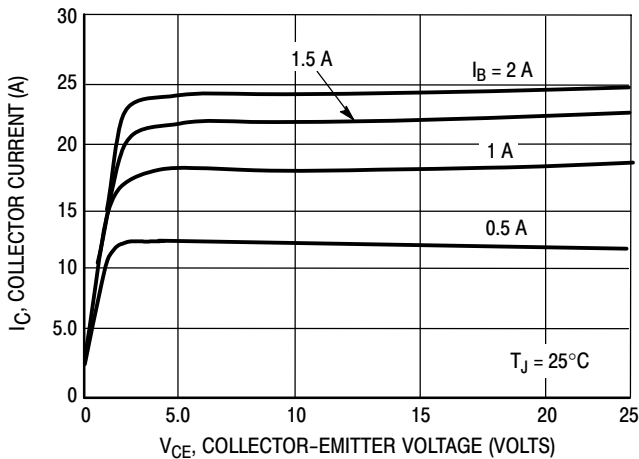
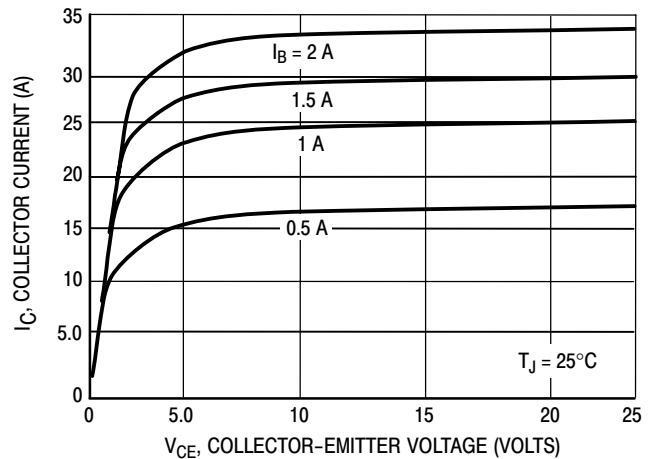


Figure 6. DC Current Gain,  $V_{CE} = 5$  V

PNP MJL21193



NPN MJL21194



TYPICAL CHARACTERISTICS

PNP MJL21193

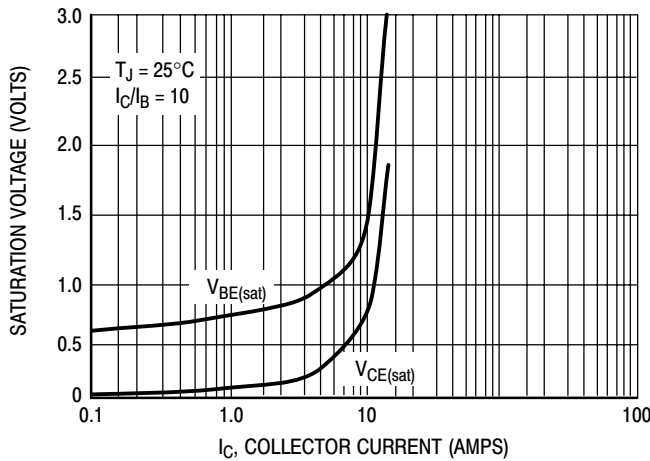


Figure 9. Typical Saturation Voltages

NPN MJL21194

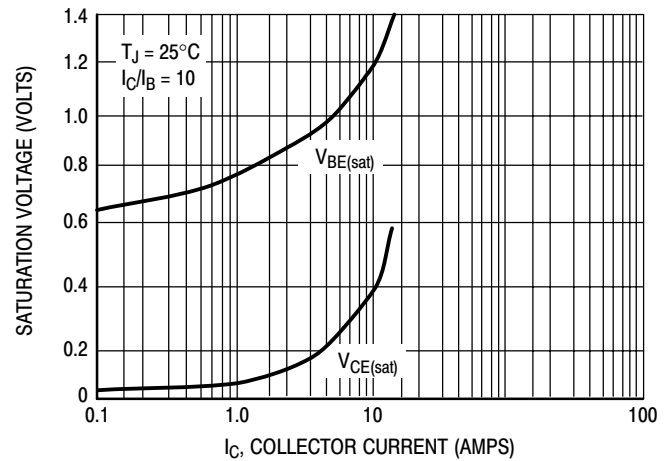


Figure 10. Typical Saturation Voltages

PNP MJL21193

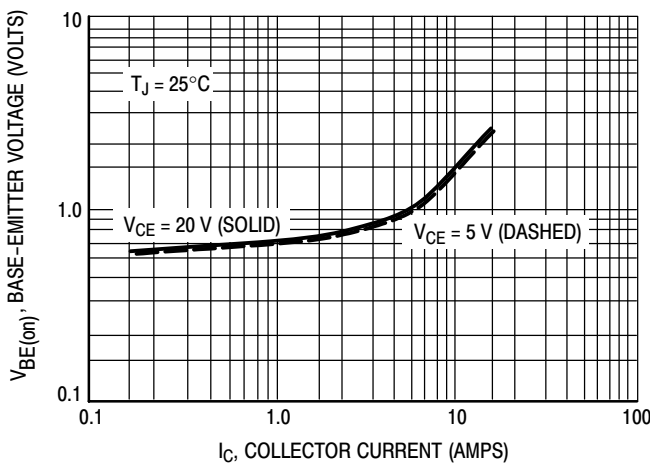


Figure 11. Typical Base-Emitter Voltage

NPN MJL21194

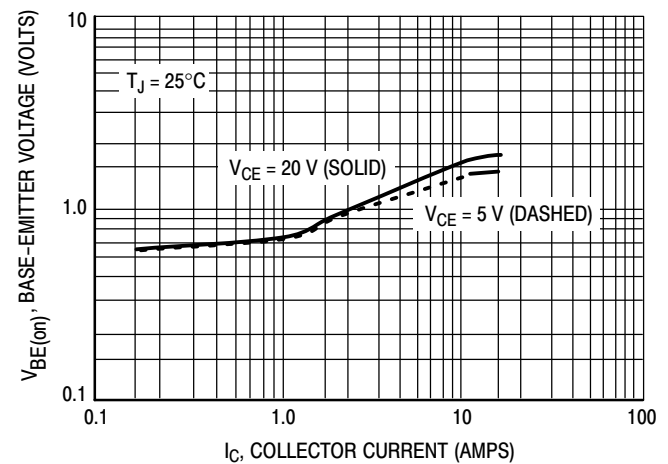


Figure 12. Typical Base-Emitter Voltage

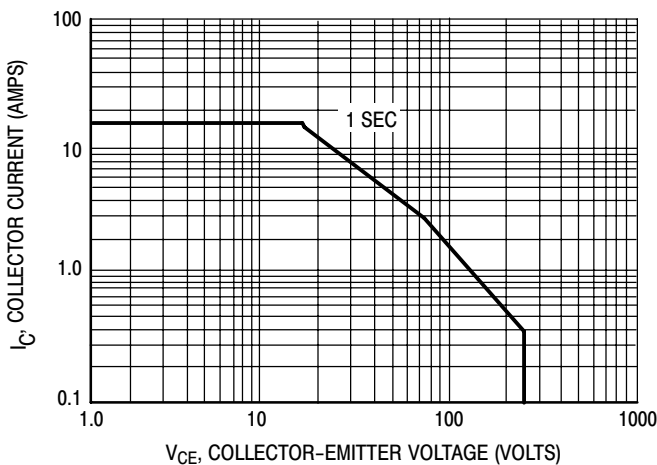


Figure 13. Active Region Safe Operating Area

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.

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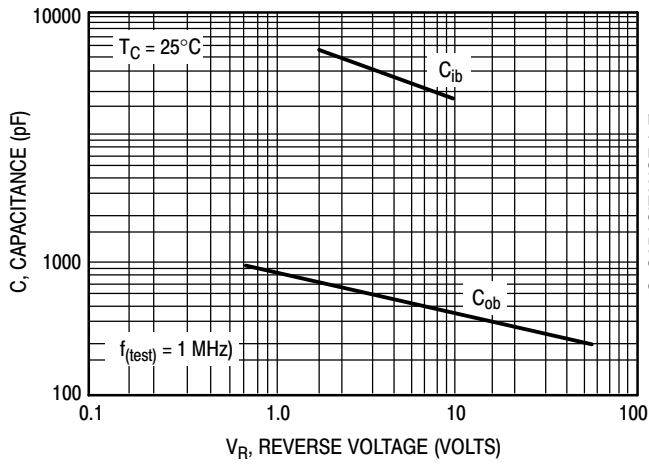


Figure 14. MJL21193 Typical Capacitance

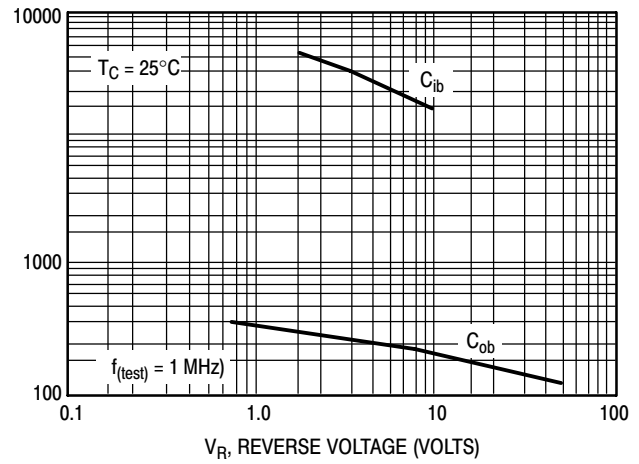


Figure 15. MJL21194 Typical Capacitance

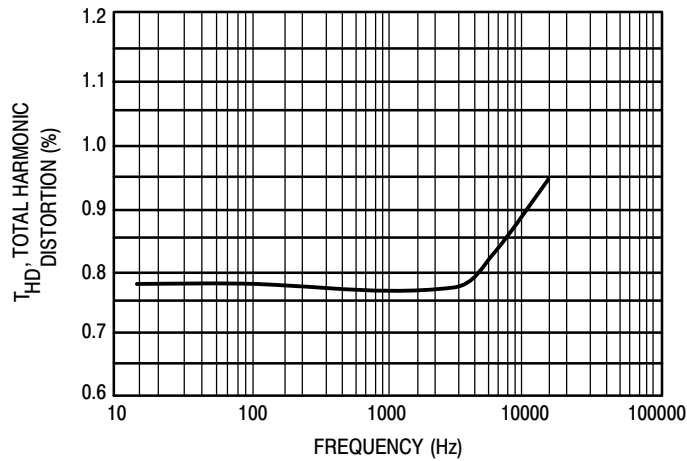


Figure 16. Typical Total Harmonic Distortion

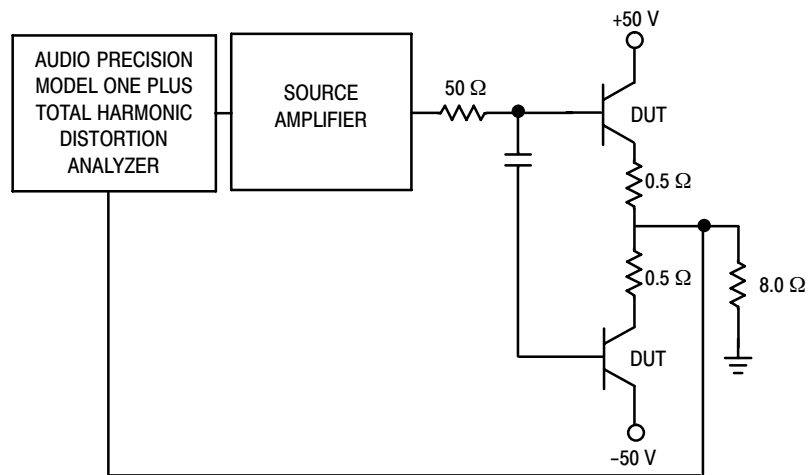
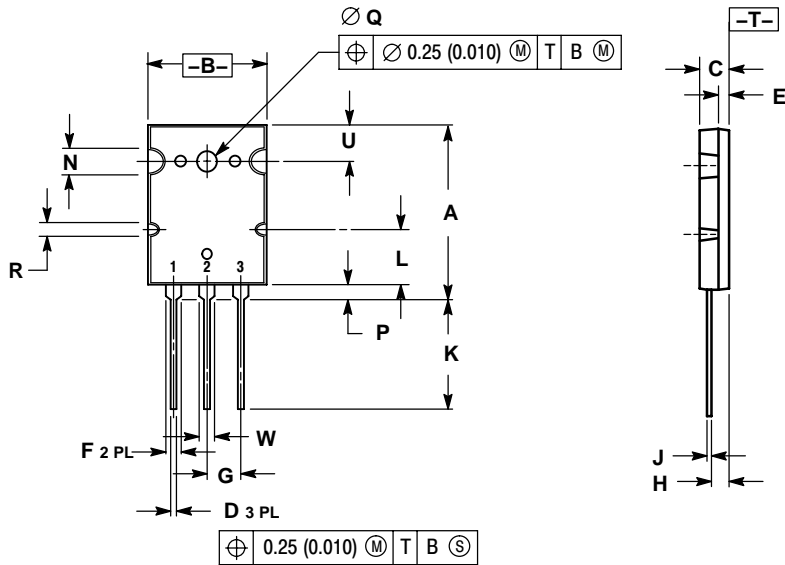


Figure 17. Total Harmonic Distortion Test Circuit

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## PACKAGE DIMENSIONS

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



### 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	11.2	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

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