Silicon Power Transistors

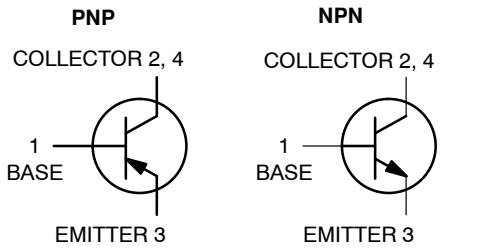
MJL21193 (PNP), MJL21194 (NPN)

16 AMPERE COMPLEMENTARY SILICON POWER TRANSISTORS 250 VOLTS, 200 WATTS

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
- 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	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 @ T_C = 25°C Derate above 25°C	P_D	200 1.43	W W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−65 to +150	°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.

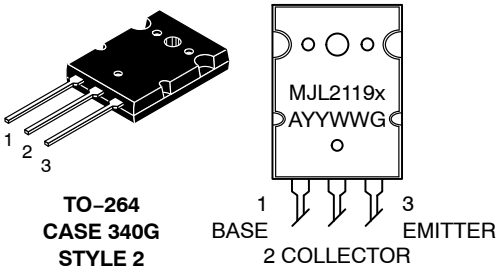
1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤2%

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction−to−Case	$R_{\theta JC}$	0.7	°C/W

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

MARKING DIAGRAM



TO−264
CASE 340G
STYLE 2

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

ORDERING INFORMATION

Device	Package	Shipping†
MJL21193G	TO−264 (Pb−Free)	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.

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector−Emitter Sustaining Voltage (I_C = 100 mAdc, I_B = 0)	$V_{CEO(sus)}$	250	–	–	Vdc
Collector Cutoff Current (V_{CE} = 200 Vdc, I_B = 0)	I_{CEO}	–	–	100	μAdc
Emitter Cutoff Current (V_{CE} = 5 Vdc, I_C = 0)	I_{EBO}	–	–	100	μAdc
Collector Cutoff Current (V_{CE} = 250 Vdc, $V_{BE(off)}$ = 1.5 Vdc)	I_{CEX}	–	–	100	μAdc
SECOND BREAKDOWN					
Second Breakdown Collector Current with Base Forward Biased (V_{CE} = 50 Vdc, t = 1 s (non−repetitive)) (V_{CE} = 80 Vdc, t = 1 s (non−repetitive))	$I_{S/b}$	 4.0 2.25	 – –	 – –	Adc
ON CHARACTERISTICS					
DC Current Gain (I_C = 8 Adc, V_{CE} = 5 Vdc) (I_C = 16 Adc, I_B = 5 Adc)	h_{FE}	 25 8	 – –	 75 –	
Base−Emitter On Voltage (I_C = 8 Adc, V_{CE} = 5 Vdc)	$V_{BE(on)}$	–	–	2.2	Vdc
Collector−Emitter Saturation Voltage (I_C = 8 Adc, I_B = 0.8 Adc) (I_C = 16 Adc, I_B = 3.2 Adc)	$V_{CE(sat)}$	 – –	 – –	 1.4 4	Vdc
DYNAMIC CHARACTERISTICS					
Total Harmonic Distortion at the Output V_{RMS} = 28.3 V, f = 1 kHz, P_{LOAD} = 100 W_{RMS} (Matched pair h_{FE} = 50 @ 5 A/5 V)	T_{HD} h_{FE} unmatched h_{FE} matched	 – –	 0.8 0.08	 – –	%
Current Gain Bandwidth Product (I_C = 1 Adc, V_{CE} = 10 Vdc, f_{test} = 1 MHz)	f_T	4	–	–	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f_{test} = 1 MHz)	C_{ob}	–	–	500	pF

PNP MJL21193

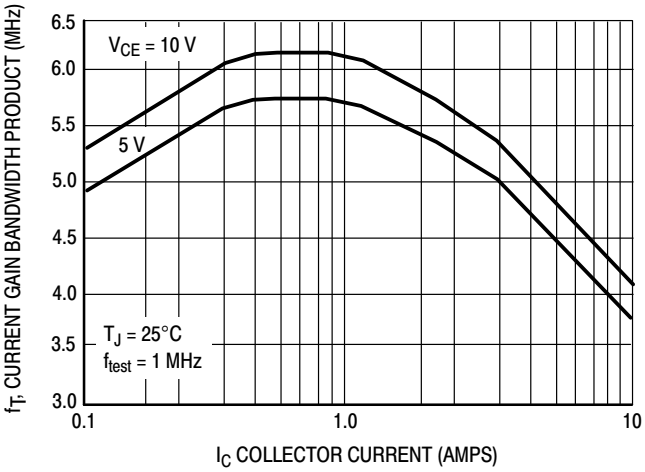


Figure 1. Typical Current Gain Bandwidth Product

NPN MJL21194

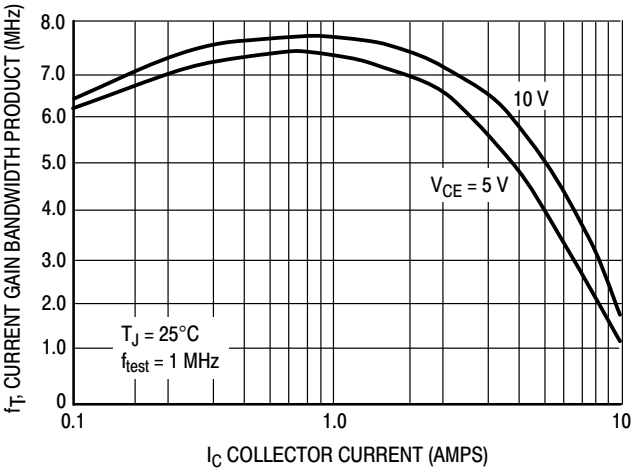


Figure 2. Typical Current Gain Bandwidth Product

TYPICAL CHARACTERISTICS

PNP MJL21193

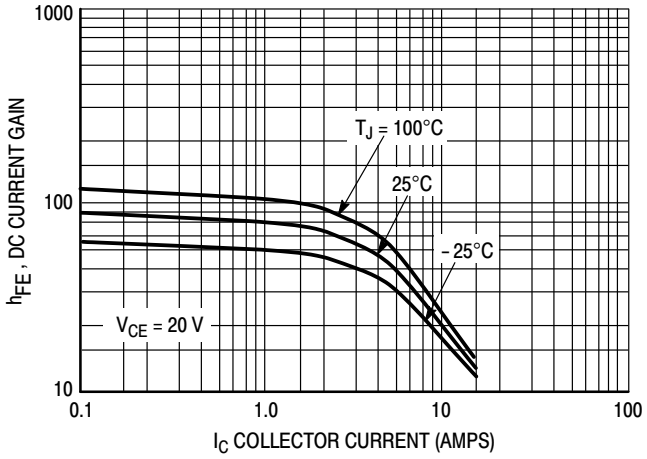


Figure 3. DC Current Gain, V_{CE} = 20 V

NPN MJL21194

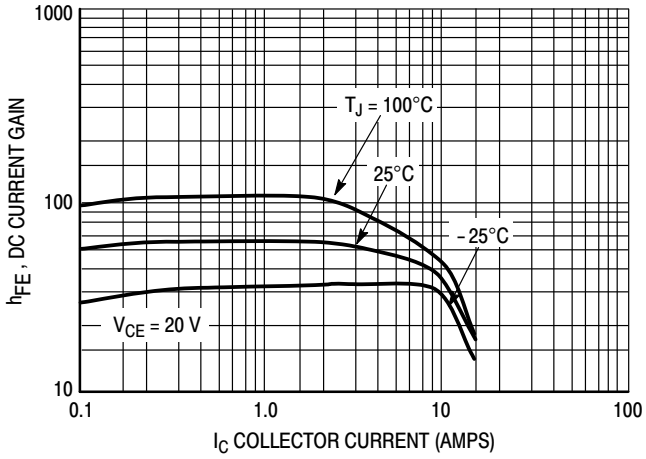


Figure 4. DC Current Gain, V_{CE} = 20 V

PNP MJL21193

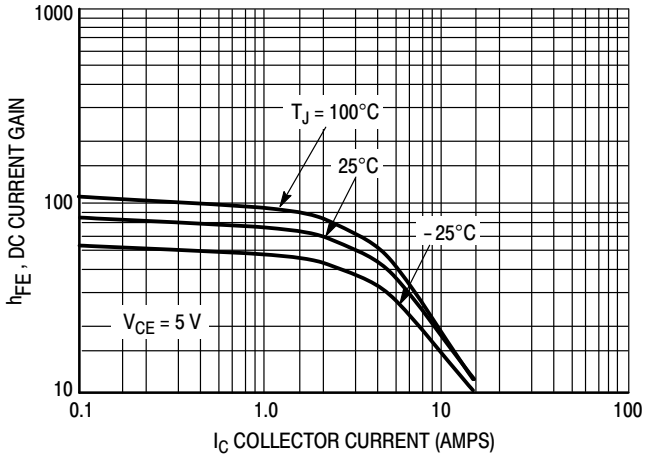


Figure 5. DC Current Gain, V_{CE} = 5 V

NPN MJL21194

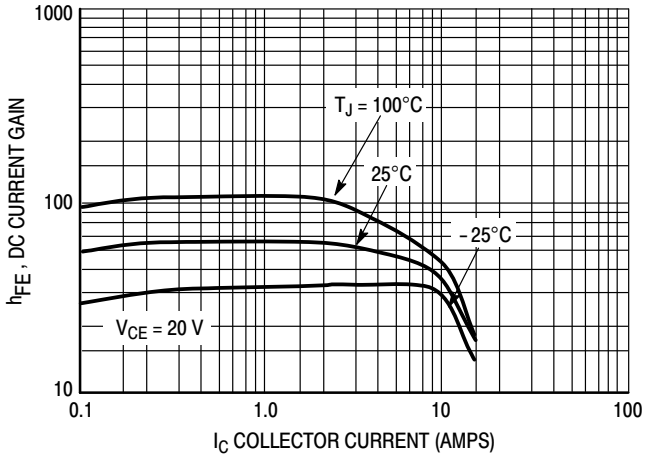


Figure 6. DC Current Gain, V_{CE} = 5 V

PNP MJL21193

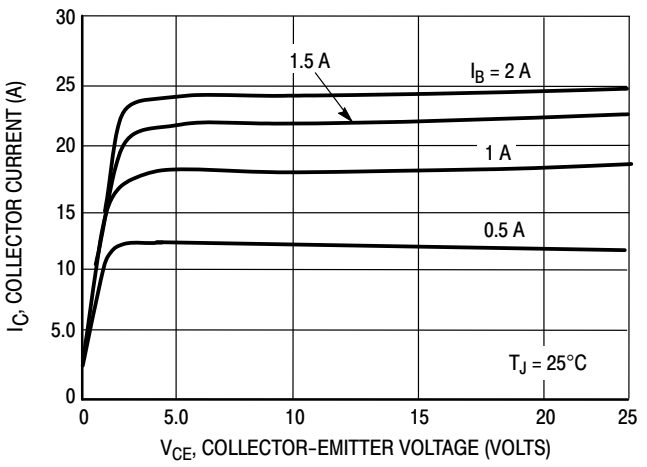


Figure 7. Typical Output Characteristics

NPN MJL21194

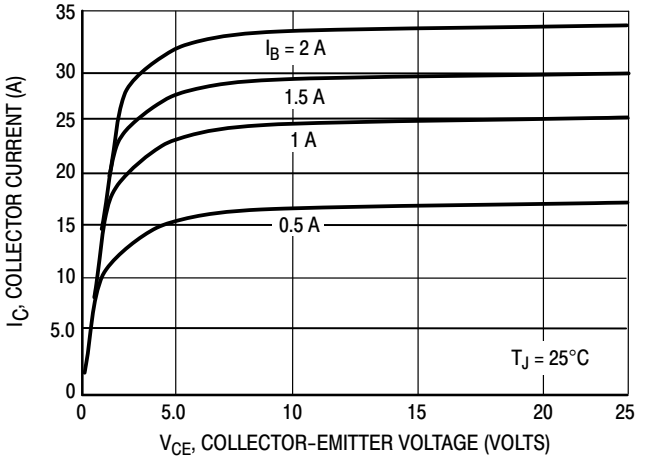


Figure 8. Typical Output Characteristics

TYPICAL CHARACTERISTICS

PNP MJL21193

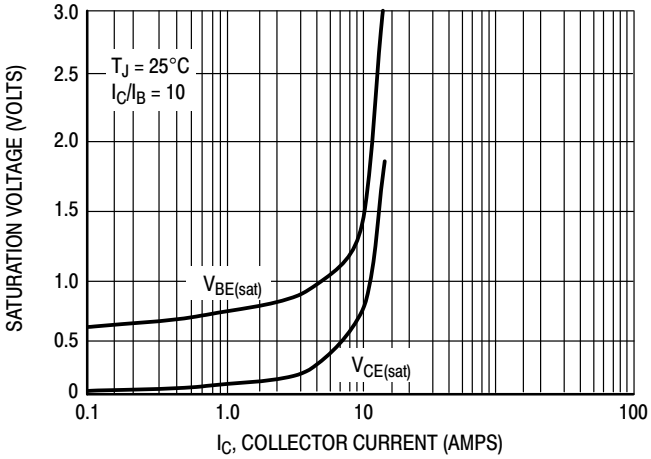


Figure 9. Typical Saturation Voltages

NPN MJL21194

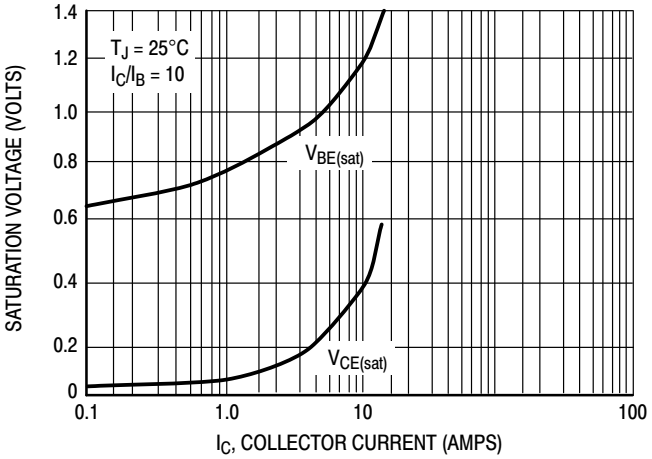


Figure 10. Typical Saturation Voltages

PNP MJL21193

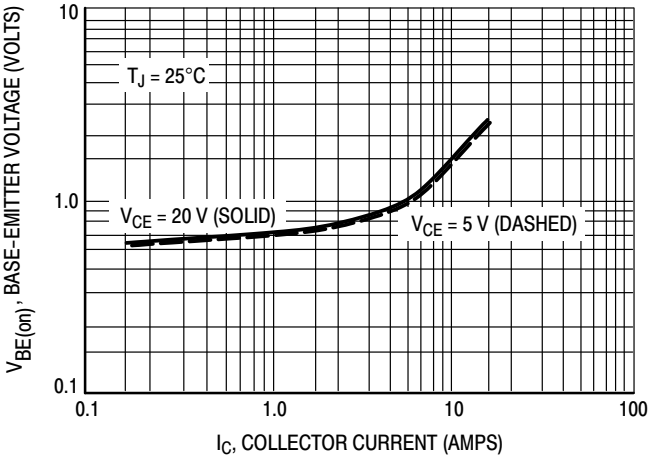


Figure 11. Typical Base−Emitter Voltage

NPN MJL21194

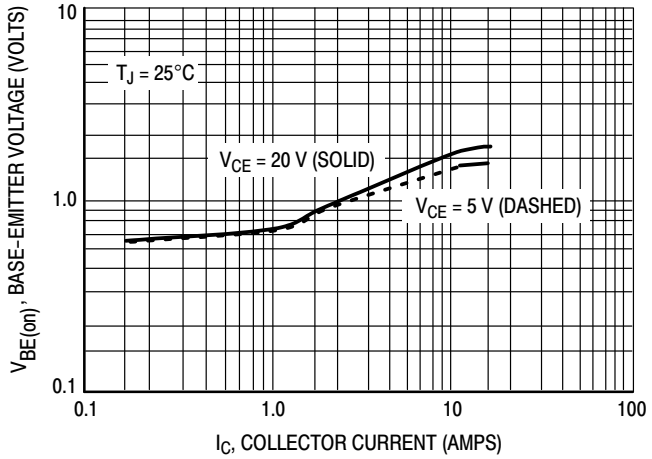


Figure 12. Typical Base−Emitter Voltage

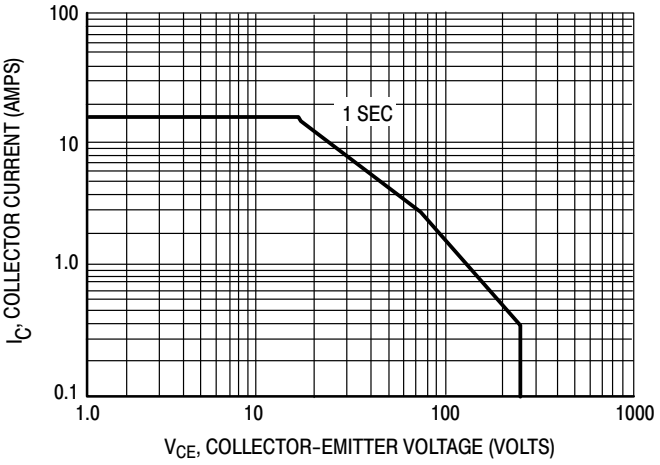


Figure 13. Active Region Safe Operating Area

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°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.

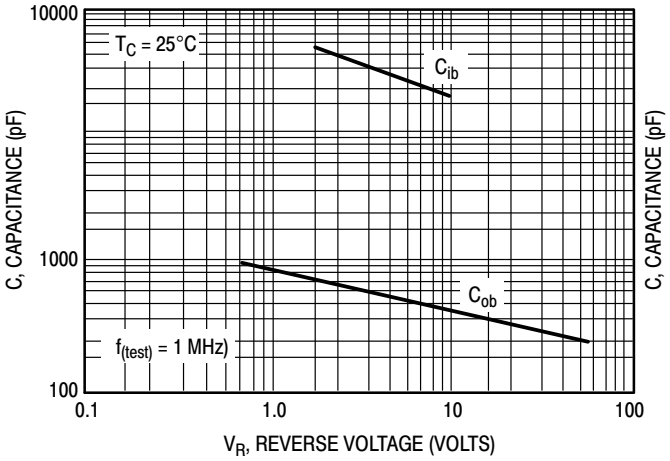


Figure 14. MJL21193 Typical Capacitance

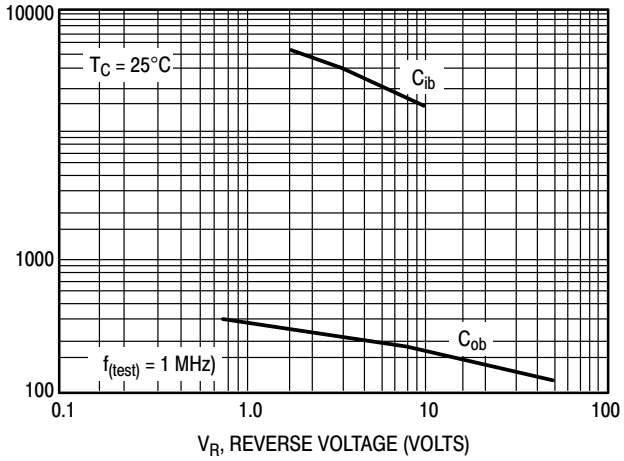


Figure 15. MJL21194 Typical Capacitance

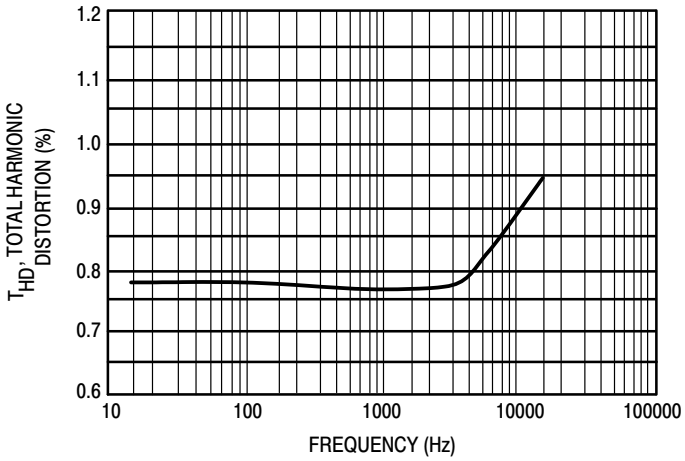


Figure 16. Typical Total Harmonic Distortion

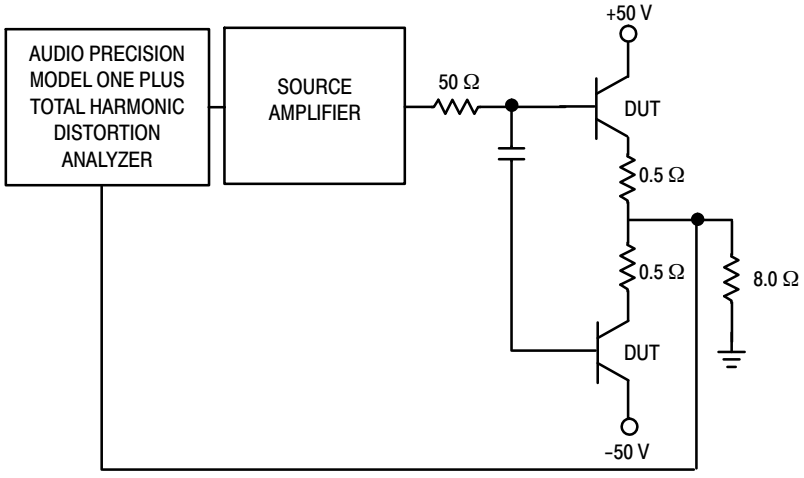
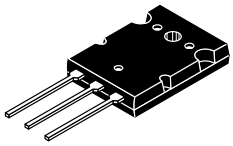


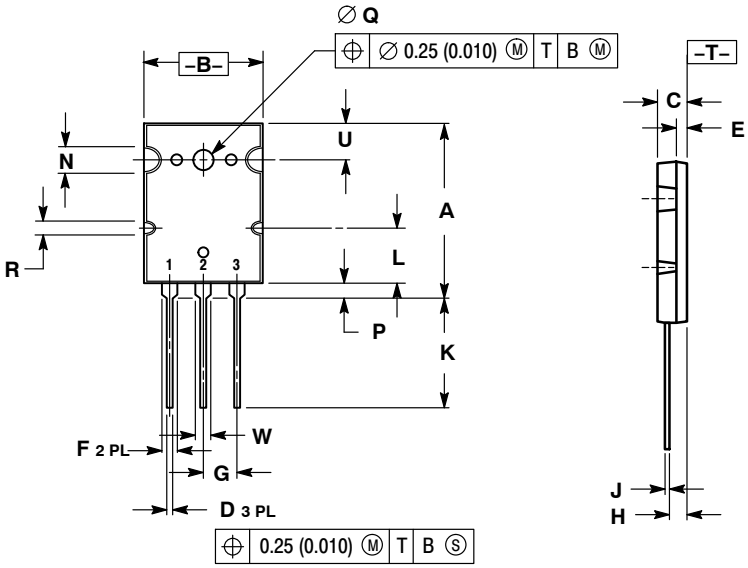
Figure 17. Total Harmonic Distortion Test Circuit



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.

	MILLIMETERS		INCHES	
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

STYLE 1:
PIN 1. GATE
2. DRAIN
3. SOURCE

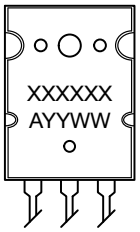
STYLE 2:
PIN 1. BASE
2. COLLECTOR
3. EMITTER

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

GENERIC MARKING DIAGRAM*



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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DESCRIPTION:	**TO−3BPL (TO−264)**		**PAGE 1 OF 1**

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