NJL21193DG (PNP), NJL21194DG (NPN)

Complementary ThermalTrak™ Transistors

The ThermalTrak family of devices has been designed to eliminate thermal equilibrium lag time and bias trimming in audio amplifier applications. They can also be used in other applications as transistor die protection devices.

Features

- Thermally Matched Bias Diode
- Instant Thermal Bias Tracking
- Absolute Thermal Integrity
- Medium Frequency Device with Extended Safe Operating Area
- These are Pb−Free Devices

Benefits

- Eliminates Thermal Equilibrium Lag Time and Bias Trimming
- Superior Sound Quality Through Improved Dynamic Temperature Response
- Significantly Improved Bias Stability
- Simplified Assembly
  - Reduced Labor Costs
  - Reduced Component Count
- High Reliability

Applications

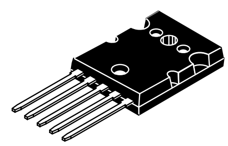
- High−End Consumer Audio Products
  - Home Amplifiers
  - Home Receivers
- Professional Audio Amplifiers
  - Theater and Stadium Sound Systems
  - Public Address Systems (PAs)

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

ON Semiconductor®

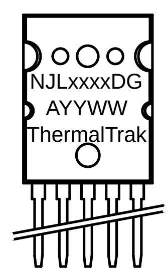
http://onsemi.com

BIPOLAR POWER TRANSISTORS
16 A, 250 V, 200 W

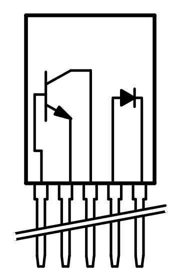


TO−264, 5 LEAD
CASE 340AA
STYLE 1

MARKING DIAGRAM



SCHEMATIC



xxxx	= Specific Device Code
G	= Pb−Free Device
A	= Assembly Location
YY	= Year
WW	= Work Week

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

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	5.0	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
DC Blocking Voltage	V_R	200	V
Average Rectified Forward Current	$I_{F(AV)}$	1.0	A

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction−to−Case	$R_{\theta JC}$	0.625	°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 = 5 ms, Duty Cycle < 10%.

ATTRIBUTES

Characteristic	Value
ESD Protection Human Body Model Machine Model	>8000 V > 400 V
Flammability Rating	UL 94 V−0 @ 0.125 in

ORDERING INFORMATION

Device	Package	Shipping
NJL21193DG	TO−264 (Pb−Free)	25 Units / Rail
NJL21194DG	TO−264 (Pb−Free)	25 Units / Rail

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

Characteristic	Symbol	Min	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	$I_{S/b}$			Adc
(V_{CE} = 50 Vdc, t = 1 s (non−repetitive)		4.0	−	
(V_{CE} = 80 Vdc, t = 1 s (non−repetitive)		2.25	−	
ON CHARACTERISTICS				
DC Current Gain	h_{FE}			
(I_C = 8 Adc, V_{CE} = 5 Vdc)		25	75	
(I_C = 16 Adc, I_B = 5 Adc)		8	−	
Base−Emitter On Voltage (I_C = 8 Adc, V_{CE} = 5 Vdc)	$V_{BE(on)}$	−	2.2	Vdc
Collector−Emitter Saturation Voltage	$V_{CE(sat)}$			Vdc
(I_C = 8 Adc, I_B = 0.8 Adc)		−	1.4	
(I_C = 16 Adc, I_B = 3.2 Adc)		−	4	
DYNAMIC CHARACTERISTICS				
Total Harmonic Distortion at the Output	T_{HD}			%
V_{RMS} = 28.3 V, f = 1 kHz, P_{LOAD} = 100 W_{RMS} — h_{FE} unmatched		−	−	
(Matched pair h_{FE} = 50 @ 5 A/5 V) — h_{FE} matched		−	−	
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
Maximum Instantaneous Forward Voltage (Note 2)	v_F			V
(i_F = 1.0 A, T_J = 25°C)		1.1		
(i_F = 1.0 A, T_J = 150°C)		0.93		
Maximum Instantaneous Reverse Current (Note 2)	i_R			μA
(Rated dc Voltage, T_J = 25°C)		10		
(Rated dc Voltage, T_J = 150°C)		100		
Maximum Reverse Recovery Time (i_F = 1.0 A, di/dt = 50 A/μs)	t_{rr}	100		ns

2. Diode Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

PNP NJL21193

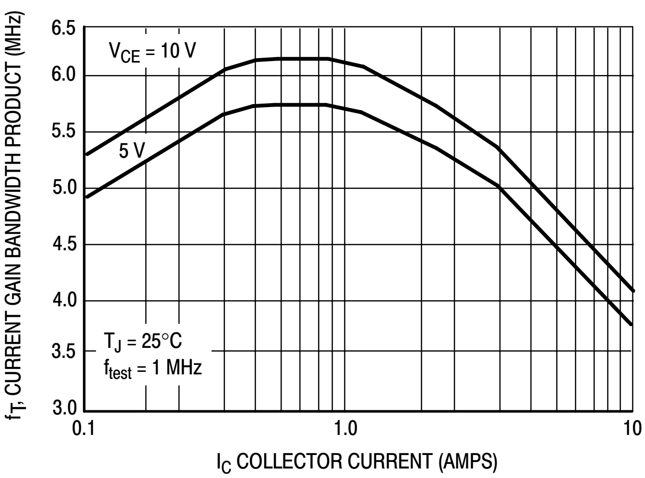


Figure 1. Typical Current Gain Bandwidth Product

NPN NJL21194

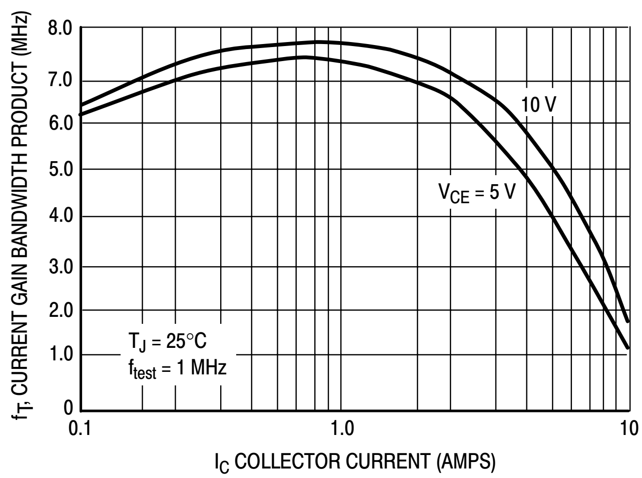


Figure 2. Typical Current Gain Bandwidth Product

TYPICAL CHARACTERISTICS

PNP NJL21193

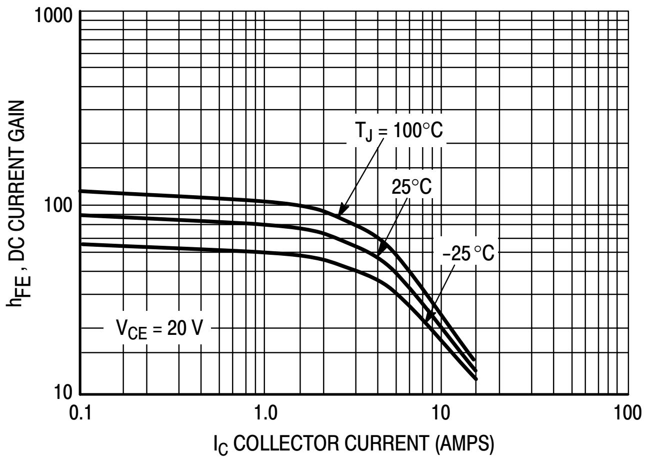


Figure 3. DC Current Gain, V_{CE} = 20 V

NPN NJL21194

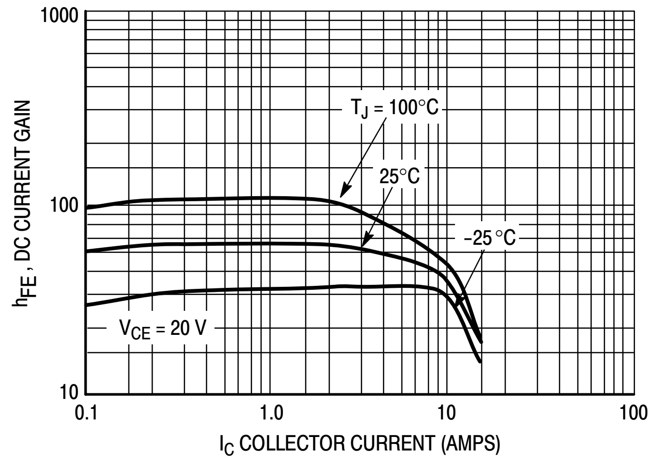


Figure 4. DC Current Gain, V_{CE} = 20 V

PNP NJL21193

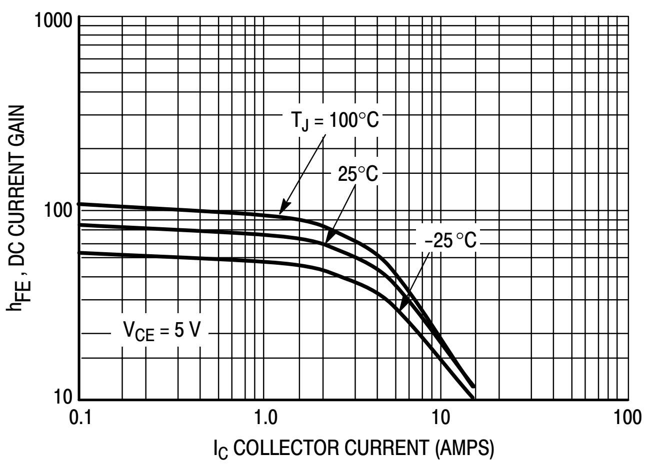


Figure 5. DC Current Gain, V_{CE} = 5 V

NPN NJL21194

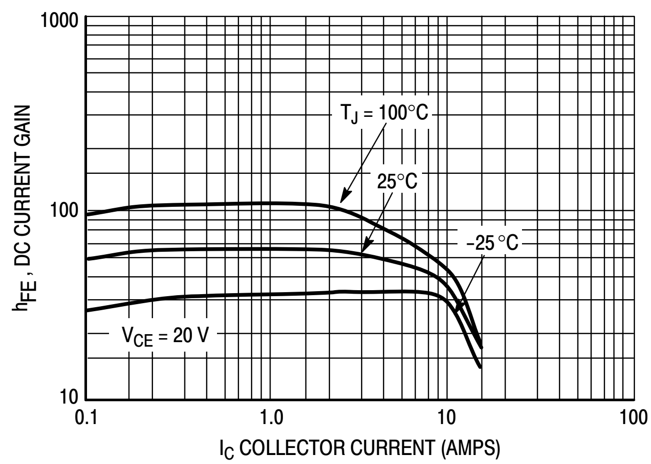
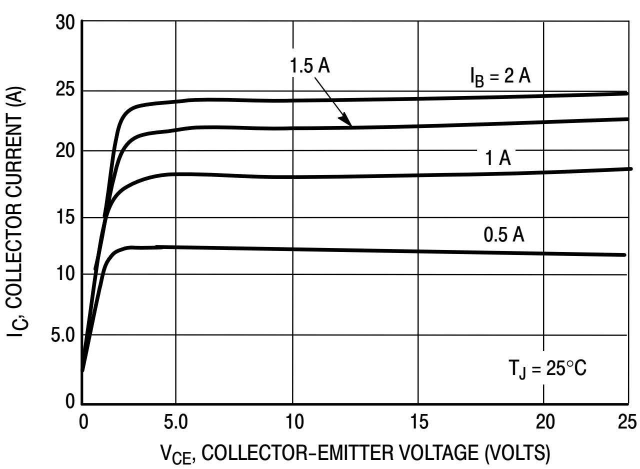
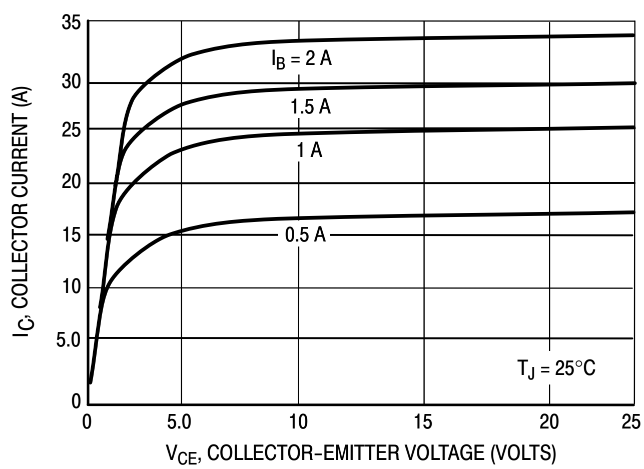


Figure 6. DC Current Gain, V_{CE} = 5 V

PNP NJL21193



NPN NJL21194



TYPICAL CHARACTERISTICS

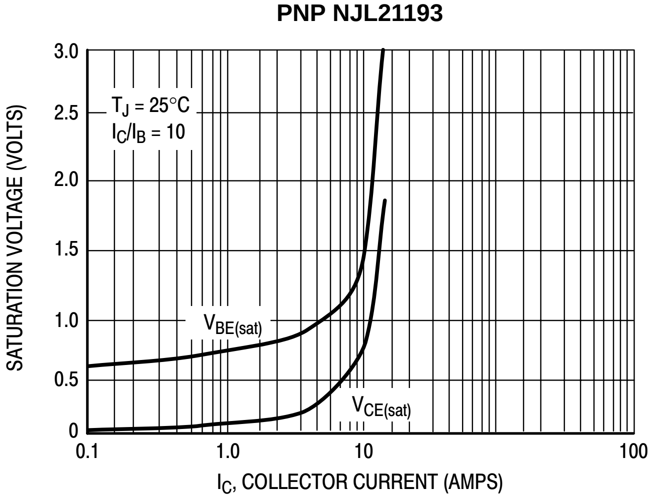


Figure 9. Typical Saturation Voltages

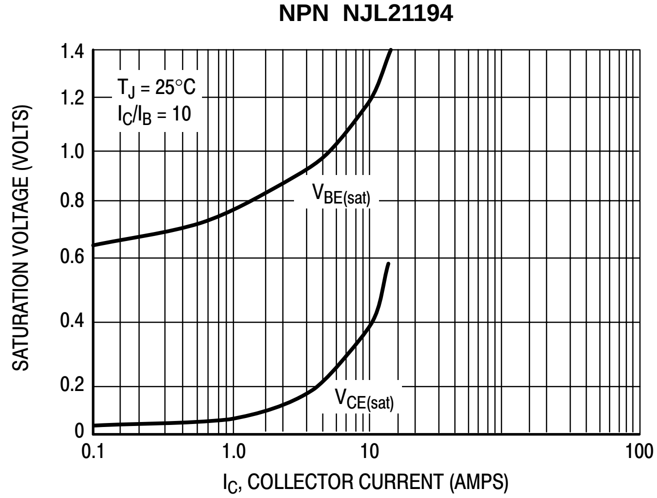


Figure 10. Typical Saturation Voltages

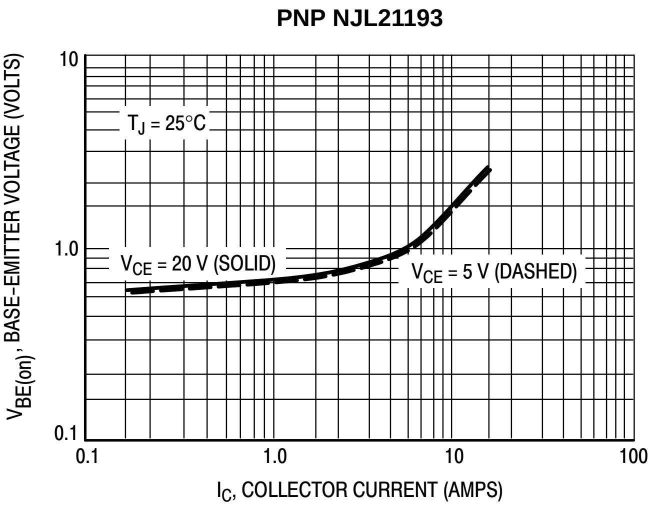


Figure 11. Typical Base−Emitter Voltage

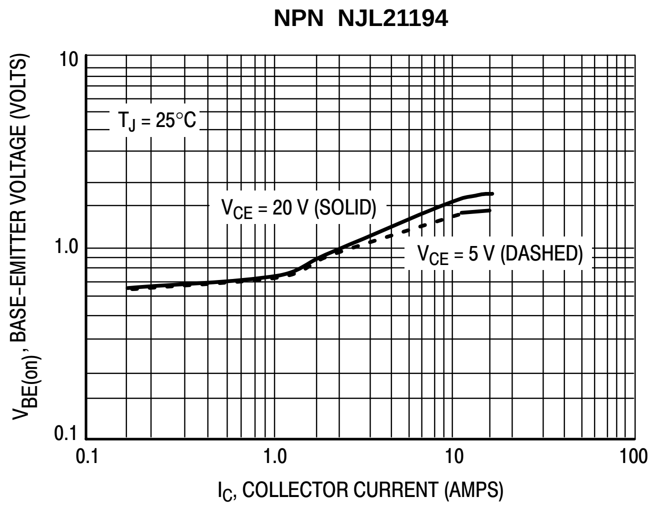


Figure 12. Typical Base−Emitter Voltage

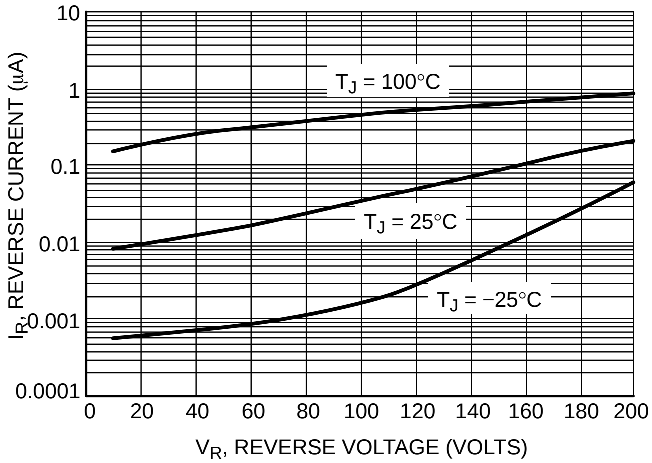


Figure 13. Typical Reverse Current

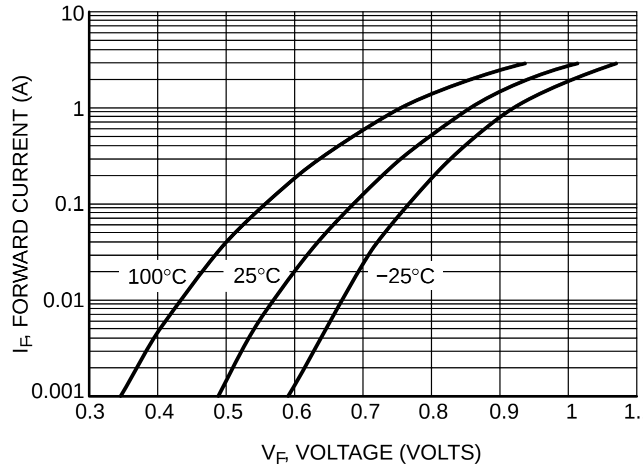


Figure 14. Typical Forward Voltage

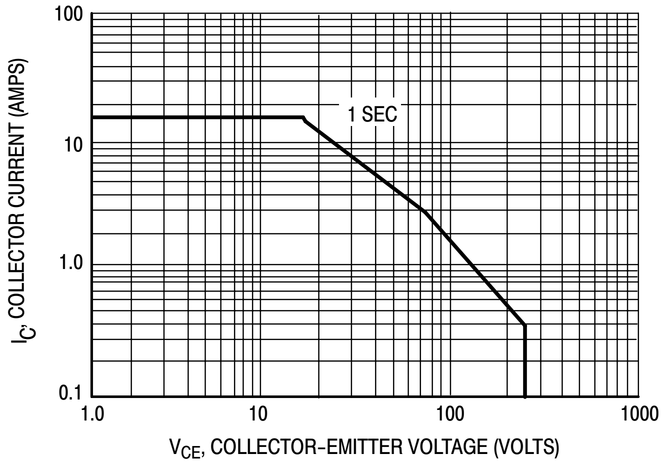


Figure 15. Active Region Safe Operating Area

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 15 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.

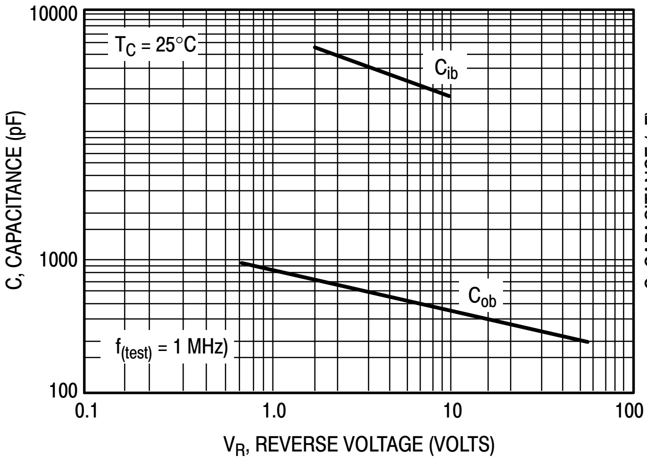


Figure 16. NJL21193 Typical Capacitance

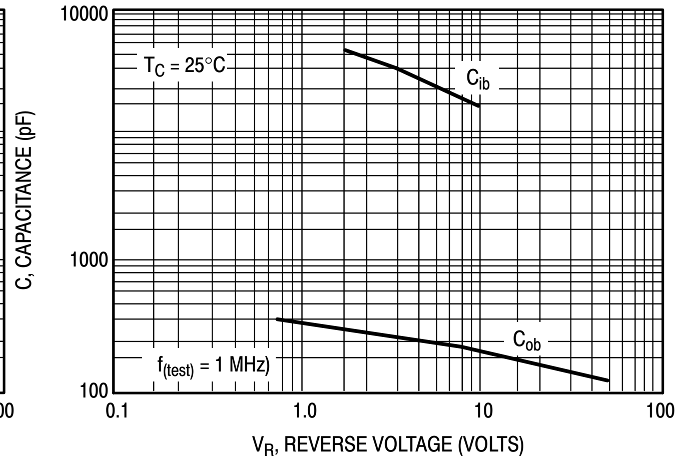


Figure 17. NJL21194 Typical Capacitance

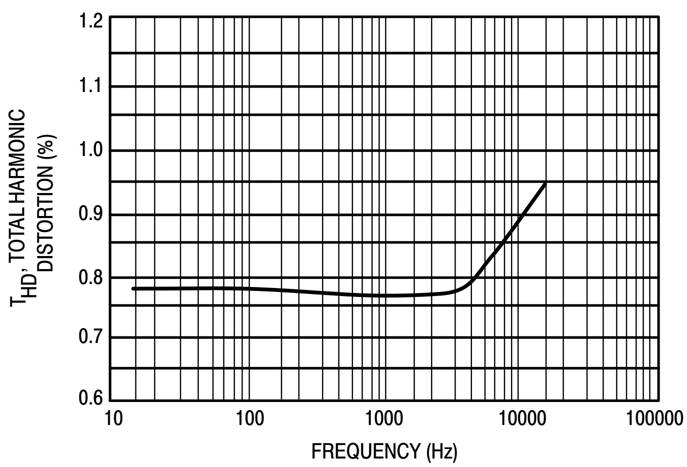


Figure 18. Typical Total Harmonic Distortion

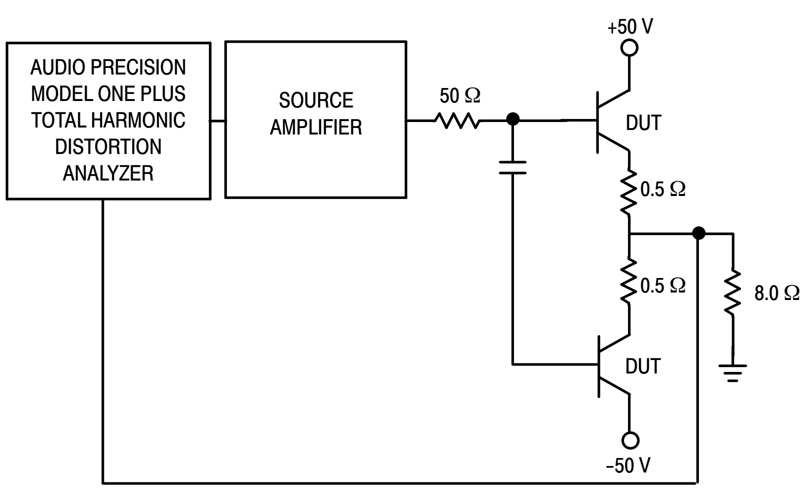


Figure 19. Total Harmonic Distortion Test Circuit

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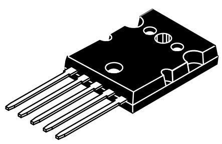
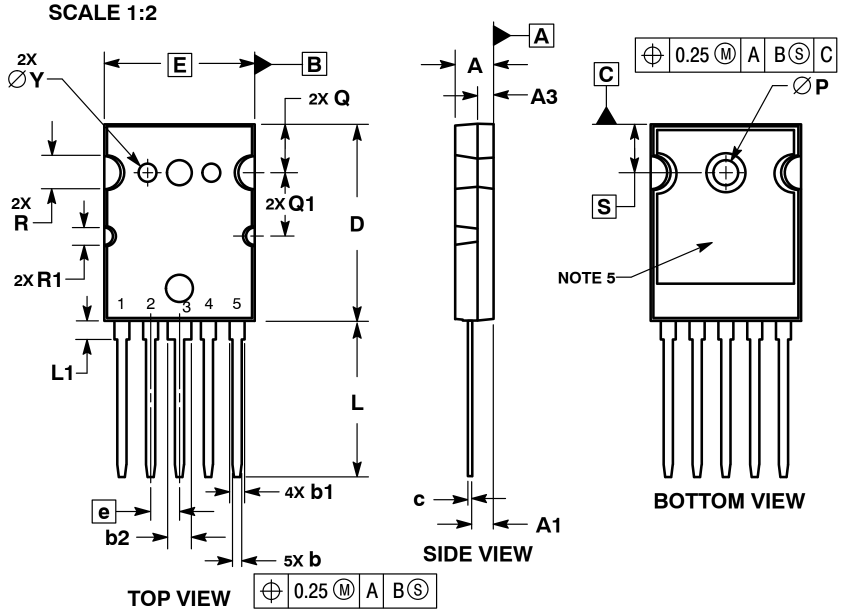


SCALE 1:2

TO−264, 5−LEAD
CASE 340AA
ISSUE A

DATE 04 FEB 2013

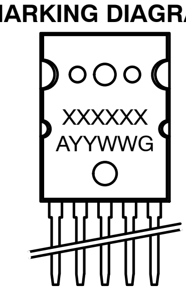


NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES BETWEEN 2.50 AND 3.81 FROM THE LEAD TIP.
4. DIMENSION S APPLIES TO THE MOUNTING HOLE (∅P). DIMENSION Q APPLIES TO THE NOTCHES (2X R).
5. THERMAL PAD SIZE AND SHAPE MAY VARY WITHIN THE AREA DEFINED BY DIMENSIONS D AND E.

	MILLIMETERS	
DIM	MIN	MAX
A	4.70	5.31
A1	2.50	3.10
A3	2.00 REF	
b	1.10	1.50
b1	2.00 REF	
b2	3.00 REF	
c	0.43	0.74
D	25.58	26.59
E	19.30	20.29
e	3.81 BSC	
L	19.79	21.39
L1	2.10	2.30
P	3.00	3.51
Q	5.80	6.20
Q1	8.80	9.20
R	4.00 REF	
R1	2.00 REF	
S	9.00 BSC	
Y	1.80 REF	

STYLE 1:
PIN 1. BASE
2. EMITTER
3. COLLECTOR
4. ANODE
5. CATHODE

GENERIC MARKING DIAGRAM*



XXXXXX = Specific Device Code
A = Assembly Location
YY = 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.

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