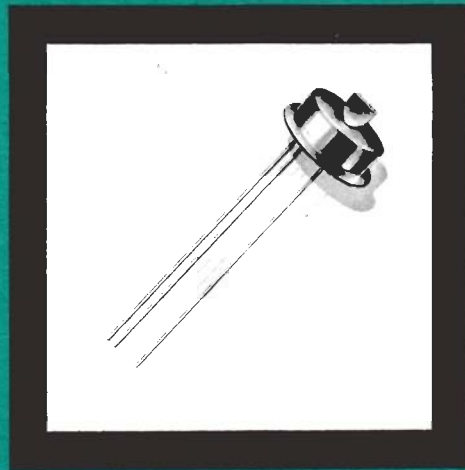




**Semiconductor Products
Syracuse, New York**



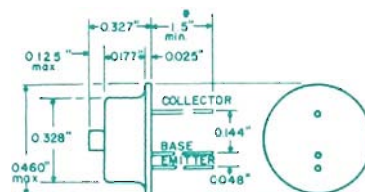
NEW

**PNP Junction Transistors
FOR THE ENTERTAINMENT MARKET**

TYPES

2N186	2N186A	2N189
2N187	2N187A	2N190
2N188	2N188A	2N191
		2N192

OUTLINE DRAWING



*CUT TO 0.200" FOR USE IN SOCKETS
LEAD DIAMETER - 0.017"
MOUNTING POSITION - ANY
WEIGHT - 0.05 OZ
BASE CONNECTED TO
TRANSISTOR SHELL

TYPES 2N186, 2N187, 2N188

The 2N186, 2N187, and 2N188 are medium power PNP transistors intended for use as audio output amplifiers in radio receivers and quality sound systems. By unique process controls the current gain is maintained at an essentially constant

value for collector currents from 1 ma to 200 ma. This linearity of current gain insures low distortion in Class B circuits, and permits use of any two transistors from a particular type without matching.

SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS:

Voltages		Power	
Collector to Base (emitter open)	-25 volts	Collector Dissipation (25°C)*	75 mw
Collector to Emitter ($R_{EB} = 1 \text{ K ohm}$)	-25 volts	Temperature	
Emitter to Base (collector open)	-5 volts	Operating Range	-55 to 60°C
Collector Current	200 ma	Storage Range	-55 to 85°C

*Derate 1.25 mw/°C increase in ambient temperature within range 25°C to 60°C.

ELECTRICAL CHARACTERISTICS: (25°C)**

CLASS B AUDIO AMPLIFIER OPERATION

(Values for two transistors. Note that matching is not required to hold distortion to less than 5% for any two transistors from a type)

Maximum Class B Ratings (Common Emitter)

Collector Supply Voltage	E_{cc}	-12	-12	-12 volts
Power Output (Distortion less than 5%)	PO_e	300	300	300 mw

Design Center Characteristics

Input Impedance large signal base to base ($\Delta I_E = 150 \text{ ma}$)	h_{ie}	1200	2000	2600 ohms
Base Current Gain ($V_{CE} = -1 \text{ v}$; $I_C = 150 \text{ ma}$)	h_{FE}	24	36	54
Collector Capacity ($V_{CB} = -5 \text{ v}$; $I_E = 1 \text{ ma}$; $f = 1 \text{ mc}$)	C_{cb}	35	35	35 μmf
Frequency Cutoff ($V_{CE} = -5 \text{ v}$; $I_E = 1 \text{ ma}$)	f_{ab}	.8	1.0	1.2 mc

Class B Circuit Performance (Common Emitter)

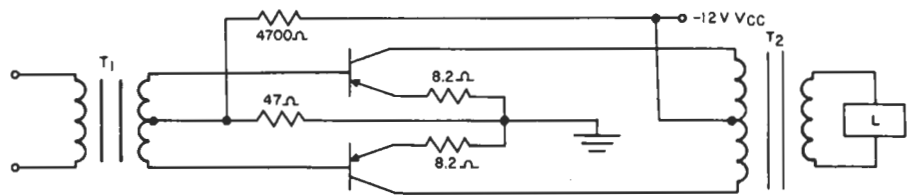
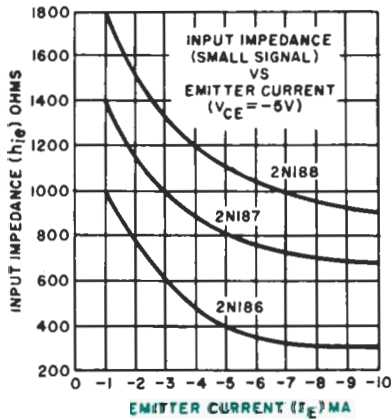
Collector Voltage (See test circuit for other conditions of operation)	V_{ce}	-12	-12	-12 volts
Minimum Power Gain at 100 mw power output	G_e	28 min	30 min	32 min db

CUTOFF CHARACTERISTICS

Maximum Collector Cutoff Current ($V_{CB} = -25 \text{ v}$)	I_{CO}	16 max	16 max	16 max μa
Maximum Emitter Cutoff Current ($V_{EB} = -5 \text{ v}$)	I_{EO}	10 max	10 max	10 max μa

**Values are typical unless indicated as minimum or maximum.

POWER GAIN TEST CIRCUIT



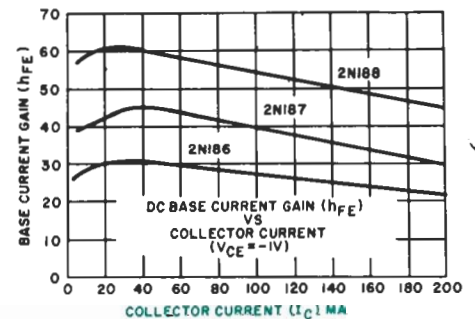
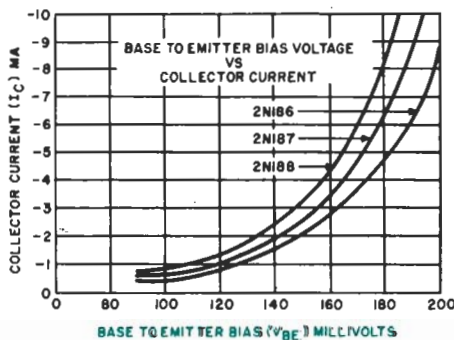
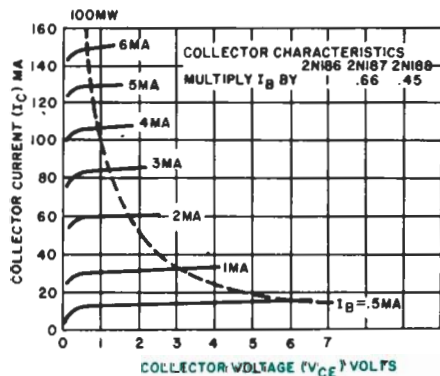
See Application Notes for additional amplifier design information.

T_1 Transformer
 Primary 15000 ohms
 Secondary (base to base) 2000 ohms CT

T_2 Transformer
 Primary (collector to collector) 3000 ohms CT
 Secondary 3.2 ohms

The 4700 ohms resistor should be adjusted to minimize crossover distortion if supply voltage is changed. Minimum distortion occurs when the no signal total collector current is approximately 1.5 ma.

The 8.2 ohms resistor prevents thermal run-away within temperature ratings. A lower value will give higher power gains, but the junction operating temperature must be limited to a lower value.



TYPES 2N186A, 2N187A, 2N188A

The 2N186A, 2N187A, and 2N188A are medium power PNP transistors intended for use as audio output amplifiers in radio receivers and quality sound systems. By unique process controls the current gain is maintained at an essentially constant value for collector currents from 1 ma to 200 ma. This linearity of

current gain insures low distortion in both Class A and Class B circuits, and permits the use of any two transistors from a particular type without matching in Class B Circuits.

SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS:

Voltages		Power	
Collector to Base (emitter open)	-25 volts	Collector Dissipation (25°C)*	180 mw
Collector to Emitter (R _{EB} =1 K ohm)	-25 volts	Temperature	
Emitter to Base (collector open)	-5 volts	Operating Range	-55 to 60°C
Collector Current	200 ma	Storage Range	-55 to 85°C

*Derate 3 mw/°C increase in ambient temperature within range 25°C to 60°C.

ELECTRICAL CHARACTERISTICS: (25°C)**

CLASS B AUDIO AMPLIFIER OPERATION

(Values for two transistors. Note that matching is not required to hold distortion to less than 5% for any two transistors from a type)

Maximum Class B Ratings (Common Emitter)

Collector Supply Voltage
Power Output (Distortion less than 5%)

Design Center Characteristics

Input Impedance large signal base to base ($\Delta I_E = 150$ ma)
Base Current Gain ($V_{CE} = -1$ v; $I_C = 150$ ma)
Collector Capacity ($V_{CB} = -5$ v; $I_E = 1$ ma; $f = 1$ mc)
Frequency Cutoff ($V_{CB} = -5$ v; $I_E = 1$ ma)

Class B Circuit Performance (Common Emitter)

Collector Voltage (See test circuit for other conditions of operation)
Minimum Power Gain at 100 mw power output

2N186A **2N187A** **2N188A**

E_{ce}	-12	-12	-12 volts
PO_p	750	750	750 mw
h_{ib}		2000	2600 ohms
h_{FE}	24	36	54
C_{cb}	35	35	35 μ f
f_{ab}	.8	1.0	1.2 mc
V_{ce}	-12	-12	-12 volts
G_p	28 min	30 min	32 min db
G_p	30	32	34 db
I_{CO}	16 max	16 max	16 max μ a
I_{EO}	10 max	10 max	10 max μ a

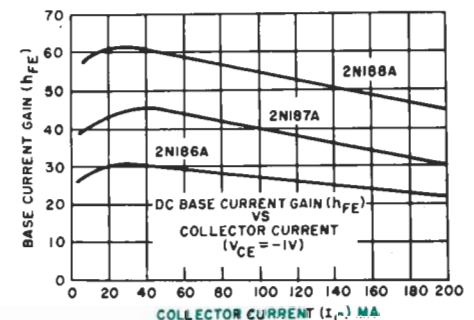
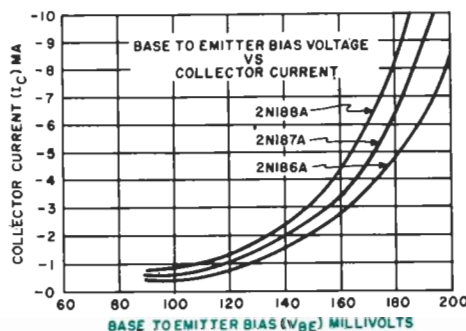
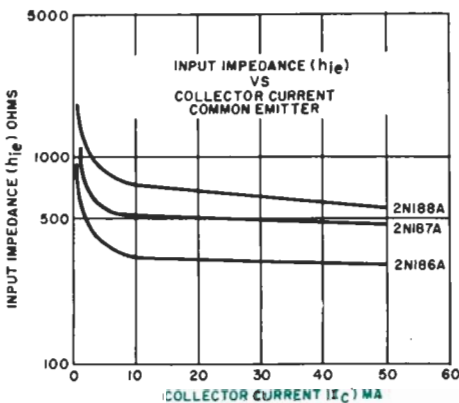
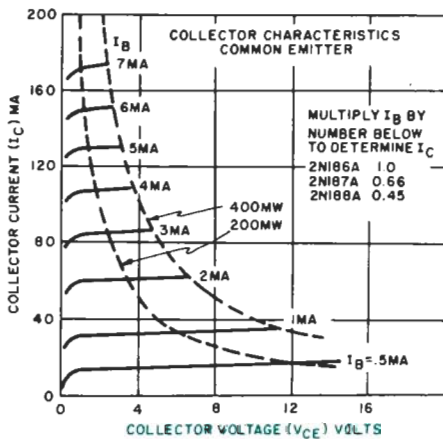
CLASS A AUDIO AMPLIFIER OPERATION (COMMON EMITTER)

($E_{ce} = -12$ v; $I_E = 10$ ma)
Power Gain at 50 mw power output

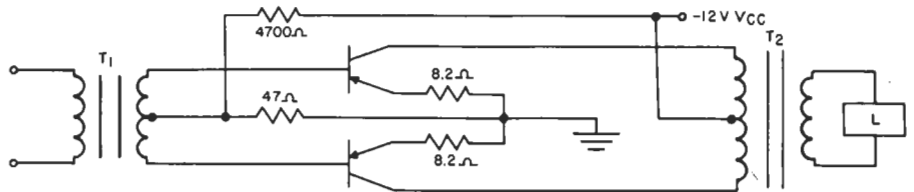
CUTOFF CHARACTERISTICS

Maximum Collector Cutoff Current ($V_{CB} = -25$ v)
Maximum Emitter Cutoff Current ($V_{EB} = -5$ v)

**Values are typical unless indicated as minimum or maximum.



POWER GAIN TEST CIRCUIT



See Application Notes for additional amplifier design information.

- T_1 Transformer
Primary 15000 ohms
Secondary (base to base) 2000 ohms CT
- T_2 Transformer
Primary (collector to collector) 3000 ohms CT
Secondary 3.2 ohms

The 4700 ohms resistor should be adjusted to minimize crossover distortion if supply voltage is changed. Minimum distortion occurs when the no signal total collector current is approximately 1.5 ma.

The 8.2 ohms resistor prevents thermal run-away within temperature ratings. A lower value will give higher power gains, but the junction operating temperature must be limited to a lower value.

TYPES 2N189, 2N190, 2N191, 2N192

The 2N189, 2N190, 2N191, and 2N192 are alloy junction PNP transistors intended for driver service in transistorized audio amplifiers. By control of transistor characteristics during manufacture, a specific power gain is provided

for each type. Special processing techniques and the use of hermetic seals insures stability of these characteristics throughout life.

SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS:

Voltages		Temperature	
Collector to Emitter ($R_{EB} = 1 \text{ K ohm}$)	-25 volts	Operating Range	-55 to 60°C
Collector Current	50 ma	Storage Range	-55 to 85°C
Power			
Collector Dissipation (25°C)*	75 mw		

*Derate 1.25 mw/°C increase in ambient temperature within range 25°C to 60°C.

ELECTRICAL CHARACTERISTICS: (25°C)**

AUDIO DRIVER CLASS A OPERATION

(Values for one transistor driving a transformer coupled output stage)

Maximum Class A Ratings (Common Emitter)

Collector Supply Voltage

E_{cc}	12	12	12	12 volts
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Design Center Characteristics

Input Impedance base to emitter ($I_E = 1 \text{ ma}$)

\bar{h}_{ie}	1000	1400	1800	2200 ohms
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Base Current Gain ($V_{CE} = -5 \text{ v}; I_E = 1 \text{ ma}$)

h_{re}	24	36	54	75
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Collector Capacity ($V_{CB} = -5 \text{ v}; I_E = 1 \text{ ma}$)

C_{ob}	35	35	35	35 μmf
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Frequency Cutoff ($V_{CB} = -5 \text{ v}; I_E = 1 \text{ ma}$)

$f_{a.o}$.8	1.0	1.2	1.5 mc
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Noise Figure ($V_{CB} = -5 \text{ v}; I_E = 1 \text{ ma}; f = 1 \text{ KC}; \text{BW} = 1 \text{ cycle}$)

NF	15	15	15	15 db
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Audio Circuit Performance (Common Emitter)

Collector Supply Voltage

V_{cc}	12	12	12	12 volts
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Emitter Current (See test circuit for other conditions of operation)

I_E	1	1	1	1 ma
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Minimum Power Gain at 1 mw power output

G_p	37 min	39 min	41 min	43 min db
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SMALL SIGNAL CHARACTERISTICS (COMMON BASE)

($V_{CB} = -5 \text{ v}; I_E = 1 \text{ ma}; f = 270 \text{ cps}$)

Input Impedance

h_{ib}	29	29	29	29 ohms
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Voltage Feedback Ratio

h_{rb}	4×10^{-4}	4×10^{-4}	4×10^{-4}	4×10^{-4}
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Current Amplification

h_{rb}	.96	.973	.98	.987
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Output Admittance

h_{ob}	1.0	.8	.6	.5 μmhos
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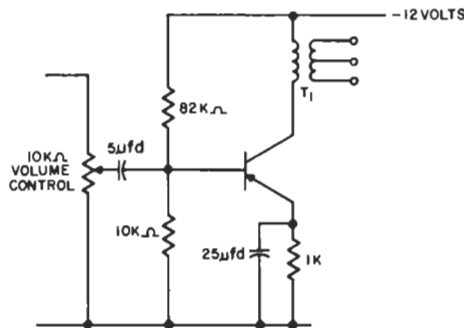
CUTOFF CHARACTERISTICS

Maximum Collector Cutoff Current ($V_{CB} = 25 \text{ v}$)

I_{co}	16 max	16 max	16 max	16 max μa
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**Values are typical unless indicated as minimum or maximum.

POWER GAIN TEST CIRCUIT



See Application Notes for additional amplifier design information.

T_1 Transformer

Primary

Secondary (base to base)

15000 ohms

2000 ohms CT

