National Semiconductor

NA11 (NPN) NA12 (PNP) 1 Amp complementary power transistors

features

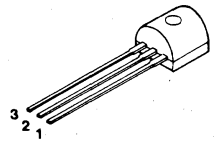
- 20 Volt/1 Amp rating
- Low V_{CE} (sat) and V_{BE} (sat) characteristics at I_C = 400 mA, I_B = 10 mA
- Guaranteed V_{BE} (on) characteristics at low current for stable biasing
- Matched HFE groupings for complementary applications
- "Epoxy B" packaging concept for excellent reliability

applications

- 0.2 to 1 Watt audio power amplifiers
- Medium power switching circuits
- Converter/Inverter circuits
- Circuits for toys

1 package and lead coding

TO-92

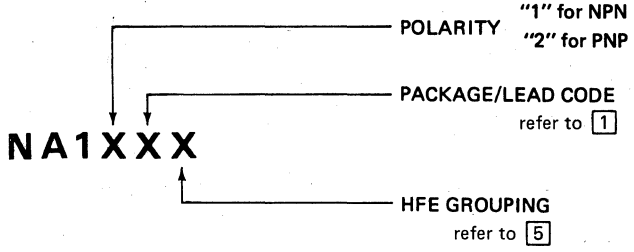


PACKAGE CODE TO-92	LEAD 1	2	3
E	E	B	C
F	E	C	B
H	C	B	E

2 maximum ratings

PARAMETER	SYMBOL	RATING	UNIT
Collector-Emitter Voltage	V_{CEO}	20	V_{DC}
Collector-Base Voltage	V_{CB}	25	V_{DC}
Emitter-Base Voltage	V_{EB}	5.0	V_{DC}
Collector Current (continuous)	I_C (max)	1.0	A
Power Dissipation (T_A = 25°C)	P_D		
TO-92		0.6	W
Power Dissipation (T_C = 25°C)	P_D		
TO-92		1.0	W
Thermal Resistance			
TO-92	θ_{JA}	208	°C/W
	θ_{JC}	125	°C/W
Temperature, Junction and Storage	Tj, Tstg	−55 to + 150	°C

3 ordering information



4 electrical characteristics $T_C = 25°C$

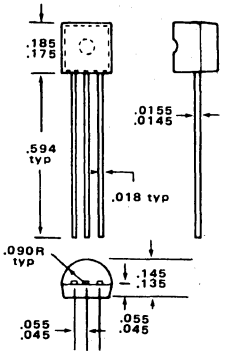
SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
BV_{CEO}	Collector-Emitter Sustaining Voltage	I_C = 1 mA	20			V
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 100μA	25			V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 10μA	5			V
I_{CEO}	Collector-Emitter Leakage Current	V_{CE} = 15V			100	μA
I_{CBO}	Collector-Base Leakage Current	V_{CB} = 20V			1	μA
V_{BE} (on)	Base-Emitter Voltage	I_C = 10 mA, V_{CE} = 3V	630	680	730	mV
V_{BE} (sat)	Base-Emitter Saturation Voltage	I_C = 400 mA, I_B = 10 mA		0.9	1.0	V
V_{CE} (sat)	Collector-Emitter Saturation Voltage	I_C = 400 mA, I_B = 10 mA		0.3	0.5	V
Cob	Collector Output Capacitance	V_{CB} = 10V, f = 1 MHz				
	NPN types			4.5		pF
	PNP types			7.0		pF
ft	Current Gain Bandwidth Product	I_C = 100 mA, V_{CE} = 3V	50	200		MHz

5 HFE groupings

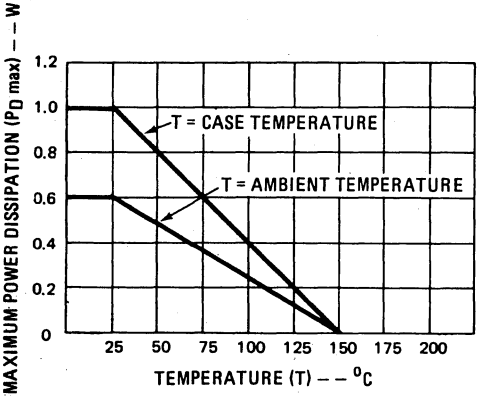
GROUPING	PARAMETER	CONDITIONS	MIN	TYP	MAX	RATIO
G	DC Current Gain	I_C = 100 mA, V_{CE} = 3V	68	85	110	1:1.6
H	DC Current Gain	I_C = 100 mA, V_{CE} = 3V	100	127	160	1:1.6
I	DC Current Gain	I_C = 100 mA, V_{CE} = 3V	140	180	240	1:1.6
J	DC Current Gain	I_C = 100 mA, V_{CE} = 3V	200	260	350	1:1.6
X	DC Current Gain	I_C = 100 mA, V_{CE} = 3V	30	58	110	1:3.5
Y	DC Current Gain	I_C = 100 mA, V_{CE} = 3V	100	190	350	1:3.5

6 physical dimensions

TO-92



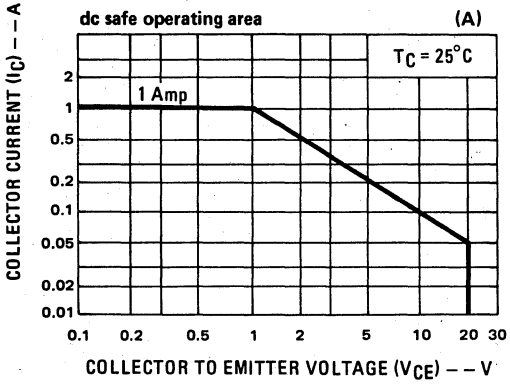
7 max power dissipation



8 typical performance characteristics

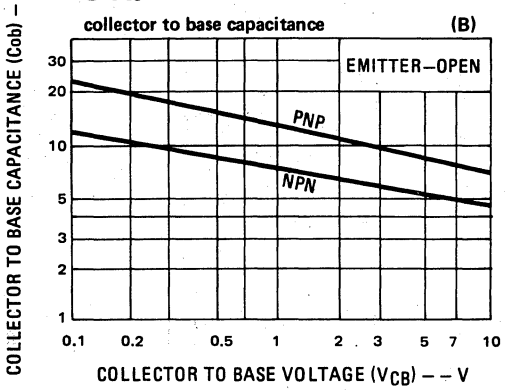
SOA

dc safe operating area (A)



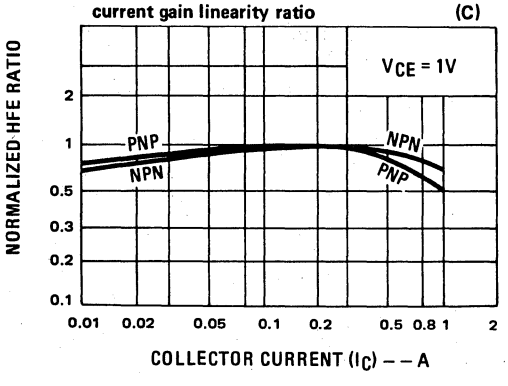
Cob

collector to base capacitance (B)



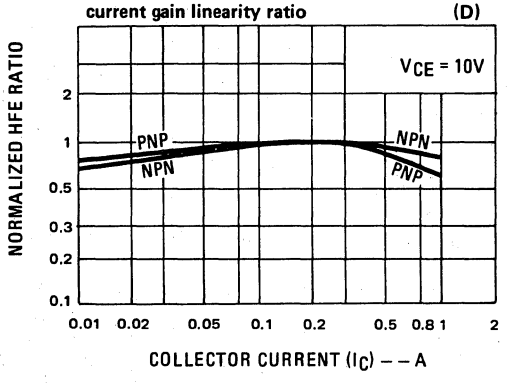
HFE1/HFE2

current gain linearity ratio (C)



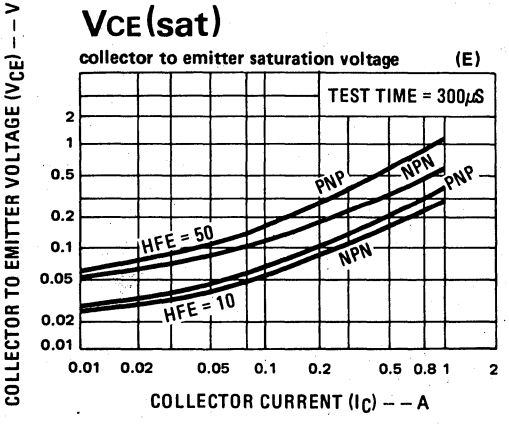
HFE1/HFE2

current gain linearity ratio (D)



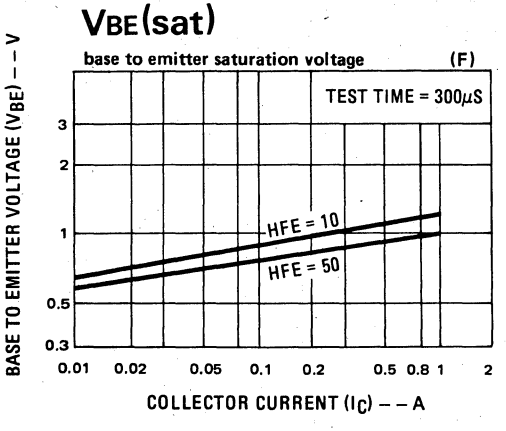
VCE(sat)

collector to emitter saturation voltage (E)

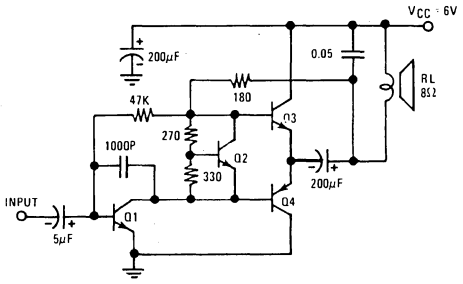


VBE(sat)

base to emitter saturation voltage (F)

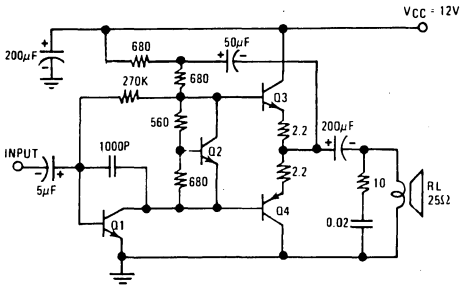


9 typical applications



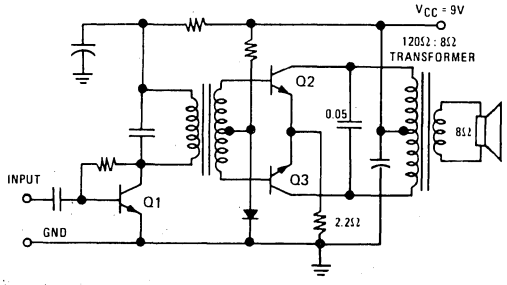
Q1 NB111EH/J Q3 NA11EG/J
Q2 NR001E Q4 NA12EG/J

Figure A. 380mW 6V/8Ω OTL Amplifier



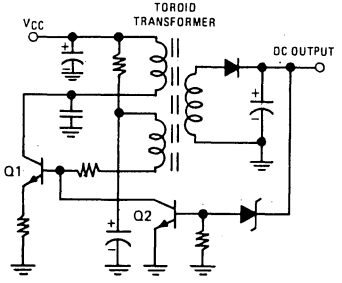
Q1 NB111EH/J Q3 NA11EG/J
Q2 NR001E Q4 NA12EG/J

Figure B. 650mW 12V/25Ω OTL Amplifier



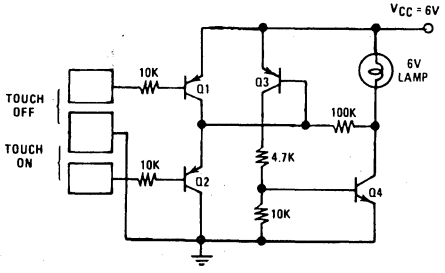
Q1 NB111EH/J Q2 NA11EG/J Q3 NA11EG/J

Figure C. 1.2W Audio Amplifier



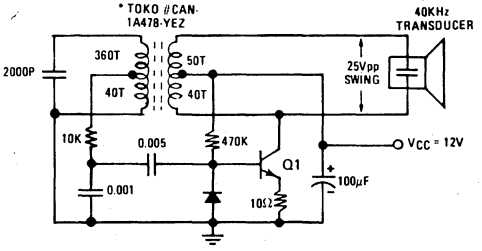
Q1 NA11EX Q2 NB111EY

Figure D. Typical Converter Circuit



Q1 NB021EY Q3 NB021EY
Q2 NB021EY Q4 NA11EX

Figure E. Touch-on/Touch-off Electronic Switch



Q1 NA11EX

Figure F. 40KHz Ultrasonic Transmitter

7