

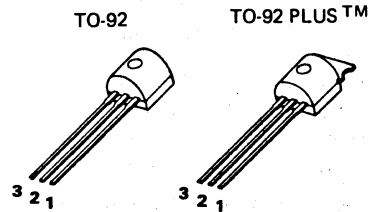


**NA21 (NPN)  
NA22 (PNP) 1.5 Amp complementary power transistors**

**features**

- 20 Volt/1.5 Amp rating
- 1.2 Watts practical power dissipation (TO-92 PLUS™)
- Low  $V_{CE(sat)}$  and  $V_{BE(sat)}$  characteristics at  $I_C = 700\text{ mA}$ ,  $I_B = 14\text{ mA}$
- Guaranteed  $V_{BE(on)}$  characteristics at small current for stable biasing
- Matched HFE groupings for complementary applications
- "Epoxy B" packaging concept for excellent reliability

**1 package and lead coding**



**applications**

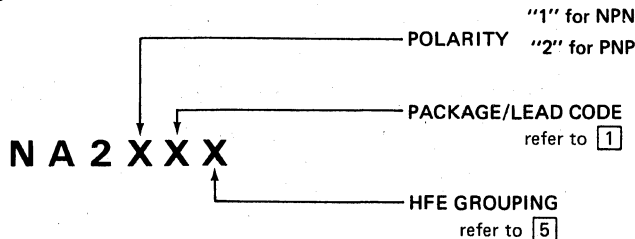
- 0.5 – 2 Watt audio power amplifiers
- Medium power switching circuits
- Converter/Inverter circuits
- Toy circuits

PACKAGE CODE		LEAD		
TO-92	TO-92 PLUS	1	2	3
E	X	E	B	C
F	Y	E	C	B
	Z	B	C	E
H		C	B	E

**2 maximum ratings**

PARAMETER	SYMBOL	RATING	UNIT
Collector-Emitter Voltage	$V_{CE}$	20	$V_{DC}$
Collector-Base Voltage	$V_{CB}$	25	$V_{DC}$
Emitter-Base Voltage	$V_{EB}$	5.0	$V_{DC}$
Collector Current (continuous)	$I_C (max)$	1.5	A
Power Dissipation ( $T_A = 25^\circ\text{C}$ )	$P_D$		
TO-92		0.6	W
TO-92 PLUS		0.75	W
Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_D$		
TO-92		1.0	W
TO-92 PLUS		2.5	W
Thermal Resistance			
TO-92	$\theta_{JA} / \theta_{JC}$	208/125	$^\circ\text{C/W}$
TO-92 PLUS	$\theta_{JA} / \theta_{JC}$	167/50	$^\circ\text{C/W}$
Temperature, Junction and Storage	$T_j, T_{stg}$	-55 to + 150	$^\circ\text{C}$

**3 ordering information**



**4** electrical characteristics  $T_C = 25^\circ\text{C}$

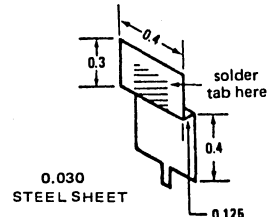
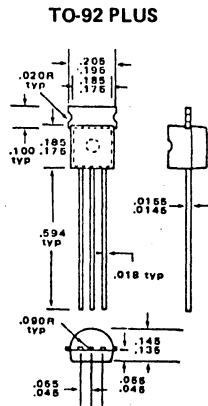
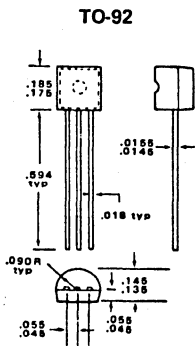
SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
$BV_{CEO}$	Collector-Emitter Sustaining Voltage	$I_C = 1 \text{ mA}$	20			V
$BV_{CBO}$	Collector-Base Breakdown Voltage	$I_C = 100 \mu\text{A}$	25			V
$BV_{EBO}$	Emitter-Base Breakdown Voltage	$I_E = 10 \mu\text{A}$	5			V
$I_{CEO}$	Collector-Emitter Leakage Current	$V_{CE} = 15\text{V}$			100	$\mu\text{A}$
$I_{CBO}$	Collector-Base Leakage Current	$V_{CB} = 20\text{V}$			1	$\mu\text{A}$
$V_{BE}(\text{on})$	Base-Emitter Voltage	$I_C = 10 \text{ mA}, V_{CE} = 3\text{V}$	600	670	730	mV
$V_{BE}(\text{sat})$	Base-Emitter Saturation Voltage	$I_C = 700 \text{ mA}, I_B = 14 \text{ mA}$		0.9	1.0	V
$V_{CE}(\text{sat})$	Collector-Emitter Saturation Voltage	$I_C = 700 \text{ mA}, I_B = 14 \text{ mA}$				
	NPN types			0.35	0.5	V
	PNP types			0.65	1	V
$C_{ob}$	Collector Output Capacitance	$V_{CB} = 10\text{V}, f = 1 \text{ MHz}$		0.45		pF
	NPN types			0.7		pF
	PNP types					
$f_t$	Current Gain Bandwidth Product	$I_C = 100 \text{ mA}, V_{CE} = 3\text{V}$	50	200		MHz

**5** HFE groupings

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

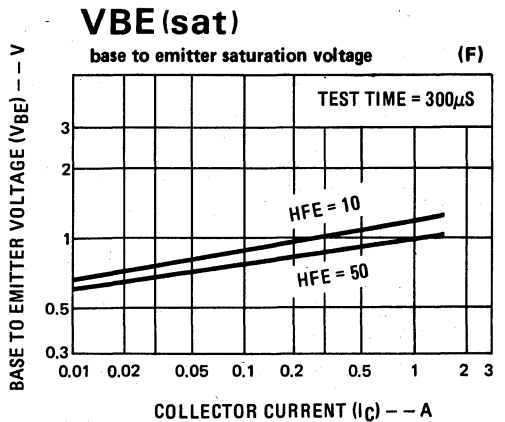
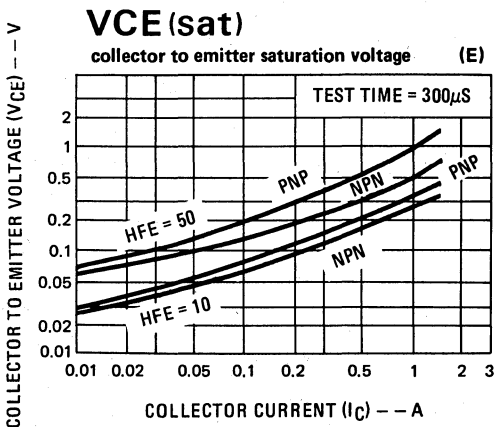
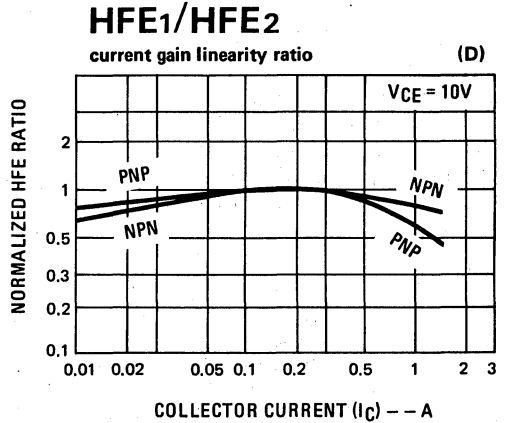
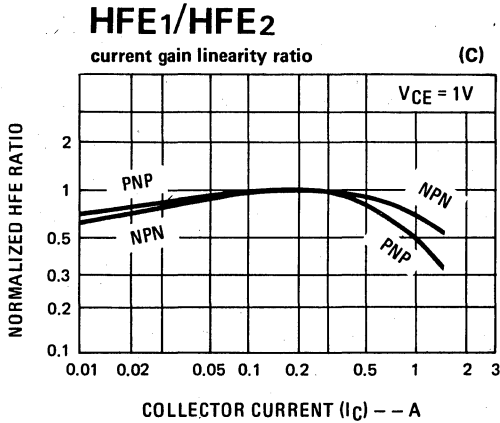
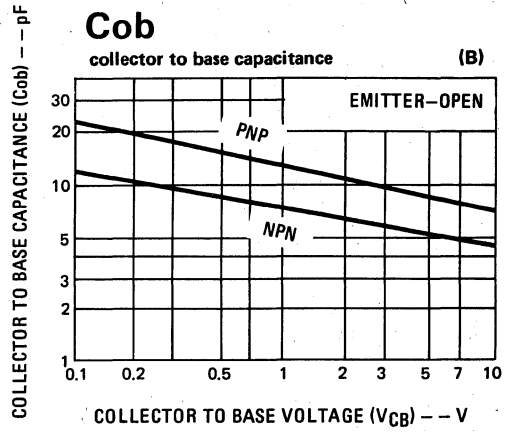
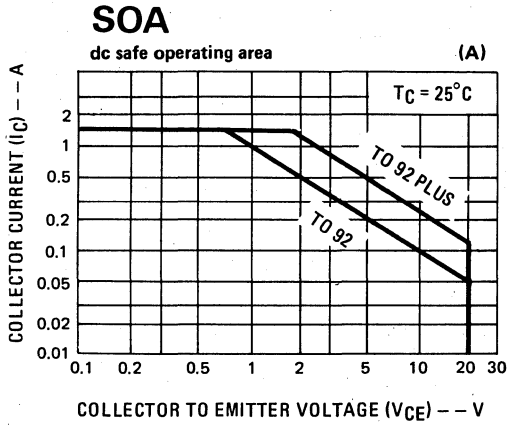
**6** physical dimensions

**7** heatsink information

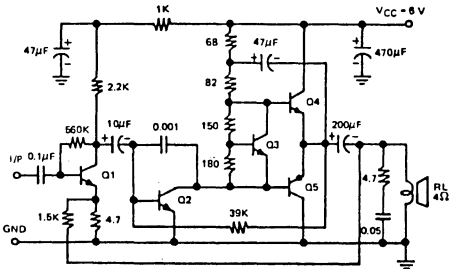


- TO-92 PLUS package with heat-sink shown on right permits 1.6 Watts power dissipation and combined Thermal Resistance  $\theta_{JA} = 78^\circ\text{C/W}$ . If used without heatsink and PCB land area at collector lead  $> 1 \text{ sq. inch}$ ,  $P_D = 1.2\text{W}$ .

8 typical performance characteristics

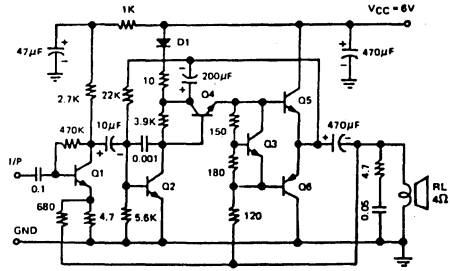


9 typical applications



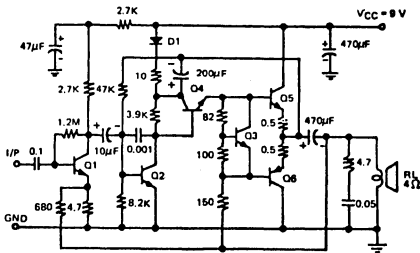
Q1 NB011EY Q3 NR001E Q5 NA22EG/J  
Q2 NB111EH/J Q4 NA21EG/J

Figure A. 700mW 6V/4Ω OTL Amplifier



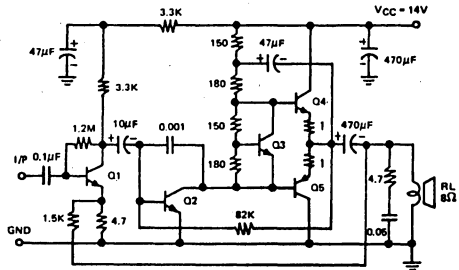
Q1 NB011EY Q3 NR001E Q5 NA21EG/J  
Q2 NB011EY Q4 NB111EY Q6 NA22EG/J

Figure B. 950mW 6V/4Ω OTL Amplifier



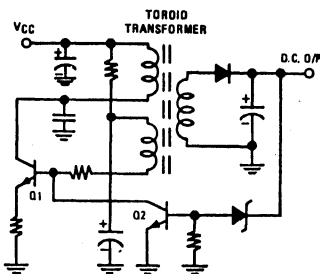
Q1 NB011EY Q3 NR001E Q5 NA21EG/J  
Q2 NB011EY Q4 NB111EY Q6 NA22EG/J

Figure C. 2W 9V/4Ω OTL Amplifier



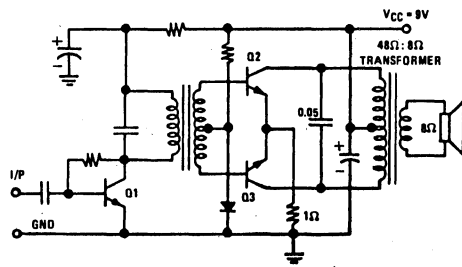
Q1 NB011EY Q3 NR001E Q5 NA22EG/J  
Q2 NB111EH/J Q4 NA21EG/J

Figure D. 2.2W 14V/8Ω OTL Amplifier



Q1 NA21EX Q2 NB111EY

Figure E. Typical Converter Circuit



Q1 NB111E Q2 NA21Y G/J Q3 NA21Y G/J

Figure F. 2W Audio Amplifier