National Semiconductor

NB211,212,213(NPN) NB221,222,223(PNP) 500mA medium current driver transistors

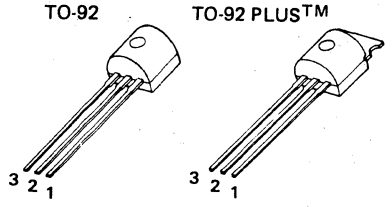
features

- 35 to 65 Volt at 500 mA collector ratings
- 1.2 Watts practical power dissipation (TO-92 PLUS™)
- 400 mV guaranteed V_{CE} (sat) characteristics at I_C = 100 mA and I_B = 2 mA
- Matched HFE groupings for complementary applications
- "Epoxy B" packaging concept for excellent reliability

applications

- 4 to 6 Watt amplifier class A drivers
- Medium current level switching circuits
- LED drivers
- TV receivers

1 package and lead coding

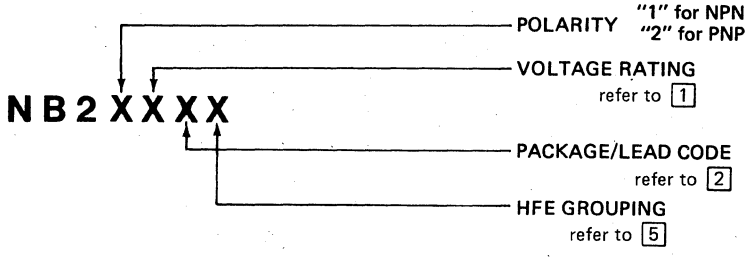


PACKAGE CODE TO-92	PACKAGE CODE TO-92 PLUS	LEAD 1	LEAD 2	LEAD 3
E	X	E	B	C
F	Y	E	C	B
	Z	B	C	E
H		C	B	E

2 maximum ratings

PARAMETER	SYMBOL	NB211 NB221	NB212 NB222	NB213 NB223	UNIT
Collector-Emitter Voltage	V_{CEO}	35	50	65	V_{DC}
Collector-Base Voltage	V_{CB}	40	55	70	V_{DC}
Emitter-Base Voltage	V_{EB}	6.0	6.0	6.0	V_{DC}
Collector Current (continuous)	I_C (max)	500	500	500	mA
Power Dissipation (T_A = 25°C)	P_D				
TO-92		0.6	0.6	0.6	W
TO-92 PLUS		0.75	0.75	0.75	W
Power Dissipation (T_C = 25°C)	P_D				
TO-92		1.0	1.0	1.0	W
TO-92 PLUS		2.5	2.5	2.5	W
Thermal Resistance					
TO-92	θ_{JA}/θ_{JC}	208/125	208/125	208/125	°C/W
TO-92 PLUS	θ_{JA}/θ_{JC}	167/50	167/50	167/50	°C/W
Temperature, Junction and Storage	Tj, Tstg	−55 to +150	−55 to +150	−55 to +150	°C

3 ordering information



4 electrical characteristics $T_C = 25°C$

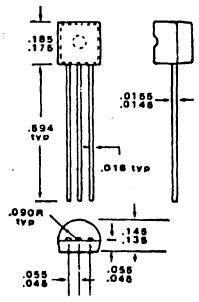
SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
BV_{CEO}	Collector-Emitter Sustaining Voltage	I_C = 1 mA				
	NB211/221		35			V
	NB212/222		50			V
	NB213/223		65			V
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 100μA				
	NB211/221		40			V
	NB212/222		55			V
	NB213/223		70			V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 10μA	6			V
I_{CEO}	Collector-Emitter Leakage Current	V_{CE} = 30V NB211/221			10	μA
		45V NB212/222			10	μA
		60V NB213/223			10	μA
I_{CBO}	Collector-Base Leakage Current	V_{CB} = 35V NB211/221			0.5	μA
		50V NB212/222			0.5	μA
		65V NB213/223			0.5	μA
I_{EBO}	Emitter-Base Leakage Current	V_{EB} = 5V			0.1	μA
V_{BE} (sat)	Base-Emitter Saturation Voltage	I_C = 100 mA, I_B = 2 mA		0.8	0.95	V
V_{CE} (sat)	Collector-Emitter Saturation Voltage	I_C = 100 mA, I_B = 2 mA		0.2	0.4	V
H_{FE1}	DC Current Gain	I_C = 1 mA, V_{CE} = 5V	30			ratio
Cob	Collector Output Capacitance	V_{CB} = 10V, f = 1 MHz				
	NPN types			3.5		pF
	PNP types			4.5		pF
ft	Current Gain Bandwidth Product	I_C = 20 mA, V_{CE} = 5V	50			MHz

5 HFE groupings

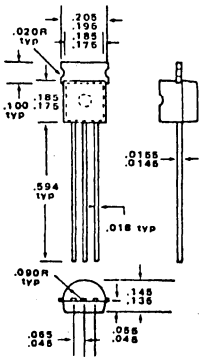
GROUPING	PARAMETER	CONDITIONS	MIN	TYP	MAX	RATIO
G	DC Current Gain	I_C = 30 mA, V_{CE} = 5V	68	85	110	1:1.6
H	DC Current Gain	I_C = 30 mA, V_{CE} = 5V	100	127	160	1:1.6
I	DC Current Gain	I_C = 30 mA, V_{CE} = 5V	140	180	240	1:1.6
J	DC Current Gain	I_C = 30 mA, V_{CE} = 5V	200	260	350	1:1.6
X	DC Current Gain	I_C = 30 mA, V_{CE} = 5V	30	58	110	1:3.5
Y	DC Current Gain	I_C = 30 mA, V_{CE} = 5V	100	190	250	1:3.5

6 physical dimensions

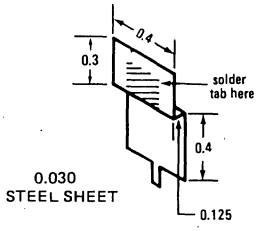
TO-92



TO-92 PLUS



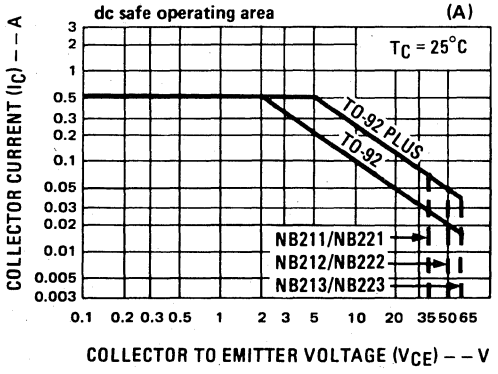
7 heatsink information



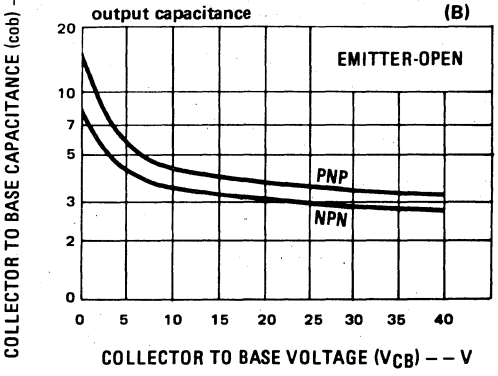
- TO-92 PLUS package with heatsink shown on right permits 1.6 Watts power dissipation and combined Thermal Resistance θ_{JA} = 78°C/W. If used without heatsink and PCB land area at collector lead > 1 sq. inch, P_D = 1.2W.

8 typical performance characteristics

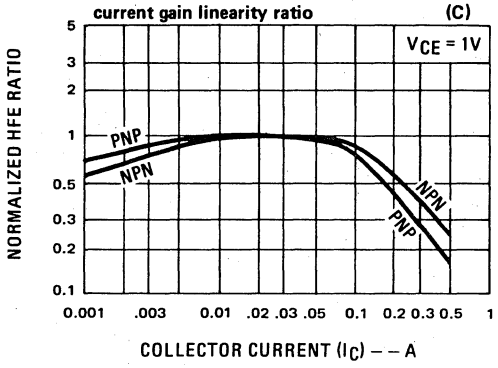
SOA
dc safe operating area (A)



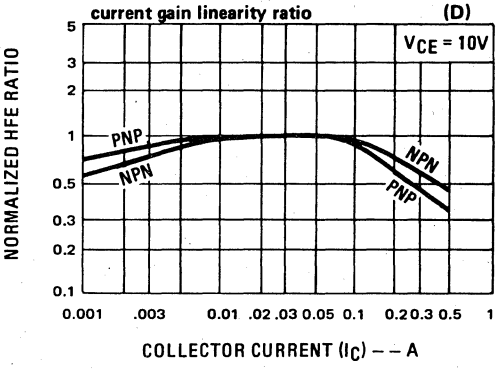
Cob
output capacitance (B)



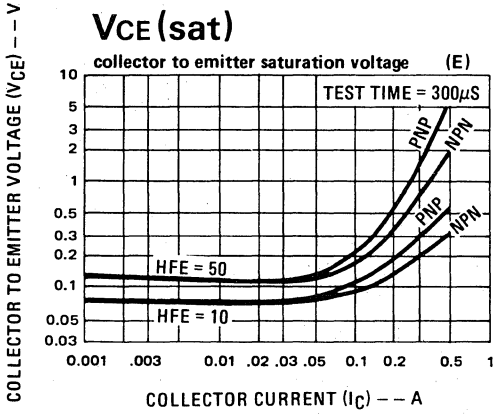
HFE1/HFE2
current gain linearity ratio (C)



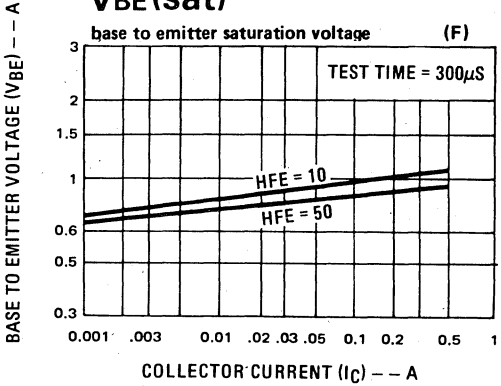
HFE1/HFE2
current gain linearity ratio (D)



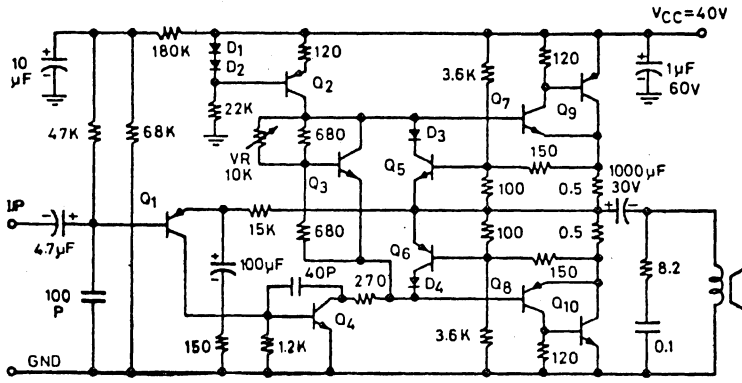
VCE(sat)
collector to emitter saturation voltage (E)



VBE(sat)
base to emitter saturation voltage (F)

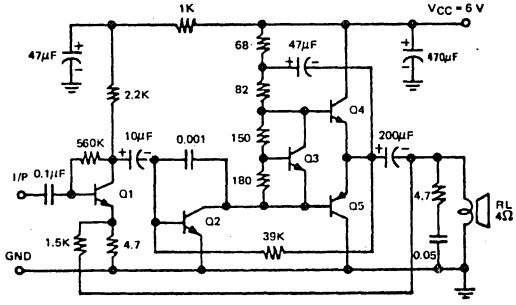


9 typical applications



Q1 NB022EY
Q2 NB123EY
Q3 NR001E
Q4 NB113EY
Q5 NB111EY
Q6 NB121EY
Q7 NB313Y
Q8 NB323Y
Q9 NA72W
Q10 NA71W

Figure A. 25 Watt OTL Amplifier



Q1 NB011EY
Q2 NB111EH/J
Q3 NR001
Q4 NA21EG/J
Q5 NA22EG/J

Figure B. 700mW 6V/4Ω OTL Amplifier

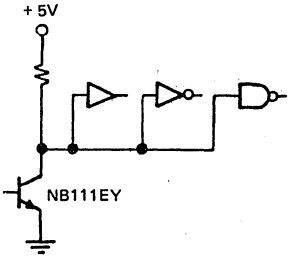


Figure C. High fan-out TTL driver

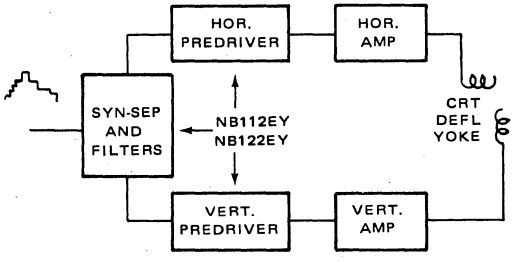


Figure D. TV processor/predriver applications

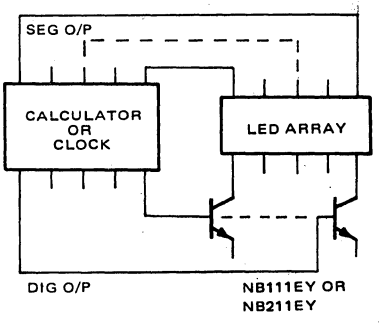


Figure E. Calculator/Clock driver application