

FEATURES

- **ULTRA-HIGH SWITCHING SPEED :**
 t_{ON} 0.7 ns TYP, t_{OFF} 0.5 ns TYP
- **HIGH f_T :** 3 GHz TYP
- **HIGH GAIN:** 10 dB at 1 GHz MIN
- **LOW NOISE :** 1 dB at 70 MHz
- **HIGH RELIABILITY GOLD METALLIZATION**

DESCRIPTION

The NE327 series of NPN silicon transistors is designed for use in ultrahigh speed current mode switching applications and for use in microwave amplifiers up to 1 GHz. Transistors in this series are available in chip form and in several reliable ceramic-metal stripline packages, including a dual-chip package (NE32740). The NE32740 is available in two lead configurations which offer the engineer a large degree of design flexibility. Reliability is assured by NEC's stringent production controls and platinum, titanium, and gold metallization system.

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

PART NUMBER EIAJ ¹ REGISTERED NUMBER			NE32700			NE32708			NE32740A/B 2SC1924 2SC1925 40A/B		
PACKAGE OUTLINE			00 (CHIP)			08					
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
f_T	Gain Bandwidth Product at $V_{CE} = 5\text{V}$, $I_C = 15\text{mA}$	GHz	2.5	3			2.5	3		2.5	3
NF _{OPT}	Optimum Noise Figure ² at $V_{CE} = 5\text{V}$, $I_C = 3\text{mA}$, $f = 70\text{MHz}$	dB		1			1				
	$f = 0.5\text{GHz}$	dB		1.8			1.8				
	$f = 1\text{GHz}$	dB		3.4			3.4	4.5			
MAG	Maximum Available Gain ³ at $V_{CE} = 5\text{V}$, $I_C = 15\text{mA}$, $f = 1\text{GHz}$	dB		13		10	13				
S _{21E} ²	Insertion Power Gain at $V_{CE} = 5\text{V}$, $I_C = 15\text{mA}$, $f = 0.5\text{GHz}$	dB					15				
	$f = 1\text{GHz}$	dB				8	10				
	$f = 2\text{GHz}$	dB					4				
t_{ON}	Switching Time ⁷ at $V_{CE} = 5\text{V}$, $I_E = 30\text{mA}$	ns		0.7			0.7			0.7	
t_{OFF}	Switching Time ⁵ at $V_{CE} = 5\text{V}$, $I_E = 30\text{mA}$	ns		0.5			0.5			0.5	
h _{FE}	Forward Current Gain ³ Ratio at $V_{CE} = 5\text{V}$, $I_C = 10\text{mA}$		30	100	300	30	100	300	30	100	300
h _{FE1} h _{FE2}	Forward Current Gain Ratio ⁴ at $V_{CE} = 5\text{V}$, $I_C = 10\text{mA}$					0.8		1			
I _{CBO}	Collector Cutoff Current at $V_{CB} = 10\text{V}$, $I_E = 0$	μA			0.5			0.5			0.1
I _{EBO}	Emitter Cutoff Current at $V_{EB} = 2\text{V}$, $I_C = 0$	μA			0.5			0.5			0.1
C _{CB}	Collector to Base Capacitance ⁵ at $V_{CB} = 5\text{V}$, $I_C = 0$, $f = 1\text{MHz}$	pF		0.9	1.5		0.9	1.5		1.1	1.5
C _{EB}	Emitter to Base Capacitance at $V_{EB} = 0.5\text{V}$, $I_C = 0$, $f = 1\text{MHz}$	pF		0.9	1.5		0.9	1.5		1.1	1.5
ΔV _{BE}	Base Emitter Voltage Difference at $V_{CE} = 5\text{V}$, $I_C = 10\text{mA}$	mV									10
R _{E(HIE)}	Input Resistance at $V_{CE} = 5\text{V}$, $I_C = 15\text{mA}$, $f = 1\text{GHz}$	Ω		30			30	50			
R _{TH (J-C)}	Thermal Resistance (Junction to Case)	°C/W			50			70			50
P _T	Total Power Dissipation	mW			250			250			300 ⁶

Notes:

1. Electronic Industrial Association of Japan.
2. Input and output are tuned for optimum noise figure.
3. Pulse Width $\leq \mu\text{s}$, Duty Cycle $\leq 2\%$ /pulsed.
4. h_{FE2} is the smallest of the two.
5. C_{CB} measurement employs a three-terminal capacitance bridge incorporating a guard circuit. The emitter terminal shall be connected to the guard terminal.
6. P_T is limited to 200 mW/chip in the dual chip configuration (NE32740).
7. See Test Circuit.

NE327 SERIES

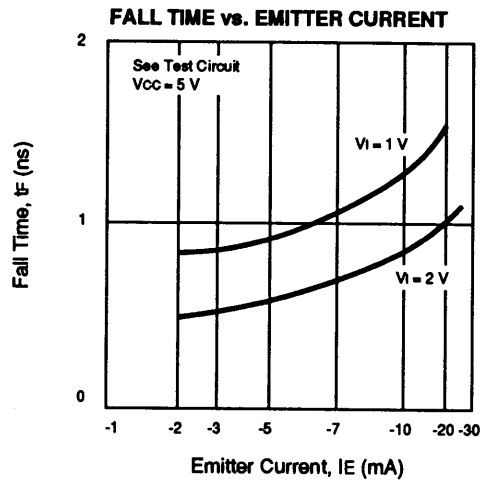
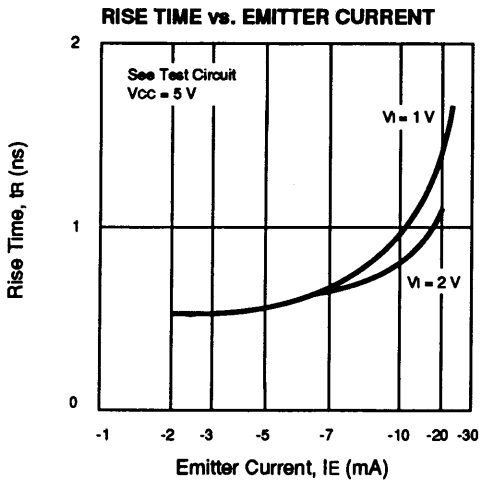
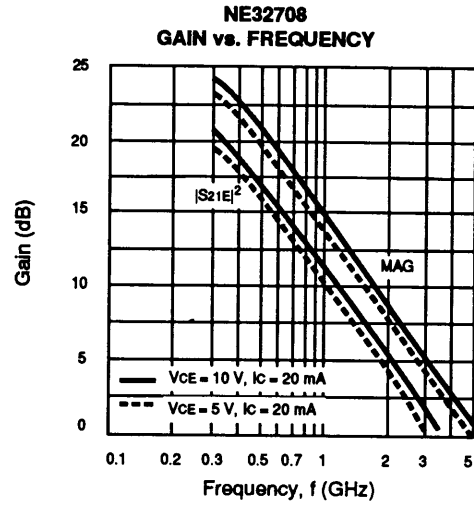
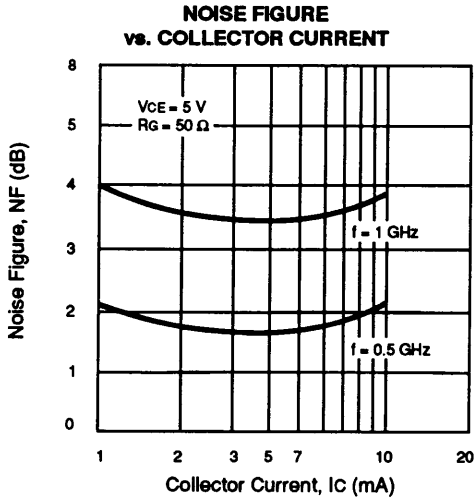
ABSOLUTE MAXIMUM RATINGS¹ (T_A = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V _{CB0}	Collector to Base Voltage	V	20
V _{CE0}	Collector to Emitter Voltage	V	12
V _{EB0}	Emitter to Base Voltage	V	3
I _C	Collector Current	mA	50
T _J	Junction Temperature	°C	200
T _{STG}	Storage Temperature	°C	-65 to +200

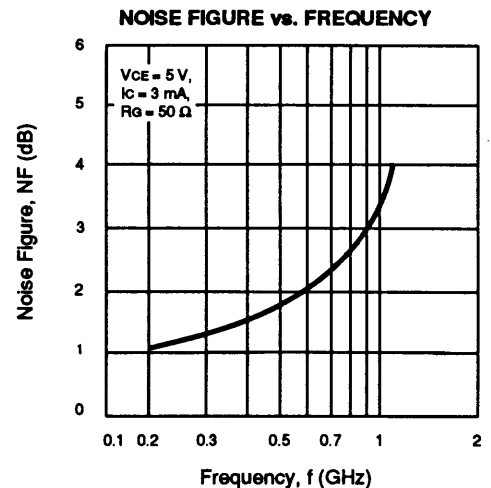
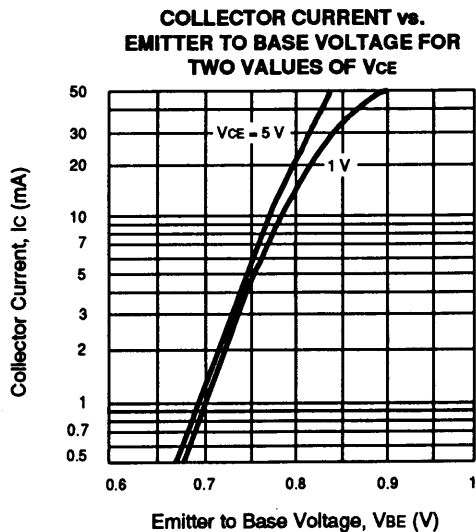
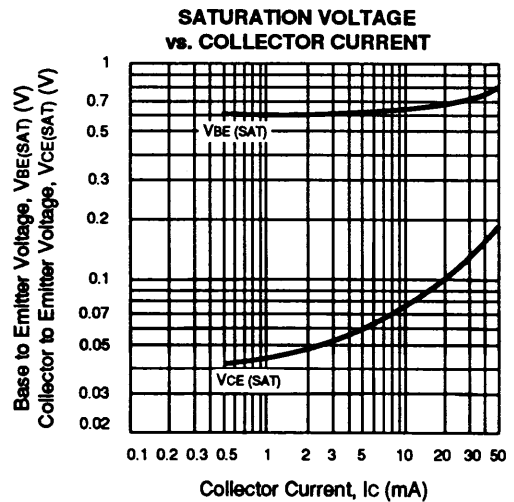
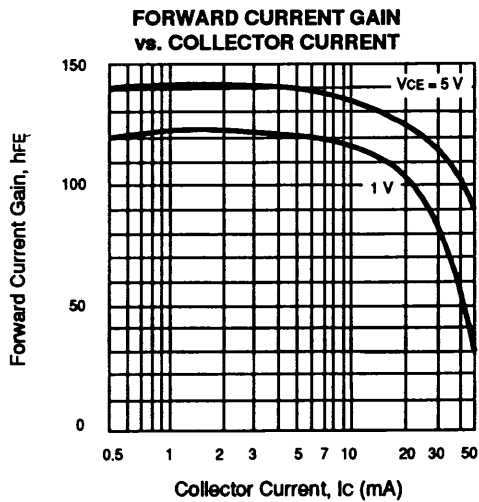
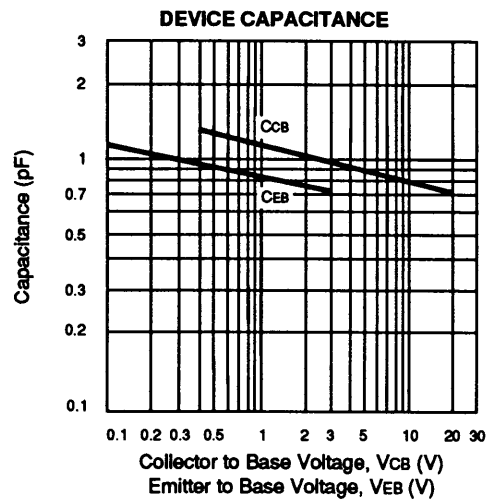
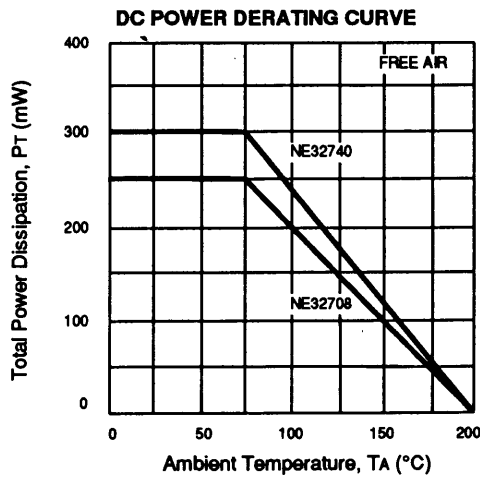
Notes:

1. Operation in excess of any one of these parameters may result in permanent damage.

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

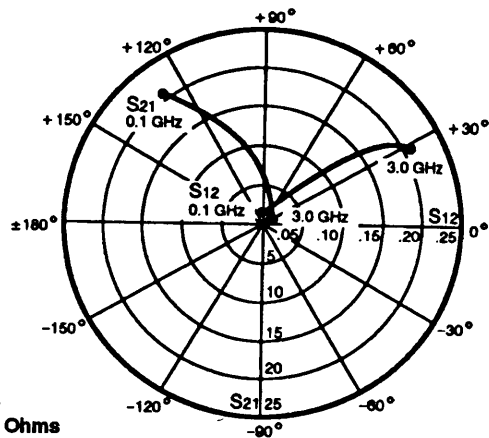
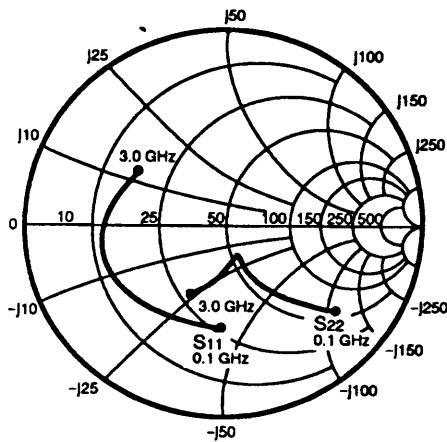


TYPICAL PERFORMANCE CURVES (TA = 25°C)



NE327 SERIES

TYPICAL COMMON EMITTER SCATTERING PARAMETERS (TA = 25°C)



NE32708
Coordinates in Ohms
Frequency in GHz
(VCE = 5 V, IC = 15 mA)

VCE = 5 V, IC = 3 mA

FREQUENCY (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG ¹
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		
100	.80	-35	8.45	148	.02	75	.93	-17	0.16	26.3
500	.60	-123	4.19	99	.12	37	.49	-50	0.55	15.4
1000	.54	-154	2.34	75	.15	31	.37	-65	0.88	11.9
1500	.50	-167	1.65	56	.18	27	.38	-76	1.07	8.0
2000	.48	175	1.29	38	.21	22	.40	-90	1.15	5.5
2500	.47	168	1.06	27	.23	17	.43	-99	1.24	3.7
3000	.47	163	0.93	15	.25	13	.48	-109	1.2	3.0

VCE = 5 V, IC = 15 mA

100	.54	-93	20.27	128	.01	63	.70	-38	0.69	33.1
500	.60	-163	5.74	87	.04	49	.21	-65	1.32	18.2
1000	.60	-180	3.00	70	.09	50	.18	-75	1.18	12.7
1500	.55	174	2.04	55	.13	44	.22	-85	1.26	8.9
2000	.56	161	1.57	40	.16	36	.28	-98	1.23	7.0
2500	.56	154	1.26	31	.19	33	.33	-106	1.22	5.4
3000	.55	149	1.09	20	.21	28	.39	-114	1.2	4.4

VCE = 10 V, IC = 3 mA

100	.83	-31	8.60	150	.01	77	.94	-13	0.24	29.3
500	.59	-113	4.54	102	.10	41	.56	-41	0.57	16.6
1000	.52	-146	2.57	77	.14	35	.44	-53	0.85	12.6
1500	.47	-160	1.80	58	.17	29	.45	-63	1.03	9.2
2000	.45	-178	1.42	40	.20	24	.45	-78	1.11	6.5
2500	.44	175	1.15	29	.22	19	.47	-87	1.21	4.4
3000	.44	170	1.00	17	.24	14	.52	-97	1.18	3.6

VCE = 10 V, IC = 15 mA

100	.55	-79	21.22	131	.01	65	.75	-30	0.59	33.3
500	.55	-157	6.37	89	.04	50	.29	-45	1.23	19.1
1000	.55	-174	3.31	71	.08	51	.25	-53	1.23	13.3
1500	.53	178	2.26	57	.12	44	.29	-65	1.2	10.0
2000	.53	165	1.71	41	.16	38	.33	-81	1.13	8.1
2500	.52	158	1.38	31	.18	33	.37	-91	1.2	6.1
3000	.52	153	1.19	21	.20	29	.43	-101	1.14	5.5

Note:

1. Gain Calculations:

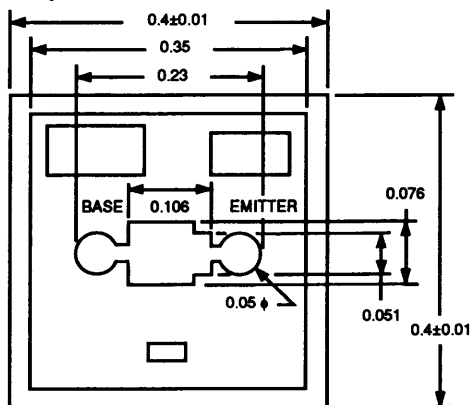
$$MAG = \frac{|S_{21}|}{|S_{12}|} (K \pm \sqrt{K^2 - 1}) \quad \text{When } K \leq 1, \text{ MAG} = \text{MSG} \quad \text{MSG} = \frac{|S_{21}|}{|S_{12}|}, \quad K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12} S_{21}|}, \quad \Delta = S_{11} S_{22} - S_{21} S_{12}$$

MAG = Maximum Available Gain

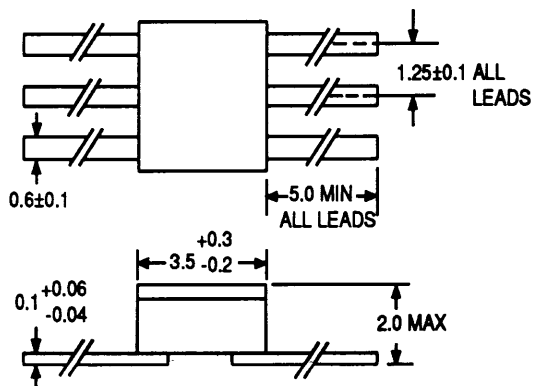
MSG = Maximum Stable Gain

OUTLINE DIMENSIONS (Units in mm)

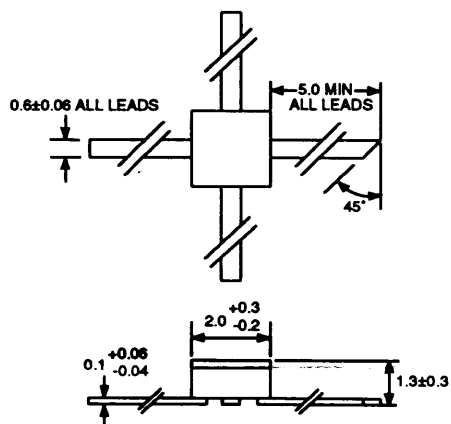
NE32700 (CHIP)



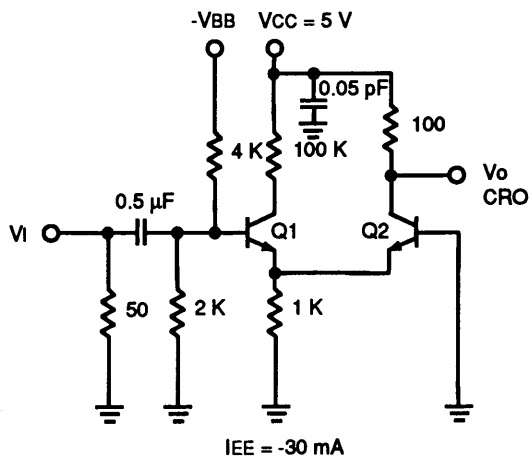
PACKAGE OUTLINE 40A/B



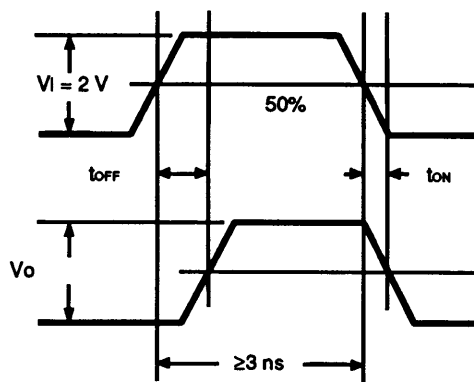
PACKAGE OUTLINE 08



TEST CIRCUITS



ton 0.7 ns TYP
toff 0.5 ns TYP



ALL RESISTORS VALUES ARE TYPICAL AND IN OHMS

Notes:

1. Base voltage V_{BB} is adjusted so that IC of Tr1 is zero when V_i is zero.
2. IC variation range is between zero and about 30 mA.

INPUT AND OUTPUT WAVEFORMS AND DEFINITION TO t_{on} and t_{off}