NEC

NPN MEDIUM POWER UHF-VHF TRANSISTOR

NE74100 NE74113 NE74114

FEATURES

- **HIGH GAIN BANDWIDTH PRODUCT:** f_T = 1.7 GHz
- **LOW NOISE FIGURE AT 200 MHz:** NF = 2.7 dB
- **LOW DISTORTION**
- **HIGH POWER GAIN**
- **RELIABLE**

DESCRIPTION

The NE741 series of NPN epitaxial silicon transistors is designed for wide bandwidth UHF and VHF amplifiers. Its low distortion and noise figures make it an excellent choice for CATV and MATV applications, especially those requiring higher than normal reliability. Besides the chip (NE74100) the series comes packaged in two versions of the TO-39 can. The NE74113 has the collector connected to the case whereas the NE74114 has all leads insulated from the case. The series is normally screened to NEC's Grade D level of reliability, but higher reliability screening is available depending upon customer requirements. Performance and quality are assured by QC procedures patterned after MIL-S-19500 and NEC's exclusive Pt-Si-Ti/Pt/Au metallization.

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ELECTRICAL CHARACTERISTICS (T_A = 25°C)

PART NUMBER EIAJ[1] REGISTERED NUMBER PACKAGE OUTLINE			NE74100 00 (CHIP)			NE74113 2SC1365 13 (TO-39)			NE74114 2SC1252 14 (TO-39)		
SYMBOLS	**PARAMETERS AND CONDITIONS**	**UNITS**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**
f_T	Gain Bandwidth Product at V_{CE} = 15 V, I_C = 70 mA	GHz	1.4	1.7		1.4	1.7		1.4	1.7	
NF_{MIN}	Minimum Noise Figure at V_{CE} = 15 V, I_C = 30 mA, R_G = 50 Ω f = 200 MHz V_{CE} = 15 V, I_C = 10 mA f = 200 MHz	 dB dB		 3 2.7			 3 2.7	 4 		 3 2.7	 4
MAG	Maximum Available Gain at V_{CE} = 15 V, I_C = 50 mA, f = 200 MHz	 dB		 17		 15	 17		 15	 17	
$\|S_{21E}\|^2$	Insertion Power Gain at V_{CE} = 15 V, I_C = 80 mA, f = 0.2 GHz f = 0.5 GHz f = 1 GHz	 dB dB dB		 15 8 3			 15 8 3			 15 8 3	
P_{1dB}	Power Output at 1 dB Compression V_{CE} = 15 V, I_C = 150 mA, f = 500 MHz	 dBm		 30			 30			 30	
h_{FE}	Forward Current Gain at V_{CE} = 10 V[3], I_C = 50 mA		20	80	200	20	80	200	20	80	200
I_{CBO}	Collector Cutoff Current at V_{CB} = 30 V, I_E = 0	µA			0.1			0.1			0.1
I_{EBO}	Emitter Cutoff Current at V_{EB} = 2 V, I_C = 0	µA			0.5			0.5			0.5
C_{OB}	Output Capacitanceat V_{CB} = 15 V, I_E = 0, f = 1 MHz[4]	pF					2	3		2	3
P_T	Total Power Dissipation (T_C = 25°C)	W						5[5]			5[5]
R_{TH}	Thermal Resistance (Junction to Case)	°C/W						35			35

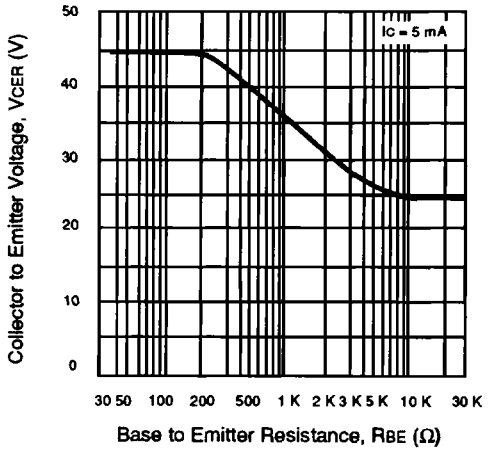
Notes:
1. Electronic Industrial Association of Japan.
2. Input and output are tuned for optimum noise figure.
3. Pulse Width ≤ 350 µs, Duty Cycle ≤ 2% pulsed.
4. The emitter is grounded.
5. P_T = 3.2 W at T_C = 88°c.

ABSOLUTE MAXIMUM RATINGS[1] (TA = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CBO}	Collector to Base Voltage	V	45
V_{CEO}	Collector to Emitter Voltage	V	25
V_{EBO}	Emitter to Base Voltage	V	3
I_C	Collector Current	mA	300
T_J	Junction Temperature	°C	200
T_{STG}	Storage Temperature	°C	-65 to +200

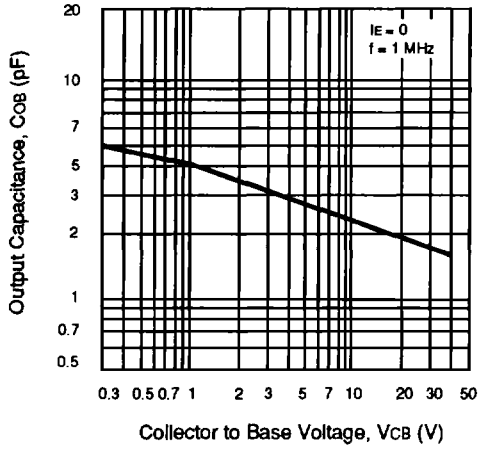
Notes:
1. Operation in excess of any one of these parameters may result in permanent damage.

COLLECTOR TO EMITTER VOLTAGE vs. BASE TO EMITTER RESISTANCE

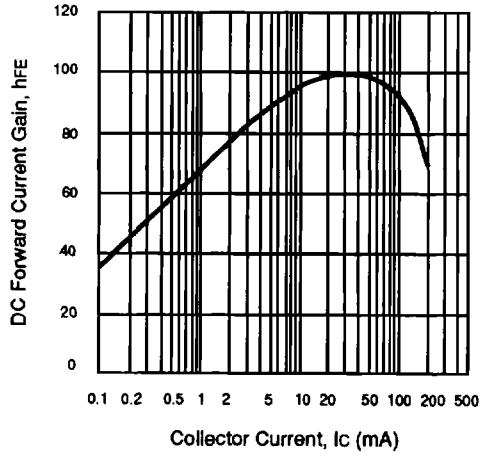


TYPICAL PERFORMANCE CURVES (TA = 25°C)

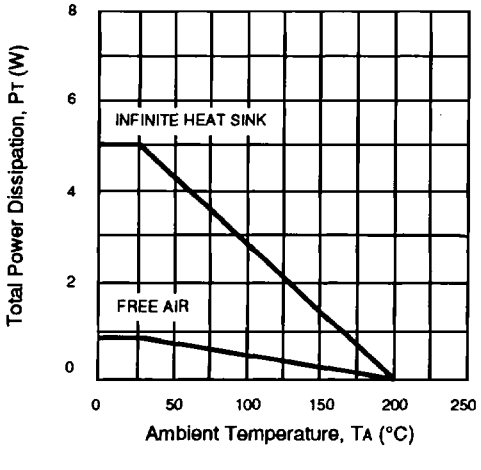
OUTPUT CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



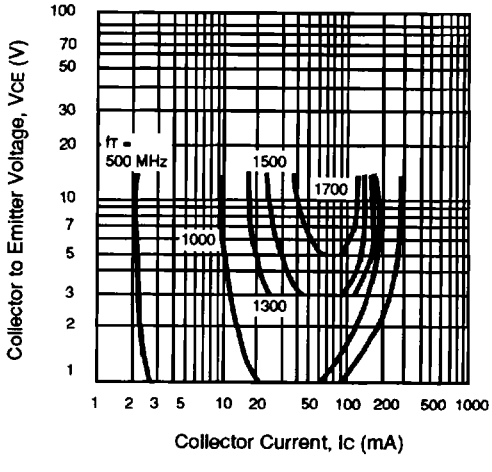
DC FORWARD CURRENT GAIN vs. COLLECTOR CURRENT



DC POWER DERATING CURVES

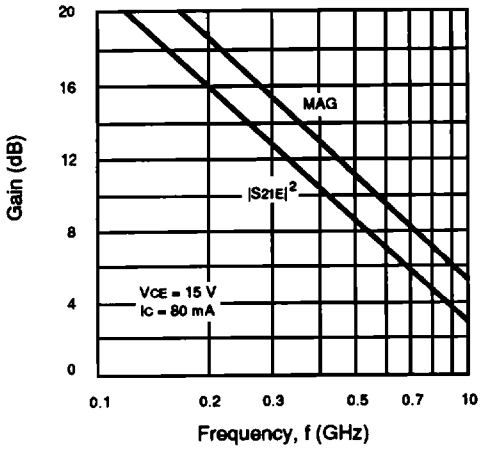


MAP OF THE GAIN BANDWIDTH PRODUCT

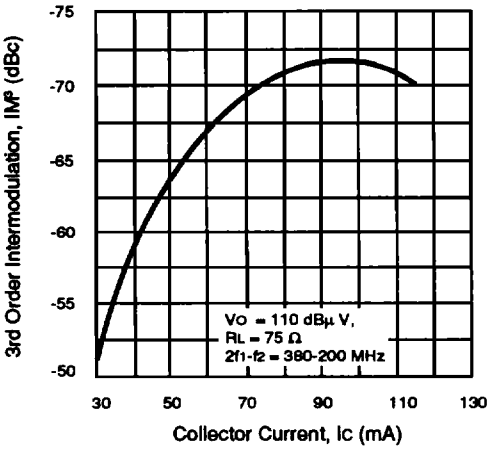


TYPICAL PERFORMANCE CURVES (TA = 25°C)

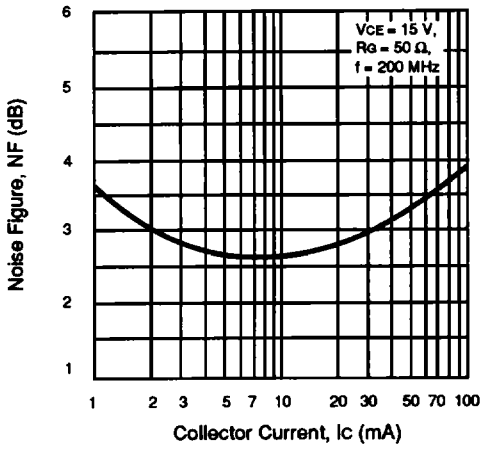
FORWARD INSERTION GAIN AND MAXIMUM AVAILABLE GAIN vs. FREQUENCY



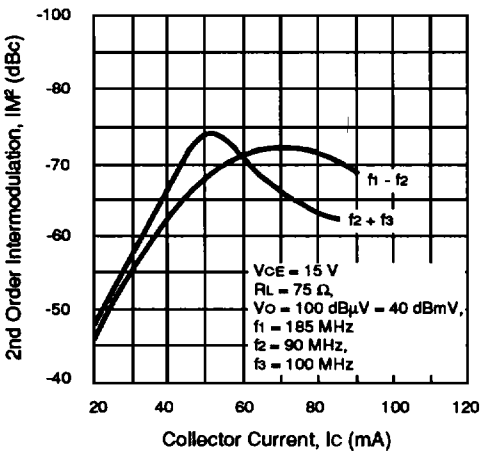
3RD ORDER INTERMODULATION DISTORTION vs. COLLECTOR CURRENT USING TEST CIRCUIT NO. 1



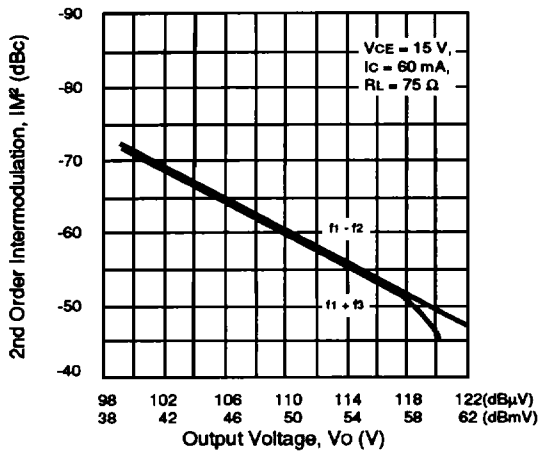
NOISE FIGURE vs. COLLECTOR CURRENT



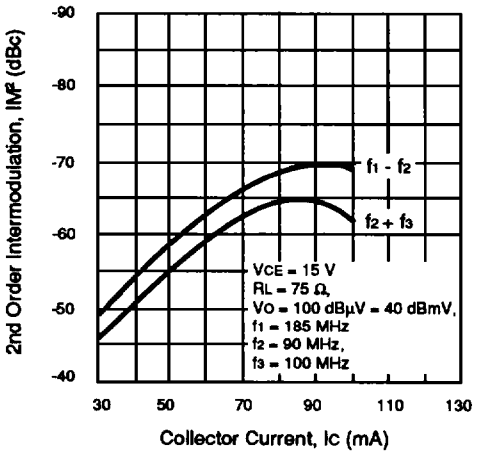
2ND ORDER INTERMODULATION DISTORTION vs. COLLECTOR CURRENT TEST CIRCUIT NO.1



2ND ORDER INTERMODULATION DISTORTION vs. OUTPUT VOLTAGE USING TEST CIRCUIT NO. 1



2ND ORDER INTERMODULATION DISTORTION vs. COLLECTOR CURRENT TEST CIRCUIT NO. 2



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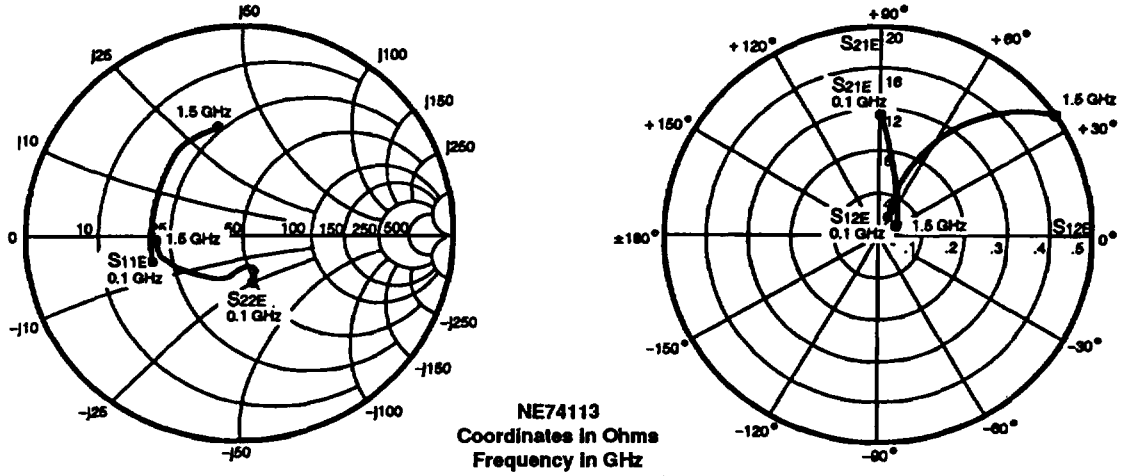
TYPICAL COMMON EMITTER SCATTERING PARAMETERS (TA = 25°C)



NE74113
Coordinates in Ohms
Frequency in GHz
(V_{CE} = 15 V, I_C = 60 mA)

V_{CE} = 15 V, I_C = 20 mA

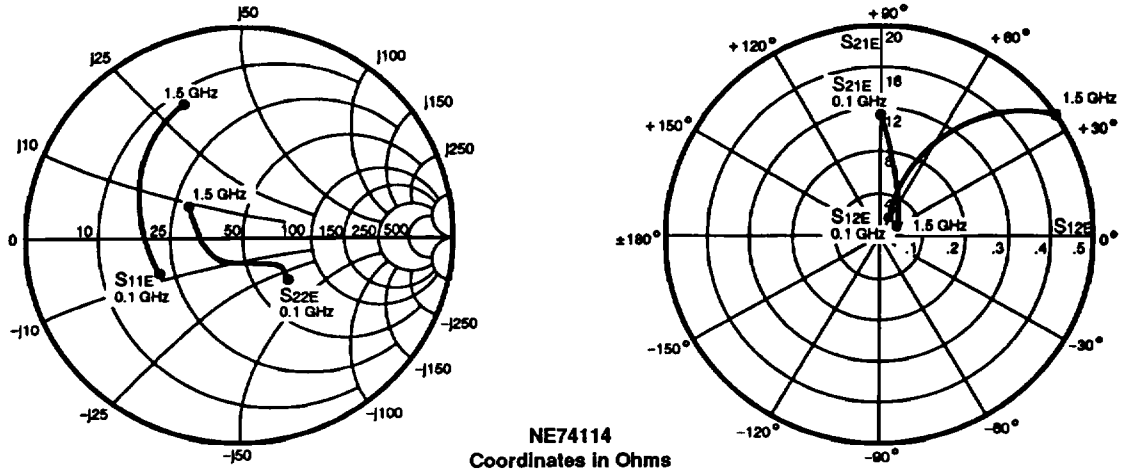
FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG[1]
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
100	0.42	-149	9.75	96	0.05	62	0.31	-54	0.88	22.9
200	0.42	-172	5.08	81	0.09	68	0.24	-58	0.98	17.5
500	0.45	158	2.15	56	0.21	68	0.24	-87	0.99	10.1
1000	0.51	126	1.25	27	0.39	55	0.33	-135	0.92	5.1
1500	0.56	100	0.96	8	0.56	40	0.43	-174	0.92	2.3
VCE = 15 V, IC = 40 mA										
100	0.39	-158	10.48	93	0.05	68	0.25	-60	0.93	23.2
200	0.39	-177	5.4	80	0.09	72	0.19	-65	1.02	16.9
500	0.42	157	2.29	57	0.22	68	0.2	-94	1	10.2
1000	0.48	126	1.33	28	0.4	53	0.29	-140	0.94	5.2
1500	0.54	120	1.03	8	0.55	39	0.39	-176	0.86	2.7
VCE = 15 V, IC = 60 mA										
100	0.38	-162	10.75	92	0.05	70	0.23	-72	0.95	23.3
200	0.38	-178	5.52	80	0.09	72	0.18	-68	1.03	16.8
500	0.41	156	2.33	57	0.22	67	0.19	-97	1.01	9.6
1000	0.47	127	1.36	28	0.4	52	0.27	-142	0.95	5.3
1500	0.53	103	1.05	8	0.54	38	0.37	-176	0.93	2.9
VCE = 15 V, IC = 80 mA										
100	0.37	-163	10.79	92	0.05	71	0.21	-63	0.97	23.3
200	0.38	-179	5.55	80	0.1	73	0.17	-70	0.98	17.4
500	0.41	156	2.34	57	0.22	67	0.18	-99	1.01	9.7
1000	0.47	127	1.37	28	0.4	51	0.27	-143	0.94	5.3
1500	0.53	103	1.05	7	0.55	38	0.36	-177	0.92	2.8

Note
1. Gain Calculations:

$$MAG = \frac{|S_{21}|}{|S_{12}|}\left(K \pm \sqrt{K^2 - 1}\right)$$. When $K \le 1$, MAG = MSG. $$MSG = \frac{|S_{21}|}{|S_{12}|}$$, $$K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2\,|S_{12}S_{21}|}$$, $\Delta = S_{11}S_{22} - S_{21}S_{12}$

MAG = Maximum Available Gain
MSG = Maximum Stable Gain

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



NE74114
Coordinates in Ohms
Frequency in GHz
(V_{CE} = 15 V, I_C = 60 mA)

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V_{CE} = 15 V, I_C = 20 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG[1]
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
100	0.45	-145	10.29	97	0.04	60	0.38	-36	0.88	24.1
200	0.44	-168	5.4	83	0.07	67	0.31	-34	1.02	18.0
500	0.48	164	2.28	57	0.17	70	0.25	-51	1.01	10.7
1000	0.58	134	1.33	25	0.34	57	0.19	-121	0.89	5.9
1500	0.7	107	0.98	0	0.51	37	0.32	153	0.87	2.8

V_{CE} = 15 V, I_C = 40 mA

100	0.4	-153	11.22	95	0.04	65	0.32	-38	0.94	24.5
200	0.41	-172	5.82	82	0.07	71	0.25	-35	1.06	17.7
500	0.45	164	2.45	57	0.18	69	0.19	-51	1.01	10.7
1000	0.56	135	1.42	25	0.34	54	0.13	-128	0.92	6.2
1500	0.69	109	1.04	0	0.5	35	0.28	147	0.87	3.2

V_{CE} = 15 V, I_C = 60 mA

100	0.39	-156	11.55	94	0.04	68	0.29	-39	0.96	24.6
200	0.4	-173	5.98	81	0.08	71	0.23	-36	0.98	18.7
500	0.44	164	2.51	57	0.18	68	0.17	-50	1.02	10.6
1000	0.56	136	1.45	26	0.34	53	0.11	-134	0.92	6.3
1500	0.69	109	1.07	0	0.49	35	0.27	143	0.87	3.4

V_{CE} = 15 V, I_C = 80 mA

100	0.38	-157	11.7	93	0.04	68	0.27	-40	0.98	24.7
200	0.39	-173	6.04	81	0.08	72	0.21	-36	1.00	18.8
500	0.44	164	2.53	57	0.18	68	0.16	-50	1.02	10.6
1000	0.56	136	1.46	26	0.34	52	0.10	-138	0.92	6.3
1500	0.69	109	1.07	0	0.49	34	0.26	141	0.87	3.4

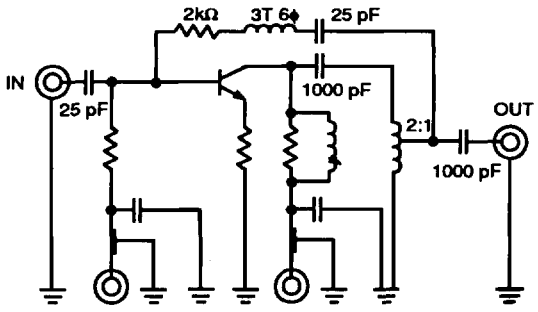
Note:
1. Gain Calculations:

$$MAG = \frac{|S_{21}|}{|S_{12}|}\left(K \pm \sqrt{K^2 - 1}\right)$$. When $K \le 1$, MAG = MSG. $$MSG = \frac{|S_{21}|}{|S_{12}|}$$, $$K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2\,|S_{12}S_{21}|}$$, $\Delta = S_{11}S_{22} - S_{21}S_{12}$

MAG = Maximum Available Gain
MSG = Maximum Stable Gain

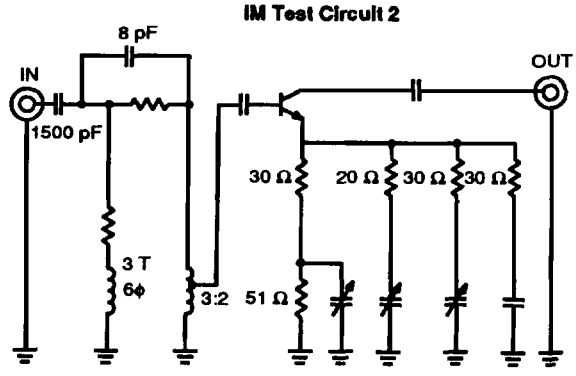
TEST CIRCUITS

IM Test Circuit 1



TEST CONDITION
BANDWITH: 80 to 320 MHz
VOLTAGE GAIN: 6dB

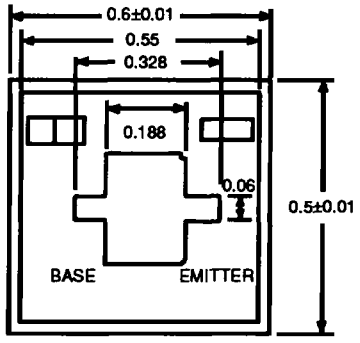
IM Test Circuit 2



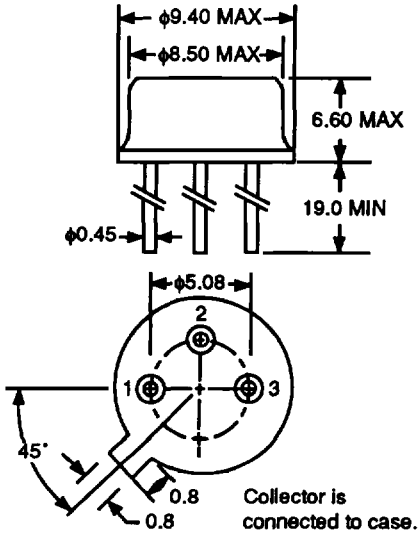
TEST CONDITION
BANDWIDTH: 70 to 250 MHz
VOLTAGE GAIN: 6 dB

OUTLINE DIMENSIONS (Units in mm)

NE74100 (CHIP)

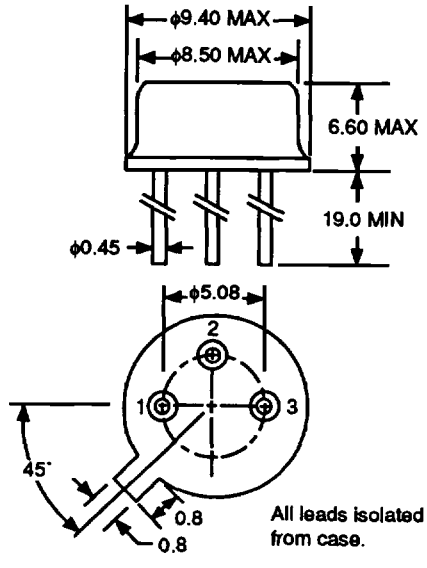


PACKAGE OUTLINE 13
(TO-39)



Collector is connected to case.

PACKAGE OUTLINE 14
(TO-39)



All leads isolated from case.

All dimensions typical unless noted.