T-33-05

NEC®

NPN MEDIUM POWER MICROWAVE TRANSISTOR

NE24600 NE24615 NE24620

FEATURES

- **EXCELLENT IM DISTORTION CHARACTERISTICS AT HIGH OUTPUT LEVELS:**
  NE24615 IM_2 = -56 dB, IM_3 = -64
  NE24620 IM_2 = -63 dB, IM_3 = -72
  @ Vo = 120 dBμ V/75 Ω
- **HIGH GAIN**
- **SUITABLE FOR CATV TRUNK LINE AMPLIFIERS**
- **HIGH RELIABILITY METALLIZATION**

DESCRIPTION AND APPLICATIONS

The NE246 is an NPN transistor designed for broadband VHF and UHF amplifier applications. The intermodulation distortion and noise figure of the NE246 are low at high output levels; therefore, the transistor is well suited for use as a linear amplifier. A proprietary process is used to form the emitter ballast resistance which prevents current concentration. Reliable operation is assured by NEC's Pt-Si/Ti/Pt/Au metallization process. The NE246 is available as a chip or in hermetically sealed packages.

PERFORMANCE SPECIFICATIONS (T_A = 25°C)

PART NUMBER EIAJ REGISTERED NUMBER PACKAGE OUTLINE			NE24600[1] 00 (CHIP)			NE24615 2SC2952 15			NE24620 2SC2953 20		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
f_T	Gain Bandwidth Product at V_{CE} = 10 V, I_C = 60 mA V_{CE} = 15 V, I_C = 100 mA	 GHz GHz		 4.5		 2.8				 4.5	
$\|S_{21E}\|^2$	Insertion Power Gain at V_{CE} = 10 V, I_C = 60 mA, f = 0.5 GHz V_{CE} = 15 V, I_C = 100 mA, f = 0.5 GHz	 dB dB		 13.5		 8.5	 10		 12	 13.5	
MAG	Maximum Available Gain at V_{CE} = 10 V, I_C = 60 mA, f = 0.5 GHz f = 1 GHz V_{CE} = 15 V, I_C = 100 mA, f = 0.5 GHz f = 1 GHz	 dB dB dB dB		 17 11		 	 11 5 		 	 17 11	
NF	Noise Figure at V_{CE} = 10 V, I_C = 60 mA, f = 1 GHz V_{CE} = 15 V, I_C = 80 mA, f = 1 GHz	 dB dB		 4		 3.5				 4	
IM_2	Second Order Intermodulation Product, Vo = 120 dBμ V/75 Ω f_1 = 100 MHz f_2 = 90 MHz $f = f_1 + f_2$ V_{CE} = 10 V, I_C = 60 mA V_{CE} = 15 V, I_C = 80 mA	 dB dB		 -63		 	 -56		 	 -63	
IM_3	Third Order Intermodulation Product, Vo = 120 dBμ V/75 Ω f_1 = 200 MHz f_2 = 190 MHz $f = 2f_1 - f_2$ V_{CE} = 10 V, I_C = 100 mA V_{CE} = 15 V, I_C = 120 mA	 dB dB		 -72		 	 -64		 	 -72	

Note:
1. RF characteristics are measured in #20 package.

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

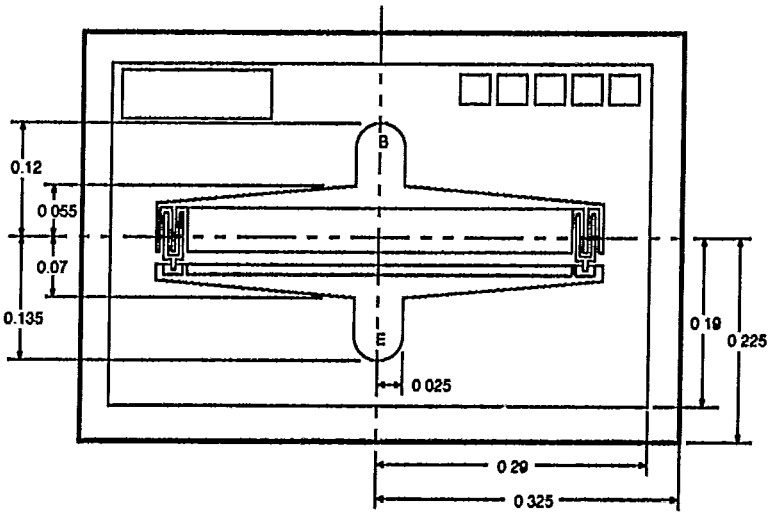
PART NUMBER EIAJ REGISTERED NUMBER PACKAGE OUTLINE			NE24600 00 (CHIP)			NE24615 2SC2952 15			NE24620 2SC2953 20		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
I_{CBO}	Collector Cutoff Current at V_{CB} = 20 V, I_E = 0	µA			10			10			10
I_{EBO}	Emitter Cutoff Current at V_{EB} = 2 V, I_C = 0	µA			10			10			10
h_{FE}	Forward Current Gain at V_{CE} = 10 V, I_C = 80 mA (pulsed)		30	80	200	30	80	200	30	80	200
C_{CB}	Collector-Base Capacitance at V_{CB} = 10 V, I_E = 0 mA, f = 1 MHz	pF		1.8	2.5		1.8	2.5		1.8	2.5

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CBO}	Collector to Base Voltage	V	30
V_{CEO}	Collector to Emitter Voltage	V	20
V_{EBO}	Emitter to Base Voltage	V	3
I_C	Collector Current	mA	250
T_J	Junction Temperature	°C	200
T_{STG}	Storage Temperature	°C	-65 to +200
$R_{TH\ (J-C)}$	Thermal Resistance	°C/W	25
P_T	Total Power Dissipation	W	5

OUTLINE DIMENSIONS (Units in mm)

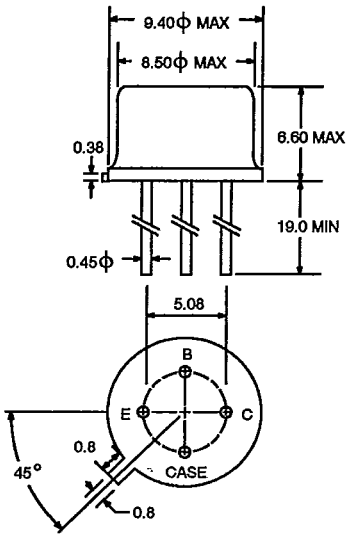
NE24600 (CHIP)



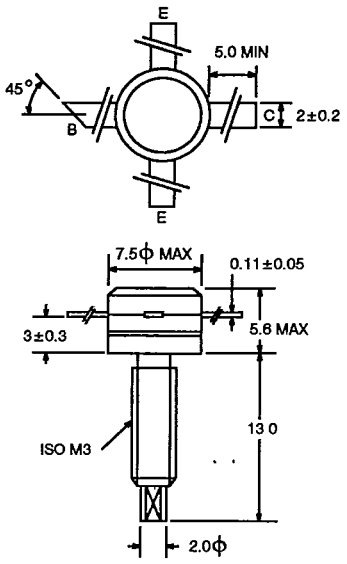
Die Thickness: .110 to .160 mm

OUTLINE DIMENSIONS (Units in mm)

OUTLINE 15
(TO-33)

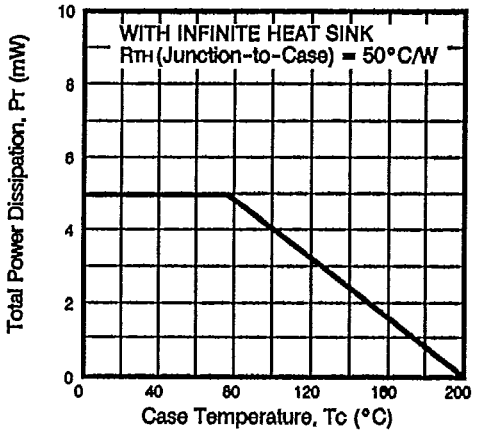


OUTLINE 20

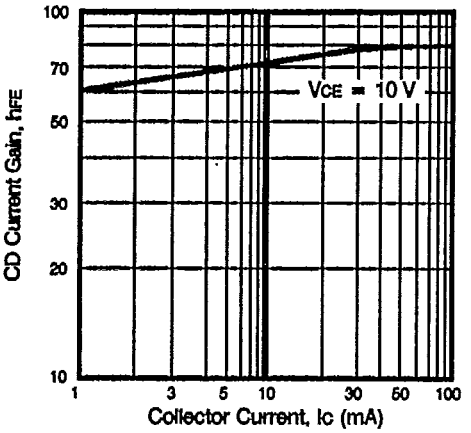


TYPICAL PERFORMANCE CHARACTERISTICS (T_A = 25°C)

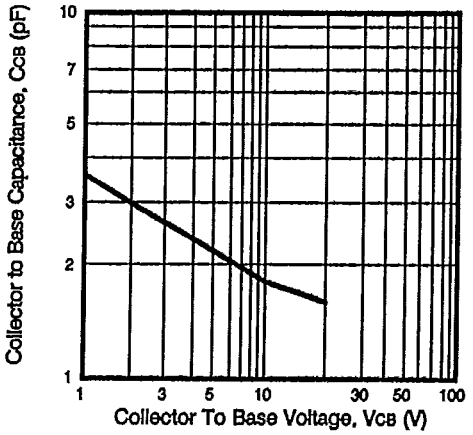
NE246
DC POWER DERATING CURVES



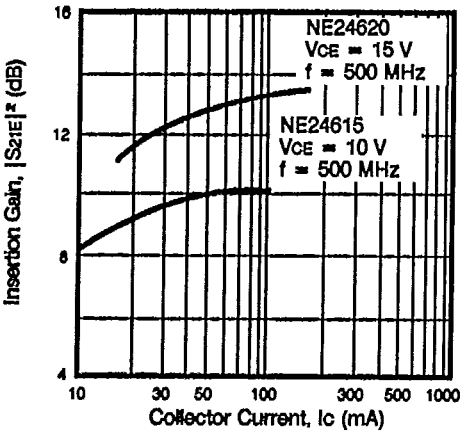
NE24615 AND NE24620
DC CURRENT GAIN vs.
COLLECTOR CURRENT



NE24615 AND NE24620
COLLECTOR CAPACITANCE vs.
COLLECTOR TO BASE VOLTAGE

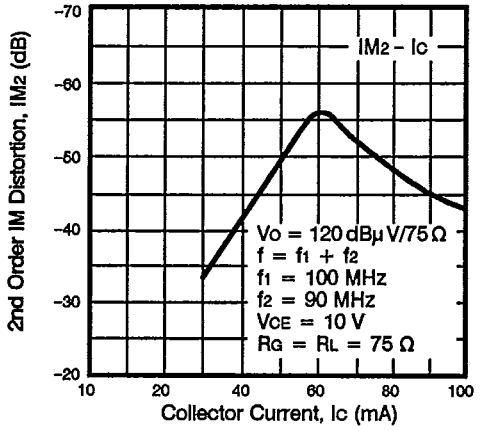


NE24615 AND NE24620
FORWARD INSERTION GAIN vs.
COLLECTOR CURRENT

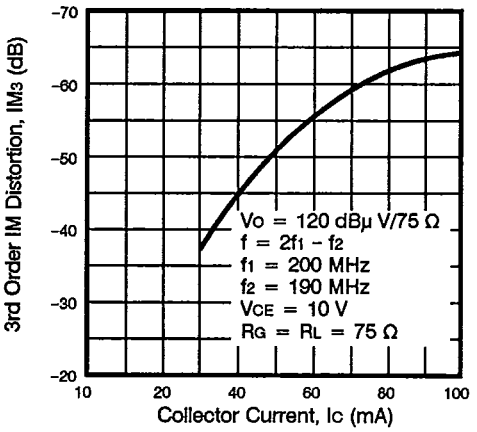


TYPICAL PERFORMANCE CHARACTERISTICS (T_A = 25°C)

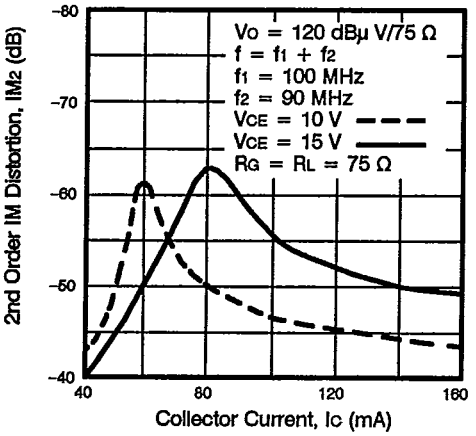
NE24615
SECOND ORDER IM DISTORTION vs. COLLECTOR CURRENT



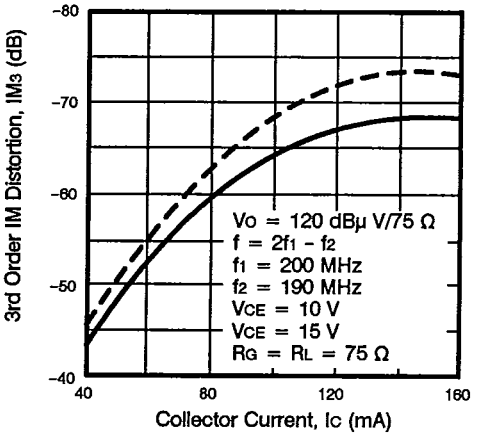
NE24615
THIRD ORDER IM DISTORTION vs. COLLECTOR CURRENT



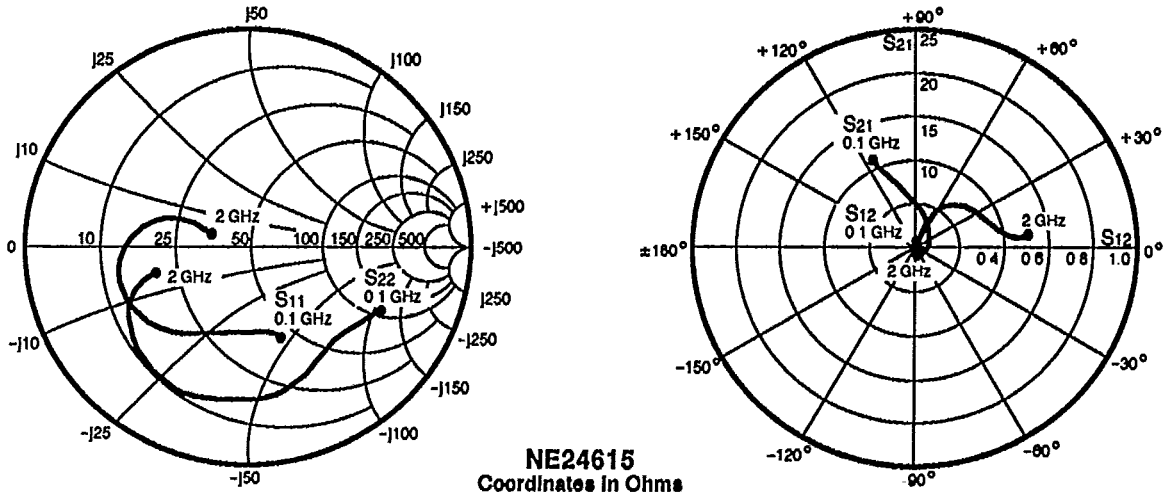
NE24620
SECOND ORDER IM DISTORTION vs. COLLECTOR CURRENT



NE24620
THIRD ORDER IM DISTORTION vs. COLLECTOR CURRENT



TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE24615
Coordinates in Ohms
Frequency in GHz
(V_{CE} = 10 V, I_C = 20 mA)

S-MAGN AND ANGLES:

VCE = 10 V, IC = 20 mA

FREQUENCY (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
100	.45	-68	11.74	115	.04	75	.72	-27
500	.49	-128	3.57	67	.19	66	.69	-69
1000	.55	-176	2.00	17	.34	36	.68	-124
1500	.37	159	1.17	-12	.39	18	.52	-154
2000	.13	138	.91	-24	.52	8	.38	-162

VCE = 10 V, IC = 60 mA

100	.35	-59	13.82	108	.04	81	.63	-30
500	.49	-118	3.98	67	.21	67	.64	-77
1000	.53	-173	2.12	20	.36	32	.57	-134
1500	.36	162	1.27	-6	.40	14	.41	-159
2000	.08	130	1.08	-19	.54	4	.28	-156

VCE = 10 V, IC = 100 mA

100	.35	-57	14.12	107	.04	80	.61	-31
500	.49	-118	4.00	67	.21	65	.62	-79
1000	.53	-173	2.12	20	.36	31	.55	-137
1500	.35	161	1.28	-5	.41	13	.39	-161
2000	.05	119	1.11	-18	.55	3	.25	-154

VCE = 15 V, IC = 20 mA

100	.50	-66	11.83	116	.04	75	.74	-27
500	.49	-127	3.61	67	.18	66	.70	-67
1000	.54	-174	2.05	18	.34	37	.69	-122
1500	.37	161	1.20	-12	.39	17	.54	-152
2000	.13	141	.92	-25	.51	8	.40	-161

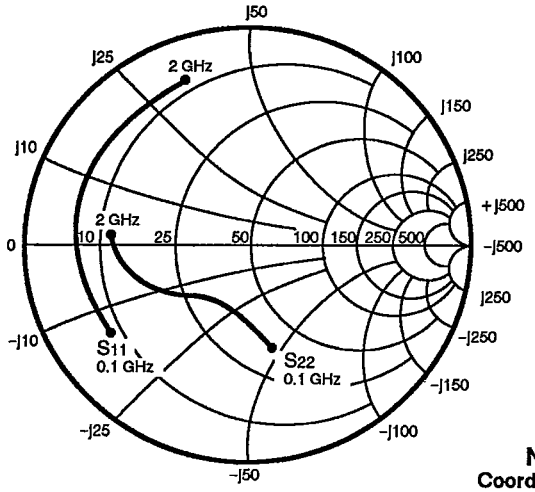
VCE = 15 V, IC = 60 mA

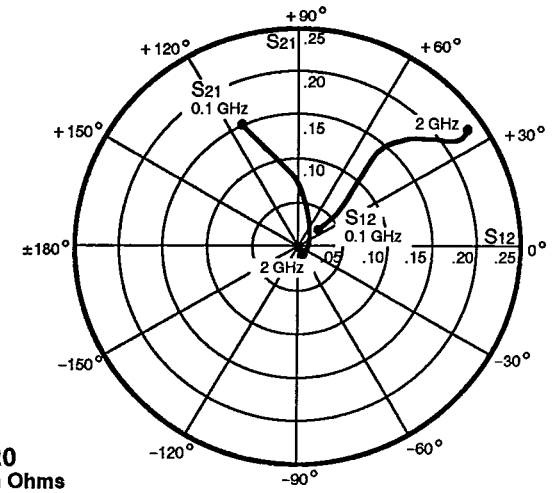
100	.38	-58	13.87	109	.04	78	.64	-30
500	.50	-117	4.02	68	.21	67	.65	-75
1000	.54	-172	2.17	20	.36	32	.58	-132
1500	.35	163	1.30	-6	.40	15	.42	-157
2000	.06	142	1.10	-21	.53	3	.30	-152

VCE = 15 V, IC = 100 mA

100	.37	-57	14.16	108	.04	78	.62	-30
500	.50	-116	4.05	68	.21	66	.63	-77
1000	.53	-172	2.17	21	.36	31	.56	-134
1500	.35	163	1.31	-5	.40	14	.40	-159
2000	.04	131	1.13	-20	.55	2	.27	-149

TYPICAL COMMON EMITTER SCATTERING PARAMETERS





NE24620
Coordinates in Ohms
Frequency in GHz
(V_{CE} = 10 V, I_C = 20 mA)

S-MAGN AND ANGLES:

VCE = 10 V, IC = 20 mA

FREQUENCY (MHz)	S11		S21		S12		S22	
100	.71	-144	15.60	112	.04	37	.50	-73
500	.79	172	3.49	68	.05	38	.26	-124
1000	.78	151	1.77	41	.08	46	.34	-142
1500	.81	137	1.16	19	.13	48	.43	-157
2000	.81	121	.89	4	.19	41	.52	-170

VCE = 10 V, IC = 60 mA

100	.72	-159	19.13	108	.02	39	.47	-98
500	.77	168	4.13	70	.05	52	.32	-157
1000	.77	149	2.11	46	.10	52	.35	-171
1500	.78	135	1.43	26	.15	47	.40	-179
2000	.78	120	1.13	11	.20	38	.45	175

VCE = 10 V, IC = 100 mA

100	.72	-163	19.94	106	.02	44	.47	-106
500	.77	168	4.26	70	.06	54	.35	-163
1000	.77	149	2.18	47	.10	53	.37	-177
1500	.78	134	1.48	28	.15	47	.41	175
2000	.77	119	1.18	12	.21	35	.45	170

VCE = 15 V, IC = 20 mA

100	.72	-143	15.98	112	.03	36	.51	-71
500	.78	172	3.59	68	.05	40	.26	-121
1000	.78	151	1.81	42	.08	48	.34	-141
1500	.80	136	1.20	20	.13	49	.42	-156
2000	.81	121	.91	5	.19	41	.52	-169

VCE = 15 V, IC = 60 mA

100	.71	-158	19.61	108	.02	42	.47	-97
500	.77	169	4.25	70	.05	52	.32	-156
1000	.77	149	2.16	46	.10	52	.34	-170
1500	.78	135	1.47	26	.15	47	.39	-178
2000	.78	120	1.16	11	.20	38	.45	176

VCE = 15 V, IC = 100 mA

100	.72	-162	20.57	106	.02	44	.47	-104
500	.77	168	4.39	70	.05	56	.34	-163
1000	.77	149	2.24	48	.10	54	.37	-176
1500	.78	134	1.53	28	.15	47	.40	176
2000	.77	120	1.21	13	.21	36	.44	171