

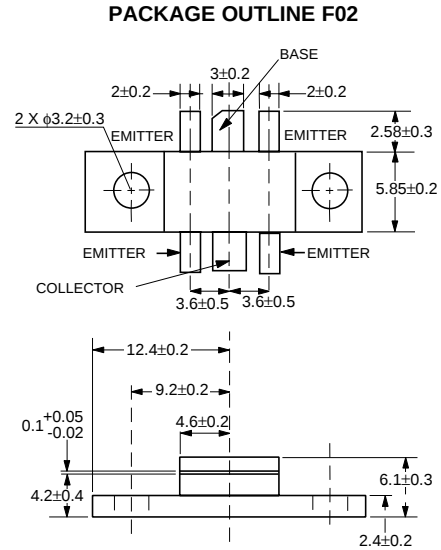
FEATURES

- **HIGH OUTPUT POWER:**
1.5 W Class A, 7 W Class AB
- **USEABLE FROM 1.5 TO 2.0 GHz**
(Input Pre-matched)
- **HIGH LINEAR GAIN:**
12.0 dB Class A, 10.0 dB Class AB
- **HIGH EFFICIENCY:**
30% Class A, 50% Class AB
- **LOW IM DISTORTION**
-37 dBc @ 1.0 W PEP (Class A)
-34 dBc @ 5.0 W PEP (Class AB)
- **COMMON EMITTER CONFIGURATION**

DESCRIPTION

NEL2004F02-24 is an NPN Silicon Epitaxial Microwave Power Transistor designed for 1.93 to 1.99 GHz, 24 Volt PCS Base Station Transmitter Applications. It can deliver 1.5 W of power at 20 V (Class A), and 7 W of power at 24 V (Class AB) over the PCS band with high gain and low distortion. The device is usable from 1.5 to 2.0 GHz and with bias as low as 8-10 V. The chips employ emitter ballast resistors and gold metallization for superior reliability and consistent performance and are packaged in industry standard, flange mount ceramic packages.

OUTLINE DIMENSIONS (Units in mm)



ELECTRICAL CHARACTERISTICS (T_c = 25°C)

PART NUMBER				NEL2004F02-24			
PACKAGE OUTLINE				F02			
Functional Characteristics	SYMBOLS	CHARACTERISTICS	UNITS	MIN	TYP	MAX	TEST CONDITIONS
	P _{1dB}	Power Out at 1 dB Compression Class A Class AB	W W	5.0	1.5 7.0		f = 1.97 GHz V _{CC} = 20 V; I _{cq} = 250 mA V _{CC} = 24 V; I _{cq} = 40 mA
	G _L	Linear Gain Class A Class AB	dB dB	8.5	12.0 9.5		V _{CC} = 20 V; I _{cq} = 250 mA V _{CC} = 24 V; I _{cq} = 40 mA
	η _c	Collector Efficiency at 1 dB Gain Compression Class A Class AB	% %	40	30 50		V _{CC} = 20 V; I _{cq} = 250 mA V _{CC} = 24 V; I _{cq} = 40 mA
	IM ₃	3rd Order Intermodulation Class A Class AB	dBc dBc		-37 -34		Δf = 100 KHz P _{OUT} = 1.0 W PEP P _{OUT} = 5.0 W PEP
	VSWR	Load mismatch Tolerance, Class AB			10:1		P _{OUT} = 5.0 W; Any Phase
Electrical DC Characteristics	BV _{CER}	Collector-Emitter Breakdown	V	30	85		I _c = 3.0 mA; R _{be} = 210 Ω
	BV _{CEO}	Collector-Emitter Breakdown	V	18	22		I _c = 3.0 mA; Open Base
	BV _{CBO}	Collector Base Breakdown	V	45	85		I _c = 3.0 mA; Open Emitter
	BV _{EBO}	Emitter Base Breakdown	V	3	4.4		I _c = 8.0 mA; Open Collector
	h _{FE}	DC Current Gain		30	100	150	V _{CE} = 5.0 V; I _c = 300 mA
	R _{TH}	Thermal Resistance (channel to case)	°C/W			9.0	
	C _{ob}	Output Capacitance	pF		6.2		V _{CB} = 24 V; f = 1.0 MHz

ABSOLUTE MAXIMUM RATINGS¹ ($T_A = 25^\circ\text{C}$)

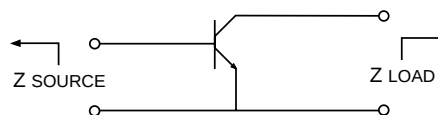
SYMBOLS	PARAMETERS	UNITS	RATINGS
V _{CBO}	Collector-Base Voltage	V	45
V _{CEO}	Collector-Emitter Voltage	V	18
V _{EB0}	Emitter to Base Voltage	V	3.0
I _C	Collector Current	A	1.5
P _T	Total Power Dissipation	W	19.4
T _J	Junction Temperature	°C	200
T _{STG}	Storage Temperature	°C	-65 to +150

Note:

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

LARGE SIGNAL IMPEDANCES

f(GHz)	Z _{Source} (Ω)	Z _{Load} (Ω)
1.94	11.6 - j9.9	6.5 + j7.9
1.97	11.9 - j8.1	6.6 + j4.2

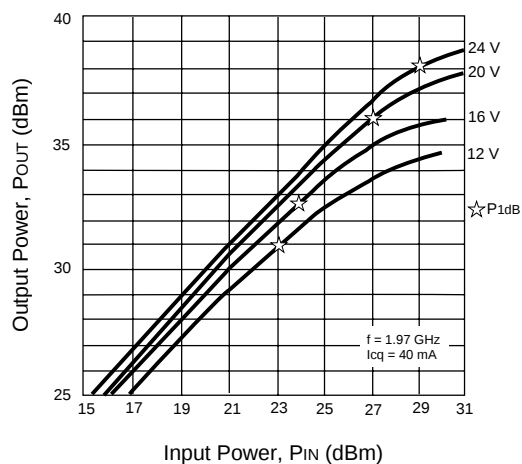


Z_{SOURCE} = Impedance of the input matching circuit as seen by the base

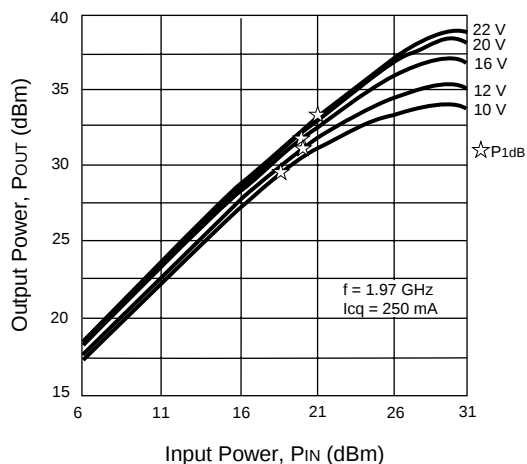
Z_{LOAD} = Impedance of the output matching circuit as seen by the collector

TYPICAL PERFORMANCE CURVES ($T_A = 25^\circ\text{C}$)

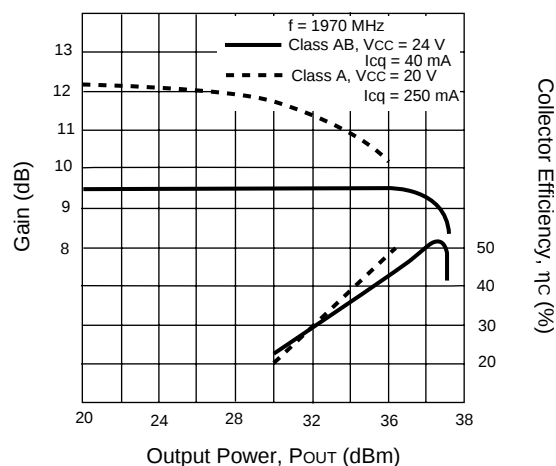
CLASS AB OUTPUT POWER vs. INPUT POWER vs. BIAS VOLTAGE



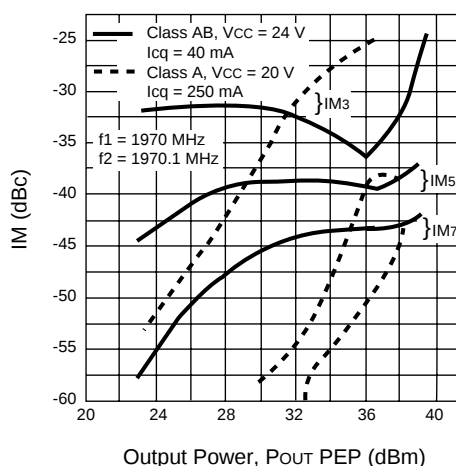
CLASS A OUTPUT POWER vs. INPUT POWER vs. BIAS VOLTAGE



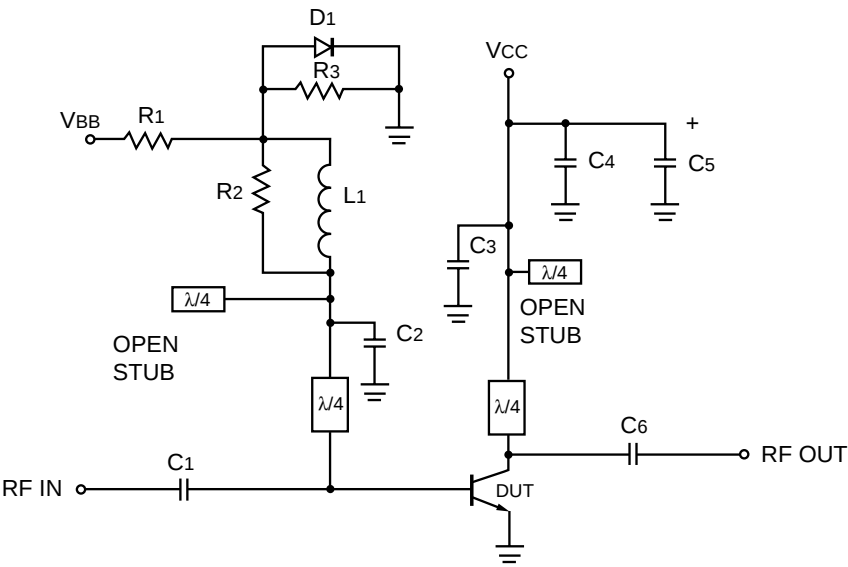
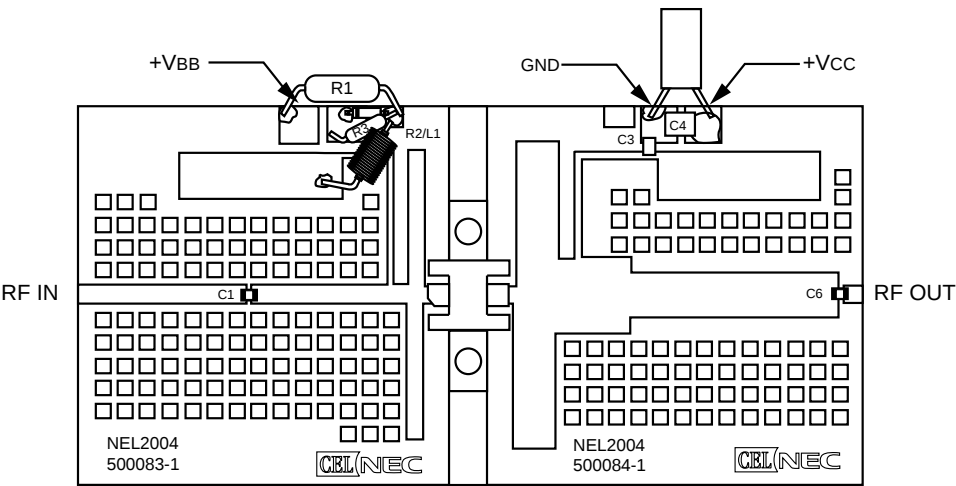
GAIN AND EFFICIENCY vs. OUTPUT POWER vs. CLASS of OPERATION



INTERMODULATION DISTORTION vs. OUTPUT POWER vs. CLASS of OPERATION



TEST CIRCUIT



NEL2004 PARTS LIST

QTY	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL/SPECIFICATION	ITEM NO.
1	1N4454	D1	DIODE (CLASS AB)	10b
1	1N5254	D1	DIODE (CLASS A)	10a
AR		L1	RF CHOKE WIRE 15.9 nH	9
1		R3	200 OHM 1/4 RESISTOR	8
1		R2	3.9 OHM 1/4W RESISTOR	7
1		R1	5.1 OHM 1/2W RESISTOR	6
1		C5	22uF 50V ELECTROLYIC CAP	5
1		C4	33nF CERAMIC CAP	4
4		C1,C2,C3,C4	18 pF CHIP CAP	3
1	500084-1		SUBSTRATE OUTPUT .030 THICK ER = 2.6	2
1	500083-1		SUBSTRATE OUTPUT .030 THICK ER = 2.6	2

NEL2004F02-24

Vcc = 20 V, Ic = 250 mA

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.886	-163.645	15.253	102.196	0.024	18.814	0.482	-141.164
0.20	0.906	-173.119	7.807	93.166	0.027	11.507	0.473	-159.197
0.50	0.896	178.609	3.318	82.128	0.033	29.996	0.473	-164.929
1.00	0.849	171.931	1.980	67.471	0.039	42.411	0.482	-158.030
1.50	0.743	168.001	1.744	44.231	0.048	34.985	0.560	-145.853
1.60	0.713	167.949	1.743	37.159	0.053	34.516	0.634	-144.591
1.70	0.683	169.126	1.709	29.280	0.054	28.391	0.689	-145.246
1.80	0.664	171.660	1.705	20.444	0.051	25.859	0.758	-145.407
1.85	0.658	173.278	1.660	15.215	0.047	23.045	0.795	-146.746
1.90	0.660	174.935	1.628	10.511	0.044	9.030	0.827	-147.783
1.95	0.665	176.690	1.591	5.478	0.037	4.900	0.864	-149.665
2.00	0.677	178.236	1.546	0.683	0.029	-6.208	0.895	-151.928
2.10	0.716	-179.841	1.411	-10.067	0.021	-19.487	0.945	-156.331
2.20	0.763	-179.445	1.262	-19.947	1.592	-104.065	0.970	-159.939
2.30	0.818	179.044	1.137	-28.769	0.014	-150.035	0.981	-165.688
2.40	0.858	176.850	0.963	-37.410	0.025	178.181	0.976	-170.129
2.50	0.893	173.812	0.859	-48.021	0.039	173.353	0.962	-174.105

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