

## SILICON POWER TRANSISTOR

# NEL200101-24

### NPN SILICON EPITAXIAL TRANSISTOR

### L Band Power Amplifier

#### DESCRIPTION AND APPLICATIONS

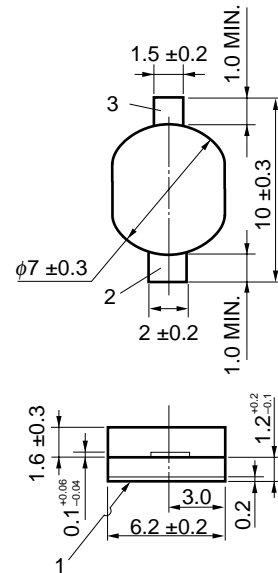
NEL2001012-24 of NPN epitaxial microwave power transistors is designed for 1.8-2 GHz PHS/PCN/PCS base station applications.

It incorporates emitter ballast resistors, gold metallizations and offers a high degree of reliability.

#### FEATURES

- High Linear Power and Gain
- Low Internal Modulation Distortion
- High Reliability Gold Metallization
- Emitter Ballasting
- 24 V Operation

#### OUTLINE DIMENSIONS (Unit: mm)



1 - EMITTER  
2 - BASE  
3 - COLLECTOR

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

PARAMETER	SYMBOL	SPECIFIED CONDITION	RATINGS	UNIT
Collector to Base Voltage	$V_{CBO}$		45	V
Collector to Emitter Voltage	$V_{CER}$	$R = 10\ \Omega$	30	V
Emitter to Base Voltage	$V_{EBO}$		3	V
Collector to Emitter Voltage	$V_{CEO}$		18	V
Collector Current	$I_C$		0.5	A
Power Dissipation	$P_T$		7.4	W
Thermal Resistance	$R_{th(j-c)}$		23.6	$^\circ\text{C/W}$
Junction Temperature	$T_j$		200	$^\circ\text{C}$
Storage Temperature	$T_{stg}$		-65 to 150	$^\circ\text{C}$

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

PARAMETER	SYMBOL	SPECIFIED CONDITION	MIN.	TYP.	MAX.	UNIT
Collector to Emitter Cutoff Current	$I_{CES}$	$V_{CE} = 24\text{ V}$			1	mA
Collector to Emitter Voltage (Base to Emitter Resistor = $10\text{ }\Omega$ )	$V_{CER}$	$I_C = 1\text{ mA}$ , $R = 10\text{ }\Omega$	30	85		V
Collector to Emitter Voltage (Open Base)	$V_{CEO}$	$I_C = 1\text{ mA}$	18	22		V
Collector to Base Voltage (Open Emitter)	$V_{CBO}$	$I_C = 1\text{ mA}$	45	85		V
Emitter to Base Voltage (Open Collector)	$V_{EBO}$	$I_C = 3\text{ mA}$	3	4.4		V
DC Forward Current Gain	$h_{FE}$	$V_{CE} = 5\text{ V}$ , $I_C = 0.1\text{ A}$	30	100	150	
Output Capacitance	$C_{ob}$	$V_{CE} = 24\text{ V}$ , $f = 1\text{ MHz}$		3		pF

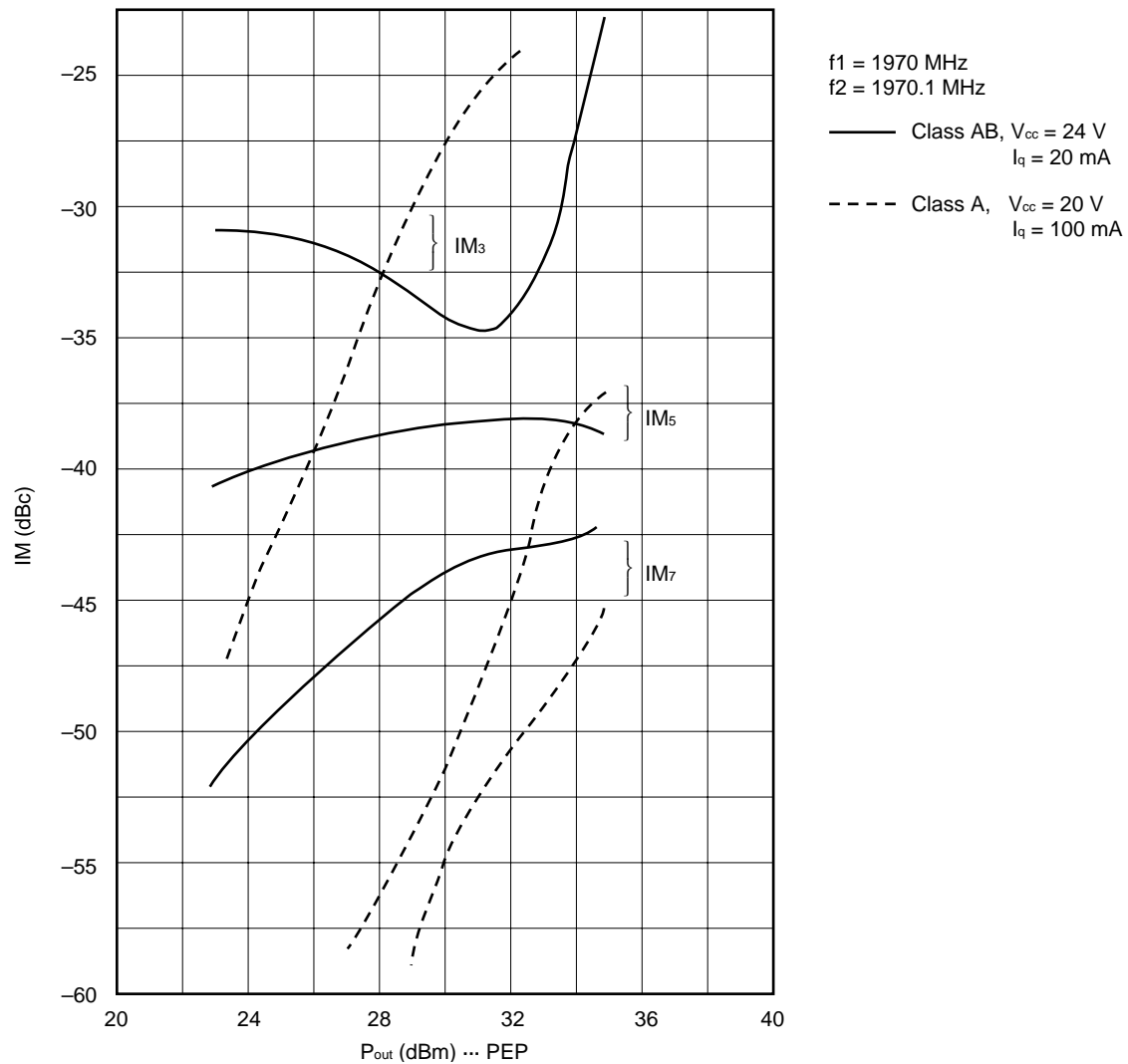
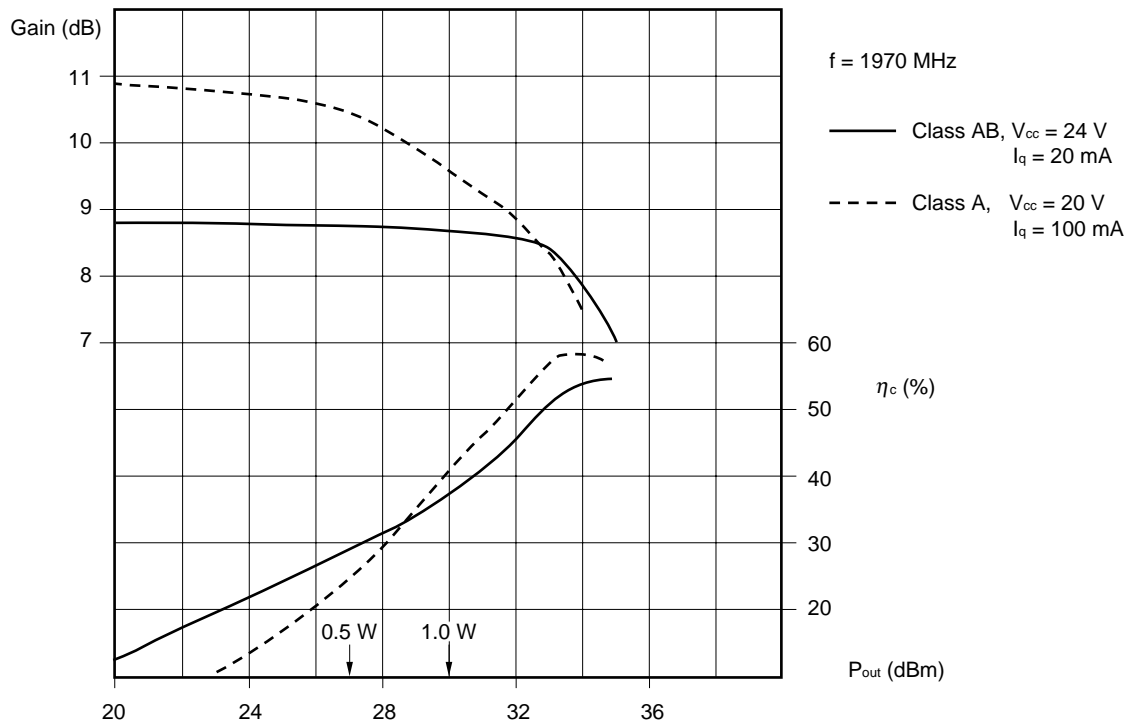
**PERFORMANCE SPECIFICATIONS ( $T_A = 25\text{ }^{\circ}\text{C}$ )**

**CLASS AB OPERATION**

PARAMETER	SYMBOL	SPECIFIED CONDITION	MIN.	TYP.	MAX.	UNIT
Output Power	$P_{\text{ldB}}$	$f = 1.97\text{ GHz}$ , $I_q = 20\text{ mA}$ , $V_{\text{CC}} = 24\text{ V}$ , CLASS AB		2.5		W
Collector Efficiency	$\eta_C$	$f = 1.97\text{ GHz}$ , $P_{\text{out}} = P_{\text{ldB}}$ , $I_q = 20\text{ mA}$ , $V_{\text{CC}} = 24\text{ V}$ , CLASS AB		54		%
Linear Gain	GL	$f = 1.97\text{ GHz}$ , $P_{\text{in}} = 0.04\text{ W}$ , $I_q = 20\text{ mA}$ , $V_{\text{CC}} = 24\text{ V}$ , CLASS AB		8.8		dB
3rd Order Intermodulation	$\text{IM}_3$	$f = 1.97\text{ GHz}$ , $\Delta f = 100\text{ kHz}$ , 2 W PEP, $V_{\text{CC}} = 24\text{ V}$ , $I_q = 20\text{ mA}$ , CLASS AB		-33		dBc

**CLASS A OPERATION**

PARAMETER	SYMBOL	SPECIFIED CONDITION	MIN.	TYP.	MAX.	UNIT
Output Power	$P_{\text{ldB}}$	$f = 1.97\text{ GHz}$ , $I_q = 100\text{ mA}$ , $V_{\text{CC}} = 20\text{ V}$ , CLASS A	0.5	0.7		W
Collector Efficiency	$\eta_C$	$f = 1.97\text{ GHz}$ , $P_{\text{out}} = P_{\text{ldB}}$ , $I_q = 100\text{ mA}$ , $V_{\text{CC}} = 20\text{ V}$ , CLASS A		30		%
Linear Gain	GL	$f = 1.97\text{ GHz}$ , $P_{\text{in}} = 0.01\text{ W}$ , $I_q = 100\text{ mA}$ , $V_{\text{CC}} = 20\text{ V}$ , CLASS A		10.8		dB
3rd Order Intermodulation	$\text{IM}_3$	$f = 1.97\text{ GHz}$ , $\Delta f = 100\text{ kHz}$ , 0.5 W PEP, $V_{\text{CC}} = 20\text{ V}$ , $I_q = 100\text{ mA}$ , CLASS A		-36		dBc



**S-PARAMETER**

NEL2001 Class A

 $V_{CC} = 20\text{ V}$ ,  $I_{CQ} = 0.1\text{ A}$ 

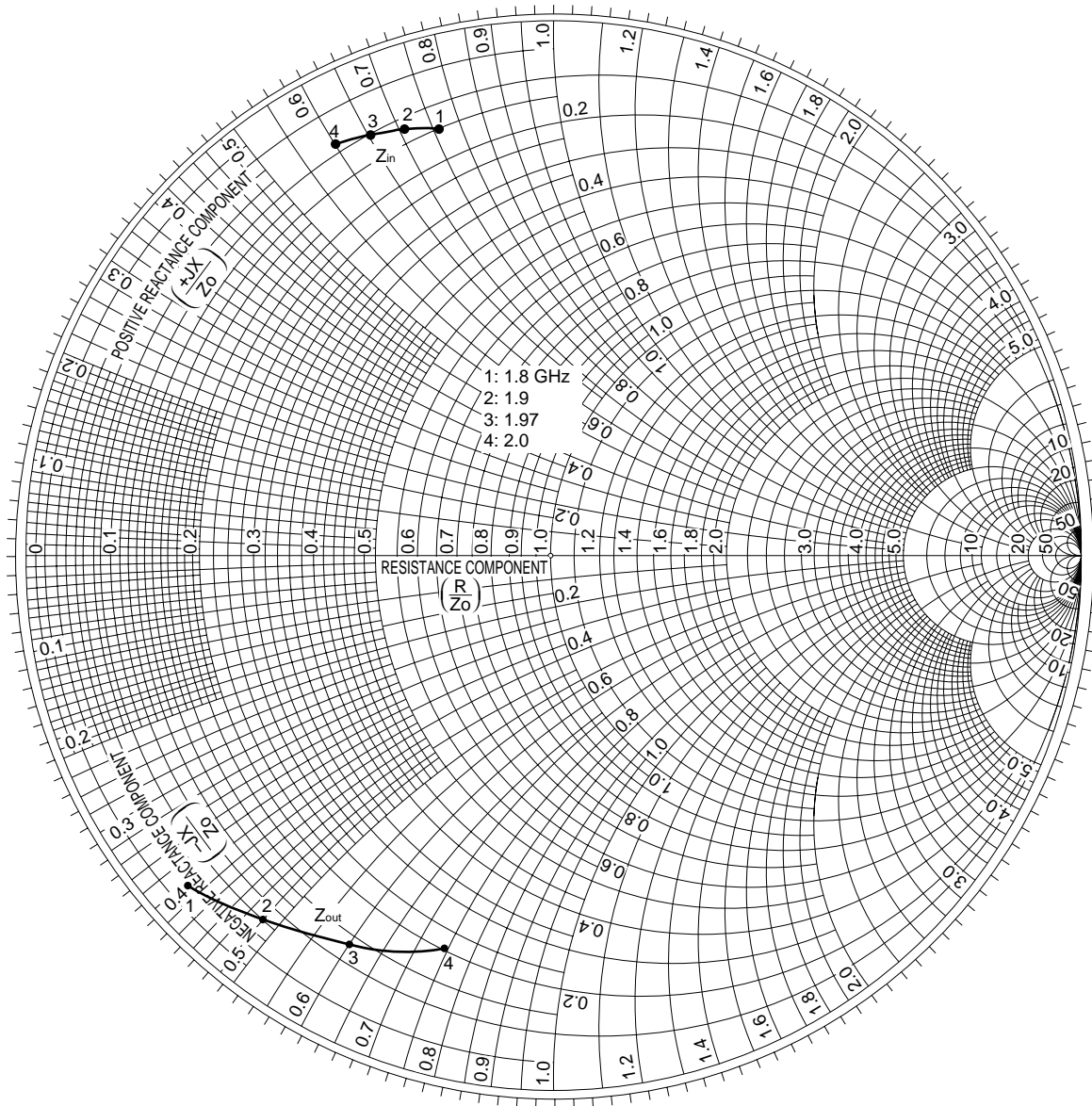
FREQUENCY GHz	MAG	S <sub>11</sub> ANG (DEG)	MAG	S <sub>12</sub> ANG (DEG)	MAG	S <sub>21</sub> ANG (DEG)	MAG	S <sub>22</sub> ANG (DEG)
1.70	0.75	130	0.07	-7	2.08	18	0.41	-155
1.71	0.75	129	0.07	-6	2.07	18	0.41	-155
1.72	0.74	129	0.07	-6	2.06	18	0.42	-156
1.73	0.74	128	0.08	-7	2.05	17	0.42	-156
1.74	0.74	128	0.08	-7	2.04	16	0.42	-156
1.75	0.74	127	0.08	-7	2.02	16	0.42	-156
1.76	0.74	127	0.08	-6	2.01	16	0.42	-156
1.77	0.74	127	0.08	-7	2.00	15	0.42	-156
1.78	0.74	126	0.08	-7	1.99	15	0.42	-157
1.79	0.74	126	0.08	-8	1.98	14	0.42	-157
1.80	0.74	125	0.08	-8	1.97	14	0.43	-157
1.81	0.74	125	0.07	-9	1.95	13	0.43	-157
1.82	0.74	124	0.07	-10	1.94	13	0.43	-158
1.83	0.74	124	0.08	-7	1.93	12	0.43	-158
1.84	0.74	124	0.08	-6	1.93	12	0.43	-158
1.85	0.75	124	0.08	-6	1.92	12	0.43	-158
1.86	0.75	123	0.08	-8	1.91	11	0.43	-158
1.87	0.75	122	0.08	-9	1.89	10	0.43	-159
1.88	0.75	122	0.08	-9	1.88	10	0.43	-159
1.89	0.75	122	0.08	-10	1.87	10	0.43	-159
1.90	0.75	121	0.08	-9	1.86	9	0.43	-159
1.91	0.75	121	0.08	-9	1.86	9	0.43	-159
1.92	0.75	120	0.08	-10	1.85	8	0.44	-159
1.93	0.75	120	0.08	-10	1.84	8	0.44	-160
1.94	0.75	119	0.08	-10	1.83	8	0.44	-160
1.95	0.75	119	0.08	-10	1.81	7	0.44	-160
1.96	0.75	119	0.08	-10	1.80	7	0.44	-161
1.97	0.75	118	0.08	-9	1.80	7	0.44	-161
1.98	0.75	118	0.08	-9	1.80	6	0.44	-161
1.99	0.75	118	0.08	-10	1.80	6	0.44	-161
2.00	0.75	117	0.08	-11	1.80	5	0.45	-161

NEL2001 Class AB

 $V_{CC} = 24\text{ V}$ ,  $I_{CQ} = 0.02\text{ A}$ 

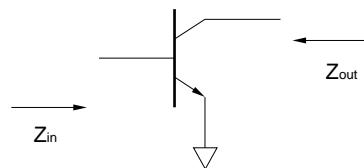
FREQUENCY GHz	MAG	S <sub>11</sub> ANG (DEG)	MAG	S <sub>12</sub> ANG (DEG)	MAG	S <sub>21</sub> ANG (DEG)	MAG	S <sub>22</sub> ANG (DEG)
1.70	0.78	131	0.07	-11	1.56	9	0.53	-132
1.71	0.78	130	0.06	-11	1.53	9	0.53	-132
1.72	0.78	130	0.06	-11	1.51	9	0.53	-133
1.73	0.78	130	0.07	-10	1.51	8	0.53	-133
1.74	0.77	129	0.07	-11	1.52	8	0.53	-133
1.75	0.77	129	0.07	-11	1.51	7	0.53	-134
1.76	0.77	128	0.07	-11	1.50	6	0.53	-134
1.77	0.77	128	0.06	-11	1.48	6	0.54	-134
1.78	0.77	128	0.06	-11	1.46	6	0.54	-135
1.79	0.77	127	0.06	-11	1.46	5	0.54	-135
1.80	0.77	127	0.06	-11	1.46	5	0.54	-135
1.81	0.78	127	0.07	-13	1.46	4	0.54	-135
1.82	0.78	126	0.07	-14	1.45	3	0.55	-136
1.83	0.78	126	0.07	-14	1.43	3	0.55	-136
1.84	0.77	125	0.07	-13	1.41	3	0.55	-137
1.85	0.77	125	0.07	-13	1.41	2	0.55	-137
1.86	0.78	124	0.07	-12	1.41	2	0.55	-137
1.87	0.78	124	0.07	-12	1.41	1	0.55	-138
1.88	0.78	123	0.07	-12	1.40	0	0.55	-138
1.89	0.78	123	0.07	-12	1.38	0	0.55	-138
1.90	0.78	122	0.07	-12	1.37	0	0.55	-139
1.91	0.78	122	0.07	-12	1.36	0	0.56	-139
1.92	0.78	121	0.07	-13	1.37	-1	0.56	-139
1.93	0.78	121	0.07	-13	1.37	-2	0.56	-140
1.94	0.78	121	0.07	-13	1.35	-2	0.56	-140
1.95	0.78	120	0.07	-13	1.34	-3	0.56	-140
1.96	0.78	120	0.07	-12	1.32	-3	0.56	-141
1.97	0.78	120	0.07	-12	1.32	-3	0.56	-141
1.98	0.78	119	0.07	-12	1.32	-3	0.56	-141
1.99	0.78	119	0.07	-12	1.33	-4	0.57	-142
2.00	0.78	118	0.07	-12	1.34	-5	0.57	-142

NEL200101-24  $Z_{in}/Z_{out}$

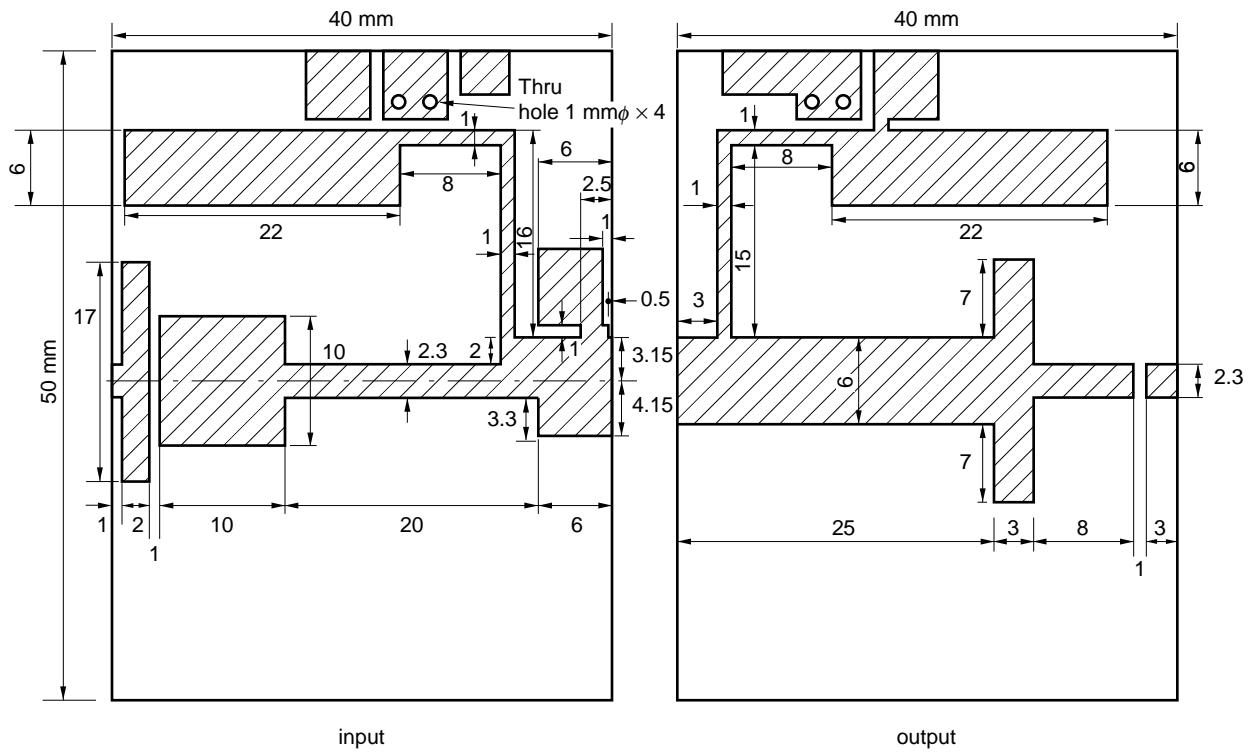


$Z_0 = 50 \text{ ohm}$

f [GHz]	$Z_{in}$ [ohm]	$Z_{out}$ [ohm]
1.80	$8.7 + j38$	$2.2 - j19$
1.90	$6.3 + j36$	$4.1 - j24$
1.97	$5.4 + j33$	$6.4 - j30$
2.00	$4.7 + j30$	$10 - j37$

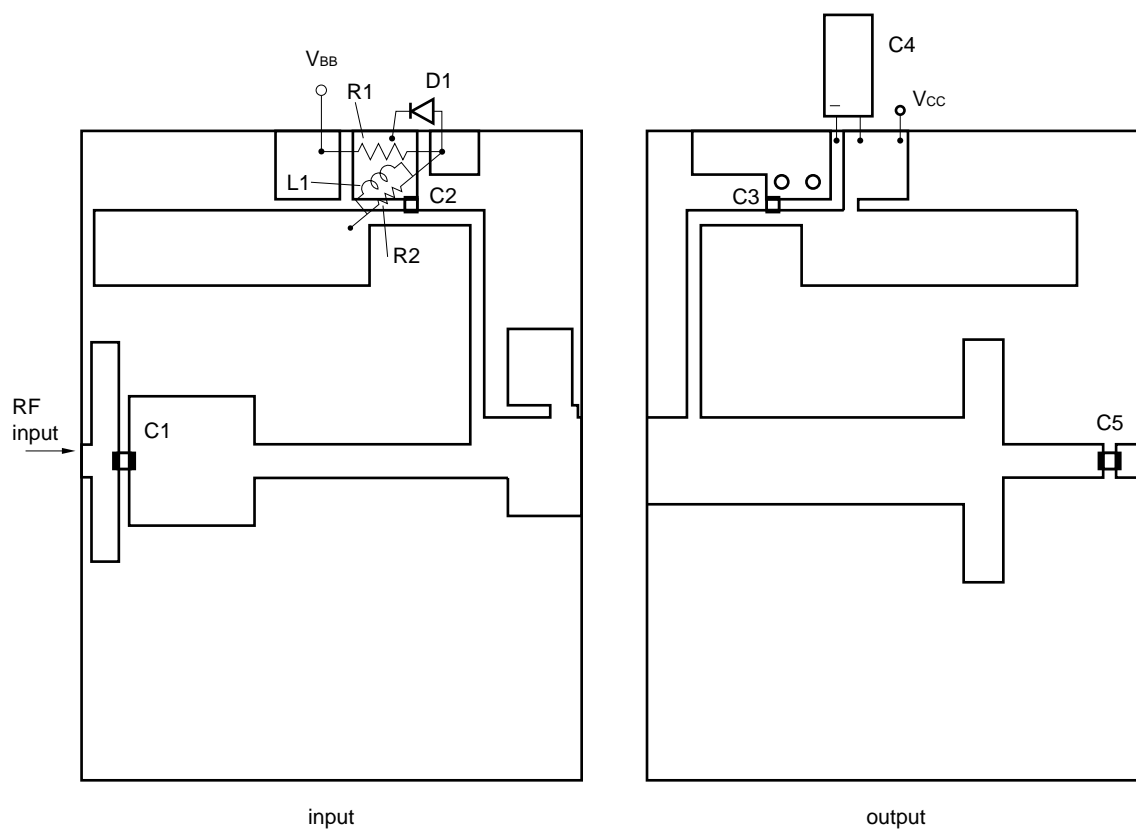


Circuit Drawing



SUBSTRATE (TEFLON)  
 DICLAD 522T®  
 THICKNESS = 0.79 mm  
 DOUBLE SIDE 35  $\mu$ m Cu  
 $\epsilon_r = 2.6$

# Components Layout

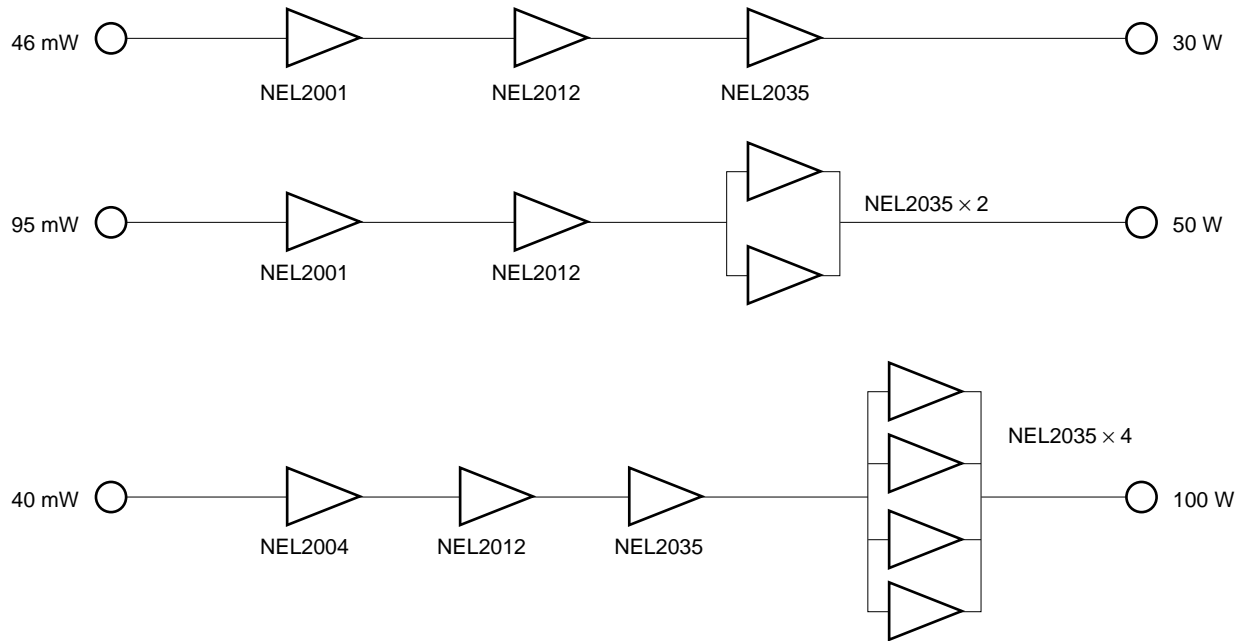


- R1: 5.1  $\Omega$
- R2: 30  $\Omega$
- L1: 5 mm $\phi$  10T Coil
- D1: 1S2075
- C1, C2, C3, C5: MURATA, 47 pF
- C4: 22  $\mu$ F (50 V)  
Electrolytic Capacitor



APPLICATION

= Amplifier Diagrams =



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[MEMO]

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