NEC

SILICON POWER TRANSISTOR
NEL2012F03-24

NPN SILICON EPITAXIAL TRANSISTOR
L BAND POWER AMPLIFIER

DESCRIPTION

The NEL2012F03-24 of NPN epitaxial microwave power transistors is designed for 1.8 GHz-2.0 GHz PCN/PCS/ PHS base station applications. It is corporate emitter ballast resistors, gold metalizations and offers a high degree of reliability.

FEATURES

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

APPLICATION

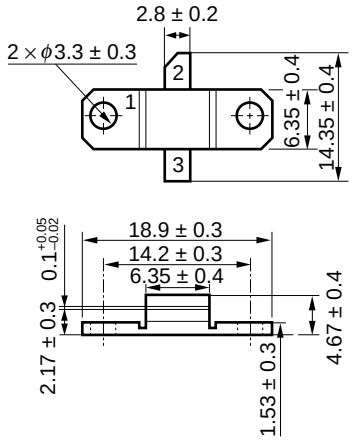
Digital Cellular : PCN/PCS etc.
Digital Cordless : PHS etc.

ORDERING INFORMATION

Part Number	Package Outline
NEL2012F03-24	F03

PACKAGE DIMENSIONS

(Unit: mm)



PIN CONNECTIONS

1. EMITTER
2. BASE
3. COLLECTOR

The information in this document is subject to change without notice.

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ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

PARAMETERS	SYMBOL	Specified Condition	RATINGS	UNIT
Collector to Base Voltage	V_{CBO}		45	V
Collector to Emitter Voltage	V_{CER}	R = 10 Ω	30	V
Emitter to Base Voltage	V_{EBO}		3	V
Collector to Emitter Voltage	V_{CEO}		18	V
Collector Current	I_C		4	A
Total Power Dissipation	P_T		41.5	W
Thermal Resistance	$R_{th\ (j\text{-}c)}$		4.2	°C/W
Junction Temperature	T_j		200	°C
Storage Temperature	T_{stg}		–65 to +150	°C

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

PARAMETERS	SYMBOL	Specified Condition	MIN.	TYP.	MAX.	UNIT
Collector to Emitter Cutoff Current	I_{CES}	V_{CE} = 24 V			8	mA
Collector to Emitter Voltage	V_{CER}	I_C = 8 mA, R = 10 Ω	30	85		V
Collector to Emitter Voltage	V_{CEO}	I_C = 8 mA	18	22		V
Collector to Base Voltage	V_{CEO}	I_C = 8 mA	45	85		V
Emitter to Base Voltage	V_{EBO}	I_C = 20 mA	3	4.4		V
DC Current Gain	h_{FE}	V_{CE} = 5 V, I_C = 0.8 A	30	100	150	
Output Capacitance	Cob	V_{CE} = 24 V, freq = 1 MHz		12.6		pF

PERFORMANCE SPECIFICATIONS (T_A = 25 °C)

CLASS AB OPERATION (Unless otherwise specified, freq = 1.97 GHz, V_{CC} = 24 V, Iq = 75 mA)

PARAMETERS	SYMBOL	Specified Condition	MIN.	TYP.	MAX.	UNIT
Output Power	P_{1dB}		12	16		W
Collector Efficiency	η_C	Pout = P_{1dB}	40	55		%
Linear Gain	G_L	Pin = 0.5 W		10.9		dB
3rd Order Intermodulation	IM_3	Δfreq = 100 kHz, 12 W PEP		–33		dBc

CLASS A OPERATION (Unless otherwise specified, freq = 1.97 GHz, V_{CC} = 20 V, Iq = 750 mA)

PARAMETERS	SYMBOL	Specified Condition	MIN.	TYP.	MAX.	UNIT
Output Power	P_{1dB}			5		W
Collector Efficiency	η_C	Pout = P_{1dB}		35		%
Linear Gain	G_L	Pin = 0.07 W		13.8		dB
3rd Order Intermodulation	IM_3	Δfreq = 100 kHz, 2.5 W PEP		–35		dBc

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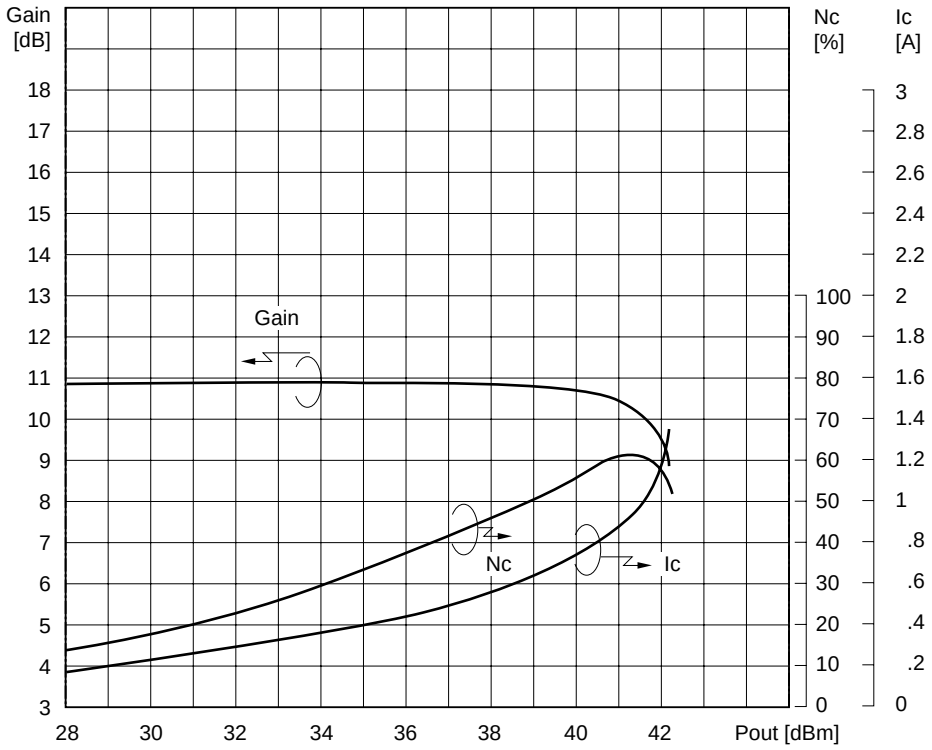
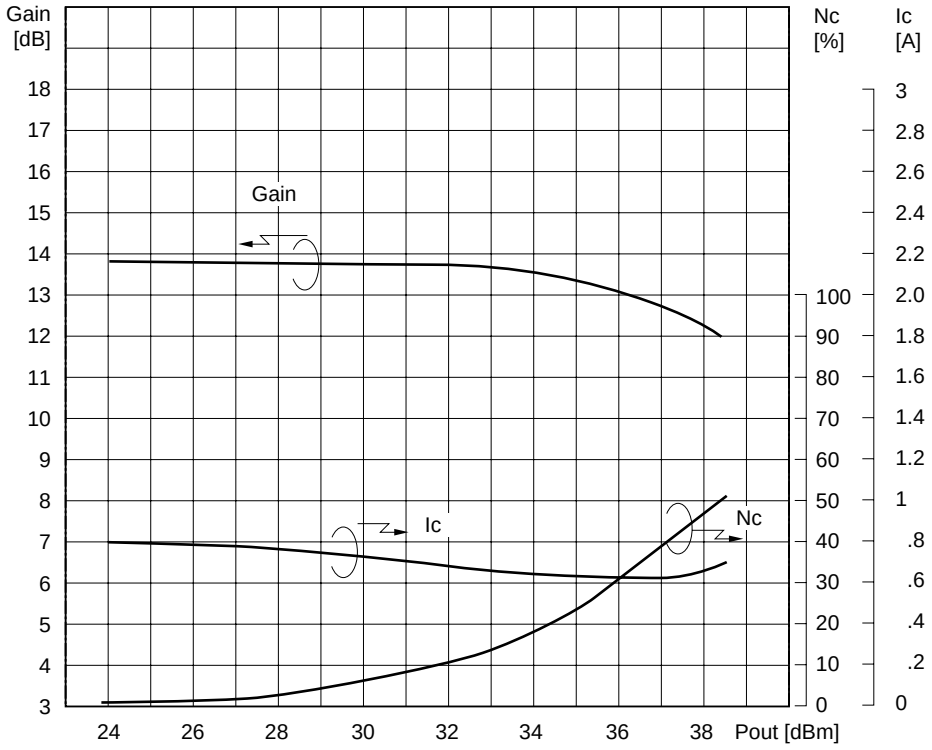
Typical Pout-Gain, Collector Efficiency (N_C) and Collector Current (I_C) Characteristics

Class AB



freq = 1.970 GHz
U_{CC} = 24.0 V
Icq = 0.075 A

Class A



freq = 1.970 GHz
U_{CC} = 20.0 V
Icq = 0.750 A

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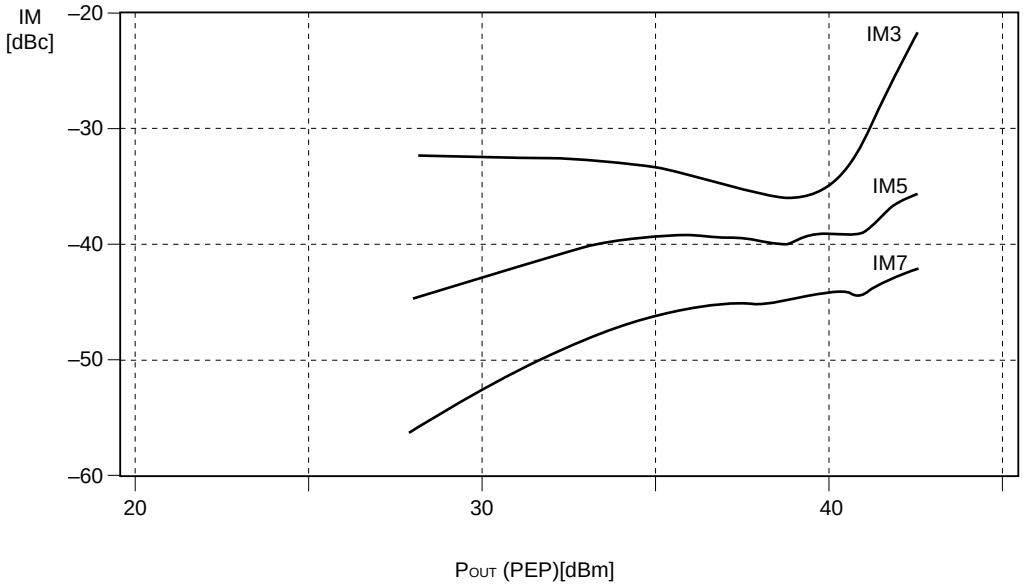
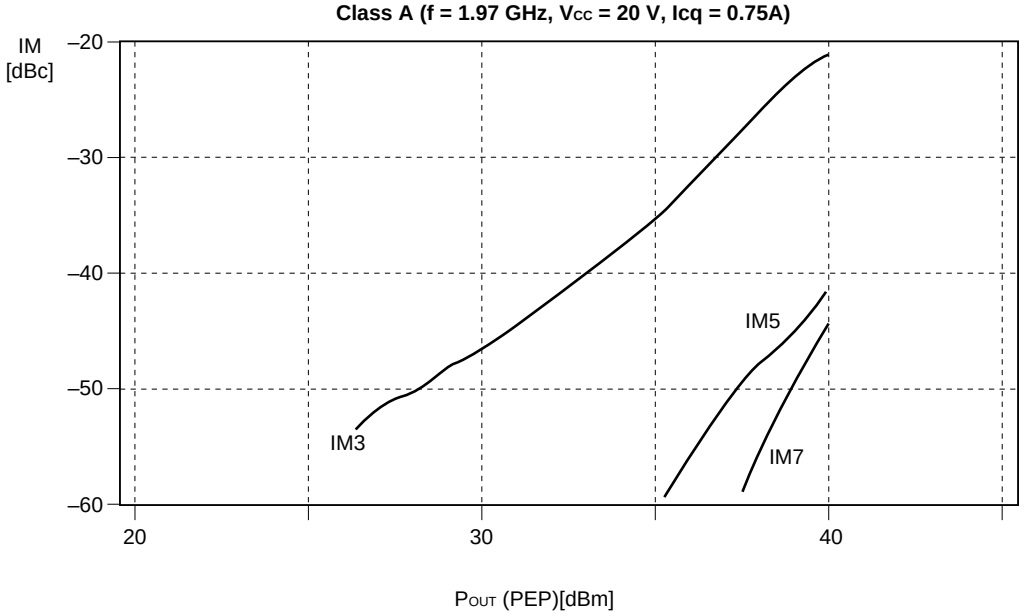
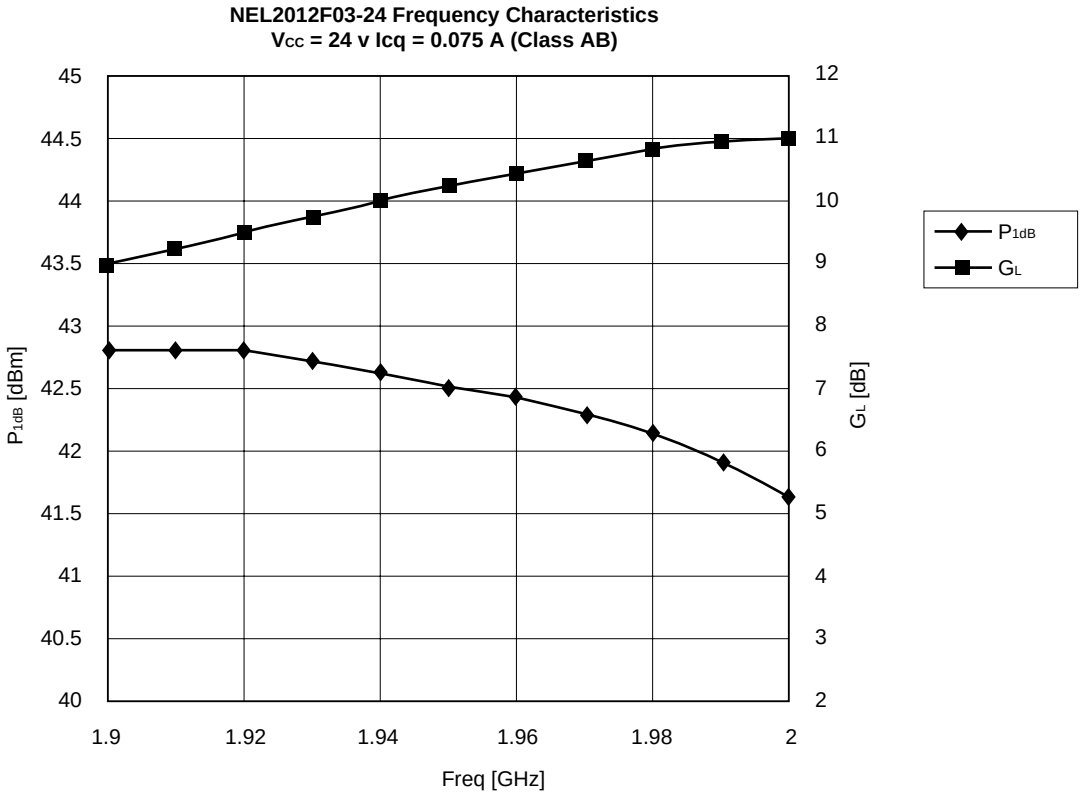
Typical Pout (PEP) - Intermodulation (IM) Characteristics

Class AB (f = 1.97 GHz, V_{CC} = 24 V, Icq = 0.075A)

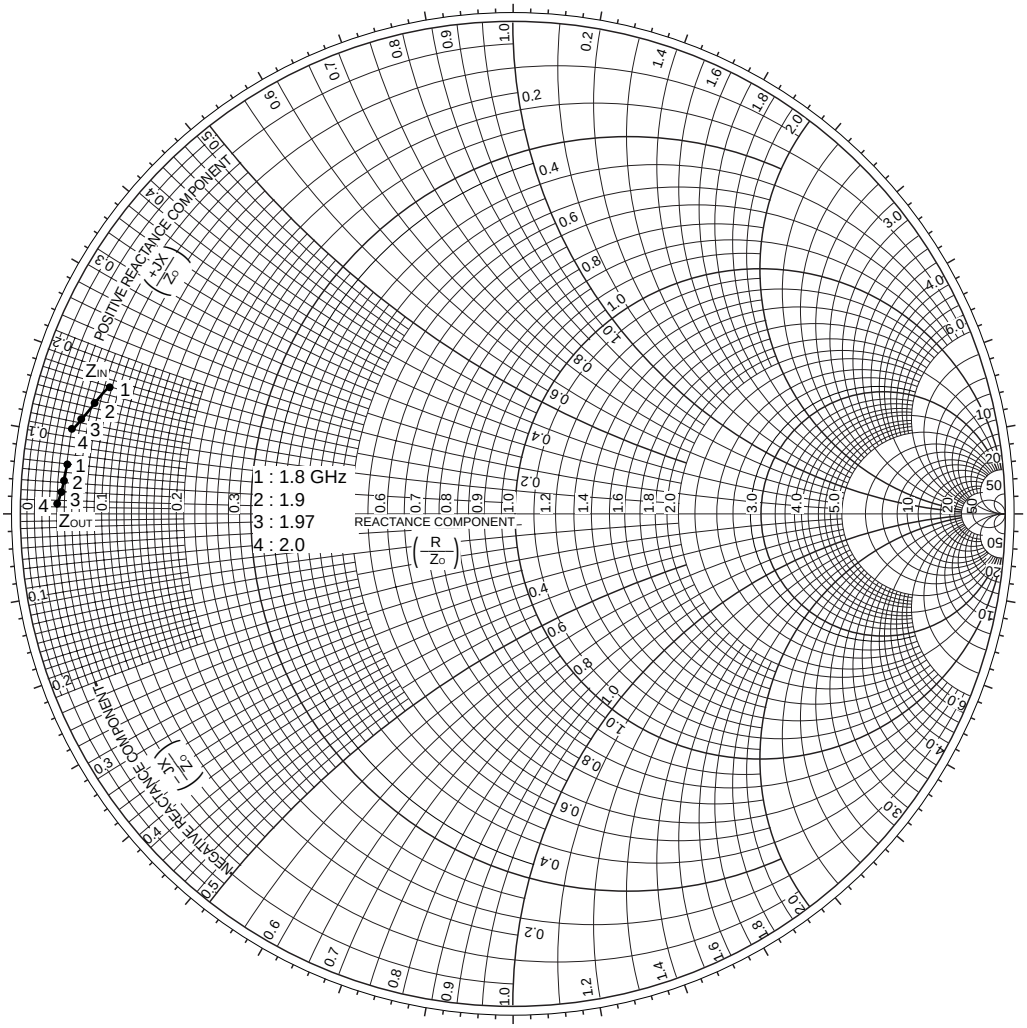


Class A (f = 1.97 GHz, V_{CC} = 20 V, Icq = 0.75A)



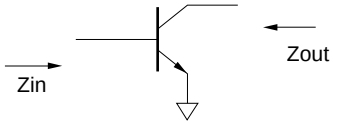

NEL2012F03-24 Frequency Characteristics
Vcc = 24 v Icq = 0.075 A (Class AB)
45
44.5
44
43.5
43
42.5
42
41.5
41
40.5
40
P1dB [dBm]
12
11
10
9
8
7
6
5
4
3
2
GL [dB]
1.9
1.92
1.94
1.96
1.98
2
Freq [GHz]
P1dB
GL

NEL2012F03-24 Zin/Zout



Z0 = 50 Ω

f [GHz]	Zin [Ω]	Zout [Ω]
1.80	4.3 + j8.9	2.6 + j2.2
1.90	3.1 + j7.4	2.4 + j1.3
1.97	2.6 + j6.3	2.2 + j0.6
2.00	2.4 + j5.9	2.2 + j0.4



NEL2012F03-24 Class A S-Parameters

V_{CC} = 20 V, Icq = 0.75 A

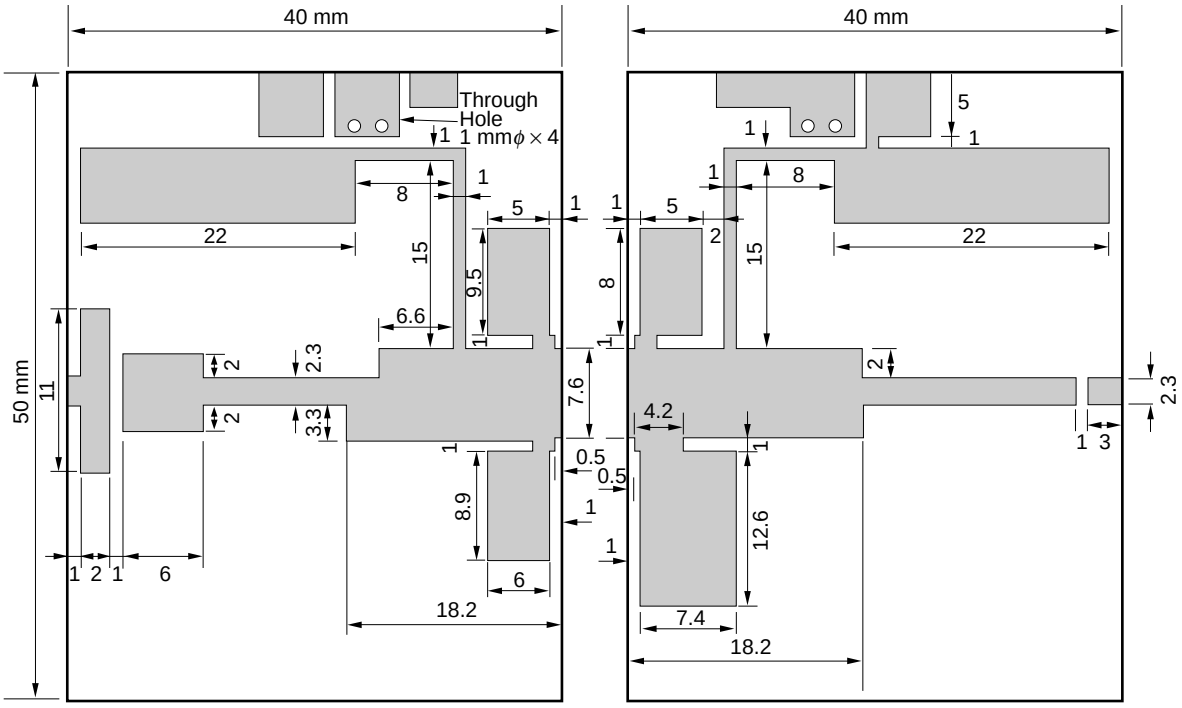
Freq	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
1.70	0.846	167.1	1.063	47.2	0.034	53.2	0.793	–178.0
1.71	0.844	167.1	1.074	46.1	0.034	53.2	0.798	–178.2
1.72	0.842	167.2	1.077	44.5	0.033	51.2	0.803	–177.7
1.73	0.841	167.4	1.080	43.3	0.032	50.7	0.809	–177.8
1.74	0.840	167.5	1.080	42.2	0.033	49.2	0.812	–177.7
1.75	0.839	167.6	1.081	41.1	0.032	48.0	0.814	–178.0
1.76	0.837	167.7	1.089	40.1	0.031	47.7	0.822	–177.7
1.77	0.837	167.9	1.095	38.3	0.030	46.4	0.830	–177.5
1.78	0.836	168.0	1.098	36.7	0.030	46.5	0.832	–177.6
1.79	0.835	168.2	1.094	35.3	0.029	46.4	0.838	–177.9
1.80	0.834	168.4	1.083	34.1	0.029	45.7	0.849	–178.2
1.81	0.835	168.5	1.077	32.7	0.028	45.2	0.850	–178.0
1.82	0.834	168.8	1.080	31.5	0.028	43.9	0.855	–178.1
1.83	0.833	168.9	1.078	30.3	0.028	42.2	0.860	–178.4
1.84	0.833	169.1	1.070	28.8	0.027	42.3	0.872	–178.5
1.85	0.835	169.3	1.059	27.4	0.026	41.7	0.872	–178.9
1.86	0.833	169.4	1.047	26.7	0.025	41.5	0.880	–178.9
1.87	0.833	169.6	1.044	25.9	0.025	38.6	0.889	–178.9
1.88	0.835	169.9	1.054	25.1	0.024	36.1	0.893	–179.1
1.89	0.836	170.0	1.063	23.9	0.023	36.4	0.897	–179.5
1.90	0.837	170.2	1.063	22.3	0.021	35.1	0.906	–179.9
1.91	0.839	170.4	1.059	20.2	0.021	33.8	0.910	–180.0
1.92	0.842	170.5	1.052	18.6	0.019	33.6	0.915	179.9
1.93	0.845	170.6	1.048	17.4	0.019	31.6	0.918	179.3
1.94	0.846	170.7	1.042	15.7	0.017	31.3	0.924	179.2
1.95	0.848	171.0	1.036	14.1	0.016	30.4	0.930	179.0
1.96	0.851	171.1	1.032	12.1	0.015	31.2	0.936	178.4
1.97	0.854	171.1	1.014	9.9	0.014	31.6	0.942	178.2
1.98	0.857	171.2	0.992	8.5	0.013	30.9	0.943	177.6
1.99	0.860	171.4	0.969	7.6	0.012	30.6	0.951	177.3
2.00	0.863	171.5	0.962	6.7	0.011	29.6	0.954	177.1

NEL2012F03-24 Class AB S-Parameters

V_{CC} = 24 V, Icq = 0.075 A

Freq	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
1.70	0.916	166.1	0.366	28.1	0.019	63.0	0.938	–175.4
1.71	0.915	166.0	0.371	27.5	0.019	63.5	0.940	–175.8
1.72	0.912	165.9	0.375	26.1	0.019	63.0	0.942	–175.9
1.73	0.911	165.9	0.376	24.9	0.018	62.4	0.943	–176.1
1.74	0.910	165.8	0.378	24.3	0.018	62.0	0.944	–176.3
1.75	0.909	165.8	0.378	23.7	0.018	61.1	0.944	–176.6
1.76	0.906	165.6	0.381	23.2	0.017	61.4	0.946	–176.8
1.77	0.905	165.5	0.382	21.8	0.017	62.3	0.950	–177.0
1.78	0.903	165.5	0.387	20.4	0.017	61.6	0.949	–177.2
1.79	0.901	165.4	0.386	19.4	0.017	63.3	0.951	–177.5
1.80	0.899	165.4	0.384	18.4	0.017	61.5	0.954	–177.8
1.81	0.897	165.3	0.382	17.4	0.017	61.0	0.954	–177.9
1.82	0.896	165.3	0.385	16.4	0.017	59.6	0.958	–178.1
1.83	0.893	165.3	0.387	15.8	0.017	60.4	0.957	–178.5
1.84	0.890	165.2	0.383	14.3	0.016	60.0	0.962	–178.6
1.85	0.890	165.3	0.383	13.3	0.016	60.0	0.962	–178.9
1.86	0.886	165.2	0.383	12.5	0.015	58.4	0.963	–178.9
1.87	0.883	165.2	0.385	12.5	0.016	56.7	0.964	–179.2
1.88	0.882	165.3	0.388	11.9	0.015	55.9	0.968	–179.5
1.89	0.879	165.3	0.396	10.6	0.014	55.3	0.967	–179.6
1.90	0.877	165.4	0.402	9.5	0.014	53.6	0.967	180.0
1.91	0.876	165.4	0.403	7.3	0.013	55.3	0.968	179.8
1.92	0.874	165.5	0.403	6.0	0.013	53.7	0.968	179.6
1.93	0.873	165.4	0.405	4.6	0.012	54.0	0.968	179.2
1.94	0.871	165.5	0.402	3.2	0.012	51.1	0.969	179.1
1.95	0.869	165.6	0.408	1.7	0.011	52.4	0.969	178.9
1.96	0.867	165.7	0.407	–0.8	0.011	49.9	0.970	178.6
1.97	0.867	165.8	0.405	–2.8	0.009	51.3	0.971	178.3
1.98	0.865	165.9	0.401	–4.3	0.009	51.8	0.971	178.0
1.99	0.864	166.0	0.396	–5.2	0.008	50.6	0.971	177.7
2.00	0.863	166.2	0.393	–6.3	0.007	50.6	0.972	177.5

Circuit Drawing



SUBSTRATE (TEFLON)
DICLAD522T®
THICKNESS = 0.79 mm
DOUBLE SIDE 35 μm Cu
εr = 2. 6

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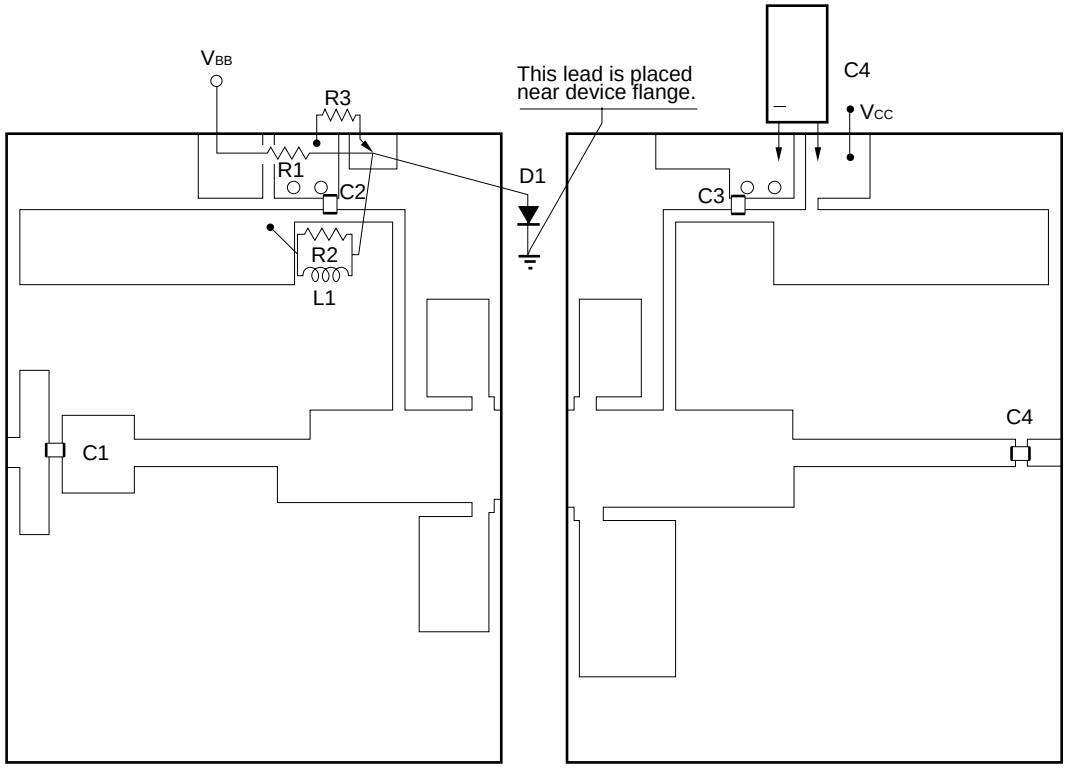
Components Layout



R1: 5.1 Ω
R2: 50 Ω R3: 47 Ω
L1: 5 mmϕ 10T Coil
C1, C2, C3, C5: MURATA, 47 pF
C4: 100 μF (50 V)
Electrolytic Capacitor
D1: V06C

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[MEMO]