

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

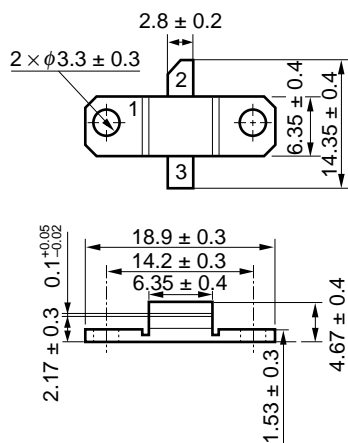
- Digital Cellular : PCN/PCS etc.
- Digital Cordless : PHS etc.

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.

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

PARAMETERS	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		4	A
Total Power Dissipation	P_T		41.5	W
Thermal Resistance	$R_{th(j-c)}$		4.2	$^{\circ}\text{C}/\text{W}$
Junction Temperature	T_j		200	$^{\circ}\text{C}$
Storage Temperature	T_{stg}		-65 to +150	$^{\circ}\text{C}$

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

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

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

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

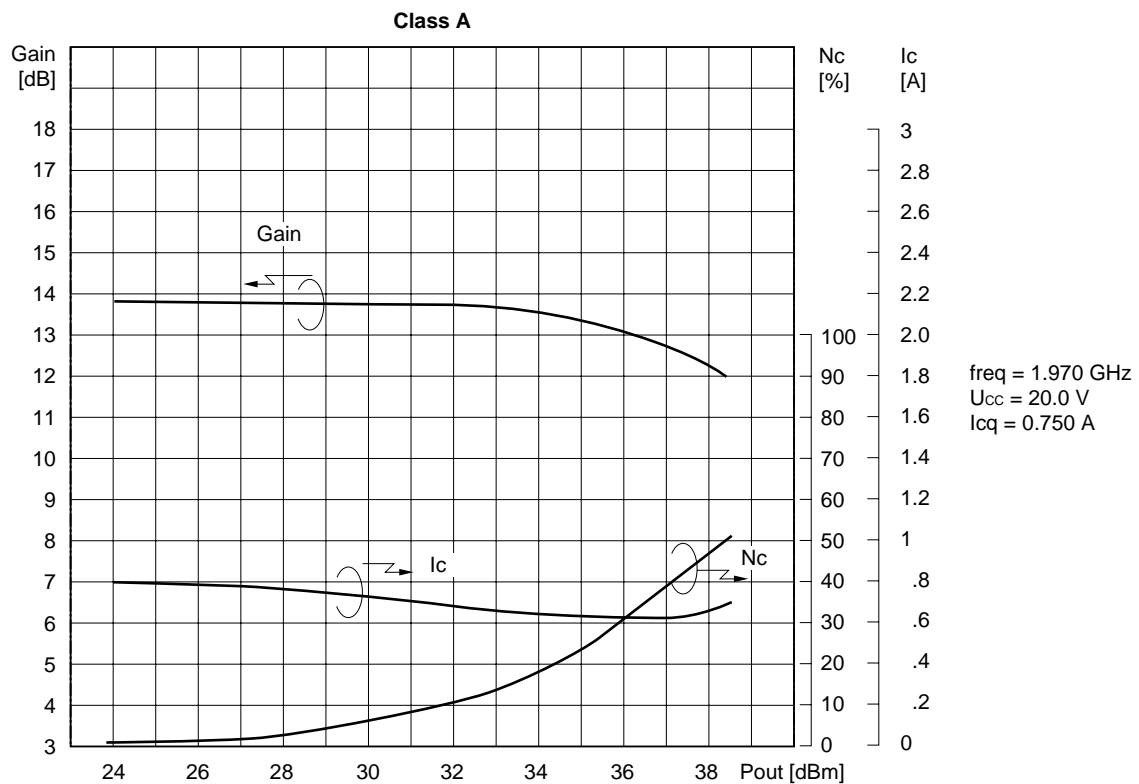
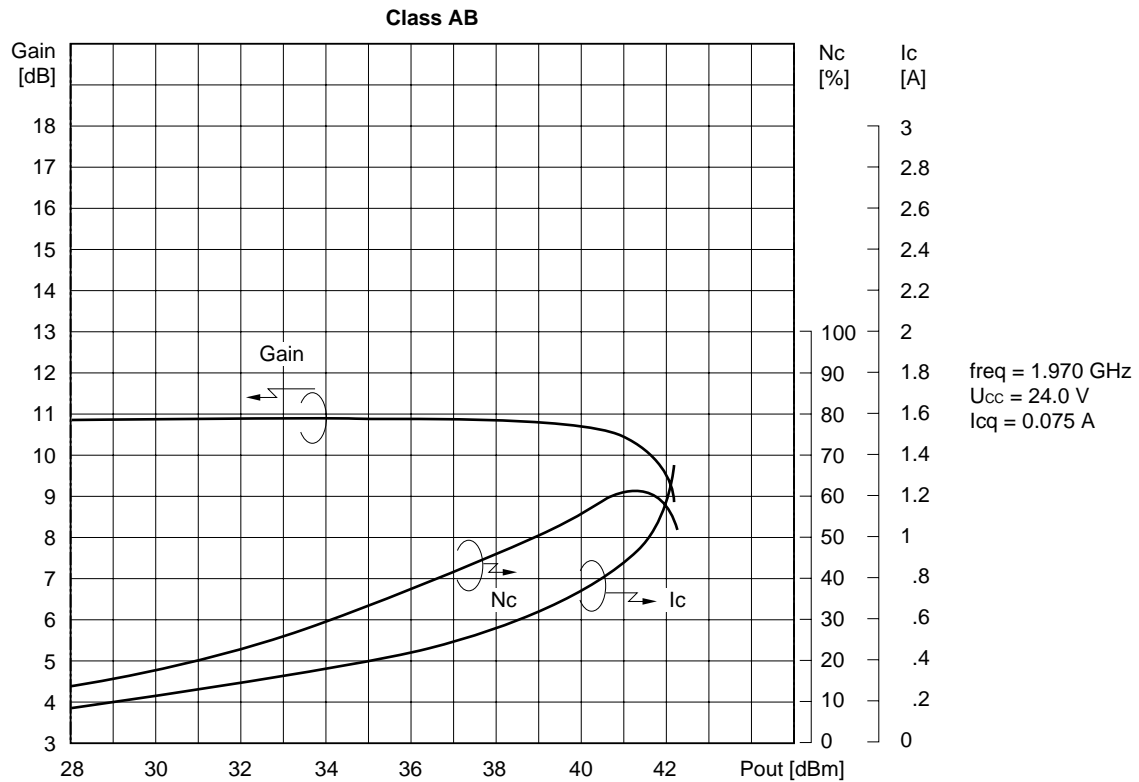
PARAMETERS	SYMBOL	Specified Condition	MIN.	TYP.	MAX.	UNIT
Output Power	P_{1dB}		12	16		W
Collector Efficiency	η_C	$P_{out} = P_{1dB}$	40	55		%
Linear Gain	GL	$P_{in} = 0.5\text{ W}$		10.9		dB
3rd Order Intermodulation	IM_3	$\Delta\text{freq} = 100\text{ kHz}$, 12 W PEP		-33		dBc

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

PARAMETERS	SYMBOL	Specified Condition	MIN.	TYP.	MAX.	UNIT
Output Power	P_{1dB}			5		W
Collector Efficiency	η_C	$P_{out} = P_{1dB}$		35		%
Linear Gain	GL	$P_{in} = 0.07\text{ W}$		13.8		dB
3rd Order Intermodulation	IM_3	$\Delta\text{freq} = 100\text{ kHz}$, 2.5 W PEP		-35		dBc

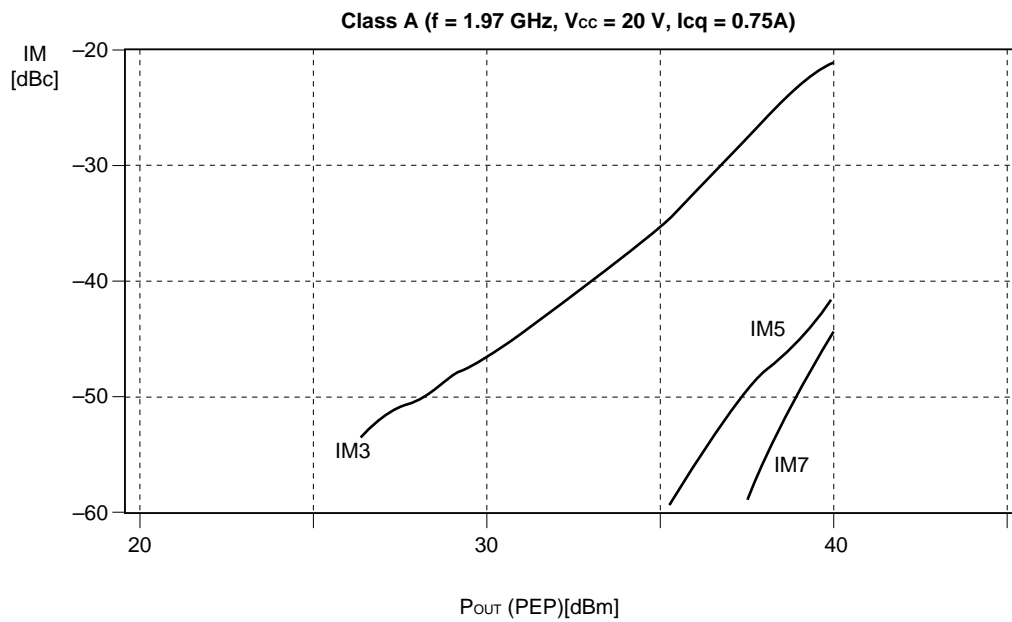
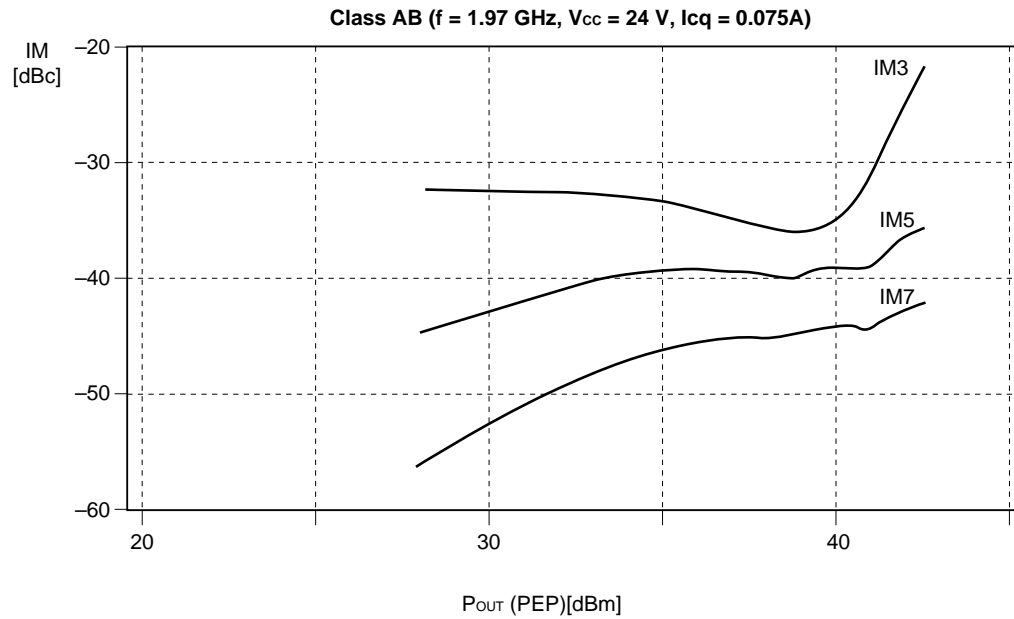
NEL2012F03-24

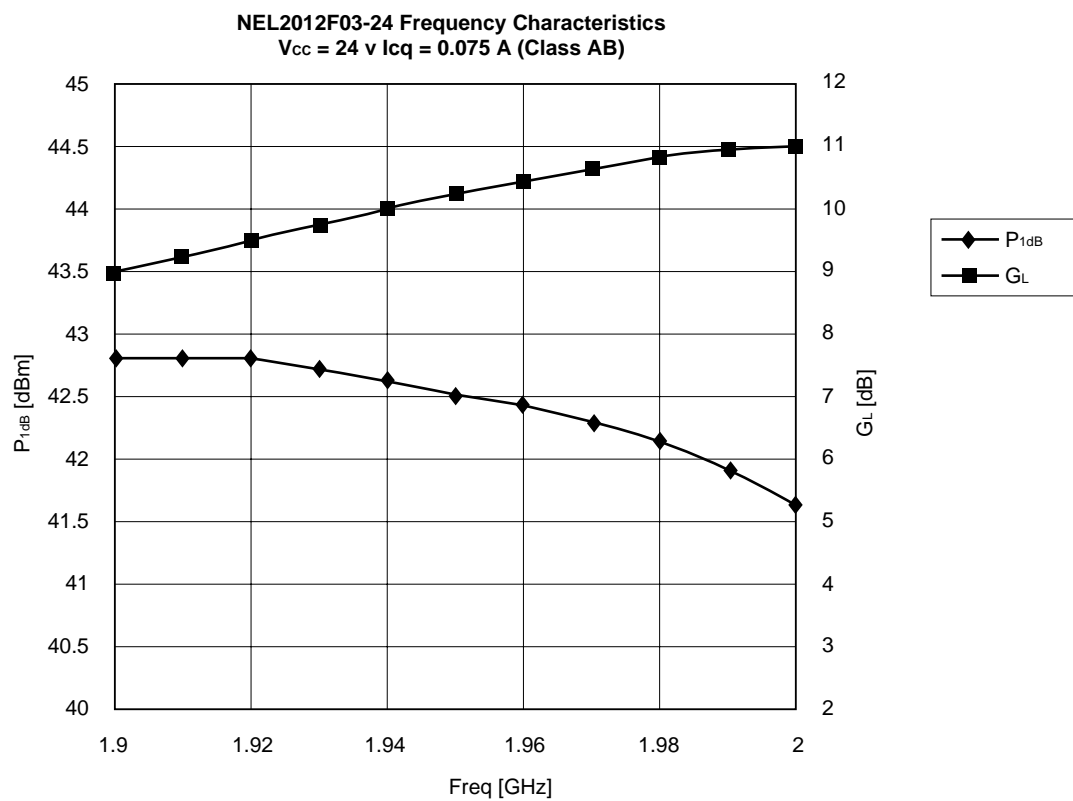
Typical Pout-Gain, Collector Efficiency (N_c) and Collector Current (I_c) Characteristics



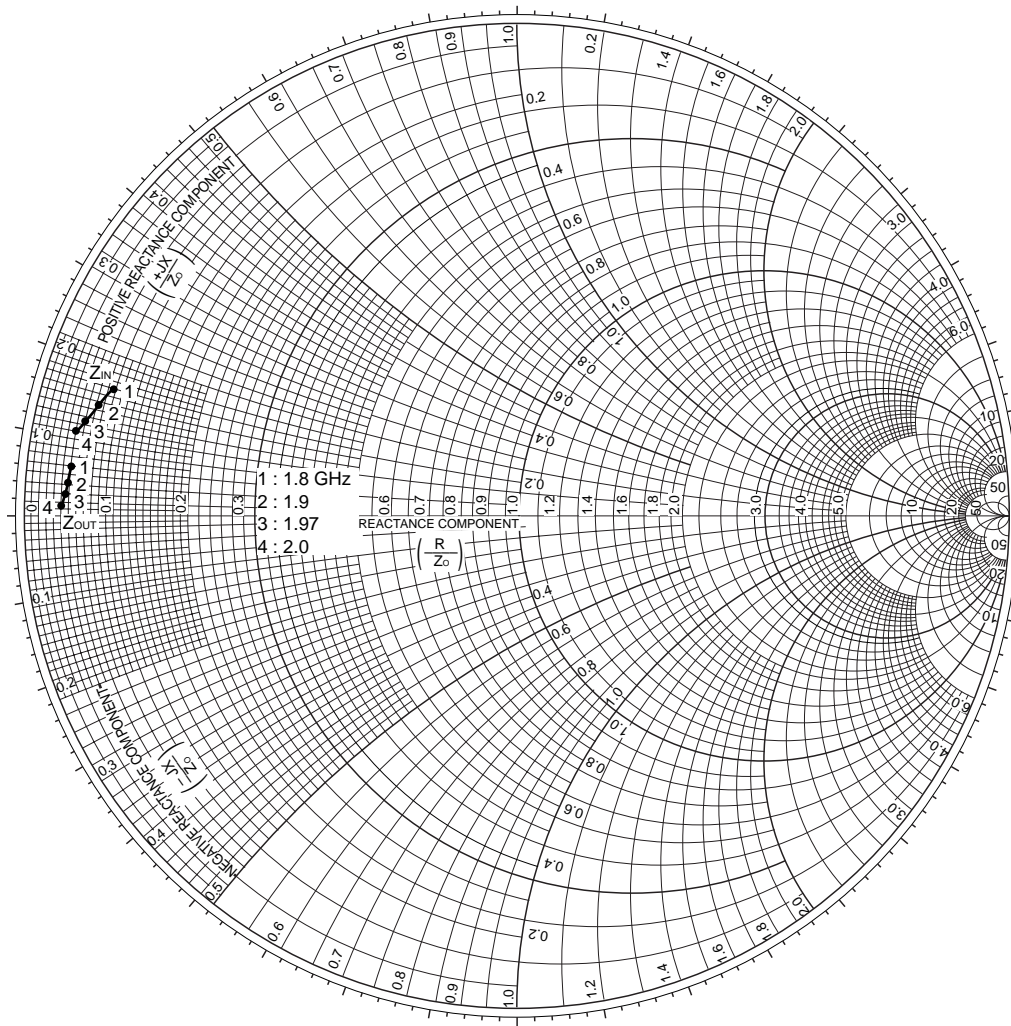
NEL2012F03-24

Typical Pout (PEP) - Intermodulation (IM) Characteristics



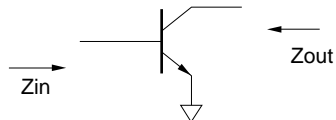


NEL2012F03-24 Zin/Zout



$Z_0 = 50 \Omega$

f [GHz]	$Z_{in} [\Omega]$	$Z_{out} [\Omega]$
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, I_{CQ} = 0.75 A

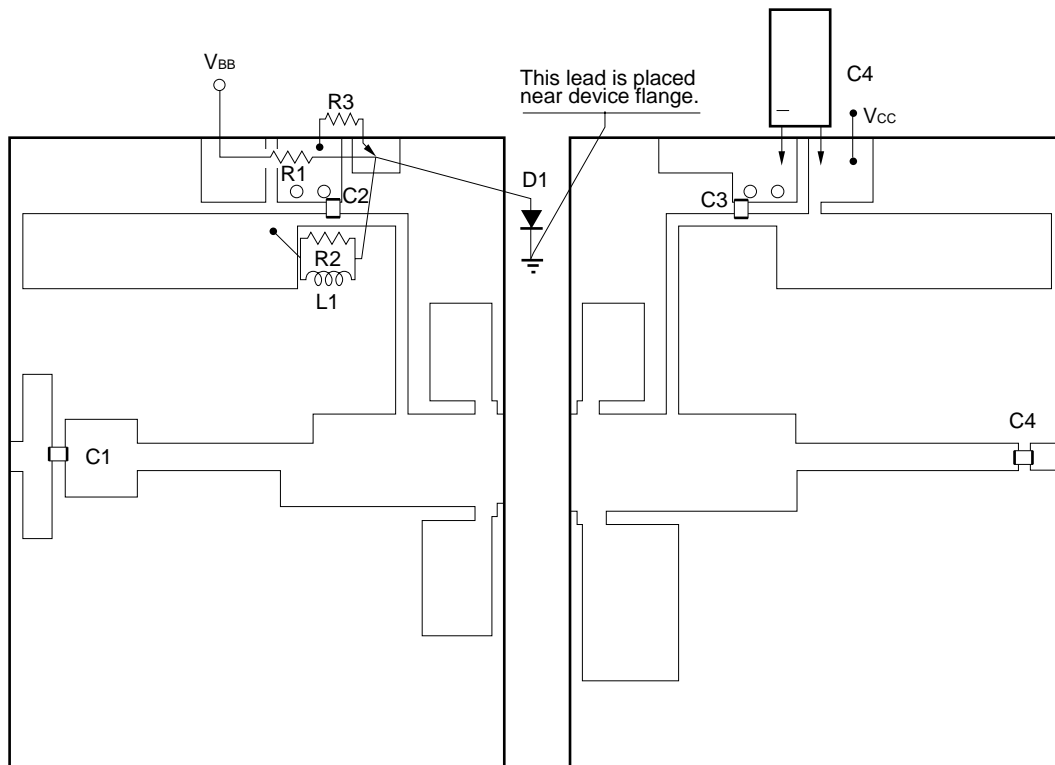
Freq (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
1.70	0.846	167.1	1.063	47.2	0.034	53.2	0.793	-178.0
1.71	0.844	167.1	1.074	46.1	0.034	53.2	0.798	-178.2
1.72	0.842	167.2	1.077	44.5	0.033	51.2	0.803	-177.7
1.73	0.841	167.4	1.080	43.3	0.032	50.7	0.809	-177.8
1.74	0.840	167.5	1.080	42.2	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, I_{CQ} = 0.075 A

Freq (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	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

Components Layout



Input

Output

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

NEL2012F03-24

[MEMO]

No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.

NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.

NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.

Anti-radioactive design is not implemented in this product.