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Renesas Electronics website: <http://www.renesas.com>

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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Evaluation Board Information

EC-NE3509M04

2.642 GHz LNA Evaluation Board for DMB Application

- **Evaluation Board Pattern Layout**
- **Circuit Description**
- **Evaluation Board Test Results**
- **Gain and Isolation**
- **Input and Output Return Loss**
- **1 dB Gain Compression Output Power**
- **P_{in} - P_{out} & IM_3 Performance**
- **L_2 vs. NF and RL_{in}/RL_{out}**

Caution	GaAs Products	<p>This product uses gallium arsenide (GaAs). GaAs vapor and powder are hazardous to human health if inhaled or ingested, so please observe the following points.</p> <ul style="list-style-type: none"> • Follow related laws and ordinances when disposing of the product. If there are no applicable laws and/or ordinances, dispose of the product as recommended below. <ol style="list-style-type: none"> 1. Commission a disposal company able to (with a license to) collect, transport and dispose of materials that contain arsenic and other such industrial waste materials. 2. Exclude the product from general industrial waste and household garbage, and ensure that the product is controlled (as industrial waste subject to special control) up until final disposal. • Do not burn, destroy, cut, crush, or chemically dissolve the product. • Do not lick the product or in any way allow it to enter the mouth.
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This document outlines general applications for this product. The application circuits and circuit constants provided in this document are simply examples and should not be used for mass production design. Be aware also that there is no intention to standardize the restrictions and characteristics of these application circuits.

The characteristics of high-frequency devices in particular vary depending on the external components and mounting pattern used.

Customers are requested to confirm all characteristics when designing a system based in part or wholly on the information in this document.

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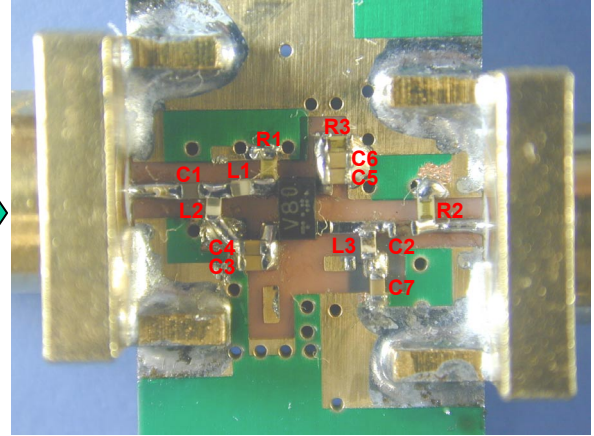
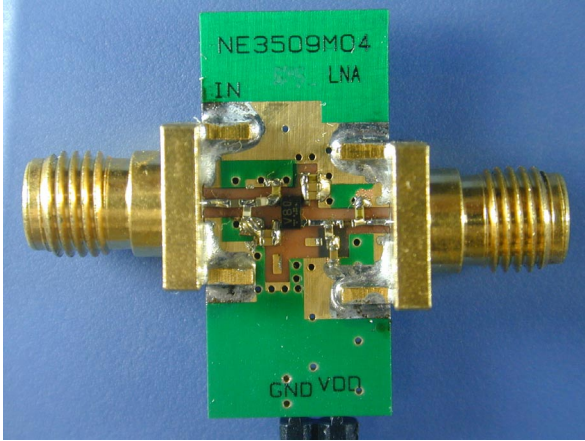
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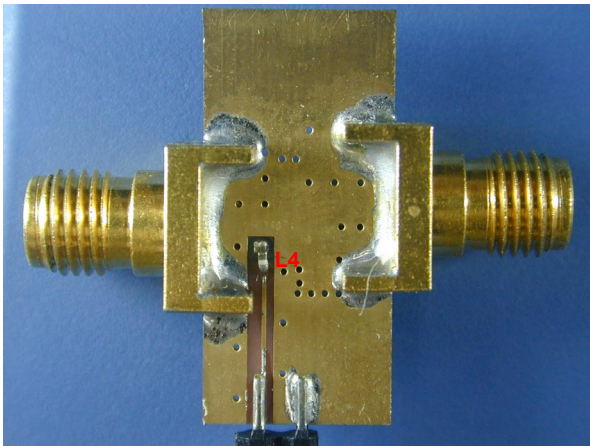
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Evaluation Board Pattern Layout

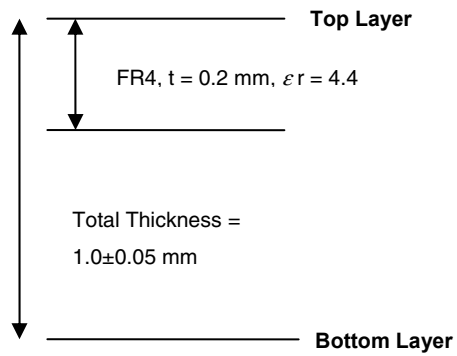
<Top View>



<Bottom View>



<PCB Cross Section>

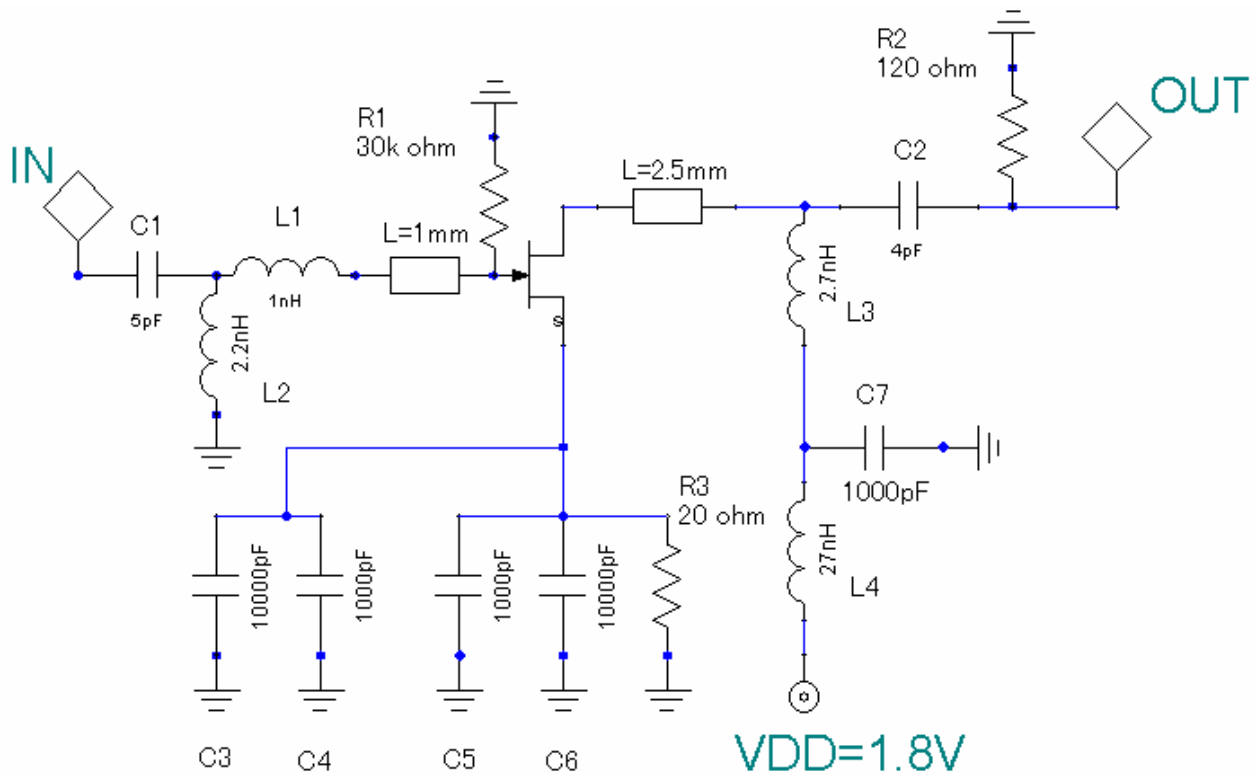


size 11.0 mm × 24.0 mm

material FR4 (ELC4756/Sumitomo)
 $t = 0.2 \text{ mm}$, $\epsilon_r = 4.4$

Circuit Description

(V_{DD} = 1.8 V, I_D = 10.0 mA, f = 2.642 GHz)



COMPONENTS OF TEST CIRCUIT

Parts	Part Number	Maker	Symbol	Value	Unit
Chip Capacitor	GRP1552C1H5R0CZ01	Murata	C1	5	pF
Chip Capacitor	GRP1552C1H4R0CZ01	Murata	C2	4	pF
Chip Capacitor	GRP155B11E103KA01	Murata	C3, C6	10 000	pF
Chip Capacitor	GRP155B11H102KA01	Murata	C4, C5, C7	1 000	pF
Chip Inductor	AML1005H1N0ST	FDK	L1	1.0	nH
Chip Inductor	AML1005H2N2ST	FDK	L2	2.2	nH
Chip Inductor	AML1005H2N7ST	FDK	L3	2.7	nH
Chip Inductor	AML1005H27NJT	FDK	L4	27	nH
Chip Resistor	RR0510-303-D	SSM	R1	30	kΩ
Chip Resistor	RR0510-121-D	SSM	R2	120	Ω
Chip Resistor	RR0510-200-D	SSM	R3	20	Ω
Transistor	NE3509M04	NEC	TR		
DC Connector	A2-2PA-2.54DSA	Hirose			
RF Connector	01K2266-00	WAKA			
Substrate	FR4 (t = 0.2 mm)	Sumitomo			

Evaluation Board Test Results

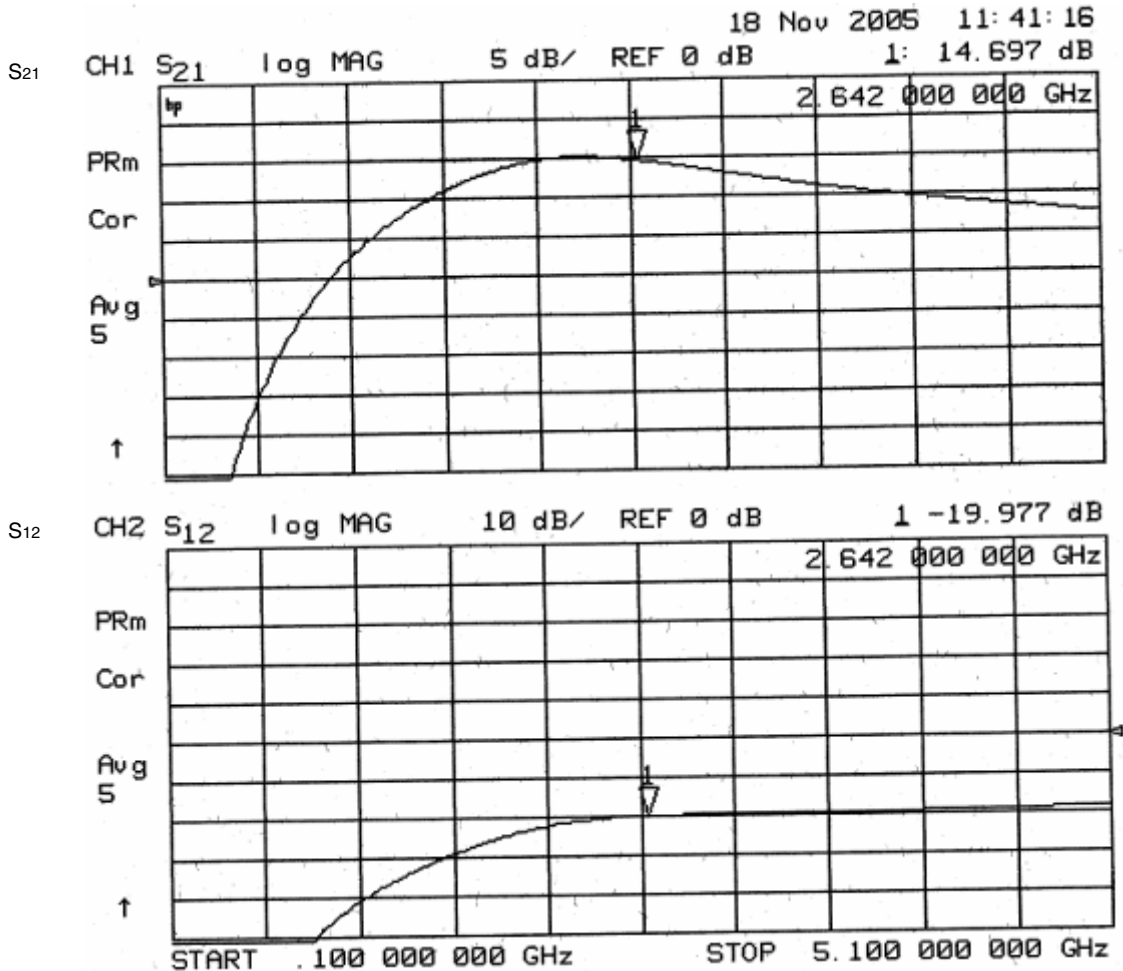
(V_{DD} = 1.8 V, I_D = 10.0 mA, f = 2.642 GHz)

Item	Symbol	Data	Unit
Noise Figure	NF ^{Note}	0.77	dB
Associated Gain	G _a ^{Note}	14.9	dB
Return Loss (in)	RL _{in}	10.4	dB
Return Loss (out)	RL _{out}	13.6	dB
Output Power at 1 dB Compression Point	P _{out (1 dB)}	4.8	dBm
Input 3rd Order Distortion Intercept Point	IIP ₃	3.0	dBm

Note A substrate loss 0.1 dB is including in value of NF & G_a

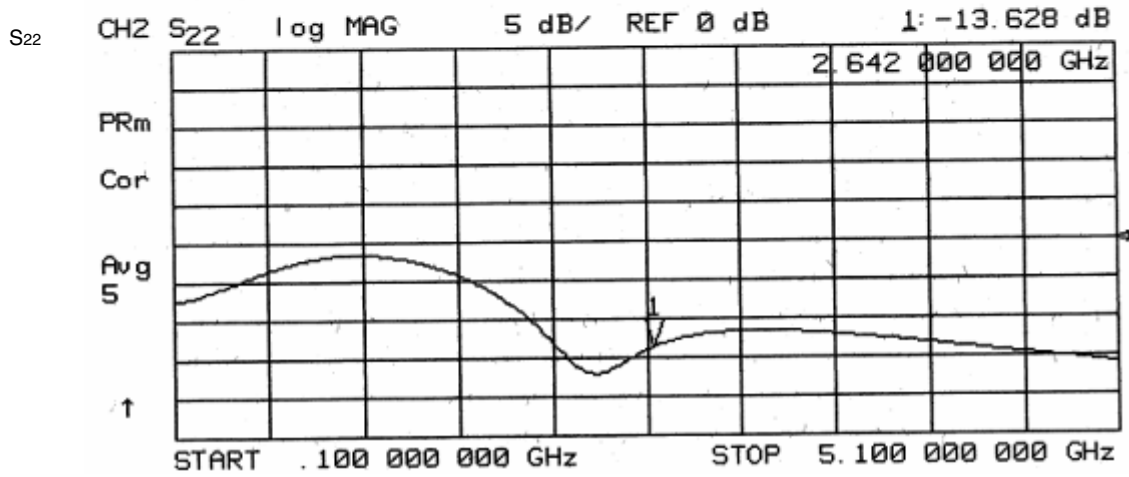
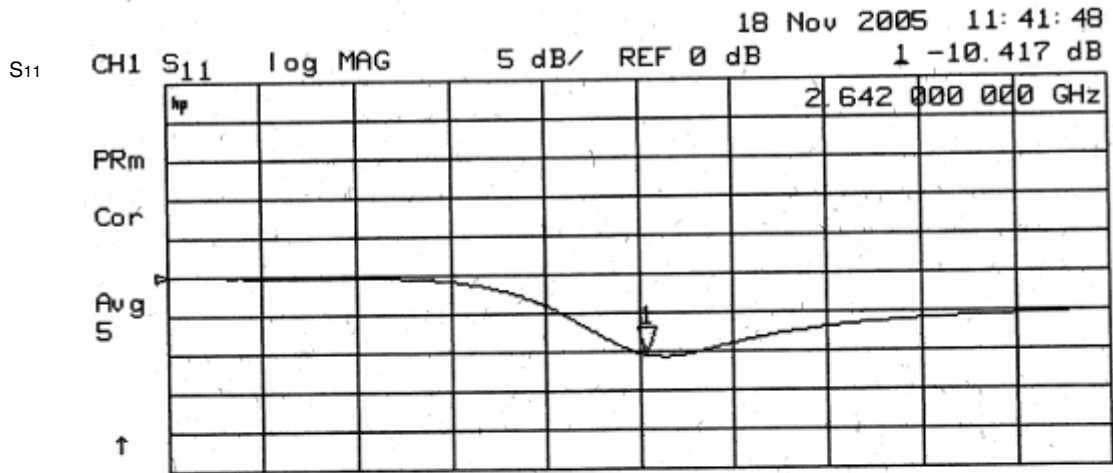
Gain and Isolation

(V_{DD} = 1.8 V, I_D = 10.0 mA, f = 2.642 GHz)



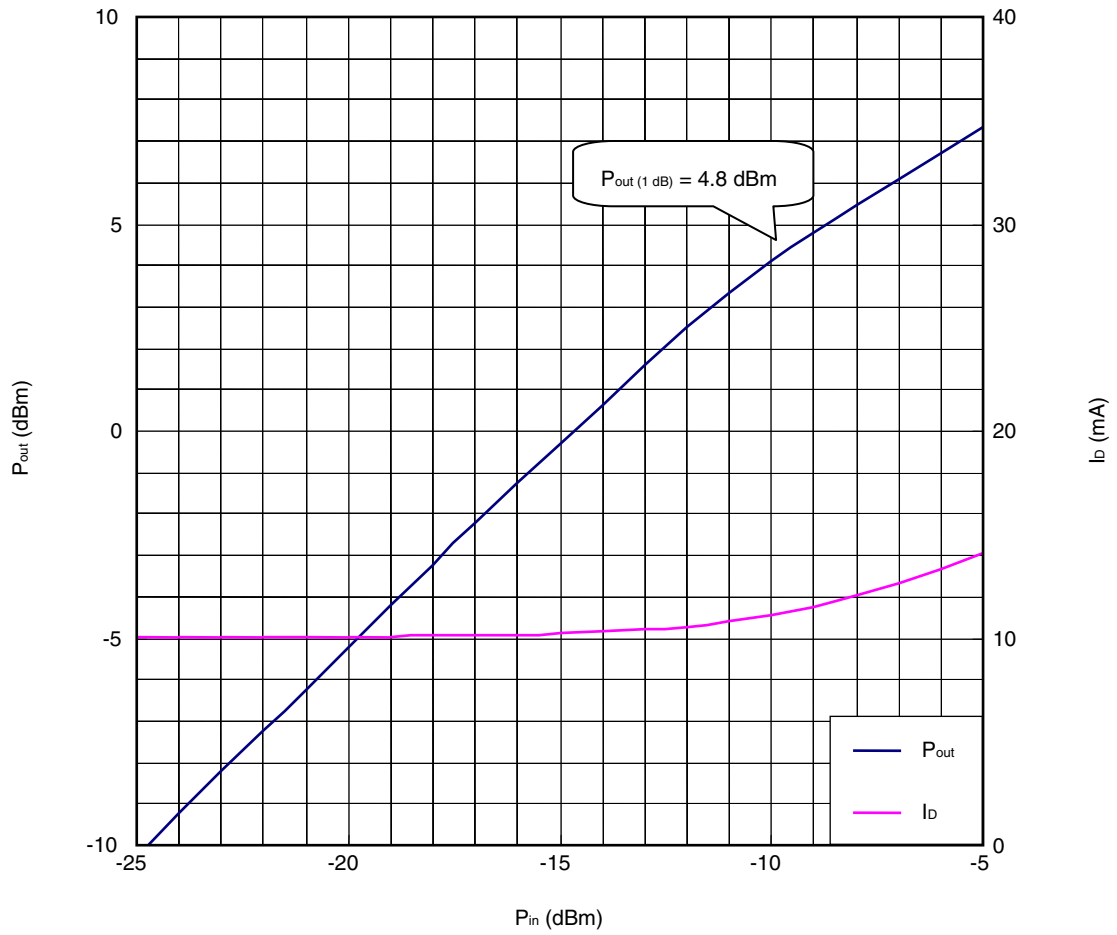
Input and Output Return Loss

($V_{DD} = 1.8\text{ V}$, $I_D = 10.0\text{ mA}$, $f = 2.642\text{ GHz}$)



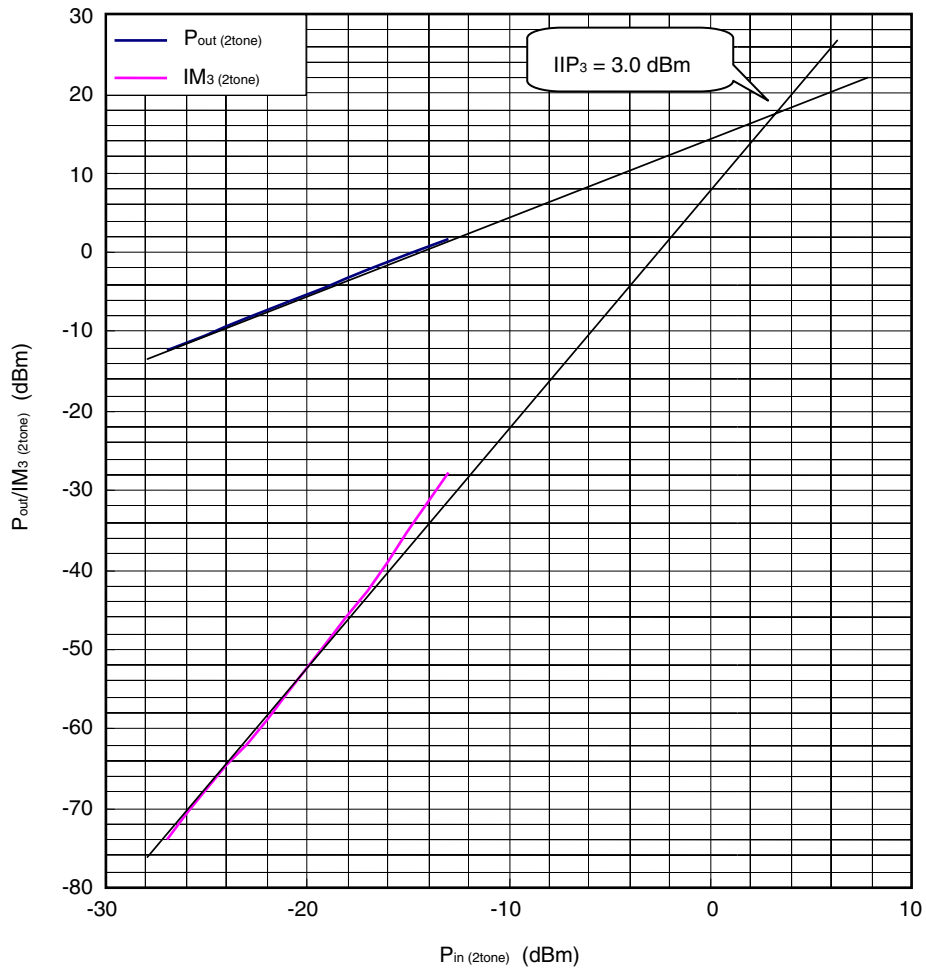
1 dB Gain Compression Output Power

($V_{DD} = 1.8\text{ V}$, $I_D = 10.0\text{ mA}$, $f = 2.642\text{ GHz}$)



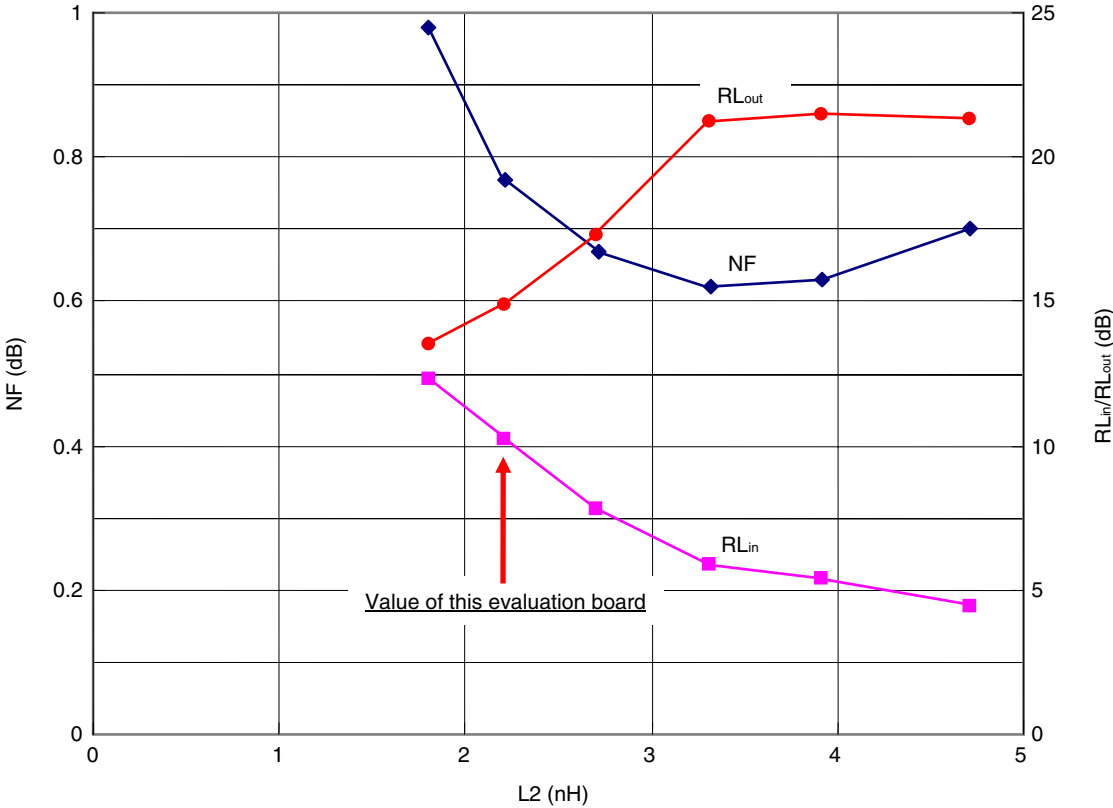
Pin-Pout & IM3 Performance

(V_{DD} = 1.8 V, I_D = 10.0 mA, f = 2.642 GHz, 1 MHz offset)



L2 vs. NF and RLin/RLout

(V_{DD} = 1.8 V, I_D = 10.0 mA, f = 2.642 GHz)



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