To our customers,

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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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RENESAS

Evaluation Board Information

EC-NE3509M04 (Ver2)
1.575 GHz LNA Evaluation Board for GPS Application (NF optimized)

- **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**
- **Stability Factor**

Reference Design Data

- **Frequency Feature of NF**

Document No. PG10585EJ02V0EB (2nd edition)
Date Published November 2008 NS

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M8E 02. 11-1

The mark <R> shows major revised points.
The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

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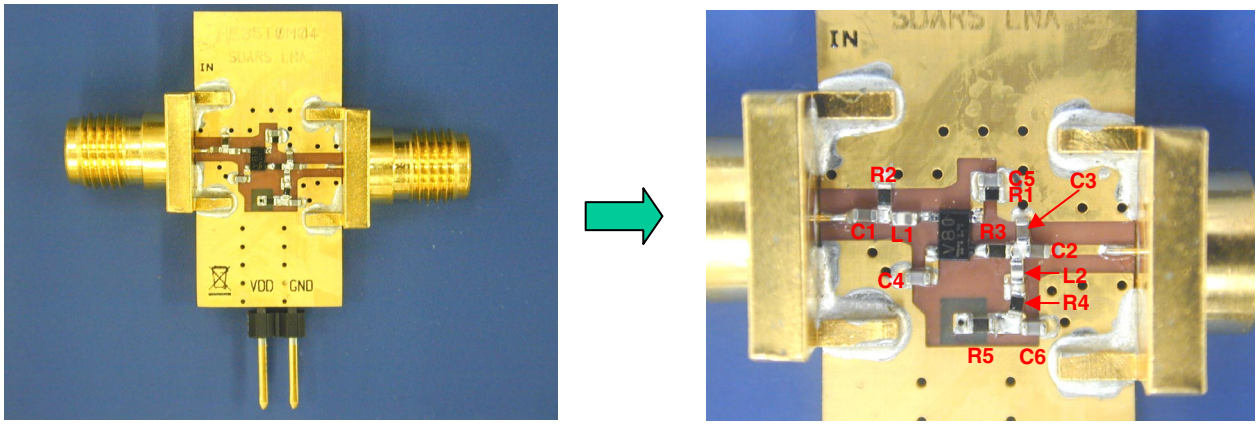
Evaluation Board Pattern Layout

<Top View>



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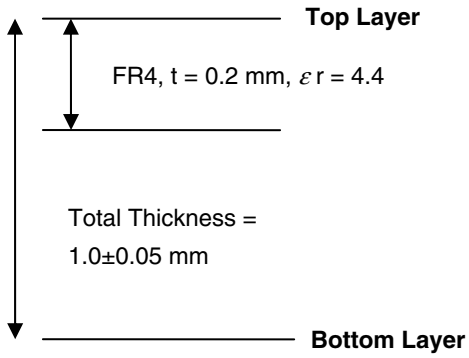

size 12 mm × 24.0 mm

material FR4 (ELC4756/Sumitomo)
t = 0.2 mm, εr = 4.4

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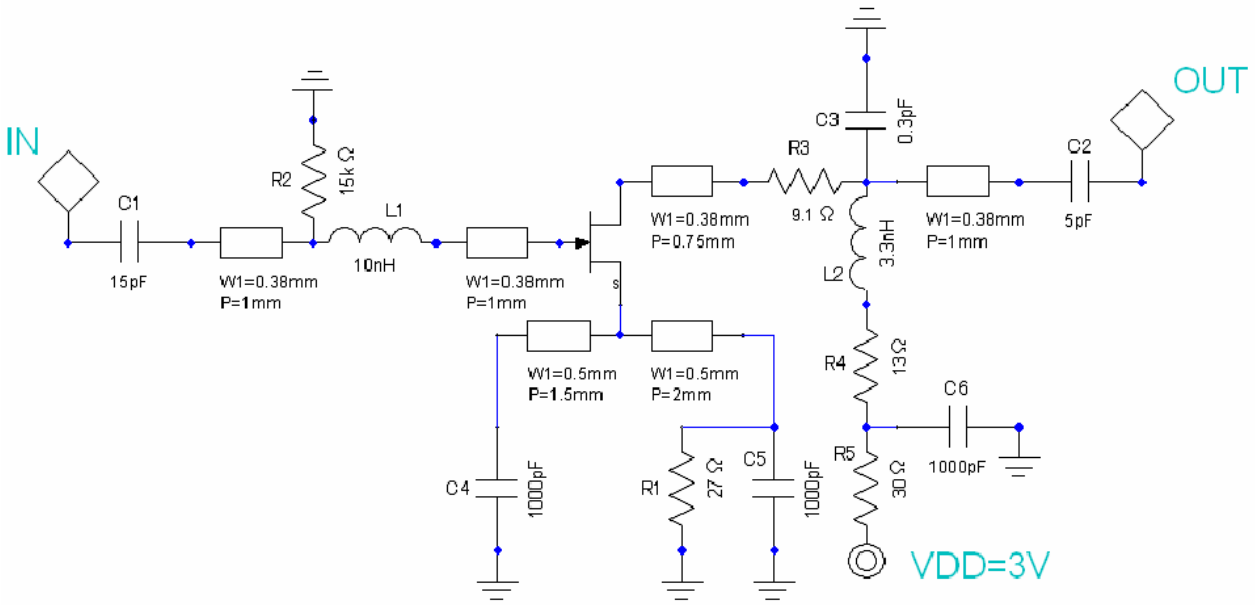
Circuit Description

(V_{DD} = 3.0 V, I_D = 9.3 mA, f = 1.575 GHz (NF optimized))



COMPONENTS OF TEST CIRCUIT

Parts	Part Number	Maker	Symbol	Value	Unit
Chip Capacitor	GRM1552C1H150JZ01	Murata	C1	15	pF
Chip Capacitor	GRM1552C1H5R0DZ01	Murata	C2	5	pF
Chip Capacitor	GRM1554C1HR30CZ01	Murata	C3	0.3	pF
Chip Capacitor	GRM155B11H102KA01	Murata	C4, C5, C6	1 000	pF
Chip Inductor	AML1005H10NJTS	FDK	L1	10	nH
Chip Inductor	AML1005H3N3STS	FDK	L2	3.3	nH
Chip Resistor	MCR01MZPJ270	ROHM	R1	27	Ω
Chip Resistor	MCR01MZPJ153	ROHM	R2	15	kΩ
Chip Resistor	MCR01MZPJ9R1	ROHM	R3	9.1	Ω
Chip Resistor	MCR01MZPJ130	ROHM	R4	13	Ω
Chip Resistor	MCR01MZPJ300	ROHM	R5	30	Ω
Transistor	NE3509M04	NEC	TR		
DC Connector	A2-2PA-2.54DSA (71)	Hirose			
RF Connector	01K2266-00	WAKA			
Substrate	FR4 (t = 0.2 mm)	Sumitomo			

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Evaluation Board Test Results

(V_{DD} = 3.0 V, I_D = 9.3 mA, f = 1.575 GHz)

Item	Symbol	Data	Unit
Noise Figure	NF Note	0.65	dB
Associated Gain	G_a	16.5	dB
Input Return Loss	RL_{in}	9.2	dB
Output Return Loss	RL_{out}	16.6	dB
Output Power at 1 dB Compression Point	$P_{O\ (1\ dB)}$	6.8	dBm

Note The loss of the substrate is included in the value of NF.

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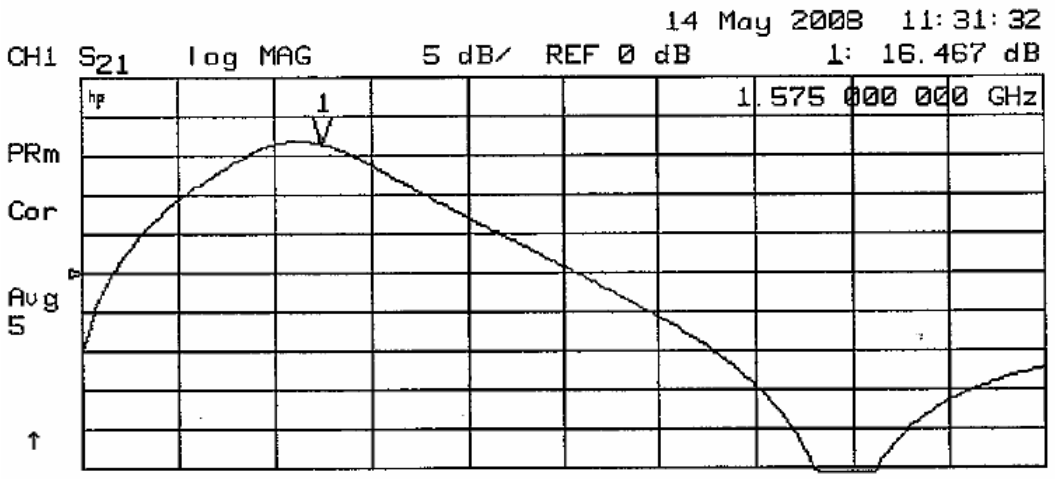
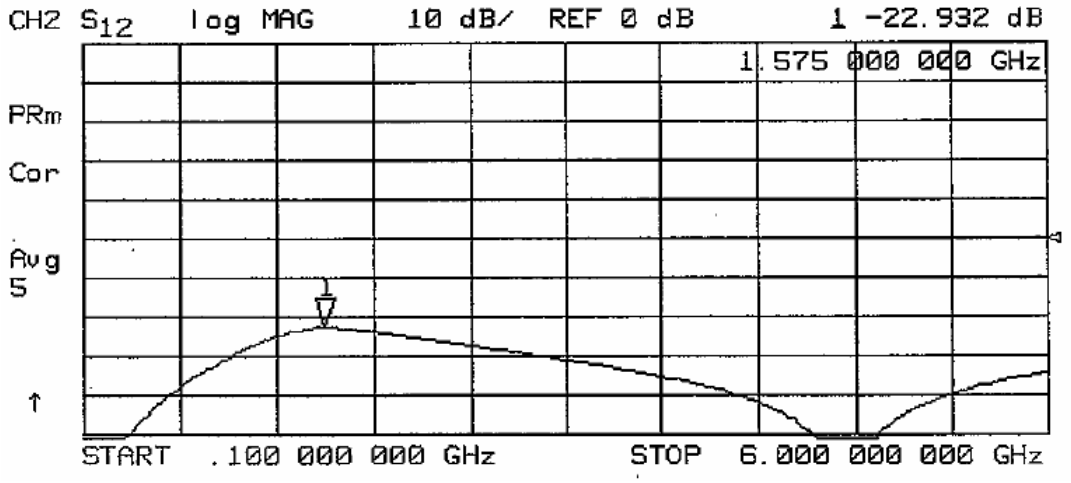
Gain and Isolation

(V_{DD} = 3.0 V, I_D = 9.3 mA, f = 1.575 GHz)

S_{21}



S_{12}



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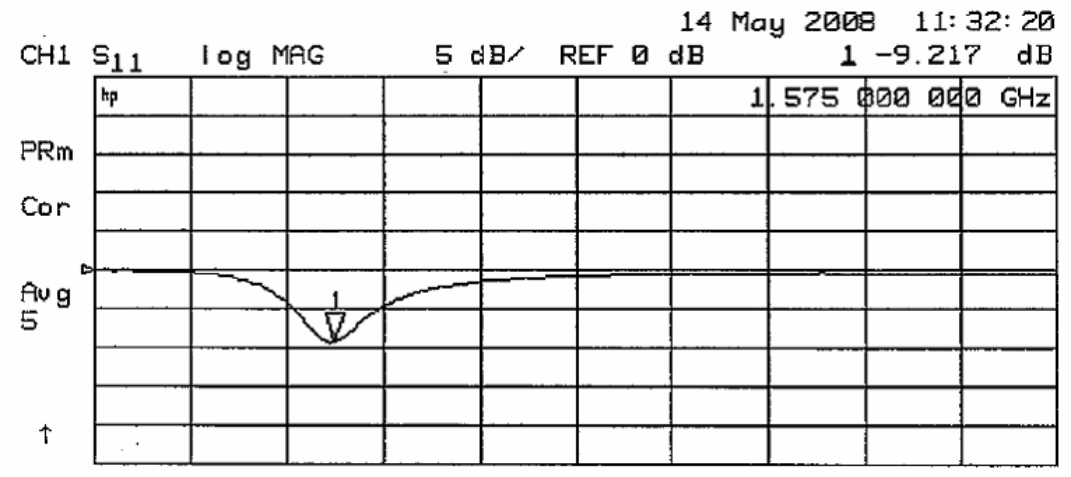
Input and Output Return Loss

(V_{DD} = 3.0 V, I_D = 9.3 mA, f = 1.575 GHz)

S_{11}



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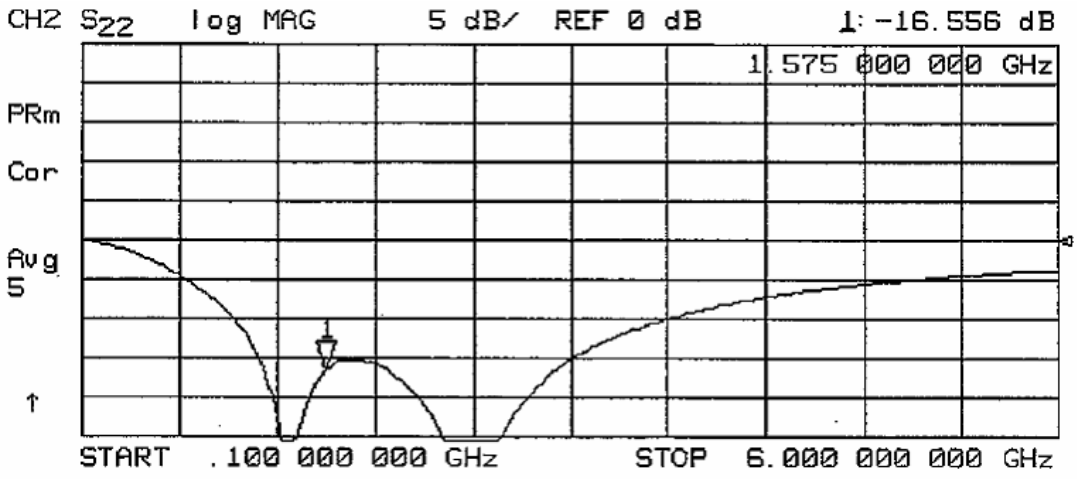
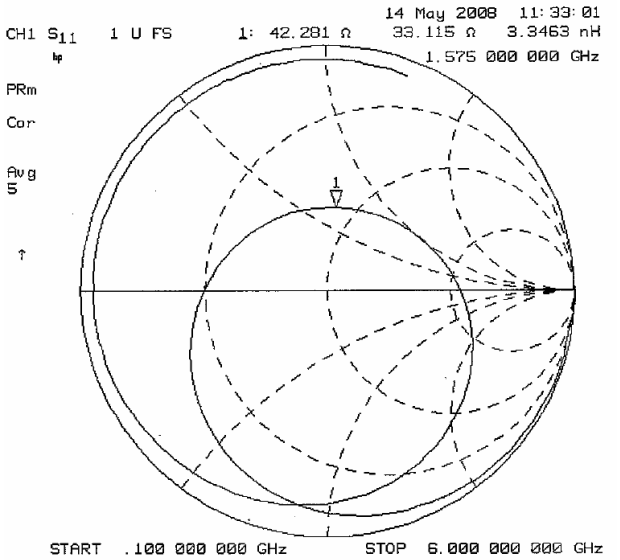


S_{11}



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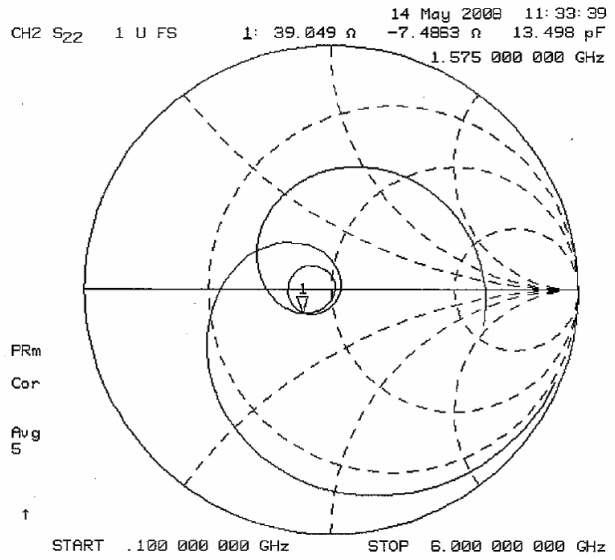

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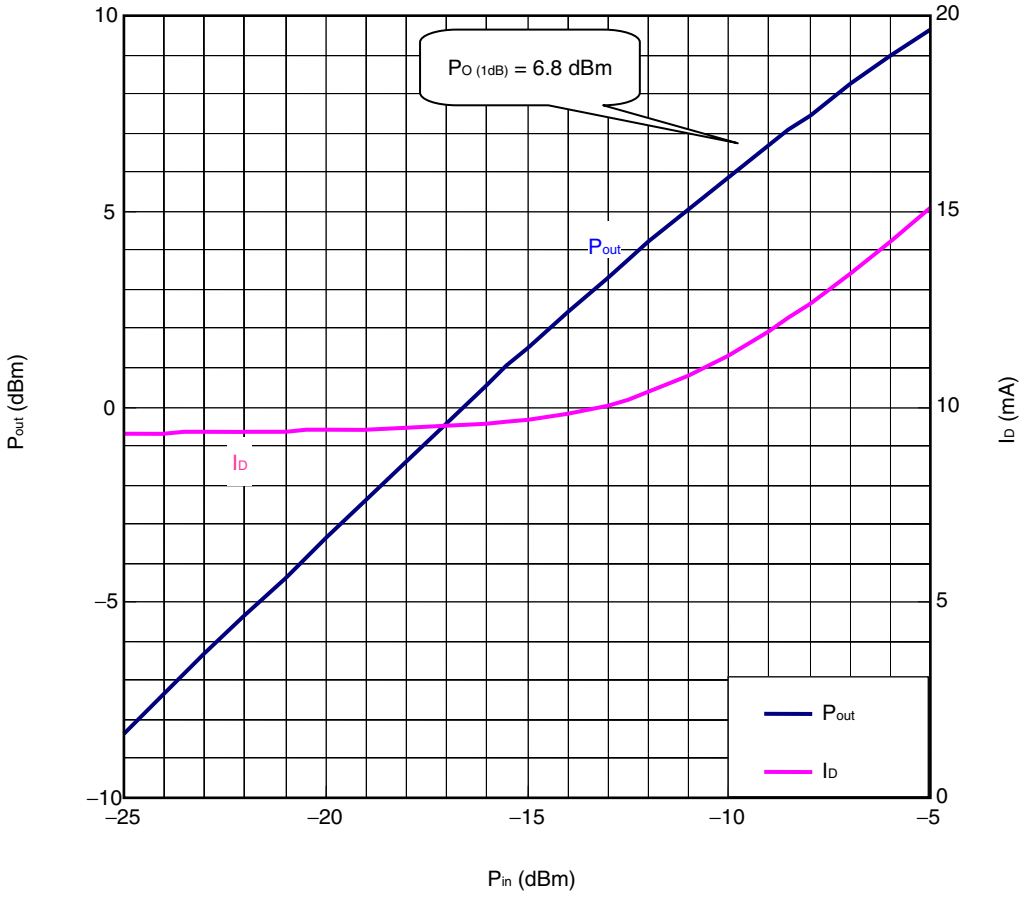
1 dB Gain Compression Output Power

(V_{DD} = 3.0 V, I_D = 9.3 mA, f = 1.575 GHz)



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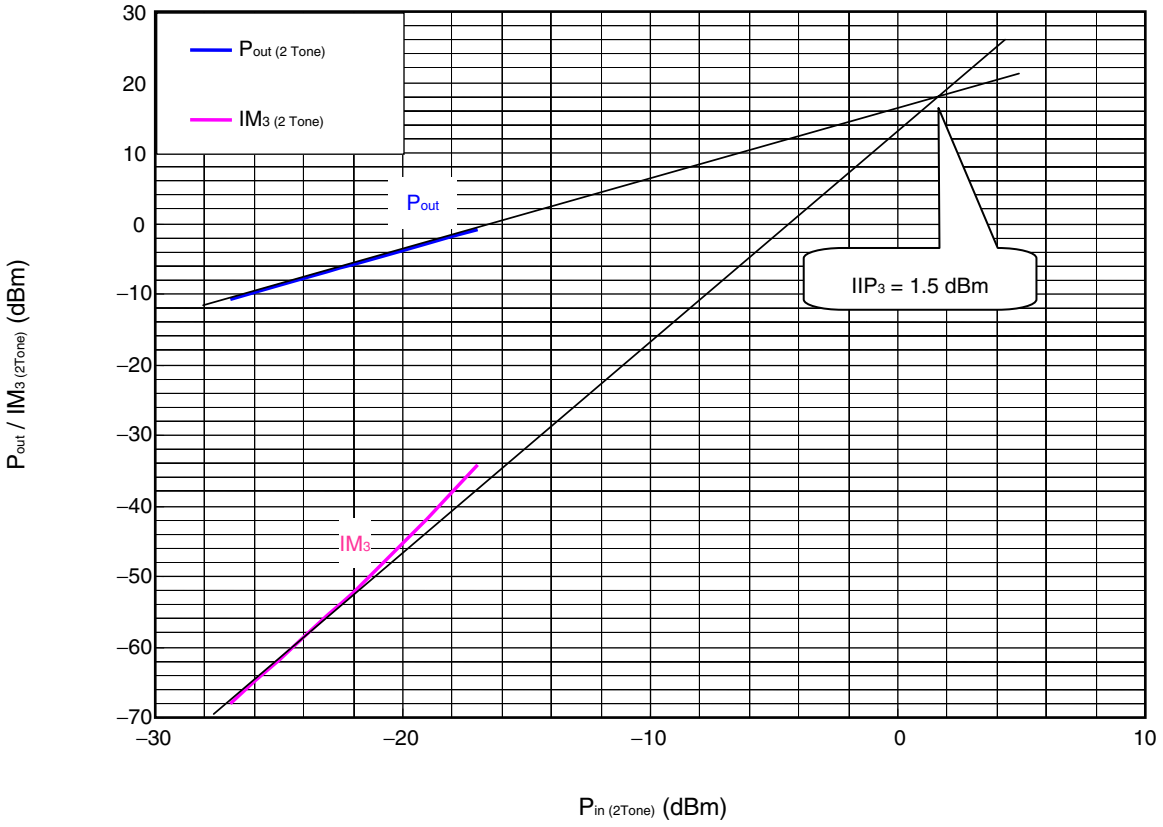
P_{in}-P_{out} & IM_3 Performance

(V_{DD} = 3.0 V, I_D = 9.3 mA, f = 1.575 GHz, 1 MHz offset)



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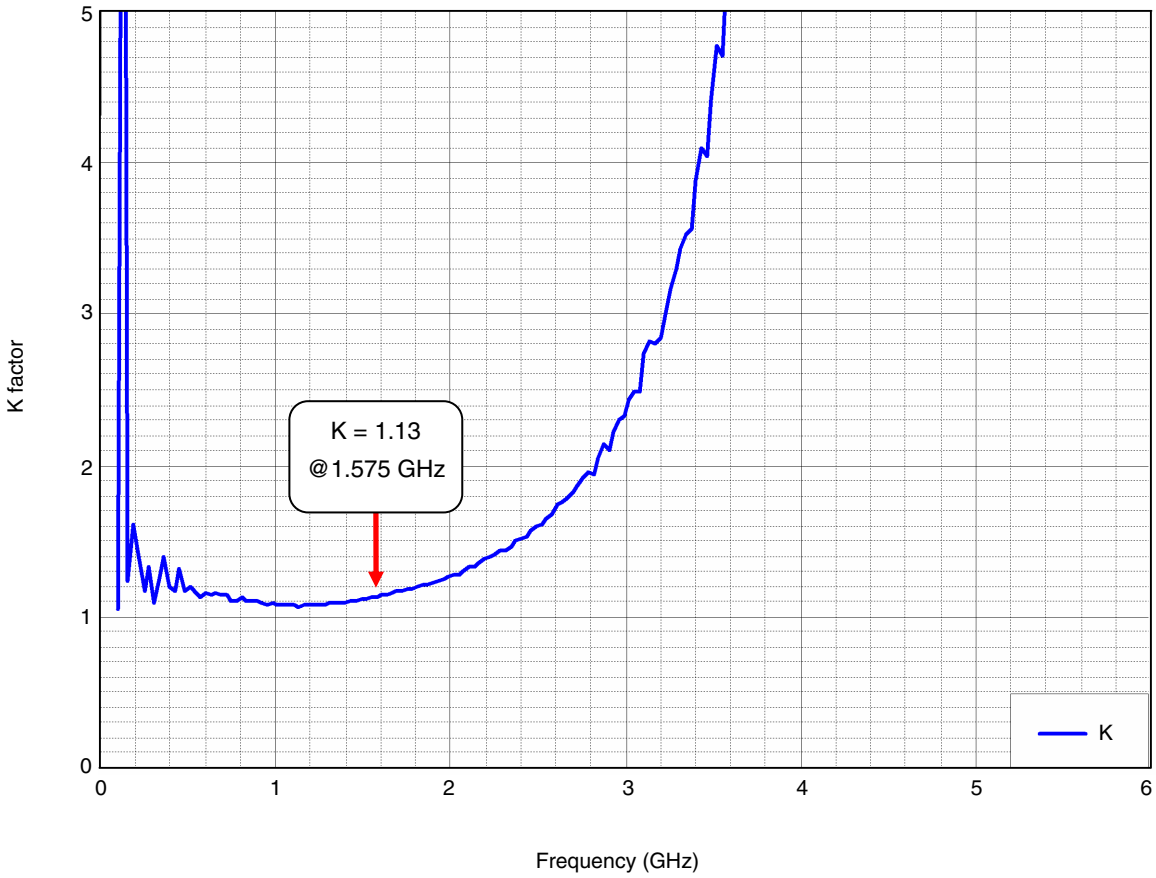
Stability Factor

K factor

(V_{DD} = 3.0 V, I_D = 9.3 mA)



Reference Design Data

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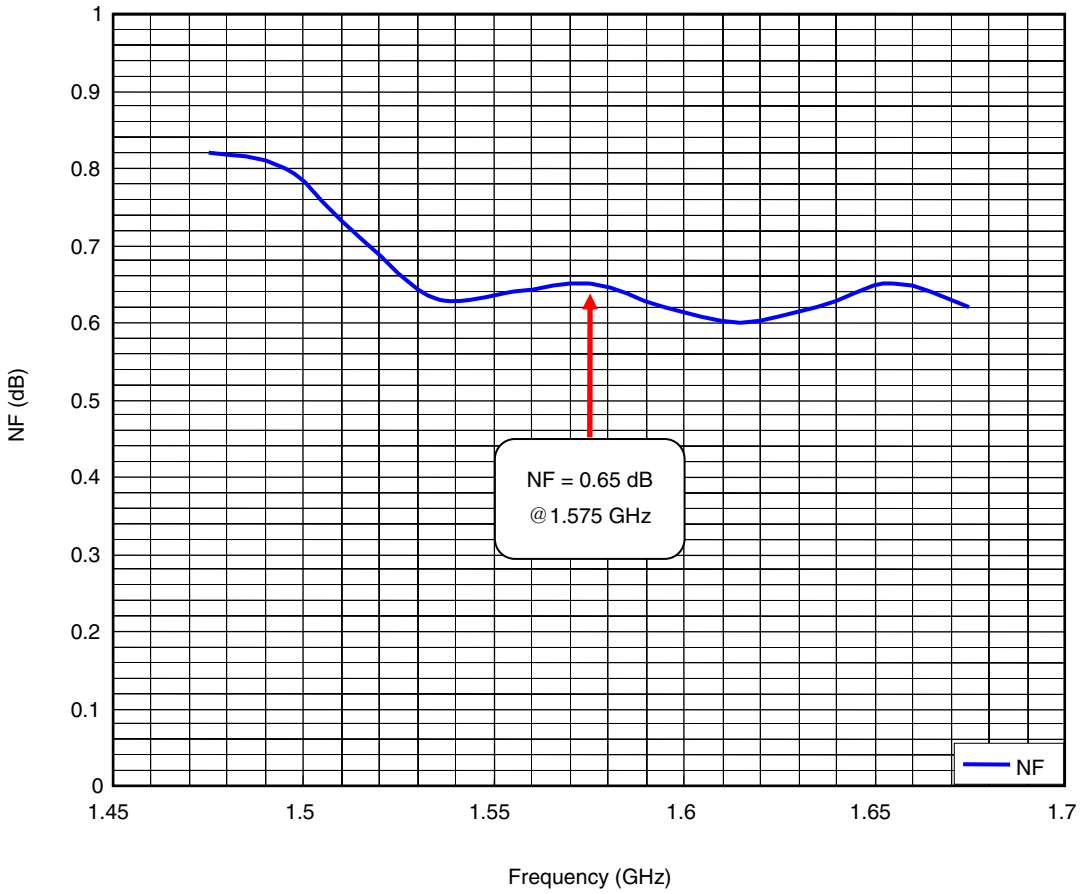
Frequency Feature of NF

(V_{DD} = 3.0 V, I_D = 9.3 mA)



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