BGA700L16

Dual-Band WLAN LNA

Small Signal Discretes

Never stop thinking

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BGA700L16, Dual-Band WLAN LNA

Revision History: 2007-03-19, Rev. 1.3

Prevision History: 2006-06-02, Rev. 1.2

Page	Subjects (major changes since last revision)
All	New datasheet design

1 Silicon Germanium Dual Band Low Noise Amplifier

Features
- B7HF silicon germanium bare die technology
- High Gain
- High Linearity
- Low noise figure
- Internal input- and output matching
- AC coupled RF input- and output ports
- Bandgap stabilized internal biasing circuit
- Digital On/Off switch
- Minimum external component required (two 1µF capacitors)
- Tiny TSLP-16-1 leadless package

Applications
- Low noise amplifier for WLAN application

2 Description

The BGA700L16 is a dual-band 2.4-2.5 GHz and 4.9-5.95 GHz Silicon Germanium low noise amplifier MMIC in tiny PG-TSLP-16-1-package.

The LNA is based upon Infineon Technologies cost effective B7HF Silicon Germanium technology.

The LNA delivers high gain of 21dB in the upper band while giving an excellent noise figure of 1.3 dB. The supply current of 19mA is chosen to maintain a high IP1dB compression point of -10dBm.

The lower band shows moderate gain of 15dB and very good noise figure of 0.9 dB, while providing outstanding out of band selection. Input- and output matching is done by internal matching circuit in combination with the bonding wire inductances. No external matching components are needed and all RF ports are AC coupled

The bandgap stabilized internal biasing circuit provides stable current conditions over temperature range.

The application circuits requires only two external 1µF blocking capacitors.

Type	Package	Marking	Chip
BGA700L16	PG-TSLP-16-1	BGA700	T1515

Note: ***ESD:*** *Electrostatic discharge sensitive device, observe handling precaution*

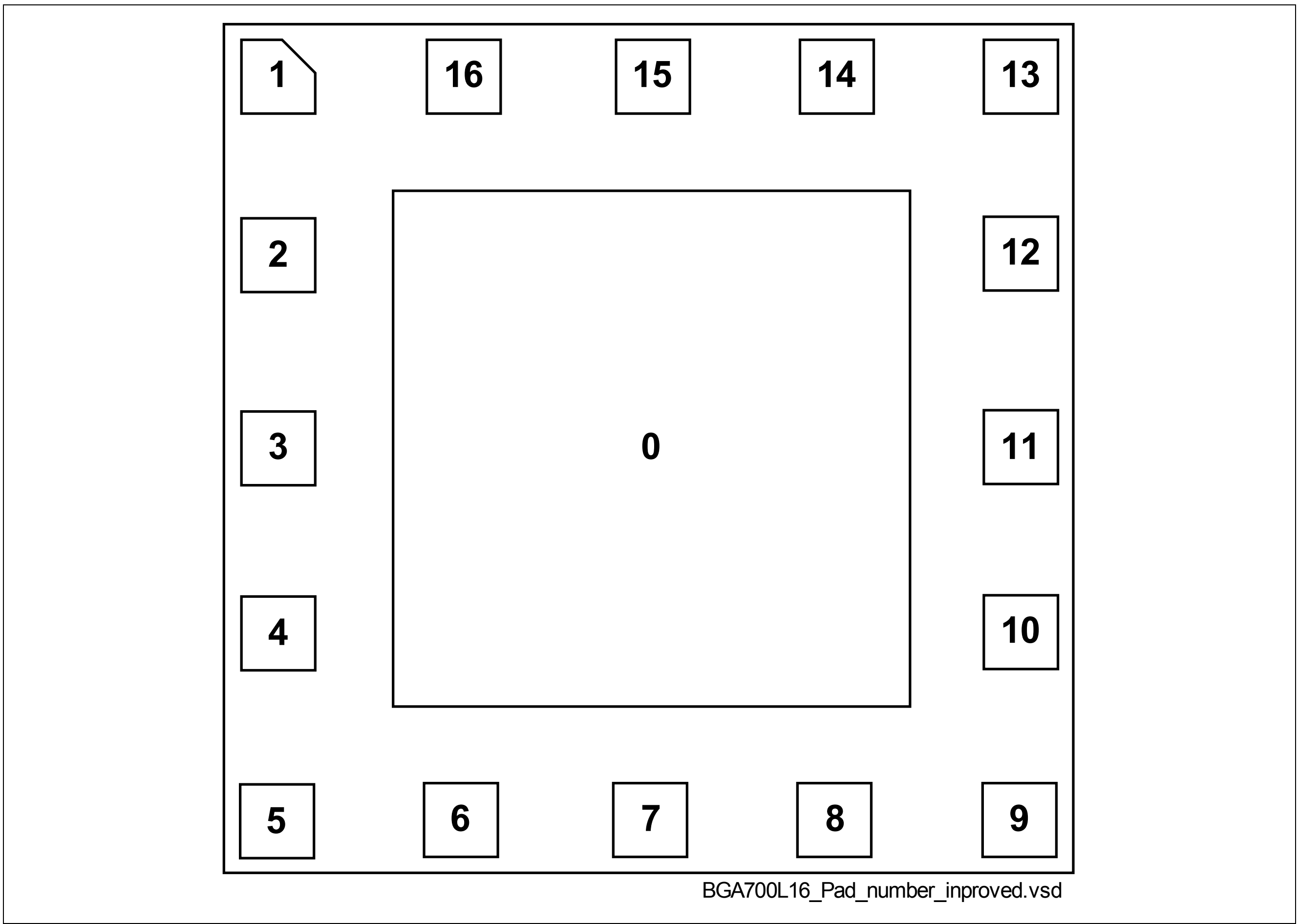


Figure 1 Bonding pad numbers (top view on package)

Pin Definition

Table 1 Pin definition and function

Bonding Pad Number	Pin Symbol	Function
0	GND, RF_GND_52 and RF_GND_24	Emitter ground for upper and lower band RF stage and ground bias
2	RF_OUT_52	Upper band RF output
4	RF_OUT_24	Lower band RF output
6	VCC1	Supply voltage for biasing circuit for both band and power supply voltage for the first RF stage in upper band
7	LNA_ON_24	Lower band power on control
9	RF_IN_24	Lower band RF input
13	RF_IN_52	Upper band RF input
15	LNA_ON_52	Upper band power on control
16	VCC2	Power supply voltage for RF output stage in upper band and lower band RF stage

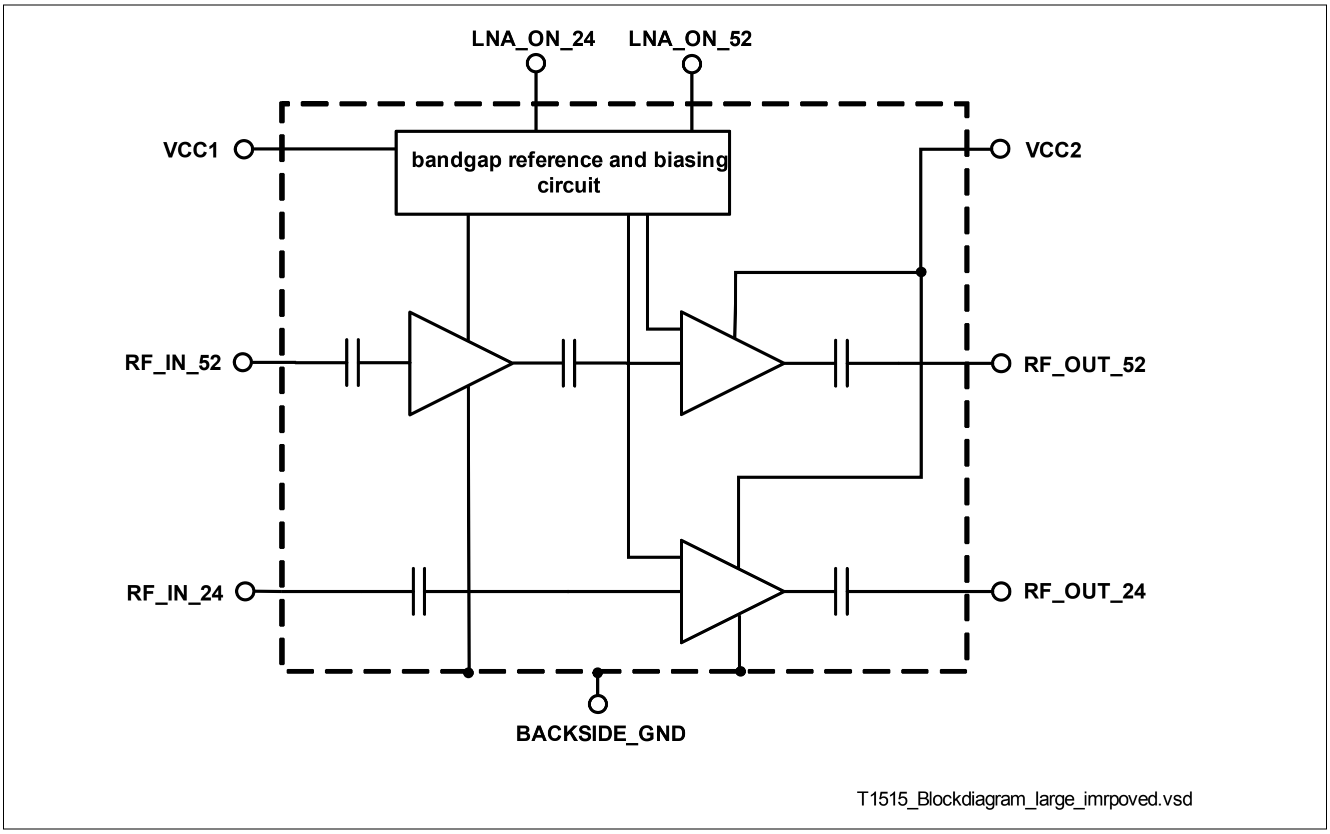


Figure 2 Electrical circuit diagram

Maximum Ratings

Table 2 Maximum ratings

Parameter	Symbol	Limit Value	Unit
Supply voltage	V_{CC1}, V_{CC2}	3.6	V
Supply current	I_{CC}	25	mA
Junction temperature	T_J	150	°C
Ambient temperature range	T_A	-30... 85	°C
Storage temperature range	T_{STG}	-65... 150	°C
ESD capability Human Body Model[1]	$V_{ESD\_HBM\_RF\_IN}$	150	V
ESD capability Human Body Model[2]	V_{ESD_HBM}	1000	V
RF input power	P_{in}	0	dBm
Junction - backside	R_{thJB}	107	K/W

1) ESD HBM-test of RF_IN-pins
2) ESD HBM-test of all other pins

3 Electrical Characteristics

3.1 2.4 GHz Band

Table 3 2.4 GHz Parameter [1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass Band Frequency Range	F_{BW}	2.4		2.5	GHz	
Gain	$\|S_{21}\|$		15		dB	
Gain flatness	ΔG		0.3		dB	In any 50 MHz instantaneous bandwidth
Reverse Isolation	$\|S_{12}\|$		-33		dB	
Noise Figure	NF		0.9		dB	
Input return loss	$\|S_{11}\|$		-12		dB	50 Ohm
Output return loss	$\|S_{22}\|$		-12		dB	50 Ohm
Input power at 1dB compression point	P_{-1dB}		-10		dBm	
Third order intercept point at input	IP_3		2		dBm	
Maximum gain out of band	$\|S_{21}\|$		-6		dB	DC - 1.0 GHz
			3		dB	1 - 1.75 GHz
			8		dB	1.75 - 2 GHz
			15		dB	2.4 - 2.5 GHz
			10		dB	3.2 - 4GHz
			1		dB	4 - 6GHz
Turn-on time	t_{on}		0.2		µs	Measured from LNAON signal turns on (90%) to the point were LNA output power stabilizes to within 0.5 dB of final value
Supply current at V_{CC1}	I_{CC1}	1.2	1.7	2.1	mA	
Supply current at V_{CC2}	I_{CC2}	7	10.5	13	mA	
Supply current	I_{CC}	8.2	12.2	15.1	mA	$I_{CC1} + I_{CC2}$
Shutdown current	I_{off}			6	µA	
Power supply rejection ratio	$PSRR$		40		dB	100 kHz - 4 MHz
Stability factor	k		>1			Unconditional stable for all frequencies

1) **T_A = 25 °C, V_{CC1} = 3.2 V, LNA_ON_24 = 3.2 V, LNA_ON_52 = 0 V, f_{TYP} = 2.45 GHz, unless otherwise specified**

3.2 5-6 GHz Band

Table 4 5-6 GHz Parameter [1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band frequency range	F_{BW}	4.9		5.95	GHz	
Gain	$\|S_{21}\|$		21		dB	
Gain flatness	ΔG		0.3		dB	In any 50 MHz instantaneous bandwidth
Reverse isolation	$\|S_{12}\|$		-38		dB	
Noise figure	NF		1.3		dB	
Input return loss	$\|S_{11}\|$		-9		dB	50 Ohm
Output return loss	$\|S_{22}\|$		-10		dB	50 Ohm
Input power at 1dB compression point	P_{-1dB}		-10		dBm	
Third order intercept point at input	IP_3		1		dBm	
Maximum gain out of band	$\|S_{21}\|$		13		dB	DC - 3.7GHz
			21		dB	4.9 - 5.95 GHz
			13.5		dB	7.5 - 18GHz
Turn-on time	t_{on}		0.2		µs	Measured from LNAON signal turns on (90%) to the point were LNA output power stabilizes to within 0.5 dB of final value
Supply current at V_{CC1}	I_{CC1}	5.5	6.5	9.5	mA	
Supply current at V_{CC2}	I_{CC1}	8.5	11	14.5	mA	
Supply current	I_{CC}	14	19	24	mA	$I_{CC1} + I_{CC2}$
Shutdown current	I_{off}			6	µA	
Power supply rejection ratio	$PSRR$		52		dB	100 kHz - 4 MHz
Stability factor	k		>1			Unconditional stable for all frequencies

1) T_A = 25 °C, V_{CC1} = 3.2 V, LNA_ON_24 = 0 V, LNA_ON_52 = 3.2 V, f_{TYP} = 5.5 GHz, unless otherwise specified

3.3 Digital Signals

Table 5 Digital Control Parameter (LNA_ON_24; LNA_ON_52)

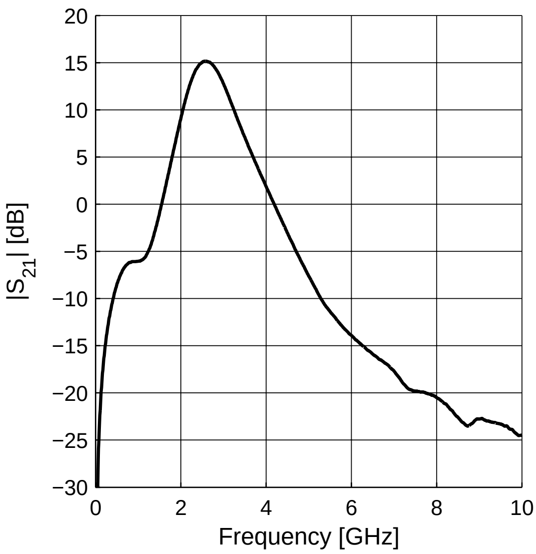
Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Power on control voltage range	U_{Pon}	-0.3		Vcc	V	
Control voltage for power on	U_{On}	2		Vcc	V	
Control voltage for power off	U_{Off}	-0.3		1.1	V	
Capacitance at power on pin	C_{in}		1		pF	
Input current at power on pin	I_{con}		160	300	µA	U_{Pon} = 3.2 V

4 Measured Parameters

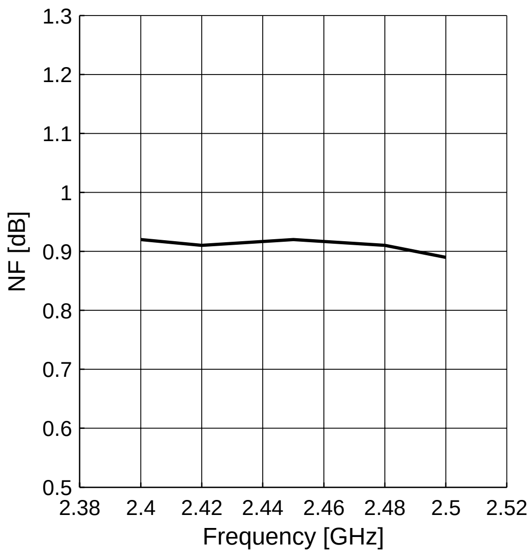
4.1 2.4 GHz Band

T_A= 25 °C, V_{CC1} = V_{CC2} = 3.2 V, LNA_ON_24 = 3.2 V, LNA_ON_52 = 0 V

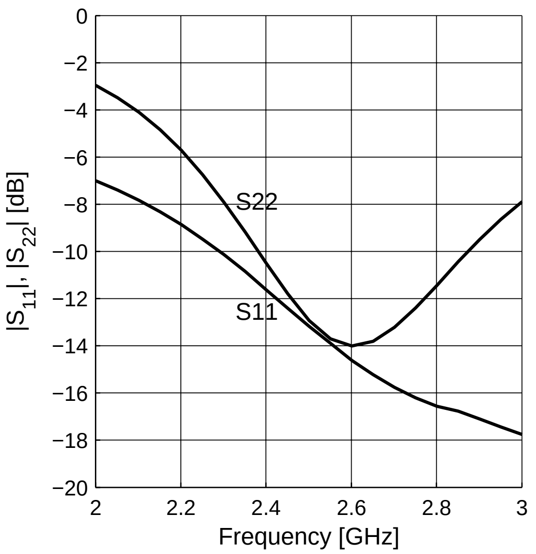
Gain $|S_{21}|$ = f (f)



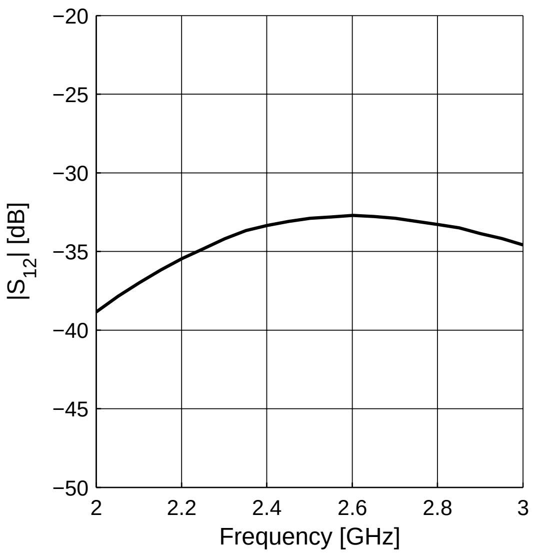
Noise figure NF = f (f)



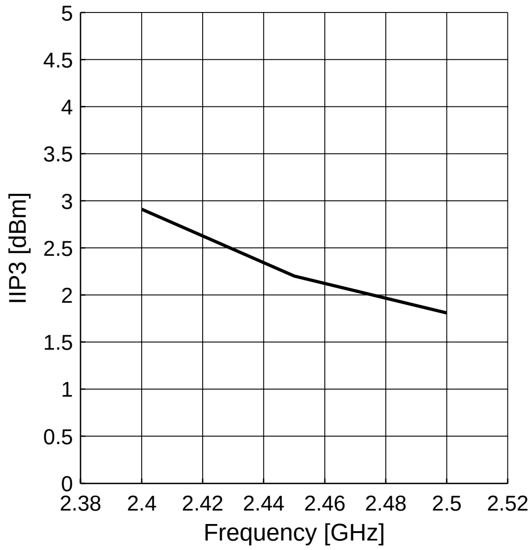
Input- and output return loss $|S_{11}|$ = f (f), $|S_{22}|$ = f (f)



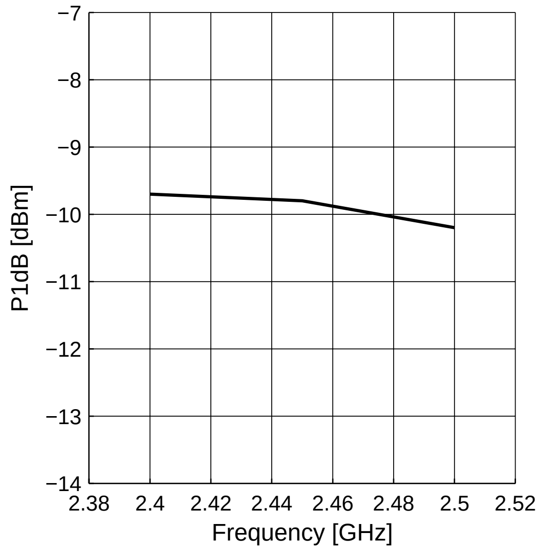
Reverse isolation $|S_{12}|$ = f (f)



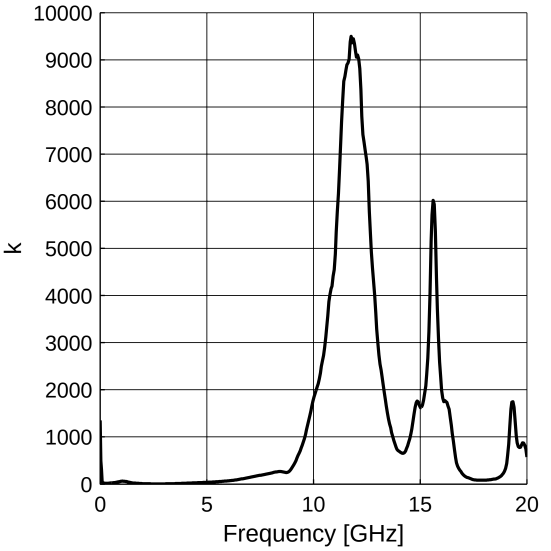
Third order intercept point at input IP_3 = f (f)



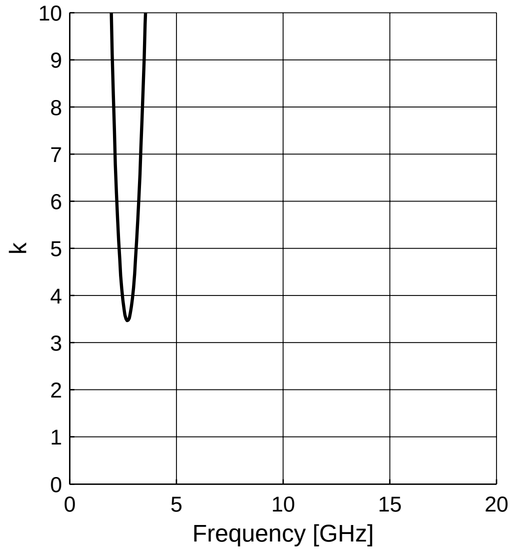
Input power at 1dB compression point P_{-1dB} = f (f)



Stability factor k = f (f)



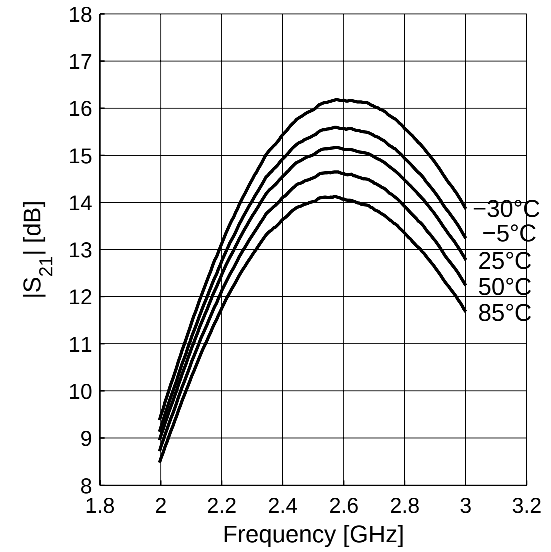
Stability factor k = f (f)



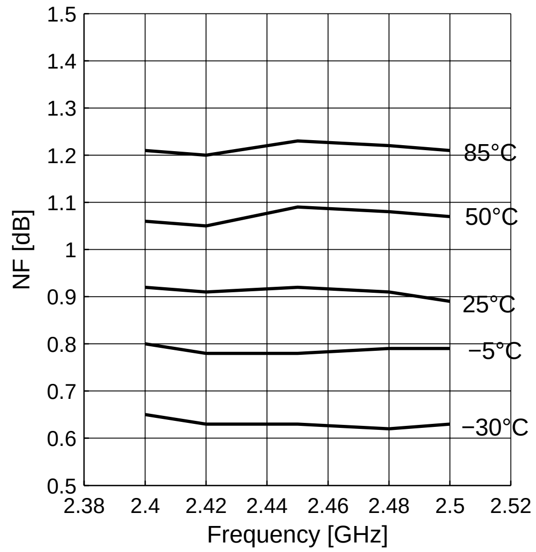
4.2 2.4 GHz Band over temperature

T_A= -30 - 85 °C, V_{CC1} = V_{CC2} = 3.2 V, LNA_ON_24 = 3.2 V, LNA_ON_52 = 0 V

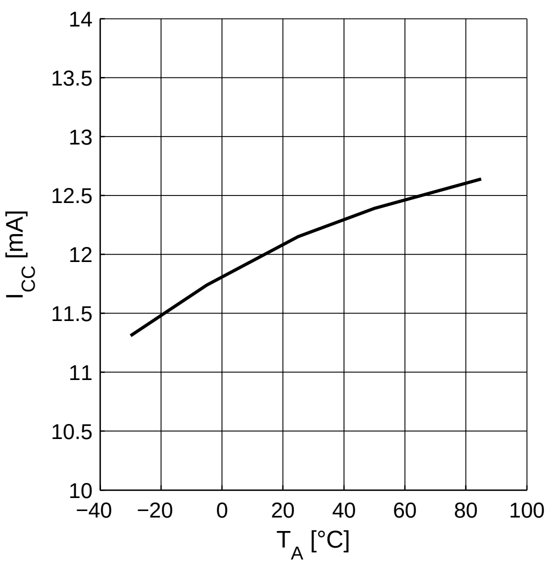
Gain $|S_{21}| = f(f)$



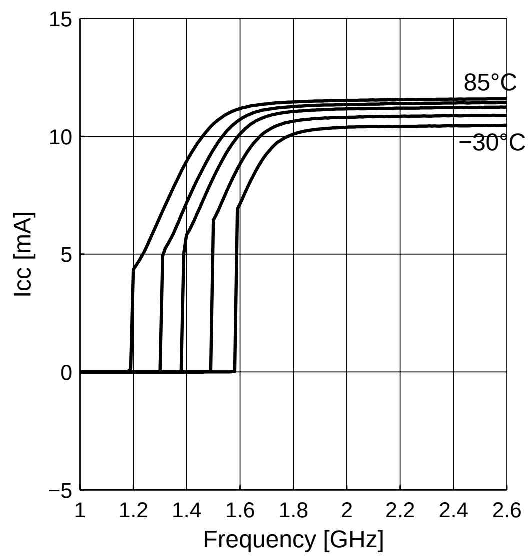
Noise figure $NF = f(f)$



Supply current $I_{CC} = f(T_A)$



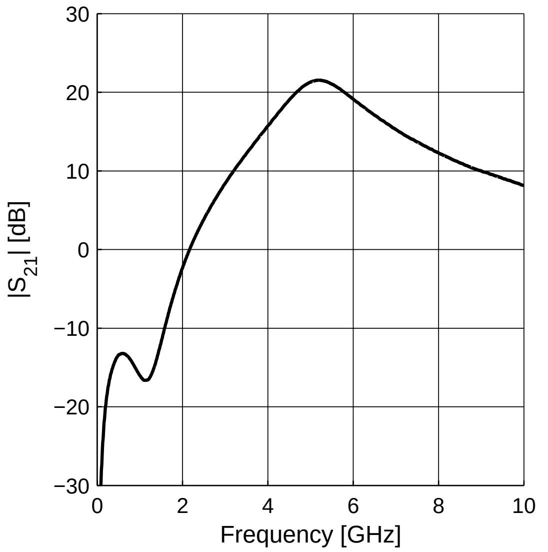
Supply current $I_{CC} = f(U_{Pon})$



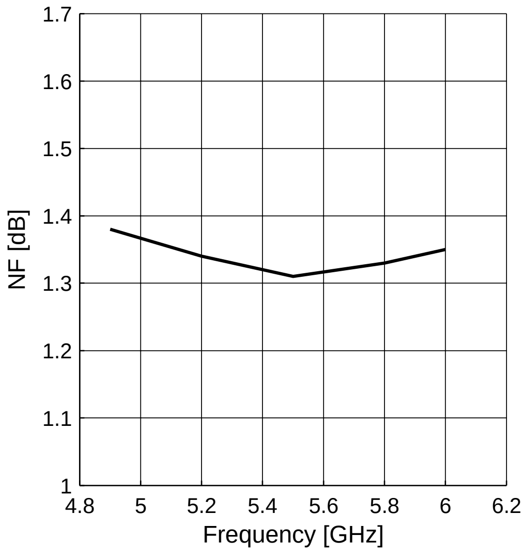
4.3 5-6 GHz Band

T_A= 25 °C, V_{CC1} = V_{CC2} = 3.2 V, LNA_ON_24 = 0 V, LNA_ON_52 = 3.2 V

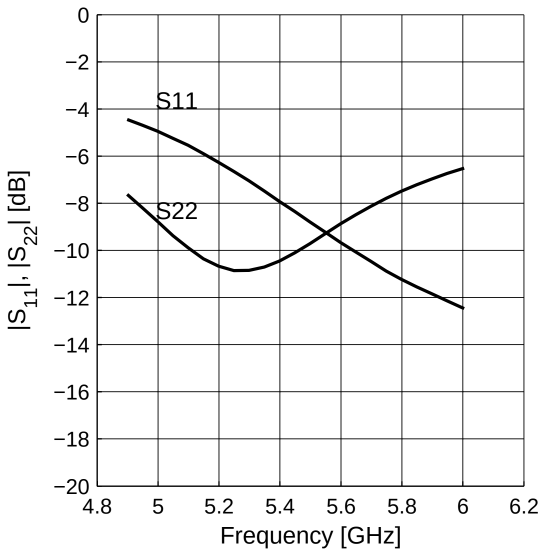
Gain $|S_{21}|$ = f (f)



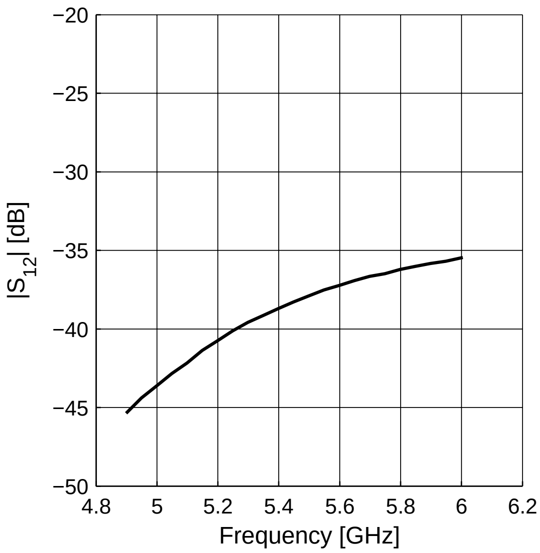
Noise figure NF = f (f)



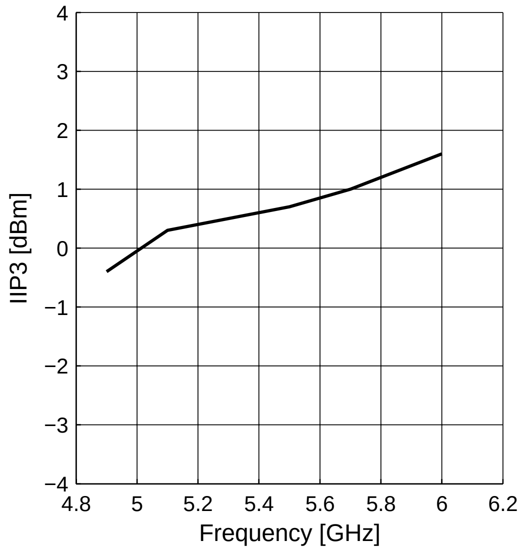
Input- and output return loss $|S_{11}|$ = f (f), $|S_{22}|$ = f (f)



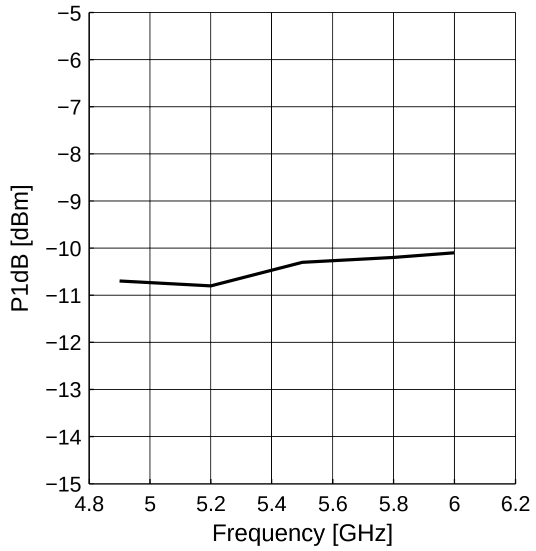
Reverse isolation $|S_{12}|$ = f (f)



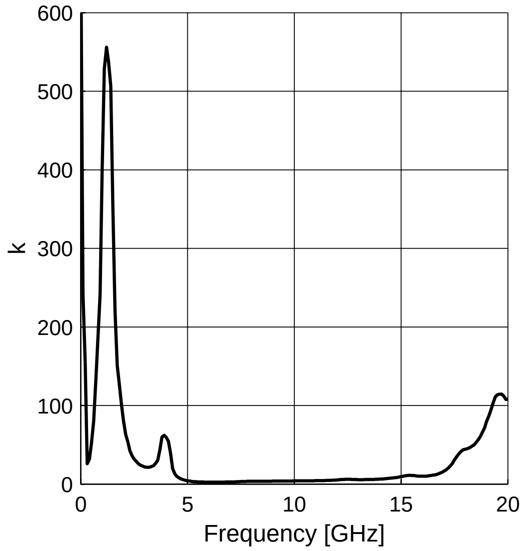
Third order intercept point at input IP_3 = f (f)



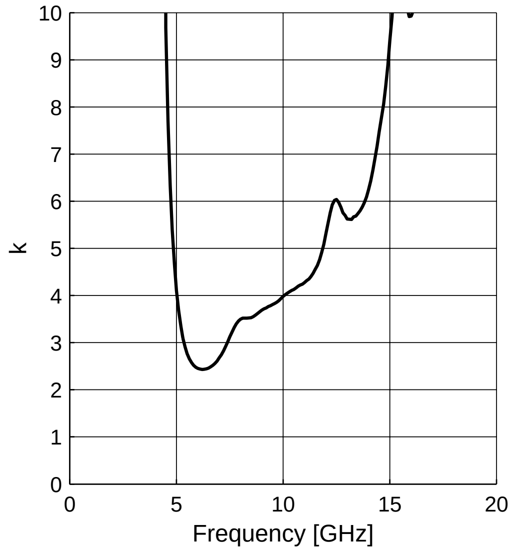
Input power at 1dB compression point P_{-1dB} = f (f)



Stability factor k = f (f)



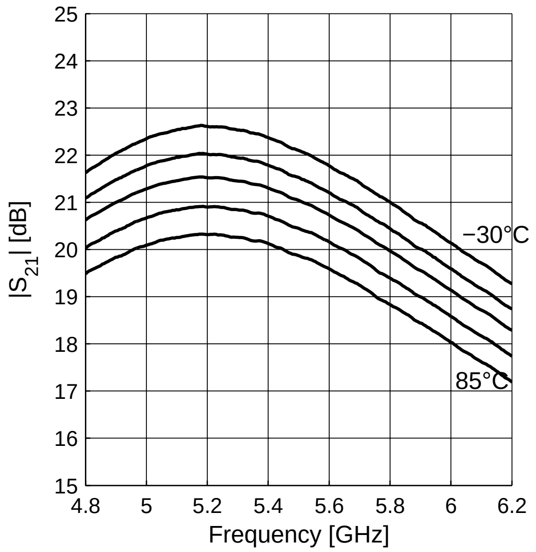
Stability factor k = f (f)



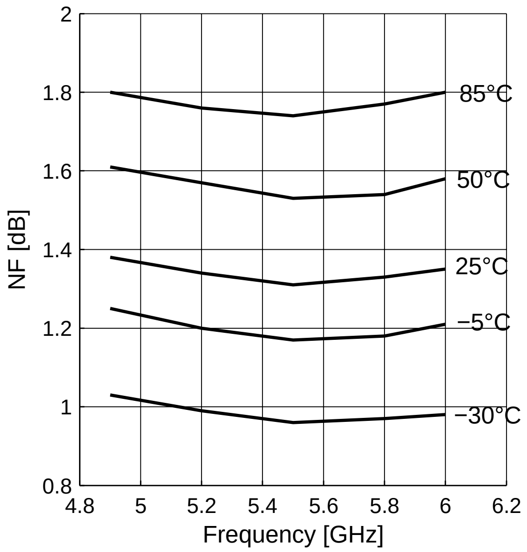
4.4 5 - 6 GHz Band over temperature

T_A= -30 - 85 °C, V_{CC1} = V_{CC2} = 3.2 V, LNA_ON_24 = 0 V, LNA_ON_52 = 3.2 V

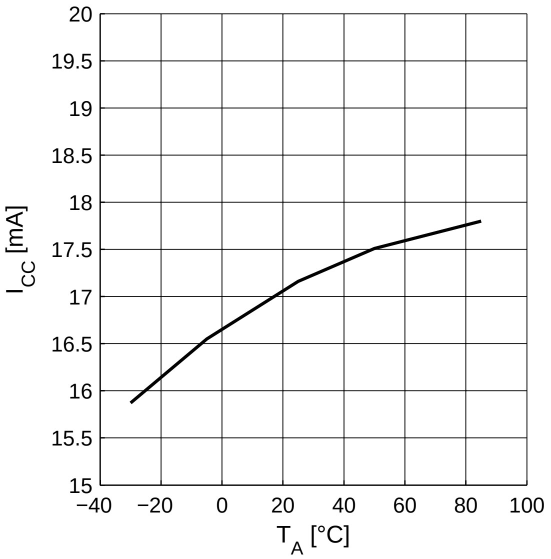
Gain $|S_{21}|$ = f (f)



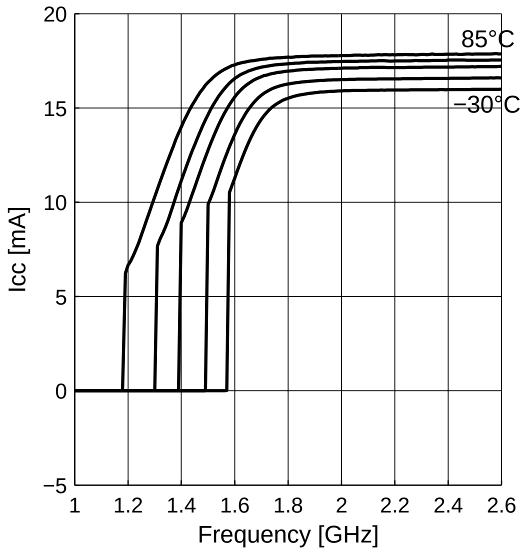
Noise figure NF = f (f)



Supply current I_{CC} = f (T_A)



Supply current I_{CC} = f (U_{Pon})



5 Pinout and Application Board

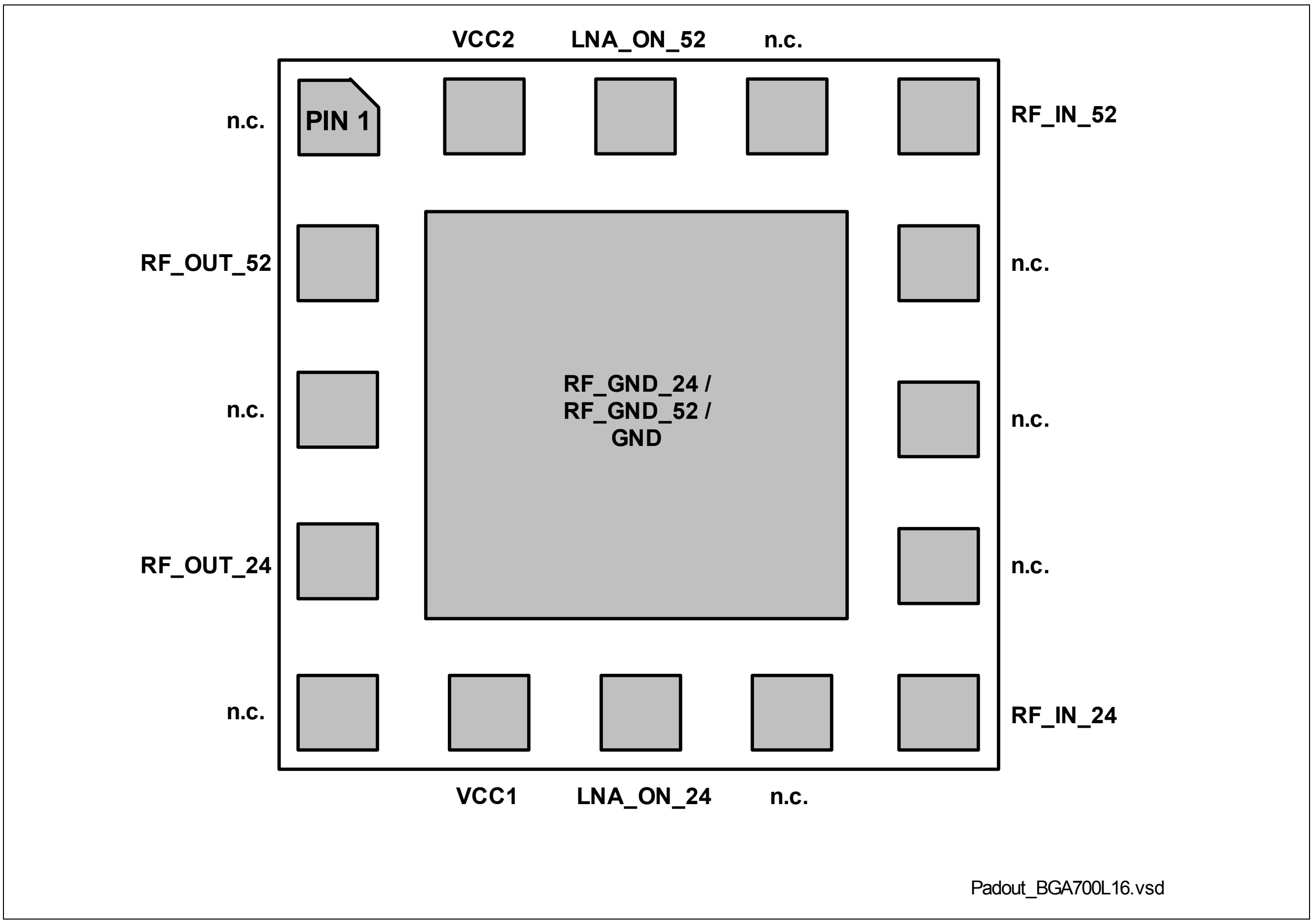


Figure 3 Pinout Dual-Band WLAN LNA (Top View)

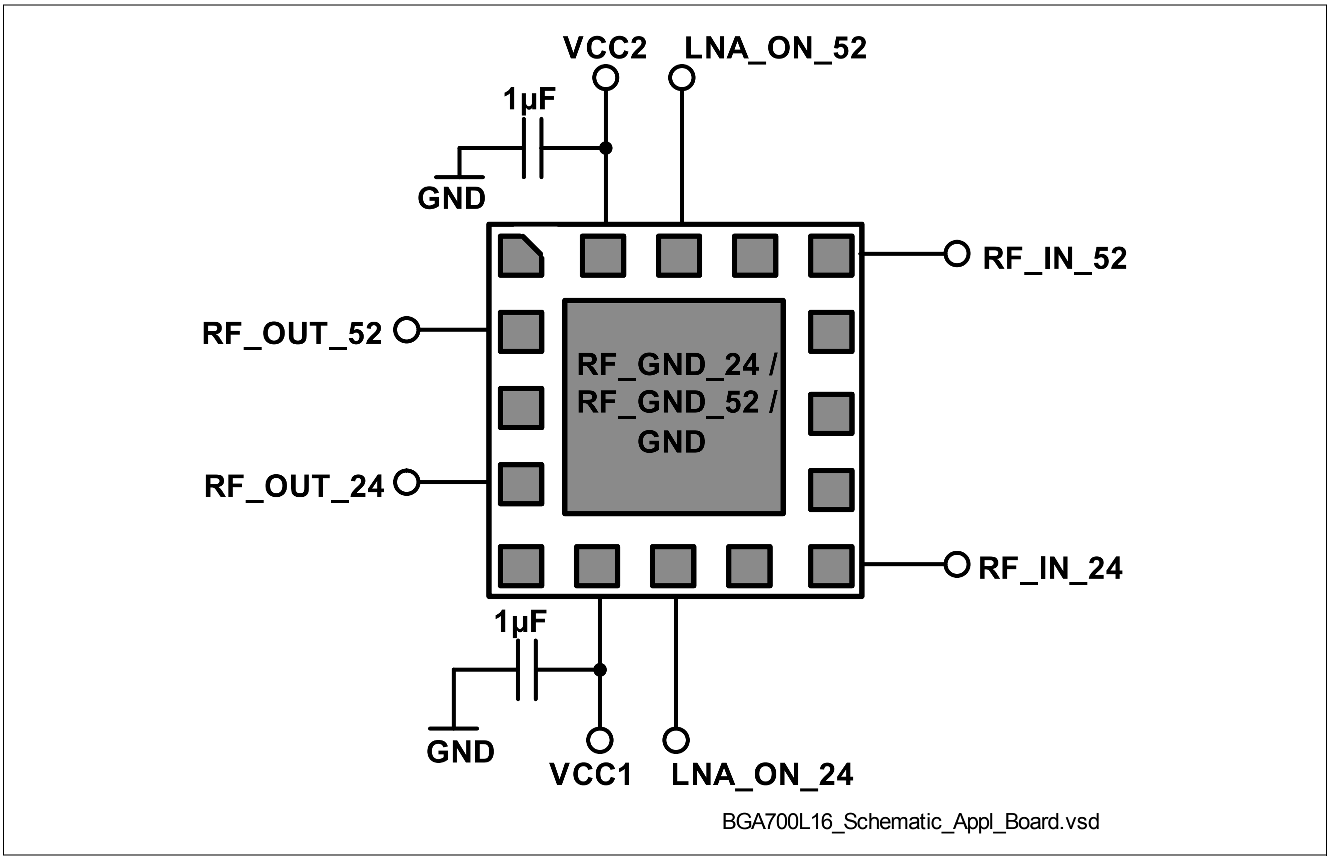


Figure 4 Schematic Application Board (Top View)

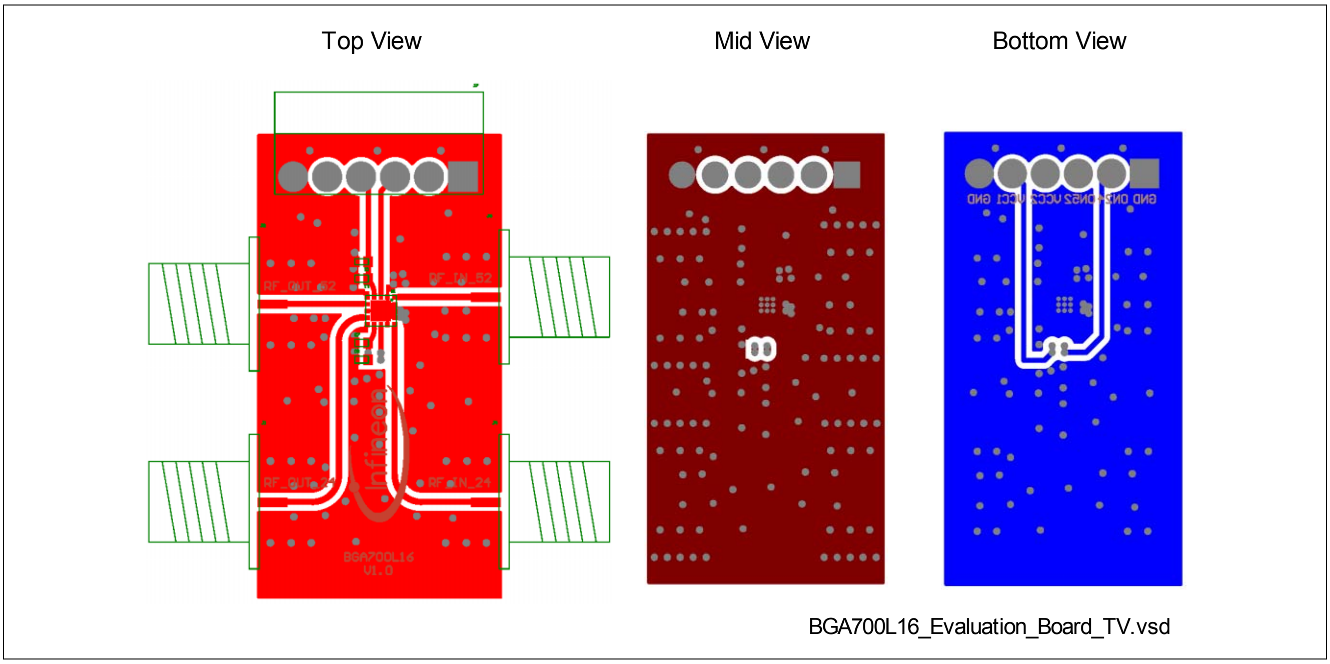


Figure 5 Top View on Evaluation Board (Dimension 37mm x 18.5mm)

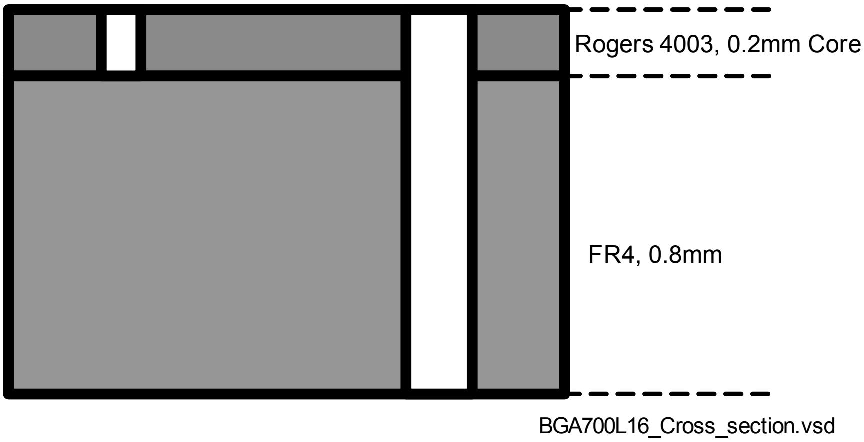


Figure 6 Cross section of Evaluation Board

6 Package Information

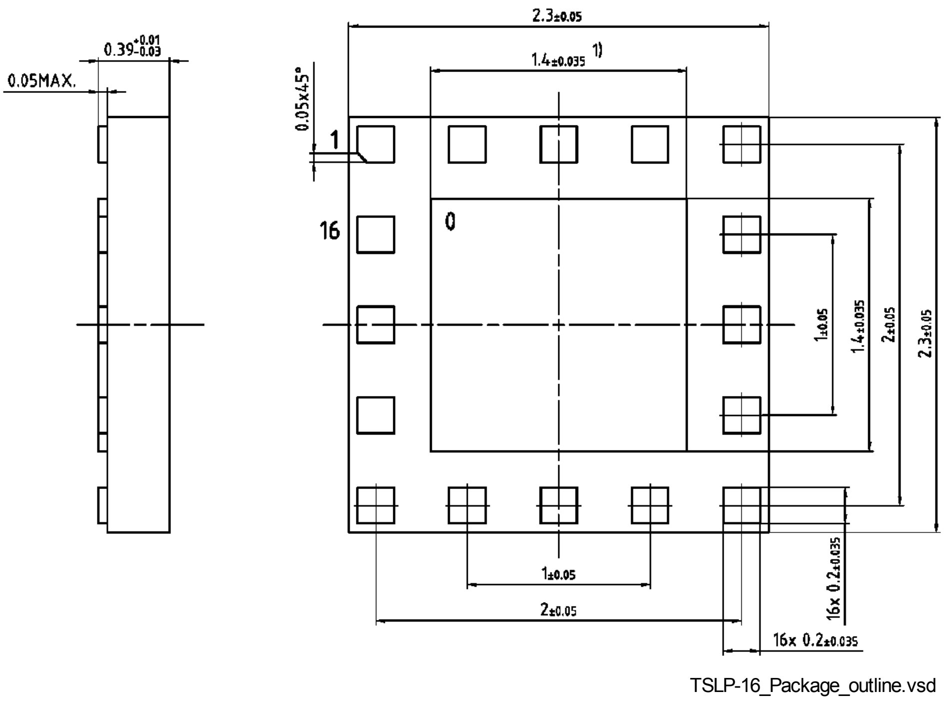


Figure 7 Package Outline PG-TSLP-16-1

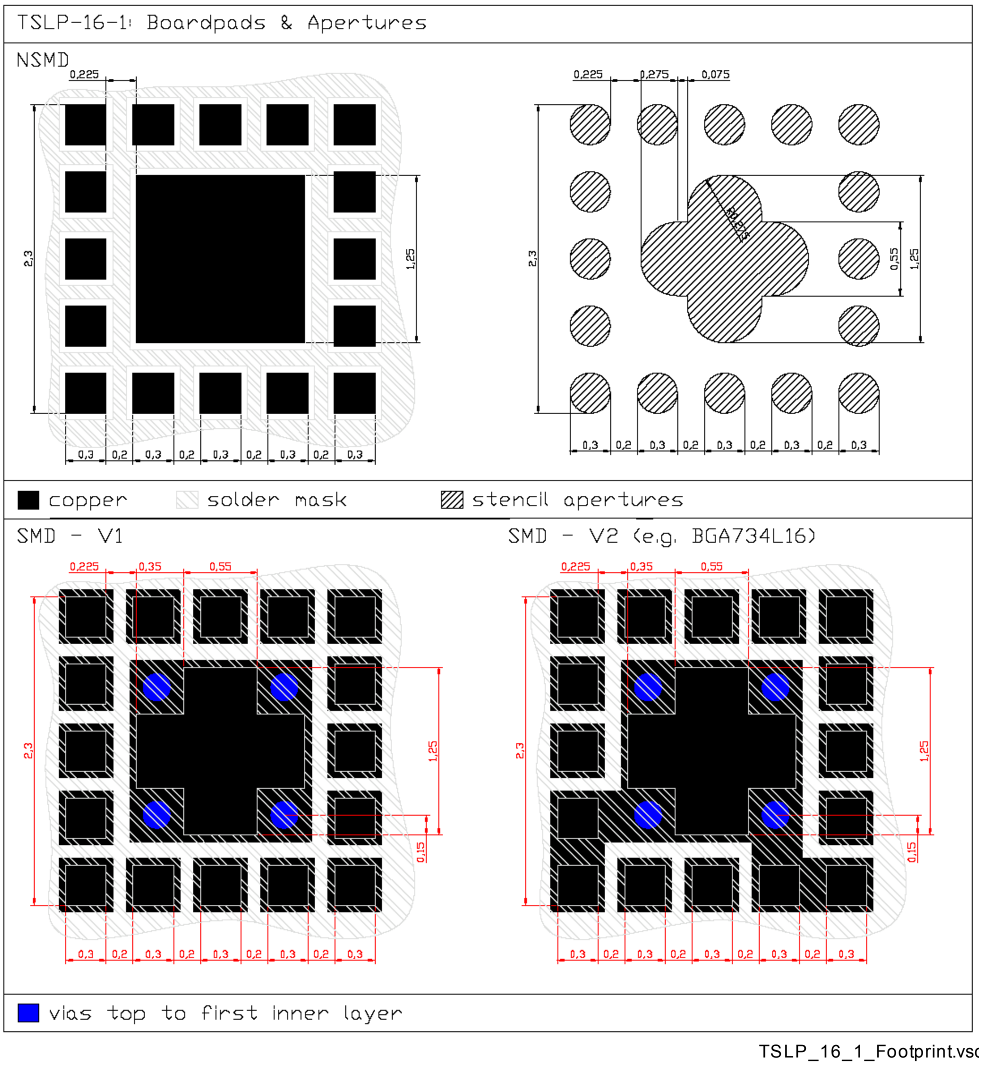
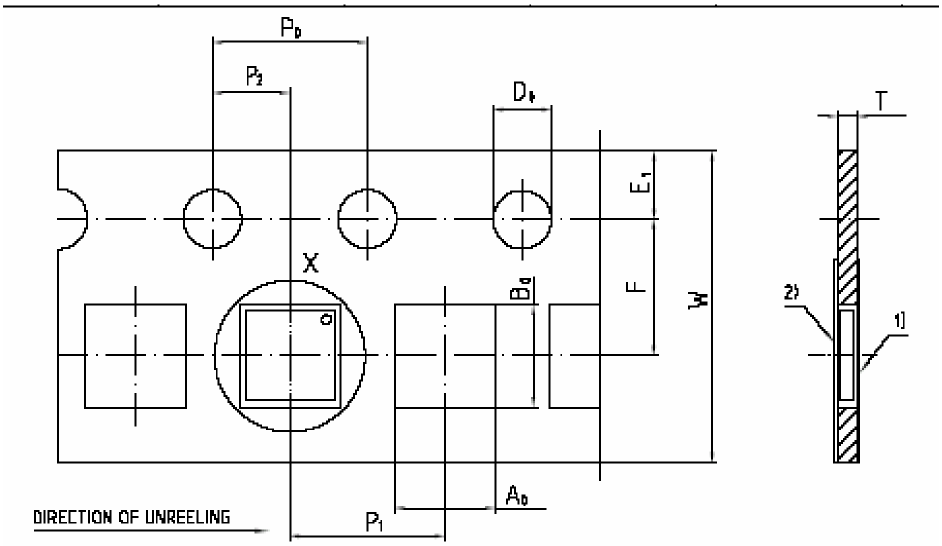


Figure 8 Footprint of PG-TSLP-16-1



TAPE DIMENSION

W	P_0	P_1	P_2	D_0	A_0	B_0	E_1	F	T
8±0.1	4±0.1	4±0.1	2±0.05	1.5+0.1	2.6±0.1	2.6±0.1	1.75±0.1	3.5±0.05	0.5±0.1

Figure 9 Taping of PG-TSLP-16-1