BGA748N16

High Linearity Quad-Band UMTS LNA (2100, 1900, 900, 800 MHz)

Data Sheet

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BGA748N16 High Linearity Quad-Band UMTS LNA (2100, 1900, 900, 800 MHz)

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Previous Revision:

Page	Subjects (major changes since last revision)

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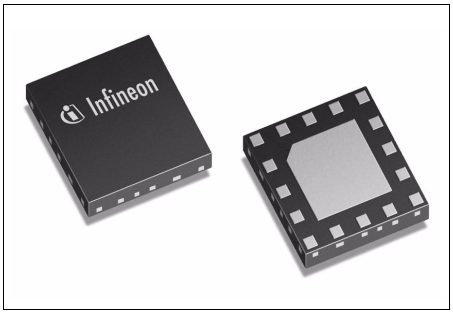


Main features:

- Gain: 16 / -8 dB typ. in high / low gain mode (all bands)
- Noise figure: 1.1 dB typ. in high gain mode
- Supply current: 4.0 / 0.75 mA typ in high / low gain mode (all bands)
- Standby mode (< 2 μA typ.)
- Output internally matched to 50 Ω
- Inputs pre-matched to 50 Ω
- 2 kV HBM ESD protection
- Low external component count
- Small leadless TSNP-16-1 package (2.3 x 2.3 x 0.39 mm)
- Pb-free (RoHS compliant) package

RoHS

Description

The BGA748N16 is a highly flexible, high linearity quad-band (2100, 1900, 900, 800 MHz) low noise amplifier MMIC for worldwide use. Based on Infineon's proprietary and cost-effective SiGe:C technology, the BGA748N16 uses an advanced biasing concept in order to achieve high linearity.

The device features dynamic gain control, temperature stabilization, standby mode and 2 kV ESD protection on-chip as well as matching off chip. Because the matching is off chip, different UMTS bands can be easily applied.

Note: UMTS bands I / II / V / VIII is the standard band combination for this product requiring no external output matching network.

Product Name	Package	Chip	Marking
BGA748N16	TSNP-16-1	T1541	BGA748

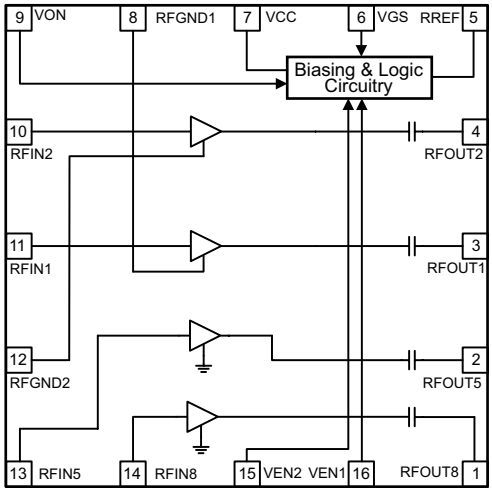


Figure 1 Block Diagram of Quad-Band LNA

2 Electrical Characteristics

2.1 Absolute Maximum Ratings

Table 1 Absolute Maximum Ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{CC}	-0.3	–	3.6	V	–
Supply current	I_{CC}	–	–	10	mA	–
Pin voltage	V_{PIN}	-0.3	–	V_{CC}+0.3	V	All pins except RF input pins.
Pin voltage RF Input Pins	V_{RFIN}	-0.3	–	0.9	V	–
RF input power	P_{RFIN}	–	–	4	dBm	–
Junction temperature	T_j	–	–	150	°C	–
Ambient temperature range	T_A	-30	–	85	°C	–
Storage temperature range	T_{stg}	-65	–	150	°C	–

Attention: Stresses exceeding the max. values listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to the integrated circuit.

2.2 Thermal Resistance

Table 2 Thermal Resistance

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance junction to soldering point	R_{thJS}	–	–	67	K/W	–

2.3 ESD Integrity

Table 3 ESD Integrity

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
ESD hardness HBM[1)]	$V_{ESD-HBM}$	–	2000	–	V	All pins

1) According to JESD22-A114

2.4 DC Characteristics

Table 4 DC Characteristics, T_A =-30 ... 85 °C

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{CC}	2.6	2.8	3.0	V	–
Supply current high gain mode	I_{CCHG}	–	4.4 3.8	–	mA	Band 1 All other bands
Supply current low gain mode	I_{CCLG}	–	0.75	–	mA	All bands
Supply current standby mode	I_{CCOFF}	–	0.1	2.0	µA	–
Logic level high	V_{HI}	1.5	2.8	–	V	All logic pins
Logic level low	V_{LO}	–	0.0	0.5	V	
Logic currents	I_{LO}	–	0.1	–	µA	All logic pins
	I_{HI}	–	5.0	–	µA	

2.5 Band Select / Gain Control Truth Table

Table 5 Band Select Truth Table, V_{CC} = 2.8 V

	Band 1	Band 2	Band 5	Band 8	Stand-by
VEN1	H	H	L	L	L
VEN2	H	L	H	L	L
VON	H	H	H	H	L

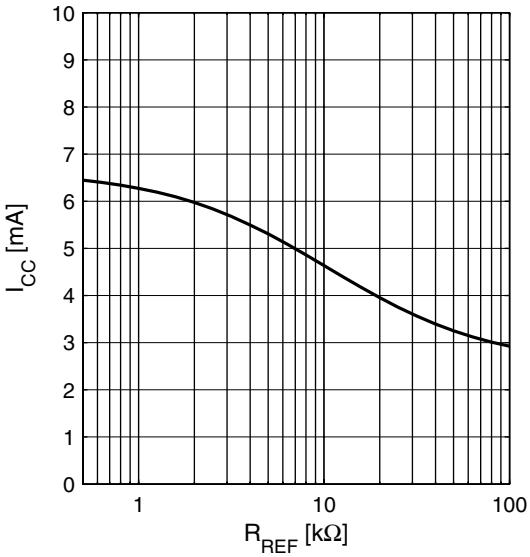
Table 6 Gain Control Truth Table, V_{CC} = 2.8 V

	High Gain	Low Gain
VGS	H	L

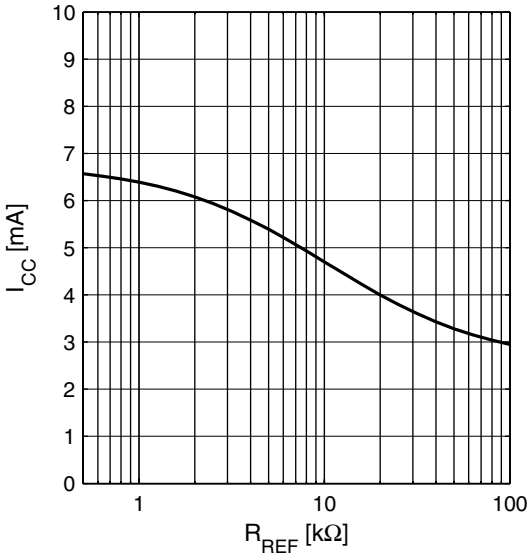
2.6 Supply Current Characteristics

Supply current high gain mode versus resistance of reference resistor R_{REF} (see Figure 2 on Page 25; low gain mode supply current is independent of reference resistor).

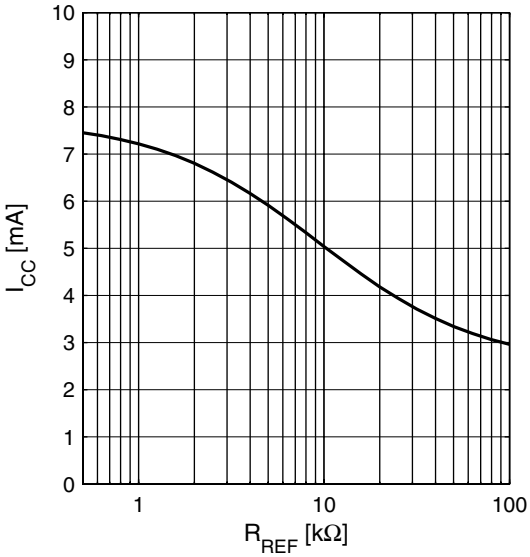
Supply Current Band 5 I_{CC} = f (R_{REF})
V_{CC} = 2.8 V, T_A = 25 °C



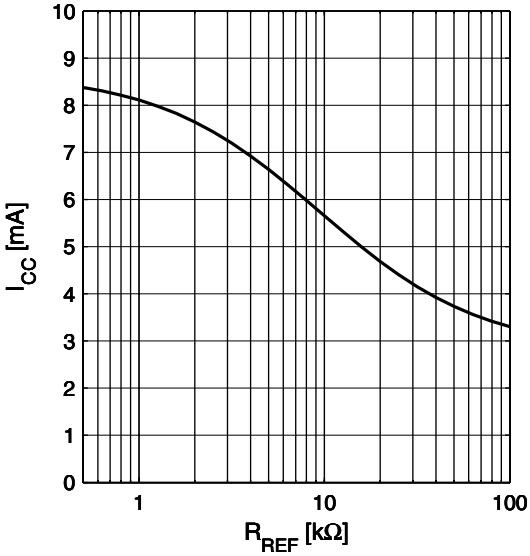
Supply Current Band 8 I_{CC} = f (R_{REF})
V_{CC} = 2.8 V, T_A = 25 °C



Supply Current Band 2 I_{CC} = f (R_{REF})
V_{CC} = 2.8 V, T_A = 25 °C



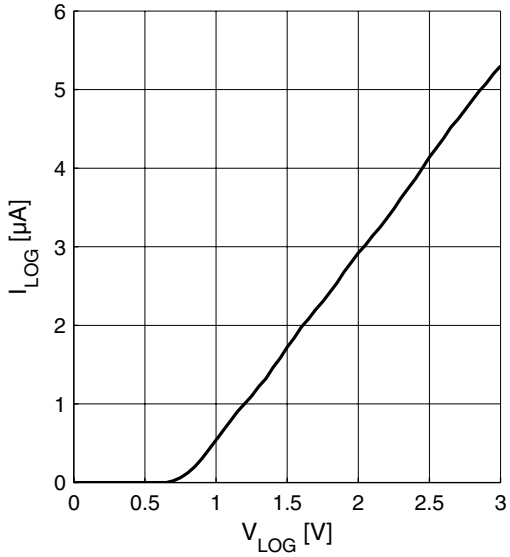
Supply Current Band 1 I_{CC} = f (R_{REF})
V_{CC} = 2.8 V, T_A = 25 °C



2.7 Logic Signal Characteristics

Current consumption of logic inputs VEN1, VEN2, VGS, VON

Logic currents I_{LOG} = f(V_{LOG})
V_{CC} = 2.8 V, T_A = 25 °C



2.8 Switching Times

Table 7 Typical Switching Times; T_A = -30 ... 85 °C

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gainstep settling time	t_{GS}	–	1	–	µs	Switching LG ↔ HG all bands
Bandselect settling time	t_{BS}	–	1	–	µs	Switching from any band to a different band (pins VEN1,2)
Power on settling time	t_{ON}	–	1	–	µs	Switching from standby mode to ON mode (pin VON)

2.9 Measured RF Characteristics UMTS Band V

Table 8 Typical Characteristics 880 MHz Band, T_A = -30 °C, V_{CC} = 2.8 V[1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band range		869	–	894	MHz	–
Current consumption	I_{CCHG}	–	3.1	–	mA	High gain mode
	I_{CCLG}	–	0.70	–	mA	Low gain mode
Gain	S_{21HG}	–	16.5	–	dB	High gain mode
	S_{21LG}	–	-7.8	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-38	–	dB	High gain mode
	S_{12LG}	–	-7.8	–	dB	Low gain mode
Noise figure	NF_{HG}	–	0.9	–	dB	High gain mode
	NF_{LG}	–	7.8	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-15	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-17	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-15	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-11	–	dB	50 Ω, low gain mode
Stability factor[3)]	k	–	>2.5	–		DC to 8 GHz; all gain modes
Input compression point[2)]	IP_{1dBHG}	–	-7	–	dBm	High gain mode
	IP_{1dBLG}	–	1	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-7 14	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 2 on Page 25
2) Verification based on AQL; random production test.
3) Guaranteed by device design; not tested in production.

2.10 Measured RF Characteristics UMTS Band V

Table 9 Typical Characteristics 880 MHz Band, T_A = 25 °C, V_{CC} = 2.8 V[1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band range		869	–	894	MHz	–
Current consumption	I_{CCHG}	–	3.8	–	mA	High gain mode
	I_{CCLG}	–	0.75	–	mA	Low gain mode
Gain	S_{21HG}	–	16.2	–	dB	High gain mode
	S_{21LG}	–	-8.0	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-38	–	dB	High gain mode
	S_{12LG}	–	-8.0	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.2	–	dB	High gain mode
	NF_{LG}	–	8.0	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-14	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-15	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-20	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-11	–	dB	50 Ω, low gain mode
Stability factor[3)]	k	–	>2.7	–		DC to 8 GHz; all gain modes
Input compression point[2)]	IP_{1dBHG}	–	-7	–	dBm	High gain mode
	IP_{1dBLG}	–	-1	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-6 12	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 2 on Page 25
2) Verification based on AQL; random production test.
3) Guaranteed by device design; not tested in production.

2.11 Measured RF Characteristics UMTS Band V

Table 10 Typical Characteristics 880 MHz Band, T_A = 85 °C, V_{CC} = 2.8 V[1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band range		869	–	894	MHz	–
Current consumption	I_{CCHG}	–	4.6	–	mA	High gain mode
	I_{CCLG}	–	0.80	–	mA	Low gain mode
Gain	S_{21HG}	–	15.6	–	dB	High gain mode
	S_{21LG}	–	-8.5	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-38	–	dB	High gain mode
	S_{12LG}	–	-8.5	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.7	–	dB	High gain mode
	NF_{LG}	–	8.5	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-17	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-14	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-20	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-11	–	dB	50 Ω, low gain mode
Stability factor[3)]	k	–	>3.2	–		DC to 8 GHz; all gain modes
Input compression point[2)]	IP_{1dBHG}	–	-8	–	dBm	High gain mode
	IP_{1dBLG}	–	-4	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-6 6	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 2 on Page 25
2) Verification based on AQL; random production test.
3) Guaranteed by device design; not tested in production.

2.12 Measured RF Characteristics UMTS Band VIII

Table 11 Typical Characteristics 940 MHz Band, T_A = -30 °C, V_{CC} = 2.8 V[1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band range		925	–	960	MHz	–
Current consumption	I_{CCHG}	–	3.1	–	mA	High gain mode
	I_{CCLG}	–	0.70	–	mA	Low gain mode
Gain	S_{21HG}	–	16.5	–	dB	High gain mode
	S_{21LG}	–	-7.8	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-35	–	dB	High gain mode
	S_{12LG}	–	-7.8	–	dB	Low gain mode
Noise figure	NF_{HG}	–	0.9	–	dB	High gain mode
	NF_{LG}	–	7.8	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-15	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-13	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-19	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-13	–	dB	50 Ω, low gain mode
Stability factor[3)]	k	–	>2.5	–		DC to 8 GHz; all gain modes
Input compression point[2)]	IP_{1dBHG}	–	-7	–	dBm	High gain mode
	IP_{1dBLG}	–	3	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-7 14	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 2 on Page 25
2) Verification based on AQL; random production test.
3) Guaranteed by device design; not tested in production.

2.13 Measured RF Characteristics UMTS Band VIII

Table 12 Typical Characteristics 940 MHz Band, T_A = 25 °C, V_{CC} = 2.8 V[1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band range		925	–	960	MHz	–
Current consumption	I_{CCHG}	–	3.8	–	mA	High gain mode
	I_{CCLG}	–	0.75	–	mA	Low gain mode
Gain	S_{21HG}	–	16.2	–	dB	High gain mode
	S_{21LG}	–	-8.0	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-36	–	dB	High gain mode
	S_{12LG}	–	-8.0	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.2	–	dB	High gain mode
	NF_{LG}	–	8.0	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-16	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-13	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-28	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-12	–	dB	50 Ω, low gain mode
Stability factor[3)]	k	–	>2.8	–		DC to 8 GHz; all gain modes
Input compression point[2)]	IP_{1dBHG}	–	-6	–	dBm	High gain mode
	IP_{1dBLG}	–	1	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-6 12	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 2 on Page 25
2) Verification based on AQL; random production test.
3) Guaranteed by device design; not tested in production.

2.14 Measured RF Characteristics UMTS Band VIII

Table 13 Typical Characteristics 940 MHz Band, T_A = 85 °C, V_{CC} = 2.8 V[1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band range		925	–	960	MHz	–
Current consumption	I_{CCHG}	–	4.6	–	mA	High gain mode
	I_{CCLG}	–	0.80	–	mA	Low gain mode
Gain	S_{21HG}	–	15.6	–	dB	High gain mode
	S_{21LG}	–	-8.5	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-36	–	dB	High gain mode
	S_{12LG}	–	-8.5	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.7	–	dB	High gain mode
	NF_{LG}	–	8.5	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-17	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-12	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-26	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-12	–	dB	50 Ω, low gain mode
Stability factor[3)]	k	–	>3.2	–		DC to 8 GHz; all gain modes
Input compression point[2)]	IP_{1dBHG}	–	-9	–	dBm	High gain mode
	IP_{1dBLG}	–	-3	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-5 5	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 2 on Page 25
2) Verification based on AQL; random production test.
3) Guaranteed by device design; not tested in production.

2.15 Measured RF Characteristics UMTS Band II

Table 14 Typical Characteristics 1960 MHz Band, T_A = -30 °C, V_{CC} = 2.8 V[1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band range		1930	–	1990	MHz	–
Current consumption	I_{CCHG}	–	3.1	–	mA	High gain mode
	I_{CCLG}	–	0.70	–	mA	Low gain mode
Gain	S_{21HG}	–	17.1	–	dB	High gain mode
	S_{21LG}	–	-7.8	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-35	–	dB	High gain mode
	S_{12LG}	–	-7.8	–	dB	Low gain mode
Noise figure	NF_{HG}	–	0.8	–	dB	High gain mode
	NF_{LG}	–	7.8	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-21	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-24	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-29	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-15	–	dB	50 Ω, low gain mode
Stability factor[3)]	k	–	>2.3	–		DC to 8 GHz; all gain modes
Input compression point[2)]	IP_{1dBHG}	–	-8	–	dBm	High gain mode
	IP_{1dBLG}	–	2	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-8 17	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 2 on Page 25
2) Verification based on AQL; random production test.
3) Guaranteed by device design; not tested in production.

2.16 Measured RF Characteristics UMTS Band II

Table 15 Typical Characteristics 1960 MHz Band, T_A = 25 °C, V_{CC} = 2.8 V[1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band range		1930	–	1990	MHz	–
Current consumption	I_{CCHG}	–	4.0	–	mA	High gain mode
	I_{CCLG}	–	0.75	–	mA	Low gain mode
Gain	S_{21HG}	–	16.5	–	dB	High gain mode
	S_{21LG}	–	-8.0	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-36	–	dB	High gain mode
	S_{12LG}	–	-8.0	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.1	–	dB	High gain mode
	NF_{LG}	–	8.0	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-20	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-17	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-32	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-15	–	dB	50 Ω, low gain mode
Stability factor[3)]	k	–	>2.6	–		DC to 8 GHz; all gain modes
Input compression point[2)]	IP_{1dBHG}	–	-8	–	dBm	High gain mode
	IP_{1dBLG}	–	2	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-7 17	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 2 on Page 25
2) Verification based on AQL; random production test.
3) Guaranteed by device design; not tested in production.

2.17 Measured RF Characteristics UMTS Band II

Table 16 Typical Characteristics 1960 MHz Band, T_A = 85 °C, V_{CC} = 2.8 V[1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band range		1930	–	1990	MHz	–
Current consumption	I_{CCHG}	–	4.9	–	mA	High gain mode
	I_{CCLG}	–	0.80	–	mA	Low gain mode
Gain	S_{21HG}	–	15.9	–	dB	High gain mode
	S_{21LG}	–	-8.5	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-36	–	dB	High gain mode
	S_{12LG}	–	-8.5	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.5	–	dB	High gain mode
	NF_{LG}	–	8.5	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-17	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-14	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-23	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-16	–	dB	50 Ω, low gain mode
Stability factor[3)]	k	–	>3.1	–		DC to 8 GHz; all gain modes
Input compression point[2)]	IP_{1dBHG}	–	-9	–	dBm	High gain mode
	IP_{1dBLG}	–	0	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-6 10	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 2 on Page 25
2) Verification based on AQL; random production test.
3) Guaranteed by device design; not tested in production.

2.18 Measured RF Characteristics UMTS Band I

Table 17 Typical Characteristics 2140 MHz Band, T_A = -30 °C, V_{CC} = 2.8 V[1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band range		2110	–	2170	MHz	–
Current consumption	I_{CCHG}	–	3.6	–	mA	High gain mode
	I_{CCLG}	–	0.70	–	mA	Low gain mode
Gain	S_{21HG}	–	18.0	–	dB	High gain mode
	S_{21LG}	–	-7.8	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-36	–	dB	High gain mode
	S_{12LG}	–	-7.8	–	dB	Low gain mode
Noise figure	NF_{HG}	–	0.8	–	dB	High gain mode
	NF_{LG}	–	7.8	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-18	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-18	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-18	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-10	–	dB	50 Ω, low gain mode
Stability factor[3)]	k	–	>2.2	–		DC to 8 GHz; all gain modes
Input compression point[2)]	IP_{1dBHG}	–	-9	–	dBm	High gain mode
	IP_{1dBLG}	–	1	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-8 16	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 2 on Page 25
2) Verification based on AQL; random production test..
3) Guaranteed by device design; not tested in production.

2.19 Measured RF Characteristics UMTS Band I

Table 18 Typical Characteristics 2140 MHz Band, T_A = 25 °C, V_{CC} = 2.8 V[1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band range		2110	–	2170	MHz	–
Current consumption	I_{CCHG}	–	4.4	–	mA	High gain mode
	I_{CCLG}	–	0.75	–	mA	Low gain mode
Gain	S_{21HG}	–	17.4	–	dB	High gain mode
	S_{21LG}	–	-8.0	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-36	–	dB	High gain mode
	S_{12LG}	–	-8.0	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.1	–	dB	High gain mode
	NF_{LG}	–	8.0	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-20	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-17	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-19	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-11	–	dB	50 Ω, low gain mode
Stability factor[3)]	k	–	>2.4	–		DC to 8 GHz; all gain modes
Input compression point[2)]	IP_{1dBHG}	–	-10	–	dBm	High gain mode
	IP_{1dBLG}	–	2	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-6 16	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 2 on Page 25
2) Verification based on AQL; random production test..
3) Guaranteed by device design; not tested in production.

2.20 Measured RF Characteristics UMTS Band I

Table 19 Typical Characteristics 2140 MHz Band, T_A = 85 °C, V_{CC} = 2.8 V[1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band range		2110	–	2170	MHz	–
Current consumption	I_{CCHG}	–	5.3	–	mA	High gain mode
	I_{CCLG}	–	0.80	–	mA	Low gain mode
Gain	S_{21HG}	–	16.8	–	dB	High gain mode
	S_{21LG}	–	-8.5	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-36	–	dB	High gain mode
	S_{12LG}	–	-8.5	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.4	–	dB	High gain mode
	NF_{LG}	–	8.5	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-23	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-16	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-17	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-11	–	dB	50 Ω, low gain mode
Stability factor[3)]	k	–	>2.7	–		DC to 8 GHz; all gain modes
Input compression point[2)]	IP_{1dBHG}	–	-11	–	dBm	High gain mode
	IP_{1dBLG}	–	1	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-5 11	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 2 on Page 25
2) Verification based on AQL; random production test..
3) Guaranteed by device design; not tested in production.

3 Application Circuit and Block Diagram

3.1 UMTS Bands I, II, V and VIII Application Circuit Schematic

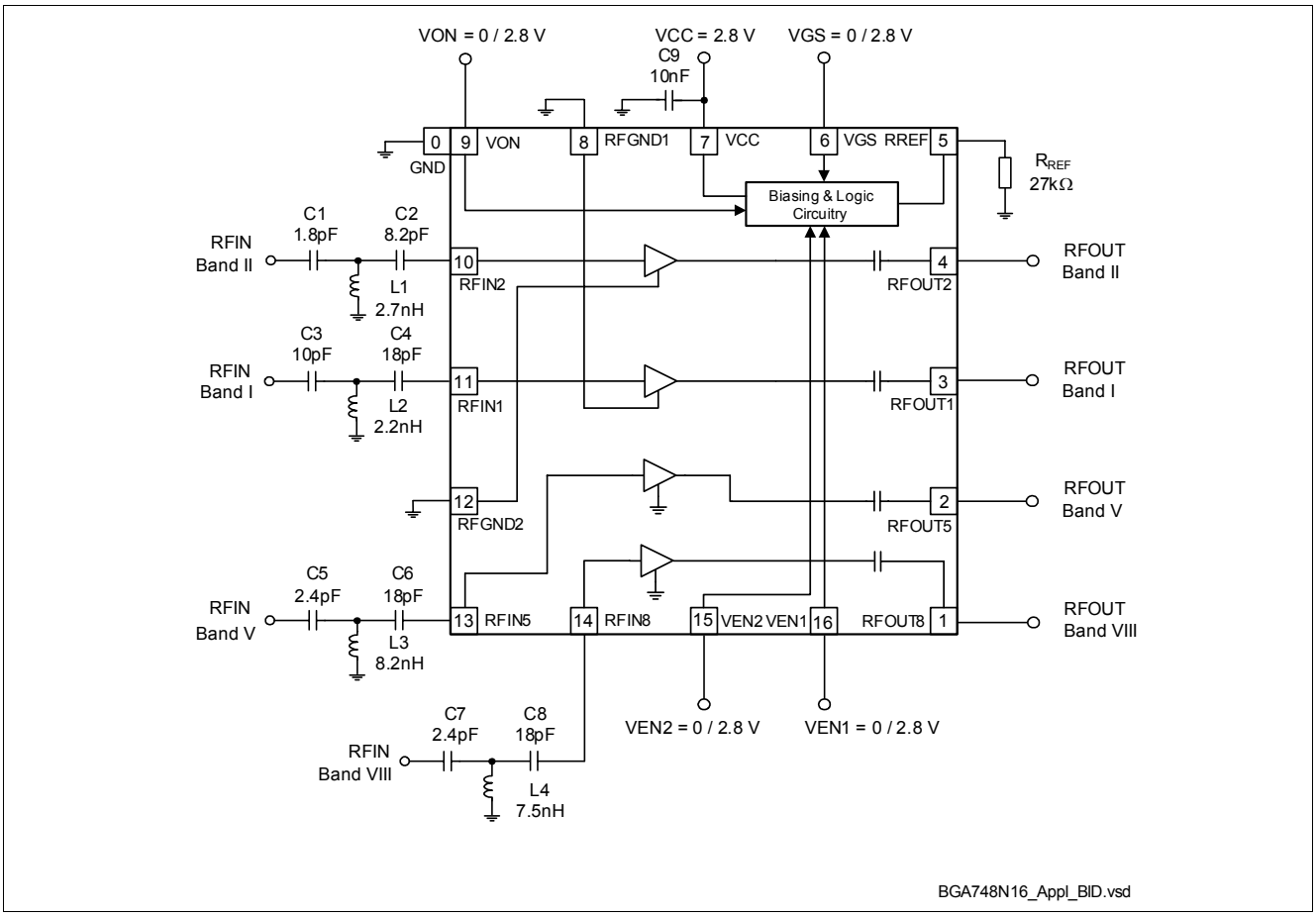


Figure 2 Application Circuit with Chip Outline (Top View)

Note: Package paddle (Pin 0) has to be RF grounded.

Table 20 Bill of Materials

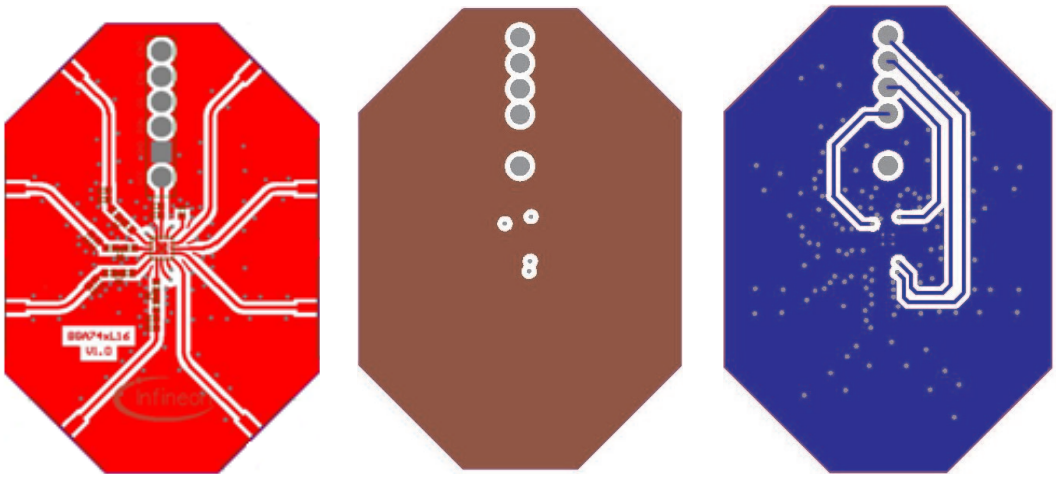
Part Number	Part Type	Manufacturer	Size	Comment
L1 ... L4	Chip inductor	Various	0402	Wirewound, Q ≈ 50
C1 ... C9	Chip capacitor	Various	0402	
R_{REF}	Chip resistor	Various	0402	

3.2 Pin Description

Table 21 Pin Definition and Function

Pin No.	Name	Function
0	GND	Ground connection for LNA and control circuitry (package paddle)
1	RFOUT8	LNA output UMTS band VIII
2	RFOUT5	LNA output UMTS band V
3	RFOUT1	LNA output UMTS band I
4	RFOUT2	LNA output UMTS band II
5	RREF	Bias current reference resistor (high gain mode)
6	VGS	Gain step control voltage
7	VCC	Supply voltage
8	RFGND1	LNA emitter ground UMTS band I
9	VON	Power on control voltage
10	RFIN2	LNA input UMTS band II
11	RFIN1	LNA input UMTS band I
12	RFGND2	LNA emitter ground UMTS band II
13	RFIN5	LNA input UMTS band V
14	RFIN8	LNA input UMTS band VIII
15	VEN2	Band select control voltage
16	VEN1	Band select control voltage

3.3 Application Board



Note: Top layer thickness: 0.2 mm, bottom layer thickness: 0.8 mm, 17 mm Cu metallization, gold plated. Board size: 32 x 45mm.

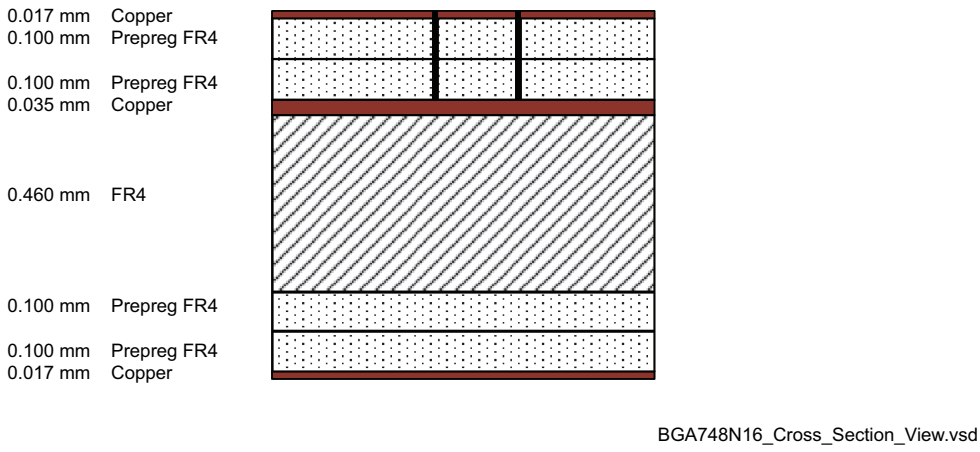


Figure 3 Cross-Section View of Application Board

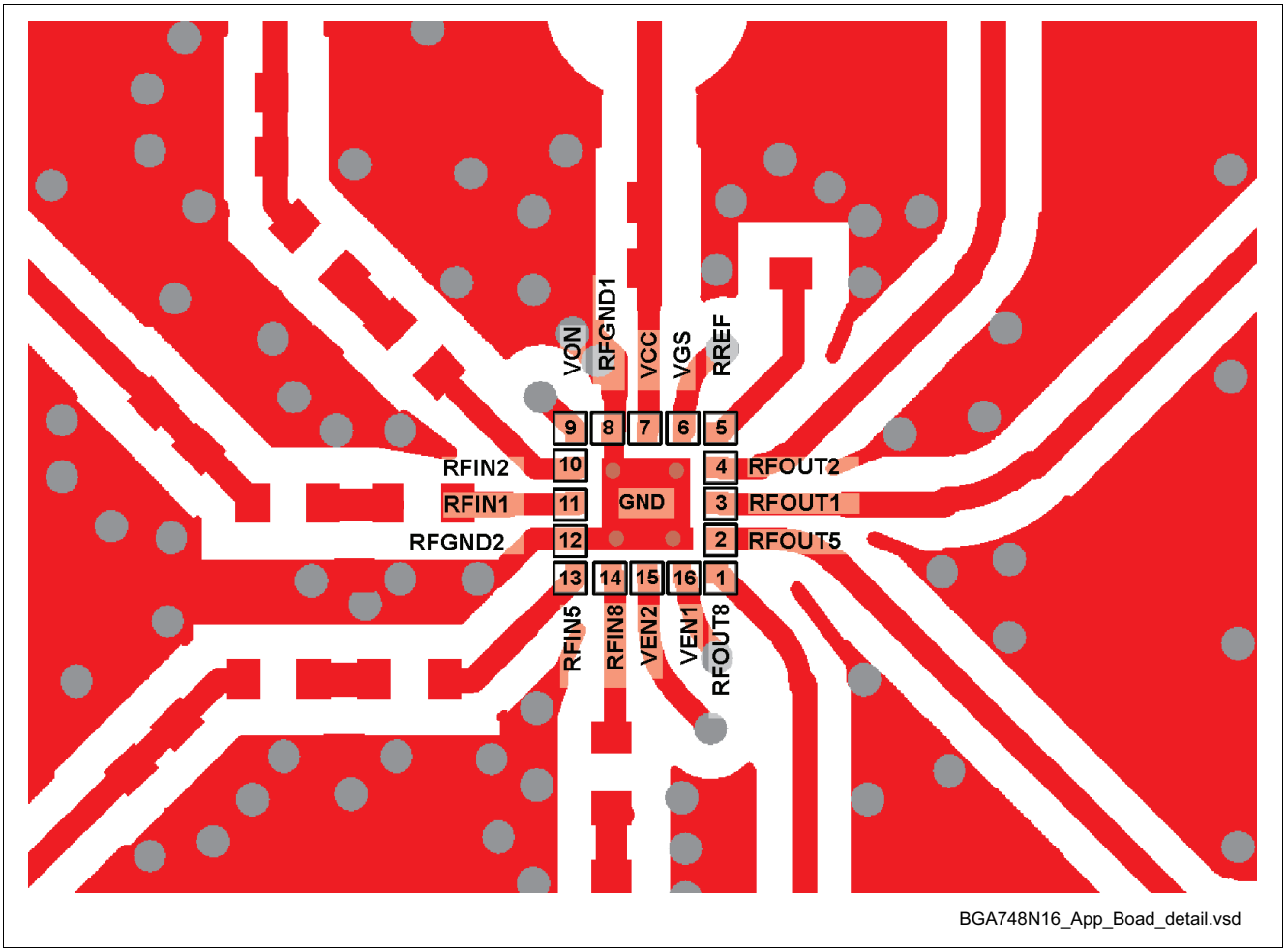


Figure 4 Detail of Application Board Layout

Note: In order to achieve the same performance as given in this datasheet please follow the suggested PCB-layout as closely as possible. The position of the GND vias is critical for RF performance.

4 Physical Characteristics

4.1 Package Footprint

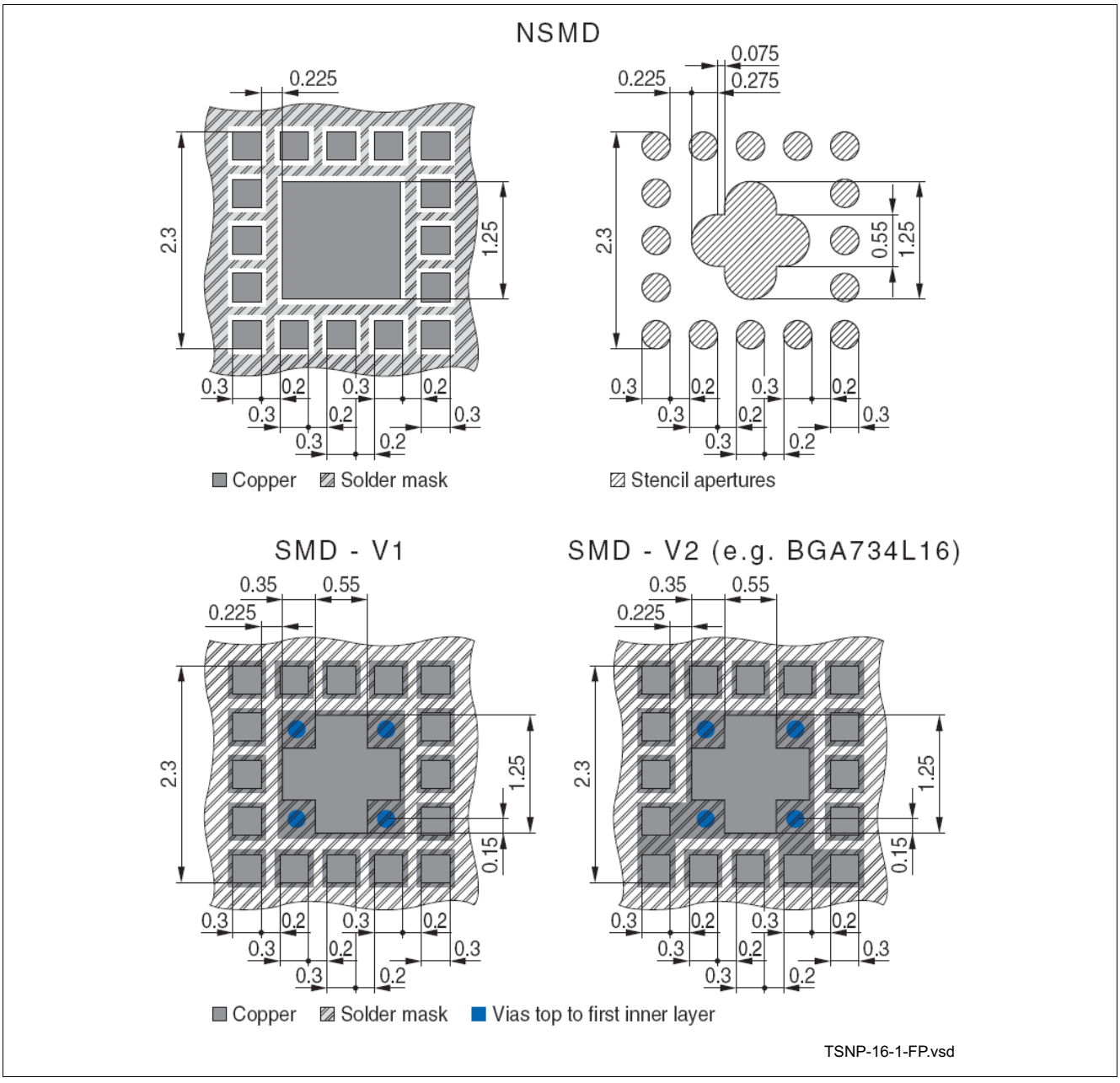


Figure 5 Recommended Footprint and Stencil Layout for the TSNP-16-1 Package

4.2 Package Dimensions

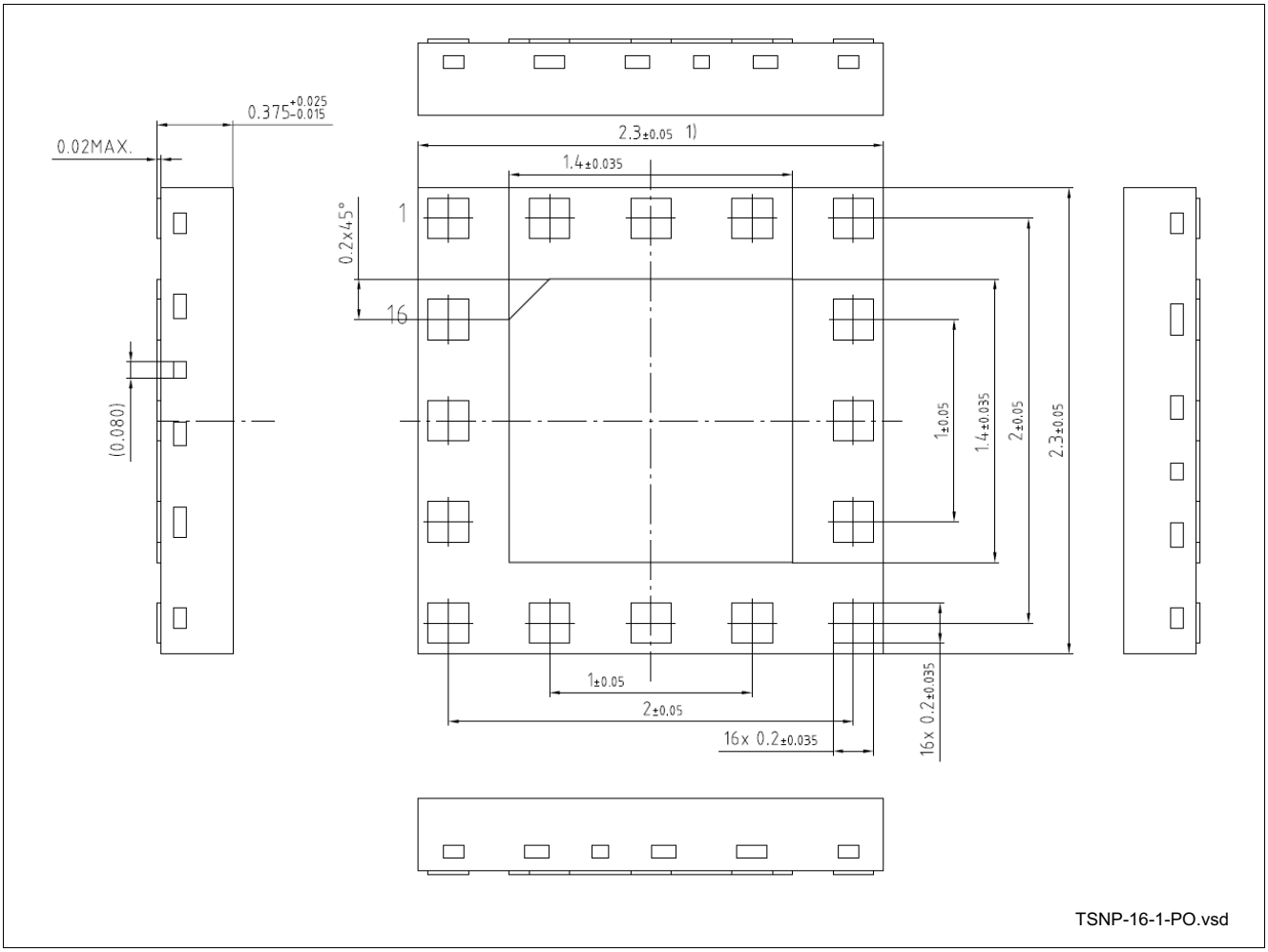


Figure 6 Package Outline (Top, Side and Bottom View)

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