BGA735N16

High Linearity Tri-Band LTE/UMTS LNA
(2600/2300/2100, 1900/1800, 900/800/700 MHz)

Data Sheet

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RF & Protection Devices

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BGA735N16 High Linearity Tri-Band LTE/UMTS LNA
(2600/2300/2100, 1900/1800, 900/800/700 MHz)

Revision History: 2010-12-23, Revision 3.8

Previous Revision: 2010-09-06, Revision 3.7

Page	Subjects (major changes since last revision)
13-14	Added LTE bands 12, 13, 14, 17
21-22	Added LTE bands 38, 40

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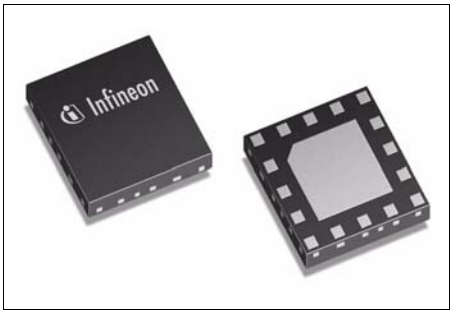
1 Features



Main features:

- Gain: 16 (17) / -7.5 dB in high / low gain mode (all bands)
- Noise figure: 1.1 / 1.1 / 1.1 dB in high gain mode
  (800 MHz / 1900 MHz / 2100 MHz)
- Supply current: 3.4 (4.0) / 0.65 mA in high / low gain mode (all bands)
- Standby mode (< 2 μA typ.)
- Output internally matched to 50 Ω
- Inputs pre-matched to 50 Ω
- 2kV 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 BGA735N16 is a highly flexible, high linearity tri-band (2600/2300/2100, 1900/1800, 900/800/700 MHz) low noise amplifier MMIC for worldwide use. Based on Infineon's proprietary and cost-effective SiGe:C technology, the BGA735N16 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 LTE/UMTS bands can be easily applied. For example, the 1900 MHz path can be converted into a 2100 MHz path and vice versa by optimizing the input and output matching network.

Note: LTE/UMTS bands 1/ 2/ 5 is the standard band combination for this product requiring no external output matching network.

Product Name	Package	Chip	Marking
BGA735N16	TSNP-16-1	T1530	BGA735

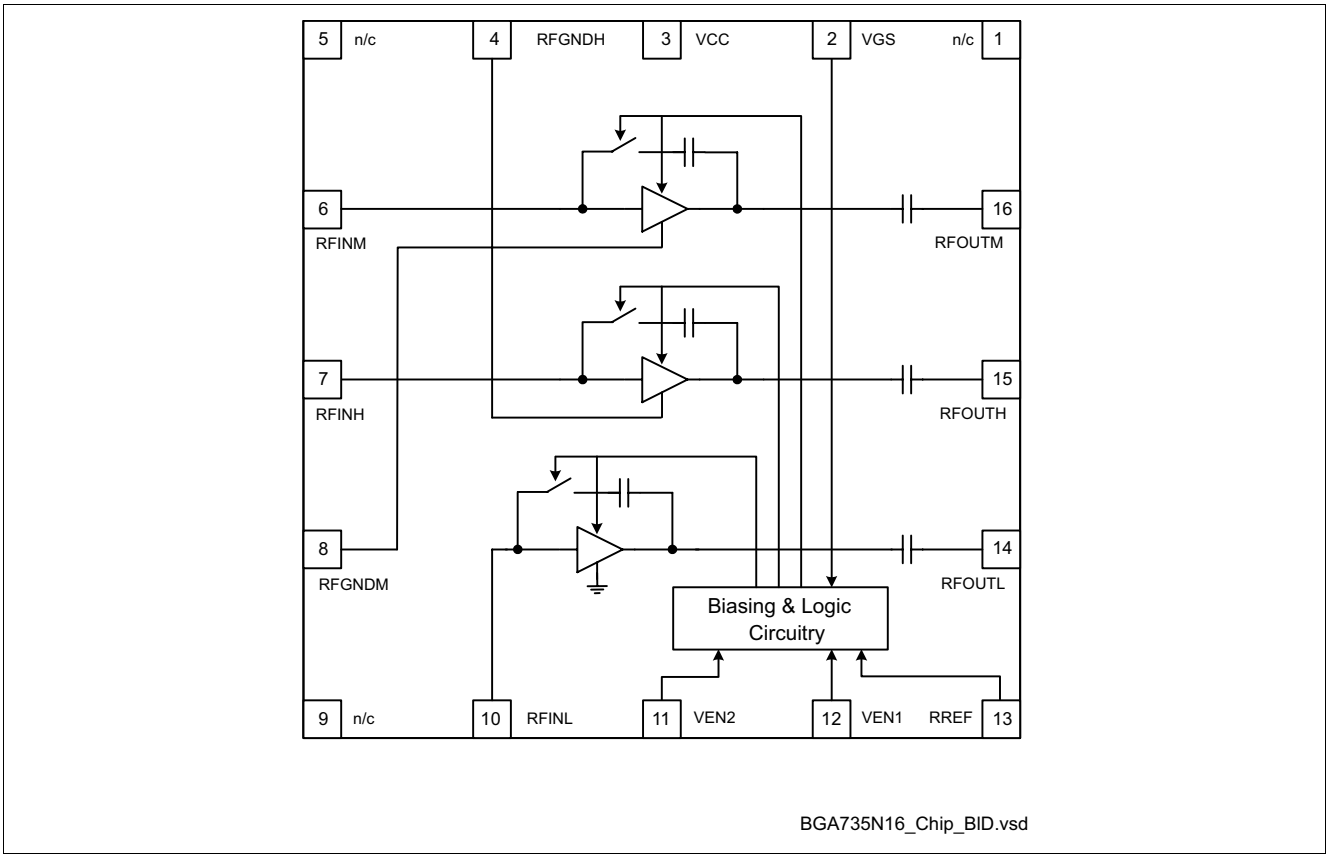


Figure 1 Block Diagram of Tri-Band LNA

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 above 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}	–	–	≤ 37	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}	–	4.0 3.4	–	mA	High band Mid and low band
Supply current low gain mode	I_{CCLG}	–	650	–	µA	All bands
Supply current standby mode	I_{CCOFF}	–	0.1	2.0	µA	–
Logic level high	V_{HI}	1.5	2.8	–	V	VEN1, VEN2 and VGS
Logic level low	V_{LO}	–	0.0	0.5	V	
Logic currents VEN	I_{ENL}	–	0.1	–	µA	VEN1 and VEN2
	I_{ENH}	–	10.0	–	µA	
Logic currents VGS	I_{GSL}	–	0.1	–	µA	VGS
	I_{GSH}	–	5.0	–	µA	

2.5 Band Select / Gain Control Truth Table

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

	High band	Mid band	Low band	Power Down
VEN1	H	H	L	L
VEN2	H	L	H	L

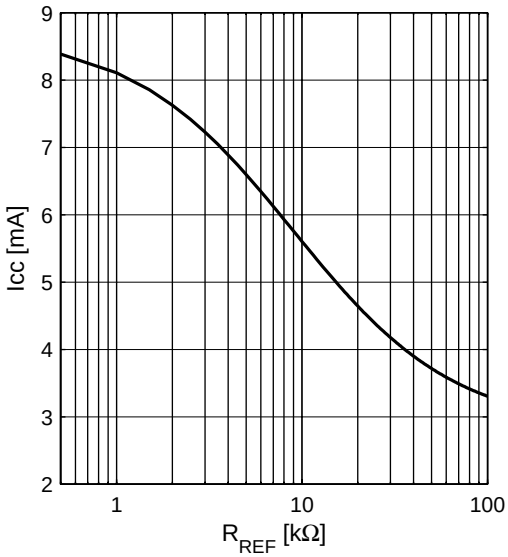
Table 6 Gain Control Truth Table, V_{CC} = 2.8 V

	High Gain	Low Gain
VGS	H	L

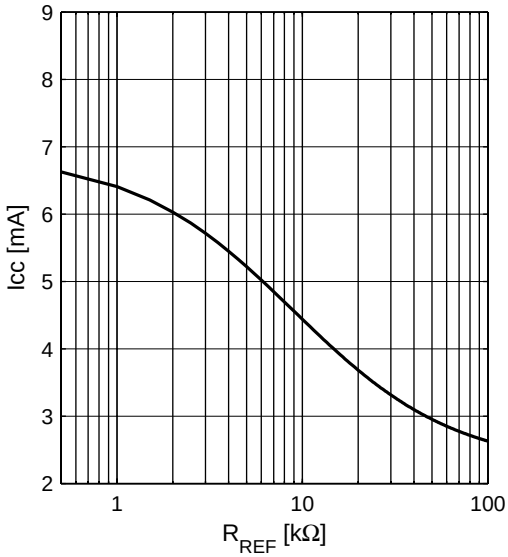
2.6 Supply Current Characteristics; T_A = 25 °C

Supply current high gain mode versus resistance of reference resistor R_{REF} (see Figure 2 on Page 24; low gain mode supply current is independent of reference resistor).

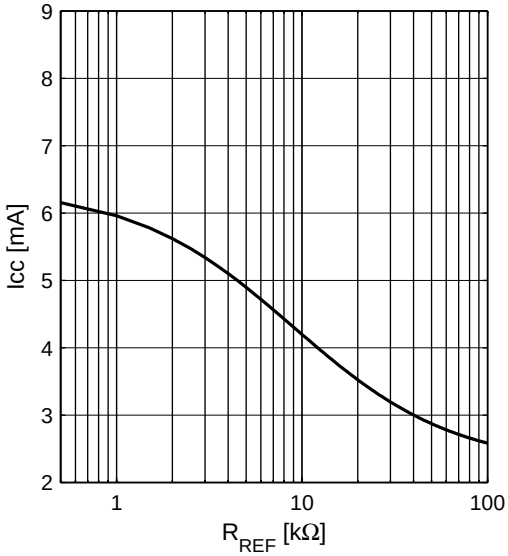
Supply Current Highband I_{CC} = f (R_{REF})
V_{CC} = 2.8 V



Supply Current Midband I_{CC} = f (R_{REF})
V_{CC} = 2.8 V



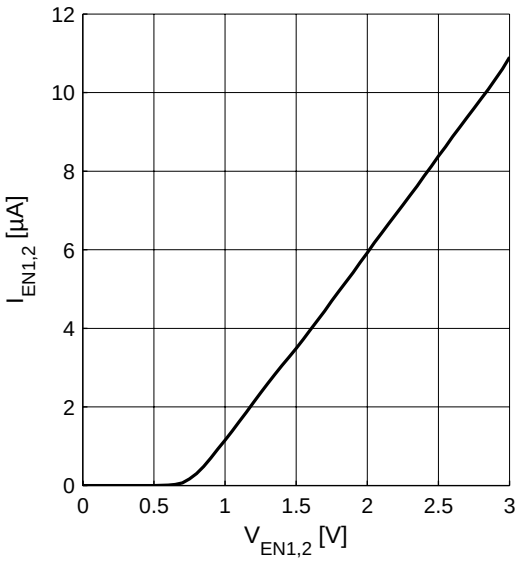
Supply Current Lowband I_{CC} = f (R_{REF})
V_{CC} = 2.8 V



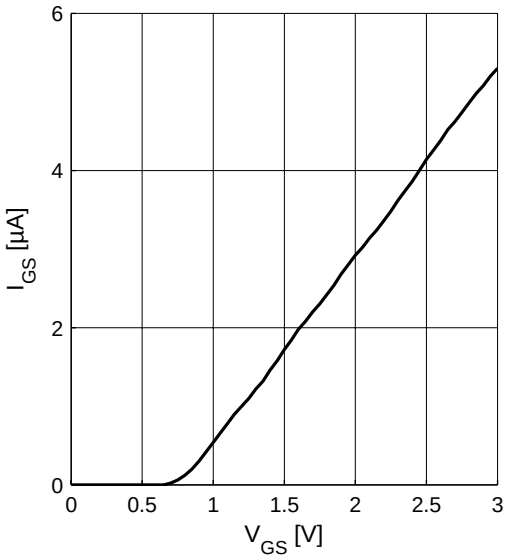
2.7 Logic Signal Characteristics; T_A = 25 °C

Current consumption of logic inputs VEN1, VEN2, VGS

Logic currents $I_{EN1,2}$ = f($V_{EN1,2}$)
V_{CC} = 2.8 V



Logic currents I_{GS} = f(V_{GS})
V_{CC} = 2.8 V



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)

2.9 Measured RF Characteristics UMTS Bands 12 / 17

Table 8 Typical Characteristics 700 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 band 12		728	–	746	MHz	–
Pass band range band 17		734	–	746	MHz	–
Current consumption	I_{CCHG}	–	3.4	–	mA	High gain mode
	I_{CCLG}	–	0.65	–	mA	Low gain mode
Gain	S_{21HG}	–	15.2	–	dB	High gain mode
	S_{21LG}	–	-9.2	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-39	–	dB	High gain mode
	S_{12LG}	–	-9.2	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.1	–	dB	High gain mode
	NF_{LG}	–	9.2	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-15	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-16	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-19	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-12	–	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}	–	-6	–	dBm	High gain mode
	IP_{1dBLG}	–	-10	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-11 -1	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 4 on Page 26
2) Verification based on AQL; random production test.
3) Guaranteed by device design; not tested in production.

2.10 Measured RF Characteristics UMTS Bands 13 / 14

Table 9 Typical Characteristics 700 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 band 13		746	–	756	MHz	–
Pass band range band 14		758	–	768	MHz	–
Current consumption	I_{CCHG}	–	3.4	–	mA	High gain mode
	I_{CCLG}	–	0.65	–	mA	Low gain mode
Gain	S_{21HG}	–	15.3	–	dB	High gain mode
	S_{21LG}	–	-8.9	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-39	–	dB	High gain mode
	S_{12LG}	–	-8.9	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.1	–	dB	High gain mode
	NF_{LG}	–	8.9	–	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}	–	-20	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-14	–	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}	–	-6	–	dBm	High gain mode
	IP_{1dBLG}	–	-10	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-11 -1	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 4 on Page 26
2) Verification based on AQL; random production test.
3) Guaranteed by device design; not tested in production.

2.11 Measured RF Characteristics UMTS Band 20

Table 10 Typical Characteristics 800 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 band 20		791	–	821	MHz	–
Current consumption	I_{CCHG}	–	3.4	–	mA	High gain mode
	I_{CCLG}	–	0.65	–	mA	Low gain mode
Gain	S_{21HG}	–	15.3	–	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}	–	1.2	–	dB	High gain mode
	NF_{LG}	–	7.8	–	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}	–	-13	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-20	–	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}	–	-6	–	dBm	High gain mode
	IP_{1dBLG}	–	-10	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-10 1	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 5 on Page 27
2) Verification based on AQL; random production test.
3) Guaranteed by device design; not tested in production.

2.12 Measured RF Characteristics UMTS Bands 5 / 6

Table 11 Typical Characteristics 800 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 band 5		869	–	894	MHz	–
Pass band range band 6		875	–	885	MHz	–
Current consumption	I_{CCHG}	–	3.4	–	mA	High gain mode
	I_{CCLG}	–	0.65	–	mA	Low gain mode
Gain	S_{21HG}	–	16.0	–	dB	High gain mode
	S_{21LG}	–	-7.5	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-36	–	dB	High gain mode
	S_{12LG}	–	-7.5	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.1	–	dB	High gain mode
	NF_{LG}	–	7.5	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-16	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-17	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-17	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-13	–	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}	–	-6	–	dBm	High gain mode
	IP_{1dBLG}	–	-8	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-7 2	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 2 on Page 24
2) Verification based on AQL; random production test.
3) Guaranteed by device design; not tested in production.

2.13 Measured RF Characteristics UMTS Band 8

Table 12 Typical Characteristics 900 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 band 8		925	–	960	MHz	–
Current consumption	I_{CCHG}	–	3.4	–	mA	High gain mode
	I_{CCLG}	–	0.65	–	mA	Low gain mode
Gain	S_{21HG}	–	16.1	–	dB	High gain mode
	S_{21LG}	–	-7.1	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-36	–	dB	High gain mode
	S_{12LG}	–	-7.1	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.1	–	dB	High gain mode
	NF_{LG}	–	7.1	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-16	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-15	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-15	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-16	–	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}	–	-5	–	dBm	High gain mode
	IP_{1dBLG}	–	-8	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-6 2	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 3 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 Bands 3 / 9

Table 13 Typical Characteristics 1800 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 band 3		1805	–	1880	MHz	–
Pass band range band 9		1844.9	–	1879.9	MHz	–
Current consumption	I_{CCHG}	–	3.4	–	mA	High gain mode
	I_{CCLG}	–	0.65	–	mA	Low gain mode
Gain	S_{21HG}	–	16.2	–	dB	High gain mode
	S_{21LG}	–	-8.7	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-36	–	dB	High gain mode
	S_{12LG}	–	-8.7	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.1	–	dB	High gain mode
	NF_{LG}	–	8.7	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-13	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-14	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-19	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-15	–	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}	–	-6	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-6 3	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 3 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 2

Table 14 Typical Characteristics 1900 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 band 2		1930	–	1990	MHz	–
Current consumption	I_{CCHG}	–	3.4	–	mA	High gain mode
	I_{CCLG}	–	0.65	–	mA	Low gain mode
Gain	S_{21HG}	–	16.0	–	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}	–	1.1	–	dB	High gain mode
	NF_{LG}	–	7.8	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-19	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-18	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-20	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-15	–	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}	–	-7	–	dBm	High gain mode
	IP_{1dBLG}	–	-7	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-6 3	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 2 on Page 24
2) Verification based on AQL; random production test.
3) Guaranteed by device design; not tested in production.

2.16 Measured RF Characteristics UMTS Bands 1 / 4 / 10

Table 15 Typical Characteristics 2100 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 band 1		2110	–	2170	MHz	–
Pass band range band 4		2110	–	2155	MHz	–
Pass band range band 10		2110	–	2170	MHz	–
Current consumption	I_{CCHG}	–	4.0	–	mA	High gain mode
	I_{CCLG}	–	0.65	–	mA	Low gain mode
Gain	S_{21HG}	–	17.2	–	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}	–	1.1	–	dB	High gain mode
	NF_{LG}	–	7.8	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-16	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-17	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-23	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-12	–	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}	–	-10	–	dBm	High gain mode
	IP_{1dBLG}	–	-6	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-3 3	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 2 on Page 24
2) Verification based on AQL; random production test.
3) Guaranteed by device design; not tested in production.

2.17 Measured RF Characteristics UMTS Band 40

Table 16 Typical Characteristics 2300 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 band 40		2300	–	2400	MHz	–
Current consumption	I_{CCHG}	–	4.0	–	mA	High gain mode
	I_{CCLG}	–	0.65	–	mA	Low gain mode
Gain	S_{21HG}	–	17.1	–	dB	High gain mode
	S_{21LG}	–	7.0	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-33	–	dB	High gain mode
	S_{12LG}	–	-7.0	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.1	–	dB	High gain mode
	NF_{LG}	–	7.0	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-20	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-18	–	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	–	>2.0	–		DC to 8 GHz; all gain modes
Input compression point[2)]	IP_{1dBHG}	–	-10	–	dBm	High gain mode
	IP_{1dBLG}	–	-4	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-2 6	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 4 on Page 26
2) Verification based on AQL; random production test.
3) Guaranteed by device design; not tested in production.

2.18 Measured RF Characteristics UMTS Band 38

Table 17 Typical Characteristics 2600 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 band 38		2570	–	2620	MHz	–
Current consumption	I_{CCHG}	–	3.4	–	mA	High gain mode
	I_{CCLG}	–	0.65	–	mA	Low gain mode
Gain	S_{21HG}	–	15.5	–	dB	High gain mode
	S_{21LG}	–	-6.5	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-33	–	dB	High gain mode
	S_{12LG}	–	-6.5	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.2	–	dB	High gain mode
	NF_{LG}	–	6.5	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-14	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-13	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-13	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-13	–	dB	50 Ω, low gain mode
Stability factor[3)]	k	–	>2.0	–		DC to 8 GHz; all gain modes
Input compression point[2)]	IP_{1dBHG}	–	-7	–	dBm	High gain mode
	IP_{1dBLG}	–	-2	–	dBm	Low gain mode
Inband IIP3[2)] f_1 - f_2 = 1 MHz	$IIP3_{HG}$ $IIP3_{LG}$	–	-3 7	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 3 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 7

Table 18 Typical Characteristics 2600 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 band 7		2620	–	2690	MHz	–
Current consumption	I_{CCHG}	–	4.0	–	mA	High gain mode
	I_{CCLG}	–	0.65	–	mA	Low gain mode
Gain	S_{21HG}	–	15.6	–	dB	High gain mode
	S_{21LG}	–	-6.3	–	dB	Low gain mode
Reverse Isolation[2)]	S_{12HG}	–	-32	–	dB	High gain mode
	S_{12LG}	–	-6.3	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.2	–	dB	High gain mode
	NF_{LG}	–	6.3	–	dB	Low gain mode
Input return loss[2)]	S_{11HG}	–	-16	–	dB	50 Ω, high gain mode
	S_{11LG}	–	-12	–	dB	50 Ω, low gain mode
Output return loss[2)]	S_{22HG}	–	-14	–	dB	50 Ω, high gain mode
	S_{22LG}	–	-13	–	dB	50 Ω, low gain mode
Stability factor[3)]	k	–	>2.0	–		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	$IIP3_{HG}$ $IIP3_{LG}$	–	-2 9	–	dBm	High gain mode Low gain mode

1) Performance based on application circuit in Figure 3 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 1, 2, 4, 5, 6 and 10 Application Circuit Schematic

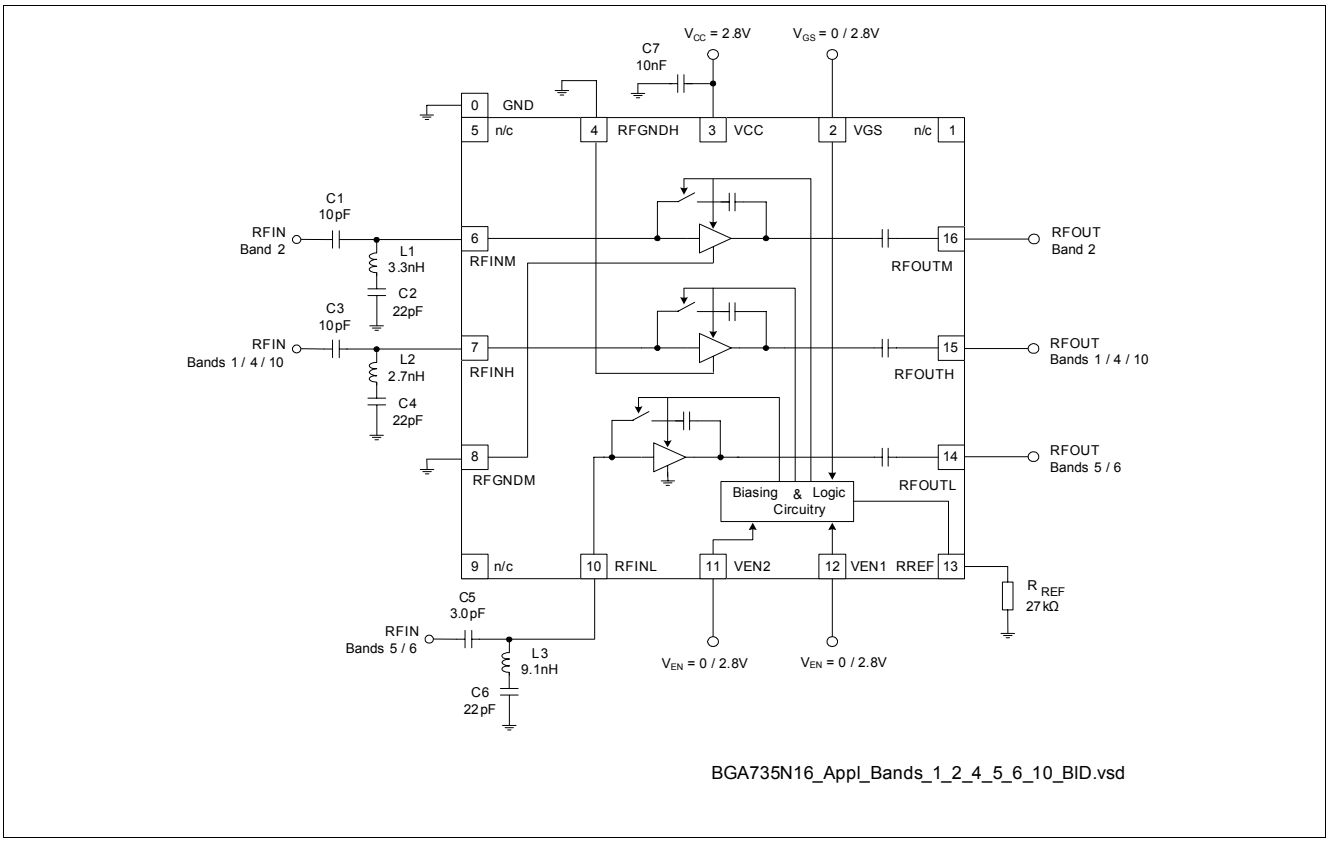


Figure 2 Application Circuit with Chip Outline (Top View)

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

Table 19 Bill of Materials

Part Number	Part Type	Manufacturer	Size	Comment
L1 ... L3	Chip inductor	Various	0402	Wirewound, Q ≈ 50
C1 ... C7	Chip capacitor	Various	0402	
R_{REF}	Chip resistor	Various	0402	

3.2 UMTS Bands 3, 7, 8, 9 and 38 Application Circuit Schematic

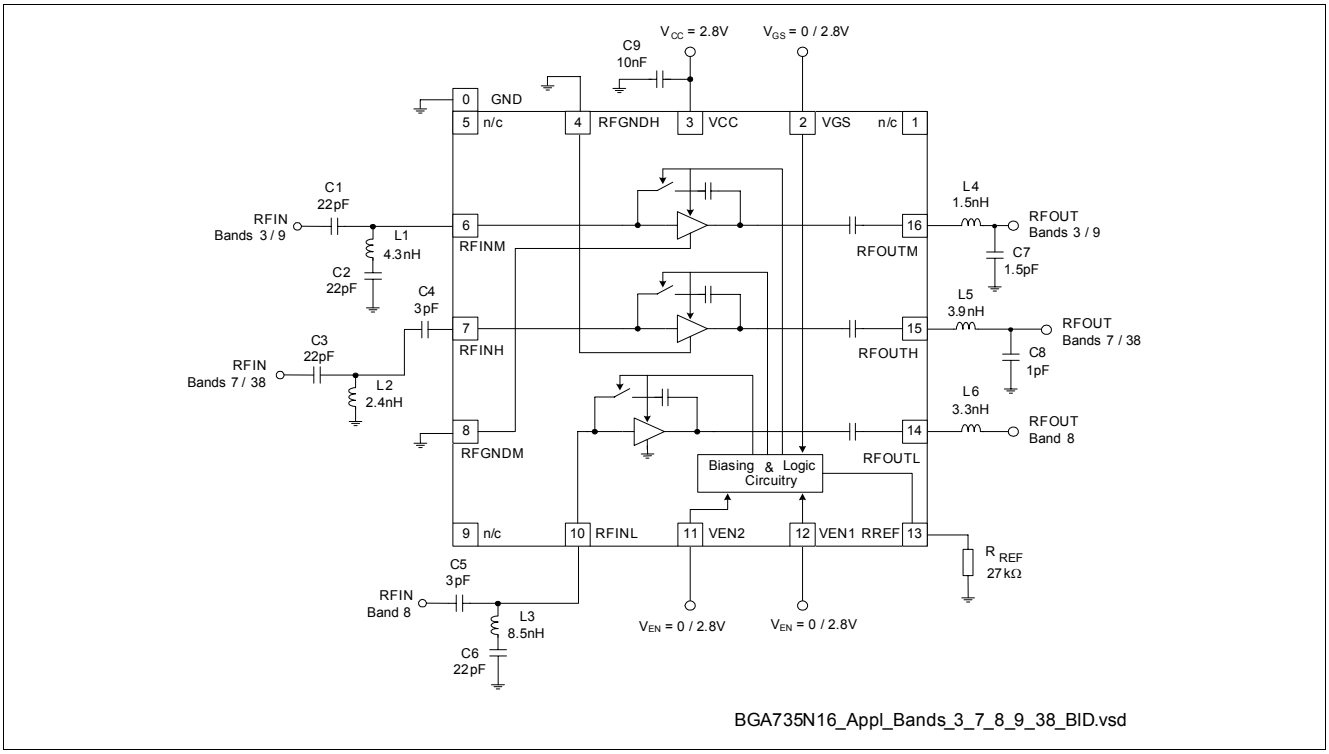


Figure 3 Application Circuit with Chip Outline (Top View)

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

Table 20 Bill of Materials

Part Number	Part Type	Manufacturer	Size	Comment
L1 ... L6	Chip inductor	Various	0402	Wirewound, Q ≈ 50
C1 ... C9	Chip capacitor	Various	0402	
R_{REF}	Chip resistor	Various	0402	

3.3 UMTS Bands 2, 12, 13, 14, 17 and 40 Application Circuit Schematic

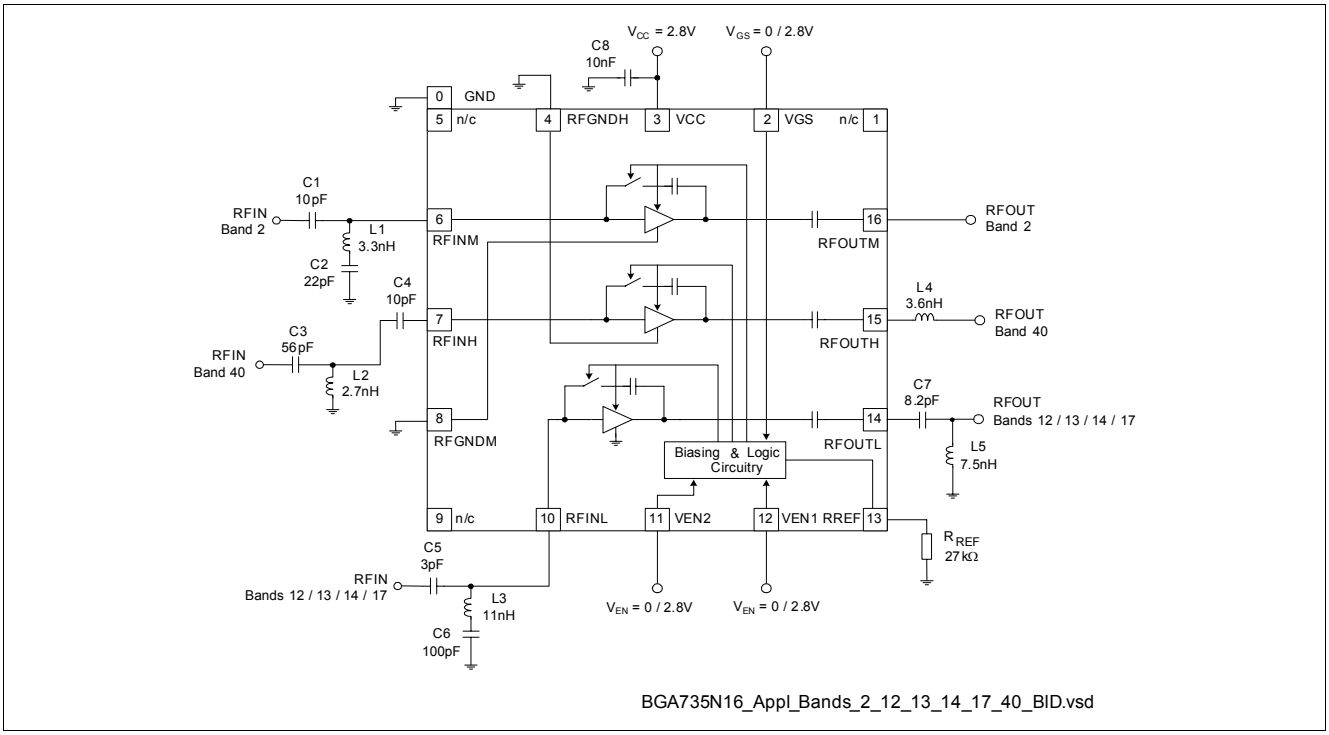


Figure 4 Application Circuit with Chip Outline (Top View)

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

Table 21 Bill of Materials

Part Number	Part Type	Manufacturer	Size	Comment
L1 ... L5	Chip inductor	Various	0402	Wirewound, Q ≈ 50
C1 ... C8	Chip capacitor	Various	0402	
R_{REF}	Chip resistor	Various	0402	

3.4 UMTS Bands 1, 2, 4, 10 and 20 Application Circuit Schematic

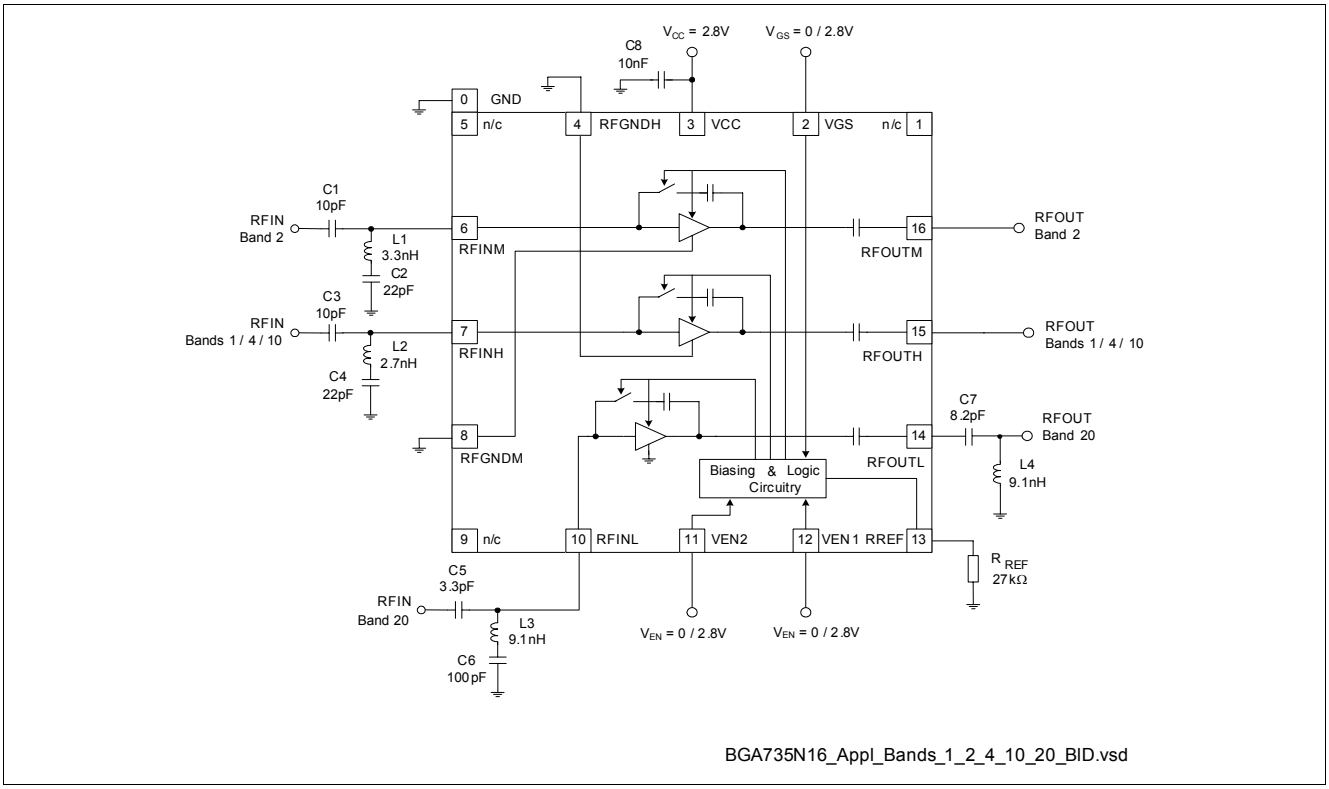


Figure 5 Application Circuit with Chip Outline (Top View)

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

Table 22 Bill of Materials

Part Number	Part Type	Manufacturer	Size	Comment
L1 ... L4	Chip inductor	Various	0402	Wirewound, Q ≈ 50
C1 ... C8	Chip capacitor	Various	0402	
R_{REF}	Chip resistor	Various	0402	

3.5 Pin Description

Table 23 Pin Definition and Function

Pin No.	Name	Pin Type	Buffer Type	Function
0	GND	–	–	Ground connection for low band LNA and control circuitry (package paddle)
1	n/c	–	–	Not connected
2	VGS	–	–	Gain step control
3	VCC	–	–	Supply voltage
4	RFGNDH	–	–	High band LNA emitter ground
5	n/c	–	–	Not connected
6	RFINM	–	–	Mid band LNA input
7	RFINH	–	–	High band LNA input
8	RFGNDM	–	–	Mid band LNA emitter ground
9	n/c	–	–	Not connected
10	RFINL	–	–	Low band LNA input
11	VEN2	–	–	Band select control
12	VEN1	–	–	Band select control
13	RREF	–	–	Bias current reference resistor (high gain mode)
14	RFOUTL	–	–	Low band output
15	RFOUTH	–	–	High band LNA output
16	RFOUTM	–	–	Mid band LNA output

3.6 Application Board

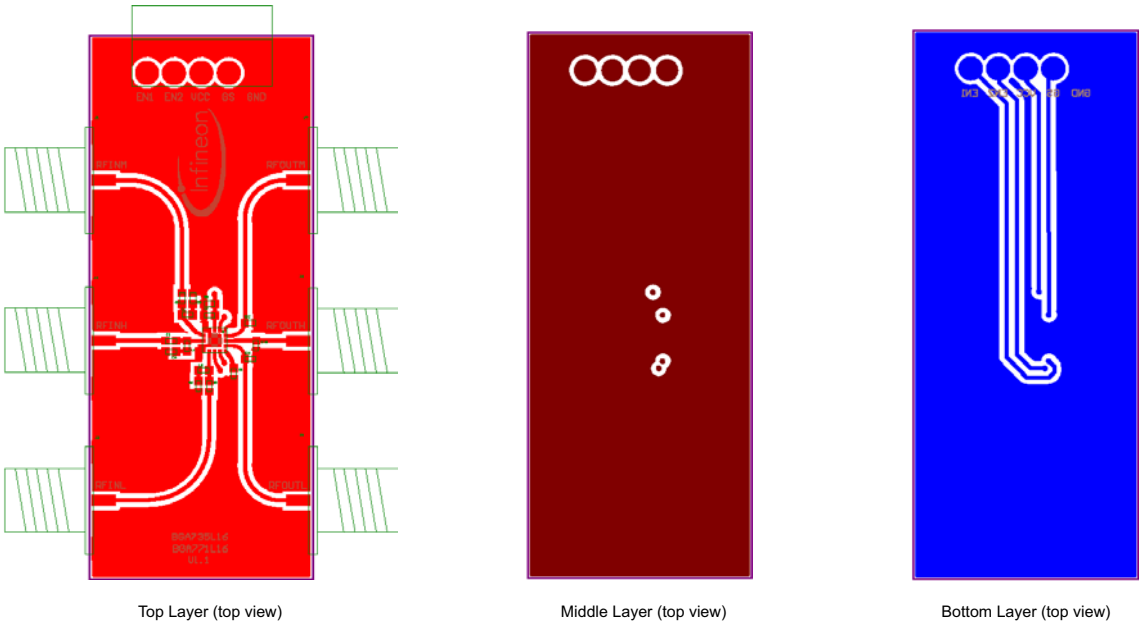


Figure 6 Application Board Layout on 3-layer FR4

Note: Top layer thickness: 0.2 mm, bottom layer thickness: 0.660 mm, 17 µm Cu metallization, gold plated. Board size: 21mm x 50 mm.

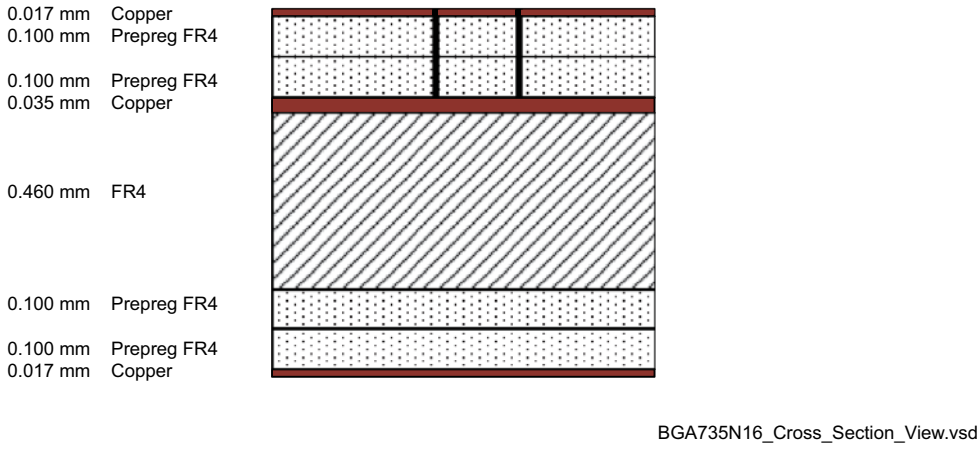


Figure 7 Cross-Section View of Application Board

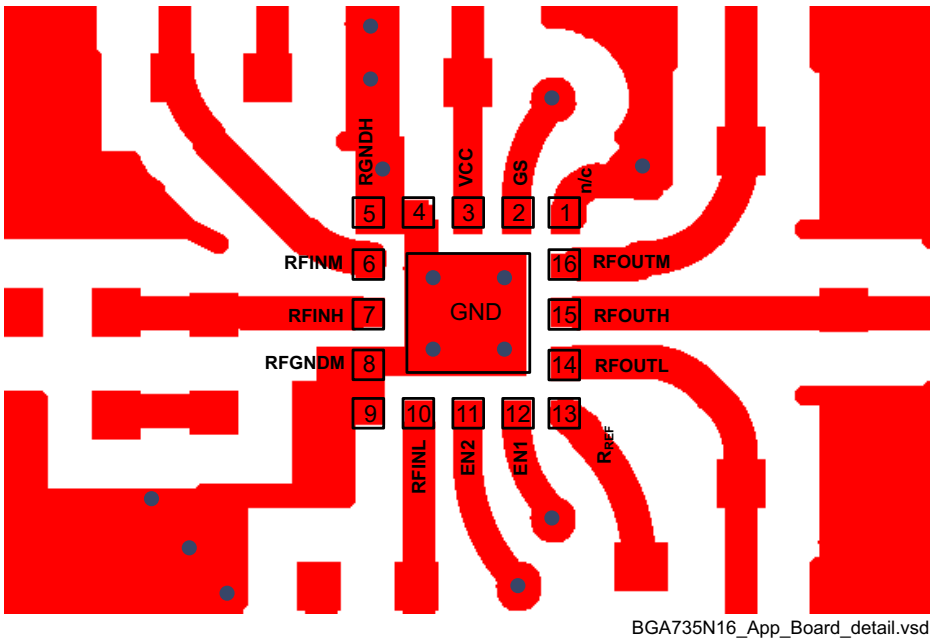


Figure 8 Detail of Application Board Layout

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

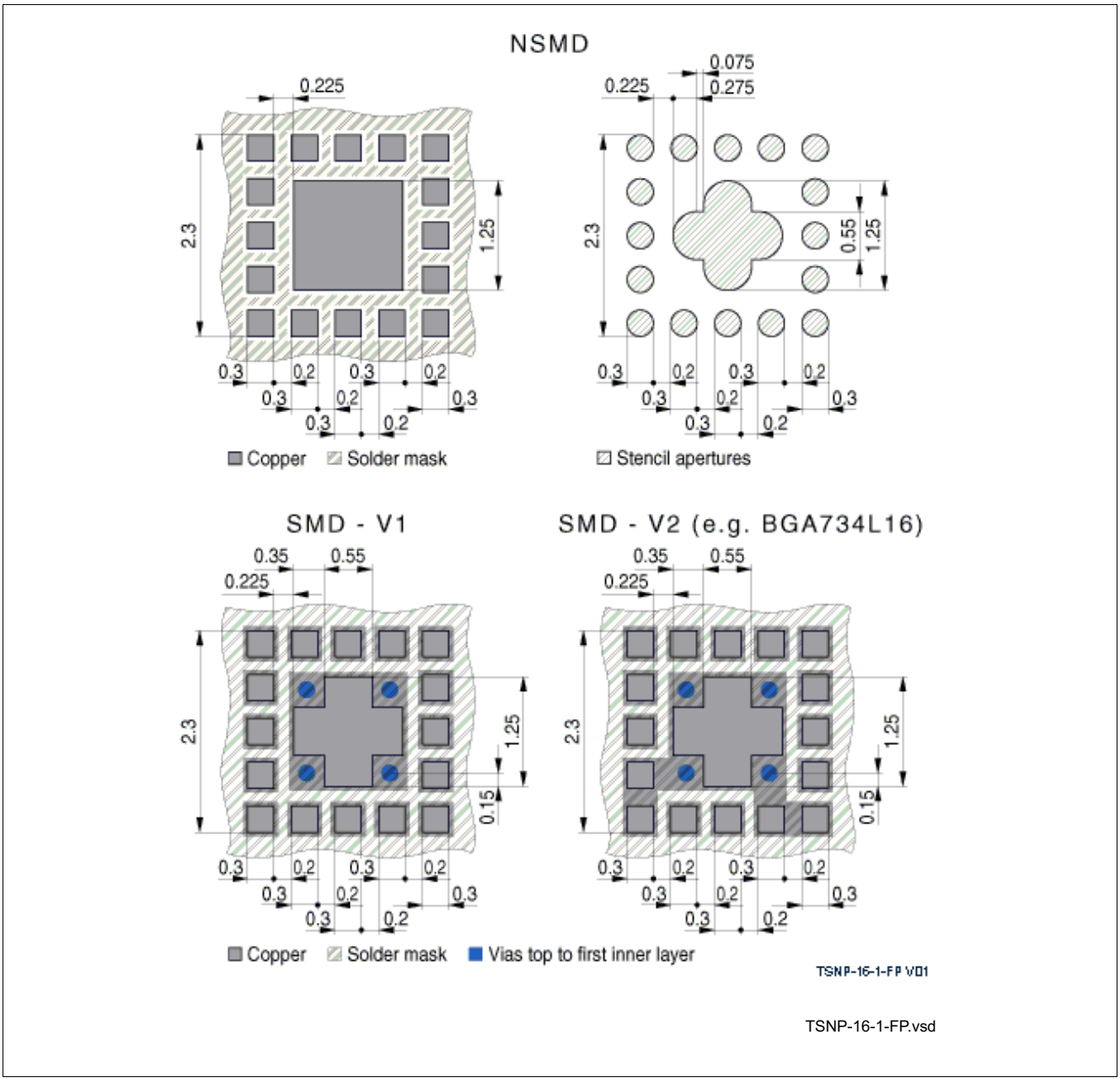


Figure 9 Recommended Footprint and Stencil Layout for the TSNP-16-1 Package

4.2 Package Dimensions

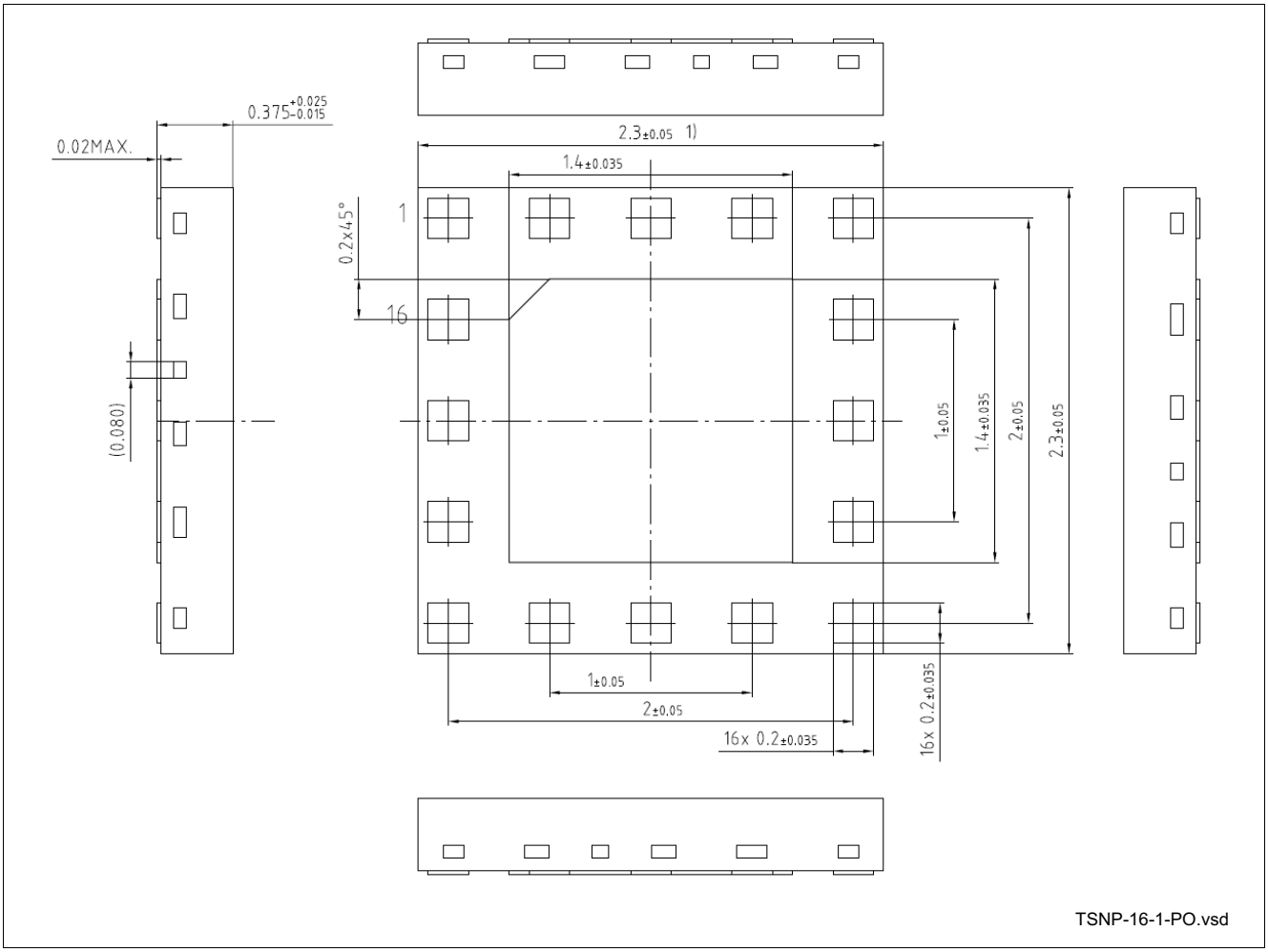


Figure 10 Package Outline (Top, Side and Bottom View)

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