

# BGM781N11

GPS Front-End Module

Small Signal Discretes



Never stop thinking

**Edition 2009-10-30**

**Published by  
Infineon Technologies AG  
81726 München, Germany**

**© Infineon Technologies AG 2009.  
All Rights Reserved.**

### **Legal Disclaimer**

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenhheitsgarantie"). With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

### **Information**

For further information on technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies Office ([www.infineon.com](http://www.infineon.com)).

### **Warnings**

Due to technical requirements components may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies Office.

Infineon Technologies Components may only be used in life-support devices or systems with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system, or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body, or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.

---

Oct. 2009

**Revision History: GPS Front-End Module, Rev.3.1**

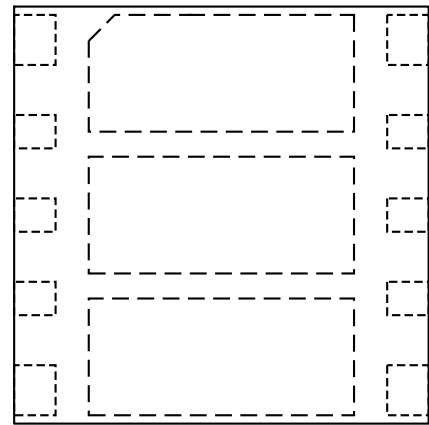
**Previous Version: 2009-09-08, Rev.3.0**

Page	Subjects (major changes since last revision)
8	Application changed from high-Q to low-Q externals, L1 and L2 values changed
4,7	typ. noise figure from 1.6dB to 1.7dB updated due to low-Q externals
6	Pin 6 and Pin 11 tied together for ESD capability HBM in Table 2
10	Updated package drawing in figure 5 from 0.20mm to 0.25mm minimum distance in package
6	Maximum RF input power updated in Table 2

# 1 GPS Front-End Module

## Features

- Operating frequency: 1575.42 MHz
- High Gain: 18.6 dB
- Low Noise Figure: 1.7 dB
- Low current consumption: 3.3 mA
- Out-of-band rejection in cellular bands: 80 dBc
- Input compression point in cellular bands: 20 dBm
- Supply voltage: 1.5 V to 3.6 V
- Tiny TSNP-11-2 leadless package
- RF input internally pre-matched to 50 Ω
- RF output internally matched to 50 Ω
- HBM ESD capability of all pins: 2 kV
- IEC ESD contact discharge of RF input pin: 8 kV
- Only 2 external SMD parts
- RoHS compliant package (Pb-free)

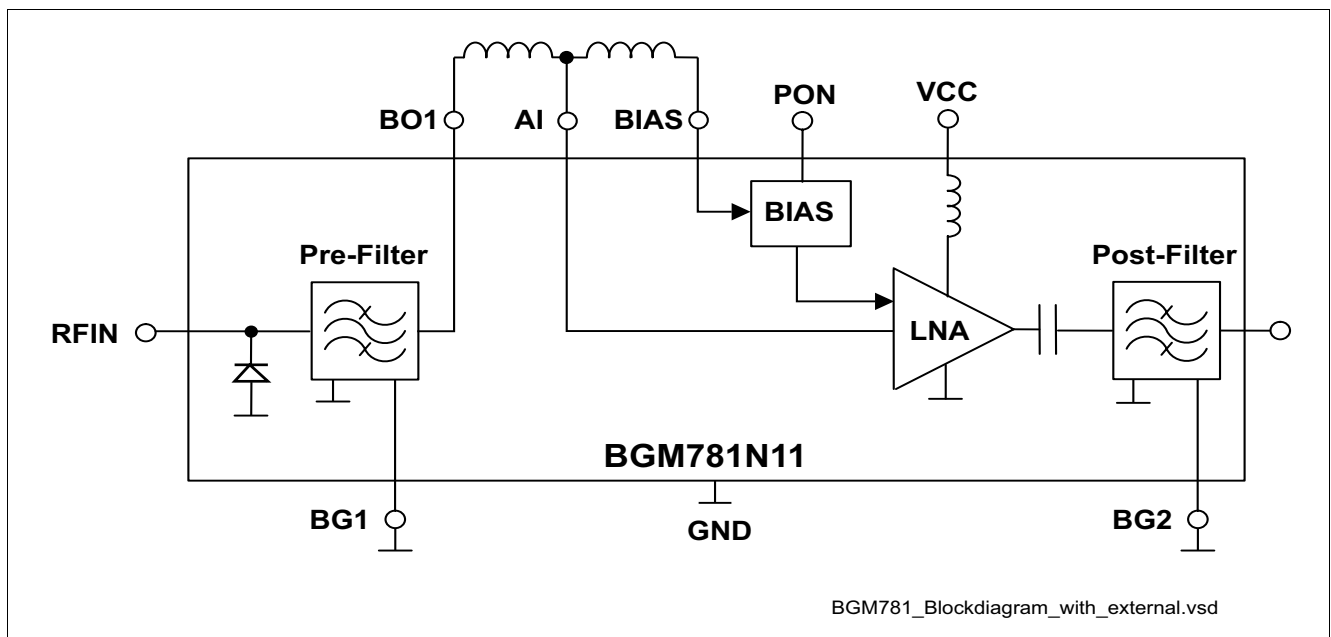


TSNP11-2.vsd

**TSNP-11-2 Package top view**  
(2.5 x 2.5 x 0.73 mm<sup>3</sup>)

## Application

- 1575.42 MHz GPS, Galileo, GPS phones, personal navigaton devices



BGM781\_Blockdiagram\_with\_external.vsd

**Figure 1** Blockdiagram with main external components

## 2 Description

The BGM781N11 is a combination of a low-insertion-loss pre-filter with Infineon's high performance low noise amplifier (LNA) and a high-attenuation post-filter for Global Positioning System (GPS) applications. Through the low insertion loss of the filters, the BGM781N11 provides 18.6 dB gain, 1.7 dB noise figure and high linearity performance. In addition BGM781N11 provides very high out-of-band attenuation in conjunction with a high input compression point. Its current consumption is as low as 3.3 mA. It operates over the 1.5 V to 3.6 V supply voltage range.

Type	Package	Marking
BGM781N11	TSNP-11-2	M781

### Pin Definition and Function

**Table 1 Pin Definition and Function**

Pin No.	Symbol	Function
1	BG2	Optional Output-Filter GND
2	PON	Power On/Off
3	VCC	Power Supply
4	n.c.	not used
5	RFIN	RF Input
6	BG1	Input-Filter GND
7	BO1	Input-Filter Output
8	AI	LNA Input
9	BIAS	BIAS
10	RFOUT	RF Output
11	GND	Package Middle Island

### Maximum Ratings

**Table 2 Maximum Ratings**

Parameter <sup>1)</sup>	Symbol	Value	Unit	Note / Test Condition
Voltage at pin BG2 to GND	$V_{BG2}$	-1...1	V	
Voltage at pin PON to GND	$V_{PON}$	-0.3...3.6	V	
Voltage at pin VCC to GND	$V_{CC}$	-0.3...3.6	V	
Voltage at pin RFIN to GND	$V_{RFIN}$	-3...3	V	
Voltage at pin BG1 to GND	$V_{BG1}$	-3...3	V	
Voltage at pin BO1 to GND	$V_{BO1}$	-3...3	V	
Voltage at pin AI to GND	$V_{AI}$	-0.3...0.9	V	
Voltage at pin BIAS to GND	$V_{BIAS}$	-0.3...0.9	V	
Voltage at pin RFOUT to GND	$V_{RFOUT}$	-3...3	V	
Current into pin VCC	$I_{VCC}$	25	mA	
RF input power inband	$P_{IN}$	3	dBm	Continuous wave signal $f = 1575.42$ MHz 50 ohm source and load impedances

**Table 2 Maximum Ratings (cont'd)**

Parameter <sup>1)</sup>	Symbol	Value	Unit	Note / Test Condition
RF input power out of band	$P_{IN,OOB}$	21		Continuous wave signal $f = 50 - 1460$ MHz and $1710 - 4000$ MHz 50 ohm source and load impedances
Total power dissipation	$P_{tot}$	90	mW	
Junction temperature	$T_J$	150	°C	
Ambient temperature range	$T_A$	-40... 85	°C	
Storage temperature range	$T_{STG}$	-65... 85	°C	
ESD capability HBM of all pins, with pin 6 and GND middle island pin 11 tied together	$V_{ESD1}$	2	kV	according to JESD22A-114
ESD contact discharge capability of RF input pin 5	$V_{ESD2}$	8	kV	according to IEC61000-4-2

1) All voltages refer pin-to-pin, unless otherwise specified.

### 3 Electrical Characteristics

**Table 3 Electrical Characteristics:  $T_A = 25\text{ °C}$ ,  $V_{CC} = 1.8\text{ V}$ ,  $V_{PON,ON} = 1.8\text{ V}$ ,  $V_{PON,OFF} = 0\text{ V}$ <sup>1)</sup>**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply Voltage	$V_{CC}$	1.5	1.8	3.6	V	
Supply Current	$I_{CC}$	-	3.3	-	mA	ON-Mode
		-	0.2	3	μA	OFF-Mode
Power On Control Voltage	$V_{pon}$	1.0	-	$V_{CC}$	V	ON-Mode
		0	-	0.4	V	OFF-Mode
Power On Control Current	$I_{pon}$	-	5	-	μA	ON-Mode
		-	-	1	μA	OFF-Mode
Power Gain Settling Time <sup>2)</sup>	$t_S$	-	5	-	μs	OFF- to ON-Mode
		-	5	-	μs	ON- to OFF-mode
<b>Passband Parameters @ <math>f = 1575.42\text{ MHz}</math></b>						
Insertion Power Gain	$ S_{21} ^2$	17.1	18.6	-	dB	
Noise Figure <sup>3)</sup>	$NF$	-	1.7	2.3	dB	$Z_S = 50\ \Omega$
Input Return Loss	$RL_{in}$	-	12	-	dB	
Output Return Loss	$RL_{out}$	-	15	-	dB	
Reverse Isolation	$1/ S_{12} ^2$	-	40	-	dB	
Inband Input 3rd Order Intercept Point	$IIP_3$	-	-7	-	dBm	$f_1 = 1575.42\text{ MHz}$ $f_2 = f_1 + 1\text{ MHz}$
Inband Input 1 dB Compression Point	$IP_{1dB}$	-	-15	-	dBm	$f_1 = 1575.42\text{ MHz}$
Out-of-band Input 1 dB Compression Point	$IP_{1dB\_900M}$	-	20	-		$f_1 = 900\text{ MHz}$
Out-of-band Input 1 dB Compression Point	$IP_{1dB\_1710M}$	-	20	-		$f_1 = 1710\text{ MHz}$
<b>Stopband Parameters</b>						
Rejection <sup>4)</sup>	$Rej_{900M}$	-	90	-	dBc	$f = 806\text{ MHz} - 928\text{ MHz}$
Rejection <sup>4)</sup>	$Rej_{1800M}$	-	80	-	dBc	$f = 1710\text{ MHz} - 1980\text{ MHz}$
Rejection <sup>4)</sup>	$Rej_{2400M}$	-	72	-	dBc	$f = 2400\text{ MHz} - 2500\text{ MHz}$
Stability	$k$	-	>1	-		$f = 20\text{ MHz} - 20\text{ GHz}$

1) Specification based on performance as measured on BGM781N11 application board shown in Figure 3 and including PCB losses (unless noted otherwise)

2) To be within 1 dB of the final gain OFF- to ON-mode; to be within 3 dB of the final gain ON- to OFF-mode

3) PCB and connector losses subtracted, verified on AQL base

4)  $Rejection = |(1/|S_{21}|^2 \text{ at stopband frequency})| + |(1/|S_{21}|^2 \text{ at } 1575.42\text{ MHz})|$

## 4 Application Information

### 4.1 Application Circuit

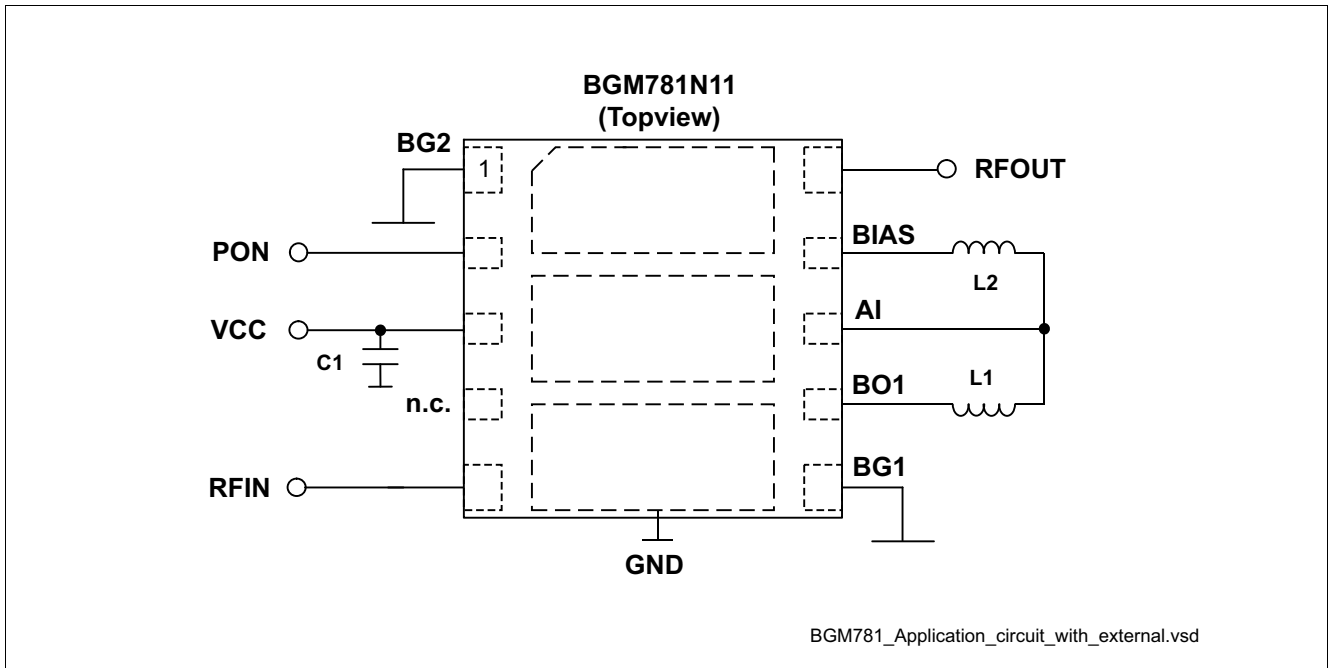


Figure 2 Application circuit with external components

Table 4 Bill of Materials

Name	Value	Package	Manufacturer	Function
C1	1 µF	0402	Various	Supply voltage filtering (optional)
L1	3.6 nH	0402	muRata LQG15HS	Input matching
L2	33 nH	0402	muRata LQG15HS	Bias
N1	BGM781N11	TSNP-11-2	Infineon	GPS FE Module



4.2 Application Board

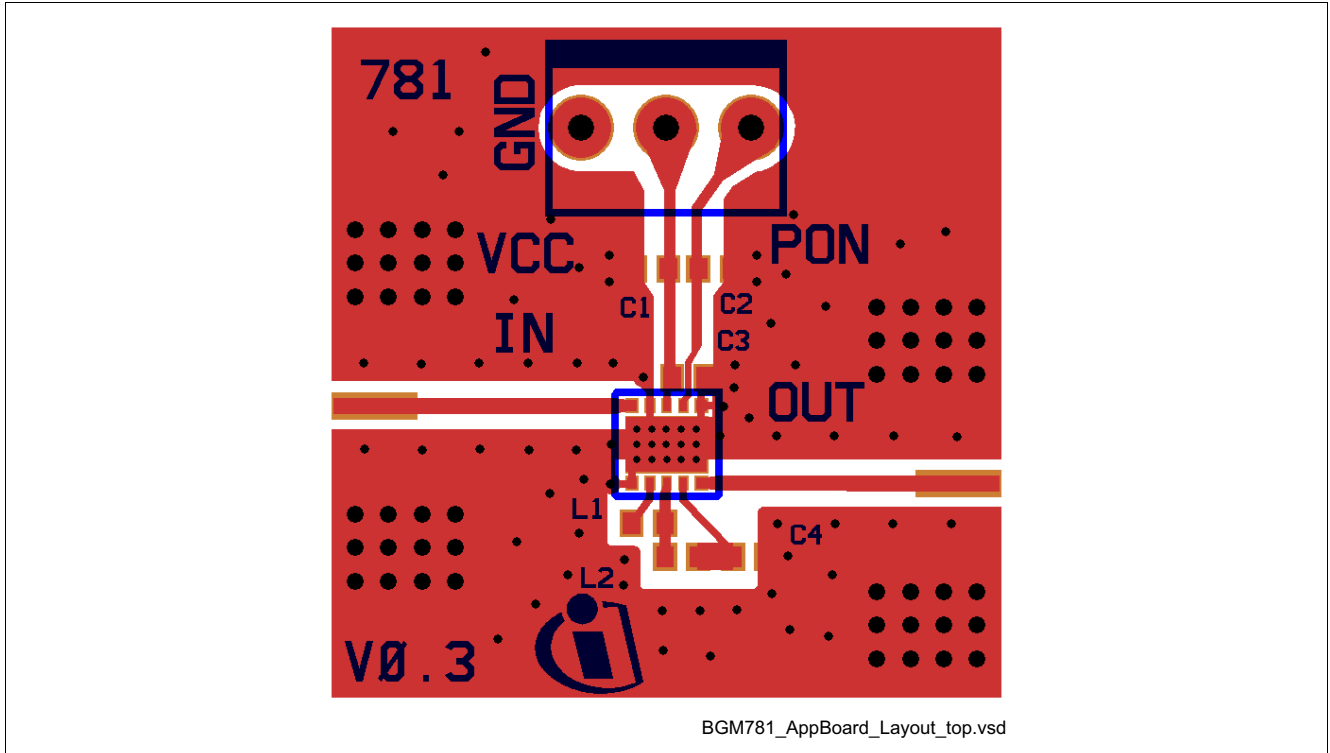


Figure 3 Top view of application board

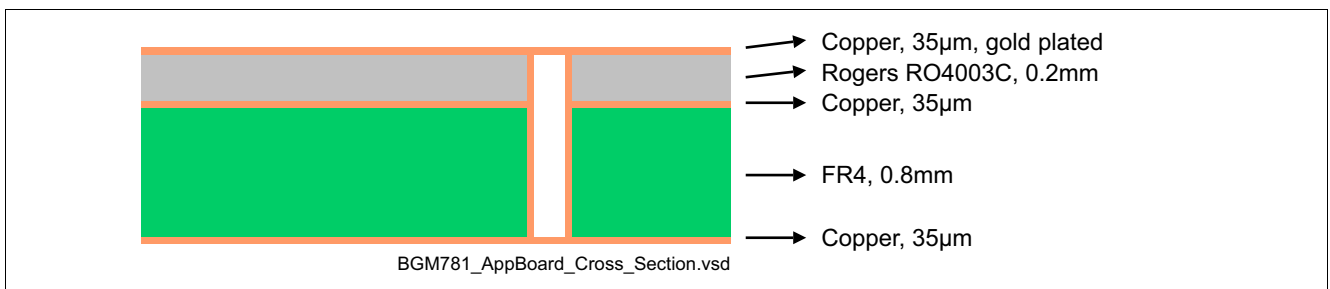


Figure 4 Cross section view of application board

## 5 Package Information

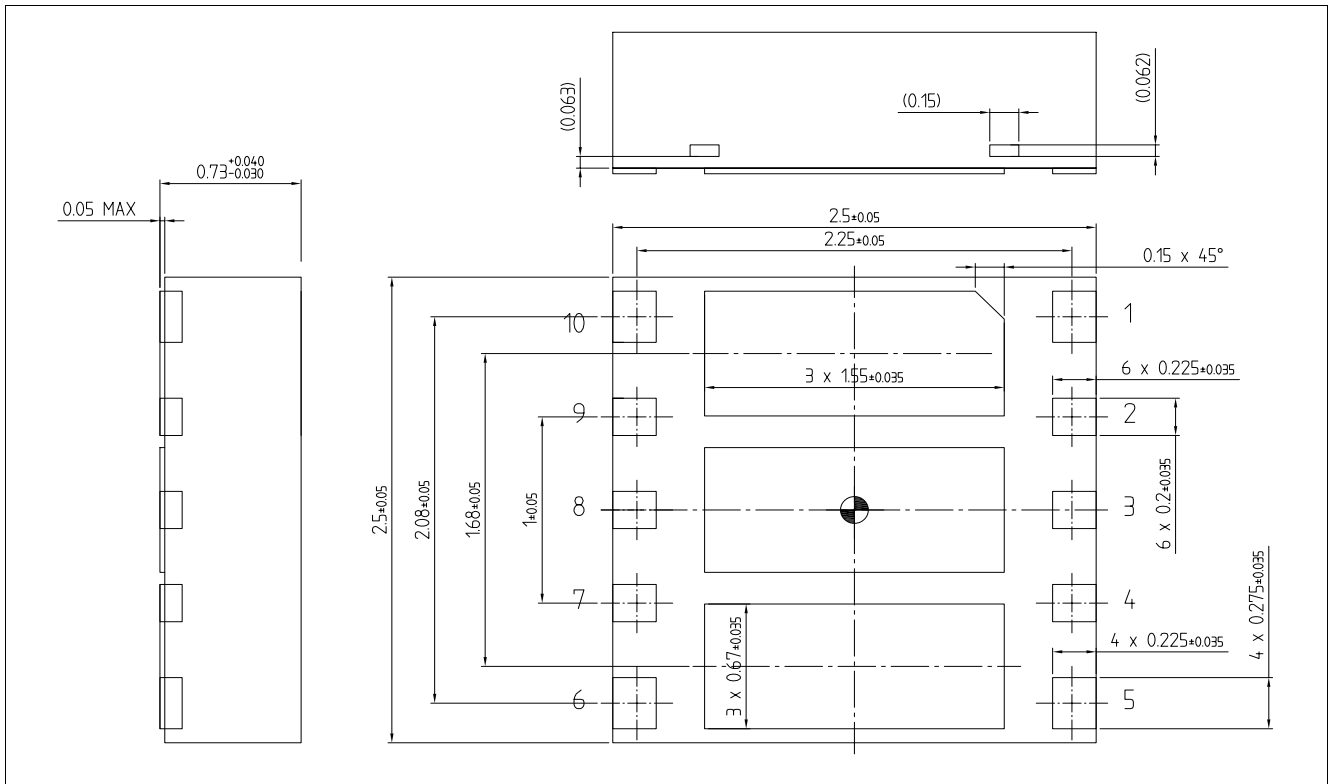


Figure 5 Side and bottom views of TSNP-11-2 package

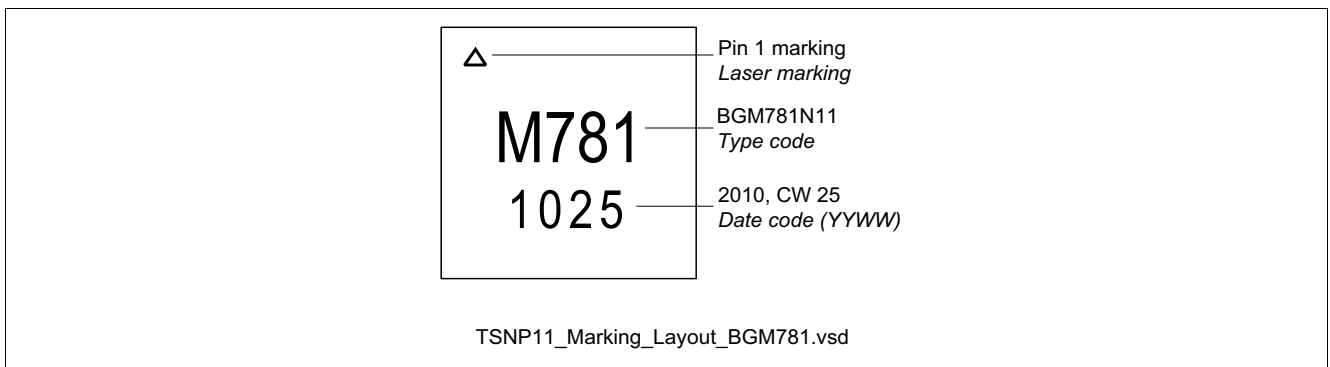


Figure 6 Marking layout

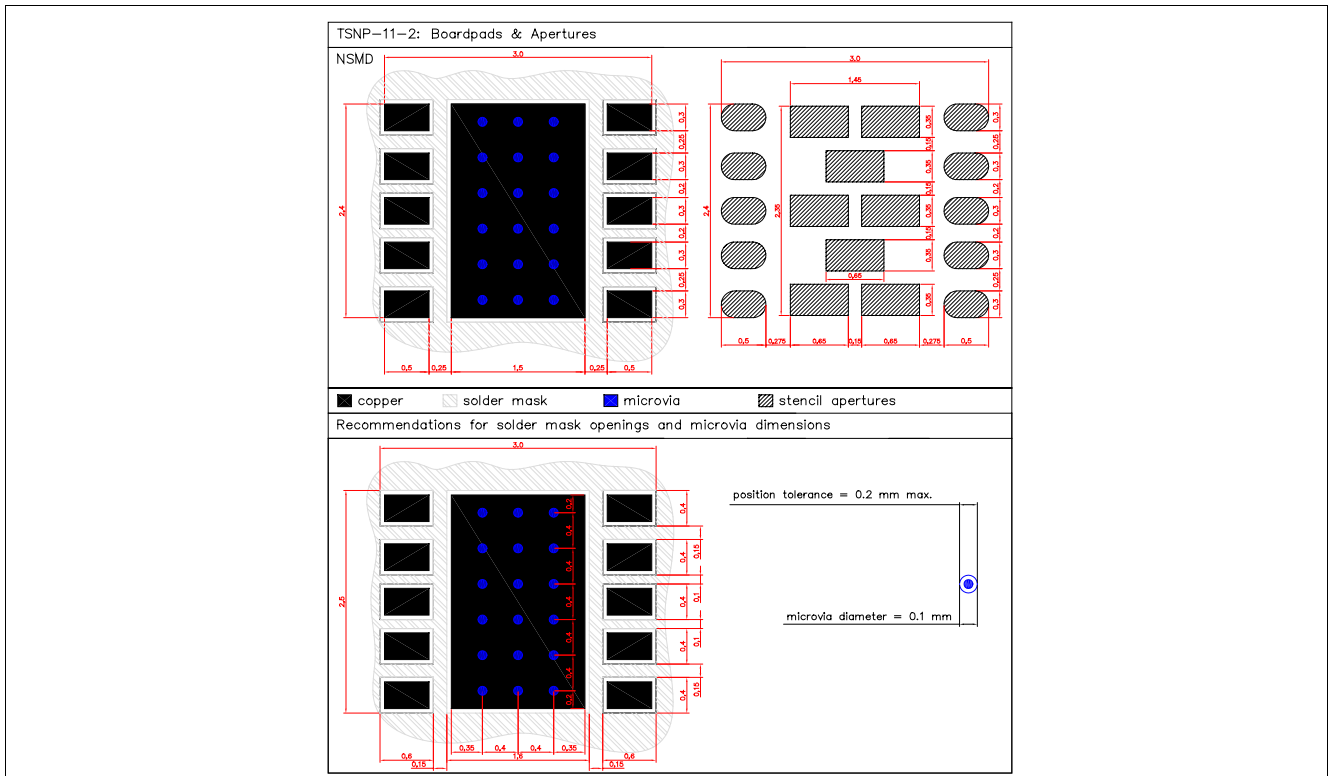


Figure 7 Recommended TSNP-11-2 footprint for optimum RF performance

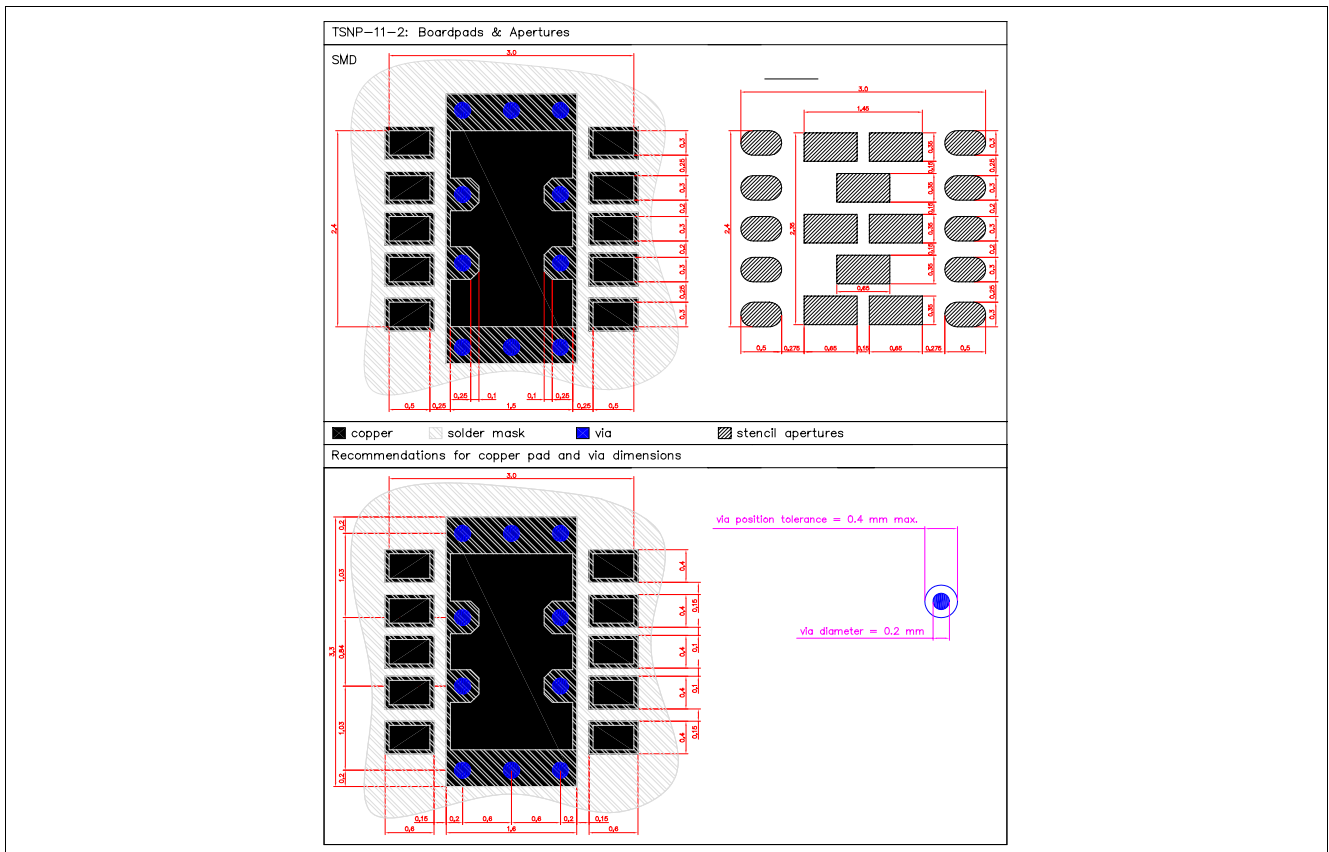


Figure 8 Alternative TSNP-11-2 footprint for low cost PCB designs

## 6 Packing Information

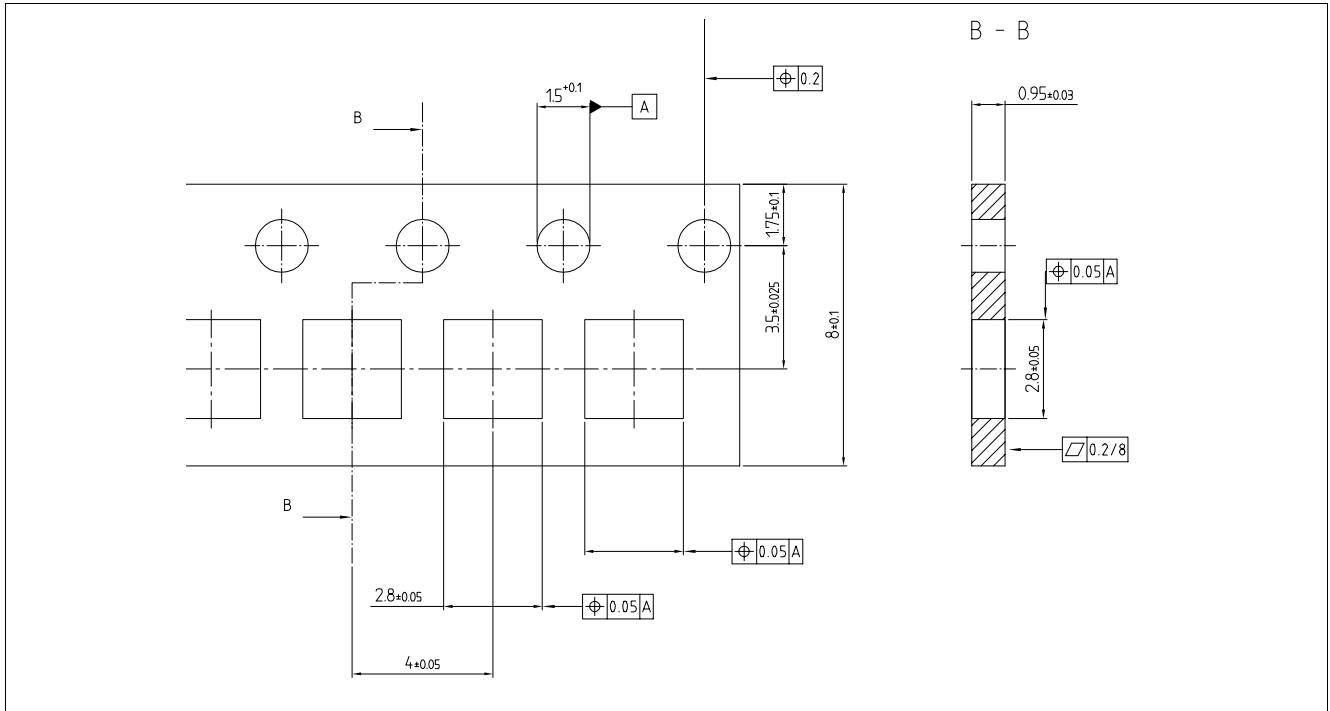


Figure 9 TSNP-11-2 carrier tape

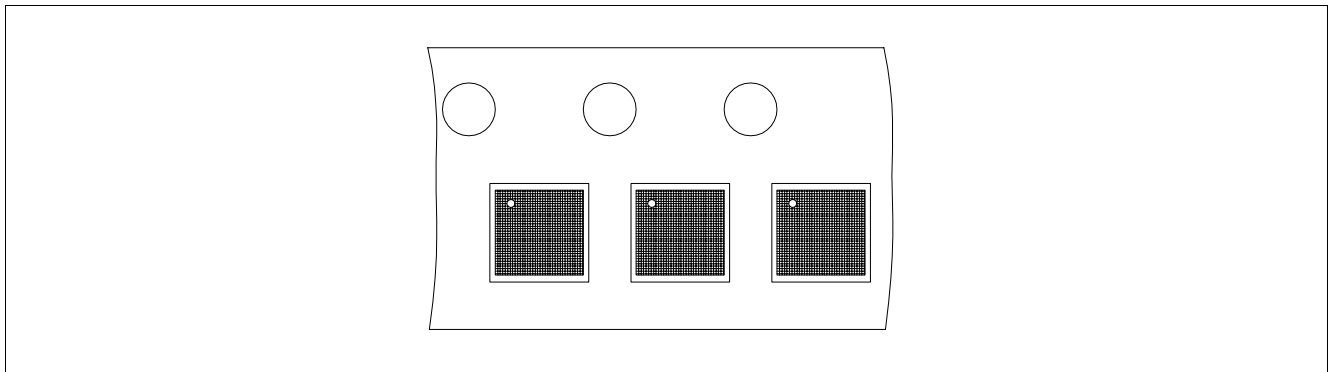


Figure 10 TSNP-11-2 pin 1 orientation in tape