BGM681L11

GPS Front-End with high Out-of-Band Attenuation

Small Signal Discretes

Infineon

Never stop thinking

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Oct. 2008

**Revision History: GPS Front-End with high Out-of-Band Attenuation, Rev.2.2**

Previous Version: 2008-10-02, Rev. 2.1

Page	Subjects (major changes since last revision)
4	Updated Figure 1
8	Updated Figure 2
7	Updated Footnote 3)
7	Updated Gain Switch Control Voltage Max. value
5	Updated Product Description

1   GPS Front-End with high Out-of-Band Attenuation

Features

- Operating frequency: 1575.42 +/- 10 MHz
- High Gain: 17.5 dB
- Low Noise Figure: 1.9 dB
- Power down function
- Input compression point in GSM bands: 24 dBm
- Input compression point in WLAN bands: 24 dBm
- Supply voltage: 2.4 V to 3.6 V
- Tiny TSLP-11-1 leadless package
- RF internally pre-matched
- RF output internally matched to 50 Ω
- RF input to antenna has 1 kV HBM ESD protection
- Minimum need of only 5 external SMD parts
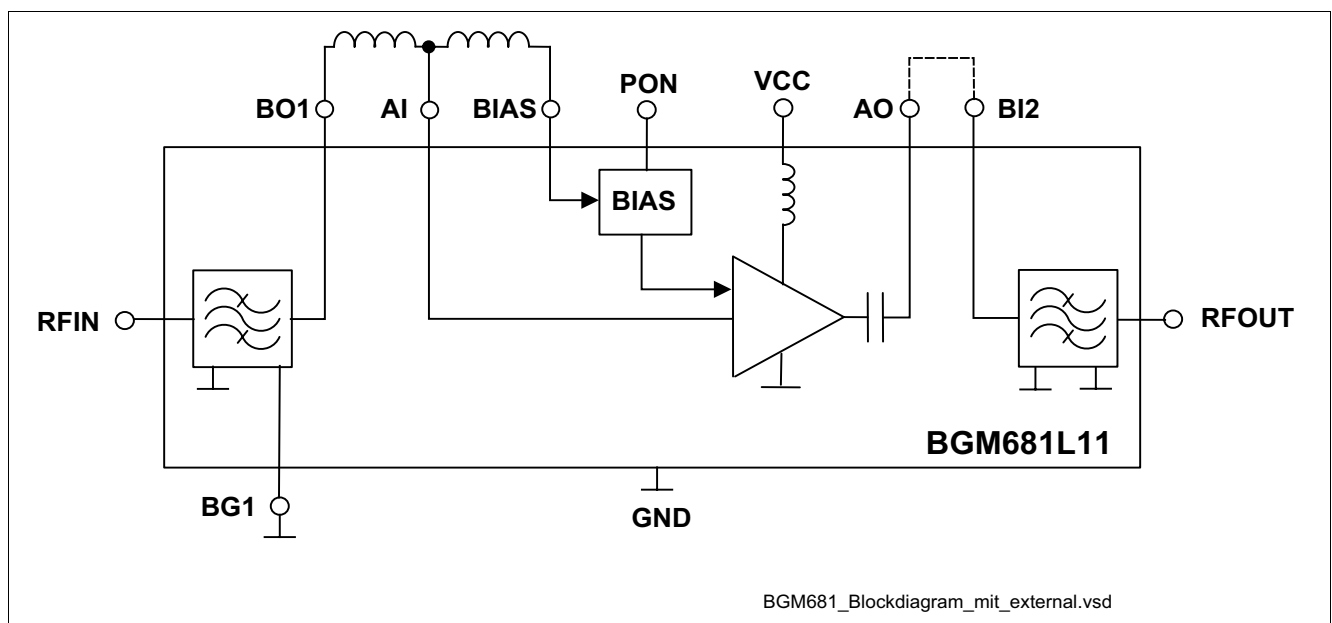- Attenuation in GSM & UMTS bands > 50 dB
- RoHS compliant package

Application
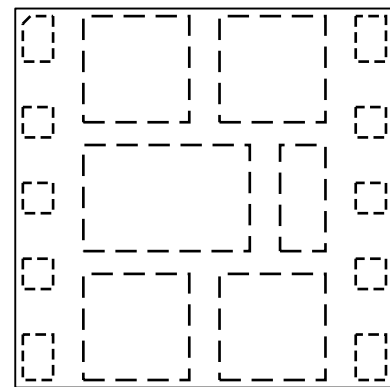
- 1575.42 MHz GPS

TSLP-11 Topview

TSLP11_v2.vsd

TSLP-11-1 Topview
(2.5 x 2.5 x 0.6 mm³)

RoHS ✓

BGM681_Blockdiagram_mit_external.vsd

Figure 1   Blockdiagram with main external SMDs

2 Description

The BGM681L11 is a combination of a low-insertion-loss input filter with Infineon's high performance low noise amplifier BGA615L7 and a high-attenuation output filter for Global Positioning System (GPS) applications. Through the low insertion loss of the filters, the BGM681L11 provides 17.5 dB gain, 1.9 dB noise figure and high linearity performance. In addition BGM681 provides very high out-of-band attenuation in conjunction with a high input compression point. Its current consumption is as low as 5.6 mA. It operates over the 2.4 V to 3.6 V supply voltage range.

Type	Package	Marking
BGM681L11	TSLP-11-1	M681

Pin Definition and Function

Table 1   Pin Definition and Function

Pin No.	Symbol	Function
1	BI2	Output-Filter Input
2	PON	Power On
3	VCC	Power Supply
4	AO	LNA Output
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[1]	Symbol	Value	Unit
Voltage at pin BI2 to GND	V_{BI2}	-10...10	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 AO to GND	V_{AO}	$-0.3...V_{CC} + 0.3$	V
Voltage at pin RFIN to GND	V_{RFIN}	-10...10	V
Voltage at pin BG1 to GND	V_{BG1}	-10...10	V
Voltage at pin B01 to GND	V_{BO1}	-10...10	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}	-10...10	V
Current into pin VCC	I_{VCC}	25	mA
RF input power @ 1575 MHz	P_{IN}	10	dBm
Total power dissipation	P_{tot}	90	mW

Table 2   Maximum Ratings (cont'd)

Parameter[1]	Symbol	Value	Unit
Junction temperature	T_J	150	°C
Ambient temperature range	T_A	-30... 85	°C
Storage temperature range	T_{STG}	-65... 150	°C
ESD capability (HBM: JESD22A-114) of all pins except pins 6, 7 and 10	V_{ESD1}	1000	V
ESD capability (HBM: JESD22A-114) of pins 7 and 10, with pin 6 and GND Middle Island pin 11 tied together	V_{ESD2}	500	V

1) All voltages refer pin-to-pin.

3 Electrical Characteristics

For out of band P 1dB Compression Point and IP3, please refer to Infineon Application Note AN162

Table 3 Electrical Characteristics: T_A = 25 °C, V_{CC} = 2.8 V, $V_{PON,ON}$ = 2.8 V, $V_{PON,OFF}$ = 0 V[1]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply Voltage	V_{CC}	2.4	2.8	3.6	V	
Supply Current	I_{CC}	-	5.6	6.3	mA	ON-Mode
		-	0.2	3	µA	OFF-Mode
Gain Switch Control Voltage	V_{pon}	2.1	-	3.6	V	ON-Mode
		0	-	0.5	V	OFF-Mode
Gain Switch Control Current	I_{pon}	-	1.5	3.0	µA	ON-Mode
		-	0	1	µA	OFF-Mode
Power Gain settling time[2]	t_S	-	5	-	µs	OFF- to ON-Mode
		-	5	-	µs	ON- to OFF-mode
Passband Parameters @ f = 1575.42 MHz						
Insertion Power Gain	$|S_{21}|^2$	15	17.5	19	dB	High-Gain Mode
Noise Figure[3]	NF	-	1.9	-	dB	Z_S = 50 Ω
Input Return Loss	RL_{in}	-	10	-	dB	
Output Return Loss	RL_{out}	-	10	-	dB	
Reverse Isolation	$1/|S_{12}|^2$	-	25	-	dB	
Inband Input 3rd Order Intercept Point	IIP_3	-	-3	-	dBm	f_1 = 1575 MHz, $f_2 = f_1$ +/- 1 MHz
Inband Input 1 dB compression point	IP_{1dB}	-	-10	-	dBm	f = 1575 MHz
Stopband Parameters						
Attenuation[4]	$Attn_{900M}$	-	60	-	dB	f = 806 MHz - 928 MHz
Attenuation[4]	$Attn_{1800M}$	-	50	-	dB	f = 1710 MHz - 1980 MHz
Attenuation[4]	$Attn_{2400M}$	-	40	-	dB	f = 2400 MHz - 2500 MHz
Attenuation[4]	$Attn_{>2500M}$	-	30	-	dB	f = 2500 MHz - 6000 MHz
Stability	k	-	>1	-		f = 10 MHz - 10 GHz

1) Measured on BGM681L11 application board including PCB losses (unless noted otherwise)
2) Within 1 dB of the final gain
3) PCB losses subtracted, verified on AQL base
4) Due to high in-band to out-of-band dynamic range, the out-of-band attenuation value depends strongly on the grounding of the PCB
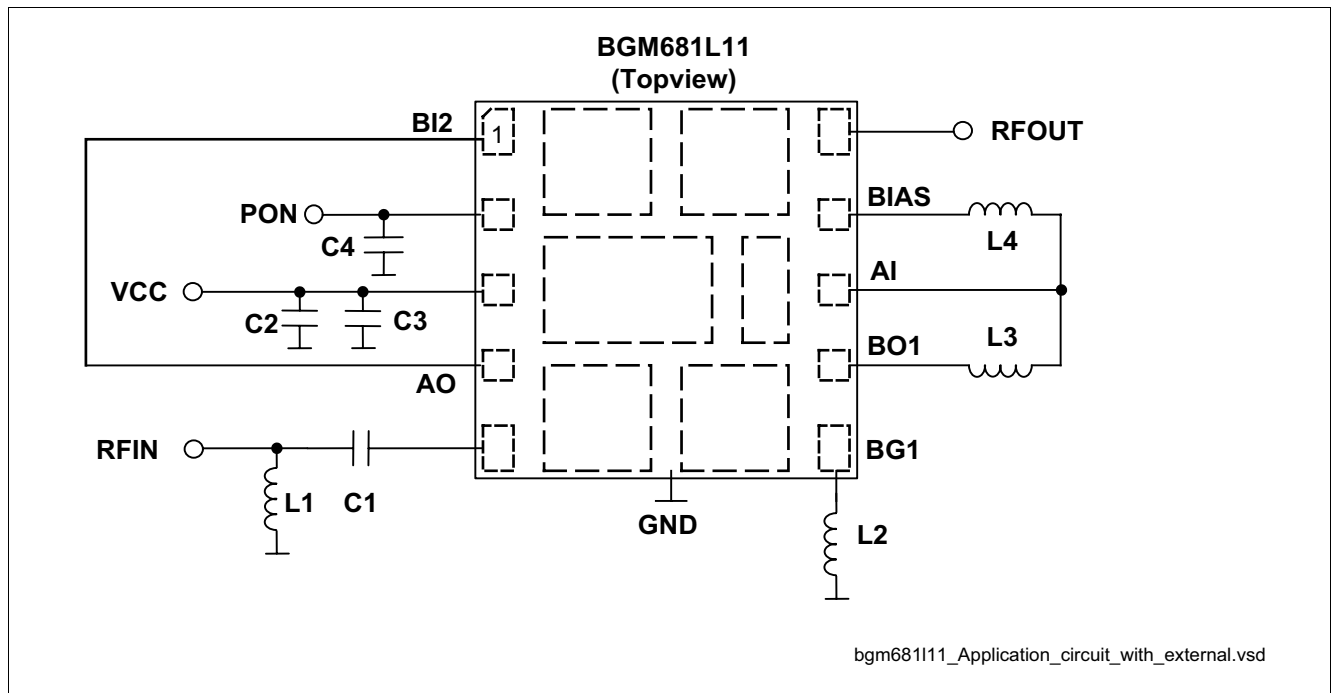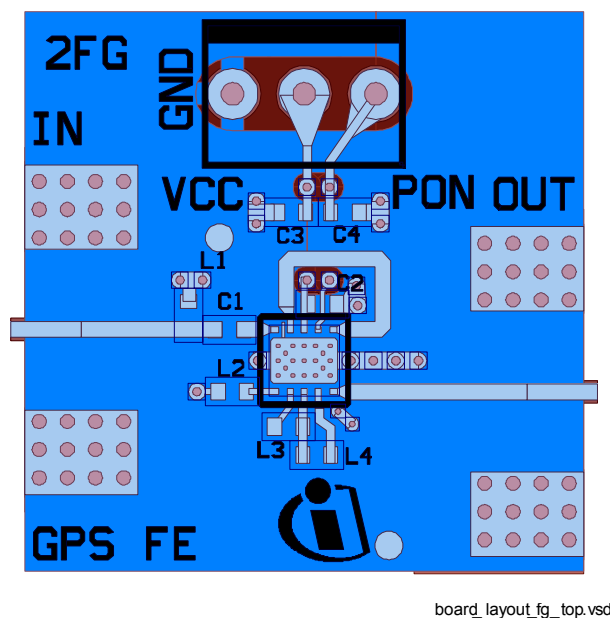
4 Application Information

4.1 Application Circuit

Figure 2 **Application Circuit with external components**

Table 4 **Bill of Materials**

Name	Value	Package	Manufacturer	Function
C1	2.2 pF	0402	Various	Input matching
C2	2.2 nF	0402	Various	Supply voltage filtering (optional)
C3	100 pF	0402	Various	Supply voltage filtering
C4	10 pF	0402	Various	Control voltage filtering
L1	4.7 nH	0402	muRata LQW15A	Input matching / ESD protection
L2	3.3 nH	0402	muRata LQW15A	Attenuation and Linearity improvement at 1710 - 1980 MHz (optional)
L3	2.9 nH	0402	muRata LQW15A	Input matching
L4	68 nH	0402	muRata LQW15A	Bias
N1	BGM681L11	TSLP-11-1	Infineon	GPS FE System

4.2 Application Board

board_layout_fg_top.vsd
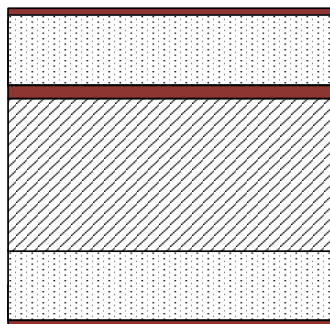
Figure 3   Top View of Application board

0.017 mm   Copper
0.200 mm   Prepreg FR4
0.035 mm   Copper

0.460 mm   FR4

0.200 mm   Prepreg FR4
0.017 mm   Copper

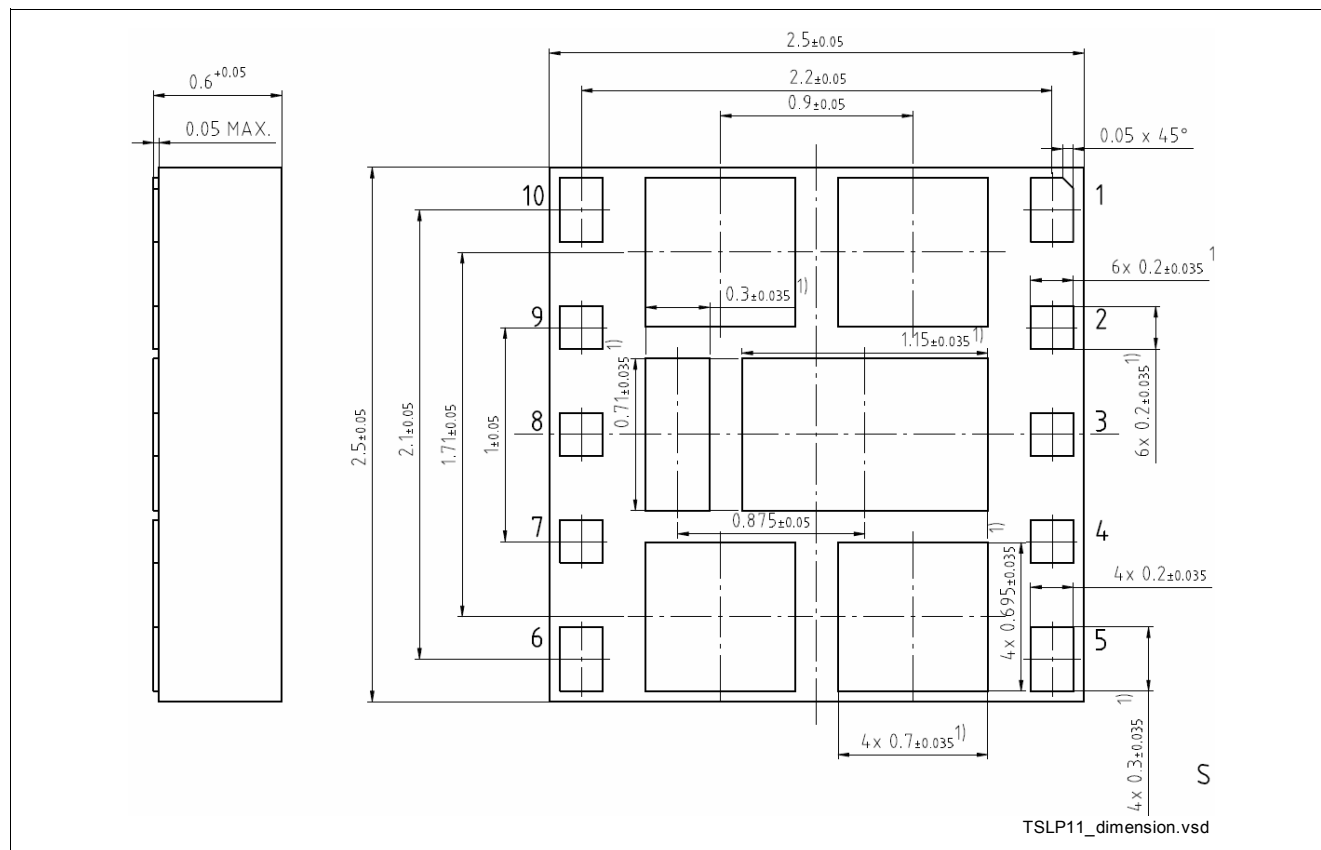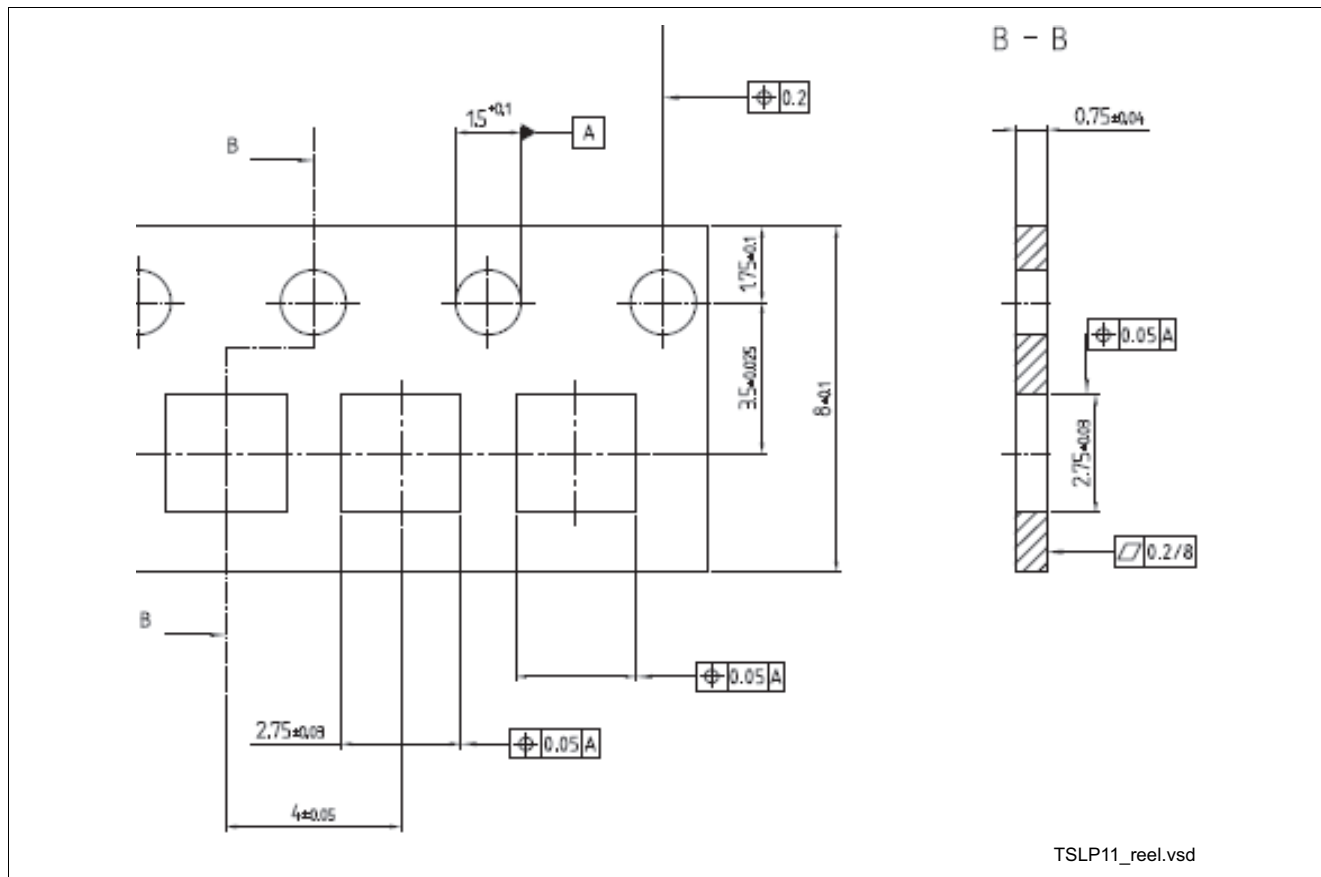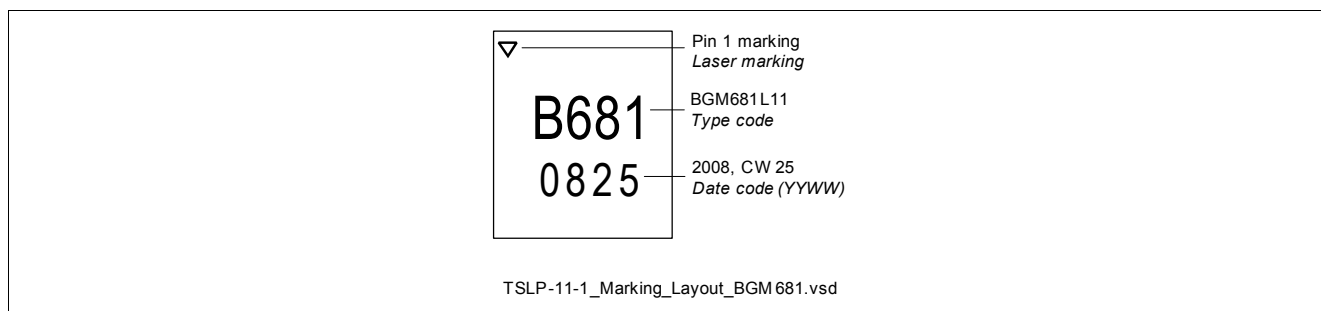**Figure 4   Cross section View of Application board**

5 Package Information

Figure 5   TSLP-11-1 Side View and Bottom View

Figure 6   TSLP-11-1 tape

Figure 7   Marking Layout