

# BGA728L7

Broadband Low Noise Amplifier for Portable and Mobile TV Applications

Small Signal Discretes



Never stop thinking

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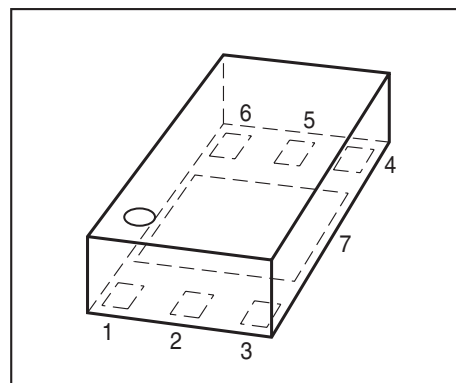
**BGA728L7****Revision History: 2009-01-20, Rev. 2.0****Previous Version: 2008-09-25, Rev. 1.2**

Page	Subjects (major changes since last revision)
All	Status changed from preliminary to final data sheet

# 1 Broadband Low Noise Amplifier for Portable and Mobile TV Applications

## Features

- High gain mode: 15.75 dB gain
- Low gain mode: -5.2 dB gain
- Noise figure: 1.3 / 5.5 dB in high / low gain mode
- Power off function
- Operating frequency: 100 ~ 1700 MHz
- Supply voltage: 1.5 V to 3.6 V
- Small leadless TSLP-7-1 package (2.0 x 1.3 x 0.4 mm<sup>3</sup>)
- Output internally matched to 50  $\Omega$
- Input pre-matched to 50  $\Omega$
- Low external component count
- Integrated ESD protection (1 kV HBM)
- Moisture sensitivity level: MSL 1
- Pb-free (RoHS compliant) package



TSLP-7-1



## Applications

- Portable and mobile TV in VHFIII-, UHF- and L-bands
- ISM applications in 100... 1700 MHz
- RKE applications

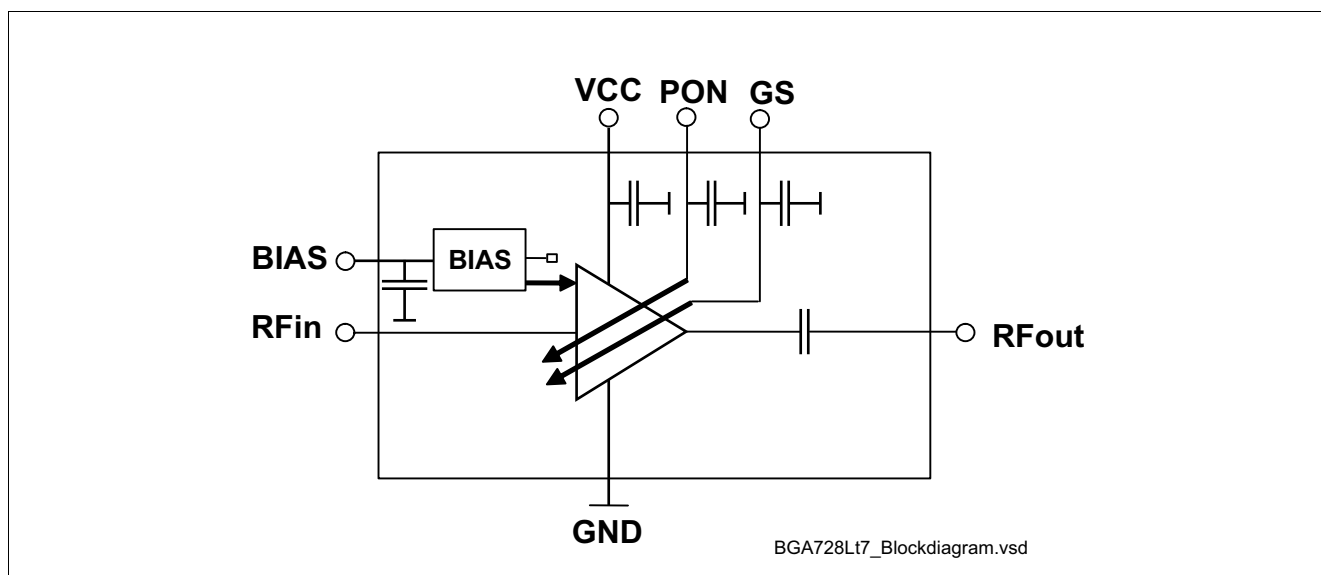


Figure 1 Block diagram

## 2 Description

The BGA728L7 is a low power low noise amplifier (LNA) MMIC for portable and mobile TV applications in the VHFIII-, UHF- and L-Bands. The low gain mode with much higher linearity enables this LNA to work with much lower current consumption than commonly used TV LNAs. The LNA is based upon Infineon Technologies cost effective B7HFM Silicon Germanium technology and comes into a low profile TSLP-7-1 leadless green package. This document specifies the electrical parameters, pin-out, application circuit and packaging of the chip.

Type	Package	Marking
BGA728L7	TSLP-7-1	AP

### Pin Definition and Function

**Table 1 Pin Definition and Function**

Pin No.	Symbol	Function
1	GS	High-gain / Low-gain control
2	RFin	RF input
3	BIAS	Bias voltage
4	PON	Power on / off control
5	RFout	RF output
6	VCC	Supply voltage
7	GND	DC/RF ground

### Maximum Ratings

**Table 2 Maximum Ratings**

Parameter <sup>1)</sup>	Symbol	Value	Unit
Voltage at pin VCC	$V_{CC}$	-0.3... 3.6	V
Voltage at pin RF_IN	$V_{RFIN}$	-0.3... 0.9	V
Voltage at pin RF_OUT	$V_{RFOUT}$	-0.3... $V_{CC} + 0.3$	V
Voltage at pin PON	$V_{PON}$	-0.3... $V_{CC} + 0.3$	V
Current into pin VCC	$I_{CC}$	20	mA
RF input power	$P_{IN}$	10	dBm
Total power dissipation	$P_{tot}$	72	mW
Junction temperature	$T_J$	150	°C
Ambient temperature range	$T_A$	-40... 85	°C
Storage temperature range	$T_{STG}$	-65... 150	°C
ESD integrity HBM <sup>2)</sup>	$V_{ESD}$	1	kV

1) All voltages refer to GND-Node.

2) According to JESD22-A114

## Thermal resistance

**Table 3 Thermal resistance**

Parameter	Symbol	Value	Unit
Junction - soldering point <sup>1)</sup>	$R_{thJS}$	240	K/W

1) For calculation of  $R_{thJA}$  please refer to Application Note Thermal Resistance

## 3 Electrical Characteristics

**Table 4 DC Characteristics:  $T_A = 25\text{ °C}$  ;  $V_{CC} = 2.8\text{ V}$ , unless otherwise stated; no RF input signal**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	$V_{CC}$	1.5		3.6	V	
Supply current high gain mode	$I_{CCHG}$		5.85		mA	
Supply current low gain mode	$I_{CCLG}$		0.55		mA	
Supply current at shutdown	$I_{OFF}$			5	μA	
Logic levels PON pin	$V_{PON}$	1.5		3.3	V	High
		0		0.4	V	Low
Current into PON pin	$I_{PON}$		25		μA	$V_{PON} = \text{High}, V_{GS} = \text{Low}$
			35		μA	$V_{PON} = \text{High}, V_{GS} = \text{High}$
			5		μA	$V_{PON} = \text{Low}, V_{GS} = \text{High}$
				2	μA	$V_{PON} = \text{Low}, V_{GS} = \text{Low}$
Logic levels GS pin	$V_{GS}$	1.5		3.3	V	High
		0		0.4	V	Low
Current into GS pin	$I_{GS}$		35		μA	$V_{GS} = \text{High}$
				2	μA	$V_{GS} = \text{Low}$

## Electrical Characteristics

**Table 5** Typical RF Characteristics<sup>1)</sup> High-Gain Mode:  $T_A = 25\text{ °C}$ ,  $V_{CC} = 2.8\text{ V}$ ,  $V_{PON} = 2.8\text{ V}$ ,  $V_{GS} = 0\text{ V}$ 

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Frequency Range	$F_{BW}$	170 <sup>2)</sup>		1675	MHz	VHFIII/UHF/L-Band US/L-Band EU
Power Gain	$ S_{21} $		15.75		dB	$f = 470\text{ MHz}$
Power Gain Variation over Frequency	$\Delta S_{21} $		1		dB	$f = 170\text{ MHz}-1675\text{ MHz}$
Reverse Isolation	$1/ S_{12} $		>25		dB	
Noise figure <sup>3)</sup>	$NF$		1.3		dB	$f = 470\text{ MHz}$
Input return loss	$1/ S_{11} $		>8		dB	50 $\Omega$
Output return loss	$1/ S_{22} $		>8		dB	50 $\Omega$
Stability factor <sup>3)</sup>	$k$		>1.5			From 30 kHz to 6 GHz
Input 1 dB compression point <sup>3)</sup>	$IP_{1dB}$		-10		dBm	$f = 170\text{ MHz}$
			-10		dBm	$f = 470\text{ MHz}$
			-9		dBm	$f = 1500\text{ MHz}$
3rd order input intercept point <sup>3)</sup>	$IIP_3$		-7		dBm	$f = 170\text{ MHz}$ ; 1 MHz offset
			-7		dBm	$f = 470\text{ MHz}$ ; 1 MHz offset
			-3		dBm	$f = 1500\text{ MHz}$ ; 1 MHz offset
Settling time for Power On <sup>3)</sup>	$t_{PON}$		3.5		$\mu\text{s}$	
Settling time Power Off <sup>3)</sup>	$t_{POFF}$		2		$\mu\text{s}$	

1) Measured on BGA728L7 application board without subtracting PCB losses (unless noted otherwise) at 470 - 1675 MHz

2) 170 MHz to 240 MHz (VHF III) can be covered by adding external capacitor on input circuit (see [Application Information](#))

3) Verify by random sampling

## Electrical Characteristics

**Table 6** Typical RF Characteristics<sup>1)</sup> Low-Gain Mode:  $T_A = 25\text{ °C}$ ,  $V_{CC} = 2.8\text{ V}$ ,  $V_{PON} = 2.8\text{ V}$ ,  $V_{GS} = 2.8\text{ V}$ 

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Frequency Range	$F_{PW}$	170 <sup>2)</sup>		1675	MHz	VHFIII/UHF/L-Band US/L-Band EU
Power Gain	$ S_{21} $		-5.2		dB	
Power Gain Variation over Frequency	$\Delta S_{21} $		2.1		dB	$f = 170\text{ MHz}-1675\text{ MHz}$
Noise figure <sup>3)</sup>	$NF$		5.5		dB	$f = 470\text{ MHz}$
Input return loss	$1/ S_{11} $		>8		dB	50 $\Omega$
Output return loss	$1/ S_{22} $		>8		dB	50 $\Omega$
Input compression point <sup>3)</sup>	$IP_{1dB}$		3		dBm	$f = 170\text{ MHz}$
			3.5		dBm	$f = 470\text{ MHz}$
			5		dBm	$f = 1500\text{ MHz}$
3rd order input intercept point <sup>3)</sup>	$IIP_3$		16		dBm	$f = 170\text{ MHz}$ ; 1 MHz offset
			16		dBm	$f = 470\text{ MHz}$ ; 1 MHz offset
			20		dBm	$f = 1500\text{ MHz}$ ; 1 MHz offset
Settling time GS ON <sup>3)</sup>	$t_{GSON}$		2		$\mu\text{s}$	
Settling time GS OFF <sup>3)</sup>	$t_{GSOFF}$		3.5		$\mu\text{s}$	

1) Measured on BGA728L7 application board including PCB losses (unless noted otherwise) at 470 - 1675 MHz

2) 170 MHz to 240 MHz (VHF III) can be covered by adding external capacitor on input circuit (see [Application Information](#))

3) Verify by random sampling

### Gain Mode Selection Truth Table

Control Voltage $V_{PON}$ <sup>1)</sup>	Control Voltage $V_{GS}$ <sup>1)</sup>	Gain Mode
High	Low	High Gain
High	High	Low Gain
Low	High	Low Gain
Low	Low	OFF

1) See [Table 4](#) for the High/Low voltage range



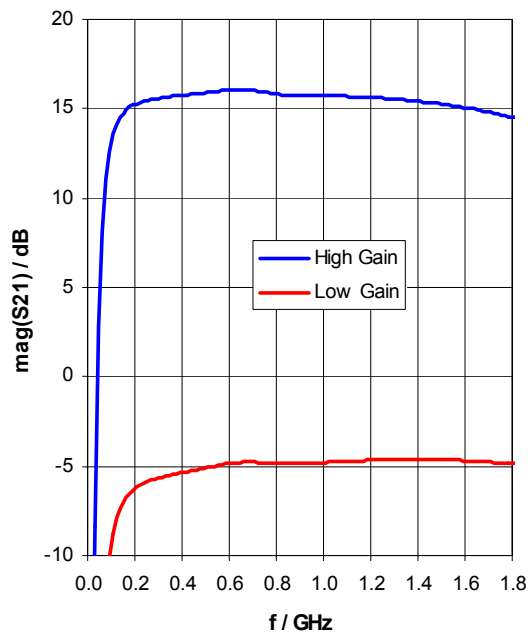
## 4 Typical Measured Results

$T_A = 25\text{ °C}$ ,  $V_{CC} = 2.8\text{ V}$ ,  $V_{PON} = 2.8\text{ V}$ ,  $V_{GS} = 0\text{ V}$  for High Gain Mode,  $V_{GS} = 2.8\text{ V}$  for Low Gain Mode

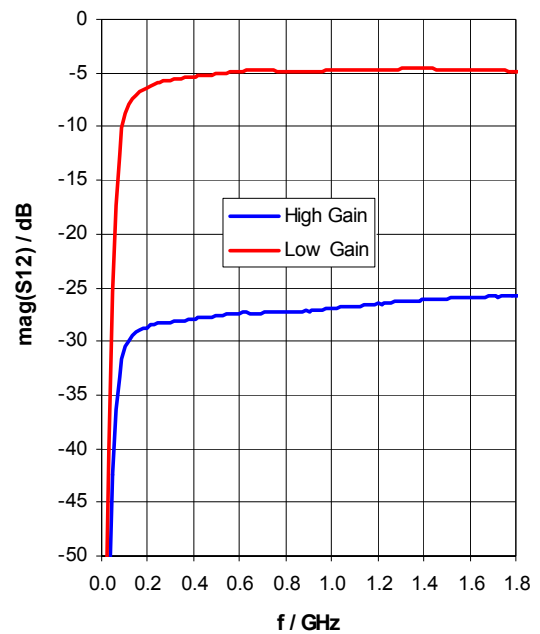
Note: Measurements based on VHF-board application. For UHF application NF can be further optimized by omitting the optional capacitor C5.

Note: Board losses are not subtracted

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

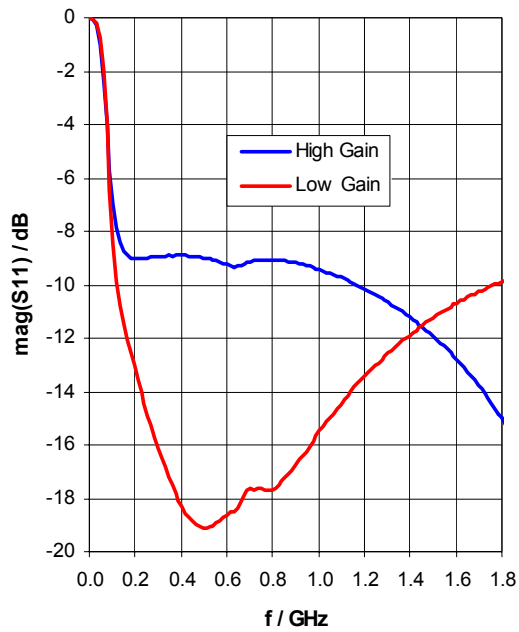


Isolation  $|S_{12}| = f(f)$



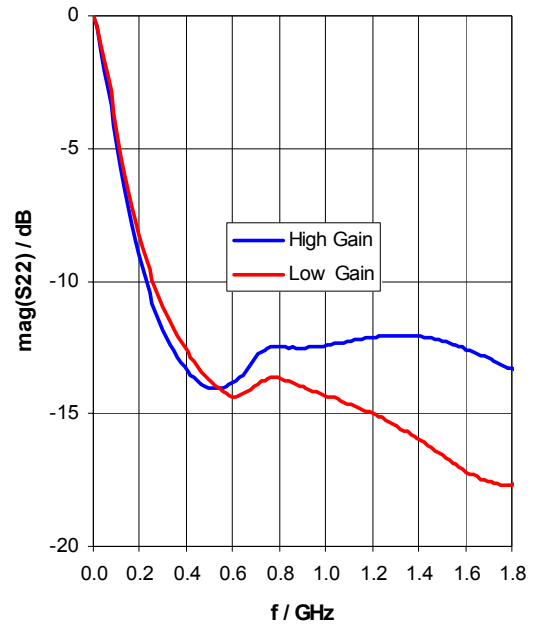
Typical Measured Results

Input Return Loss  $|S_{11}| = f(f)$



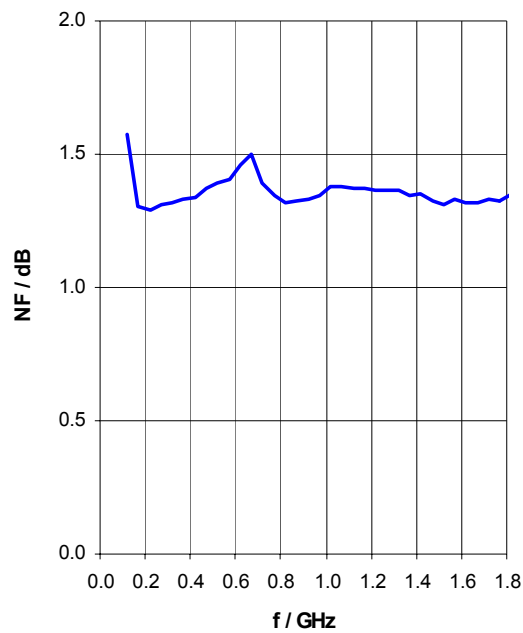
IRL.vsd

Output Return Loss  $|S_{22}| = f(f)$



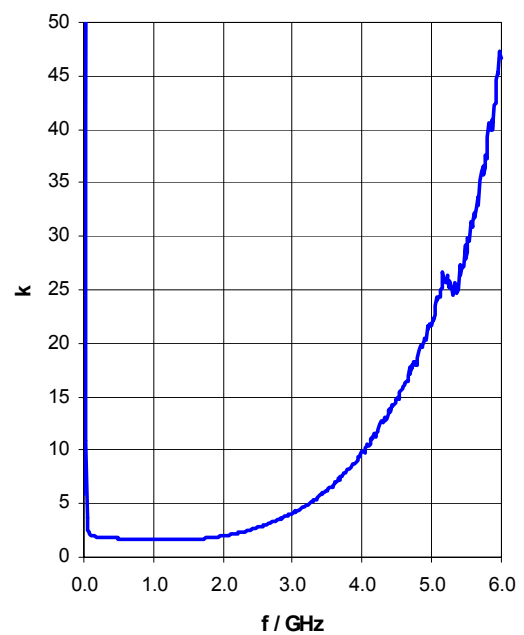
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High Gain Noise Figure  $NF = f(f)$



NF.vsd

High Gain Stability Factor  $k = f(f)$



K\_factor.vsd

## 5 Application Information

### Application Circuit

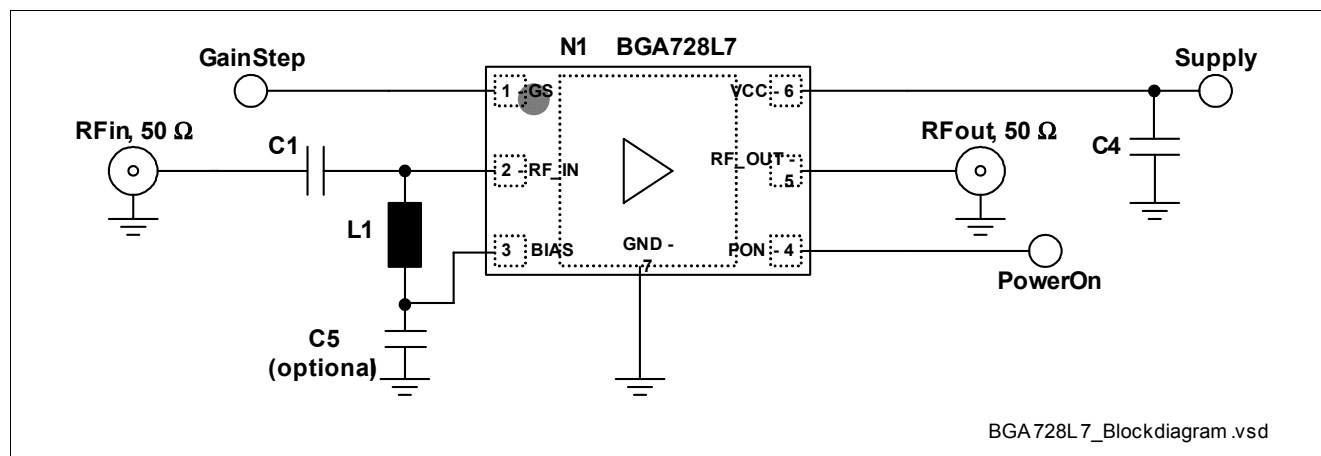


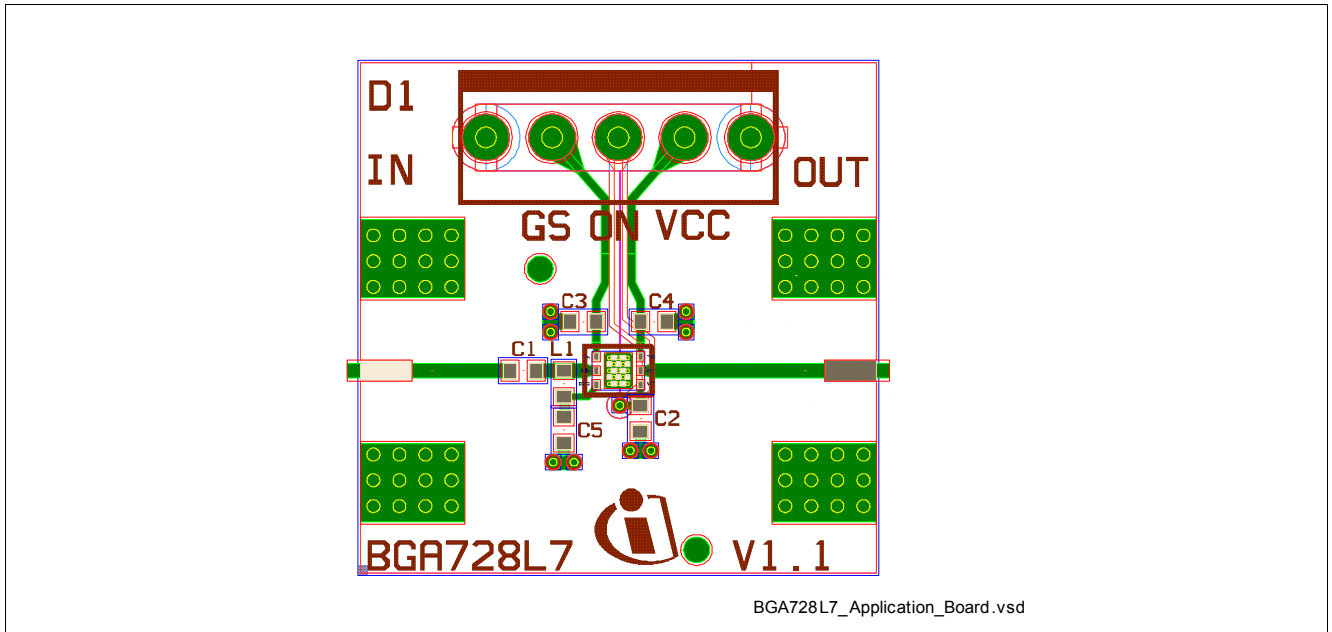
Figure 2 Application circuit of BGA728L7

Table 7 Bill of Materials

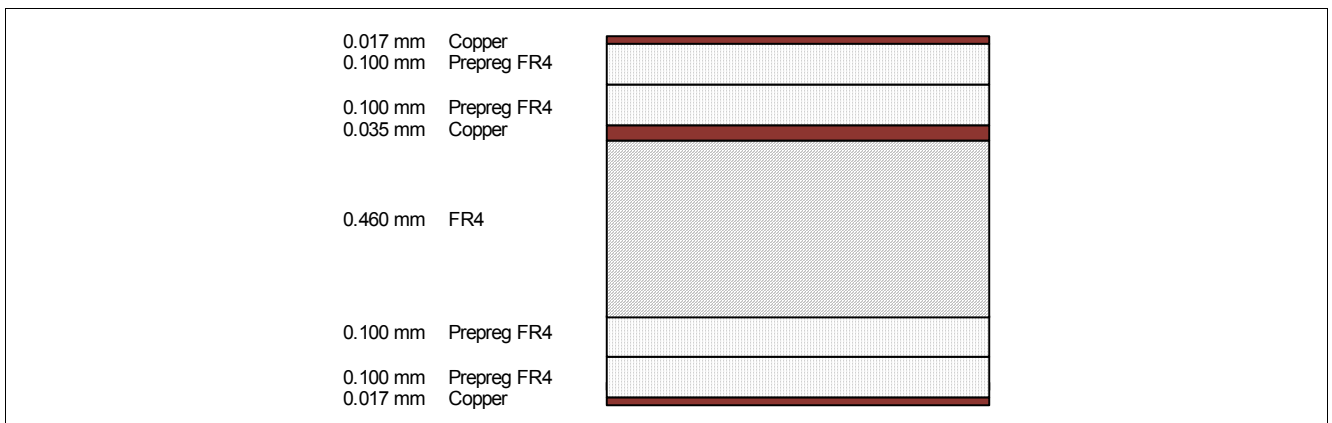
Name	Value	Package	Manufacturer	Function
C1	56 pF	0402	Various	DC block
C4	1 nF	0402	Various	Supply voltage filtering
C5	1 nF	0402	Various	Optional for VHF-band
L1	75 nH	0402	Murata LQW15AN75NG00	Bias Feed
N1	BGA728L7	TSLP-7-1	Infineon	SiGe LNA
C2, C3	not used			

A list of all application notes including AN163 in particular for BGA728L7 is available at <http://www.infineon.com/MobileTVLNA>

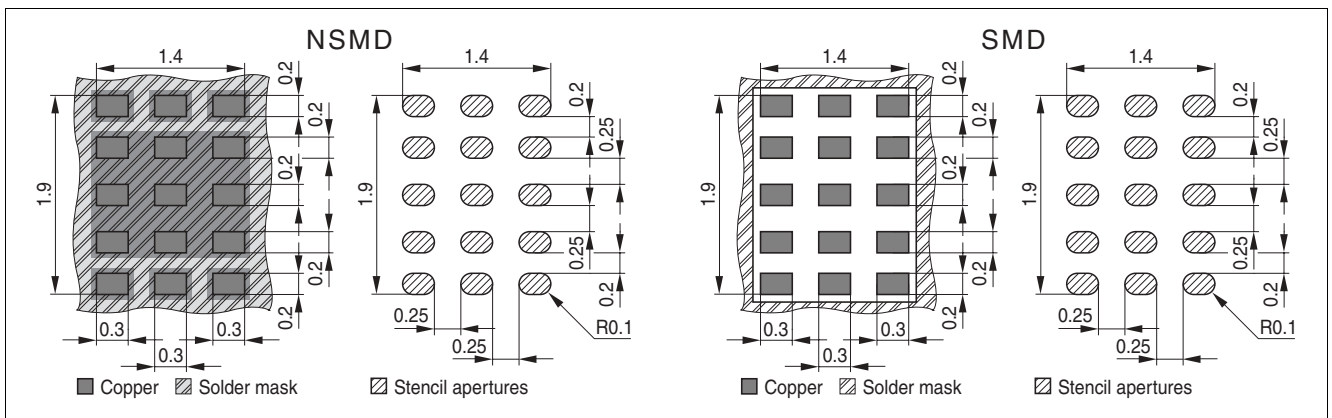
## Application Board



**Figure 3 Application Board**



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



**Figure 5 Recommended Land Pattern**

## 6 Package Information

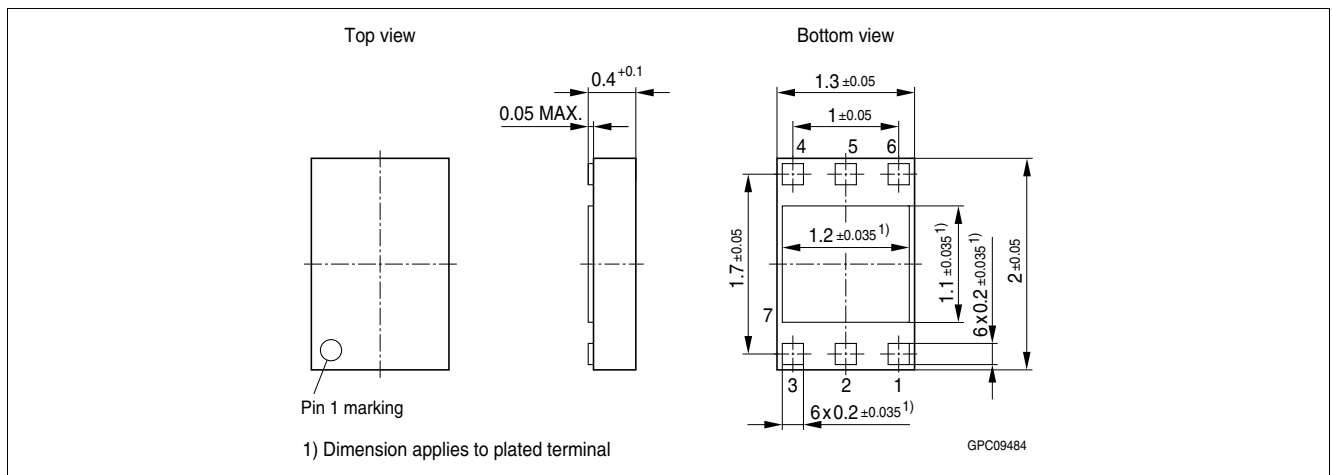


Figure 6 Package Dimensions for TSLP-7-1

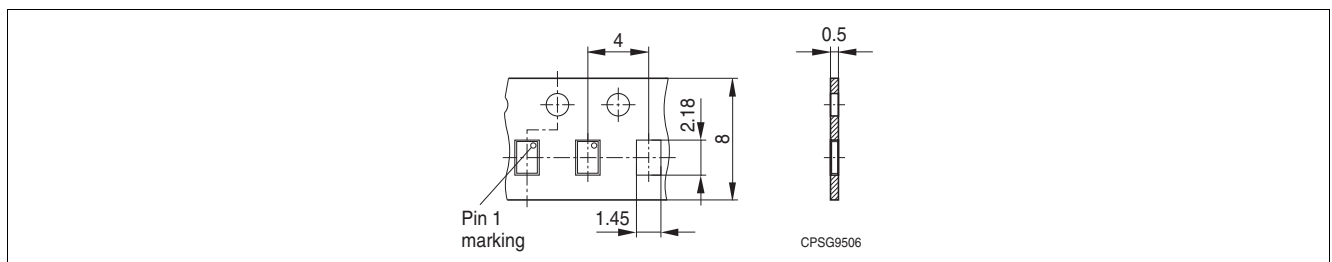


Figure 7 Tape & Reel Dimensions (Ø reel 180, pieces/reel 7500)

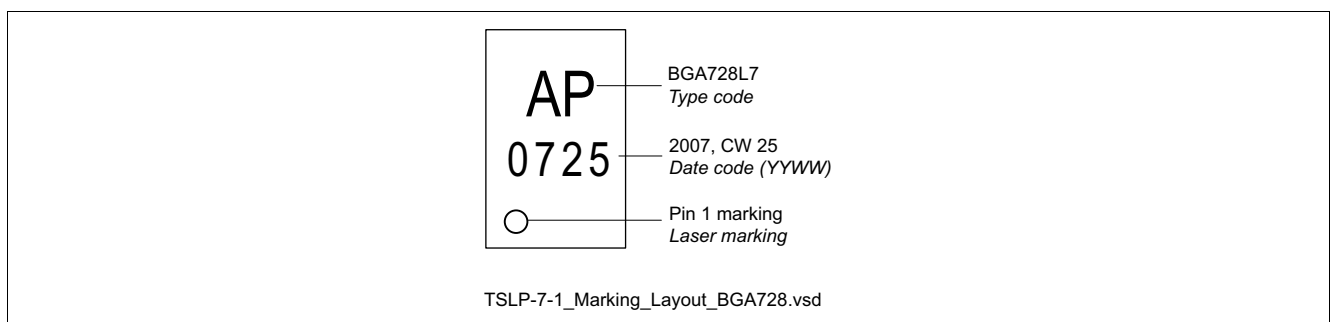


Figure 8 Marking Layout