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

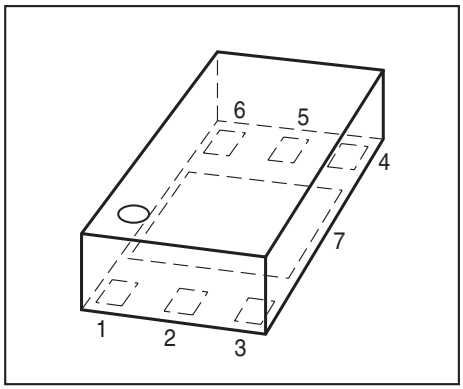
Previous Version: 2008-09-25, Rev. 1.2

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 mm³)
- Output internally matched to 50 Ω
- Input pre-matched to 50 Ω
- Low external component count
- Integrated ESD protection (1 kV HBM)
- Moisture sensitivity level: MSL 1
- Pb-free (RoHS compliant) package



TSLP-7-1

RoHS

Applications

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

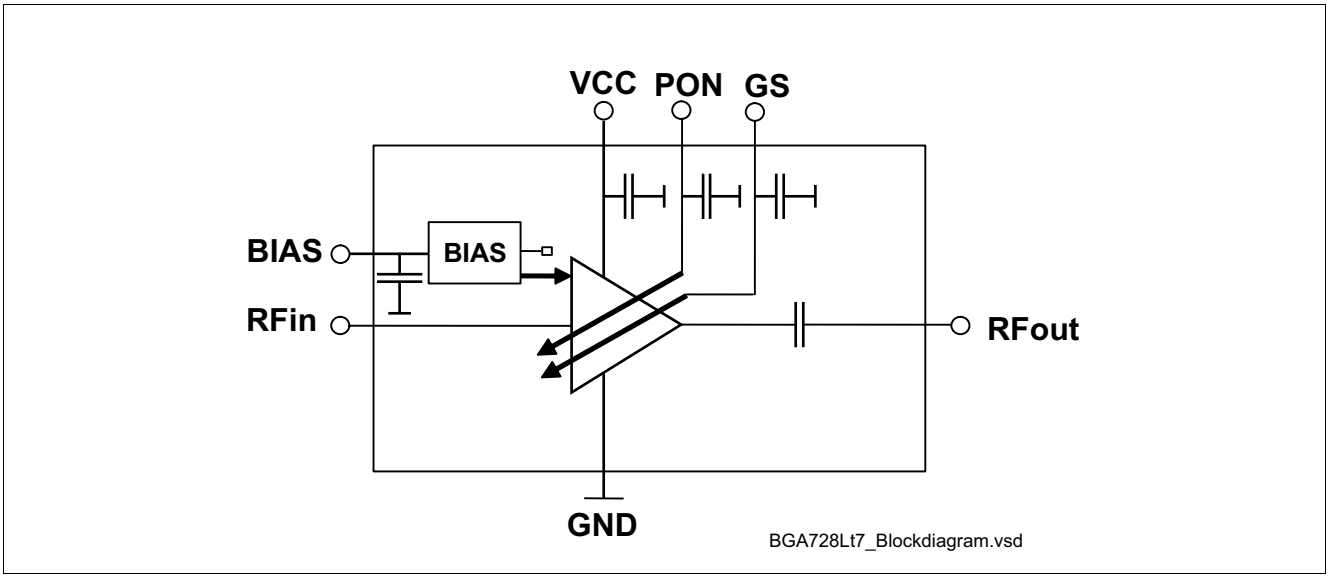


Figure 1 Block diagram

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[1)]	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[2)]	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[1)]	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 °C ; V_{CC} = 2.8 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} = High, V_{GS} = Low
			35		µA	V_{Pon} = High, V_{GS} = High
			5		µA	V_{Pon} = Low, V_{GS} = High
				2	µA	V_{Pon} = Low, V_{GS} = 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} = High
				2	µA	V_{GS} = Low

Table 5 Typical RF Characteristics[1] High-Gain Mode: T_A = 25 °C, V_{CC} = 2.8 V, V_{PON} = 2.8 V, V_{GS} = 0 V

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

1) Measured on BGA728L7 application board without substracting 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

Table 6 Typical RF Characteristics[1] Low-Gain Mode: T_A = 25 °C, V_{CC} = 2.8 V, V_{PON} = 2.8 V, V_{GS} = 2.8 V

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Frequency Range	F_{PW}	170[2]		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 MHz-1675 MHz
Noise figure[3]	NF		5.5		dB	f = 470 MHz
Input return loss	$1/\|S_{11}\|$		>8		dB	50 Ω
Output return loss	$1/\|S_{22}\|$		>8		dB	50 Ω
Input compression point[3]	IP_{1dB}		3		dBm	f = 170 MHz
			3.5		dBm	f = 470 MHz
			5		dBm	f = 1500 MHz
3rd order input intercept point[3]	IIP_3		16		dBm	f = 170 MHz; 1 MHz offset
			16		dBm	f = 470 MHz; 1 MHz offset
			20		dBm	f = 1500 MHz; 1 MHz offset
Settling time GS ON[3]	t_{GSON}		2		µs	
Settling time GS OFF[3]	t_{GSOFF}		3.5		µs	

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}[1]	Control Voltage V_{GS}[1]	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

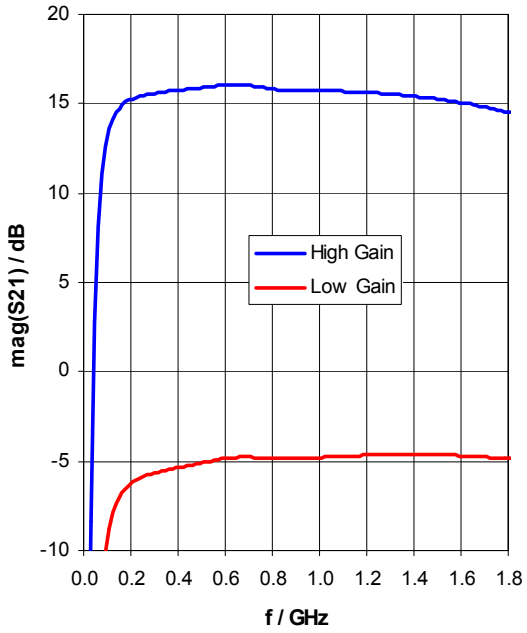
4 Typical Measured Results

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

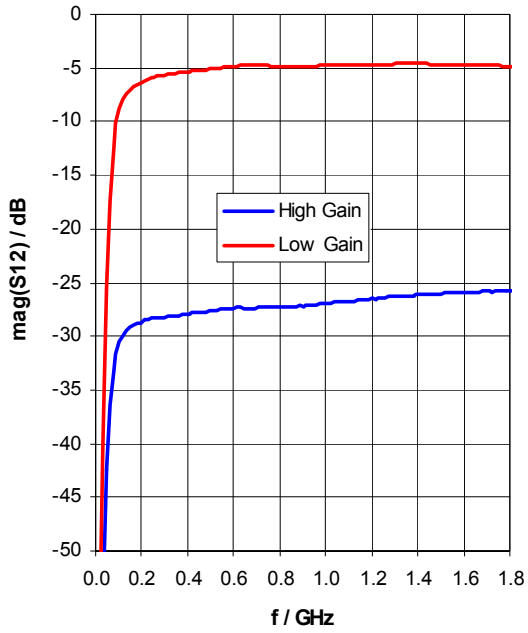
Note: Measurements based on VHF-board application. For UHF application NF can be further optimized by omitting the optional capacitor C5.

Note: Board losses are not substracted

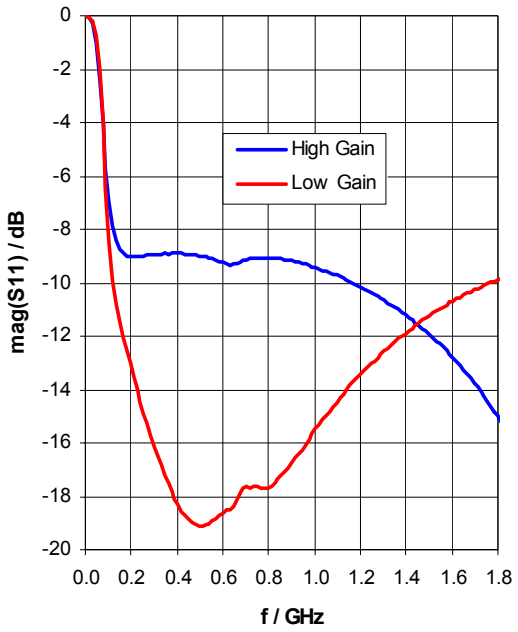
Gain $|S_{21}|$ = f (f)



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

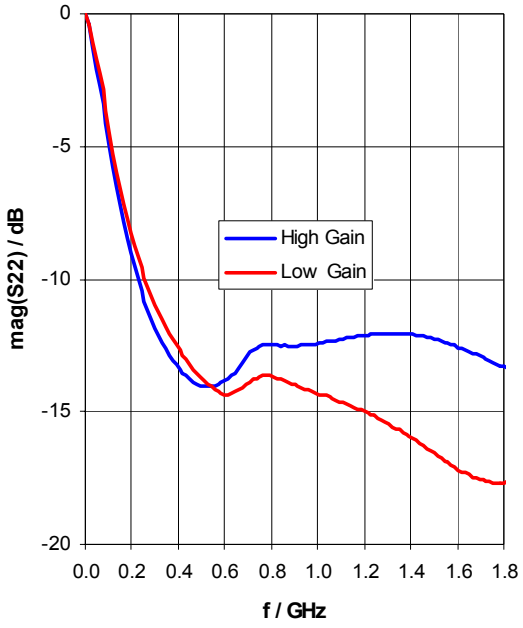


Input Return Loss $|S_{11}|$ = f (f)



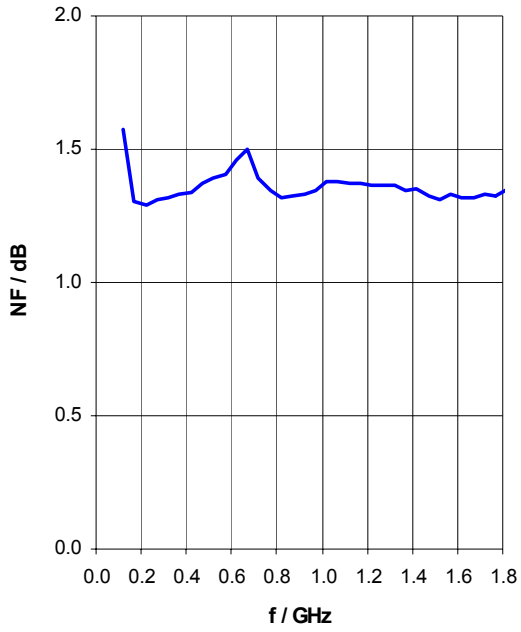
IRL.vsd

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



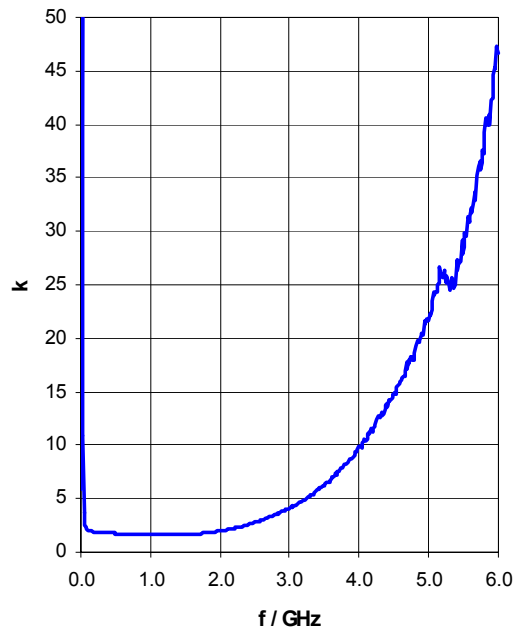
ORL.vsd

High Gain Noise Figure NF = f (f)



NF.vsd

High Gain Stability Factor k = f (f)



K_factor.vsd

5 Application Information

Application Circuit

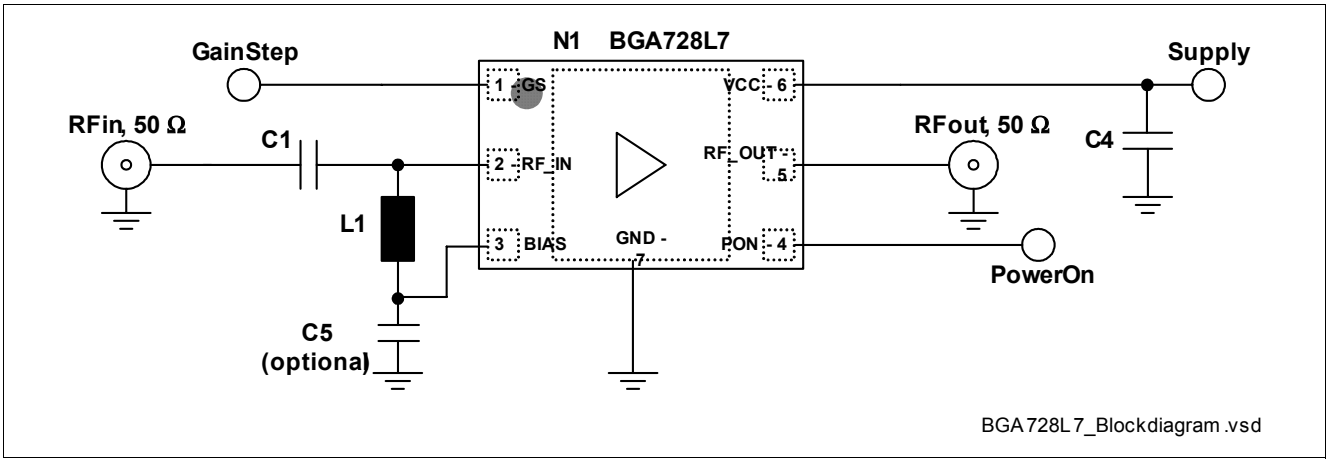


Figure 2 Application circuit of BGA728L7

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

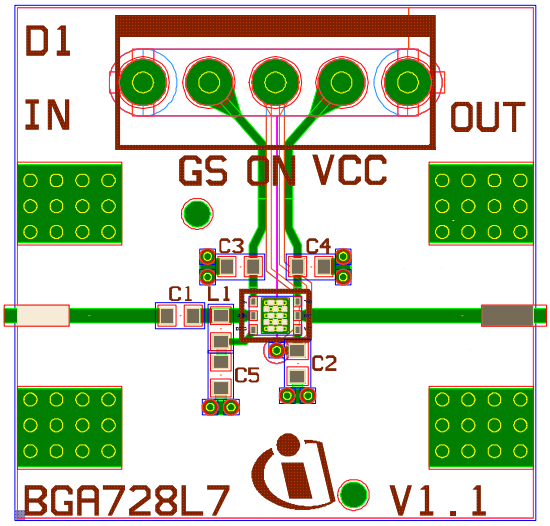


Figure 3 Application Board

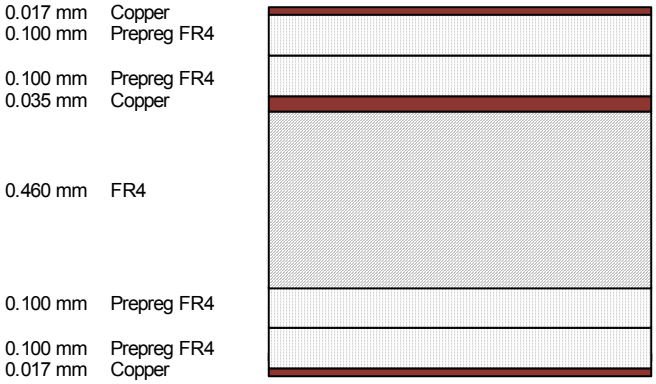


Figure 4 Cross section View of Application board

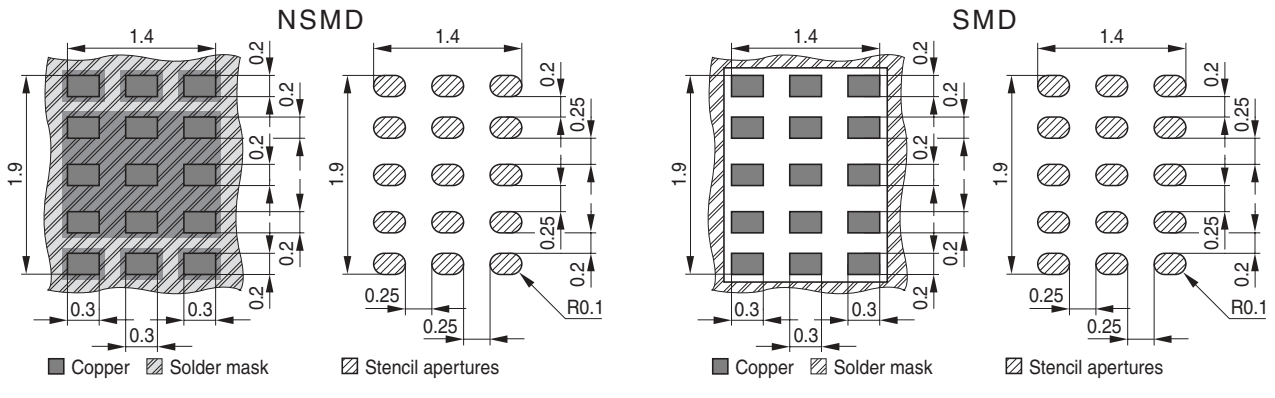


Figure 5 Recommended Land Pattern

6 Package Information

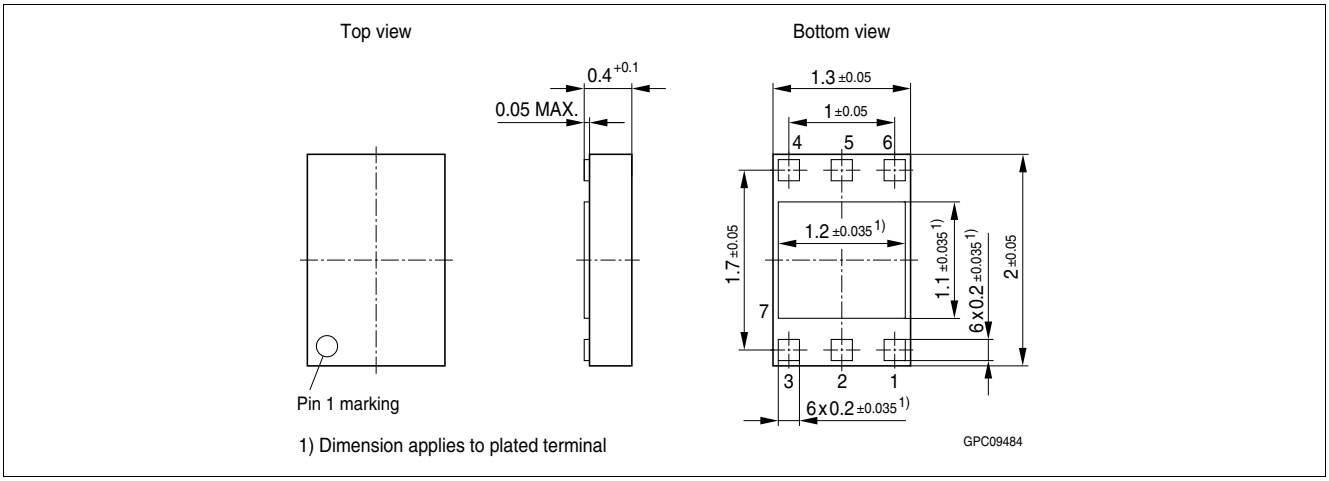


Figure 6 Package Dimensions for TSLP-7-1

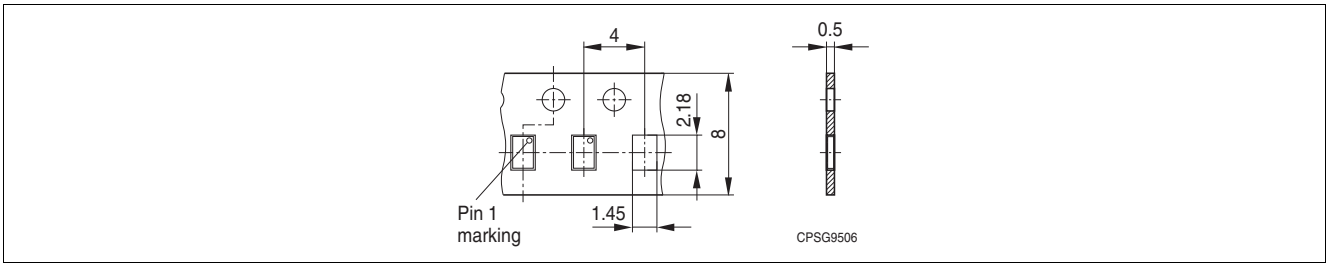


Figure 7 Tape & Reel Dimensions (Ø reel 180, pieces/reel 7500)

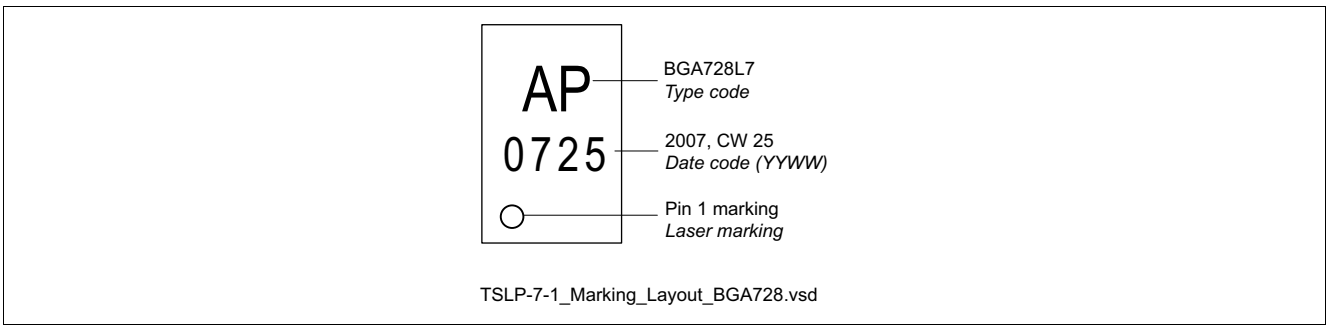


Figure 8 Marking Layout

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BGA 728L7 E6327