

# BGB717L7ESD

SiGe:C Low Noise Amplifier MMIC for FM Radio Applications

## Data Sheet

Revision 3.3, 2010-06-24

**RF & Protection Devices**

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**Revision History**

Page / Item	Subjects (major changes since last revisions)
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**Revision 3.3, 2010-06-24**

	Converted to the new IFX Template.
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**Revision 3.2**

	Supply Voltage limited to 4.0 V
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Last Trademarks Update 2010-03-22

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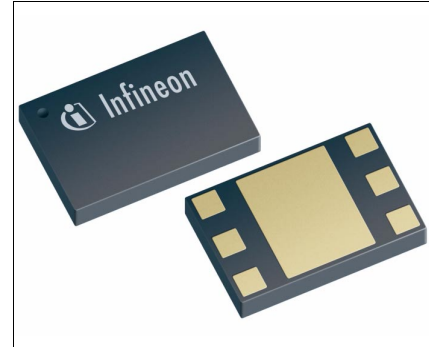
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## 1 Features

Main features:

- High performance FM radio LNA with integrated biasing
- Worldwide FM band support (76 MHz to 108 MHz)
- Integrated ESD protection for all pins (3 kV for RF input vs. GND, 2 kV for all other pin combinations, HBM)
- Very high gain at low current consumption
- High input compression point
- High input impedance
- Excellent noise figure from latest SiGe:C technology
- Integrated active biasing circuit enables stable operation point against temperature- and processing-variations
- Minimum external components
- Operation voltage: 1.8 V to 4.0 V
- Power-off function
- Very small and leadless package TSLP-7-1, 2.0 x 1.3 x 0.4 mm
- Pb-free (RoHS compliant) and halogen-free (WEEE compliant) package



## Applications

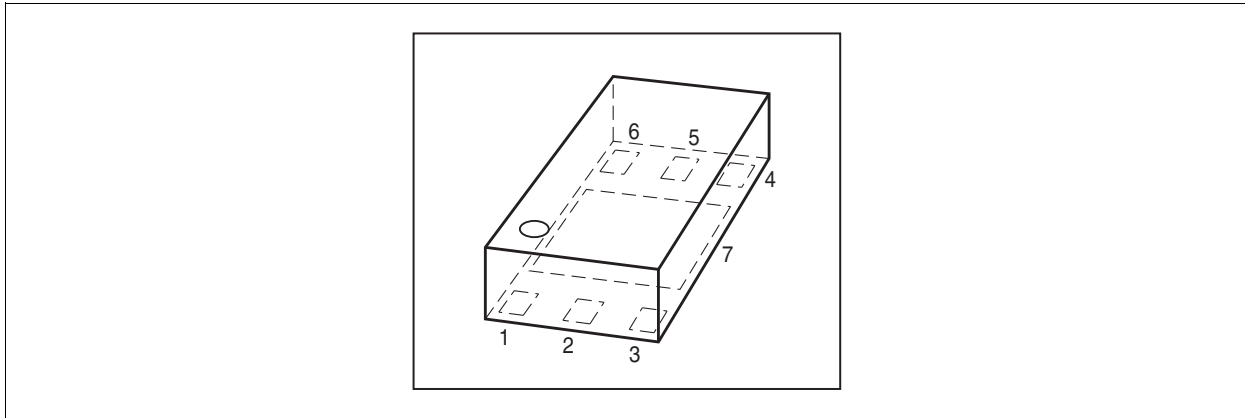
- Active FM antenna systems
- Portable FM radio
- Personal headphone radio
- ISM applications

Product Name	Package	Marking
BGB717L7ESD	TSLP-7-1	AX

## 2 Product Brief

The BGB717L7ESD is an advanced low noise amplifier MMIC with integrated ESD protection and active biasing specifically designed for FM antenna systems requiring high gain, reduced power consumption and very low distortion. The external components determine the gain of the FM amplifier and can also be modified to extend the operating frequency.

The device is based upon Infineon Technologies cost effective SiGe:C technology and comes in a low profile TSLP-7-1 leadless green package.



**Figure 1 Pinning of BGB717L7ESD**

**Table 1 Pinning Table**

Pin	Function
1	GND
2	RF-In
3	Bias-Out
4	Ctrl On/Off
5	RF-Out
6	$V_{CC}$
7	GND



### 3 Maximum Ratings

**Table 2 Maximum Ratings at  $T_A = 25^\circ\text{C}$** 

Parameter	Symbol	Value			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage $T_A = -55^\circ\text{C}$	$V_{CC}$	–	–	4.0 3.5	V	–
Supply current at VCC pin	$I_{CC}$	–	–	25	mA	–
IDC current at RF-In Pin	$I_B$	–	–	3	mA	–
Control On / Off voltage	$V_{ctrl}$	–	–	4.0	V	–
Total power dissipation <sup>1)</sup> $T_S \leq 112^\circ\text{C}^2)$	$P_{tot}$	–	–	100	mW	–
Operation junction temperature	$T_{JOp}$	-55	–	150	$^\circ\text{C}$	–
Storage temperature	$T_{Stg}$	-55	–	150	$^\circ\text{C}$	–

**ESD Capability**

Human Body Model JESD22-A114-B	–	–	–	2000	V	–
Machine Model JESD22-A115-A	–	–	–	100	V	–
Charge Device Model JESD22-C101-C	–	–	–	1500	V	–

 1)  $T_S$  measured at the GND pin (7) at soldering point to the PCB

 2)  $T_S$  soldering point temperature

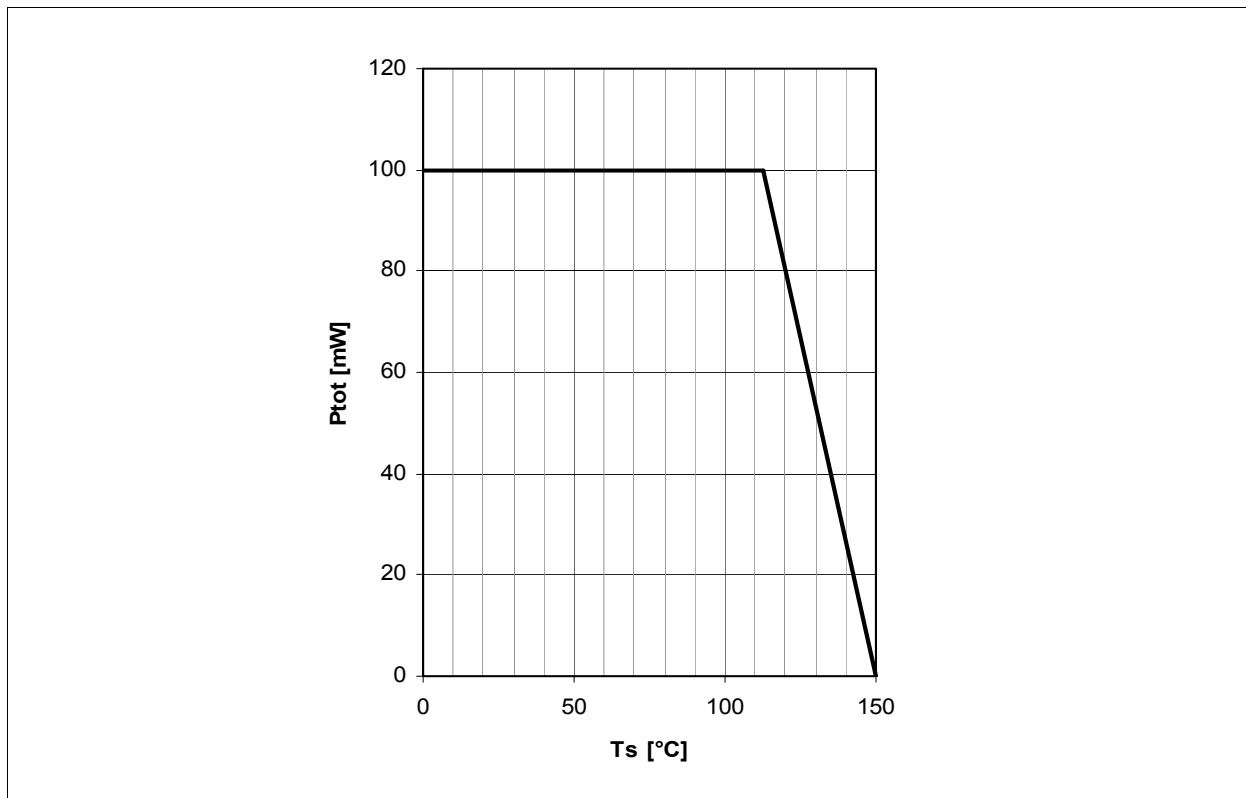
**Attention: Stresses above the max. values listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to the integrated circuit.**

## 4 Thermal Characteristics

**Table 3 Thermal Resistance**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Junction - soldering point <sup>1)</sup>	$R_{thJS}$	–	375	–	K/W	–

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



**Figure 2 Total Power Dissipation  $P_{tot} = f(T_s)$**

## 5 Operation Conditions

**Table 4 Operation Conditions**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	$V_{CC}$	1.8	3.0	4.0	V	–
Voltage Ctrl On/Off pin in On mode	$V_{ctrl-on}$	1.2	3.0	4.0	V	–
Voltage Ctrl On/Off pin in Off mode	$V_{ctrl-off}$	-0.3	0	0.3	V	–

## 6 Electrical Characteristics

### 6.1 DC Characteristics

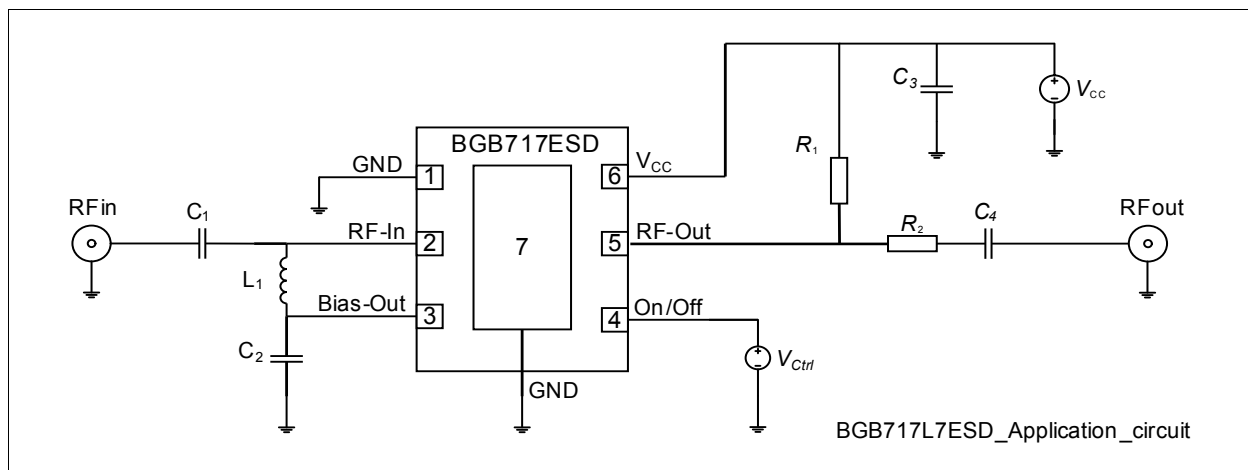
**Table 5 DC Characteristics at  $T_A = 25\text{ }^\circ\text{C}$** 

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply current	$I_{CC}$	2.4	3.0	3.6	mA	$V_{CC} = 3\text{ V}$ $V_{ctrl} = 3\text{ V}$ Small signal operation
Supply current in Off mode	$I_{CC-off}$	–	1	6	$\mu\text{A}$	$V_{CC} = 4.0\text{ V}$ $V_{ctrl} = 0\text{ V}$
Current into Ctrl On/Off pin in On mode	$I_{ctrl-on}$	–	14	20	$\mu\text{A}$	$V_{CC} = 3\text{ V}$ $V_{ctrl} = 3\text{ V}$
Current into Ctrl On/Off pin in Off mode	$I_{ctrl-off}$	–	–	0.1	$\mu\text{A}$	$V_{CC} = 4.0\text{ V}$ $V_{ctrl} = 0\text{ V}$

### 6.2 AC Characteristics

This section presents the AC characteristics of the BGB717L7ESD as measured in a high-ohmic FM radio application circuit using a PCB and a population as described in the application note AN176. Please consult our website to download the application note: [www.infineon.com/rf.appnotes](http://www.infineon.com/rf.appnotes).

The application schematic is shown in **Figure 3** and the function of each component is explained in **Table 6**.


**Figure 3 FM Radio Testing Circuit**

**Table 6 Bill of Material**

Component	Value	Manufacturer / Type	Function
C <sub>1</sub>	330 pF	Various / 0402	DC blocking
C <sub>2</sub>	47 nF	Various / 0402	DC stabilization
C <sub>3</sub>	47 nF	Various / 0402	DC stabilization
C <sub>4</sub>	330 pF	Various / 0402	DC blocking
R <sub>1</sub>	56 Ω	Various / 0402	For biasing, output matching and stabilization
R <sub>2</sub>	10 Ω	Various / 0402	For output matching and stabilization
L <sub>1</sub>	470 nH	Taiyo Yuden LK1608R47K-T / 0603	RF choke

The following table gives an overview on the performance of the FM radio LNA application circuit. All data were measured in a 50 Ω system.

**Table 7 AC Characteristics in the FM Radio LNA Application<sup>1)</sup>**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Insertion power gain	$ S_{21} ^2$	10	12	14	dB	–
Input return loss <sup>2)</sup>	$RL_{IN}$	0	0.5 <sup>3)</sup>	3	dB	–
Output return loss <sup>2)</sup>	$RL_{OUT}$	13	16 <sup>4)</sup>	19	dB	–
Noise figure <sup>5)</sup>	$F_{50\Omega}$	–	1.0	1.5	dB	$Z_s = 50 \Omega$
Input 1dB gain compression point <sup>2)</sup>	$IP_{-1dB}$	-8.0	-5.5	–	dBm	–
Input 3 <sup>rd</sup> Order Intercept Point <sup>2)</sup>	$IIP_3$	-15.5	-12.5	–	dBm	$P_{RFIN} = -40 \text{ dBm}$

1) As described in AN176,  $T_A = 25^\circ\text{C}$ ,  $V_{CC} = 3 \text{ V}$ ,  $V_{ctrl} = 3 \text{ V}$ ,  $I_{CC} = 3 \text{ mA}$ ,  $f = 100 \text{ MHz}$

2) Verified by random sampling

3) High LNA input impedance leads to power matching with high ohmic antennas

4) Output matching is accomplished by the external resistors R1 and R2

5) An aggressive low pass filter prevents radio broadcast signals from distorting the NF measurement

## 7 Package Information

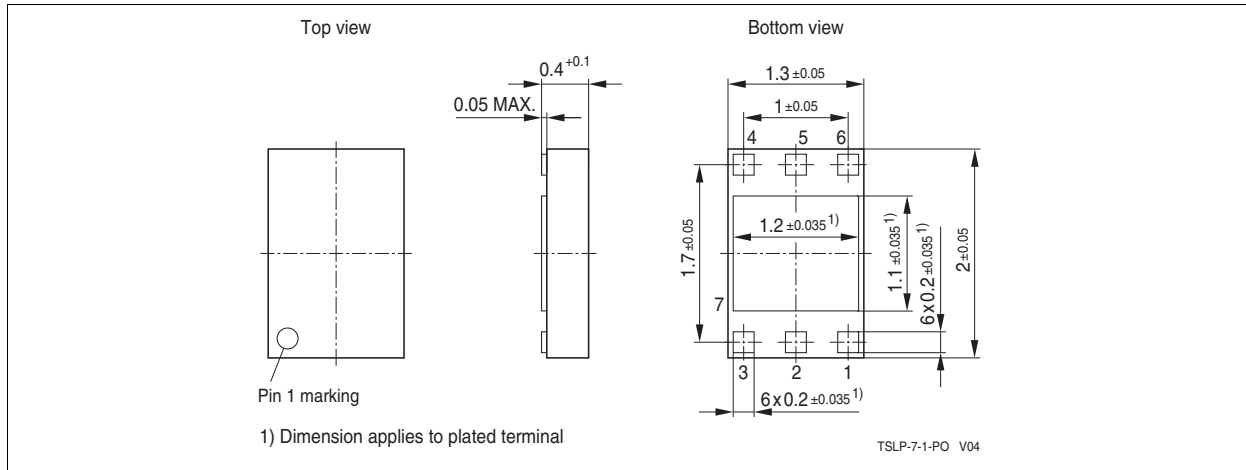


Figure 4 Package Outline TSLP-7-1 (bottom view)

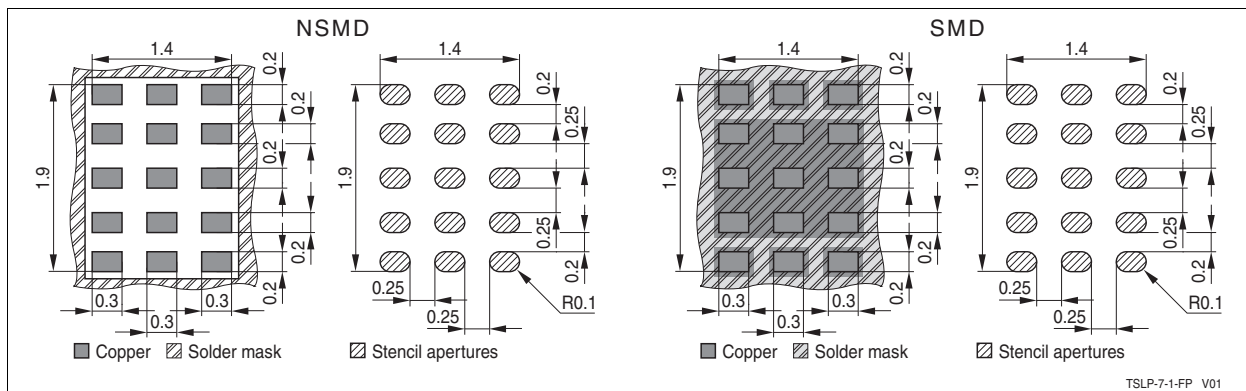


Figure 5 Footprint TSLP-7-1

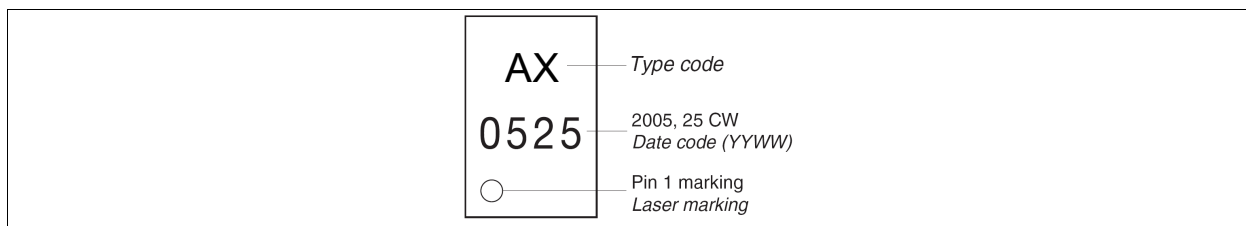


Figure 6 Marking of TSLP-7-1

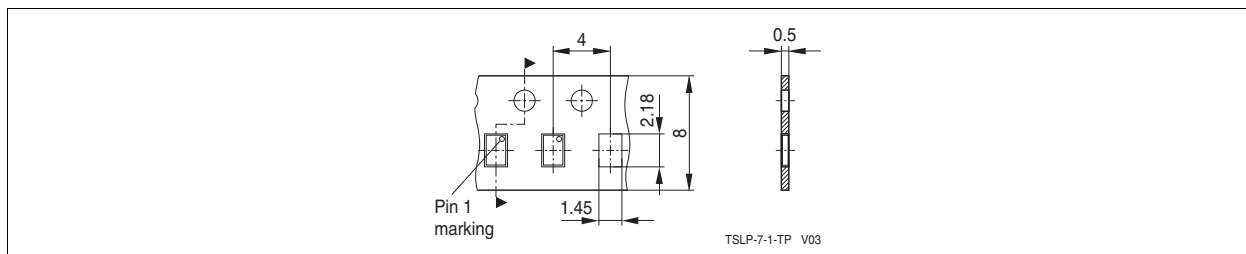


Figure 7 Tape of TSLP-7-1

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