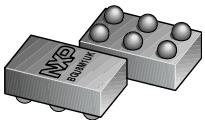


BGU8M1UK

SiGe:C Low Noise Amplifier MMIC for LTE

Rev. 2 — 16 January 2017 Product data sheet

1. Product profile

1.1 General description

The BGU8M1UK is, also known as the LTE1001MC, a Low Noise Amplifier (LNA) for LTE receiver applications. It comes as an extremely small and thin Wafer Level Chip Scale Package (WLCSP). The BGU8M1UK requires one external matching inductor.

The BGU8M1UK adapts itself to the changing environment resulting from co-habitation of different radio systems in modern cellular handsets. It has been designed for low power consumption and optimal performance. At low jamming power levels it delivers 17 dB gain at a noise figure of 0.7 dB. During high power levels, it temporarily increases its bias current to improve sensitivity.

The BGU8M1UK is optimized for 1805 MHz to 2200 MHz.

1.2 Features and benefits

- Operating frequency from 1805 MHz to 2200 MHz
- Noise figure (NF) = 0.7 dB
- Gain = 17 dB
- High input 1 dB compression point of −5 dBm
- High in band $IP3_i$ of 3 dBm
- Supply voltage 1.5 V to 3.1 V
- Self shielding package concept
- Integrated supply decoupling capacitor
- Optimized performance at a supply current of 5.0 mA
- Power-down mode current consumption < 1 μA
- Integrated temperature stabilized bias for easy design
- Require only one input matching inductor
- Output DC decoupled
- ESD protection on all pins (HBM > 2 kV)
- Integrated matching for the output
- Extremely small Wafer Level Chip Scale Package (WLCSP) 0.65 × 0.44 × 0.2 mm; 6 solder bumps; 0.22 mm bump pitch
- 180 GHz transit frequency - SiGe:C technology

1.3 Applications

- LNA for LTE reception in smart phones, feature phones, tablet PCs and RF front-end modules.

1.4 Quick reference data

Table 1. Quick reference data

f = 1843 MHz; V_{CC} = 2.8 V; $V_{I(ENABLE)} \geq 0.8$ V; T_{amb} = 25 °C; input matched to 50 Ω using a 4.7 nH inductor; unless otherwise specified.

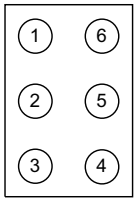
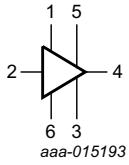
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		1.5	-	3.1	V
I_{CC}	supply current		-	5.0	-	mA
G_p	power gain	[1]	-	17	-	dB
NF	noise figure	[1][2]	-	0.70	-	dB
$P_{i(1dB)}$	input power at 1 dB gain compression	[1]	-	−5	-	dBm
$IP3_i$	input third-order intercept point	[1]	-	2	-	dBm

[1] E-UTRA operating band 3 (1805 MHz to 1880 MHz).

[2] PCB losses are subtracted.

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	ENABLE	 Bump side view	 aaa-015193
2	RF_IN		
3	GND_RF		
4	RF_OUT		
5	V_{CC}		
6	GND		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BGU8M1UK	WLCSP6	wafer level chip-size package; 6 balls; 0.65 × 0.44 × 0.29 mm	BGU8M1UK

4. Marking

Table 4. Marking codes

Type number	Marking code
BGU8M1UK	single character, indicating assembly month.[1]

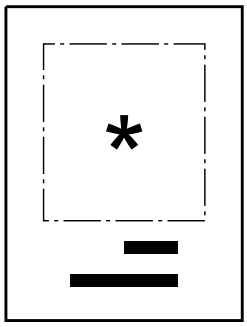
[1] Month code see Table 5.

Table 5. Calender marking month code

Asterisk (*) in Figure 1 is replaced by character in table.

Year [1]	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
2014	Y	Z	b	d	f	h	3	4	5	6	7	9
2015	A	B	C	D	E	F	G	H	I	J	K	L
2016	M	N	O	P	Q	R	S	T	U	V	W	X

[1] Rotates every 3 years.



Pin 1 location: the marking stripes below character indicate the side where pin 1 is located.

Fig 1. Marking code description example

5. Limiting values

Table 6. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage	RF input AC coupled [1]	−0.5	+5.0	V
$V_{I(ENABLE)}$	input voltage on pin ENABLE	$V_{I(ENABLE)} < V_{CC} + 0.6$ V [1][2]	−0.5	+5.0	V
$V_{I(RF\_IN)}$	input voltage on pin RF_IN	DC, $V_{I(RF\_IN)} < V_{CC} + 0.6$ V [1][2]	−0.5	+5.0	V
$V_{I(RF\_OUT)}$	input voltage on pin RF_OUT	DC, $V_{I(RF\_OUT)} < V_{CC} + 0.6$ V [1][2][3]	−0.5	+5.0	V
P_i	input power	[1]	-	10	dBm
P_{tot}	total power dissipation	$T_{sp} \leq 130$ °C	-	55	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		-	150	°C
V_{ESD}	electrostatic discharge voltage	Human Body Model (HBM) According to ANSI/ESDA/JEDEC standard JS-001	-	±2	kV
		Charged Device Model (CDM) According to JEDEC standard JESD22-C101C	-	±1	kV

[1] Stressed with pulses of 200 ms in duration.

[2] Warning: due to internal ESD diode protection, the applied DC voltage shall not exceed V_{CC} + 0.6 V and shall not exceed 5.0 V in order to avoid excess current.

[3] The RF output is AC coupled through internal DC blocking capacitors.

6. Recommended operating conditions

Table 7. Operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		1.5	-	3.1	V
T_{amb}	ambient temperature		−40	+25	+85	°C
$V_{I(ENABLE)}$	input voltage on pin ENABLE	OFF state	-	-	0.3	V
		ON state	0.8	-	-	V

7. Thermal characteristics

Table 8. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point		225	K/W

8. Characteristics

Table 9. Characteristics at V_{CC} = 1.8 V

1805 MHz ≤ f ≤ 2200 MHz; V_{CC} = 1.8 V; $V_{I(ENABLE)}$ ≥ 0.8 V; T_{amb} = 25 °C; input matched to 50 Ω using a 4.7 nH inductor; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CC}	supply current	$V_{I(ENABLE)}$ ≥ 0.8 V	-	4.7	-	mA
		$V_{I(ENABLE)}$ ≤ 0.3 V	-	-	1	µA
G_p	power gain	f = 1843 MHz [1]	-	17.0	-	dB
		f = 1960 MHz [2]	-	16.5	-	dB
		f = 2140 MHz [3]	-	16.0	-	dB
RL_{in}	input return loss	f = 1843 MHz [1]	-	9.5	-	dB
		f = 1960 MHz [2]	-	11.5	-	dB
		f = 2140 MHz [3]	-	13.0	-	dB
RL_{out}	output return loss	f = 1843 MHz [1]	-	15	-	dB
		f = 1960 MHz [2]	-	15	-	dB
		f = 2140 MHz [3]	-	11	-	dB
ISL	isolation	f = 1843 MHz [1]	-	25	-	dB
		f = 1960 MHz [2]	-	25	-	dB
		f = 2140 MHz [3]	-	25	-	dB
NF	noise figure	f = 1843 MHz [1][4]	-	0.75	-	dB
		f = 1960 MHz [2][4]	-	0.8	-	dB
		f = 2140 MHz [3][4]	-	0.85	-	dB
$P_{i(1dB)}$	input power at 1 dB gain compression	f = 1843 MHz [1]	-	−10	-	dBm
		f = 1960 MHz [2]	-	−9	-	dBm
		f = 2140 MHz [3]	-	−8	-	dBm

Table 9. Characteristics at V_{CC} = 1.8 V *…continued*

1805 MHz ≤ f ≤ 2200 MHz; V_{CC} = 1.8 V; $V_{I(ENABLE)}$ ≥ 0.8 V; T_{amb} = 25 °C; input matched to 50 Ω using a 4.7 nH inductor; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$IP3_i$	input third-order intercept point	f = 1843 MHz [1]	-	–2	-	dBm
		f = 1960 MHz [2]	-	–2	-	dBm
		f = 2140 MHz [3]	-	0	-	dBm
K	Rollett stability factor		1	-	-	
t_{on}	turn-on time	time from $V_{I(ENABLE)}$ ON, to 90 % of the gain	-	-	3	µs
t_{off}	turn-off time	time from $V_{I(ENABLE)}$ OFF, to 10 % of the gain	-	-	1	µs

[1] E-UTRA operating band 3 (1805 MHz to 1880 MHz).

[2] E-UTRA operating band 2 (1930 MHz to 1990 MHz).

[3] E-UTRA operating band 1 (2110 MHz to 2170 MHz).

[4] PCB losses are subtracted

Table 10. Characteristics at V_{CC} = 2.8 V

1805 MHz ≤ f ≤ 2200 MHz; V_{CC} = 2.8 V; $V_{I(ENABLE)}$ ≥ 0.8 V; T_{amb} = 25 °C; input matched to 50 Ω using a 4.7 nH inductor; unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CC}	supply current	$V_{I(ENABLE)}$ ≥ 0.8 V		-	5.0	-	mA
		$V_{I(ENABLE)}$ ≤ 0.3 V		-	-	1	µA
G_p	power gain	f = 1843 MHz	[1]	-	17.0	-	dB
		f = 1960 MHz	[2]	-	17.0	-	dB
		f = 2140 MHz	[3]	-	16.0	-	dB
RL_{in}	input return loss	f = 1843 MHz	[1]	-	10.0	-	dB
		f = 1960 MHz	[2]	-	12.0	-	dB
		f = 2140 MHz	[3]	-	14.0	-	dB
RL_{out}	output return loss	f = 1843 MHz	[1]	-	15	-	dB
		f = 1960 MHz	[2]	-	15	-	dB
		f = 2140 MHz	[3]	-	11	-	dB
ISL	isolation	f = 1843 MHz	[1]	-	25	-	dB
		f = 1960 MHz	[2]	-	25	-	dB
		f = 2140 MHz	[3]	-	25	-	dB
NF	noise figure	f = 1843 MHz	[1][4]	-	0.7	-	dB
		f = 1960 MHz	[2][4]	-	0.75	-	dB
		f = 2140 MHz	[3][4]	-	0.8	-	dB
$P_{i(1dB)}$	input power at 1 dB gain compression	f = 1843 MHz	[1]	-	−5	-	dBm
		f = 1960 MHz	[2]	-	−4	-	dBm
		f = 2140 MHz	[3]	-	−3	-	dBm
$IP3_i$	input third-order intercept point	f = 1843 MHz	[1]	-	2	-	dBm
		f = 1960 MHz	[2]	-	3	-	dBm
		f = 2140 MHz	[3]	-	4	-	dBm
K	Rollett stability factor			1	-	-	
t_{on}	turn-on time	time from $V_{I(ENABLE)}$ ON, to 90 % of the gain		-	-	3	µs
t_{off}	turn-off time	time from $V_{I(ENABLE)}$ OFF, to 10 % of the gain		-	-	1	µs

[1] E-UTRA operating band 3 (1805 MHz to 1880 MHz).

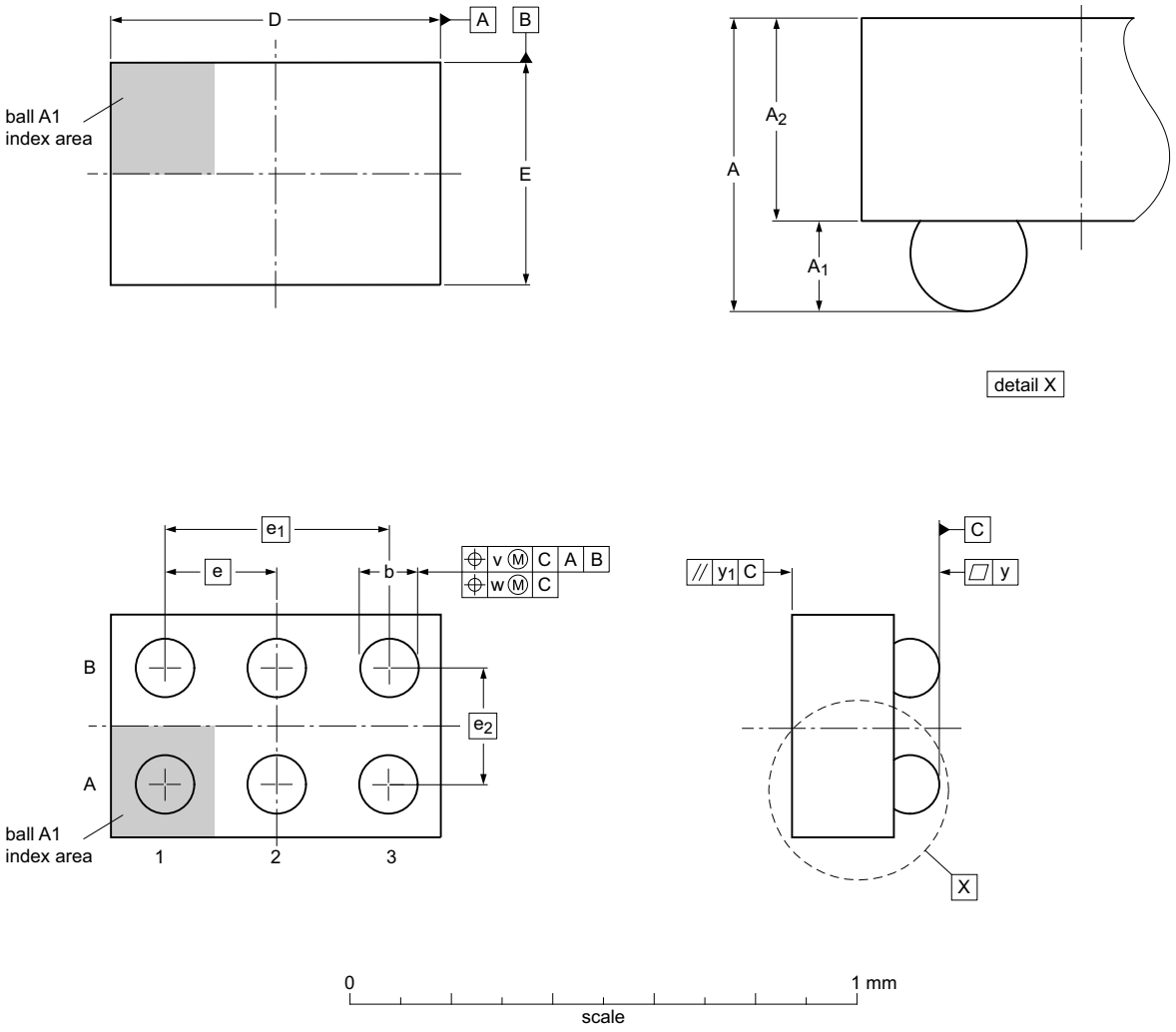
[2] E-UTRA operating band 2 (1930 MHz to 1990 MHz).

[3] E-UTRA operating band 1 (2110 MHz to 2170 MHz).

[4] PCB losses are subtracted

9. Package outline

WLCSP6: wafer level chip-size package; 6 balls; 0.65 x 0.44 x 0.29 mm **BGU8M1UK**



Dimensions (mm are the original dimensions)

Unit		A	A_1	A_2	b	D	E	e	e_1	e_2	v	w	y	y_1
	max	0.32	0.105	0.215	0.131	0.68	0.47							
mm	nom	0.29	0.090	0.200	0.116	0.65	0.44	0.22	0.44	0.23	0.05	0.05	0.05	0.1
	min	0.26	0.075	0.185	0.101	0.62	0.41							

wlcsp6_bgu8m1uk_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
BGU8M1UK						~~14-08-25~~ 14-12-01

Fig 2. Package outline BGU8M1UK (WLCSP6)

10. Handling information

CAUTION

This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices.

Such precautions are described in the *ANSI/ESD S20.20*, *IEC/ST 61340-5*, *JESD625-A* or equivalent standards.

11. Abbreviations

Table 11. Abbreviations

Acronym	Description
ESD	ElectroStatic Discharge
E-UTRA	Evolved Universal Terrestrial Radio Access
HBM	Human Body Model
LTE	Long Term Evolution
MMIC	Monolithic Microwave Integrated Circuit
PCB	Printed Circuit Board
SiGe:C	Silicon Germanium Carbon

12. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BGU8M1UK v.2	20170116	Product data sheet	-	BGU8M1UK v.1
Modifications:	• Section 1: added LTE1001MC according to our new naming convention			
BGU8M1UK v.1	20150519	Product data sheet	-	-

13. Legal information

13.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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15. Contents

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