

# BGU7042

## 1 GHz wideband low-noise amplifier with bypass

Rev. 2 — 13 September 2011

Product data sheet

## 1. Product profile

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### 1.1 General description

The BGU7042 MMIC is a 3.3 V wideband amplifier with bypass mode. It is designed specifically for high linearity, low-noise applications over a frequency range of 40 MHz to 1 GHz. It is especially suited for Set-Top Box applications.

The LNA is housed in a 6-pin SOT363 plastic SMD package.

### 1.2 Features and benefits

- Voltage supply of 3.3 V
- Internally biased
- Programmable between  $G_p = 10$  dB and bypass
- Flat gain between 40 MHz and 1 GHz
- Noise figure of 3.8 dB
- High linearity with an  $IP3_O$  of 29 dBm
- $75\ \Omega$  input and output impedance
- Power-down during bypass mode
- Bypass mode current consumption  $< 5$  mA
- ESD protection  $> 2$  kV Human Body Model (HBM) and  $> 1.5$  kV Charged Device Model (CDM) on all pins

### 1.3 Applications

- Terrestrial and cable Set-Top Boxes (STB)
- Silicon and “Can” tuners
- Personal and Digital Video Recorders (PVR and DVR)
- Home networking and in-house signal distribution



### 1.4 Quick reference data

**Table 1. Quick reference data**

$T_{amb} = 25\text{ }^{\circ}\text{C}$ ; typical values at  $V_{CC} = 3.3\text{ V}$ ;  $Z_S = Z_L = 75\text{ }\Omega$ ;  $R_{bias} = 7.5\text{ }\Omega$ ;  $40\text{ MHz} \leq f_1 \leq 1000\text{ MHz}$ .

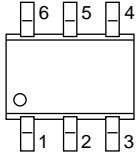
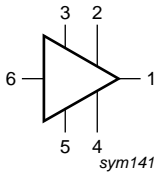
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$V_{CC}$	supply voltage	RF input AC coupled	3.1	3.3	3.5	V	
$I_{CC(tot)}$	total supply current	$G_p = 10\text{ dB}$ mode	[1]	-	38	-	mA
		bypass mode	[1]	-	3	-	mA
$T_{amb}$	ambient temperature		-10	-	+70	$^{\circ}\text{C}$	
NF	noise figure	$G_p = 10\text{ dB}$ mode	[1]	-	3.8	-	dB
		bypass mode	[1]	-	2.5	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	1 GHz; $G_p = 10\text{ dB}$ mode	[1]	-	12	-	dBm
IP3O	output third-order intercept point	$G_p = 10\text{ dB}$ mode	[1][2]	-	29	-	dBm

[1] Mode depends on setting of  $V_{CTRL}$ ; see Table 8.

[2] The fundamental frequency ( $f_1$ ) is 1000 MHz. The intermodulation product (IM3) is  $2 \times f_2 - f_1$ , where  $f_2 = f_1 \pm 1\text{ MHz}$ . Input power  $P_i = -10\text{ dBm}$ .

## 2. Pinning information

**Table 2. Pinning**

Pin	Description	Simplified outline	Graphic symbol
1	RF_OUT		
2	$V_{CC}$		
3	n.c.		
4	CTRL		
5	GND		
6	RF_IN		

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		Version
	Name	Description	
BGU7042	-	plastic surface-mounted package; 6 leads	SOT363

## 4. Marking

**Table 4. Marking codes**

Type number	Marking code	Description
BGU7042	*VB	* = p : made in Hong Kong * = W : made in China * = t : made in Malaysia

## 5. Limiting values

**Table 5. 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	-0.6	3.5	V
$V_{ctrl(Gp)}$	power gain control voltage	pin CTRL	[1] 0	$V_{CC}$	V
$I_{CC(tot)}$	total supply current		-	60	mA
$P_{tot}$	total power dissipation	$T_{sp} \leq 100\text{ °C}$	[2] -	250	mW
$P_i$	input power	single tone	-	10	dBm
$T_{stg}$	storage temperature		-65	+150	°C
$T_j$	junction temperature		-	150	°C
$T_{amb}$	ambient temperature		-10	+70	°C
$V_{ESD}$	electrostatic discharge voltage	Human Body Model (HBM); according to JEDEC standard 22-A114E	2	-	kV
		Charged Device Model (CDM); according to JEDEC standard 22-C101B	1.5	-	kV

[1]  $V_{ctrl(Gp)}$  must not exceed  $V_{CC}$ ;  $I_{CTRL}$  must be limited to 5 mA (maximum).

[2]  $T_{sp}$  is the temperature at the solder point of the ground lead.

**Remark:**  $V_{ctrl(Gp)}$  must not exceed  $V_{CC}$ ;  $I_{CTRL}$  must be limited to a maximum of 5 mA.

## 6. Thermal characteristics

**Table 6. Thermal characteristics**

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point		240	K/W

## 7. Characteristics

**Table 7. Characteristics**

$T_{amb} = 25\text{ °C}$ ; typical values at  $V_{CC} = 3.3\text{ V}$ ;  $Z_S = Z_L = 75\ \Omega$ ;  $R_{bias} = 7.5\ \Omega$ ;  $40\text{ MHz} \leq f_1 \leq 1000\text{ MHz}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage	RF input AC coupled	3.1	3.3	3.5	V
$I_{CC(tot)}$	total supply current	$G_p = 10\text{ dB mode}$	[1] -	38	-	mA
		bypass mode	[1] -	3	-	mA
$ S_{21} ^2$	insertion power gain	$G_p = 10\text{ dB mode}$	[1] -	10	-	dB
		bypass mode	[1] -	-2	-	dB
$SL_{sl}$	slope straight line	$G_p = 10\text{ dB mode}$	-	-1	-	dB
FL	flatness of frequency response	$G_p = 10\text{ dB mode}$	-	0.2	-	dB
NF	noise figure	$G_p = 10\text{ dB mode}$	[1] -	3.8	-	dB
		bypass mode	[1] -	2.5	-	dB

**Table 7. Characteristics ...continued**

$T_{amb} = 25\text{ }^{\circ}\text{C}$ ; typical values at  $V_{CC} = 3.3\text{ V}$ ;  $Z_S = Z_L = 75\ \Omega$ ;  $R_{bias} = 7.5\ \Omega$ ;  $40\text{ MHz} \leq f_1 \leq 1000\text{ MHz}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
RL <sub>in</sub>	input return loss	G <sub>p</sub> = 10 dB mode	[1]	-	21	- dB
		bypass mode	[1]	-	10	- dB
RL <sub>out</sub>	output return loss	G <sub>p</sub> = 10 dB mode	[1]	-	12	- dB
		bypass mode	[1]	-	10	- dB
P <sub>L(1dB)</sub>	output power at 1 dB gain compression	1 GHz; G <sub>p</sub> = 10 dB mode	[1]	-	12	- dBm
IP <sub>3O</sub>	output third-order intercept point	G <sub>p</sub> = 10 dB mode	[1][2]	-	29	- dBm
		bypass mode	[1][2]	-	29	- dBm

[1] Mode depends on setting of V<sub>ctrl(Gp)</sub> (V<sub>CTRL</sub>); see [Table 8](#).

[2] The fundamental frequency (f<sub>1</sub>) is 1000 MHz. The intermodulation product (IM3) is 2 × f<sub>2</sub> - f<sub>1</sub>, where f<sub>2</sub> = f<sub>1</sub> ± 1 MHz. Input power P<sub>i</sub> = -10 dBm.

**Table 8. Gain selection (pin CTRL)**

-10 °C ≤ T<sub>amb</sub> ≤ +70 °C; recommended power-up condition: V<sub>CTRL</sub> = logic 0 or < 0.7 V.

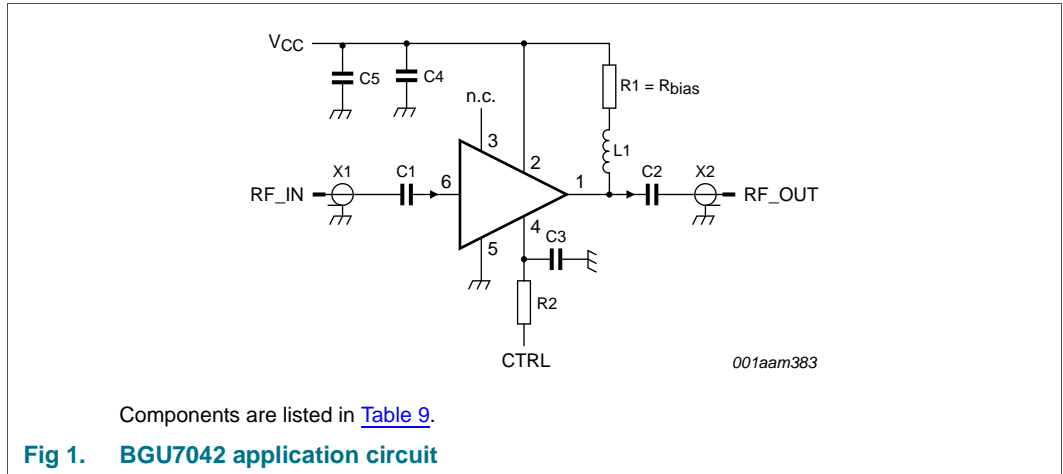
V <sub>ctrl(Gp)</sub> (V <sub>CTRL</sub> ) (V)	Mode
≤ 0.7	bypass
≥ 1.5	G <sub>p</sub> = 10 dB

**Remark:** V<sub>ctrl(Gp)</sub> must not exceed V<sub>CC</sub>; I<sub>CTRL</sub> must be limited to a maximum of 5 mA.

## 8. Application information

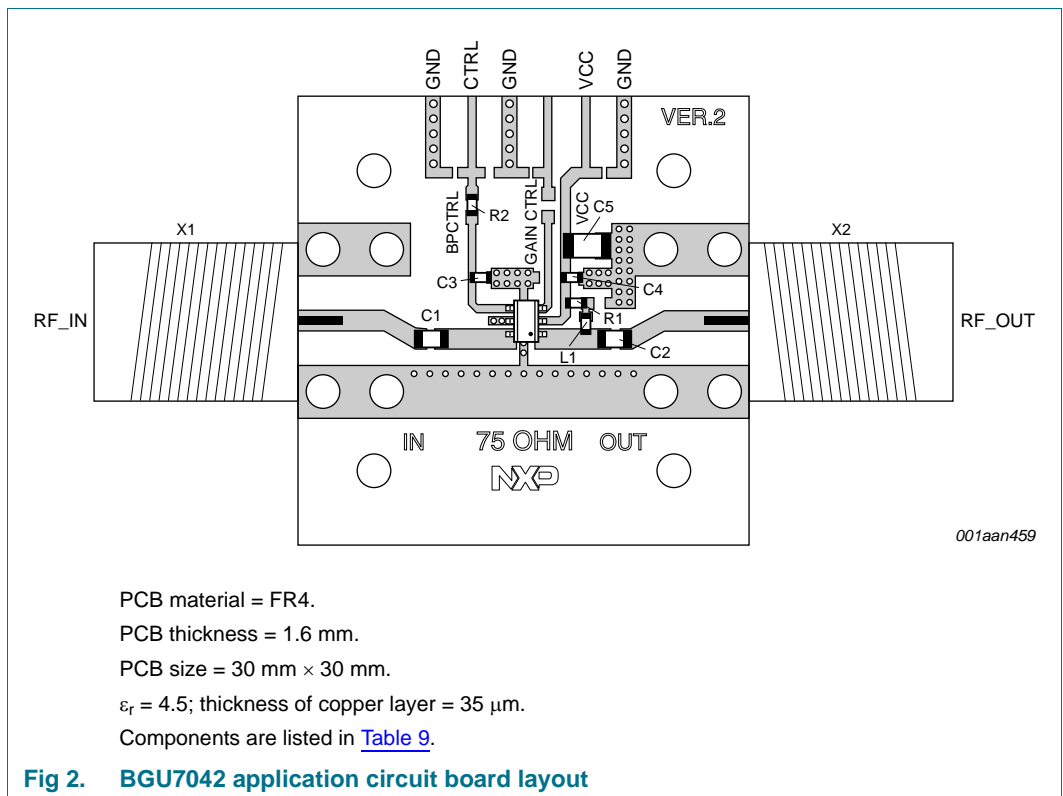
Other applications are possible. Please contact your local sales representative for more information. Application notes are available on the NXP website.

### 8.1 Application circuit



All control and supply lines must be decoupled properly. The decoupling capacitors must be placed as close to the device as possible.

### 8.2 Application circuit board layout



**Table 9. List of components**See [Figure 1](#) and [Figure 2](#).

Component	Description	Value	Remarks	Function
C1, C2	capacitor	10 nF		DC blocking
C3, C4	capacitor	10 nF		decoupling
C5	capacitor	10 $\mu$ F		decoupling
L1	chip ferrite bead	1.5 k $\Omega$	[1] Murata BLM18HE152SN1DF	RF choke
R1	resistor	7.5 $\Omega$	[1] R <sub>bias</sub>	bias setting
R2	resistor	1.8 k $\Omega$		current limiting
X1, X2	connector	75 $\Omega$	F-connector, edge mount PCB reflow type, Bomar 861V509ER6	input/output

[1] L1 and R1 must have a power rating of 0.1 W or higher.

9. Package outline

Plastic surface-mounted package; 6 leads

SOT363

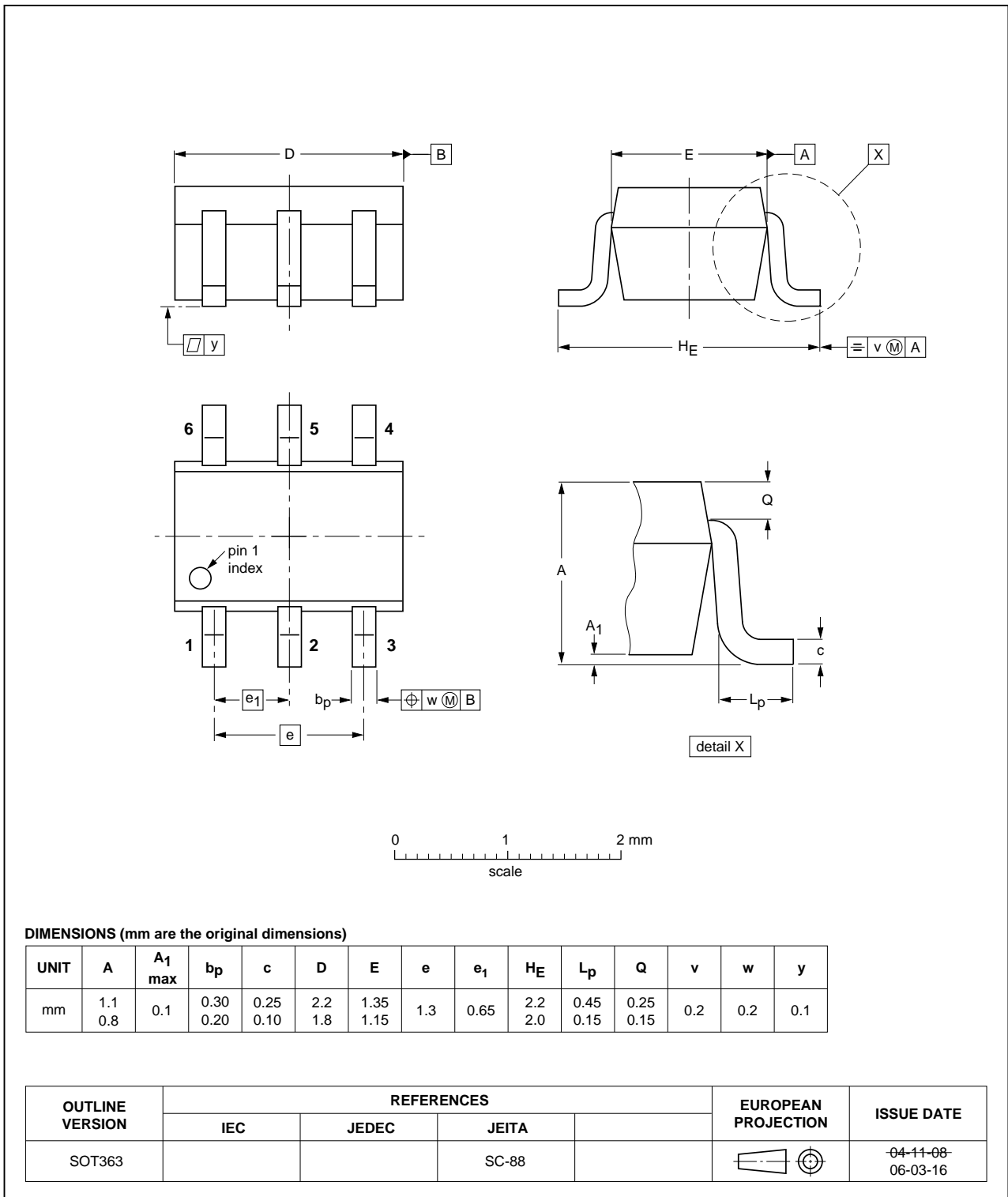


Fig 3. Package outline SOT363

## 10. Abbreviations

Table 10. Abbreviations

Acronym	Description
AC	Alternating Current
DC	Direct Current
ESD	ElectroStatic Discharge
LNA	Low-Noise Amplifier
MMIC	Monolithic Microwave Integrated Circuit
PCB	Printed-Circuit Board
RF	Radio Frequency
SMD	Surface-Mounted Device

## 11. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BGU7042 v.2	20110913	Product data sheet		BGU7042 v.1
Modifications:	<ul style="list-style-type: none"><li>Noise figure value updated</li></ul>			
BGU7042 v.1	20110208	Product data sheet	-	-



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### 12.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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.

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

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