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BGU7033

1 GHz wideband low-noise amplifier with bypass

Rev. 2 — 13 September 2010

Product data sheet

1. Product profile

1.1 General description

The BGU7033 MMIC is a wideband amplifier with selectable gain and 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 to Set-Top Box applications.

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

CAUTION



This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling.

1.2 Features and benefits

- Internally biased
- Programmable gain and bypass modes: $G_p = 10$ dB, $G_p = 5$ dB and bypass
- Flat gain between 40 MHz and 1 GHz
- Noise figure of 4.5 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) 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 $V_{CC} = 5\text{ V}$; $Z_S = Z_L = 75\text{ }\Omega$; $R_{bias} = 43\text{ }\Omega$; $40\text{ MHz} \leq f_1 \leq 1000\text{ MHz}$.

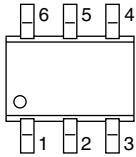
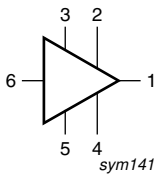
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage	RF input AC coupled	4.75	5.0	5.25	V
$I_{CC(tot)}$	total supply current	$G_p = 5\text{ dB mode}$	[1]	-	43	- mA
		$G_p = 10\text{ dB mode}$	[1]	-	43	- mA
		bypass mode	[1]	-	4	- mA
T_{amb}	ambient temperature		-10	-	+70	$^{\circ}\text{C}$
NF	noise figure	$G_p = 10\text{ dB mode}$	[1]	-	4.5	- 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]	-	14	- dBm
IP3O	output third-order intercept point	$G_p = 10\text{ dB mode}$	[1][2]	-	29	- dBm

[1] Mode depends on setting of V_{CTRL1} and V_{CTRL2} ; 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	CTRL1 (gain control)		
4	CTRL2 (bypass control)		
5	GND		
6	RF_IN		

3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
BGU7033	-	plastic surface-mounted package; 6 leads	SOT363

4. Marking

Table 4. Marking codes

Type number	Marking code
BGU7033	SE%

Note: % character indicates the location of production.

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	5.25	V
$V_{ctrl(Gp)}$	power gain control voltage	pin CTRL1	[1] 0	V_{CC}	V
$V_{ctrl(bp)}$	bypass control voltage	pin CTRL2	[2] 0	V_{CC}	V
$I_{CC(tot)}$	total supply current		-	60	mA
P_{tot}	total power dissipation	$T_{sp} \leq 100\text{ °C}$	[3] -	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

[1] $V_{ctrl(Gp)}$ must not exceed V_{CC} ; I_{CTRL1} must be limited to 5 mA (maximum).

[2] $V_{ctrl(bp)}$ must not exceed V_{CC} ; I_{CTRL2} must be limited to 5 mA (maximum).

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

Remark: $V_{ctrl(Gp)}$ must not exceed V_{CC} ; I_{CTRL1} must be limited to a maximum of 5 mA.

Remark: $V_{ctrl(bp)}$ must not exceed V_{CC} ; I_{CTRL2} 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 $V_{CC} = 5\text{ V}$; $Z_S = Z_L = 75\ \Omega$; $R_{bias} = 43\ \Omega$; $40\text{ MHz} \leq f_1 \leq 1000\text{ MHz}$.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage	RF input AC coupled	4.75	5.0	5.25	V
$I_{CC(tot)}$	total supply current	$G_p = 5\text{ dB mode}$	[1][2] -	43	-	mA
		$G_p = 10\text{ dB mode}$	[1][2] -	43	-	mA
		bypass mode	[1][2] -	4	-	mA
$ S_{21} ^2$	insertion power gain	$G_p = 5\text{ dB mode}$	[1] -	5	-	dB
		$G_p = 10\text{ dB mode}$	[1] -	10	-	dB
		bypass mode	[1] -	-2	-	dB
SL_{sl}	slope straight line		-	-1	-	dB

Table 7. Characteristics ...continued

$T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values at $V_{CC} = 5\text{ V}$; $Z_S = Z_L = 75\text{ }\Omega$; $R_{bias} = 43\text{ }\Omega$; $40\text{ MHz} \leq f_1 \leq 1000\text{ MHz}$.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
FL	flatness of frequency response		-	-0.2	-	dB
NF	noise figure	$G_p = 5\text{ dB mode}$	[1]	-	6.0	dB
		$G_p = 10\text{ dB mode}$	[1]	-	4.5	dB
		bypass mode	[1]	-	2.5	dB
RL _{in}	input return loss	$G_p = 5\text{ dB mode}$	[1]	-	17	dB
		$G_p = 10\text{ dB mode}$	[1]	-	18	dB
		bypass mode	[1]	-	8	dB
RL _{out}	output return loss	$G_p = 5\text{ dB mode}$	[1]	-	12	dB
		$G_p = 10\text{ dB mode}$	[1]	-	12	dB
		bypass mode	[1]	-	8	dB
P _{L(1dB)}	output power at 1 dB gain compression	1 GHz; $G_p = 5\text{ dB mode}$	[1]	-	9	dBm
		$G_p = 10\text{ dB mode}$	[1]	-	14	dBm
IP3 _O	output third-order intercept point	$G_p = 5\text{ dB mode}$	[1][2]	-	29	dBm
		$G_p = 10\text{ dB mode}$	[1][2]	-	29	dBm
		bypass mode	[1][2]	-	29	dBm

[1] Mode depends on setting of V_{CTRL1} and V_{CTRL2}; see Table 8.

[2] The fundamental frequency (f₁) is 1000 MHz. The intermodulation product (IM3) is 2 × f₂ - f₁, where f₂ = f₁ ± 1 MHz. Input power P_i = -10 dBm.

Table 8. Gain selection (pins CTRL1, CTRL2)

-10 °C ≤ T_{amb} ≤ +70 °C; recommended power-up condition: V_{CTRL1} and V_{CTRL2} = logic 0 or < 0.7 V.

V _{CTRL1} (V _{ctrl(Gp)}) (V)	V _{CTRL2} (V _{ctrl(bp)}) (V)	Mode
≤ 0.7	≤ 0.7	bypass
≥ 4.3	≤ 0.7	bypass
≤ 0.7	≥ 4.3	G _p = 5 dB
≥ 4.3	≥ 4.3	G _p = 10 dB

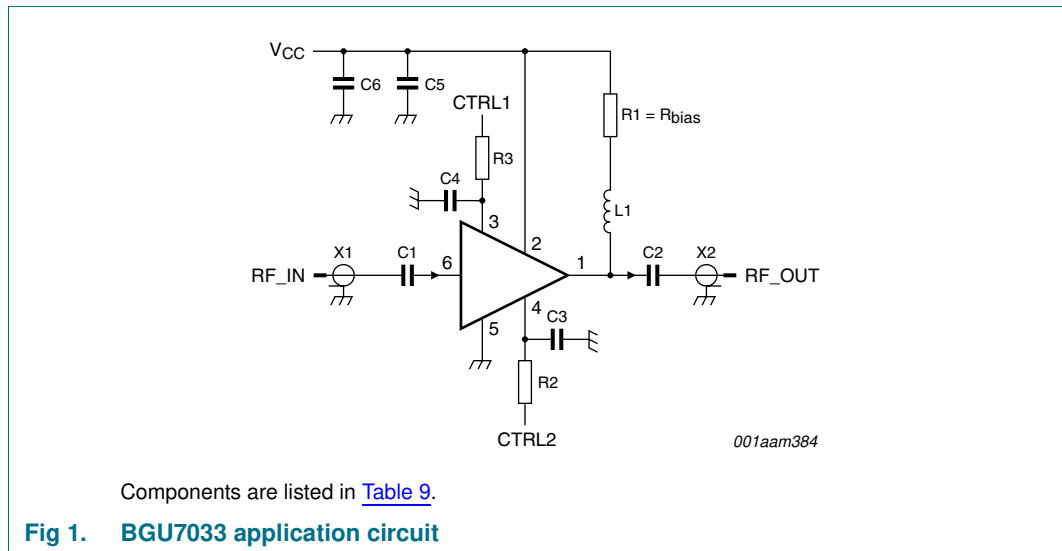
Remark: V_{ctrl(Gp)} must not exceed V_{CC}; I_{CTRL1} must be limited to a maximum of 5 mA.

Remark: V_{ctrl(bp)} must not exceed V_{CC}; I_{CTRL2} 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

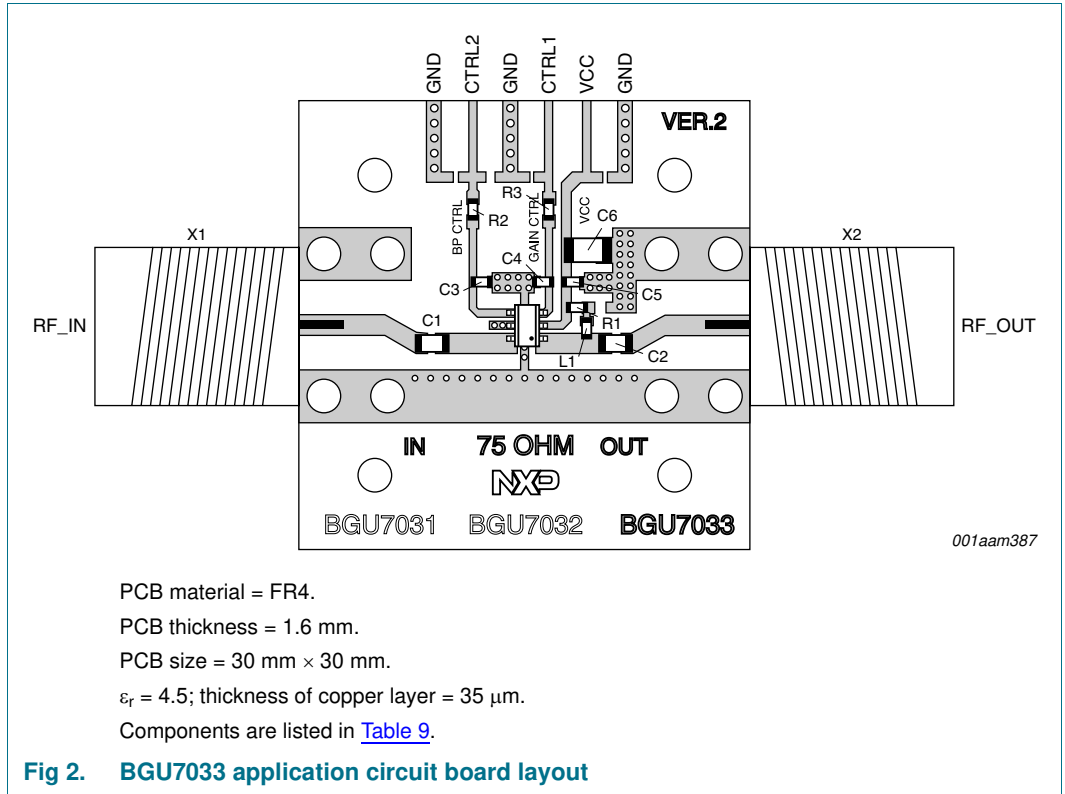


Table 9. List of components

See [Figure 1](#) and [Figure 2](#).

Component	Description	Value	Remarks	Function
C1, C2	capacitor	10 nF		DC blocking
C3, C4, C5	capacitor	10 nF		decoupling
C6	capacitor	10 μF		decoupling
L1	chip ferrite bead	1.5 kΩ	[1] Murata BLM18HE152SN1DF	RF choke
R1	resistor	43 Ω	[1] R _{bias}	bias setting
R2, R3	resistor	1.8 kΩ		current limiting
X1, X2	connector	75 Ω	F-connector, edge mount PCB reflow type, Bomar 861V509ERG	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

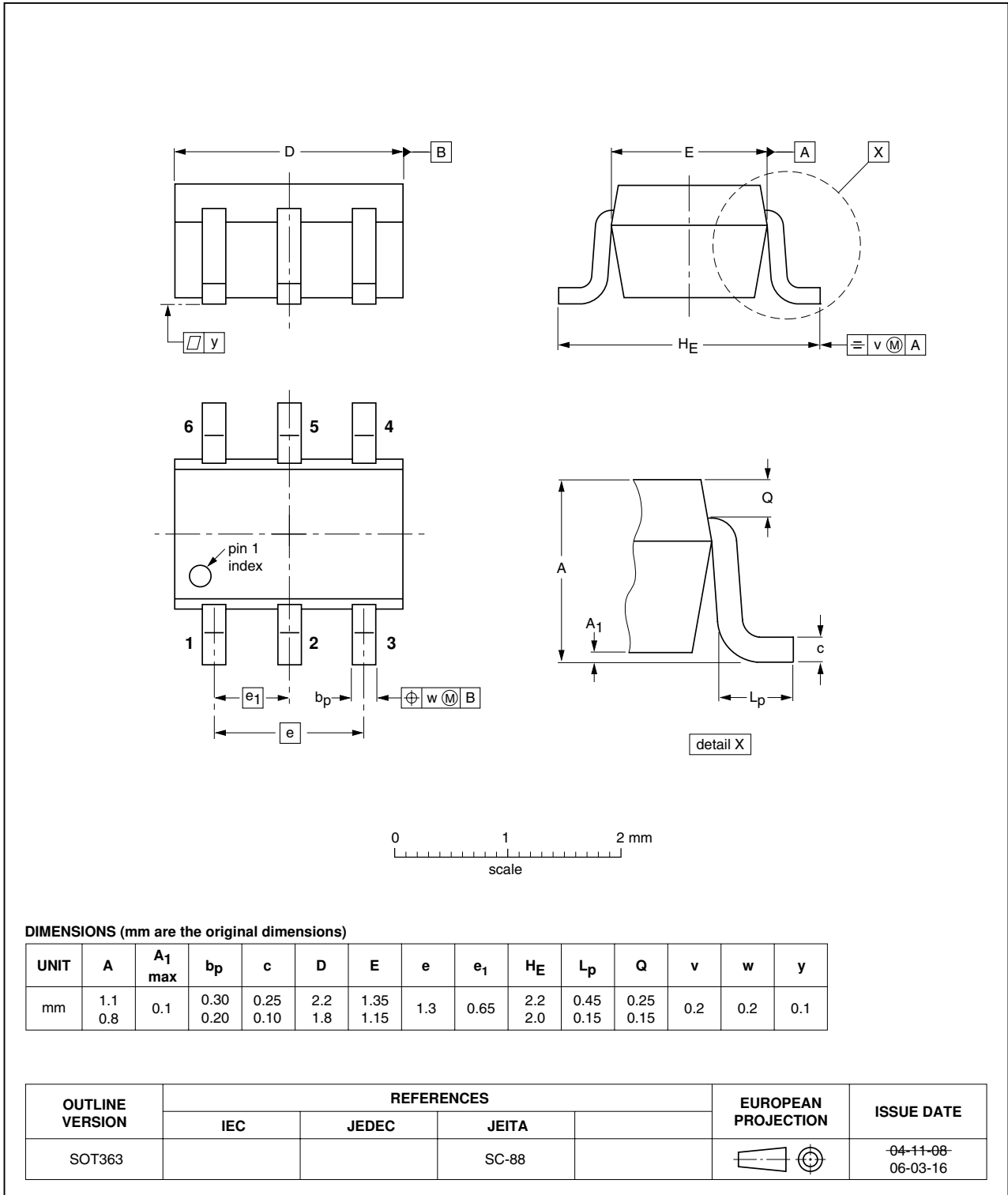


Fig 3. Package outline SOT363

10. Abbreviations

Table 10. Abbreviations

Acronym	Description
AC	Alternating Current
DC	Direct Current
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
BGU7033 v.2	20100913	Product data sheet	-	BGU7033 v.1
Modifications:	• The status of this data sheet has been changed to Product data sheet.			
BGU7033 v.1	20100816	Preliminary data sheet	-	-

12. Legal information

12.1 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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Date of release: 13 September 2010

Document identifier: BGU7033