

NLB-400

Cascadable Broadband GaAs MMIC Amplifier DC to 6GHz

The NLB-400 cascadable broadband InGaP/GaAs MMIC amplifier is a low-cost, high-performance solution for general purpose RF and microwave amplification needs. This 50Ω gain block is based on a reliable HBT proprietary MMIC design, providing unsurpassed performance for small-signal applications. Designed with an external bias resistor, the NLB-400 provides flexibility and stability. The NLB-400 is packaged in a low cost, surface-mount plastic package, providing ease of assembly for high-volume tape-and-reel requirements.



Functional Block Diagram

Ordering Information

NLB-400	Cascadable Broadband GaAs MMIC Amplifier DC to 6GHz
NLB-400-T1	Tape & Reel, 1000 Pieces
NLB-400-E	Fully Assembled Evaluation Board
NBB-X-K1	Extended Frequency InGaP Amp Designer's Tool Kit



Package: Micro-X, 4-pin, Plastic

Features

- Reliable, Low-Cost HBT Design
- 15.5dB Gain, +12.0dBm
 P1dB at 2Ghz
- High P1dB of +14.6dBm at 6.0GHz
- Single Power Supply Operation
- 50Ω I/O Matched for High Frequency Use

Applications

- Narrow and Broadband Commercial and Military Radio Designs
- Linear and Saturated Amplifiers
- Gain Stage or Driver Amplifiers for MWRadio/Optical Designs (PTP/PMP/LMDS/UNII/VSAT/ WLAN/Cellular/DWDM)



Absolute Maximum Ratings

Parameter	Rating	Unit
RF Input Power	+20	dBm
Power Dissipation	300	mW
Device Current	70	mA
Channel Temperature	200	°C
Operating Temperature	-45 to +85	°C
Storage Temperature	-65 to +150	°C

Exceeding any one or a combination of these limits may cause permanent damage.



RoHS

RoHS

RoHS (Restriction of Hazardous Substances): Compliant per EU Directive 2011/65/EU.

Caution! ESD sensitive device.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

Nominal Operating Parameters

Parameter	Sp	Specification		Unit	Condition		
Falameter	Min	Тур	Max	Unit			
General Performance					V _D = +3.9V, I _{CC} = 47mA, Z ₀ = 50Ω, T _A = +25°C		
Small Signal Power Gain, S21	16.0	17.0		dB	f = 0.1GHz to 1.0GHz		
		13.0		dB	f = 1.0GHz to 4.0GHz		
	10.8	11.5		dB	f = 4.0GHz to 6.0GHz		
Gain Flatness, GF		±0.65		dB	f = 0.1GHz to 2.0GHz		
Input VSWR		1.65:1			f = 0.1GHz to 4.0GHz		
		1.65:1			f = 4.0GHz to 6.0GHz		
		1.75:1			f = 6.0GHz to 10.0GHz		
Output VSWR		1.5:1			f = 0.1GHz to 4.0GHz		
		1.9:1			f = 4.0GHz to 6.0GHz		
		2.2:1			f = 6.0GHz to 10.0GHz		
Bandwidth, BW		4.7		GHz	BW3 (3dB)		
Output Power at -1dB Compression, P1dB		12.0		dBm	f = 2.0GHz		
		14.6		dBm	f = 6.0GHz		
Noise Figure, NF		4.1		dB	f = 3.0GHz		
Third Order Intercept, IP3		+29.6		dBm	f = 2.0GHz		
		+27.3			f = 6.0GHz		
Reverse Isolation, S12		-18		dB	f = 0.1GHz to 12.0GHz		
Device Voltage, V_{D}	3.6	3.9	4.2	V			
Gain Temperature Coefficient, $\delta G_T / \delta T$		-0.0015		dB/°C			

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Deremeter	Specification			Unit	Condition
Falallelel	Min	Тур	Max	Unit	
MTTF versus Temperature at I _{cc} = 50mA					
Case Temperature		85		°C	
Junction Temperature		119		°C	
MTTF		>1,000,000		hours	
Thermal Resistance					
θ _{JC}		185		°C/W	$\frac{\mathbf{J}_T - \mathbf{T}_{CASE}}{\mathbf{V}_D \cdot \mathbf{I}_{CC}} = \theta_{JC} (^{\circ}\text{C/Watt})$



Pin Names and Descriptions

Pin	Name	Description	Interface Schematic
1	RFIN	RF input pin. This pin is NOT internally DC blocked. A DC blocking capacitor, suitable for the frequency of operation, should be used in most applications. DC coupling of the input is not allowed, because this will override the internal feedback loop and cause temperature instability.	
2	GND	Ground connection. For best performance, keep traces physically short and connect immediately to ground plane.	
3	RFOUT	RF output and bias pin. Biasing is accomplished with an external series resistor and choke inductor to VCc. The resistor is selected to set the DC current into this pin to a desired level. The resistor value is determined by the following equation: $R = \frac{(V_{CC} - V_{DEVICE})}{I_{CC}}$ Care should also be taken in the resistor selection to ensure that the current into the part never exceeds maximum datasheet operating current over the planned operating temperature. This means that a resistor between the supply and this pin is always required, even if a supply near 5.0V is available, to provide DC feedback to prevent thermal runaway. Because DC is present on this pin, a DC blocking capacitor, suitable for the frequency of operation, should be used in most applications. The supply side of the bias network should also be well bypassed.	
4	GND	Same as pin 2.	

Package Drawing



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Typical Bias Configuration



NOTE: Application notes related to biasing circuit, device footprint, and thermal considerations are available on request.

Recommended Bias Resistor Values							
Supply Voltage, V _{CC} (V) 5 8 10 12 15 20							
Bias Resistor, R _{CC} (Ω) 23 87 129 172 236 343							



Extended Frequency InGaP Amplifier Designer's Tool Kit (NBB-X-K1)

This tool kit was created to assist in the design-in of the RFMD NBB- and NLB- series InGap HBT gain block amplifiers. Each tool kit contains the following:

- 5 each NBB-300, NBB-310 and NBB-400 Ceramic Micro-X Amplifiers
- 5 each NLB-300, NLB-310 and NLB-400 Plastic Micro-X Amplifiers
- 2 Broadband Evaluation Boards and High Frequency SMA Connectors
- Broadband Bias Instructions and Specification Summary Index for ease of operation





Tape and Reel Dimensions (all dimensions in millimeters)



	14.732 mm (7") REEL	Plastic, Micro-X		
	ITEMS	SYMBOL	SIZE (mm)	SIZE (inches)
	Diameter	В	178 +0.25/-4.0	7.0 +0.079/-0.158
FLANGE	Thickness	Т	18.4 MAX	0.724 MAX
	Space Between Flange	F	12.8 +2.0	0.50 +0.08
	Outer Diameter	0	76.2 REF	3.0 REF
HUB	Spindle Hole Diameter	S	13.716 +0.5/-0.2	0.540 +0.020/-0.008
	Key Slit Width	A	1.5 MIN	0.059 MIN
	Key Slit Diameter	D	20.2 MIN	0.795 MIN





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Typical Performance



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Note: The s-parameter gain results shown above include device performance as well as evaluation board and connector loss variations. The insertion losses of the evaluation board and connectors are as follows:

1GHz to 4GHz = -0.06dB 5GHz to 9GHz = -0.22dB 10GHz to 14GHz = -0.50dB 15GHz to 20GHz = -1.08dB

RoHS Banned Material Content

RoHS Compliant:	Yes
Package Total Weight in Grams (g):	0.024
Compliance Date Code:	0602
Bill of Materials Revision:	-
Pb Free Category:	e3

Bill of Materials	Parts Per Million (PPM)								
	Pb	Cd	Hg	Cr VI	PBB	PBDE			
Die	0	0	0	0	0	0			
Molding Compound	0	0	0	0	0	0			
Lead Frame	0	0	0	0	0	0			
Die Attach Epoxy	0	0	0	0	0	0			
Wire	0	0	0	0	0	0			
Solder Plating	0	0	0	0	0	0			

This RoHS banned material content declaration was prepared solely on information, including analytical data, provided to RFMD by its suppliers, and applies to the Bill of Materials (BOM) revision noted



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Наши контакты:

Телефон: +7 812 627 14 35

Электронная почта: sales@st-electron.ru

Адрес: 198099, Санкт-Петербург, Промышленная ул, дом № 19, литера Н, помещение 100-Н Офис 331