

High Directivity

# Monolithic Amplifier

VNA-28B+

50Ω 0.5 to 2.5 GHz

## The Big Deal

- 2.8 & 5V operation
- High directivity, 16-23 dB
- Footprint compatible with VNA-28 & VNA-28A+



CASE STYLE: DL1020

## Product Overview

VNA-28B+ is a wideband amplifier providing high directivity. It has built-in DC blocks at input and output and a separate lead for DC. It is fabricated using PHEMT technology and enclosed in a 5x6 mm MCLP plastic package.

## Key Features

Feature	Advantages
Footprint compatible with VNA-28 & VNA-28A+	Can be used as a replacement for obsolete parts VNA-28+ and VNA-28A+ without PCB design change. Refer to AN-60-089
High directivity, 16-23 dB	Acts as a low cost isolator, minimizing the interaction of pre and post circuits.
Built-in DC blocks	Eliminates need for external DC blocks, lowering PCB size & cost.
Separate terminal for DC	Eliminates need for output bias-tee, further reducing external component count, cost & PCB size.
DC voltage, 2.8 to +5V	No voltage dropping resistor required, allowing low voltage operation.
5 x 6mm 8-lead MCLP package	Provides low inductance, repeatable transitions, and excellent thermal contact to PCB.



High Directivity

# Monolithic Amplifier

0.5-2.5 GHz

## Product Features

- 2.8V & 5V operation
- no external biasing circuit required
- internal DC blocking at RF input and output
- high directivity, 16-23 dB typ.
- wide bandwidth, 0.5 to 2.5 GHz
- low noise figure, 3.0 dB typ.
- output power, up to +11.4 dBm typ. at 1.5 GHz
- potential replacement for VNA-28A+ see (AN-60-089)
- low cost



## VNA-28B+

CASE STYLE: DL1020

**+RoHS Compliant**

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

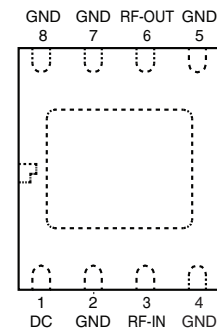
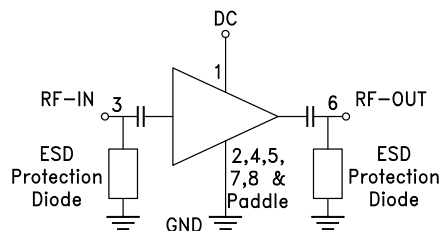
## Typical Applications

- buffer amplifier
- cellular
- PCN

## General Description

VNA-28B+ is a wideband amplifier offering high dynamic range. It is enclosed in an 8-lead 5X6 mm MCLP package, footprint compatible with SOIC-8 lead package. VNA-28B+ is fabricated using PHEMT technology. It has built-in DC blocks at RF-IN and RF-OUT ports and separate pad for DC eliminating the need for bias tee.

### simplified schematic and pad description



### Pad description

Function	Pad Number	Description
RF-IN	3	RF input pin.
RF-OUT	6	RF output pin.
DC	1	Bias pin
GND	2,4,5,7,8 and paddle	Connections to ground. Use via holes as shown in "Suggested Layout for PCB Design" to reduce ground path inductance for best performance.

Electrical Specifications<sup>1</sup> at 25°C, 50Ω unless noted

Parameter	Condition (GHz)	Vs=5V			Vd=2.8V	Units
		Min.	Typ.	Max.	Typ.	
Frequency range		0.5		2.5	0.5-2.5	GHz
Gain	0.5		21.2		20.2	dB
	0.75		23.2		21.9	
	1.0		23.5		22.0	
	1.5		23.0		21.1	
	2.0	19.5	21.7	24.0	19.7	
	2.5		19.9		17.9	
Input return loss	0.5		5.0		5.2	dB
	0.75		10.0		10.7	
	1.0		14.9		16.1	
	1.5		17.3		19.4	
	2.0		16.1		17.0	
	2.5		13.9		14.0	
Output return loss	0.5		12.0		12.5	dB
	0.75		13.9		21.0	
	1.0		11.7		17.9	
	1.5		10.6		16.3	
	2.0		11.2		17.3	
	2.5		13.3		20.8	
Output power @ 1dB compression	0.5		13.3		11.4	dBm
	0.75		12.9		11.4	
	1.0		11.9		10.8	
	1.5		11.4		10.2	
	2.0		10.9		9.7	
	2.5		10.5		9.1	
Output IP3	0.5		24.3		22.2	dBm
	0.75		24.6		22.3	
	1.0		23.4		21.5	
	1.5		22.7		20.8	
	2.0		21.8		20.1	
	2.5		21.2		19.3	
Noise figure	0.5		3.2		3.3	dB
	0.75		3.0		3.1	
	1.0		3.0		3.0	
	1.5		2.9		3.1	
	2.0		3.0		3.1	
	2.5		3.1		3.3	
Directivity (Isolation-Gain)	0.5		17.1		19.5	dB
	0.75		20.0		23.0	
	1.0		23.3		22.9	
	1.5		20.7		18.9	
	2.0		18.7		17.4	
	2.5		17.5		16.5	
DC Current			34	45	32	mA
Device current variation vs temperature <sup>2</sup>			16		7	μA/°C
Device current variation vs voltage			0.0004 <sup>3</sup>		0.0013 <sup>4</sup>	mA/mV
Thermal resistance at 85°C			64		64	°C/W

1. Measured on Mini-Circuits Characterization test board TB-01-28B+. See Characterization Test Circuit (Fig. 1)

2. Current at 85°C - Current at -45°C/130

3. Current at 5.25V - Current at 3.29V/1.35

4. Current at 3.9V - Current at 2.66V/1.24

Absolute Maximum Ratings<sup>5</sup>

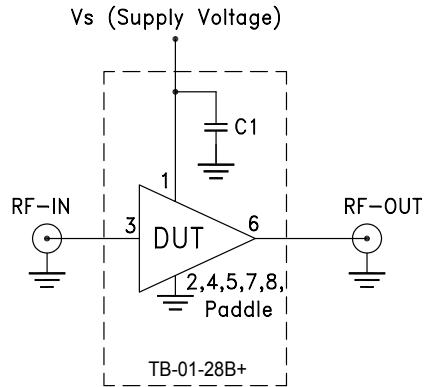
Parameter	Ratings
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
DC Voltage	+7V at pad 1 1V at pads 3 & 6; 10V at pads 3,6
Power Dissipation	700 mW
Input Power	+5 dBm (continuous operation) +28 dBm (5 minutes max.)

5. Permanent damage may occur if any of these limits are exceeded.

These ratings are not intended for continuous normal operation.



Characterization Test Circuit

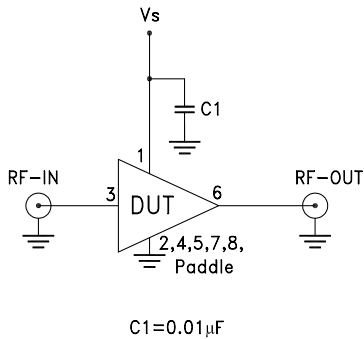


**Fig 1.** Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization test board TB-01-28B+) Gain, Return loss, Output power at 1dB compression (P1 dB), output IP3 (OIP3) and noise figure measured using Agilent’s N5242A PNA-X microwave network analyzer.

**Conditions:**

1. Gain: Pin= -25dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, -5 dBm/tone at input.

Recommended Application Circuit



**Fig 2.** Recommended Application Circuit

Product Marking



Additional Detailed Technical Information	
<i>additional information is available on our dash board. To access this information <a href="#">click here</a></i>	
<b>Performance Data</b>	Data Table
	Swept Graphs
	S-Parameter (S2P Files) Data Set (.zip file)
<b>Case Style</b>	DL1020 <i>Plastic model, 8 lead, 5x6 mm MCLP, tin-silver over nickel</i>
<b>Tape &amp; Reel</b> Standard quantities available on reel	F68 <i>7" reels with 20, 50, 100, 200, 500 or 1K devices 13" reels with 2K, 4K devices</i>
<b>Suggested Layout for PCB Design</b>	PL-077
<b>Evaluation Board</b>	TB-01-28B+
<b>Environmental Ratings</b>	ENV08T1

**ESD Rating**

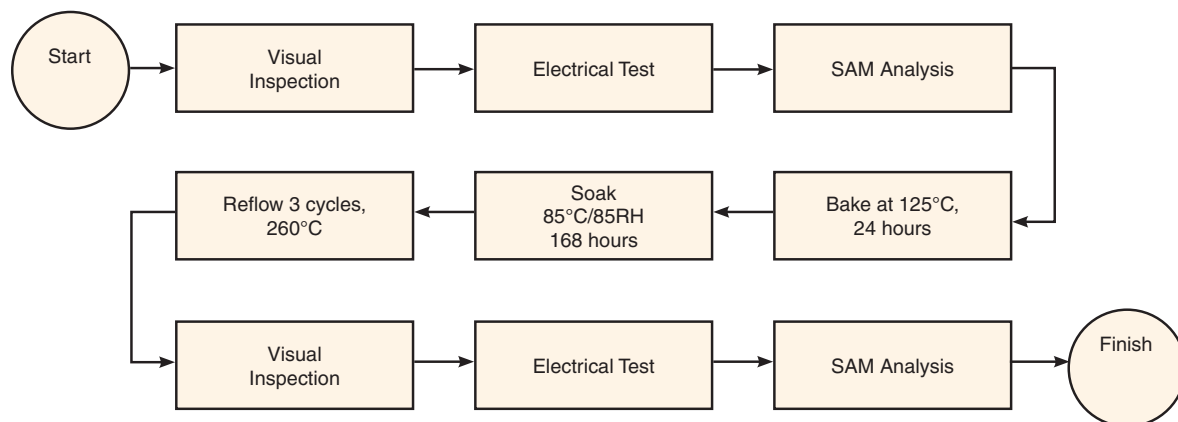
Human Body Model (HBM): Class 1A (250V to <500V) in accordance with ANSI/ESD STM 5.1 - 2001

Machine Model (MM): Class M1 (Pass 25V) in accordance with ANSI/ESD STM5.2-1999

**MSL Rating**

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020D

**MSL Test Flow Chart**



**Additional Notes**

- A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuits' applicable established test performance criteria and measurement instructions.
- C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at [www.minicircuits.com/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp)