



DATA SPECIFICATION FOR THE HIGH INTERCEPT LOW NOISE AMPLIFIER W/ CUSTOM FILTERING

MODEL NUMBER:

HILNA™ CF

38 dB GAIN

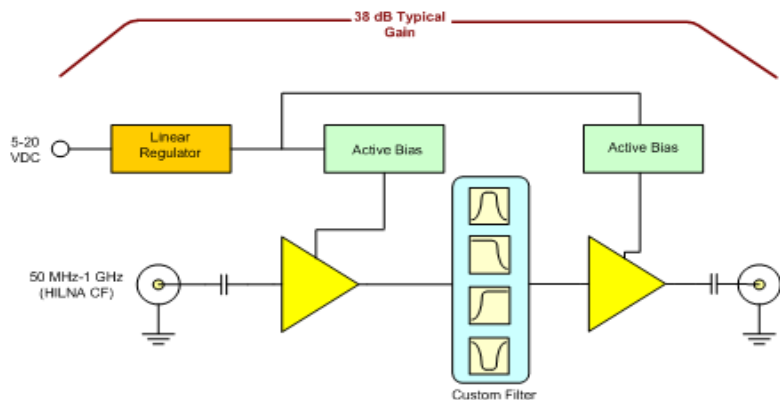
NuWaves Engineering

SUPERIOR ENGINEERING DESIGN SERVICES

NuWaves' High Intercept, Low Noise Amplifier with Custom Filter (HILNA™ CF) is designed to allow end-users the capability to select their own **custom filter** (Bandpass, Highpass, Lowpass or Band Reject) while achieving extremely low noise, high third-order intercept point, and high RF gain. These characteristics are maintained across a wide band, from 50 MHz to 1 GHz. Standard units support nominal filtering bandwidths of 20%.

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1. PRODUCT OVERVIEW

1.1 Product Highlights

- High Performance - Noise, Gain, Intercept, Dynamic Range, RF Filtering: Unprecedented unique combination of extremely low noise (0.8 dB), High Gain (38 dB typical, depending upon the type of filter used), High Output Intercept (+32 dBm), wide band frequency coverage (50 MHz to 1 GHz), and user selectable filtering.
- User Definable Custom Filters: The HILNA™ CF Amplifier is designed to allow-end users the ability to select their own custom filter, Bandpass, Highpass, Lowpass, or Band Reject. Typical designs incorporate a 3-7 pole filter structure, with nominal bandwidths of 20%. Tighter tolerance filters are available at additional cost.
- Robust Power Supply: Operates over a very broad range of power supply voltages (5-20 VDC), easily allowing the HILNA™ CF to be integrated into systems without regard to power supply precision. Included with each amplifier is a mating power connector with cable attached
- Enclosure: The HILNA™ CF Amplifier is housed in a sleek black anodized extruded aluminum enclosure with mounting flanges.
- Completely Characterized: The HILNA™ family of Amplifiers has been completely characterized over temperature, voltage, and frequency. The amplifiers are robust offering significant value for the OEM user or the Systems Integrator.
- Low Cost: The HILNA™ CF amplifier is competitively priced. The unique combination of linearity, low noise, custom filtering, and broadband operation meet the demanding needs of state-of-the-art designs delivering high value for little cost.
- User Friendly: Reverse voltage protection and regulator thermal shutdown provide defenses against user interface issues.
- High Reliability: NuWaves' selection of conservatively rated components provides high reliability delivering high MTBF numbers. Each HILNA™ CF is quality inspected to IPC-A-610 Class III standards.

1.2 Product Description

Product	HILNA™ CF
Functional Description	<p>NuWaves' HILNA™ CF Amplifiers are designed to allow end-users the ability to select their own custom filter (Bandpass, Highpass, Lowpass, or Band Reject) for the attenuation of interferers and other undesired out-of-band emissions, while achieving extremely low noise, high linearity, and wideband operation delivering high RF gain. Other characteristics include reverse voltage protection and an internal regulator and active bias.</p>
Applications	<p>IF or RF Buffer Amplifier ▪ User defined Filters can filter out unwanted VHF, UHF, cellular and other interfering signals unwanted signals ▪ Overcome Systematic RF Losses ▪ Increase Antenna Signal Levels ▪ Military Radios ▪ RF Wideband Front-Ends ▪ RF PreAmp ▪ TV ▪ Final Stage Amplifier for Low-Level Repeaters ▪ Long Cable Runs to Antenna ▪ Ultra Low Noise Applications ▪ LNA for Cellular Base Station ▪ High Linearity Systems ▪ General Purpose Amplification ▪ High Performance Receivers ▪ High Power Drive Signals for Increased Dynamic Range ▪ High Reliability RF Amplifier Applications ▪ Base Station Applications ▪ VHF/UHF Amplification ▪ Final PA for Low-Power Applications ▪ Low-Noise Transmit Driver ▪ Cable Modem ▪ ▪ Fixed Wireless ▪ Mobile Infrastructure ▪ Industrial Scientific Medical Band Applications</p>
Users	<p>Engineering and Scientific Laboratories ▪ Test and Measurement Facilities ▪ OEMs of RF High End Systems ▪ Research Laboratories ▪ Communications Engineering Firms ▪ Cable TV System Engineers ▪ RF System Integrators ▪ Test Ranges ▪ Universities ▪ Antenna Design Facilities ▪ Field Service Technicians ▪ Aerospace and Defense Systems ▪ Radio and TV Engineers ▪ Amateur Radio ▪ Scientific and Consulting Agencies ▪ Radio and Wireless Communication Services ▪ Precision Equipment Repair Organizations ▪ Professional and Technical Service Institutions ▪ Military Radio & Communication Facilities</p>

1.3 Product Variants

This data sheet focuses on the HILNA™ CF configuration; however, NuWaves offers several variants of the HILNA™ line-up. Furthermore, the HILNA™ family of amplifiers covers 50 MHz to 3 GHz, with plans to expand the HILNA™ line-up to 5 GHz. The variants and their availability include:

- HILNA™ CF – 50 MHz to 1 GHz, 38 dB Gain (FULL PRODUCTION)
- μ HILNA™ - 50MHz to 1 GHz, 20 dB Gain (FULL PRODUCTION)
- HILNA™ G2V1 – 50 MHz to 1 GHz, 40 dB Gain (FULL PRODUCTION)
- HILNA™ V1 – 50 MHz to 1 GHz, 20 dB Gain (FULL PRODUCTION)
- HILNA™ GPS – 1.2 GHz to 1.6 GHz, 32 dB Gain (FULL PRODUCTION)
- μ HILNA™ V2 – 1 GHz to 3 GHz, 16 dB Gain (PILOT PRODUCTION)



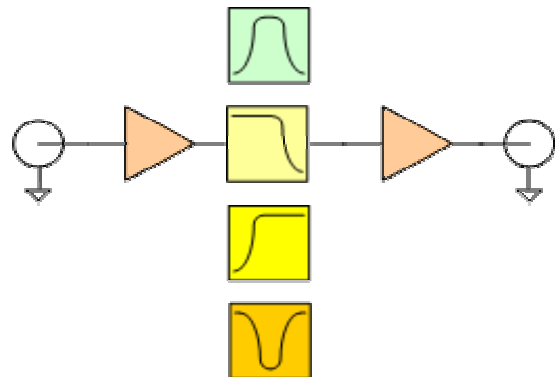
Figure 1: HILNA™ CF MODULE

1.4 Part Number Ordering Information

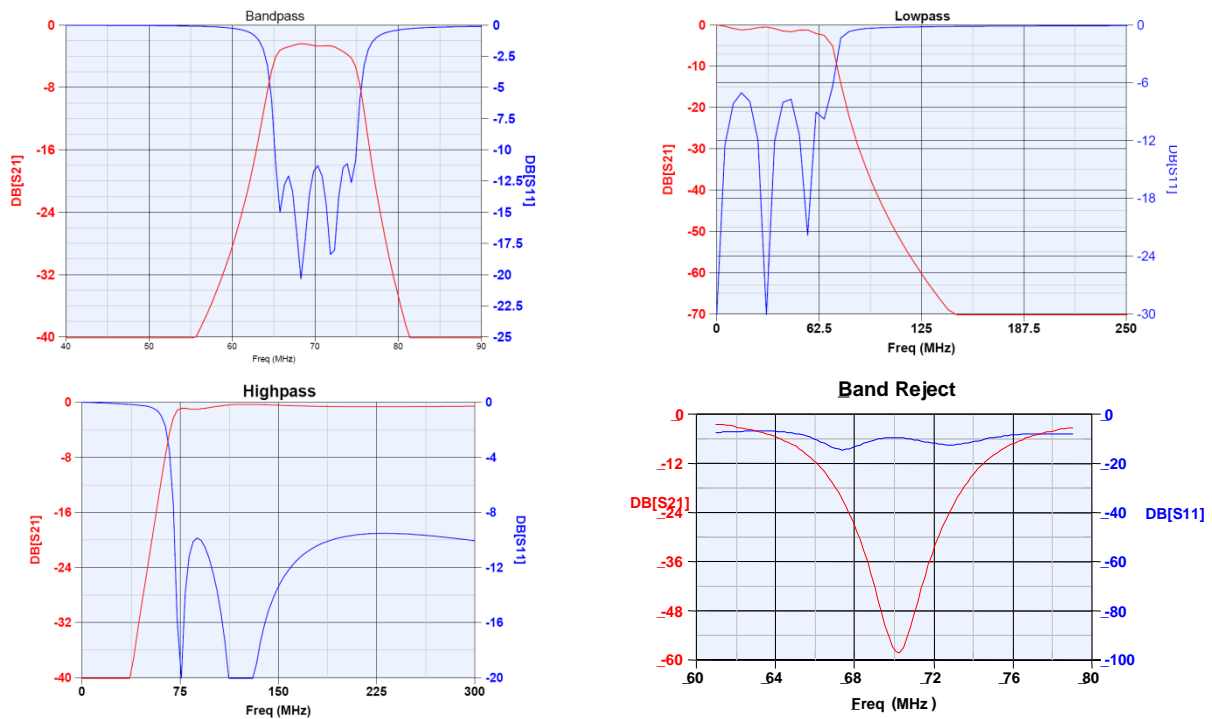
<u>Base Part Number</u>	<u>Part# Extension</u> Frequency: 50-1000 (MHz)	<u>Description</u>
HILNA™ CF-01-	XXX-XXXX	HILNA w/ Custom Bandpass Filter Ex: HILNA CF-01-075-0375 (75 MHz BW at 375 MHz)
HILNA™ CF-02-	XXXX	HILNA w/ Custom Highpass Filter Ex: HILNA CF-02-0750 (3 dB Freq at 750 MHz)
HILNA™ CF-03-	XXXX	HILNA w/ Custom Lowpass Filter Ex: HILNA CF-03-0225 (3 dB Freq at 225 MHz)
HILNA™ CF-04-	XXX-XXXX	HILNA w/ Custom Band Reject Filter Ex: HILNA CF-04-050-0175 (50 MHz wide notch at 175 MHz)

2. HILNA™ CF BANDWIDTH CHARACTERISTICS

The HILNA™ CF topology consists of a low noise highly linear RF amplifier followed by a custom specified filter. The filter specified can be one of four types; bandpass, highpass, lowpass, or band reject (notch) filter. After the filter is another gain stage. This gain stage provides high gain, is highly linear, and maintains a low noise figure.



Filters are specified at their 3 dB points, that is, if a highpass filter is specified at 400 MHz then the HILNA™ CF will pass all frequencies greater than 400 MHz and amplify those signals. Filter topologies implement a 3-7 pole structure depending on the filtering requirements. Typical passbands for band reject and bandpass filters are designed to meet >20% bandwidths. NuWaves can design your custom filter to specifications less than 20% but with an increased cost per unit. Contact NuWaves Application Engineering as specified in Section 6 to get assistance in specifying your HILNA™ CF unit.



The HILNA™ CF boasts extremely high gain over an extremely broad band. Figure 2 depicts gain over 45 dB at 200 MHz and a gain of 40 dB at 800 MHz. While implementation losses of the filter will lower the overall gain, the high gain of the HILNA™ CF is impressive.

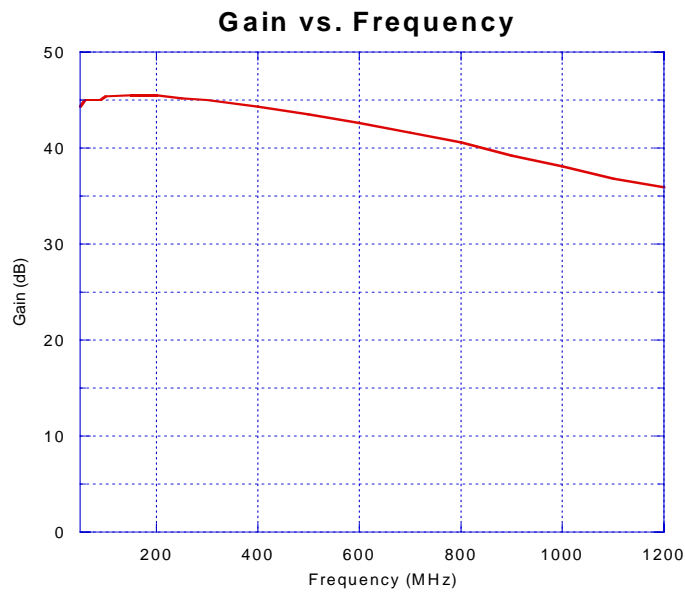


Figure 2: HILNA™ CF Plot of Gain vs. Frequency without any Filtering Implemented

The HILNA™ CF's noise figure remains below 0.8 dB up to 800 MHz; refer to Figure 3. At 1 GHz the noise figure is still quite respectable at 1.0 dB.

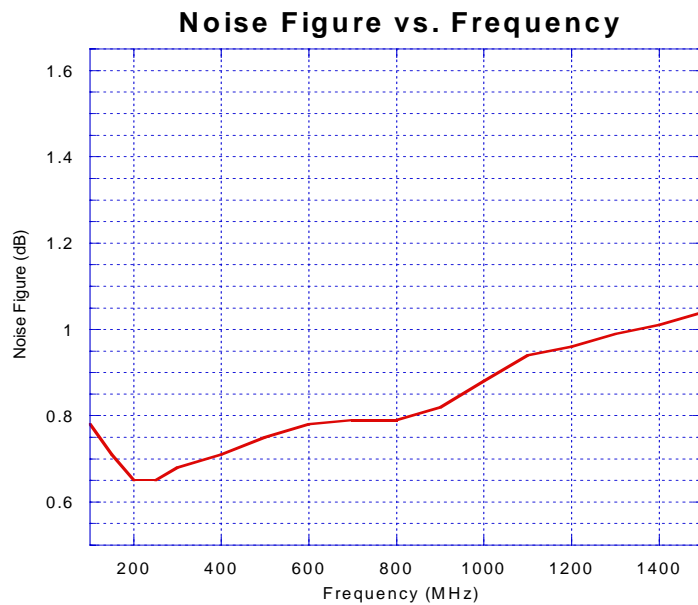


Figure 3: HILNA™ CF Noise Figure vs. Frequency without Filtering Implemented

3. INSTALLATION, CONNECTING, AND USING THE HILNA™ CF AMPLIFIER

HILNA™ amplifiers have been designed to be highly reliable under the specified operating conditions. The following installation and hook-up guide lines should be followed to prevent damage to the RF module.

The HILNA™ CF amplifier contains components that are sensitive to Electro-Static Discharge (ESD). The use of wrist strap, mats, and ground straps should be adhered to during the installation process.



3.1 CABLING

The HILNA™ CF unit is equipped with high performance RF connectors. Gold plated SMA-type receptacles are used because they perform very well across the usable frequency range of the unit. For optimal performance, a high quality 50Ω coaxial cable with SMA-type plugs should be used to interface with the Amplifier.

CAUTION: Due to the wideband nature of the unit, installation should not be attempted on a tower with transmit antennas.

If cables with the SMA-type connectors are not available, high quality adaptors are available for most coaxial connector types.

3.2 POWER SUPPLY

The HILNA™ CF contains internal linear voltage regulators. These regulators protect the circuitry from voltage variations at the input and allows for the wide operating voltage. The power connector is an industry standard 2.1mm circular connector. The only restrictions on the power source for the unit are:

- Capable of sourcing 200mA of current
- Capable of sourcing +5VDC to +20VDC

Car batteries (through a cigarette lighter adaptor), laboratory DC power supplies, or wall transformers are suitable power sources as long as the superimposed ripple is low in amplitude.

3.3 CONNECTIONS

Note: Do not apply RF to the unit until after all cable connections are made and power has been applied.

Making the connections from the HILNA™ CF is easily accomplished:

One 50Ω coaxial cable is used to connect the RF Source to the RF Destination. A second 50Ω coaxial cable is used to connect to the "RF OUT" connector on the unit. Finally, power is applied to the unit by first plugging the power cable sent with the unit into the 5-20VDC connector on the unit. Next connect the red lead to the positive side of the power supply and connect the black lead to the negative side of the power supply. Apply RF to the input cable assembly. Powering down the unit is done by reversing this procedure.

Connection Summary:

- Connect the RF Output to a good load. The characteristic impedance is 50Ω.
- Apply 5-20 VDC (12 VDC Typical) at the power connector.
- Connect an RF source to the RF Input connector.



Excess drive levels at the input to the amplifier can permanently damage the HILNA™ CF amplifier. Under no circumstance should the RF Input level exceed +10 dBm.

3.4 ENVIRONMENT

The HILNA™ CF unit is rated for operation from -20°C to +70°C. The enclosure is NOT watertight so the unit must be kept dry. It is recommended that the unit be installed in a well-ventilated area or mounted to a heat sink if the input voltage exceeds +15VDC. The unit will run warmer as the input voltage increases.

3.5 INSTALLATION SUMMARY

The HILNA™ CF is an ideal Amplifier for the filtering of out-of-band signals and interferers. By following this installation guide, a unit can be successfully installed in most scenarios.

4. ELECTRICAL DATA

4.1 ABSOLUTE MAXIMUM RATINGS

Operating Voltage	20 VDC
RF P _{in}	+10 dBm
Operating Temperature	-20° C ... + 70° C
Storage Temperature	-20° C ... + 70° C

4.2 DC CHARACTERISTICS

		min	typ	max
Operating Voltage	V	5	12	20
Current Consumption	mA	130	145	160

4.3 RF CHARACTERISTICS

PARAMETER	UNIT	HILNA CF		
		min	typ	max
Frequency Range	MHz	50		1000
* Gain	dB	35	38	42
Noise Figure	dB	.7	.8	1.6
OIP3	dBm	28	30	32
P1dB	dBm	16	18	19
VSWR In			1.5	
VSWR Out			1.5	
Reverse Isolation	dB	45	53	56

Measurement Conditions:

Z₀ = 50 Ω at input and output

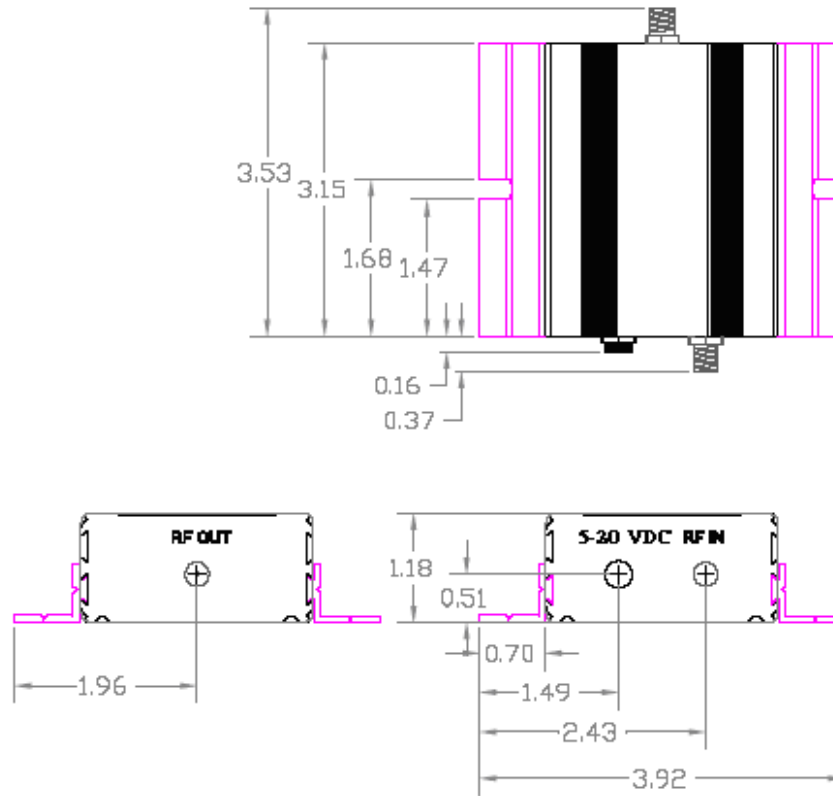
P_{in} = -40 dBm

T_{amb} = 25° C

*Depending upon the specified filter type and technique, the RF gain will fall within a range of 35-42 dB due to filter implementation loss.

5. MECHANICAL OUTLINES

5.1 ENCLOSURE



HILNA RF Bulkhead Connector Type = SMA (Female)
 HILNA RF Input and Output Mating Connector: SMA (Male)

HILNA DC Power Connector Type = 2.1mm Circular
 HILNA Bulkhead Connector: Switchcraft 772A
 Mating Connector: Switchcraft S760

Maximum Outline Dimensions (with mounting flanges)	
Length	3.15 in
Width	2.50 in
Height	1.18 in
Weight	4.4 oz.

6. GETTING ASSISTANCE – PRODUCT SUPPORT

NuWaves is proud of its products and getting assistance in setting up your HILNA™ CF amplifier is easy. Technical Assistance and Application Engineering:

Sales and Technical Solutions Engineering:

Mr. Kevin Harrison
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Email: kharrison@nuwaves-ltd.com

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NuWaves Home Page: www.nuwaves-ltd.com

Standard Product Warranty: http://nuwaves-ltd.com/pdf/Standard_Warranty.pdf

7. GENERAL INFORMATION

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