NuPower Xtender DUAL-S-50-C01-S01 Bidirectional S-Band Amplifier User Manual

Part Number:
NW-BA-DUAL-S-50-C01-S01

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Revision History	
Revision	**Description**
1.0	Initial Release

1 NUPOWER XTENDER™ PRODUCT LINE OVERVIEW

The NuPower Xtender™ family of solid-state bidirectional RF amplifier modules, or "T/R modules," is designed to meet the demanding needs of the Aerospace & Defense, Industrial, and Commercial markets. Based on the latest Gallium Nitride (GaN) technology, NuPower Xtender's power efficiency and miniature form factor make it ideal for size, weight, and power-constrained broadband RF telemetry and tactical communications systems.

1.1 NUPOWER XTENDER™ PRODUCT LINE HIGHLIGHTS

- High Performance: Unique combination of broadband coverage, miniature form factors, and high efficiency.

- Enclosures: The NuPower Xtender™ family of bidirectional amplifiers is housed in an aluminum enclosure with mounting holes incorporated into the chassis.

- Completely Characterized: The NuPower Xtender™ family of solid-state bidirectional amplifiers have been completely characterized over temperature, voltage, and frequency. These high-performance modules offer significant value for the OEM user or the Systems Integrator.

- User Friendly: Reverse-voltage and over-voltage protection and regulator thermal shutdown provide defenses against user interface issues.

- High Reliability: NuWaves' selection of conservatively rated components provides high reliability. Each NuPower Xtender™ is inspected to IPC-A-610 Class II quality standards. NuWaves' Quality Management System is AS9100:2016 Rev D and ISO 9001:2015 certified.

- Applications: Unmanned Aircraft Systems (UAS) • Unmanned Ground Vehicles (UGV) • Unmanned Surface Vehicles (USV) • Broadband RF Telemetry • RF Communication Systems • Software Defined Radios • Test Labs

- Available Options:

    - Labeled interface cable with flying leads or banana jack plugs

2 NUPOWER XTENDER DUAL-S-50-C01-S01 OVERVIEW

The NuPower Xtender™ DUAL-S-50-C01-S01 is a 50W 2x2 dual channel bi-directional amplifier, ideal for extending the range of communications and datalinks for ISR applications. This amplifier supports NxN MIMO radios, where 2x2 or 4x4 configurations are used for high data rate applications. This amplifier combines a power amplifier, LNA, and switches, in an integrated microwave assembly for a low SWaP solution to pair with MIMO radios.

Based on highly linear LDMOS technology, this amplifier is perfect for applications requiring both high data rates and high RF output power for long distance data links. It supports complex modulations with high peak-to-average ratios (PARs), where minimal signal distortion is required.

At a nominal +25dBm (CW) RF input, the amplifier typically provides 21.5dB of gain at each of the antenna ports. Driven with an 802.11g BPSK waveform, each channel provides 50W linear RF power. Each channel is its own independent bi-directional amplifier. The amplifier switches between transmit and receive through a DC control input. Alternatively, the module can be configured for Autosense where it switches between transmit and receive automatically based on the RF input power detected at the XCVR Port.

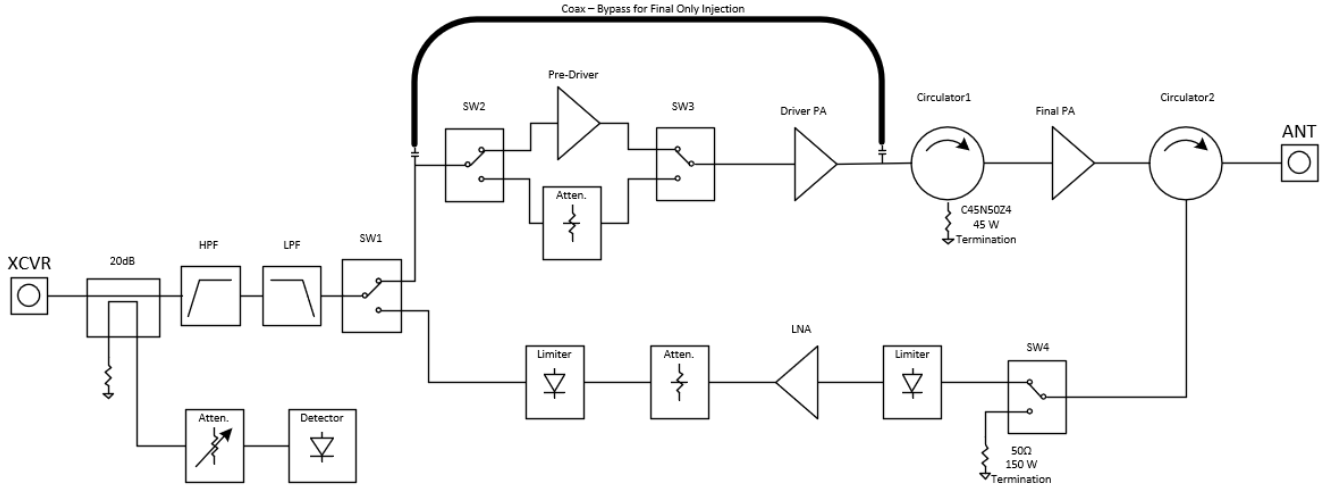


Figure 1: NuPower Xtender™ DUAL-S-50-C01-S01 Functional Diagram

2.1 SPECIFICATIONS

The subsequent tables in this section outline the NuPower Xtender™ DUAL-S-50-C01-S01's performance specifications.

Table 1: NuPower Xtender™ DUAL-S-50-C01-S01 Electrical Specifications

Parameter	Specification		
Frequency Range	2200 to 2500 MHz		
RF Output Power	**Waveform**	**Output Power (W)**	**EVM (dB)**
	CW	46 (@ Pin= +25dBm)	N/A
	BPSK	50	-7
	QPSK	35	-15
	16QAM	20	-21
	64QAM	10	-27
Transmit RF Gain	21.5 dB (typ)		
Nominal Input Drive Level	+25 dBm (CW)		
Maximum Input Drive Level	+28 dBm (CW)		
Receive RF Gain	14.5 dB (typ) / 12 dB (min)		
Receive Noise Figure	2.5 dB (typ)		
T/R Mode	Manual T/R Line (Default), Autosense (Factory Change)		
Supply Voltage	+24 to +30 VDC		
Transmit Current Consumption – Pin = +25dBm (CW)	6.05 A @ +28 VDC (typ)		
Receive Current Consumption	57 mA @ +28 VDC (typ)		

Table 2: NuPower Xtender™ DUAL-S-50-C01-S01 Environmental Specifications

Operating Conditions	Specification
Operating Temperature (100% transmit duty cycle)	-40 to +85 °C (baseplate)
Storage Temperature	-55 to +85 °C

2.1.1 MECHANICAL SPECIFICATIONS

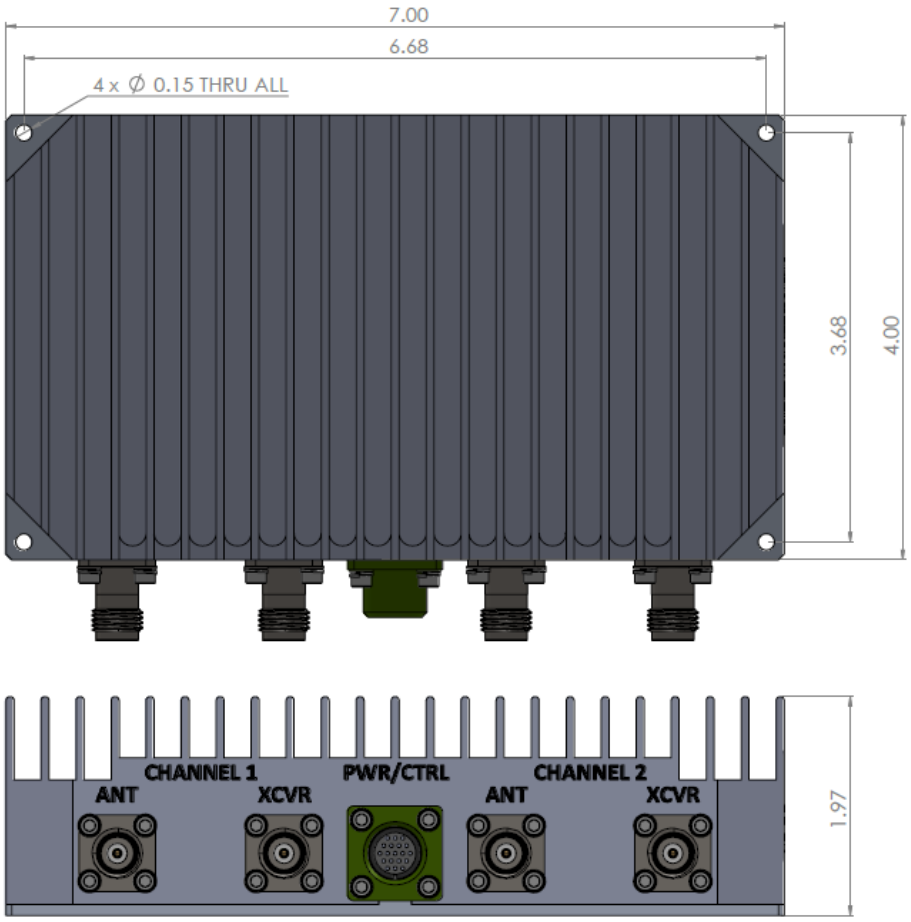


Figure 2: NuPower Xtender™ DUAL-S-50-C01-S01 Mechanical Outline

Table 3: NuPower Xtender™ DUAL-S-50-C01-S01 Mechanical Specifications

Parameter	Specification
RF Connectors	TNC (female)
Control / Power Interface Connector	Circular Locking
Dimensions (L x W x H)	4.00” x 7.00” x 1.97”
Weight	48.5 oz

2.2 HEAT SINKING

The NuPower Xtender™ DUAL-S-50-C01-S01's housing contains an integrated heatsink. High duty cycle operation may require additional heatsinking and/or air flow between heatsink fins to keep baseplate below +85°C.

3 SETUP AND OPERATION

This section provides specific details for proper operation of the NuPower Xtender™ DUAL-S-50-C01-S01 module. Following these guidelines will prevent damage to the bidirectional amplifier or external equipment.

3.1 POWER SUPPLY REQUIREMENTS

To operate the NuPower Xtender™ DUAL-S-50-C01-S01, ensure that the power supply has adequate overhead to source the current demand of the RF amplifier. The power supply source must provide a voltage of +24 to +30 VDC with a recommended greater than 10 amps capability.

3.2 CONNECTING A PROPER LOAD TO THE ANTENNA TERMINAL

To prevent damage to the amplifier module, the antenna terminal must be terminated into a 50 Ω load. Examples of a proper load include:

- Directly connecting to an antenna specified for the frequency range (2.2 to 2.5 GHz). Connecting to an inappropriate antenna may result in damage to the amplifier module.
- Connecting to a proper antenna through a 50 Ω transmission line or coaxial cable. Avoid using damaged cables or corroded connectors while attaching the unit to an antenna.
- Terminating the antenna terminal into a 50 Ω power attenuator with minimum 20 dB attenuation.
- Connecting to a 50 Ω load capable of dissipating the RF power from the amplifier module. Loads capable of handling 100 Watts (min) are recommended.

3.3 POWERING-UP THE NUPOWER XTENDER DUAL-S-50-C01-S01

The NuPower Xtender™ DUAL-S-50-C01-S01 must be terminated into a proper load before power is applied. Refer to Section 3.2 for the specifications of the proper load. After the amplifier is properly terminated, the interface cable can be connected to the unit and power can be applied. The amplifier is now ready for operation.

4 HARDWARE INTERFACE

- The transceiver interface connector, "XCVR," is TNC (female).
- The antenna connector, "ANT," is TNC (female).
- The pin-out definitions for the 19 pin Circular socket connector, "CTRL/PWR," are provided in Table 4. In a typical installation, the amplifier module is mated to a host controller board via a cable harness.

The ANT TNC connector is the antenna connection. This connection should always be loaded into 50 Ω, otherwise the amplifier could be damaged.

4.1 INTERFACE CONNECTOR

The NuPower Xtender™ features a 19 pin Circular interface connector for control, power, and ground connections.

Table 4: NuPower Xtender™ Interface Pin-Out Definitions

Socket No.	Name	I/O	Description
1, 4, 8	+28 VDC CHANNEL 1	I	DC Power (Primary Power, +24 to +30 Volts)
3, 7, 12	+28 VDC CHANNEL 2	I	DC Power (Primary Power, +24 to +30 Volts)
2, 5, 9	GROUND CHANNEL 1	I	Ground (DC Return)
6, 11, 16	GROUND CHANNEL 2	I	Ground (DC Return)
10	FAULT CHANNEL 2	O	FAULT (0V=No Fault; 3.3V=Fault)
13	FAULT CHANNEL 1	O	FAULT (0V=No Fault; 3.3V=Fault)
14	TX ENABLE	I	TX Enable (Manual T/R Default)
15	N/C	N/C	MAY BE N/C OR CONNECTED TO GND
17	N/C	N/C	MAY BE N/C OR CONNECTED TO GND
18	CHASSIS GROUND	I	CHASSIS GROUND
19	N/C	N/C	MAY BE N/C OR CONNECTED TO GND

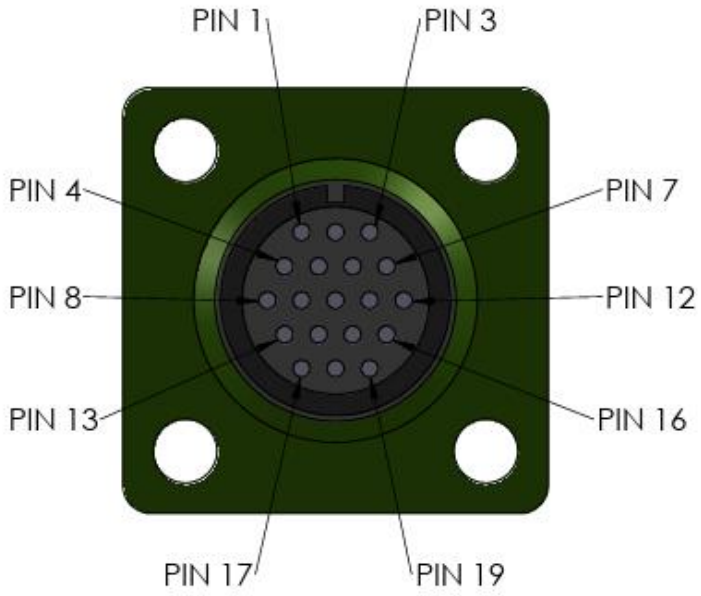


Figure 3: Circular Socket Locations (Font View of Module)

The standard interface cable harness is comprised of 19 wires, includes a Circular connector with pins, and mates directly to the NuPower Xtender™ DUAL-S-50-C01-S01 interface connector. The external pin cable's pinout is mirrored relative to the socket connector of Figure 4 above.

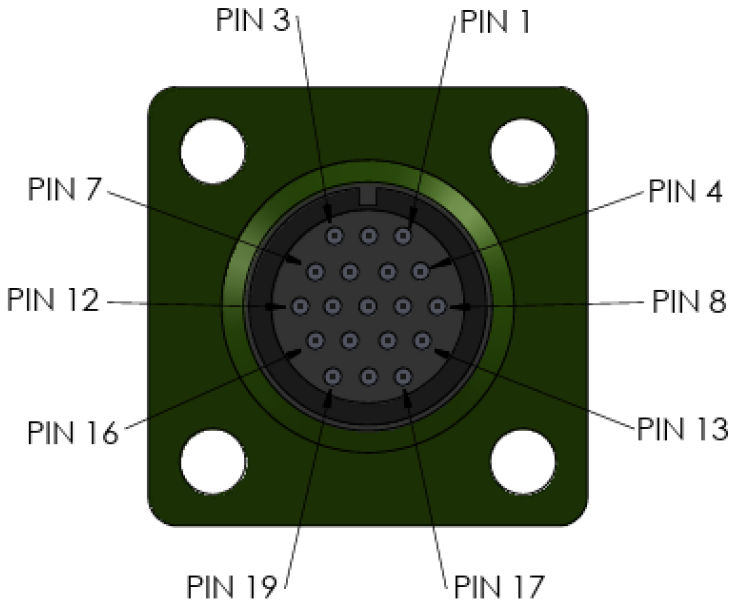


Figure 5: Circular Pin Locations (Font View of Cable Harness)

4.2 DC POWER

The nominal supply voltage for the NuPower Xtender™ DUAL-S-50-C01-S01 is +28 VDC. The amplifier module supports operation over a supply voltage range of +24 to +30 VDC with minimal performance degradation.

4.3 GROUND

The signal and power grounds are tied together in the amplifier module.

4.4 TX ENABLE OPERATION

The TX ENABLE line (pin 14) controls TX/RX operation for both channels. A low voltage state on this pin relative to CHASSIS GND (pin 18) will enable and place both channels in the receive state. The TX ENABLE line must be pulled high to +3.3VDC to enter transmit mode. This is the default mode. This product contains factory configurable options for TX Enable, supporting Active High or Active Low transmit and 3.3V or 5.0V logic signals.

4.5 FAULT CONDITIONS

The FAULT lines (pin 10 for Channel 2 and pin 13 for Channel 1) will indicate a fault condition with a 3.0V level indicating fault and 0V indicating no fault condition. Each channel may fault independently. A fault condition may be indicated due to over temperature, input voltage, or over current.

4.5.1 Temperature Fault

If the channel temperature exceeds approximately 85°C, a fault condition will be set and transmit operation will be inhibited until the channel temperature has dropped to approximately 75°C which will clear the fault condition. Receive operation is not impacted during a temperature fault.

4.5.2 Input Voltage Fault

If the input voltage is less than approximately 15V, a fault condition will be set and transmit operation will be inhibited until the input voltage returns above 15V, which will clear the fault condition.

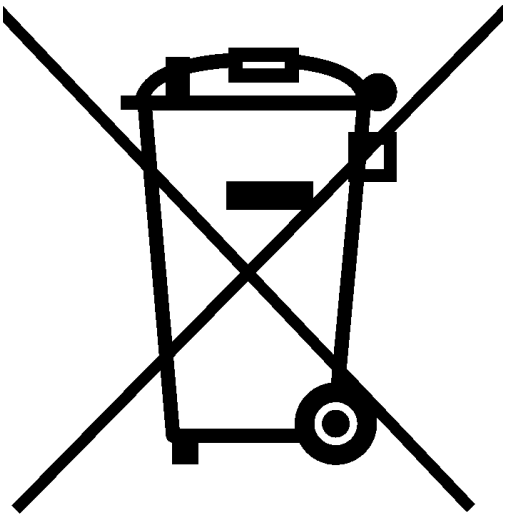
4.5.3 Input Current Fault

If the input current exceeds safe operating levels, a fault condition will be set and transmit operation will be inhibited. If current exceeds 10A, the current fault will be set. The input current fault does not automatically clear and is latched until TX ENABLE is cycled (set to RX and returned to TX).

5 PRODUCT DISPOSAL – END-OF-LIFE

Safety is a guiding principle of NuWaves RF Solutions. We ensure safe production and operation of our products, as well as end-of-life disposal. Improper disposal can adversely affect the environment, wildlife and human health. Please follow these guidelines when disposing of a NuWaves product:

- Do not remove the cover or any hardware
- Do not remove components from the circuit card assembly
- Do not incinerate
- Do not crush or shred
- Do not dispose of as unsorted municipal waste
- Do not export e-waste outside of the original destination country for recycling
- Utilize an e-Steward or ISO14001 certified e-waste recycler
- Consider export controls during recycler selection
- If a NuWaves product is incorporated into a larger system or sub-system, ensure that these guidelines are followed at system end-of-life



6 GETTING HELP - APPLICATIONS ENGINEERING

NuWaves RF Solutions offers technical support for basic configuration help and troubleshooting, Monday through Friday, 8 a.m. to 5 p.m. Eastern Time.

Technical Assistance, Application Engineering, and Sales:

Phone: (513) 360-0800
Email: sales@nuwaves.com

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6.1 GENERAL INFORMATION