NuPower™ S-75-C01-S01
S-Band Power Amplifier
User Manual

Part Number:
NW-PA-S-75-C01-S01

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Revision History	
Revision	**Description**
1.0	Initial Release

1 NUPOWER™ PRODUCT LINE OVERVIEW

The NuPower™ family of solid-state RF power amplifier modules, are designed to meet the demanding needs of the Aerospace & Defense, Industrial, and Commercial markets. Based on the latest Gallium Nitride (GaN) technology, NuPower'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™ PRODUCT LINE HIGHLIGHTS

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

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

- Completely Characterized: The NuPower™ family of solid-state power 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™ product 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

2 NUPOWER™ S-75-C01-S01 OVERVIEW

The NuPower™ S-75-C01-S01 is a low SWaP, 75W linear power amplifier, ideal for extending the range of datalinks and transmitters.

Based on highly linear LDMOS technology, this amplifier is suitable 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. Constant envelope signals such as CW, AM, and FM are also supported.

At a nominal +26 dBm RF input, the amplifier typically provides 22.5dB of gain to achieve 75 Watts RF output power. The NuPower™ S-75-C01-S01's typical 35% power efficiency and 14 in^3 form factor make it ideal for size, weight, and power-constrained broadband RF telemetry and tactical communications systems. The NuPower™ S-75-C01-S01's rugged chassis and simple connections allow the system integrator to easily incorporate the unit into a platform operating in harsh environments with limited space.

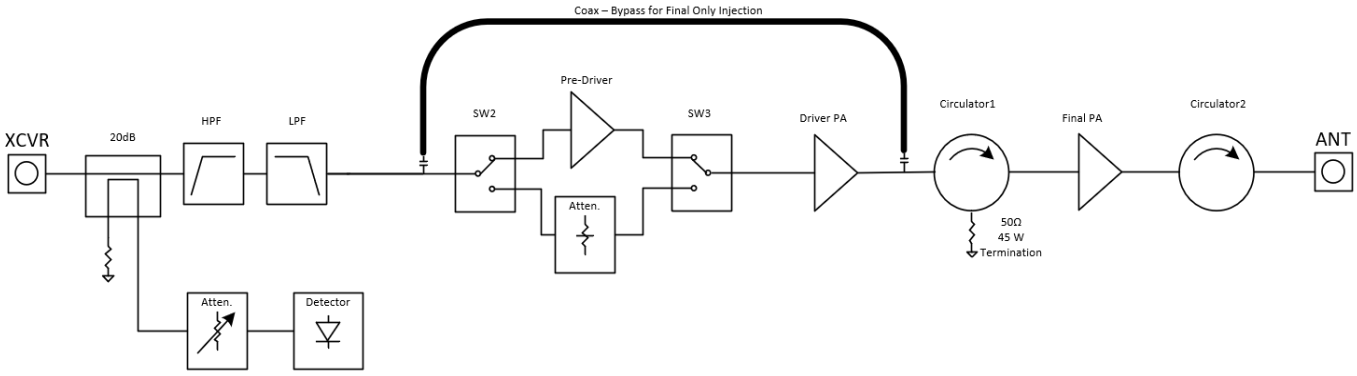


Figure 1: NuPower™ S-75-C01-S01 Functional Diagram

2.1 SPECIFICATIONS

The subsequent tables in this section outline the NuPower™ S-75-C01-S01's performance specifications.

Table 1: NuPower™ S-75-C01-S01 Electrical Specifications

Parameter	Specification		
Frequency Range	2200 to 2500 MHz		
RF Output Power	**Waveform**	**Output Power (W)**	**EVM (dB)**
	CW	75 (@ Pin= +26dBm)	N/A
	BPSK	50	-7
	QPSK	35	-15
	16QAM	20	-21
	64QAM	10	-27
RF Power Gain	22.5 dB (typ)		
Nominal Input Drive Level	+26 dBm (CW)		
Maximum Input Drive Level	+29 dBm (CW) [RF Output Power must be limited to 100W max regardless of input power]		
TX Enable	Manual T/R Line (Default), Autosense (Factory Change) [+3.3V=TX Enable; 0V=Standby]		
Supply Voltage	+24 to +30 VDC		
Transmit Current Consumption – Pin = +26dBm (CW)	7.5 A @ +28 VDC (typ)		
Quiescent Current Consumption	57 mA @ +28 VDC (typ)		

Table 2: NuPower™ S-75-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

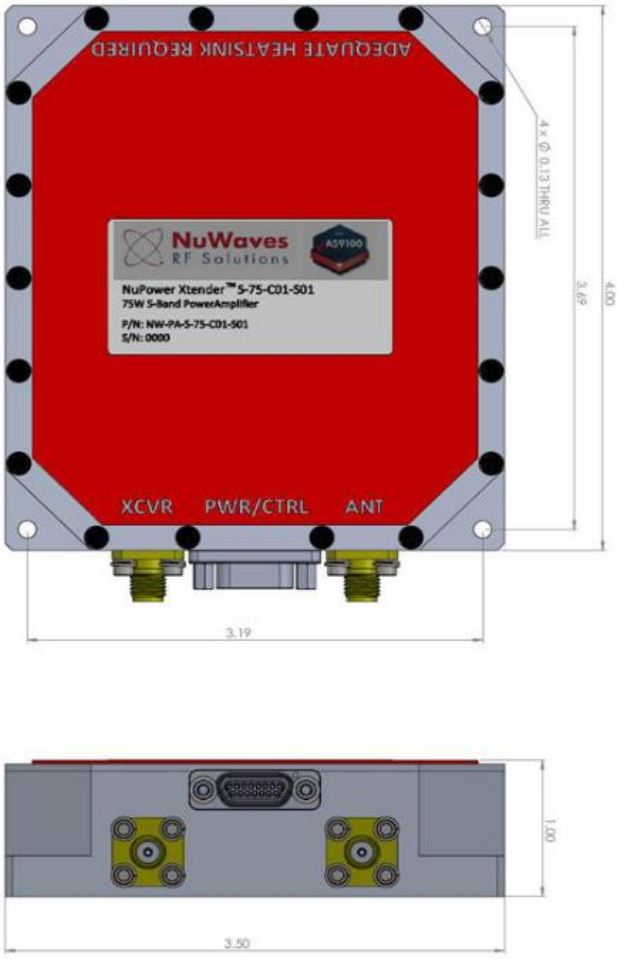


Figure 2: NuPower™ S-75-C01-S01 Mechanical Outline

Table 3: NuPower™ S-75-C01-S01 Mechanical Specifications

Parameter	Specification
RF Connectors	SMA (female)
Control / Power Interface Connector	15-Pin Micro D
Dimensions (L x W x H)	4.0” x 3.5” x 1.0”
Weight	14 oz

2.2 HEAT SINKING

The NuPower™ S-75-C01-S01 is offered as a standalone module or with an optional fan-cooled heatsink (P/N HTSK-02) and requisite power cable. Heatsink must be capable of keeping baseplate (bottom surface) of the power amplifier below +85°C.

Figure 3: NuPower™ PA Mounted to HTSK-02 (S-75-C01-S01 not shown)

3 SETUP AND OPERATION

This section provides specific details for proper operation of the NuPower™ S-75-C01-S01 module. Following these guidelines will prevent damage to the power amplifier or external equipment.

3.1 POWER SUPPLY REQUIREMENTS

To operate the NuPower™ S-75-C01-S01, ensure that the power supply has adequate overhead to source the current demand of the power 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 50Ω 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 50Ω 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 50Ω power attenuator with minimum 20 dB attenuation.
- Connecting to a 50Ω 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 S-75-C01-S01

The NuPower™ S-75-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 SMA (female).
- The antenna connector, "ANT," is SMA (female).
- The pin-out definitions for the 15 pin Micro-D socket connector, "PWR/CTRL," 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 SMA 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™ features a 15 pin Micro-D interface connector for control, power, and ground connections. See Table 4 and Figure 3 below for pinout definitions and locations of pins on both the module and external cable mate connectors.

Table 4: NuPower™ Interface Pin-Out Definitions

Socket No.	Name	I/O	Description
1-3, 9-11	+28VDC	I	DC Power (Primary Power, +24 to +30 Volts)
4-6, 12-14	Ground	I	Ground (DC Return)
7	Fault	O	Fault (0V=No Fault / 3.3V=Fault)
8	Auto/Man	I/O	User-select ability between autosense and manual T/R (disabled on this model)
15	TX ENABLE	I	TX Enable (Manual TX Enable Default) [+3.3V=TX Enable; 0V=Standby]

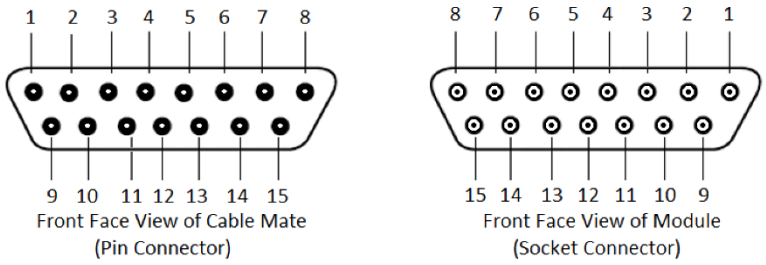


Figure 3: 15-Pin Micro D Pinout [External Harness (left), Front View (right)]

4.2 DC POWER

The nominal supply voltage for the NuPower™ S-75-C01-S01 is +28 VDC. The amplifier module supports operation over a supply voltage range of +24 to +30 VDC. Contact factory for other supply voltage options.

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 15) controls the bias to internal amplifiers. This line must be pulled high or low and not left floating. A low voltage state on this line will place the module in standby. Applying +3.3VDC logic signal to this line will place the module in transmit mode. This is the default configuration. This product contains factory configurable options for TX Enable, supporting Active High or Active Low transmit and 3.3V or 5.0V logic signals. Contact factory for other options.

4.5 FAULT CONDITIONS

The FAULT line (pin 7) will indicate a fault condition with a 3.1V level indicating fault and 0V indicating no fault condition. A fault condition may be indicated due to over temperature, input voltage, or over current. Each of these individual faults are described in more detail in the subsections below.

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.

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.

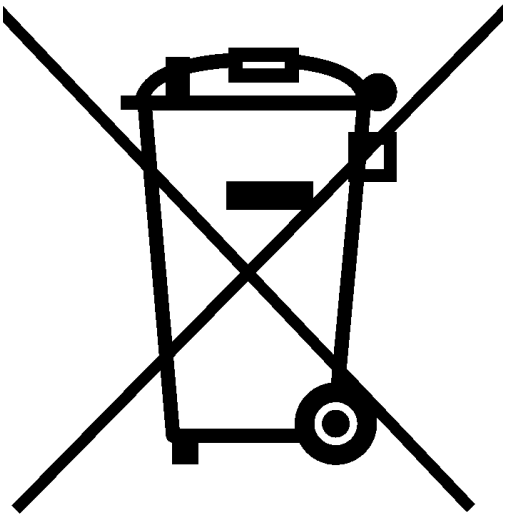
4.5.3 Input Current Fault

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 standby 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

NuWaves Home Page:

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6.1 GENERAL INFORMATION