

TSA-216047

Ka-Band SSPA

Airborne
Applications

29 - 31 GHz Compact GaN-based Hermetically Sealed SSPA

EXPORT RESTRICTIONS MAY APPLY



Description

This is a compact GaN-based hermetically sealed SSPA which produces 12W minimum Linear Power¹ (16W typical) over the entire 29-31 GHz bandwidth.

Included features are 20 dB gain control, relative output power monitoring (done by monitoring the output of the driver stage), internal temperature monitoring, enable/disable control, and fault indication. Most of this is done through the RS-422 interface. The unit also includes a hard wire, TTL (+3.3V/0V) controlled pin for disabling the unit should the RS-422 communications link fail.

The total weight is 1.6 lbs max and the size is 5.0"L x 3.7"W x 1.0"H. See the outline drawing attached. The unit has a wide operating voltage of +20.5V to +32.5V.

Features

- Small Size Weight and Power
- Wide Input Voltage Range
- Operates over 29 to 31 GHz
- Electronic Gain Control
- Discrete/RS-422 Mute
- Enable Hermetically Sealed
- Couple Output for Linearization

Other Products

- Low Noise Block Converters (Ku & X-Band)
- Block Up Converters (Ku & X-Band)
- Low Noise Amplifiers (Ku & K-Band)
- Solid State Power Amplifiers (X, Ku & Ka-Band)
- Synthesizers (L, C or X-Band)

Teledyne Microwave Solutions
Aerospace & Defense Electronics



Specifications

Parameter		Value
Operating Frequency Range		29 to 31 GHz
Operating Temperature Range		-55°C to +85°C
Minimum Gain		33 dB (at 25°C)
Gain Control Range		20 dB typ (at 25°C)
Gain Flatness: 29 to 30 GHz		±1.0 dB max
Gain Flatness: 30 to 31 GHz		±1.0 dB max
Input VSWR		1.5:1 max
Output VSWR		2:0:1 max
Noise Power Density (29-31 GHz) in Band		-90 dBm/Hz max
Linear Power (see definition on page 1)		40.8 dBm (12W) min
Max RF Input Power at Minimum Gain		+13 dBm
RF Enable		
• Settling Time ²		50 ms typ
• Disable Time ²		1 ms typ
Gain Variation over Temperature (at nom Gain, 40 dB)		±3 dB max
DC Power (RF disable)		3W max
DC Power (RF enable, P _{OUT} = 42 dBm)		150W max
DC Voltage Range ²		+24.0V to +32.5V
DC Current (DC Voltage = +28V, P _{OUT} = 42 dBm)		5.4A max
RF Input Connector		2.92mm (female)
RF Output Interface		WR-28 Cover Flange with O-Ring Groove
DC Supply/Command/Monitor Interface		25 pin Micro-D Connector (MIL-DTL-83513/2)
Size		5.0"L x 3.7"W x 1.0"H
Weight		1.6 lbs max
Altitude ³	Operational	≤60,000 ft
Shock ³	RTCA DO-160G	6g, 11ms Half Sine
Finish	Body	Electroless Nickel
Relative Humidity		100%

Micro D Connector Pinout Descriptions

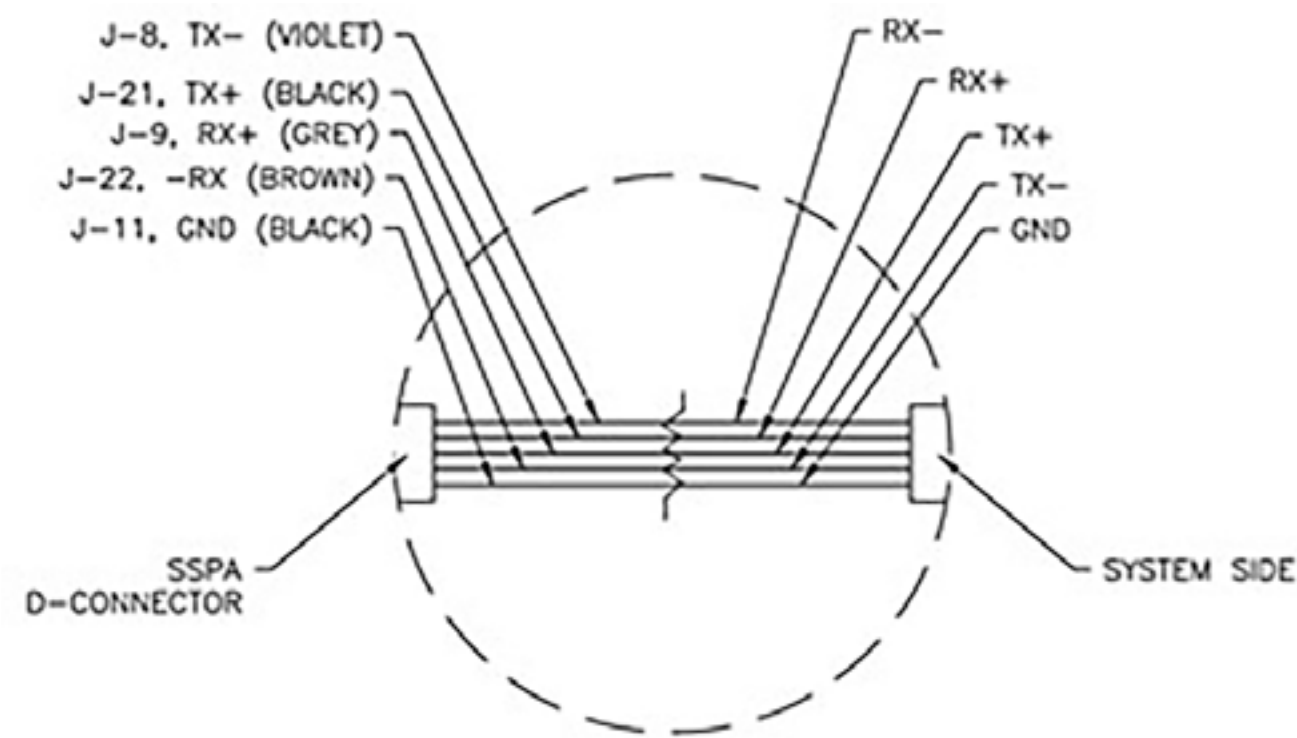
The Micro D Connector on the SSPA consists of 25 pins with the pinouts as described by Table 2. Tie all +VDC pins together. Similarly tie all GND (ground) pins together. The RS-422 GND is internally connected to the GND pins but is provided as a separate output to connect with the source RS-422 connection. Please see Figure 2 on how to interface the SSPA RS-422 with the system or source RS-422.

Table 1: 25 Pin Micro-D Connector Pinout Description

J1: 15 PIN MICRO-D CONNECTOR PER MIL_DTL-83513/2		
PIN NO.	FUNCTION	COLOR
J1-1	+VDC	BLACK
J1-2	+VDC	BROWN
J1-3	+VDC	RED
J1-4	+VDC	ORANGE
J1-5	GND	YELLOW
J1-6	GND	GREEN
J1-7	GND	BLUE
J1-8	-TX (RS-422)	VIOLET
J1-9	+RX (RS-422)	GREY
J1-10	RFTXEN (OPTIONAL, +3.3V = ON, OV = OFF)	WHITE
J1-11	GND (RS-422)	BLACK
J1-12	GND	BROWN
J1-13	GND	RED
J1-14	+VDC	ORANGE
J1-15	+VDC	YELLOW
J1-16	+VDC	GREEN
J1-17	GND	BLUE
J1-18	GND	VIOLET
J1-19	GND	GREY
J1-20	GND	WHITE
J1-21	+TX (RS-422)	BLACK
J1-22	-RX (RS-422)	BROWN
J1-23	SUMFLT (OPTIONAL, +3.3V = FAULT)	RED
J1-24	GND	ORANGE
J1-25	GND	YELLOW

±VDC voltage ranges from +20.5V to +32.5V; apply same voltage to all +VDC pins

Figure 1: RS-422 Connection with System



Digital Protocols

Communication with the SSPA is done through RS-422. However, there are two discrete pins: RFTXEN and SUMFLT. RFTXEN is a hardwired TTL controlled pin for disabling RF power in case of emergency. This pin is high through an internal pull-up. To disable the unit, simply ground this pin. SUMFLT is a hardwired TTL level (+3.3V high) signal that indicates a fault when HIGH and no fault when LOW. The fault status can be read through the RS-422.

The serial format is shown in Table 3. A high-to-low transition indicates the start of the data. A newline (“\n”) following the command indicates the end of the command.

The SSPA default gain is set to 40 dB at startup and room temperature. In order to adjust this, use the gain control command from Table 4. If another default gain setting is desired, please contact Teledyne. See Example 5, for a sample command to set the gain control to 2050 (approximately +10 dB of gain control).

See command examples on the following page. The command part is bolded and the response is un-bolded.

Table 2: Serial Format

Baud Rate	115,200 bps
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

Table 3: RS-422 Command List

"VER"	Indicates Firmware Version
"SN"	Indicates Unit Serial Number
"ECHO 0"	Turns Command Echo OFF (command sent is not repeated back)
"ECHO 1"	Turns Command Echo ON (command send is repeated back)
"RF0"	Turns RF Power OFF
"RF1"	Turns RF Power ON
"STA"	Reports Fault Status
"POUT"	Reports Output Power (dBm)
"GAIN"	Reports Current Gain DAC Value
"GC WORD HHHH"	Gain Control (0 dB to -20 dB), 4 digit HEX value (HHHH) represents the gain control. DAC value 0 to 4095
"TEMP"	Reports PA Temperature (°C)
"SAVEGC"	Save Gain Control Value to Memory

Example 1: Turn on RF Power, Echo disabled **RF1\n** PA ON

Example 2: Turn on RF Power, Echo disabled **RF1\n** RF1 PA ON

Example 3: Fault Status (No Fault), Echo disabled **STA\n** FAULT = 0

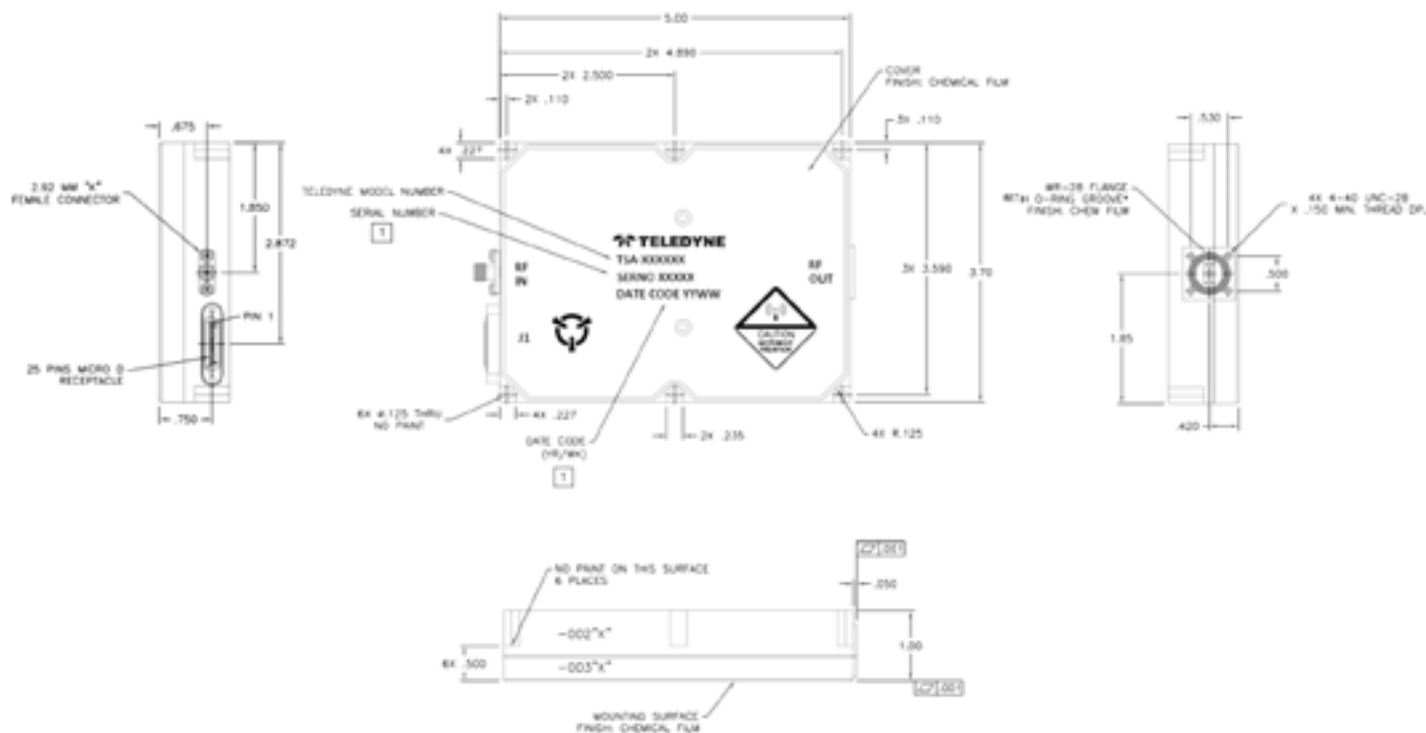
Example 4: Temperature, Echo disabled **TEMP\n** TEMPERATURE = 25.1

Example 5: Set Gain Control to 2050, Echo disabled **GC WORD 0802\n** DAC VALUE = 2050

Example 6: Read Power **POUTF\n** POUT = 40.5

Example 7: Turn off RF Power, Echo disabled **RF0\n** PA OFF

Outline Drawing



Notes (unless otherwise specified):

1. Marking as shown shall be permanent and legible per MIL-STD-130 using black epoxy based ink. Marking to be on top of SSPA and on top cover.
1. Case material: Aluminum.
2. Finish: Electroless nickel per MIL-C-26074, Type I, Class 4, Grade B, 200-400 microinches except for welded cover, mounting surface and waveguide flange. Welded cover, mounting surface and waveguide finish is chemical film per MIL-DTL-541, latest revision, Type 1, Class 3, Yellow.