TSA-214145

Ka-Band Linearized SSPA

Ground Mobile 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 40.75 dBm min Linear Power1 (42 dBm typical) over the entire 29-31 GHz bandwidth and operating temperature range. When coupled with Teledyne's Dual Band BUC with Integrated IF Linearizer, it can produce 41.75 dBm min minimum Linear Power (43 dBm typical – see Figure 1).

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

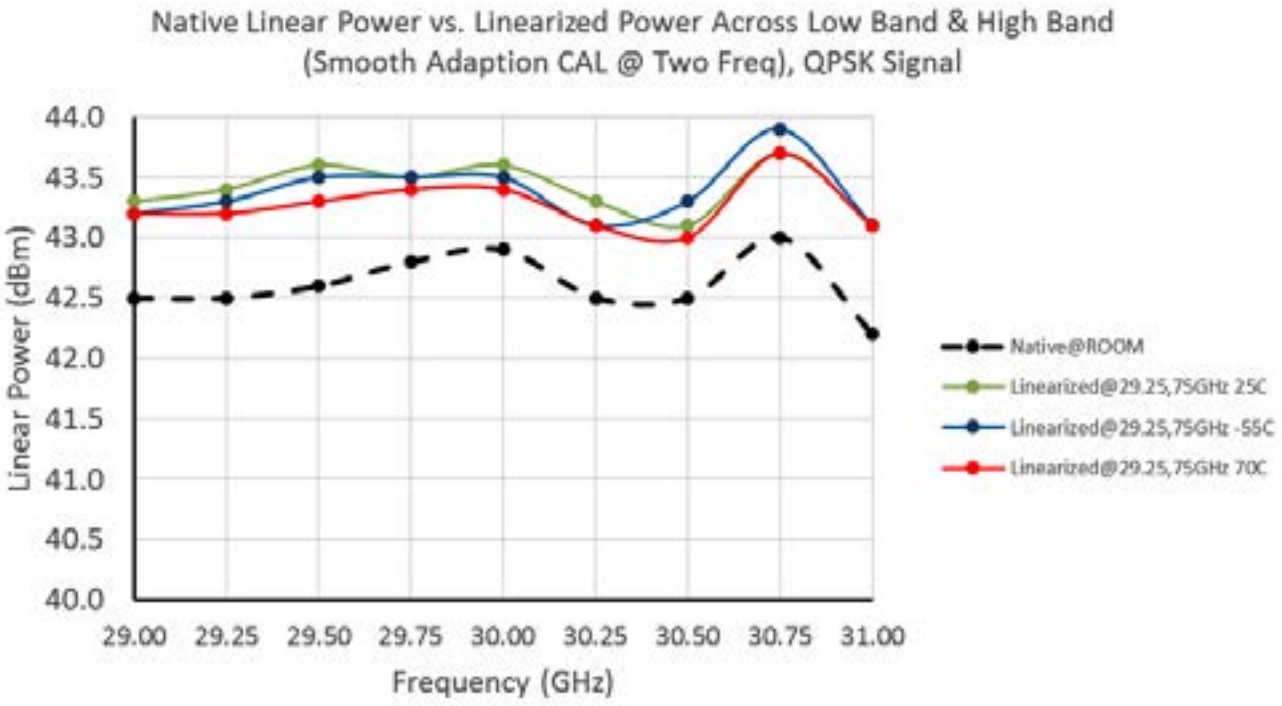
- Low Noise Block Converters (Ku & X-Band)
- Block Up Converters (Ku & X-Band)
- Low Noise Amplifiers (Ku & K-Band)
- Solid State Power Amplifiers (X, Ku & Ka-Band)
- Synthesizers (L, C or X-Band)

Specifications

Parameter	Value
Operating Frequency Range	29 to 31 GHz
Operating Temperature Range	-40 to +70°C
Small Signal Gain Range (Controlled via RS-422)	Additional Gain Range: 20 dB typ at 25°C Gain: 33 dB min at 25°C
Forward Gain Flatness	2 dB_{pk-pk} max per Band[2]
Feedback Gain Flatness	2 dB_{pk-pk} max per Band[2]
Gain Variation Over Temperature (any one frequency)	3dB_{pk-pk} max
Input VSWR	1.5:1 max
Feedback VSWR	2:1 max
Output VSWR	2:1 max
Noise Power Density (29-31 GHz) in Band @ Maximum Gain	-90 dBm/Hz max
Linear Power (see definition on page 1)	40.75 dBm min 41.75 dBm min
Power at Feedback Port @ P_{OUT} = 42 dBm	Will reconfirm typ value
Detached Power Accuracy (Read Via RS-422)	±0.075 dB typ
Max RF Input Power	+13 dBm
Reflected Power when Unit Shuts Down	36 to 37 Dbm typ
RF Enable/Disable Time **• Enable Time (Settling Time3)** **• Disable Time**	 50 ms typ 1 ms typ
DC Power (RF disable)	3W max
DC Power (RF enable, P_{OUT} = 42 dBm)	140W max
DC Voltage Range	+24.0 to +32.5V
DC Current (DC Voltage = +28V, P_{OUT} = 42 dBm)	5.4A max
RF Input Connector	2.9mm (female)
RF Feedback Connector	2.92 (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	6.6”L x 3.7”W x 1.0”H
Weight	2 lbs max

Figure 1:

Performance enhancement gained through the use of the adaptive IF linearizer function in the TSA-214145 BUC with IF linearizer (modulation parameters as described in Note 1)



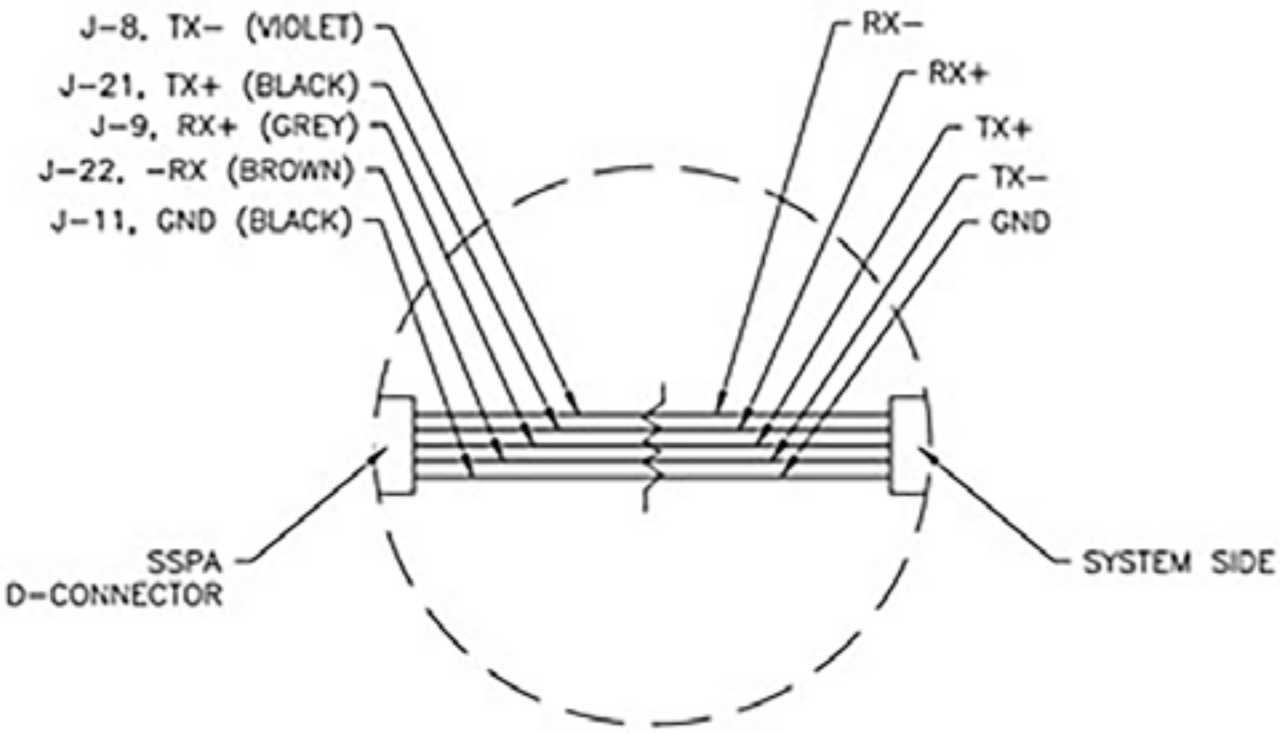
The unit has an integrated waveguide dual directional coupler at the output enabling both the detection and reporting of the output power, as well as providing an RF feedback signal to the adaptive IF linearizer when used with the Teledyne Dual Band BUC (TSA-214144). If the linearizer is not used, the feedback port should be terminated in 50 Ω, or it can be used to monitor the RF output of the amplifier. The reverse coupler senses reflected power from a short and self protects the unit by disabling it.

Included features are 20dB gain control, true output power monitoring, high reflected power shutdown capability, 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 wired, TTL controlled pin for disabling the unit should the RS-422 communications link fail.

The total weight is 2.0 lbs max and the size is 6.6”L x 3.7”W x 1”H. See the outline drawing attached. The unit has a wide operating voltage of +20.5V to +32.5V.

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	RESERVED (DO NOT CONNECT)	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	RESERVED (DO NOT CONNECT)	YELLOW



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.

In terms of defaults, at power the gain is set to the minimum gain of 35dB. In order to adjust this, use the gain control command from Table 4. See Example 5, for a sample command to set the gain control.

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

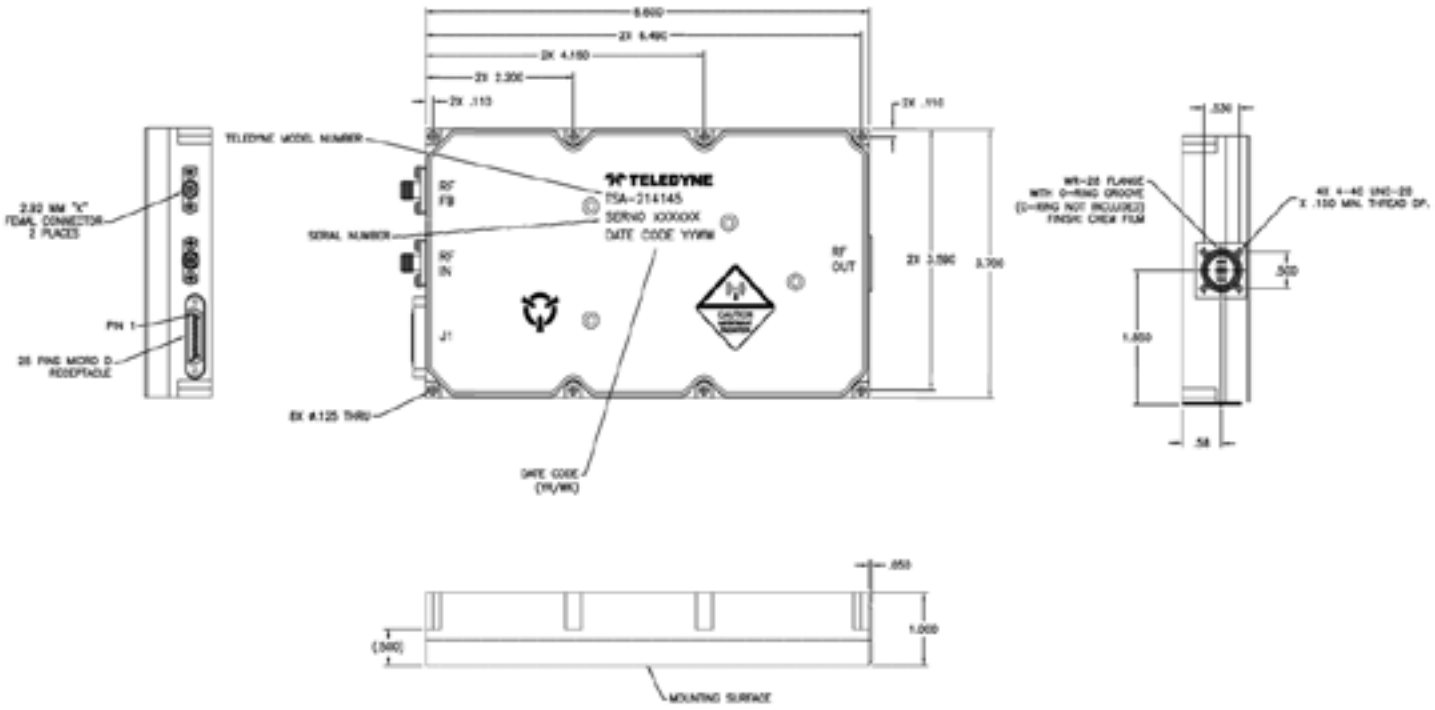
Example 4: Temperature, Echo disabled **TEMP\n** TEMPERATURE = 25.1

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.