# TSA-220010

## Ka-Band Linearized SSPA

Ground Mobile Applications

### 27.5 - 31 GHz
### Ka-Band Linearized SSPA


**EXPORT RESTRICTIONS MAY APPLY**

## Description

This is a compact GaN based Hermetically Sealed SSPA which produces 42 dBm min Linear Power1 (43dBm typical) over the entire 27.5-31GHz bandwidth and operating temperature range. When couple with Teledyne's Dual Band BUC with Integrated IF Linearizer it can produce 42.5 dBm minimum Linear Power (43.5 dBm typical).

## Features

- Small Size Weight and Power
- Wide Input Voltage Range
- Operates over 27.5 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 | 27.5 to 31 GHz |
| Operating Temperature Range | -40 to +70°C |
| Small Signal Gain Range (Controlled via RS-422) | Additional Gain Range: 20 dB<br>Typical at 25°C<br>Gain: 33 dB minimum 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) | 3 $dB_{pk-pk}$ max |
| Input VSWR | 1.5:1 max |
| Feedback VSWR | 2:1 max |
| Output VSWR | 2:1 max |
| Noise Power Density (27.5-31 GHz) in Band @ Maximum Gain | -90 dBm/Hz max |
| Linear Power (see def. on page 1) | 42 dBm min, 42.5 dBm min |
| Power at Feedback Port @ $P_{OUT}$ = 43 dBm | Will Re-Confirm Typical Value |
| Detached Power Accuracy (Read Via RS-422) | ±0.75 dB typical |
| Max RF Input Power | +13 dBm |
| Reflected Power when Unit Shuts Down | 36 to 37 dBm typical |
| RF Enable/Disable Time<br>• Enable Time (Settling Time[3])<br>• Disable Time | <br>50 ms typical<br>1 ms typical |
| DC Power (RF disable) | 5W max |
| DC Power (RF enable, $P_{OUT}$ = 43 dBm) | 280W max |
| DC Voltage Range | +24.0 to +32.5V |
| DC Current (DC Voltage = +28V, $P_{OUT}$ = 43 dBm) | 10.0A max |
| RF Input Connector | 2.92 mm (female) |
| RF Feedback Connector | 2.92 mm (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 | 7.27"L x 3.7"W x 1"H |
| Weight | 2.2 lbs max |

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-220045). 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.

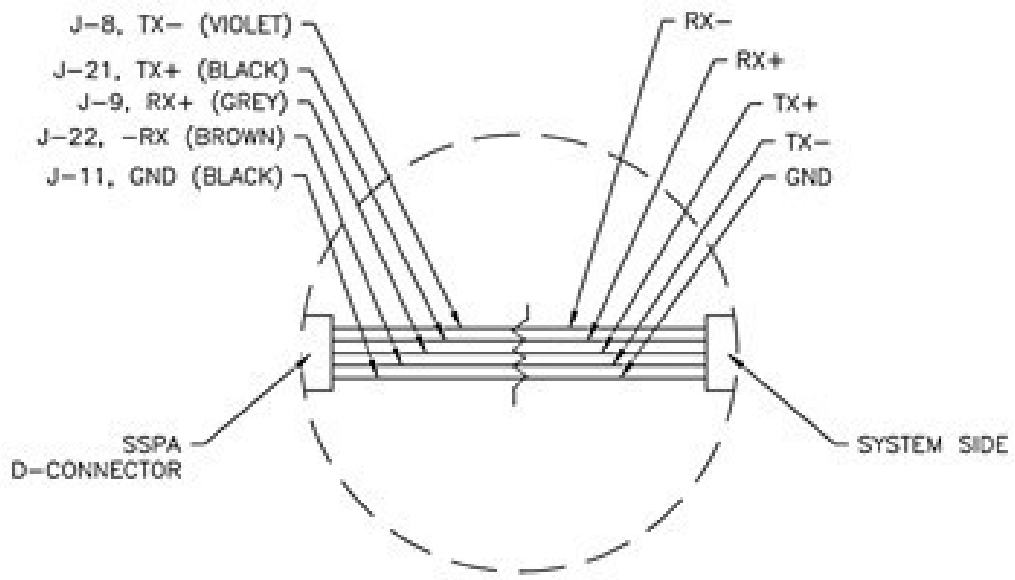
Included features are 20dB gain control, true output power monitoring, high reflected power shutdown capability, internal temperature monitoring, enable/disable control, and fault indication. Most of this is done through the RS-422 interface. The unit also includes a hard wired, TTL controlled pin for disabling the unit should the RS-422 communications link fail.

The total weight is 2.2 lbs max and the size is 7.27”L x 3.7”W x 1”H. See the outline drawing attached. The unit has a wide operating voltage of +24V to +32.5V. Suggested DC voltage is +28V.

## Table 1: 25 Pin Micro-D Connector Pinout Description

| J1: 25 PIN MICRO-D CONNECTOR PER MIL_DTL-83513/2 | | |
|---|---|---|
| PIN NO. | +VDC | 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 |

- +VDC VOLTAGE RANGES FROM +24V TO +32.5V APPLY SAME VOLTAGE TO ALL +VDC PINS
* DO NOT GROUND OPTIONAL PINS IF NOT USED, FLOAT IF NOT USED




## 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 sent 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 enabled RF1\n RF1 PA ON

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

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

**Example 5:** Set Gain Control to DAC (approximate mid Gain); Echo disabled GC WORD 0866\n, DAC VALUE = XXXX

**Example 6:** Read Power POUTF\n POUT = 42

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