



ERZ-HPA-0900-1000-56

The ERZ-HPA-0900-1000-56 is a pulsed High Power Amplifier based on GaN technology focused for Radar applications in X band. It provides more than 400W in a compact size.

Main Features:

- Frequency Range: 9 to 10 GHz
- Typical Pout: 450 W
- RF connectors (I/O): SMA (F) / WR-90
- DC & Control connectors: D-sub type
- Several mounting options
- Compact aluminum housing
- Hi-reliability and dedicated screening/
environmental tests available under request

Typical applications:

- Radar X-band

Electrical Specifications

Parameter	Value			Units
	Min	Typ	Max	
Frequency	9	-	10	GHz
Output Power (Psat)	54.6	55.5	57	dBm
Small Signal Gain	67	70	73	dB
Power Gain (@Psat)	55	59	63	dB
Pulse Width	0,02	-	100 @10% DC	us
Pulse Repetition Interval (PRI)	10	-	-	us
Duty Cycle (DC)	-	-	10	%
Output RF Pulse Rise Time	-	-	10	ns
Output RF Pulse Fall Time	-	-	10	ns
Amplifier ON/OFF Time	-	250/250	300/300	ns
Input/Output VSWR	-	1.6:1	2.0:1 / 2.0:1	-
DC Voltage	24	28	32	V
Avg. Power Consumption 10% DC (@Psat)	-	245	-	W

Specifications at a case temperature of 25°C

Output Power

Figure 1 shows saturated output power measurement as a function of frequency measured with a pulse width of 100us and a duty cycle of 10% at different temperatures (-40°C, 25°C and +60°C).

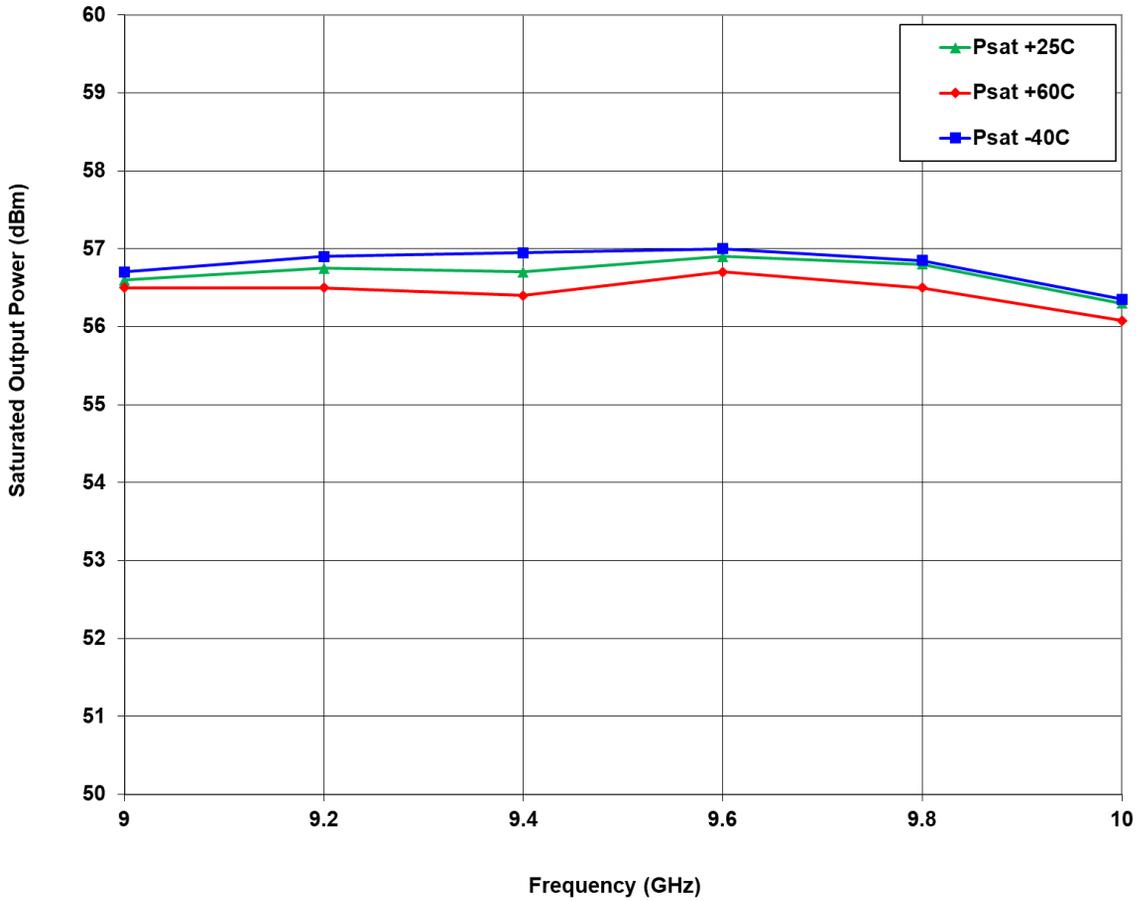


Figure 1: ERZ-HPA-0900-1000-56 Psat Vs Freq

Power Gain

Figure 2 shows power gain measurement as a function of frequency measured with a pulse width of 100us and a duty cycle of 10% at different temperatures (-40°C, 25°C and +60°C).

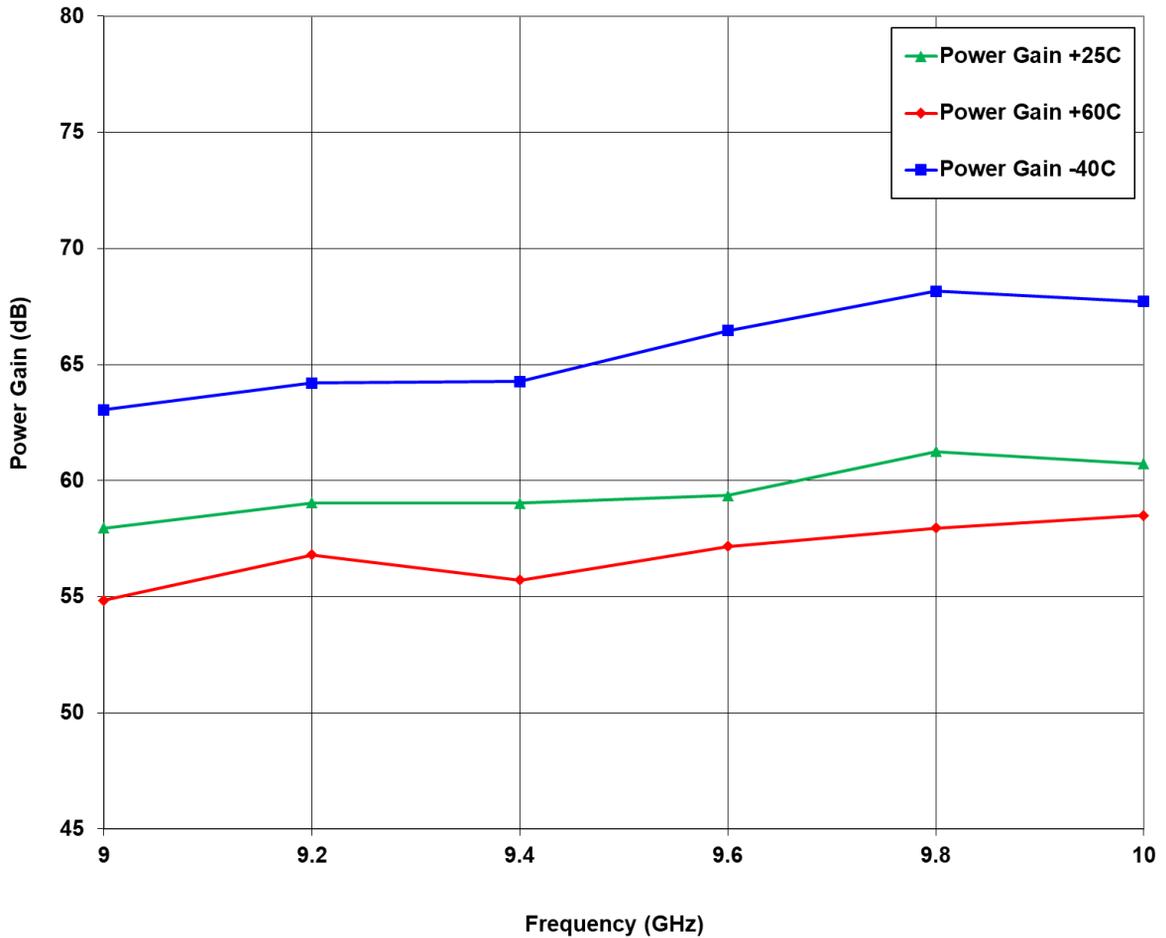


Figure 2: ERZ-HPA-0900-1000-56 Power Gain Vs Freq

Power Consumption

Figure 3 shows average current at 28V measurement as a function of frequency measured with a pulse width of 100us and a duty cycle of 10% at different temperatures (-40°C, 25°C and +60°C).

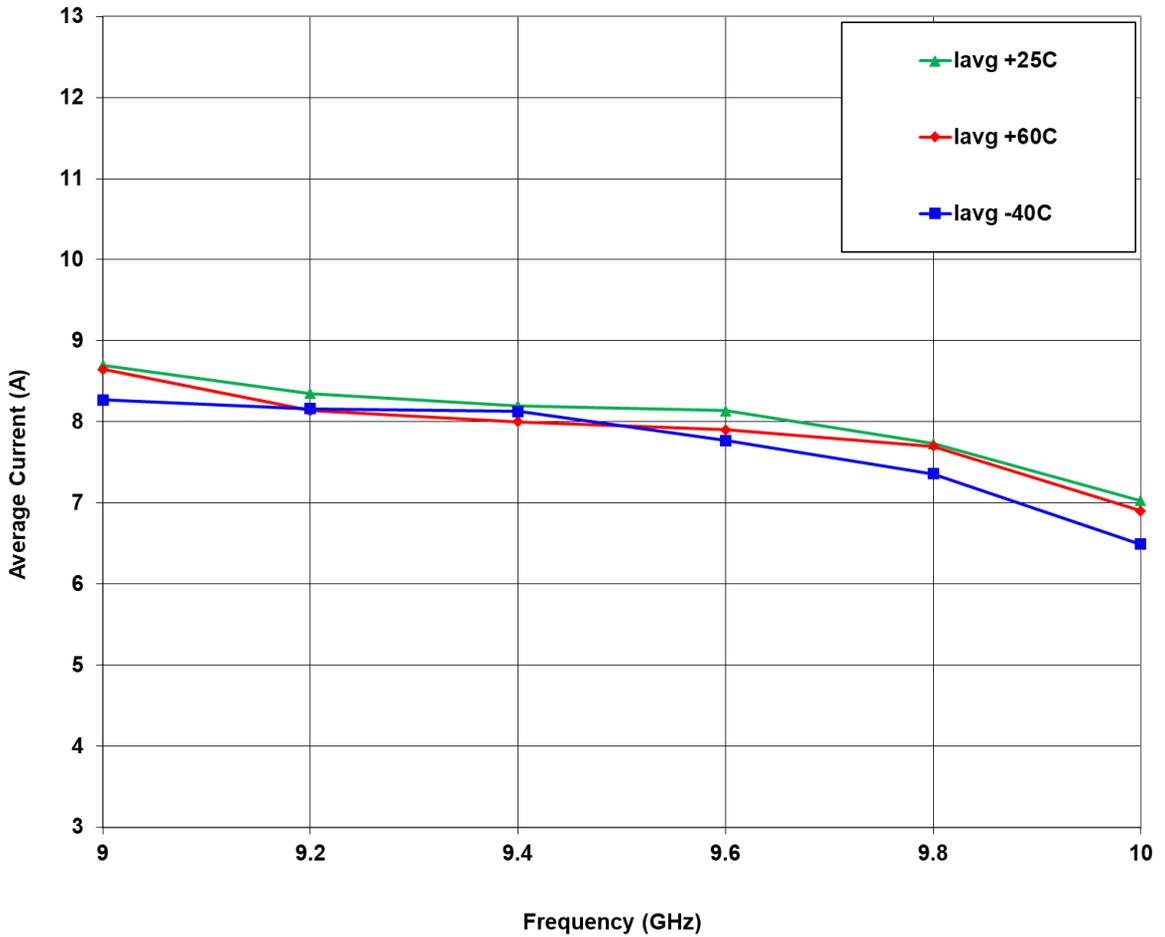


Figure 3: ERZ-HPA-0900-1000-56 Current (@28VDC) Vs Freq

Output Power, Gain and Power Consumption Vs Input Power

Figure 4 shows output power, gain and power consumption measurement as a function of input power measured with a pulse width of 100us and a duty cycle of 10% at different at room temperature (25°C)

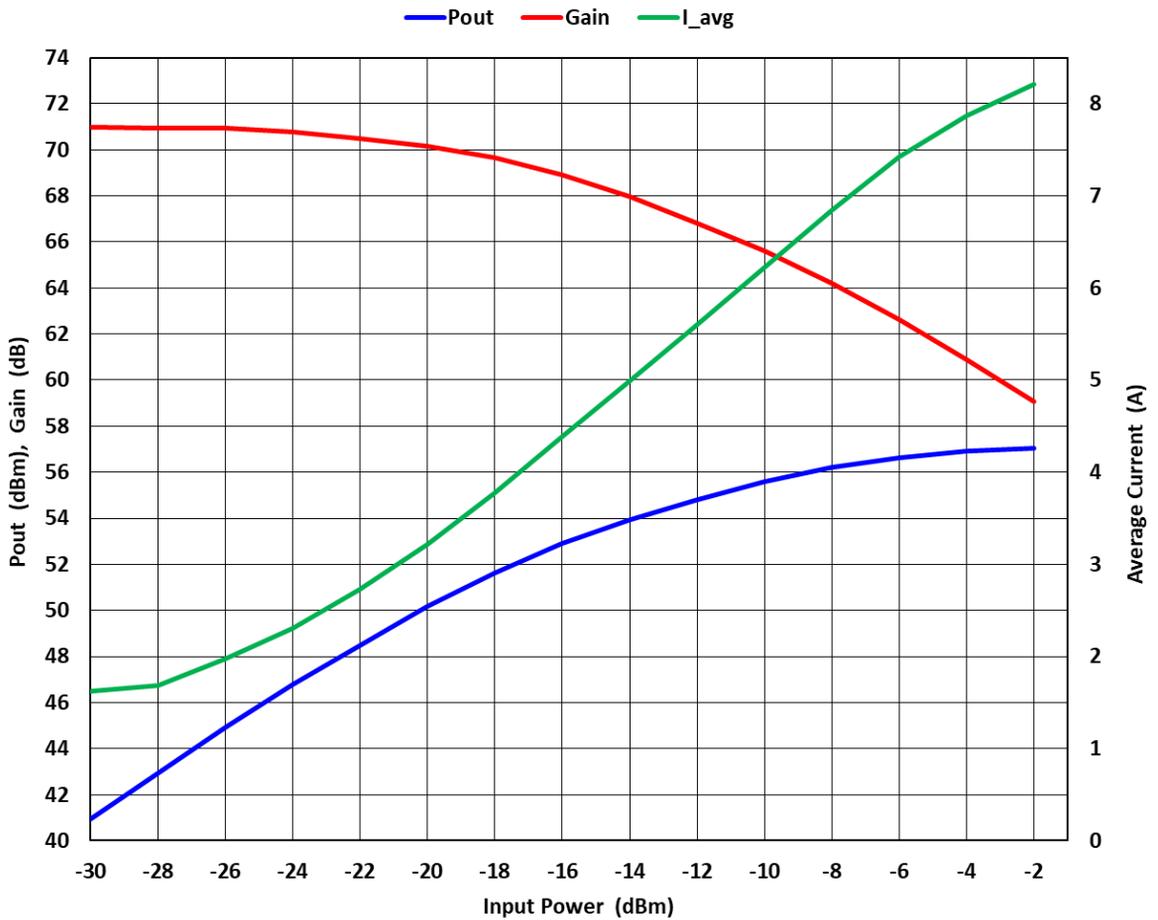


Figure 4: ERZ-HPA-0900-1000-56 Pout, Gain and Power consumption Vs Pin

Output Power Detected

Figure 5 and 6 show voltage of output power detected measured with a pulse width of 100us and a duty cycle of 10% at room temperature (25°C)

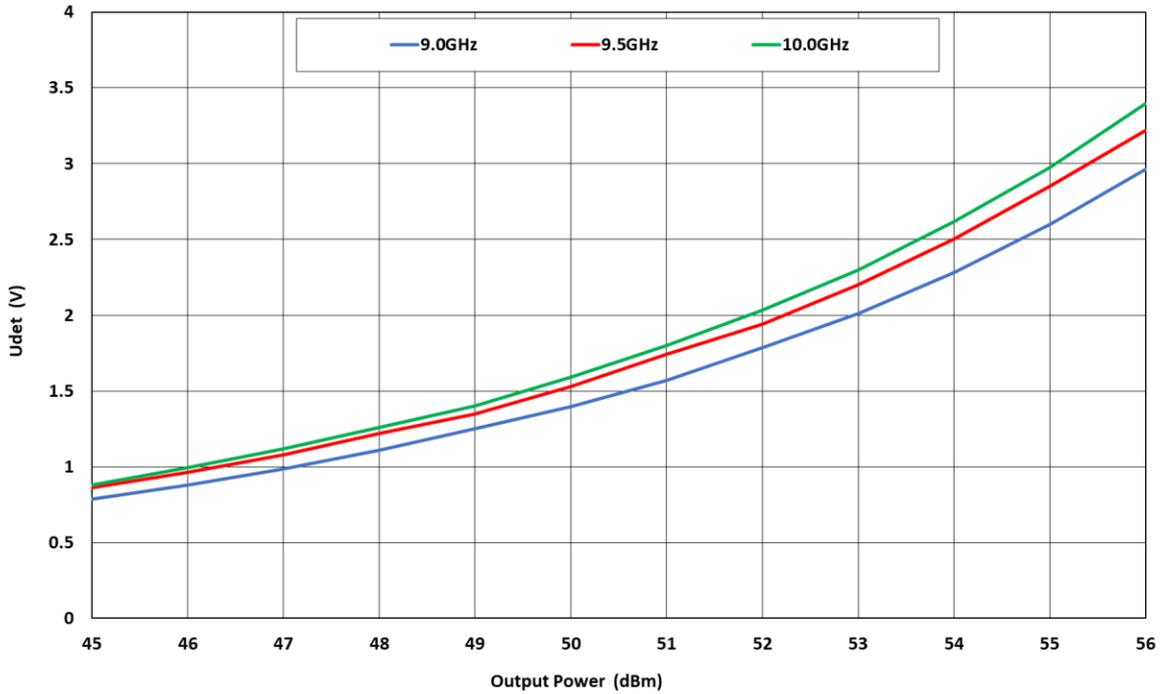


Figure 5: ERZ-HPA-0900-1000-56 Pout detected Vs Pin

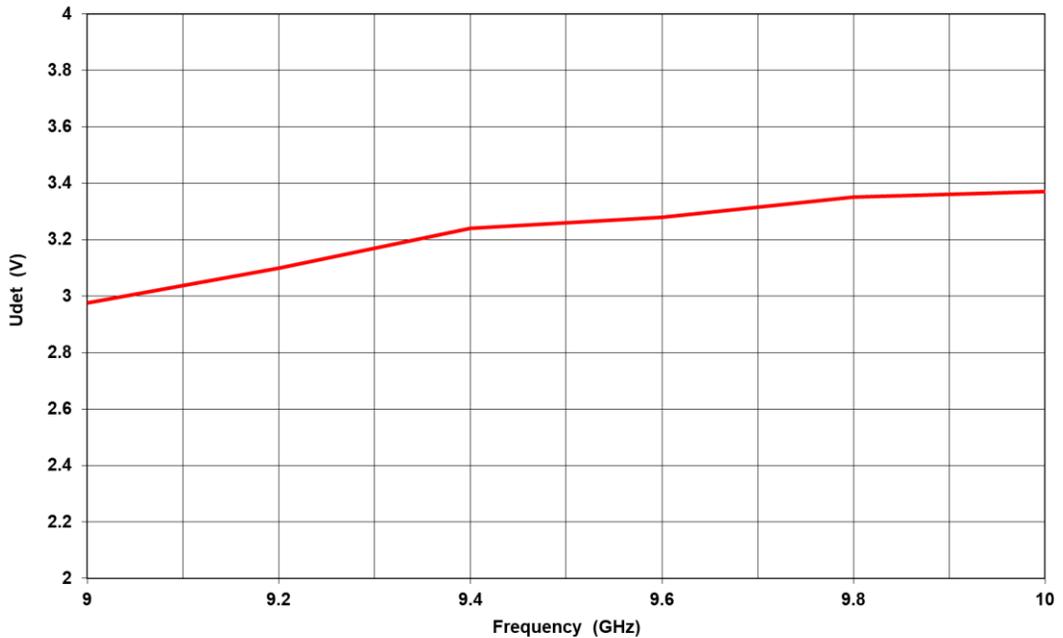


Figure 6: ERZ-HPA-0900-1000-56 Pout detected at Pout 56 dBm

Output Power Detected

Figure 7 shows output power detector 100ns pulse measured at 9.5 Ghz at Psat at room temperature (25°C). Detector load resistance is 1MOhm.

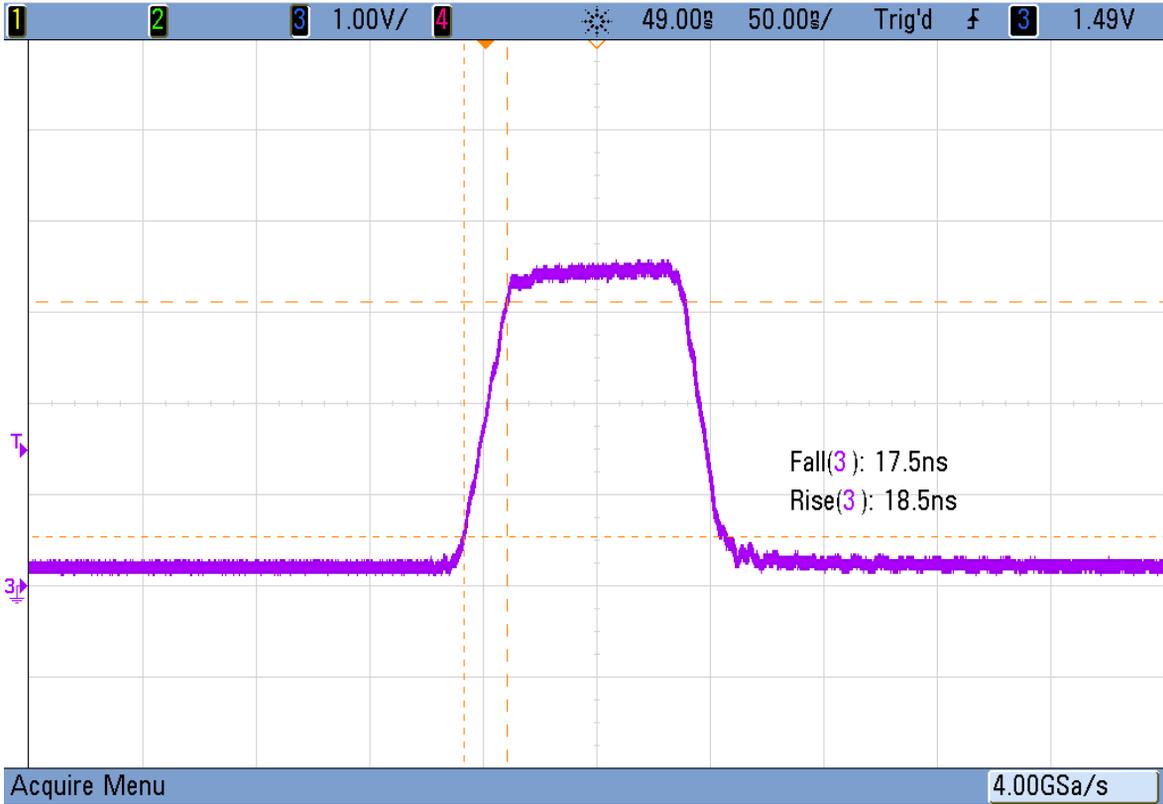


Figure 7: Detected Output Power Pulse at Psat

Small Signal Gain

Figure 8 shows small signal gain measurement as a function of frequency measured with a pulse width of 100us and a duty cycle of 10% at different at room temperature (25°C)

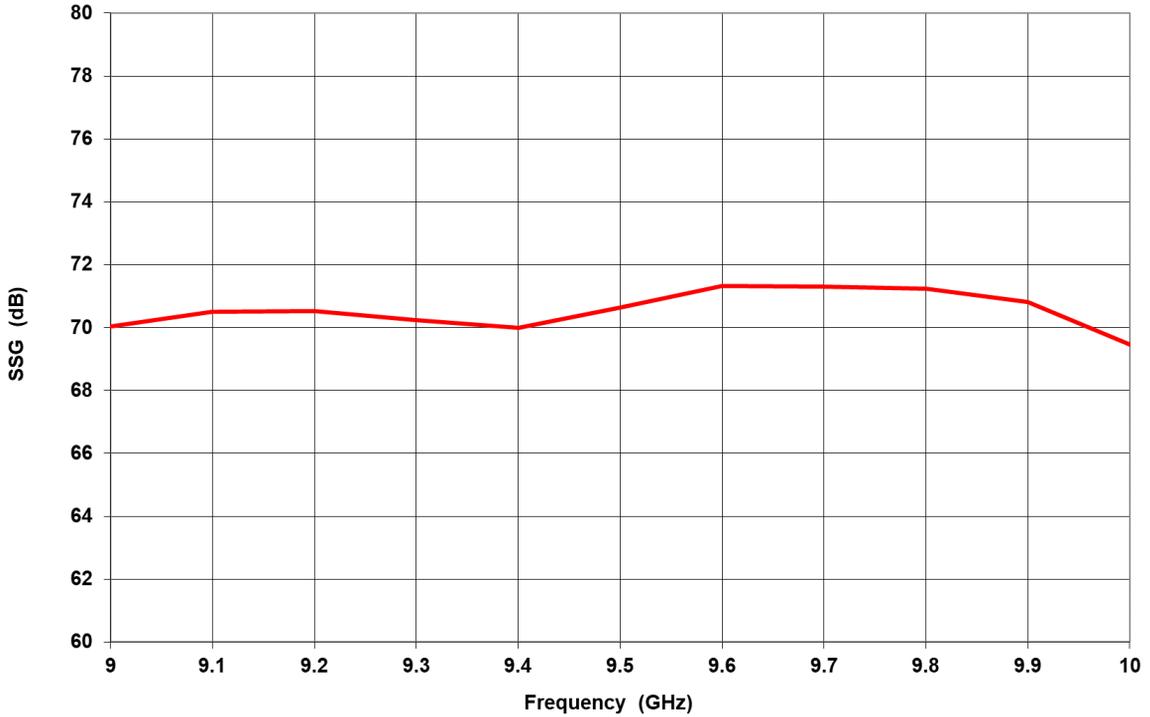


Figure 8: ERZ-HPA-0900-1000-56 Small signal gain Vs Frequency

Input and Output Matching

Figure 9 and 10 show input and output matching measurements as a function of frequency measured with a pulse width of 100us and a duty cycle of 10% at room temperature (25°C)

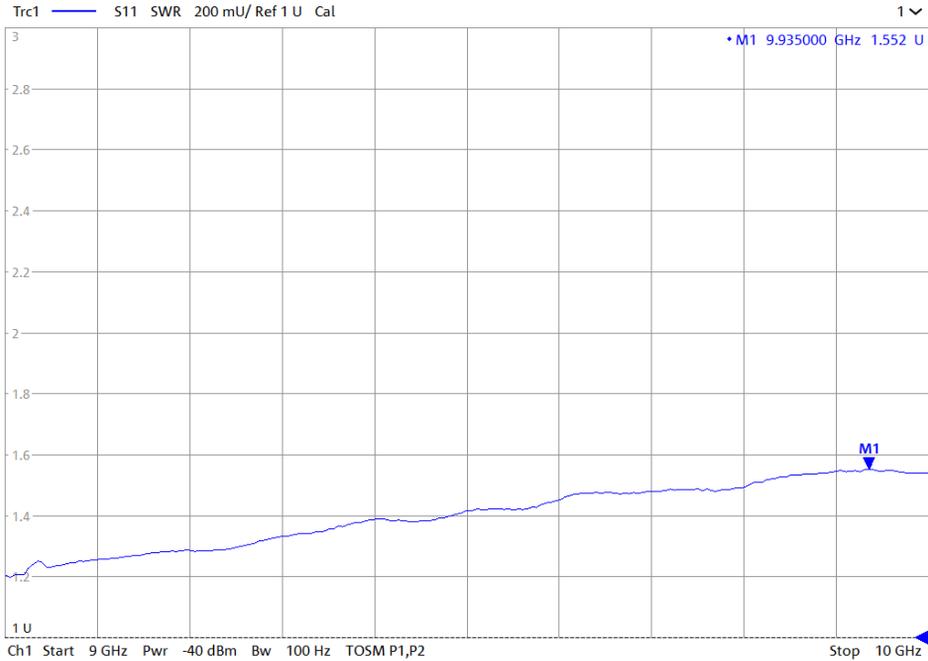


Figure 9: ERZ-HPA-0900-1000-56 Input Matching Vs Frequency

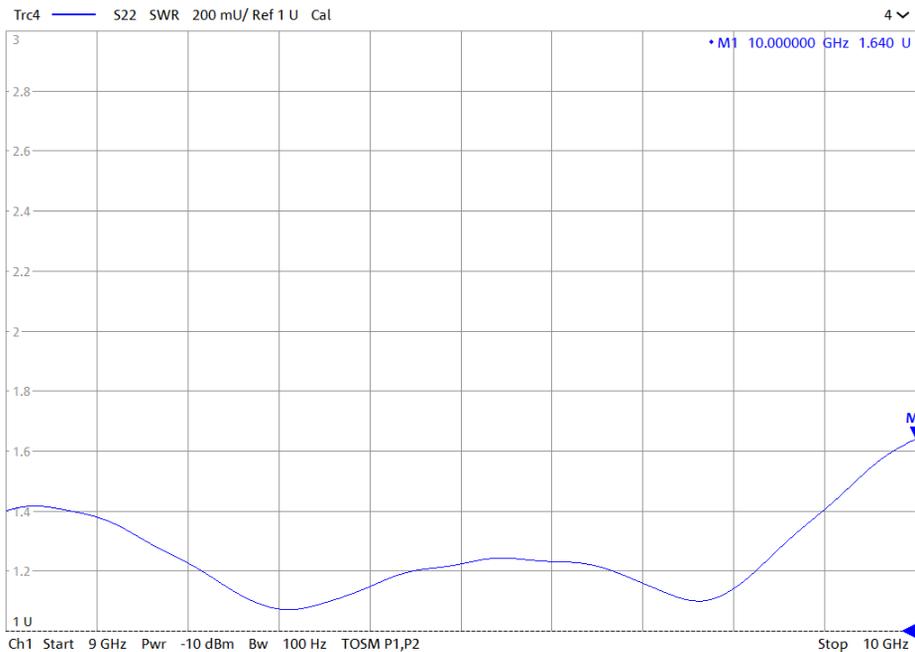


Figure 10: ERZ-HPA-0900-1000-56 Output Matching Vs Frequency

RF Output Pulses at Saturation Level

Figure 11 shows RF output pulse at different frequencies at room temperature (25°C)

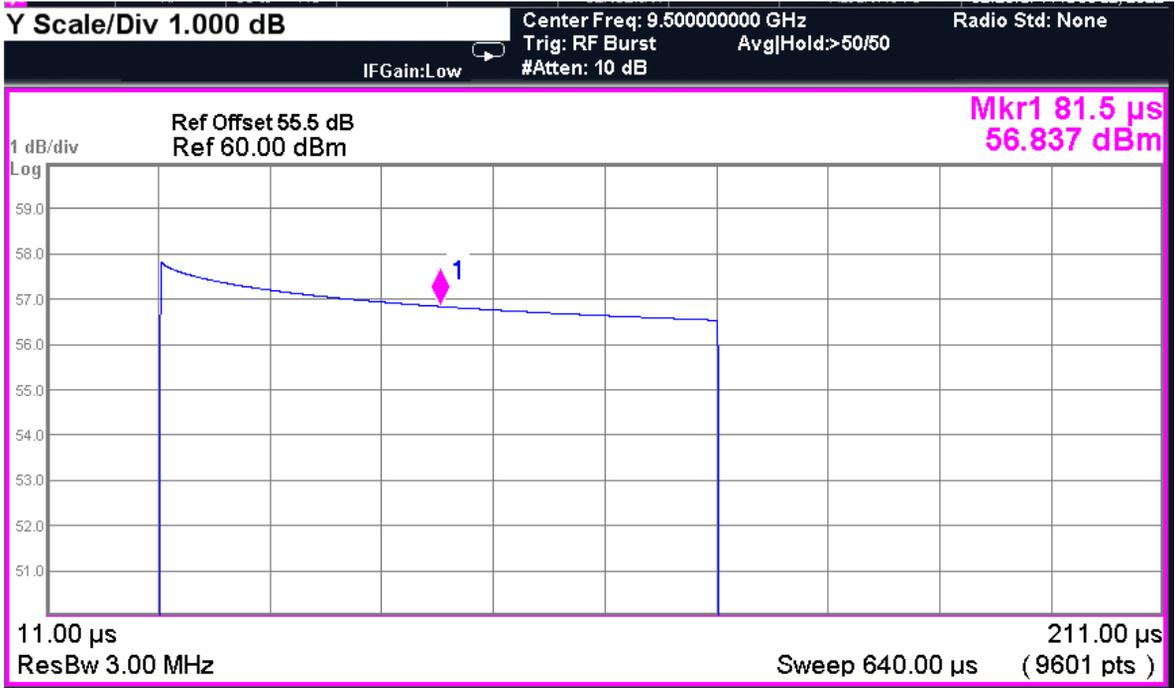


Figure 11: ERZ-HPA-0900-1000-56 RF Output Pulse at 8,5 GHz

Switch ON/OFF Time

Figures 12 and 13 show switching ON/OFF times at 9.5 GHz at room temperature (25°C)

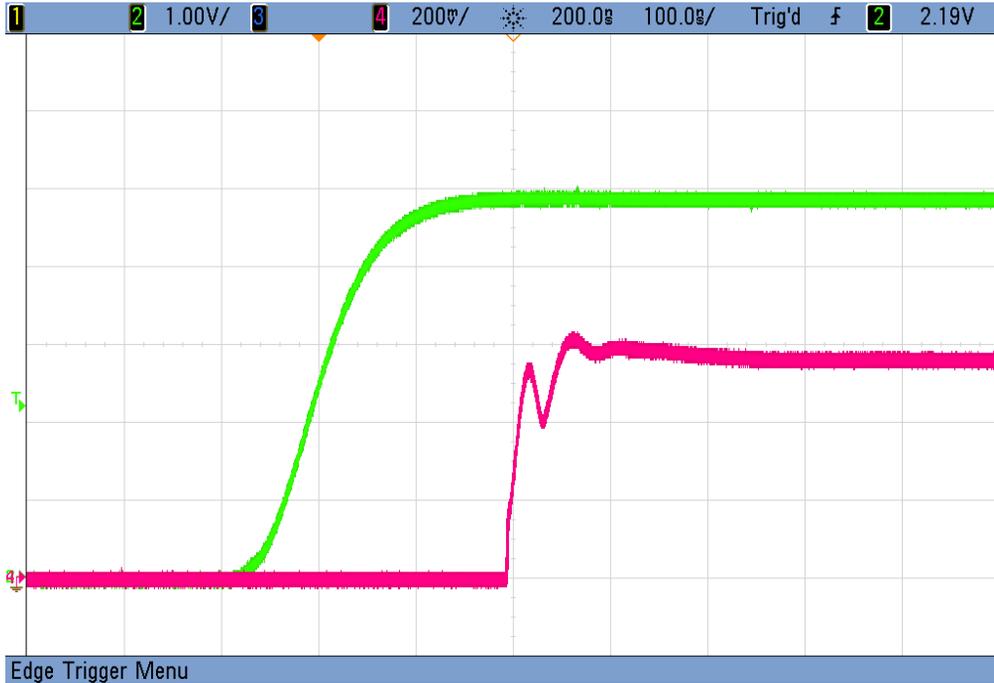


Figure 12: ERZ-HPA-0900-1000-56 Switch ON time



Figure 13: ERZ-HPA-0900-1000-56 Switch OFF time

Mechanics & Outline Drawing

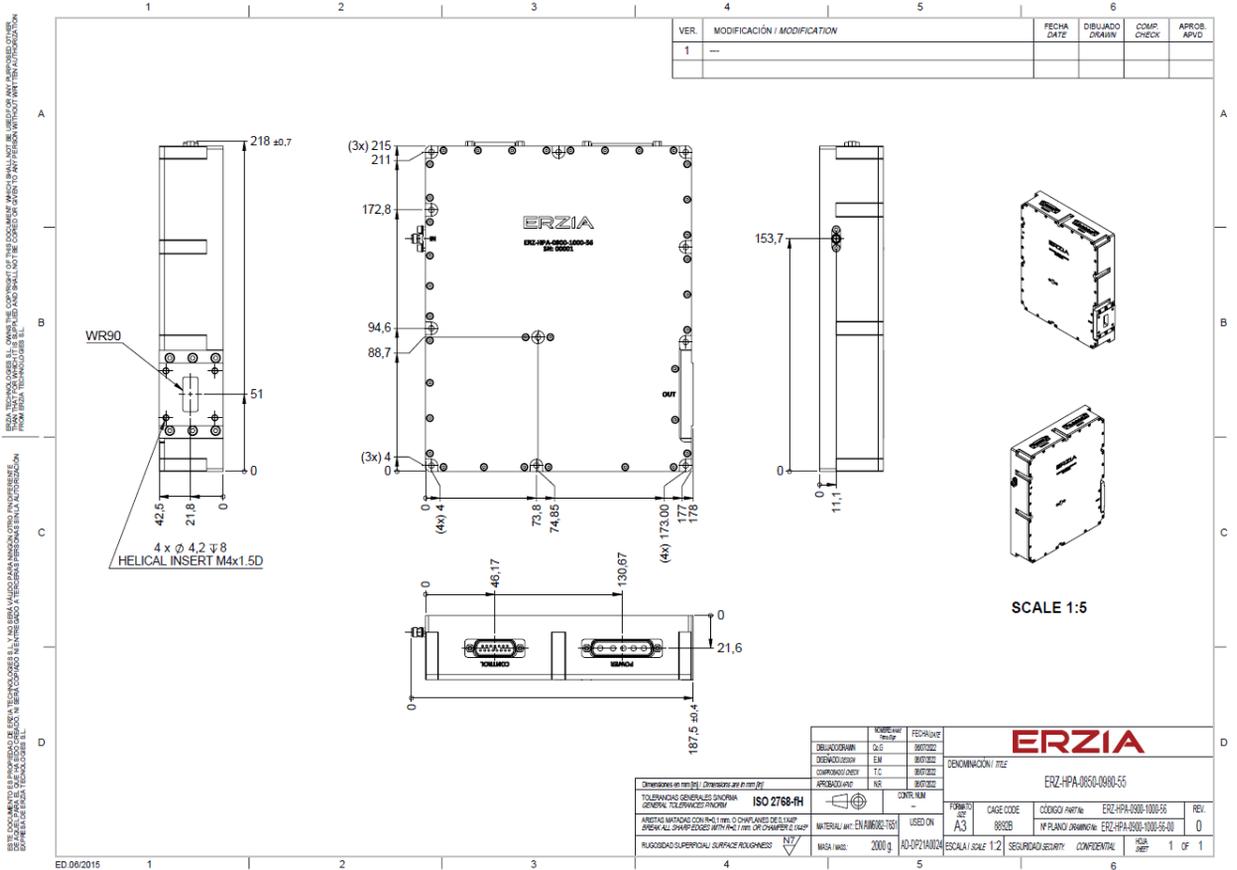


Figure 14: ERZ-HPA-0900-1000-56 Outline Drawing

Parameter	Value
Size	218 x 187.5 x 42.5 mm
Weight	2.0 kg
RF Input Connector	SMA Female
RF Output Connector	Waveguide WR90
DC Connector	5W5P
Control Connector	Dsub 15

Power Supply Interface

Power supply characteristics

- Input Voltage: 24 to 32 VDC
- TVS diode protects up to 1500W pulses of 10/1000us waveform and DC 0.01%
- IEC-61000-4-2 ESD 30kV (Air), 30kV (Contact)

Table below shows D-Sub 5W5 connector pinout

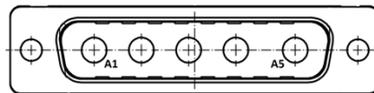


Figure 15: Power Connector. DSUB 5W5 Male Front View

PIN	LABEL	SIGNAL
A1	VCC	+28V Power Source
A2	VCC	+28V Power Source
A3	PGND	Power Ground
A4	PGND	Power Ground
A5	GND	Ground to Chasis

Control Interface

Control signals:

- Transmit gate signal
- Temperature sensor
- Reflected power detector
- Current consumption alarm
- Enable
- Transmit gate signal
- Temperature sensor
- Reflected power detector
- Current consumption alarm
- Enable

Table below shows D-Sub 15 connector pinout

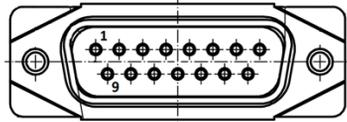


Figure 16: Control Connector. DSUB 15 Male Front View

PIN	LABEL	SIGNAL	Type
1	I_SEN	Current Sensor	Analog Output
2	P_DET	Output Power Detector	Analog Output
3	GND	Ground	Ground
4	T_ALM	Temperature Alarm	Digital Output
5	RP_ALM	Reflected Power Alarm	Digital Output
6	GND	Ground	Ground
7	RES	Reset	Digital Input
8	TGTX	Transmit Gate Signal	Digital Input
9	T_SEN	Temperature Sensor	Analog Output
10	RP_DET	Reflected Power Detector	Analog Output
11	GND	Ground	Ground
12	I_ALM	Current Consumption Alarm	Digital Output
13	GND	Ground	Ground
14	GND	Ground	Ground
15	EN	Enable	Digital Input

Control Interface

Control Signals description:

I_SEN (PIN 1): The average current consumption is given by analog voltage 0.05V per Ampere (10A average current respects to 0.5V).

RF_PWR (PIN 2): RF peak detector. The RF forward power is given by analog voltage.

TEMP_ALM (PIN 4): The temperature alarm remains high if temperature is lower than -45°C or higher than +65°C with 5°C hysteresis. The HPA keeps switched off when this alarm is high and switch on when the internal temperature returns to normal operation temperature.

RF_R_PWR_ALM (PIN 5): The reflected power alarm is high when a reflected signal in the output higher than 100-150W occurs.

RESET (PIN 7): Reset amplifier after alarm protection. Tie high to enable amplifier. This pin has an internal 10k pull down resistor.

MOD (PIN 8): Digital input of transmit gate. When control signal with high level is applied to this input transmit gate is ON and the HPA can transmit RF signal, when the level of control signal is low transmit gate is OFF and the HPA is not able to transmit RF signal.

The transmit input signal shall comply 300ns before RF pulse starts and 100ns after RF pulse ends. Transmit inhibited when disconnected.

Maximum RF pulse width is 100 μs at 10% duty cycle. Minimum Pulse Repetition Interval is 10 μs.

This pin has an internal 10k pull down resistor.

TA_SEN (PIN 9): The HPA has an internal precision temperature sensor to monitor the internal temperature. The transfer function is predominately linear with good accuracy near 25°C: $V_o = -11.69 \text{ mV}/^\circ\text{C} \times T + 1.8663\text{V}$, to best accuracy can be obtained by using the parabolic transfer function: $V_o = (-3.88 \times 10^{-6} \times T^2) + (-1.15 \times 10^{-2} \times T) + 1.8639$. The operating temperature is -40°C to +85°C.

RF_R_PWR (PIN 10): Reflected RF peak detector. The RF reflected power is given by analog voltage.

I_ALM (PIN 12): The input current alarm remains high when input current is higher than a safe value (12A).

Enable (PIN 15): Enable amplifier. Tie high to enable amplifier. Tie low or leave floating to switch off amplifier. This pin has an inter 10k pull down resistor

Digital Signals Characteristics				
Parameter	Min	Typ	Max	Unit
V _{IH}	+3,5	-	+5,5	V
V _{IL}	0	-	+1,5	V
V _o	0	-	+5	V

Absolute Maximum Ratings

Condition	Value
DC Voltage	24 to 32 VDC
Maximum Input Power (CW)	+10 dBm
Operation temperature (at case)	-40 to 60 °C
Storage temperature	-55 to 125 °C

- Stress above these ratings may cause permanent damage to the device.
- It is final user responsibility to maintain the amplifier within the specified ranges.

Environmental Specifications (By Design)

Operating Temperature:	-40 to +60 °C	(MIL-STD-810F, method 520.2)
Storage Temperature:	-55 to 125 °C	(MIL-STD-810F, method 520.2)
Vibration:	8g rms	(MIL-STD-810F, method 514.5)
Shock:	20g,11ms,saw-tooth	(MIL-STD-810F, method 516.5)
Acceleration:	15g	(MIL-STD-810F, method 513.5)

RoHS & REACH Compliance

This part is compliant with EU 2011/65/UE RoHS (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) and REACH (Registration, Evaluation, Authorization and restriction of Chemical substances) directives.



Documentation and Test Reports

All modules are at least delivered with: Electrical Test Report, Certificate of Conformance, Certificate of Acceptance and Origin. Optionally, units can be environmentally tested (temperature, vibration...).

Option (HS): Heat Sink

A heat sink (HS) can be provided to allow the operation of Power Amplifiers. Please note that most power amplifiers need heat sink or appropriate heat dissipation strategy.

Space / Military Usage

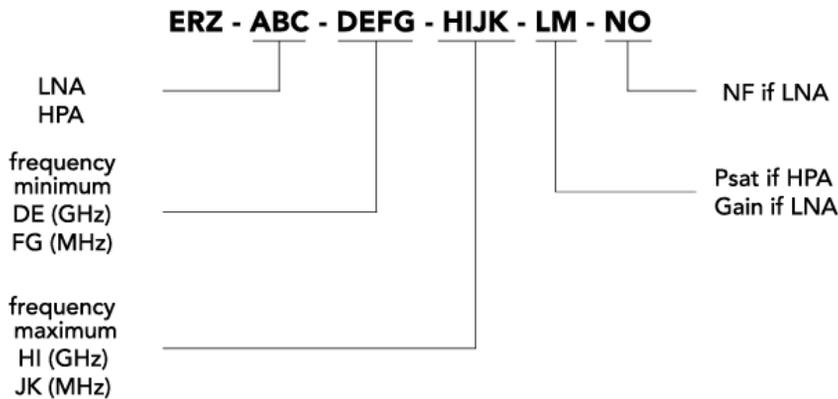
Most of ERZIA's products are based on rad-hard technologies and can be manufactured and integrated according to MIL / ECSS or specific hi-rel standard-screening for space, aeronautics, military or specific hi-reliability usage.

Customization and Extended Performances

ERZIA can fully design or adapt one of the existing RF amplifiers designs according to your specifications. Please contact us for additional information.

Model Number Codification

MODEL NUMBER



ERZIA

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