Coaxial

High Power Solid-State Amplifier ZHL-0027-1K7+

500 1700W 27MHz

1. The Big Deal

- High output power, 1700W •
- 27MHz ISM band .
- Suitable for CW and pulsed signals •
- High gain, 26 dB typical .
- High efficiency, 80% •
- **High ruggedness** •
- Built-in monitoring for temperature and current .
- Built-in emergency switch-off .



+RoHS Compliant The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

2. Product Overview

The ZHL-0027-1K7+ is a new generation light weight solid state connectorized high-power amplifier module which can be used in a wide range of industrial, scientific and medical applications in the 27MHz ISM band. The ZHL-0027-1K7+ uses the latest generation semiconductor technology and provides unsurpassed output power, efficiency and ruggedness. The amplifier is capable of amplifying signals (CW & pulsed) in excess of 1700W. A temperature compensated gate bias circuit is provided. Built-in circuitry provides temperature monitoring and current monitoring. An on-board emergency switch can be triggered with an external TTL signal to switch off the power amplifier in the case of too much reflected or dissipated power. All interfaces to the outside world are accessible through a convenient USB-C connector. The amplifier has a SMA-connector on the input and an N-connector on the output. The mounting base plate has an integrated water channel to provide cooling under difficult operating conditions, such as high mismatch or high dissipated power. Covenient rotatable push-toconnect tube fittings allow for easy and reliable water cooling connections. Integrated transformer cooling ensures a long amplifier lifetime. The amplifier is supplied with a robust shield. M5 screw holes are provided to mount the amplifier to a chassis in larger systems. Easy screw-on power supply connections are provided outside the shield.

Typical Electrical Performance of ZHL-0027-2K7+		
Parameter	Typical Performance (+25°C)	Unit
Frequency	27	MHz
Supply Voltage	65	V
Input Power (P _{IN})	37.5	dBm
Output Power CW (POUT @PIN)	62.55	dBm
	1800	W
Efficiency (@1800W)	80	%
Gain (@1800W)	26	dB
Current	34.6	А

50Ω 1700W 27MHz

3. Product Features

- High output power, 1800W
- 27MHz ISM band
- Suitable for CW and pulsed signals
- High gain, 26dB typical
- High efficiency, 80%
- Excellent ruggedness
- Built-in monitoring for temperature, and current
- TTL Emergency Shut-Off
- Light weight design



Model No. ZHL-0027-1K7+

Description 1700W High Power Amplifier with SMA input and N-Type output connectors

Feature	Advantages
High CW Power	Supports high power applications for a wide range of industrial, scientific and medical applications in the 27MHz ISM band.
High Gain	A typical gain of 26 dB at P_{3dB} allows the ZHL-0027-1K7+ to be driven to full output power with only 5 Watts of input power.
High Efficiency	The ZHL-0027-1K7+ uses high efficiency state of the art highly rugged semiconductor technology.
Temperature Compensated Gate Bias	A temperature compensated gate bias is integrated in the PA.
Built-in monitoring	The amplifier has built-in monitoring for temperature and current. Both monitoring outputs are differential.
PA Enable	A TTL PA Enable is provided. This will switch on/off the power amplifier and the monitoring functions.
Emergency Shut-Off	A TTL compatible fast emergency shut-off is provided to switch off the supply voltage to the power amplifier in order to avoid damage during high dissipation or high reflected power situations.
Easy interfacing	Power supply connections are easily accessible from the bottom of the shielded amplifier. The monitoring outputs and TTL emergency shut-off is accessible through an USB-C connector (J1).
Small and lightweight	The compact amplifier design (176mm x 96mm x 85mm) is lightweight (0.xxkg) which makes it suitable for integration in high power systems that require multiple amplifiers.
Cooling	Convenient rotatable push-to-connect tube fittings allow for easy connection of the water cooling.
Low voltage	The ZHL-0027-1K7+ operates over a large 50-65V supply voltage range.

50Ω 1700W 27MHz

4. Electrical Performance

Electrical Specifications at T_{WATER} =+25°C, V_{DS} =65V, 50 Ω System

Parameter	Symbol	Conditions	Min.	Тур.	Max.	Units
Frequency Range	f		24.12	27.12	30.12	MHz
Operating Voltage	V _{DS}		50	65	66	V
Input Power	Pin		-	-	10 40	Watts dBm
P _{1dB} Compression	P _{1dB}		1200 60.8	1350 61.3	-	Watts dBm
P _{3dB} Compression	P _{3dB}		1500 61.8	1700 62.3		Watts dBm
Power Gain	G _P	@ P _{3dB}	22	26	30	dB
Efficiency	η	@ P _{3dB}	70	80	-	%
Input return Loss	IRL	@ P _{3dB}		-15	-10	dB
Harmonics (H2 and H3)	H2, H3	@ P _{3dB}	-	TBD	-15	dBc
Current Monitor Out	СМО	Connector J1, A2=CDO+, A3=CDO-	0	-	3.3	V
Temperature Monitor Out	тмо	Connector J1, A10=TDO-, A11=TDO+	0	1	3.3	V
Power Supply Shut-Off	VDSSO	Enable (TTL low) / Disable (TTL high) on Pin A6 of Connector J1				
PA Enable	VMSO	Enable (TTL high) / Disable (TTL low) on Pin A7 of Connector J1				
Water Temperature	T _{WATER}	0 25 65		°C		
Dimensions		176 x 96 x 85 (LxWxH) 6.92 x 3.77 x 3.34		mm inches		

Test conditions: V_{DS}=65V, I_{DQ}=0.2A, f=27.12MHz, T_{WATER}=25°C, unless otherwise noted

Note 1: This amplifier <u>cannot</u> be run without water cooling. A minimum water flow rate of 4 Gallons/minute (approx. 15 liter/minute) is recommended.

Note 2: All power measurements are performed while using a Mini-Circuits NLP-30+ Low Pass Filter in front of the power sensors.

Maximum Ratings

Parameter	Ratings
Operating Water Temperature	0°C to +65°C
Storage Temperature	-20°C to +85°C
DC Voltage	66V
Input RF Power (no damage)	+40 dBm

1. Specifications apply to CW signals only. Permanent damage may occur if any of these limits are exceeded.

50Ω 1700W 27MHz

5. Application

The ZHL-0027-1K7+ amplifier module can be used as a building block in any single or multi-channel system for high power RF Energy applications such as:

- Industrial heating
- Materials processing
- Food processing (heating, tempering, and pasteurization)
- Microwave-assisted chemistry
- Plasma generation
- Plasma surface treatment
- Disinfection
- Chemistry
- RF-excited lasers
- Medical (heating, hyperthermia, and ablation)
- Semiconductor RF generators



50Ω 1700W 27MHz

Control Interface Pin-out and Functionality (J1, Multi-Pin USB-C Connector)

Pin Number	Label	Functionality
A1	GND	Ground
A2	CDO+	Current Differential Output+
A3	CDO-	Current Differential Output-
A4	GND	Ground
A5	GND	Ground
A6	PWR_ON	Power Supply Shut Off
A7	VR1_EN	PA Enable
A8	GND	Ground
A9	GND	Ground
A10	TDO-	Temperature Differential Output-
A11	TDO+	Temperature Differential Output+
A12	GND	Ground
B1-B12	Do not connect	Reserved pin for manufacturer

6. Amplifier Interfaces and suggested mating hardware*

J1 - CONN RCP USB3.1 TYPEC 24P SMD RA (Molex P/N 1054500101)

J2 - +65V Supply Conn., M5
Tightening Torque 2.2 N-m (19.5 in-lbs)
Mating M5 screw (Mcmaster P/N 92095A308) Belville washer (Mcmaster P/N 90895A027) Ring Terminal (Mcmaster P/N7113K29)



0.0	J4 - N Type Connector Receptacle, Female Socket 50Ohm
	(Amphenol P/N 172195)

*Mating hardware not included with amplifier. Similar mating hardware available from other manufactures.

50Ω 1700W 27MHz

7. Outline/Mechanical Dimensions



50Ω 1700W 27MHz

8. Typical Performance Data (65V, 50Ω System)

All graphs to be done later	
Gain & Efficiency as a function of Output Power @ +25°C base temperature	Gain & Efficiency as a function of Output Power @ 27MHz for +25°C & +65°C base temperature
FWD_AOUT (forward power analog output voltage) as a function of Output Power @ +25°C base temperature	FWD_AOUT (forward power analog output voltage)as a function of Output Power @ 2.45GHz for +25°C & +65°C base temp.
REFL_AOUT (reflected power analog output voltage) as a function of Power into J5 @ +25°C base temperature	REFL_AOUT (refl. power analog output voltage) as a function of Power into J5 @ 2.45GHz for +25°C & +65°C base temperature

50Ω 1700W 27MHz



50Ω 1700W 27MHz

9. Additional Notes

- A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- c. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at

www.minicircuits.com/MCLStore/terms.jsp