



RF applications for Drone Modules & Drone Mitigation

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Mini-Circuits Japan



The Drone Market Overview

Drone Applications – why now?:

- The proliferation of low power high bandwidth communication technologies has been a primary catalyst for rapid growth in drone product developments that address a myriad of application needs in the industrial, commercial, defense, agricultural and consumer markets.

Drone Market Growth :

- Overall market projections show growth at > 10% CAGR.
 - *Actual global drone market size expected to grow from \$73B (2024) to \$164B (2030) **
- Drone-mitigation (aka counter-UAS, anti-drone) market expanding rapidly at >20% CAGR.
 - *Anti-drone market size \$2.45B (2024) expected to grow to \$10.6B (2030) **



Drone Module – RF front-end

Candidate Products:

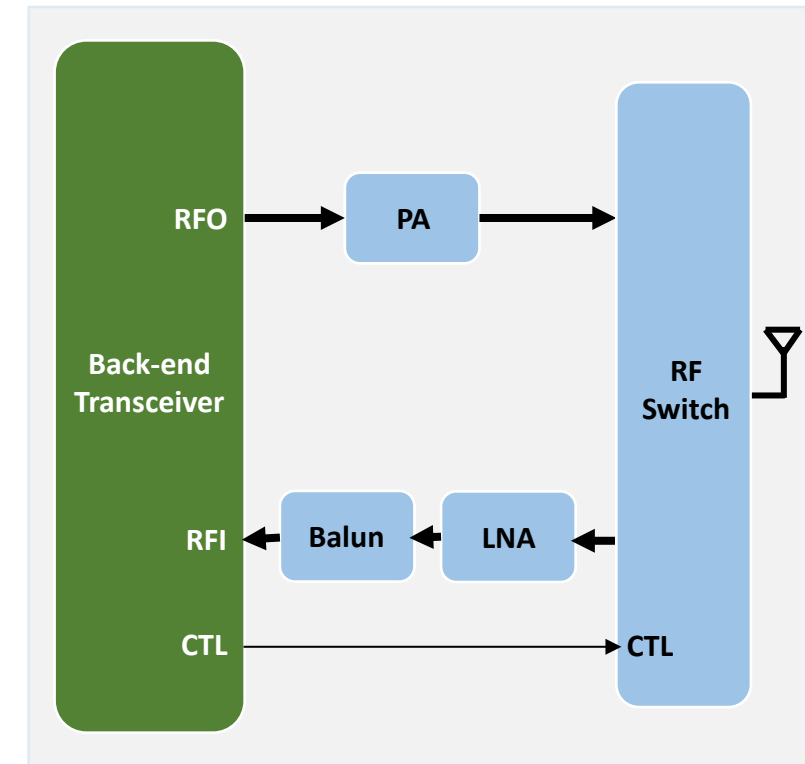
- PA: [GNA-252-5W+](#)
- Balun: [NCS2-771+](#), [NCS2-282+](#)
- LNA: [TSS-23ULN+](#)
- RF SW: [HSAW2-30DR+](#)

Other Products:

- LTCC filters: Low-Pass, High-Pass, Band-Pass & more - [filters](#)
- Balun filters: TCM1/2 series baluns & BPF+balun – [TCM1/2](#), [BBFCG](#)
Wide-band MMIC baluns – [MTX2-133+](#)
- Attenuators: XAT series are small size (1x1mm), high power - [XAT](#)

Summary:

- Mini-Circuits offers a wide choice of RF components for use in the interface between a drone antenna and its back-end transceiver.



Counter-Drone Solutions:

Candidate Products:

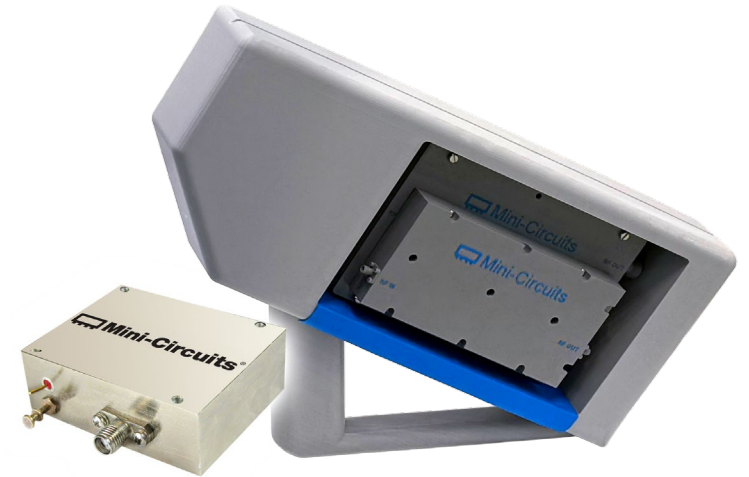
- PA: [ZVE-2W-272X+](#), [ZVE-3W-83X+](#), [GNA-63-5W+](#), [GP2S1A+](#)
- Splitter: [ZACS242-100WX+](#), [SCW-2-722+](#)
- Filters: [LFCG-1000+](#), [LFCN-2500+](#), [HFCN-1910+](#), [HFCG-4400+](#),

Other Products:

- Core & Wire: [TTC2-63W+](#), [ADT8-1T+](#)

Summary:

- Mini-Circuits connectorized PA amplifiers have been used in counter-drone solutions that are both handheld and fixed. Other components such as splitters/combiners, filters, VCOs' and attenuators have also been chosen by customers.



Drone Detection Solutions:

Candidate Products:

- Amplifiers : [PMA3-83LN+](#), [TSY-83LN+](#), [GALI-3+](#), [GALI-51F+](#), [PSA-8A+](#)
- Splitters : [ZN2PD-63-S+](#), [SCN-2-35+](#), [WP4L+](#)
- LTCC Filter : [LFCG-900+](#), [LFCG-2600+](#), [HFCG-1600+](#), [BFCN-1860+](#), [BFCG-5600+](#)
- Lumped LC: [RLP-900+](#), [RHP-250+](#), [RHPF-500+](#), [SCLF-700+](#)

Other Products:

- Switches: [ZFSWA2R-63DR+](#),
- Baluns: [TC1-1-13M+](#), [TC4-1TG2+](#), [ADT1-1WT+](#)

Summary:

- For drone detection and tracking, Mini-Circuits has supplied surface mount devices for use in receiver side circuits for fixed and mobile applications.



Parts Adopted for Drone Applications

Customer Adoption Examples

- With a portfolio of more than 30,000 RF and microwave components, Mini-Circuits provides building blocks for a wide range of system applications. The table below shows a selection of products that have been adopted by our customers for drone applications.
- This list is provided as a reference for customer adoption records. For new designs, we recommend using this list together with our [Yoni Search Tool](#) to find the optimal part for your requirements.

Type	Model	Customer Application
Balun	TTC2-63W+	Jammer & Detector
HPF	HFCG-1760+	Drone Module
Splitter	GP2S1A+	Detection Radar
Amplifier	Gali-3+	Detection Radar
LPF	LFCN-80+	Jammer & Drone Module
HPF	HFCG-1760+	Drone Module
Amplifier	PMA3-83MP+	Detection Radar
Splitter	EP2K+	Detection Radar
Amplifier	GVA-93+	Jammer
HPF	HFCG-4400+	Jammer
HPF	HFCN-1910+	Jammer
HPF	HFCW-7000+	Detection Radar
LPF	LFCG-1000+	Jammer
HPF	RHP-395+	Detection Radar
Splitter	SCW-2-722+	Jammer
Balun	TCM2-63WX+	Drone Module
Attenuator	YAT-2A+	Detection Radar
BPF	BPGE-542R+	Drone & Jammer

High-Power Amplifiers - *New!*

**COAXIAL**
High Power Amplifier
50Ω 2 to 8 GHz 30W SMA

ZHL-2G08G0030+
ZHL-2G08G0030X+

THE BIG DEAL

- 2 to 8 GHz Broadband Operation
- Suitable for CW signals
- Saturated Power, 30W (typ)
- High gain, 52 dB typical
- 50-ohm input and output impedance
- Unconditionally stable and rugged design
- Self-protected against excessive drive, high case temp., reverse polarity and shorting unit DC power

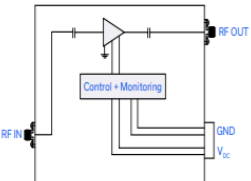
APPLICATIONS

- High Power Testing
- Burn-in / Life Testing
- Communication
- Radar



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FUNCTIONAL DIAGRAM





- 30W (Psat min: +43dBm)
- Wide-band : 2~8GHz
- High Gain: 53dB typical
- DC Vdd: 28V

**COAXIAL**
High Power Amplifier
50Ω 2 to 18 GHz 10W SMA

ZHL-2G018G010+
ZHL-2G018G010X+

THE BIG DEAL

- 2 to 18 GHz Broadband Operation
- Suitable for CW signals
- Saturated Power, 10W (min)
- High gain, 48 dB typical
- Unconditionally stable and rugged design
- Self protected from over heating and reverse polarity
- Built in current limiter

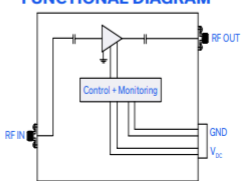
APPLICATIONS

- High power testing
- Burn-in / Life Testing
- Communication
- Radar



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FUNCTIONAL DIAGRAM





- 10W (Psat min: +40dBm)
- Wide-band : 2~18GHz
- High Gain: 48dB typical
- DC Vdd: 24V

Drone Field Testing

Candidate Products:

PWR-18PWHS-RC :

for Ultra fast (ns) Pulse Testing and Field Wifi Sniffing

SSG-9G-RC :

Dynamic Pulse modulation





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