

## Wide Band Solid State Power Amplifier 46GHz-53GHz



### Product Description

RFLUPA46G53GA is a wide band power amplifier with a frequency range of 46 to 53GHz.

The power output of this amplifier is 46.5dBm typical. The typical small signal gain is 52dB with a gain flatness of  $\pm 3$ dB. This power amplifier works with typically +28 VDC power supply.

The power amplifier input connector is 1.85mm-female and output connector is WR-19.

The operating temperature of this product is -40 to +70°C.

### Features

- Solid State Power Amplifier
- Small Signal Gain 52dB Typical
- Output Saturation Power 46.5dBm Typical
- Supply Voltage +28VDC
- 50 Ohm Matched
- Over Temperature Protection
- Over Current Protection
- Auto Calibration

### Typical Applications

- Wireless Infrastructure
- Military and Aerospace Applications
- Test Instrumentation
- Radar Systems
- 5G Wireless Communications
- Microwave Radio Systems
- TR Modules
- Research and Development
- Cellular Base Stations

### Electrical Specifications (T<sub>A</sub>=+25°C)

| Parameter                                        | Min                                            | Typ       | Max | Units |
|--------------------------------------------------|------------------------------------------------|-----------|-----|-------|
| Frequency Range                                  | 46                                             |           | 53  | GHz   |
| Small Signal Gain                                | 48                                             | 52        |     | dB    |
| Gain Flatness                                    |                                                | $\pm 3.0$ |     | dB    |
| Gain Variation Over Temperature (-40°C to +70°C) |                                                | $\pm 2.0$ |     | dB    |
| Input VSWR                                       |                                                | 1.5       | 2.0 | : 1   |
| Output 1dB Compression Point (P1dB)              |                                                | 43        |     | dBm   |
| Saturated Output Power (Psat)                    | 45                                             | 46.5      |     | dBm   |
| Supply Current (Vcc=+28V)                        |                                                | 7.5       | 13  | A     |
| Power Added Efficiency (PAE)                     |                                                | 10        |     | %     |
| Turn On/Off Speed (Switch Disable)               | ON                                             | 300       |     | ns    |
|                                                  | OFF                                            | 300       |     | ns    |
| Turn On/Off Speed (Drain Disable)                | ON                                             | 400       |     | us    |
|                                                  | OFF                                            | 600       |     | us    |
| Turn On/Off Speed (Gate Disable)                 | ON                                             | 600       |     | us    |
|                                                  | OFF                                            | 400       |     | us    |
| Weight                                           | Net                                            | 3.27 Max  |     | lbs   |
| Impedance                                        |                                                | 50        |     | Ohms  |
| Input / Output Connectors                        | 1.85mm-Female(Input) – WR-19(Output) (E-Plane) |           |     |       |
| Package                                          | Epoxy Sealed (Standard)                        |           |     |       |
|                                                  | Hermetically Sealed (Optional)                 |           |     |       |

### Absolute Maximum Ratings

| Parameter              | Rating                   |
|------------------------|--------------------------|
| Supply Voltage Range   | +30VDC                   |
| *RF Input Power (RFIN) | Psat – Large Signal Gain |

### Bias Up Procedure

1. Connect ground
2. Connect input and output with 50 Ohm source/load.  
(In band VSWR < 1.9:1 or >10dB VSWR.)
3. Connect positive supply and make sure power supply can handle max current.

### Bias Down Procedure

1. Turn off power supply
2. Remove positive supply Connection
3. Remove RF Connection
4. Remove ground

### Environmental Specifications and Test Standards

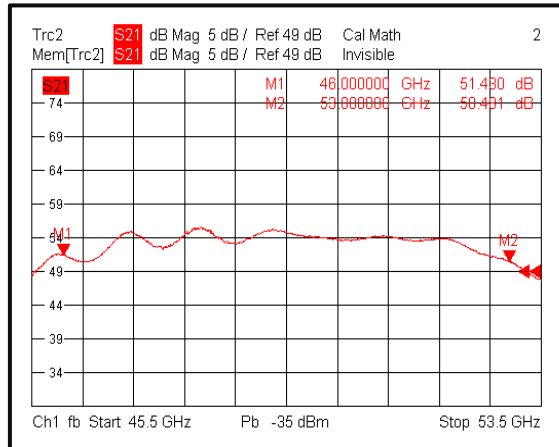
| Parameter                         | Description                                                                                                                                                                                                     |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operational Temperature           | -40°C to +70°C<br>(Case Temperature)                                                                                                                                                                            |
| Storage Temperature               | -50°C to +105°C                                                                                                                                                                                                 |
| Thermal Shock                     | -40°C → +85°C<br>(5 Cycles / 10 hours)                                                                                                                                                                          |
| **Random Vibration                | MIL-STD-202G<br>Table 214-I, Test Condition Letter C<br>1.5 Hours Per Axis                                                                                                                                      |
| High Temperature Burn In          | Temperature +70°C for 72 Hours                                                                                                                                                                                  |
| Shock                             | 1. Weight >20g, 50g half sine wave for 11ms, Speed variation 3.44m/s<br>2. Weight <=20g, 100g Half sine wave for 6ms, Speed variation 3.75m/s<br>3. Total 18 times (6 directions, 3 repetitions per direction). |
| Altitude                          | Standard: 30,000 Ft (Epoxy Sealed Controlled Environment)<br>Optional: Hermetically Sealed (60,000 ft. 1.0 PSI min)                                                                                             |
| Hermetically Sealed<br>(Optional) | MIL-STD-883 (For Hermetically Sealed Units)                                                                                                                                                                     |

\*Maximum RF input power is set to assure safety of amplifier. Input power may be increased at own risk to achieve full power of amplifier. Please reference gain and power curves.

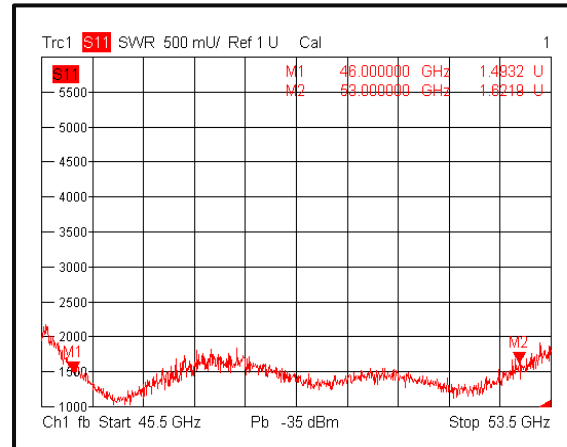
\*\*For vibration testing details please see additional information section.

Typical Performance Plots

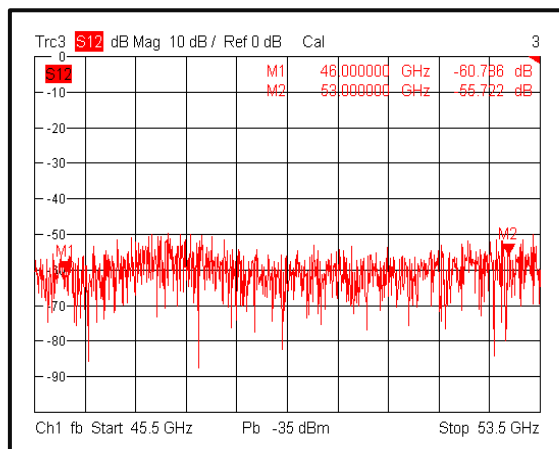
Gain @ +25°C



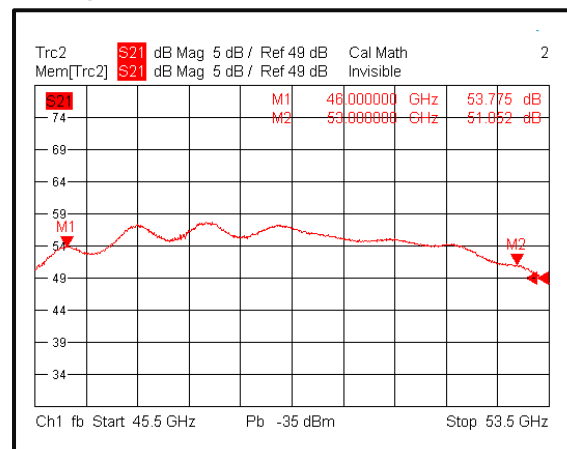
Input VSWR @ +25°C



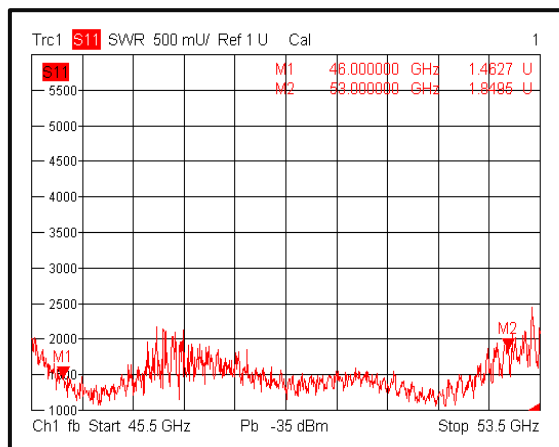
Isolation @ +25°C



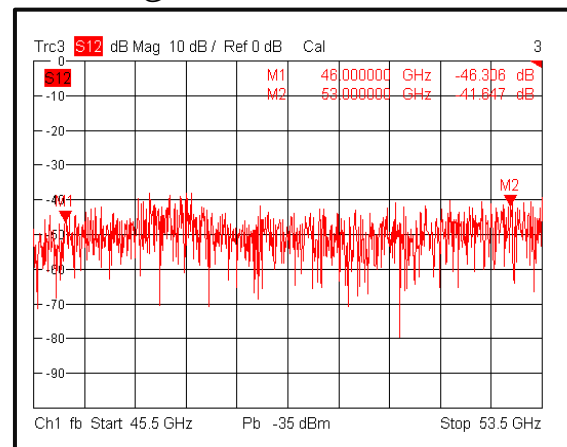
Gain @ -40°C



Input VSWR @ -40°C



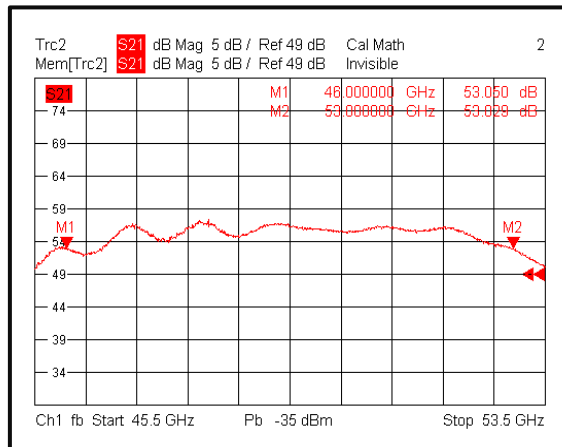
Isolation @ -40°C



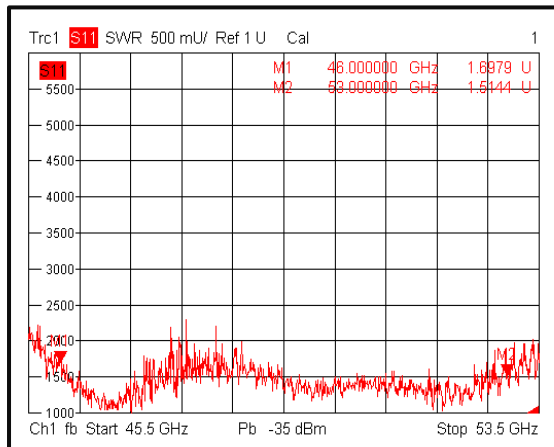
Note: Small signal VNA measurements include attenuators to protect equipment

Typical Performance Plots

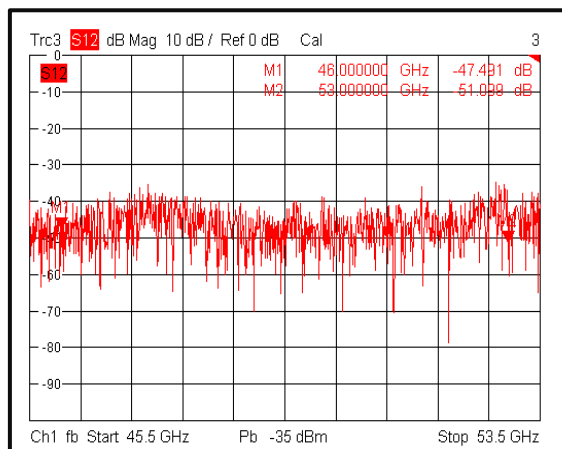
Gain @ +70°C



Input VSWR @ +70°C



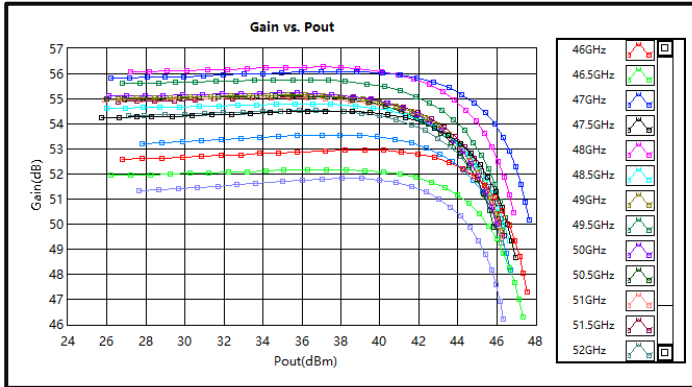
Isolation @ +70°C



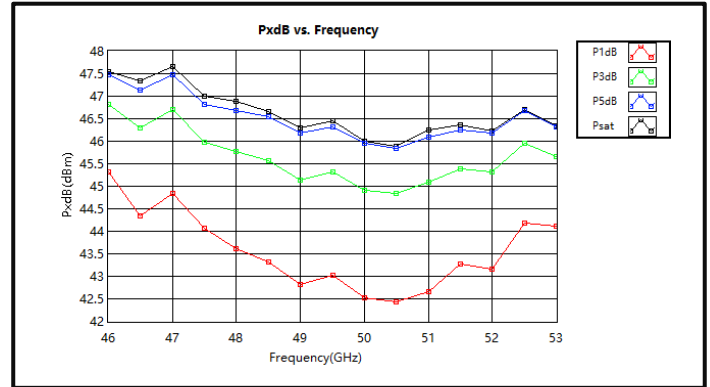
Note: Small signal VNA measurements include attenuators to protect equipment

## Typical Performance Plots

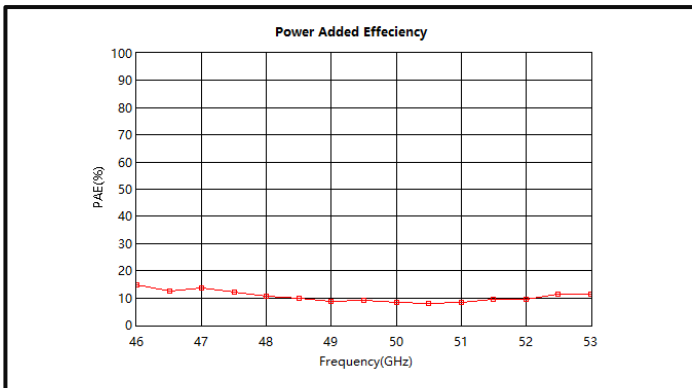
**Gain vs. Output Power**



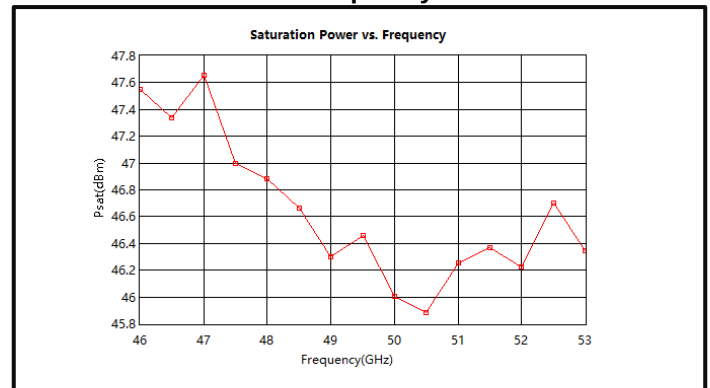
**PndB vs. Frequency**



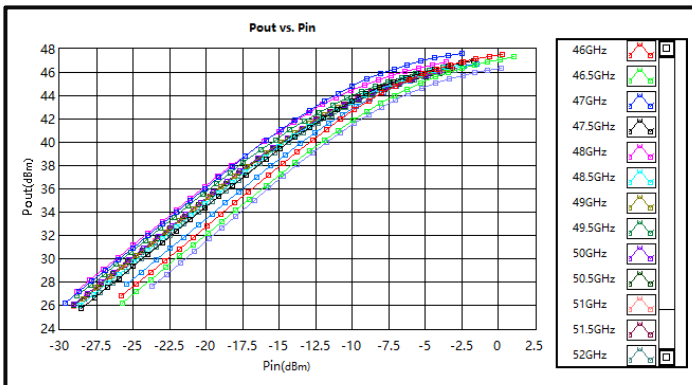
**Power Added Efficiency**



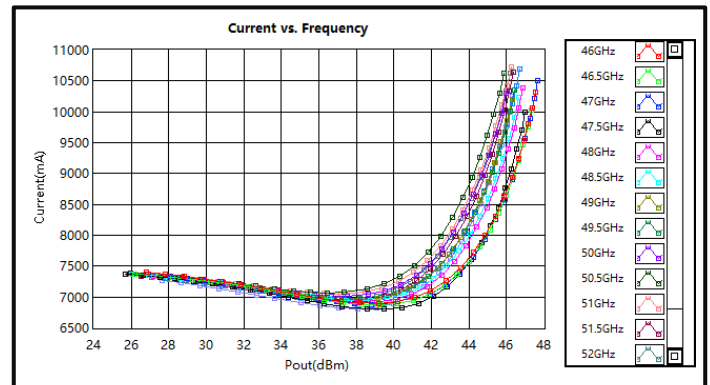
**Saturation Power vs. Frequency**



**Pout vs. Pin**

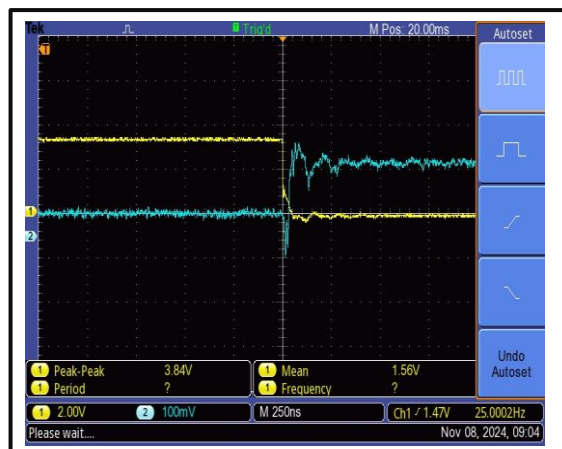


**Current vs. Pout**

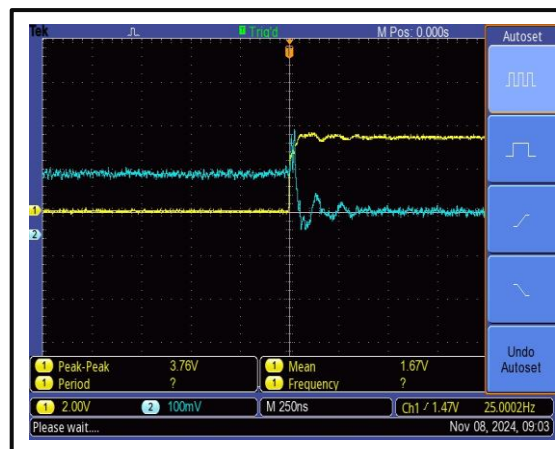


## Typical Performance Plots

The RF Switch On Time is 300ns @+25°C



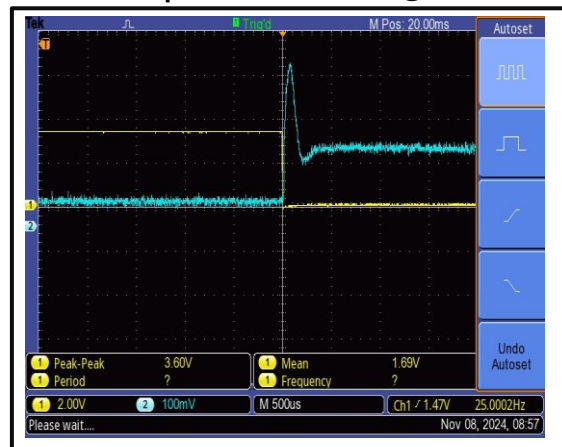
The RF Switch Off Time is 300ns @+25°C



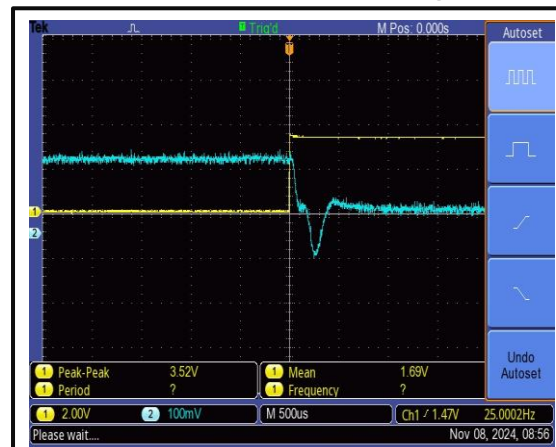
Switch control port: D-sub 17 PIN #4 (RF Input Switch) .

The yellow curve is the switch control signal, the blue curve is RF output envelope.

The Drains Open Time is 400us @+25°C



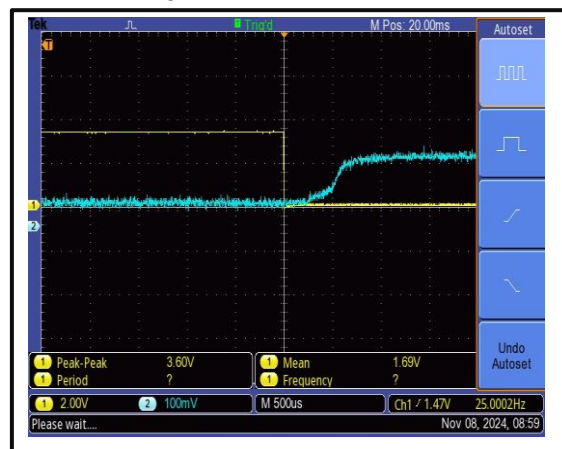
The Drains Closure Time is 600us@+25°C



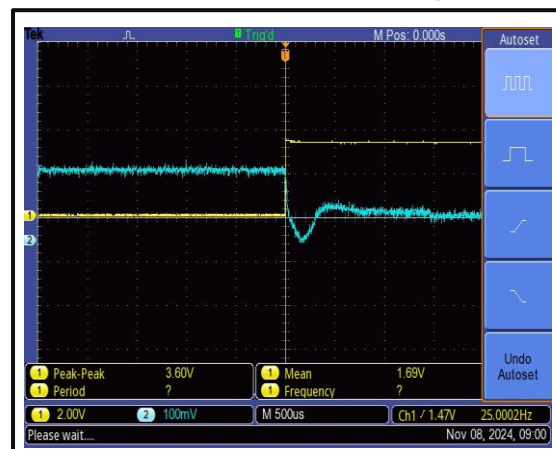
The drain control port: D-sub 17 PIN #3 (Drain Disable).

The yellow curve is the drain control signal, the blue curve is RF output envelope.

The Gates Open Time is 600us @+25°C



The Gates Closure Time is 400us @+25°C

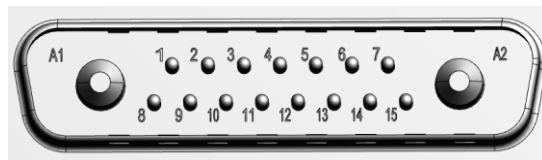


The gate control port: D-sub 17 PIN #2 (Gate Disable) .

The yellow curve is the gate control signal, the blue curve is RF output envelope.

## Protection Connector Table

Male D-Sub is on the housing  
The mating female part number: RFCBLADB17

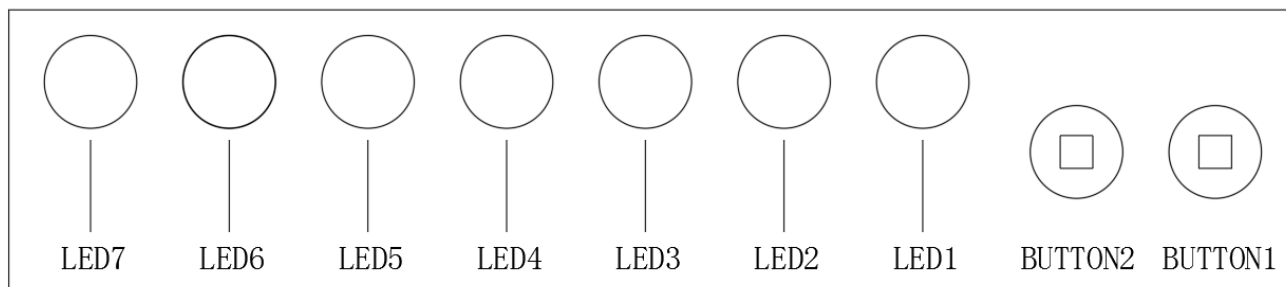


| Pin # | Name                | Function     | Initial State | Description                                                                                               | Applied |
|-------|---------------------|--------------|---------------|-----------------------------------------------------------------------------------------------------------|---------|
| A1    | VDD                 | Power Supply | +28V          | +28V DC is supply Voltage                                                                                 | Yes     |
| A2    | GND                 | Ground       | GND           | Ground                                                                                                    | Yes     |
| 1     | Reset               | Control      | HIGH          | Resets PA when logic LOW is applied for five more seconds and released                                    | Yes     |
| 2     | Gate Disable        | Control      | LOW           | Applying logic HIGH disables gate of amplifiers                                                           | Yes     |
| 3     | Drain Disable       | Control      | LOW           | Applying logic HIGH disables drain of amplifiers                                                          | Yes     |
| 4     | RF Input Switch     | Control      | LOW           | Applying logic HIGH turns off RF front-end switch to terminator                                           | Yes     |
| 5     | PA Off Alarm        | Indicator    | LOW           | Pin will be latched to logic HIGH when any of the protection limit is reached                             | Yes     |
| 6     | RF Input Over Drive | Indicator    | LOW           | Pin will be latched to logic HIGH when input signal is over limit                                         | Yes     |
| 7     | Temp Over           | Indicator    | LOW           | Pin will be latched to logic HIGH when amplifier is driven over temperature                               | Yes     |
| 8     | Current Over        | Indicator    | LOW           | Pin will be latched to logic HIGH when drain current limit is reached                                     | Yes     |
| 9     | NC                  | NC           | NC            | NC                                                                                                        | No      |
| 10    | ID Imbalance        | Indicator    | LOW           | Pin will be latched to logic HIGH when an imbalance in the drain current of the combining branches occurs | Yes     |
| 11    | NC                  | NC           | NC            | NC                                                                                                        | No      |
| 12    | NC                  | NC           | NC            | NC                                                                                                        | No      |
| 13    | NC                  | NC           | NC            | NC                                                                                                        | No      |
| 14    | +5V                 | Power Supply | +5V           | +5V DC is provided for reference *                                                                        | Yes     |
| 15    | GND                 | GND          | GND           | GND                                                                                                       | Yes     |

**Notes:**

- HIGH/LOW voltages are standard TTL signals 0.0V-0.8V = LOW. 2.8V-5V = HIGH. Input current is 10uA.
- Matching connector and cable will be shipped with the product.
- Applied=Yes means the feature is included. Applied=No means the feature is not included with this model.
- 5V reference supply can source 300mA.
- Indicator output signals can source 24mA.

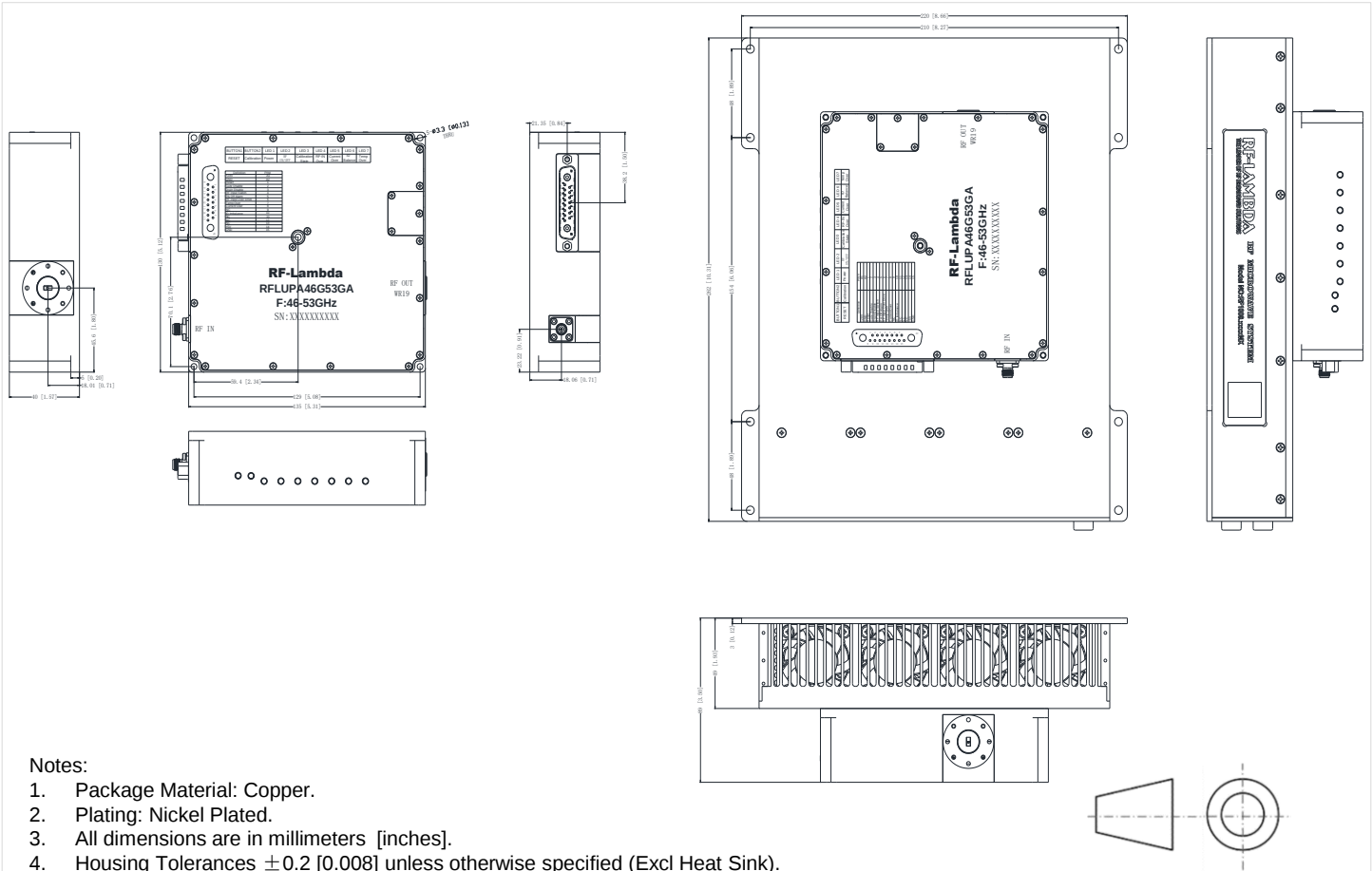
## Alarm Status Panel



|  | Name    | Function            | Initial State | Description                             | Applied                                                                                                                              |     |
|--|---------|---------------------|---------------|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|-----|
|  | BUTTON1 | Reset               | Control       | Manual reset button to reset PA         | Yes                                                                                                                                  |     |
|  | BUTTON2 | Calibration         | Control       | Manual calibration button to correct PA | Yes                                                                                                                                  |     |
|  | LED 1   | Power               | Indicator     | GREEN Color                             | Power supply normal indicator                                                                                                        | Yes |
|  | LED 2   | RF ON/OFF           | Indicator     | GREEN Color                             | RF output status indicator. PA will shut down and latch this LED to a <u>RED</u> color when any protection is triggered *            | Yes |
|  | LED 3   | Calibration State   | Indicator     | GREEN Color                             | Calibration status indicator. The red light indicates that calibration is required. The indicator will flash during calibration *    | Yes |
|  | LED 4   | RF Input Over Drive | Indicator     | GREEN Color                             | PA will shut down and latch this LED to a <u>RED</u> color when input signal is over limit *                                         | Yes |
|  | LED 5   | Over Current        | Indicator     | GREEN Color                             | PA will shut down and latch this LED to a <u>RED</u> color when current limit is reached *                                           | Yes |
|  | LED 6   | ID-Balance          | Indicator     | GREEN Color                             | PA will shut down and latch this LED to a <u>RED</u> color when an imbalance in the drain current of the combining branches occurs * | Yes |
|  | LED 7   | Over Temp           | Indicator     | GREEN Color                             | PA will shut down and latch this LED to a <u>RED</u> color when driven over temperature *                                            | Yes |

\*LED needs to be manually reset to initial state by pressing RESET button

Outline Drawing



- Notes:
1. Package Material: Copper.
  2. Plating: Nickel Plated.
  3. All dimensions are in millimeters [inches].
  4. Housing Tolerances  $\pm 0.2$  [0.008] unless otherwise specified (Excl Heat Sink).
  5. Heat sink required during operation (sold separately). Matching heatsink is listed on our website. If customer would like to use their own cooling method, please make sure the amplifier will operate under the specs that listed in page 2 of this datasheet.
  6. DB17 cable is configured for power connection port by default (RFCBLADB17)).
  7. Heat Sink required during operation (Sold Separately).
  8. Standard torque wrench must be used to secure RF connectors.



Packing List

| ID | Description                                                          | QTY |
|----|----------------------------------------------------------------------|-----|
| 2  | Fig a. DB17 cable (RFCBLADB17)                                       | 1   |
| 3  | Fig b. Waveguide to coaxial adapter (RFWA19V0COAL)(Consulting sales) | 0   |



Fig a.



Fig b.

## Additional Information

| Documentation                   | Webpage                                                                                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ESD Policy                      | <a href="https://rflambda.com/pdf/rflambda_esd_control.pdf">https://rflambda.com/pdf/rflambda_esd_control.pdf</a>                                             |
| Heatsink Lookup Specifications  | <a href="https://rflambda.com/search_heatsink.jsp">https://rflambda.com/search_heatsink.jsp</a>                                                               |
| Connector Torque Specifications | <a href="https://www.rflambda.com/pdf/Torque_Specifications.pdf">https://www.rflambda.com/pdf/Torque_Specifications.pdf</a>                                   |
| Random Vibration Test Standard  | <a href="https://www.rflambda.com/pdf/rflambda_random_vibration_MIL-STD-202G.pdf">https://www.rflambda.com/pdf/rflambda_random_vibration_MIL-STD-202G.pdf</a> |

## Ordering Information

| Part Number   | Modification                                                | Description                 |
|---------------|-------------------------------------------------------------|-----------------------------|
| RFLUPA46G53GA | Input Connector 1.85mm-Female<br>and Output Connector WR-19 | 46GHz-53GHz Power Amplifier |

## Amplifier Use

Ensure that the amplifier input and output ports are safely terminated into a proper 50 ohm load before turning on the power. Never operate the amplifier without a load. A proper 50 ohm load is defined as a load with impedance less than 1.9:1 or VSWR larger than 10dB relative to 50 Ohm within the specified operating band width.

### Power Supply Requirements

Power supply must be able to provide adequate current for the amplifier. Power supply should be able to provide 1.5 times the typical current or 1.2 times the maximum current (whichever is greater).

In most cases, RF - Lambda amplifiers will withstand severe mismatches without damage. However, operation with poor loads is discouraged. If prolonged operation with poor or unknown loads is expected, an external device such as an isolator or circulator should be used to protect the amplifier.

Ensure that the power is off when connecting or disconnecting the input or output of the amp.

Prevent overdriving the amplifier. Do not exceed the recommended input power level.

Adequate heat-sinking required for RF amplifier modules. Please inquire.

Amplifiers do not contain Thermal protection, Reverse DC polarity or Over voltage protection with the exception of a few models. Please inquire.

Proper electrostatic discharge (ESD) precautions are recommended to avoid performance degradation or loss of functionality.

### What is not covered with warranty?

Each RF - Lambda amplifier will go through power and temperature stress testing.

Since the die, ICs or MMICs are fragile, these are not covered by warranty. Any damage to these will NOT be free to repair.

## Important Notice

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