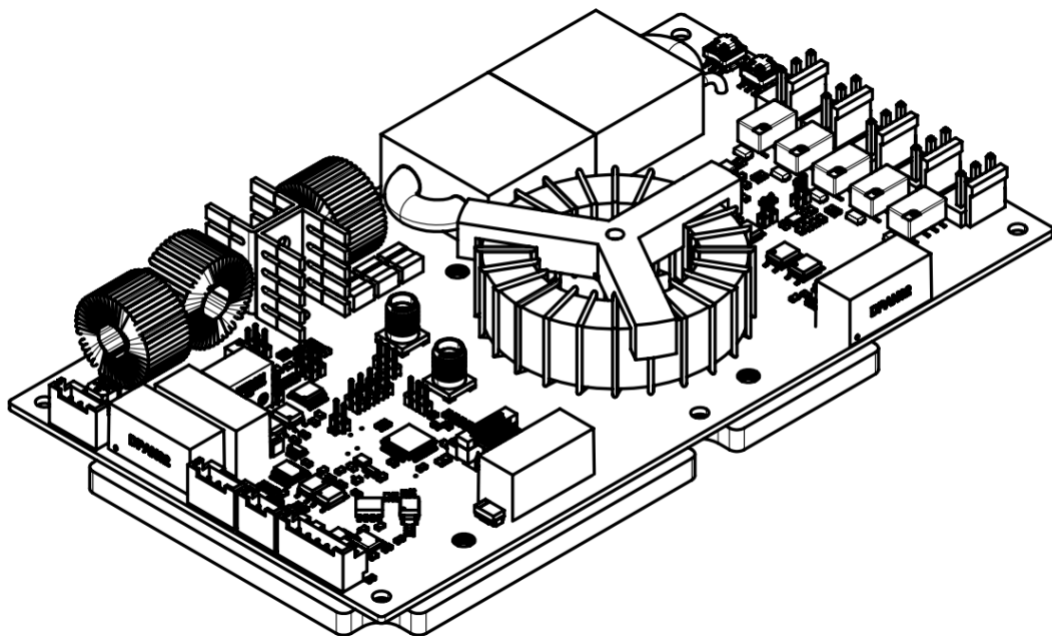


RFGM-1.00-50 RF generator module

User manual



Warning! This equipment may be dangerous.
Please read the entire user manual carefully before using the product.

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Overview

The RFGM-1.00-50 is a digitally controlled RF generator board, designed for use in aesthetic equipment, delivering 1MHz sine wave to a human body.

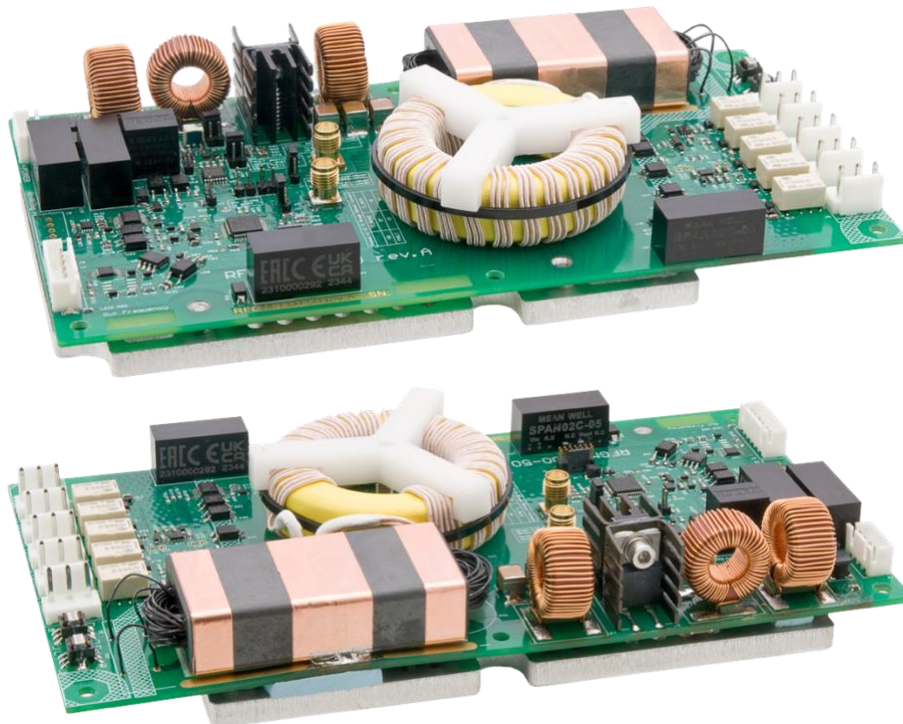
Board's main characteristics are as follows:

- 48VDC input (24VDC on request)
- 5x switchable outputs
- 1MHz output frequency (fixed, other on request)
- 50W maximum output power (achieved in 50-1000 Ohm range of load impedances)
- Safety as per IEC 60601-1 and IEC 60601-2-2
- RS-232 and analogue user interfaces (RS-485 on request)

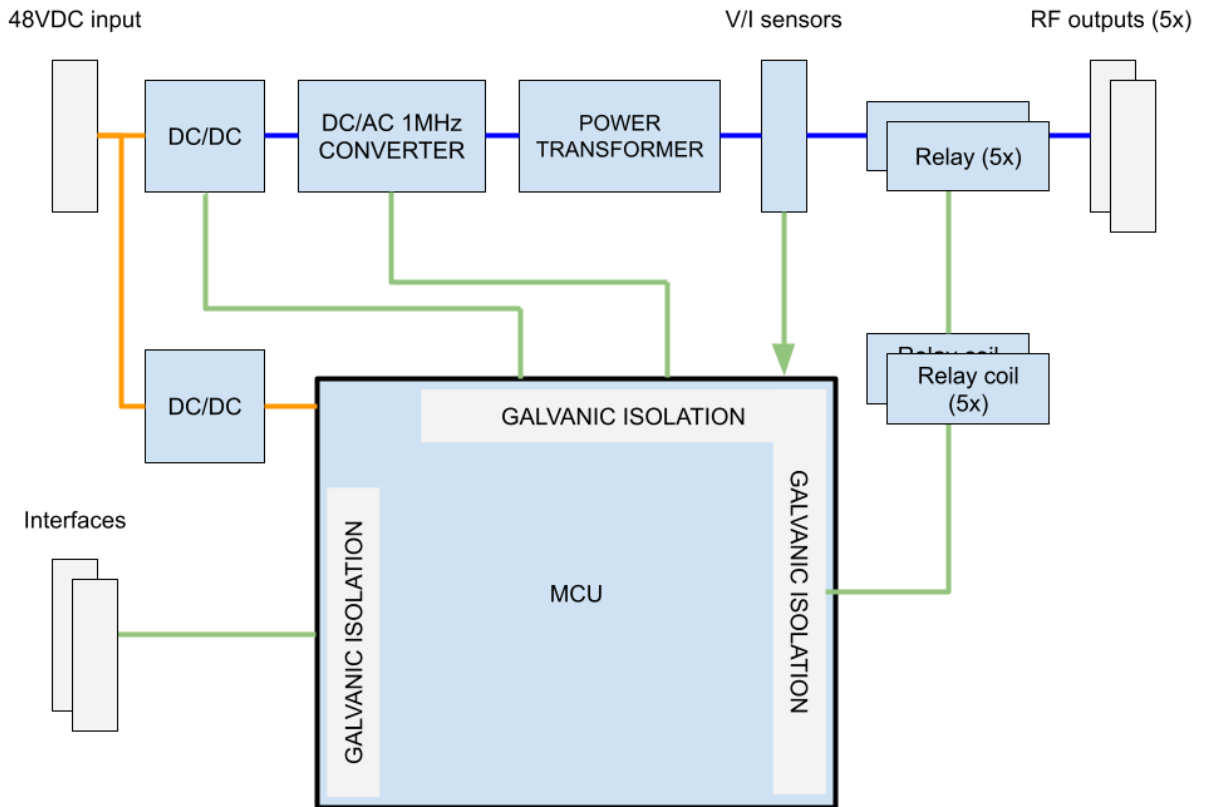
The output power is user adjustable, accurate and actively stabilized in wide range of load impedances.

Module measures, calculates, and returns to the customer all essential load characteristics (output power, reflected power, load impedance and so on).

Appearance



Block diagram



Cooling

The board design is very effective and therefore RFGM-1.00-50 doesn't require any active cooling even for continuous operating at full output power.

Contents of delivery

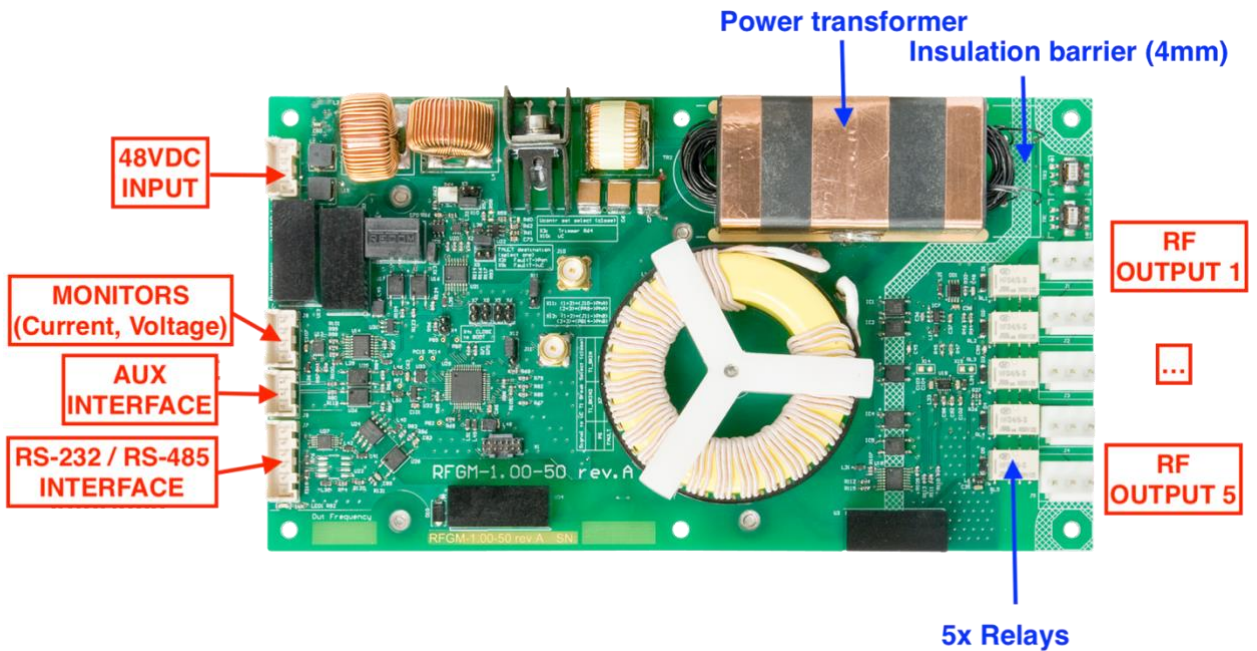
By default, the delivery package contains the RFGM-1.00-50 generator board only.

The following set of cables can be purchased optionally:

- RF output cable – 5pcs (30cm each)
- 48VDC input cable – 1pc (30cm)
- MONITORS cable – 1pc (30cm)
- AUX INTERFACE cable – 1pc (30cm)
- RS-232 cable (RS-485 cable) – 1pc (3m)
- USB/RS-232 adapter (USB/RS-485 adapter) – 1pc
- USB Flash drive with software – 1pc

Customized delivery content is available on request.

Connectors, pins, signals



RF OUTPUT 1...5: JST B3P-VH

Designation	Pin	Description
RF POWER	1, 3	RF power is delivered to these two pins. Only one output connector may be active at a time. Selection of the active output connector is possible via digital RS-232 / RS-485 interface only. See also the <i>Technical notes</i> section.
-	2	N/C

48VDC INPUT: JST B04B-XASK-1

Designation	Pin	Description
+48VDC	1, 2	Low voltage power supply connection.
GND	3, 4	Input voltage – 48VDC (24VDC on request). Maximum current consumption – 2A.

MONITORS: JST B04B-XASK-1

Designation	Pin	Description
RF CURRENT	1	RF CURRENT is the analogue output signal linear with the actual output current (RMS value), signal amplitude is 0...3V, calibration is 3:1 (i.e. 3V on PIN 1 correspond to 1A of the actual output current).

GND_AUX	2	Return of RF CURRENT signal. Pins 2 and 4 are galvanically connected, although are separated with filters.
RF VOLTAGE	3	RF VOLTAGE is the analogue output signal linear with the actual output voltage (RMS value), signal amplitude is 0...2.5V, calibration is 1:100 (i.e. 1V on PIN 3 corresponds to 100V of the actual output voltage).
GND_AUX	4	Return of RF VOLTAGE signal. Pins 2 and 4 are galvanically connected, although are separated with filters.

AUX INTERFACE: JST B03B-XASK-1

Designation	Pin	Description
FAULT	1	FAULT is the output signal (open collector type) indicating the abnormal behavior of the board. The signal is set active in the following cases: <ul style="list-style-type: none"> - Board's overheating - Overcurrent at the output - Short-circuit at the output - Buffer voltage failure
GND_AUX	2	Return of the FAULT signal.
-	3	Reserved for the future use.

RS-232 INTERFACE: JST B06B-XASK-1

Designation	Pin	Description
TXD	1	RS-232 TXD signal.
RXD	2	RS-232 RXD signal.
GND_RS	3, 6	Return of RS-232 INTERFACE signals.
+5VDC	4	Auxiliary output signal, provides 5VDC voltage with approx. 180mA current capability.
RF ENABLE	5	Input signal, 5V TTL, can be used for remote enabling/disabling the board in stand-alone operations (i.e. without any digital connection to the board).

LED:

There is the only LED onboard (**green**) indicating that the RFGM board is powered up.

MOUNTING AND GROUNDING:

The RFGM board should be mounted using 6pcs M3 screws and studs.
The recommended stud height is 10mm.

Grounding policy

The following considerations should be taken into account:

1. No protective grounding is needed.
2. HF circuits (RF OUTPUTS) and all interface circuits (MONITORS, RS-232, AUX) are isolated from the board's power circuits (48VDC INPUT and derivative HV circuits).
3. It's recommended to keep RFGM's heatsink ungrounded (i.e. not connected to the chassis).

Technical notes

OUTPUT MEASUREMENTS

We strongly recommend to measure RF output with differential probes only.



It is safe to use conventional (non-differential) probes, but the measurement results **as well as board behavior (including but not limited to forward and reflected power measurements)** will be significantly distorted. Such measurements (and resulting affection to the board behavior) are sensitive to the polarity and their results will be more correct (or rather less incorrect) if the following polarity of the connection is used:

- Probe – to PIN 3 of RF OUTPUT connector
- Probe ground – to PIN 1 of RF OUTPUT connector

Specifications

ELECTRICAL

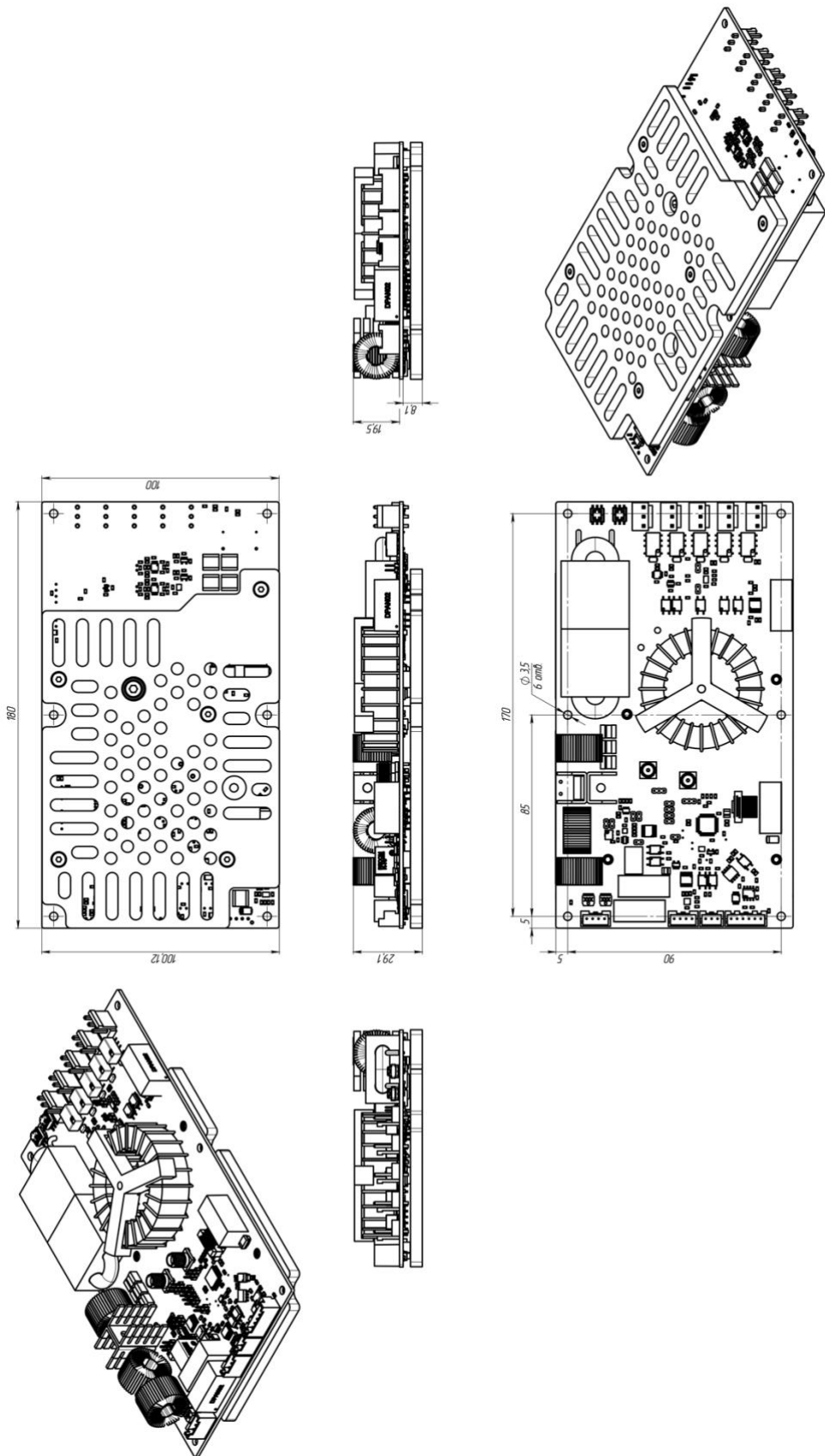
General	
Product description	RF power board that generates 1MHz sine wave to be applied directly to a human body to perform various types of aesthetic treatments
Input	
Voltage	48VDC (24VDC on request)
Current consumption	<2A
Output	
Number of outputs	5pcs (relay connected, only one output can be active at a time)
Load impedance	50-1000 Ohm (nominal) It's presumed that the load impedance is mostly active (human body) and the output circuits do not contain any parts with significant capacitance or inductivity
Frequency	1.00MHz (fixed, other on request)
Waveform	Sine wave
Max. power	50W (in 50-1000 Ohm range of load impedances, derated at >1000 Ohm impedances)
Duty cycle	0-100% (in 50-1000 Ohm range of load impedances)
Power adjustment	0.5W to 50W
Power accuracy / stability	Better than 10% of set point

Interfaces	
Analogue	A set of TTL and analogue signals (Enable, Fault, Current monitor, Voltage monitor)
Digital	RS-232 by default, RS-485 on request
Other	
Protections	<ul style="list-style-type: none"> - Overtemperature protection - Full open-circuit protection - Full short-circuit protection
Embedded output measurement functions	<ul style="list-style-type: none"> - Output power, reflected power - Load impedance - Output current, output voltage
Safety	<ul style="list-style-type: none"> - RF outputs are separated from secondary circuits as per IEC 60601-2-2, although not from each other - SELV (interface) circuits are galvanically isolated from high voltage circuits as per IEC 60601-1
Cooling	Conductive cooling
Environment	
Operating temperature	0...40 °C
Storage temperature	-20...+60 °C
Humidity	<90%, non-condensing

MECHANICAL

Dimensions (LxWxH)	Approx. 180x100x30mm (see also the dimensional drawing below)
Weight	Approx. 0.9kg

Dimensional drawing



How to order?

By default, there is the only standard part number, namely the RFGM-1.00-50.

The following options are available on request:

- 24VDC input power instead of 48VDC
- RS-485 interface instead of RS-232
- Custom frequency of operations
- Customized cables

Appendix 1. Demo software, its description

There is a demo software utility, which can be supplied for free together with the RFGM-1.00-50 generator board to simplify its integration into the customer's system.

Please request the download link or a USB flash drive with a copy at the time of ordering the RFGM-1.00-50 board.

RFGM-1.00-50 Control Demo Utility V0.2.0

COM17

Main Commands

Status Check (0x41)	0x01	0x01	<input type="button" value="Send"/>
Get FW Version (0x42)	0x01		<input type="button" value="Send"/>
Get Measured RF Voltage and Current (0x49)	0x01	0x01	<input type="button" value="Send"/>
Get RF Board ID (0x50)	0x01		<input type="button" value="Send"/>
Set Mode and Output Value (0x44)	1	0	<input type="button" value="Send"/>
Select Output Channel (0x4A)	0		<input type="button" value="Send"/>
Set Mode and Output Value with Fine resolution (0x4B)	1	0	<input type="button" value="Send"/>

Extended Commands

Status Register: **0x2106** Error Stack Top: **0: no error**

SR00: Reserved
SR01: BUCK-BOOST IS ON
SR02: POWER IS GOOD
SR03: HOST_EN INPUT ACTIVE
SR04: Reserved
SR05: OVERHEAT
SR06: FAIL OUT IS ACTIVE
SR07: Reserved
SR08: RF TRANSFORMER IS ON
SR09: Reserved
SR10: Reserved
SR11: Reserved
SR12: SETTINGS CHANGED
SR13: Service bit
SR14: Reserved
SR15: MANUFACTURER DEFAULTS LOADED

Select output channel: 1 2 3 4 5 X
Selected: 1 Active: 1

Mode:

Value: 50.0 50.0

RF Generator:

Board Info

Firmware Version: 0.2.0
Product ID: 1.0
UC ID: 82851P 1 0025004F
Board Name: RFGM-1.00-50
Serial Number: 1

Monitor

Board Temperature, °C: 33
RF Voltage, RMS, V: 157.581
RF Current, RMS, A: 0.322
Output Power, W: 49.959
Reflected Power, W: 0.018
Required Power, W: 50.0
Required Voltage (RMS), V: 50.0
Load Impedance
|Z|, Ω: 488.7
Z, Ω: 483.6 - j70.4

Appendix 2. RS-232 / RS-485 communicative protocol, its description

A complete description of the current version of the RS-232 / RS-485 communication protocol is supplied with the RFGM-1.00-50 generator board. Please request the description from the manufacturer if you need it in advance.