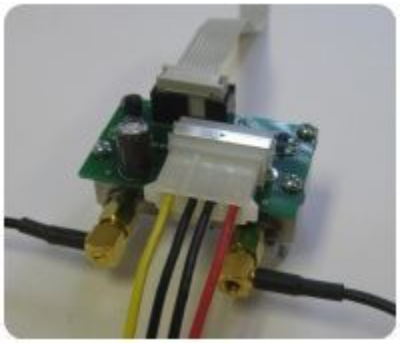
RF Power Amplifier

PA10W

Owner's Manual



SpinCore Technologies, Inc.
http://www.spincore.com

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We appreciate your business!

At SpinCore we try to fully support the needs of our customers. If you are in need of assistance, please contact us and we will strive to provide the necessary support.

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I. Precautions

Working with RF power amplifiers can be dangerous and even fatal if not handled properly. Output voltages can reach values greater than 90 V peak-to-peak and can be fatal. Follow these steps to avoid damaging the amplifier or inflicting serious injuries.

Connecting & Disconnecting Power Amplifiers

When connecting the power amplifier, follow these steps to avoid damaging the amplifier or inflicting serious injuries.

1) Apply the load to the amplifier (make sure a load is ALWAYS present when working with power amplifiers).

2) Apply the DC power to the amplifier.

3) Apply the RF input to the amplifier.

Repeat the steps in reverse order when disconnecting the amplifier.

Power Considerations

Make sure the following considerations have been made before applying power to the amplifier.

1) Be sure your load can appropriately dissipate the maximum power being applied by the amplifier.

2) When applying an RF signal, work with low duty cycles to limit the power being dissipated. The duty cycle ratio should be below 1% for safe operation.

II. PA10W – 10 W Power Amplifier Module

1. Overview

The PA10W RF power amplifier comes in a very compact broadband module delivering 10 Watts RMS (20 Watts PEP, Peak Envelope Power) into a 50-ohm load. It has a 3 dB range of 10 MHz to 75 MHz and is powered by a DC +12 V power supply (with the negative terminal grounded). The PA10W has standard female SMA jacks for RF input and output, and a standard 4-pin ATX connector for the input DC power. The PA10W typically operates in Class AB. The rise and fall time for the RF pulse output is typically around 200 ns.

The product comes with blanking circuitry – the blanking circuitry keeps the PA10W blanked (turned off) until a TTL input (logical high) is applied to deblank it. The blanking circuitry helps to conserve power, keeps the amplifier cool under typical operating conditions, and provides noise reduction during the reception of NMR signals.

The PA10W module measures 2.25" x 1.4" x 1.4" (57 x 36 x 36 mm). There are multiple ordering options available, such as enclosures with integrated AC power supplies and enclosures with a complete RF front-end with preamplifiers and filters for a complete mobile NMR, NQR and MRI system. See the “Configuration Options” section later in this document for more information. The use of a low pass (or band pass) filter at the output of the PA10W is recommended to reduce high frequency noise and improve performance.

2. Electrical Specifications

Parameter	Specification	Units
Max DC Input Voltage	12	V (DC)
Max RF input power	50	mW
Max. continuous RF output power	10	W (RMS)
TTL Deblaking Voltage	3.3	V

Table 1: Basic electrical specifications for the PA10W power amplifier module.

3. PA10W RF Module with Deblanking Circuitry

This configuration shown in Figure 1 does not have an enclosure and includes the switching circuitry mounted on top of the power amplifier to enable it when a TTL pulse is applied to the input pin. This feature reduces power consumption and keeps the power amplifier cool.

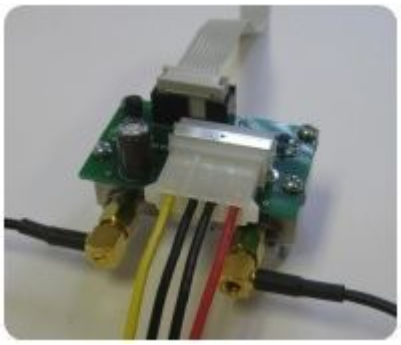

Figure 1: PA10W RF power amplifier module

RF Input and Output Connectors

A top view of the PA10W module depicting RF input and output connectors is shown on the next page in Figure 2. When connecting the PA10W power amplifier, the RF signal source should be connected to the SMA jack on the right hand side (top view) of the circuit (RF in). The SMA jack on the left hand side (top view) is the RF output from the power amplifier (RF out).

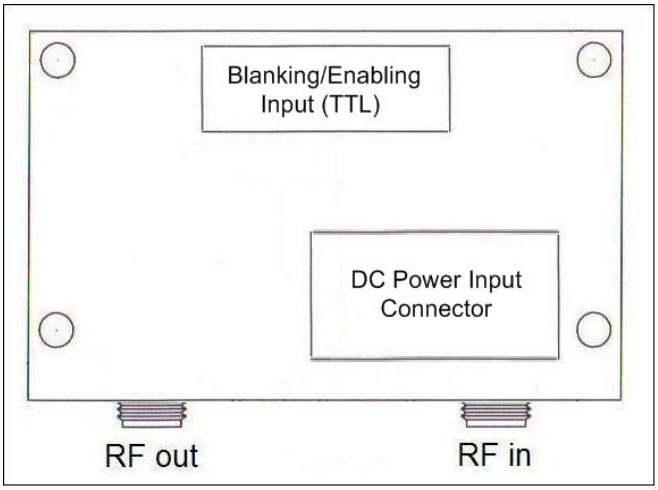

Figure 2: Diagram of power amplifier RF connectors (top view). RF out and RF in are SMA jack connectors.

TTL Control Input Connector

The PA10W power amplifier module has a 10-pin shrouded male IDC connector[1], also shown in Figure 2 above, which supplies the input TTL control signal. The control signal is pin 8 on the IDC header and the corresponding ground is pin 7. The input is terminated by a 100-ohm load and requires an external TTL signal source capable of outputting at least 10 mA. The TTL requirements for the deblanking control input are standard low voltage TTL values of 3.3V for a logical high, 0V for a logical low. A logical high signal is required to deblank (enable) the PA10W. The deblanking bit must be set at least 3 ms prior to sending the RF signal or optimal power will not be achieved.

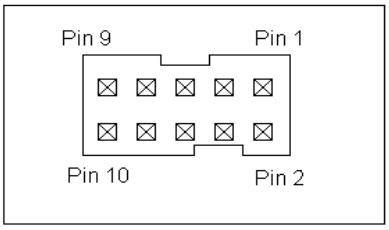

Figure 3: 10-pin IDC connector (Digi-Key part A33159-ND). Mates with Digi-Key part HKC10H-ND or similar.

1 **Note:** The deblanking TTL input header is denoted P2 on the circuit board. Please see Figure 3 above, for pin diagram.

The timing diagram of a typical application of PA10W with the deblanking pulse applied prior to the RF pulse is presented in Figure 4 below. When working with short RF pulses, on the order of 1 us or so, triggering the oscilloscope on the falling edge of the deblanking pulse will help with identifying and capturing the RF pulse on the scope.

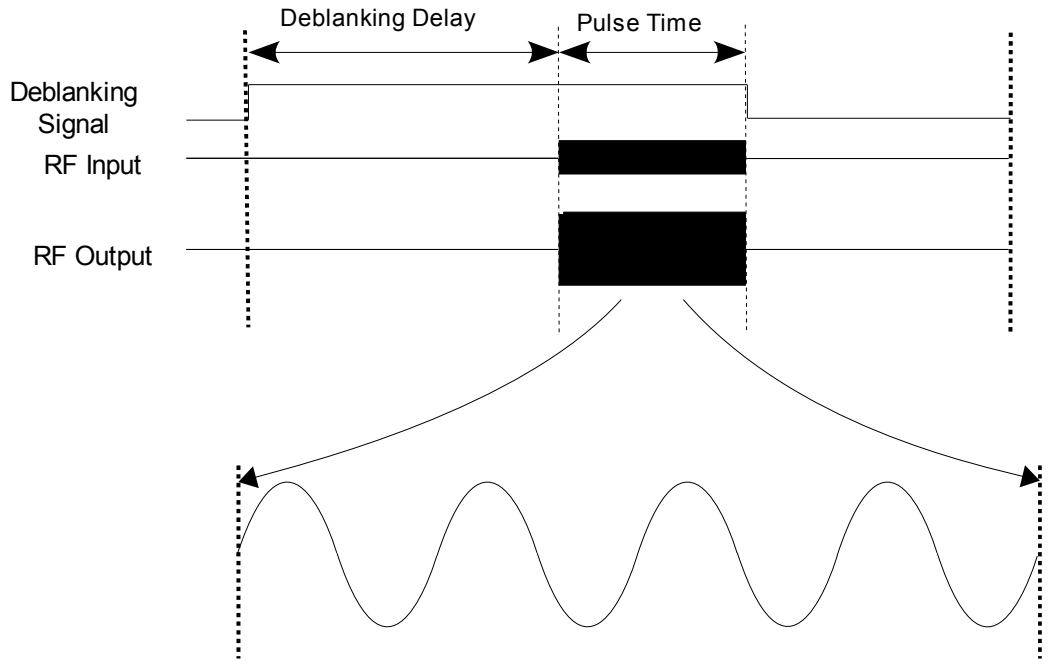

Figure 4: Representation of the deblanking and RF input and output signals to the PA10W. The PA10W requires at least 3.0 ms of deblanking time prior to the RF pulse for full output power.

DC Power Input Connector

The PA10W RF power amplifier has a 4-pin input power connector. The input is for use with a standard PC ATX power supply connector. The pin arrangements for this connector are shown on the next page in Figure 5.

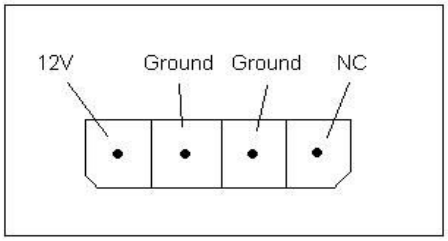

Figure 5: 4-Pin input connector (Molex part 0531090410). Mates with standard PC power supply connector or Molex part 0015244048.

4. PA10W RF Module Enclosure Options

The PA10W RF power amplifier module can be delivered in various external enclosures which protect the RF power amplifier circuitry and include an AC/DC power supply, internal RF cables and output low-pass (or band-pass) filter (please specify your operating frequency at the time of purchase). The power input is 90-264 V AC, the RF input/output signals are provided on external BNC connectors, and the TTL inputs are routed through female DB-9 input connectors. The active TTL signal needs to be connected to pin 4, with the corresponding ground line connected to pin 8. Three standard enclosure configurations are available:

1) PA10W module in a single bay enclosure (Figure 6)

Single bay enclosure additional specifications include:

-Excellent EMI/RFI shielding which meets FCC & CE regulations.

-Built-in 4x4 cm quiet cooling fan.

-High quality 50 Watt AC input switching power supply.

-Dimensions are approximately 10.25” x 7.75” x 2.25” (26 x 19.5 x 6 cm).

Figure 6: PA10W RF power amplifier – single bay enclosure.

2) PA10W module enclosed with iSpin-NMR™ system (Figure 7)

iSpin-NMR enclosure additional specifications include:

-Metal body with streamlined plastic front panel.

-Built-in 8x8 cm quiet cooling fan.

-High quality 80 Watt AC input switching power supply.

-Dimensions are approximately 11” x 7” x 6.75” (28 x 18 x 17 cm).

Figure 7: PA10W RF power amplifier – enclosed with iSpin system.

3) PA10W module in Lightweight aluminum enclosure (Figure 8)

Small aluminum enclosure additional specifications include:

-Lightweight aluminum enclosure.

-High quality external 60 Watt AC input switching power supply.

-Dimensions are approximately 4” x 2.4” x 3” (10 x 6 x 8 cm).

Figure 8: PA10W RF power amplifier – lightweight aluminum enclosure.

4) PA10W RF in enclosure with Preamplifier Option

The enclosure can also include input preamplifiers (approx 45 or 60 dB of gain – please specify when ordering) to the RadioProcessor board. This option is perfect in combination with the iSpin-Mini system to provide a complete mobile NMR system (see Figure 9).

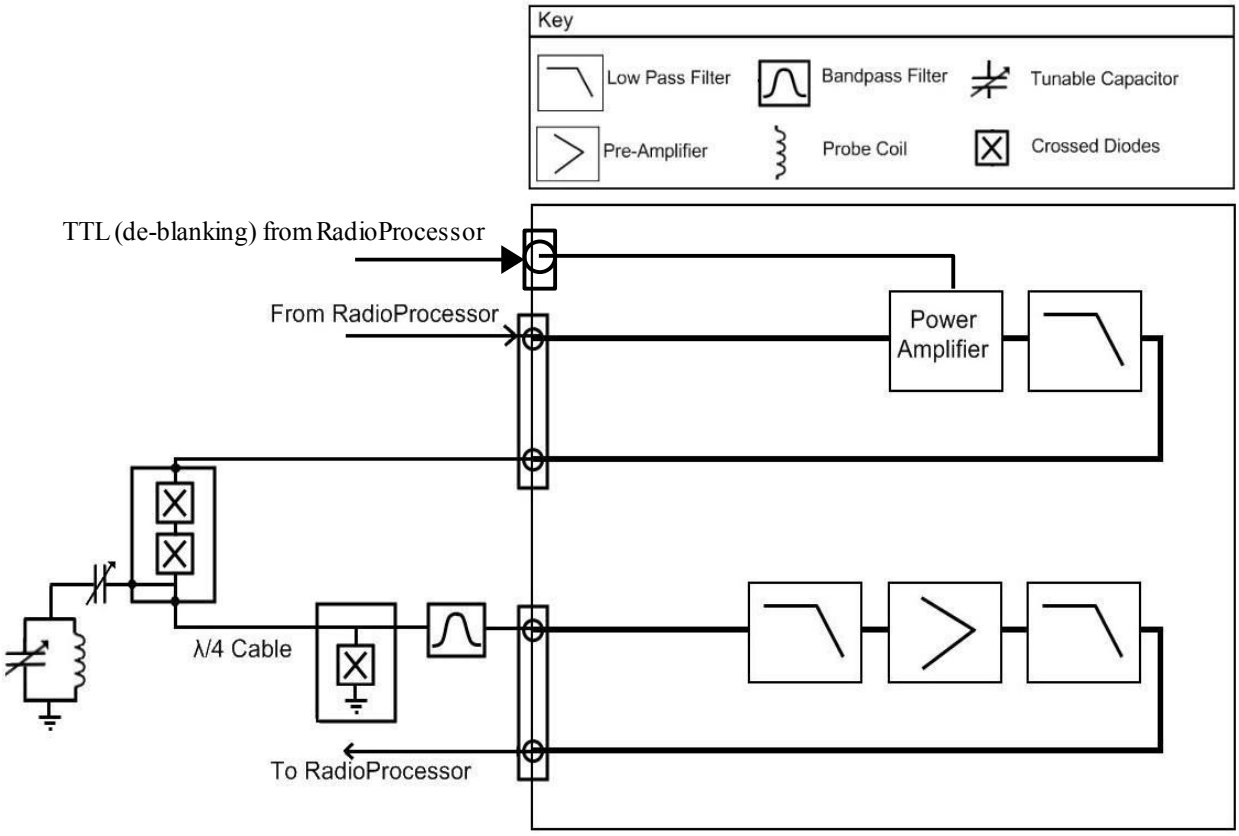

Figure 9: Block diagram of RF front-end for the RadioProcessor; typical applications include NMR, NQR, and MRI experiments.

III. Related Products and Accessories

1. Alternate power levels available: 15 W, 75 W and 100 W. For more information, please visit the URL http://www.spincore.com/products/RFPA/

2. iSpin-NMR, The Complete, Simple, Intuitive, Effective and Portable NMR System. For more information, please visit http://spincore.com/products/iSpinNMR/

3. Complete single-card solution for RF pulse generation and acquisition, the RadioProcessor. For more information, please visit http://www.spincore.com/products/RadioProcessor/

4. NMR Permanent Magnets are available for conducting NMR experiments. For more information, please visit http://www.spincore.com/products/Magnets/

5. If you require a custom power level, please inquire with SpinCore Technologies through our contact form, which is available at http://www.spincore.com/contact.shtml

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V. Document Information

Revision history available at SpinCore.