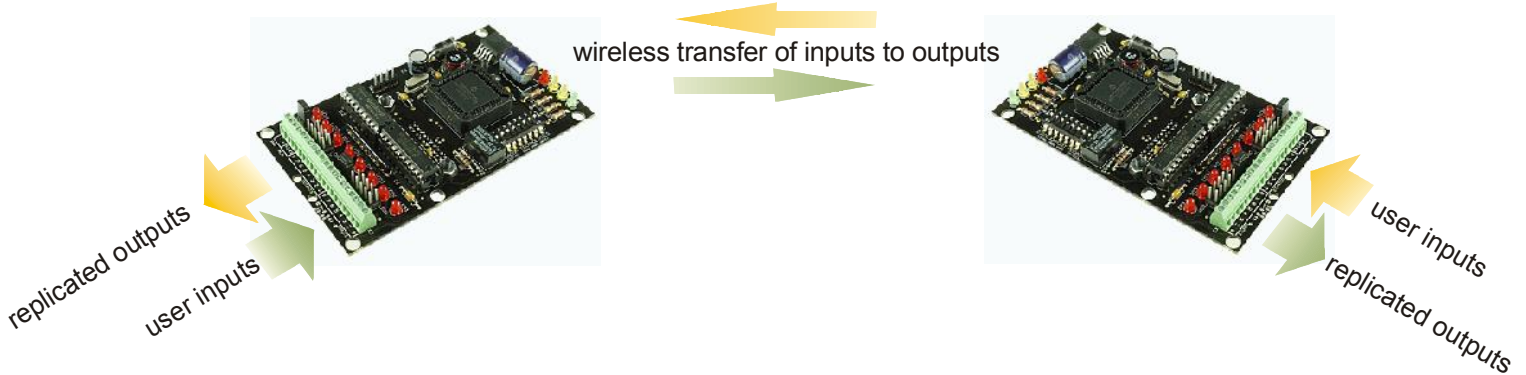




16IO-AC-09 Bi-Directional Wireless I/O Extension RF Transceiver

The 16IO-AC-09 spread spectrum transceiver modules interface to external devices inputs and outputs. The state of the module's inputs at the local transceiver will be replicated as outputs at the remote transceiver. With its bi-directional communications, the reverse is also true: the input states at the remote transceiver will be replicated as outputs at the local transceiver. Furthermore, outputs can be linked to inputs at remote end to provide looped back output confirmation to the local end.

A network group of 16IO-AC-09 transceivers comprising of 2, 3, 5 or 9 modules can be deployed. Additionally, multiple network groups can be configured and operate, without mutual interference, within the same local environment .



Typical Applications

- Irrigation Control Systems
- PLC expansion
- PLC Replacement
- Bi-directional Remote Control with Feedback
- Tank level monitoring and pump control

Features

- 902-928MHz FHSS Operation
- 200mW RF output power
- Radio Link Watchdog
- 8x Discrete 5V Digital Inputs. Active low.
- 8x Discrete 5V Digital Outputs
- 8x Open Collector Outputs
- Configurable for HIGH or LOW Outputs On Power Up
- Up to 4 miles LOS range (with 3dBi gain antenna)
- Output Status LED's
- Communication, Timeout and Power LED's
- Secure FHSS Architecture
- Outputs configurable for TRUE or INVERTED states
- MMCX Antenna Connector . RPSMA option.
- Wide supply range: 7.5V-24Vdc, 50mA nominal
- Dimensions: 4.25" x 2.5" x 0.75"

Setup and Configuration

Power supply

The 16IO-ACHP-09 may be powered by a DC power supply from 7.5Vdc to 24Vdc. Typical operation would be at 12VDC which may be a linear power supply such as wall adaptor or battery. The power supply should be capable of providing at least 500mA. If the open collector outputs are to be used, the power supply voltage and current should be determined by the user based on the open collector loads to be driven.

Digital Inputs / Digital Outputs

(Refer to the examples for typical I/O interfacing on page 5)

The digital input lines are 5V CMOS/TTL compatible. The inputs have pull up resistors to +VDC. They are normally held HIGH and are active LOW. The 16IO-AC-09 inputs will accept voltages of 0V and 5V. Care should be taken not to exceed the input voltage above or below the 0V and 5V limits as this will damage the 16IO-ACHP-09.

An input taken LOW by the externally connected device will be replicated as a LOW (0V) on the corresponding digital output at the remote 16IO-AC-09. For example: A **closed** contact connected across the local 16IO-AC-09 input 1 and 0V (GND) will provide a 0V (LOW) output at the remote 16IO-AC-09 digital output 1. An input left open (ie not connected) or applied with +5V will be replicated as a HIGH (+5V) the corresponding digital output at the remote 16IO-AC-09. **Note:** an input change must be $\geq 50\text{ms}$ duration for it to be reflected at the corresponding output of the remote 16IO-ACHP-09 module. For pulsed inputs the maximum input pulse rate is 5Hz.

Outputs may be configured to be TRUE or INVERTED via DIP switch 4

Outputs may be configured to be HIGH or LOW when power is first applied to the module. Once the radio link is established the outputs will adopt the appropriate state as determined by the remote inputs and by the configuration of DIP switch 4.

Digital Inputs / Open Collector Outputs

(Refer to the examples for typical I/O interfacing on page 5)

In addition to the eight discrete digital outputs, the 16IO-AC-09 modules feature 8 open collector outputs. The open collector outputs are able to switch loads that demand higher operating voltages and/or currents. The open collector outputs include EMF transient protection diodes for driving inductive loads such as relay coils. The absolute maximum open collector load current is 500mA with only **one** active output conducting. With all open collector outputs conducting the maximum load current should not exceed 100mA per output. Other load current configurations are shown in table 1 below

As with the digital outputs described above, the open collector outputs may be configured to be TRUE or INVERTED.

Number of Outputs Conducting Simultaneously For : Open Collector Channels 1-8	Maximum Load Current @ 100% Duty Cycle	Maximum Load Current @ 50% Duty Cycle
1	450mA	500mA
2	290mA	450mA
3	210mA	350mA
4	175mA	290mA
5	150mA	250mA
6	125mA	210mA
7	110mA	190mA
8	100mA	140mA

Table 1: Maximum Open Collector Output Current

Output State at Power Up

The 16IO-AC-09 outputs may be user configured to default to all HIGH or all LOW when power is applied to the module. Power-up output state is configured with DIP switch 3 as indicated in table 2 below. As soon as communication between a pair of 16IO-AC-09 modules is established, the outputs will then take on the state of the remote module's inputs. The output states are indicated by an array of 8 LED's. An LED ON indicates an output is HIGH and OFF indicates an output is LOW

SW3	Function
OFF	Local outputs LOW at power up
ON	Local outputs HIGH at power up

Table 2

Timeout Function

The 16IO-AC-09 transceivers continually monitor the integrity of the RF link.

If for any reason there is a breakdown in the communications between a pair of 16IO-AC-09 modules, each module will signal the event by activating the yellow timeout (TO) LED and simultaneously energize the timeout relay. Note: in a network of multiple 16IO-AC-09 modules, the timeout will only occur if the master unit fails to communicate with the slave units.

In a timeout condition, the single pole, normally open relay contacts will close. This may be used for example, as an emergency system shutdown or it may be used to trigger an external device to reset the 16IO-AC-09 through cycling the power supply.

The timeout timing configuration is given in the table 3 below. DIP switches 1 and 2 are used to configure the timeout function and may be set for: disabled, 3 seconds, 10 seconds or 30 seconds. The 16IO-AC-09 will accept the timeout setting at power up. Note that changes made to these settings whilst power is applied will only be accepted once the power is cycled.

SW2	SW1	Function
OFF	OFF	Timeout disabled
OFF	ON	3 second timeout
ON	OFF	10 second timeout
ON	ON	30 second timeout

Table 3

Output Invert Function

The state of the eight outputs of the 16IO-AC-09 modules may be configured to be TRUE or INVERTED by setting the DIP switch 4 on the 16IO-AC-09. When set to TRUE, the eight outputs replicate the state of the eight inputs on the remote unit. When set to INVERT, the eight outputs will be set to output the inverse state of the eight inputs at the remote unit.

SW4	Output
ON	TRUE
OFF	INVERTED

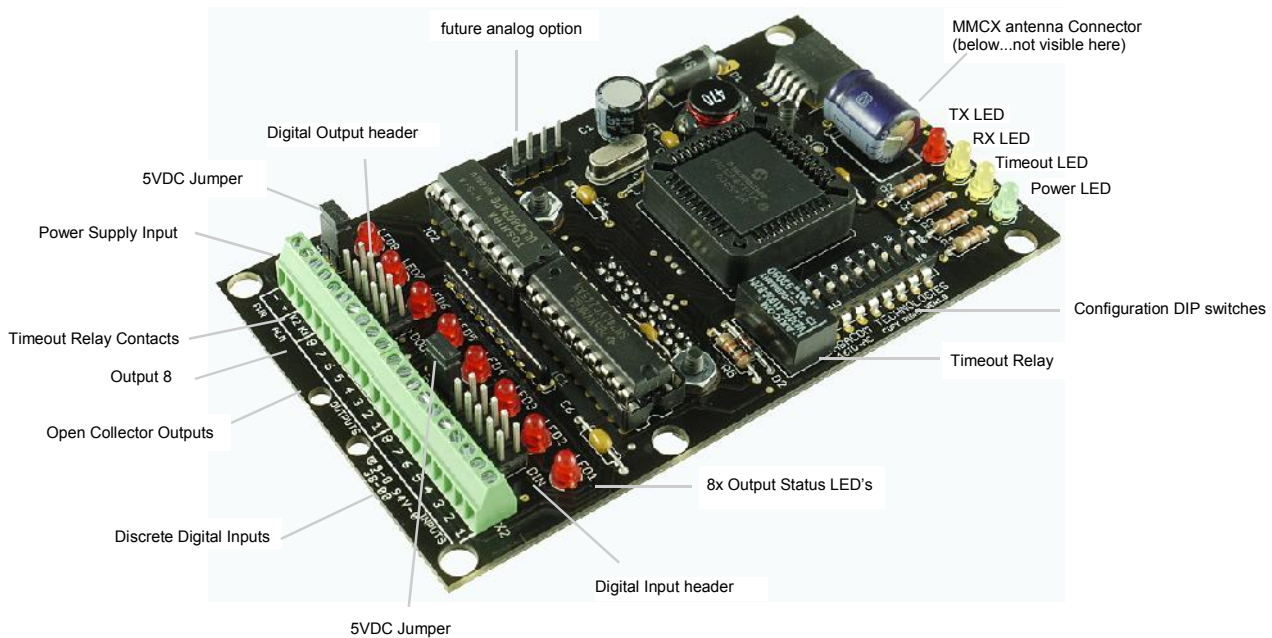
Table 4

Antenna

The 16IO-AC-09 antenna connection is via MMCX connector. This connector accommodates the 1/2-900-MMCX articulating dipole antenna for direct connection to the 16IO-AC-09. For applications that require an off board antenna, terminated cables with an MMCX connector for the modules side, and an RPSMA bulkhead for the antenna side are available to order. (part # MMCX-RPSMA-X, where x = length in inches). For extended communication range , directional gain antenna are available.

Positioning the antenna is important for optimal performance. Keep as much free space around the antenna as possible.

16IO-ACHP-09 Anatomy



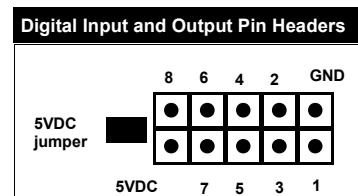
Input/Output and Power Supply Connections

Screw terminals are available connecting:

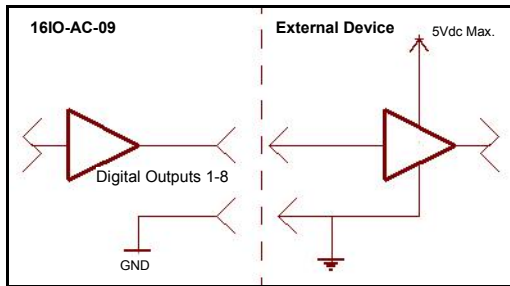
- Power
- Timeout relay contacts
- Eight Open Collector outputs
- Eight Digital Inputs

10 Pin Headers are available for connecting:

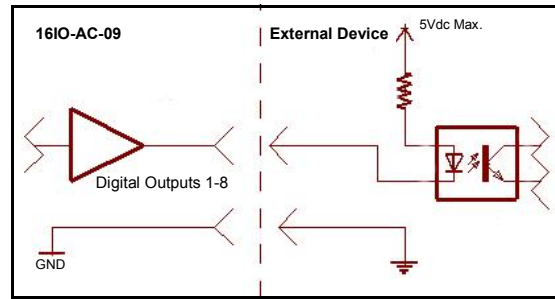
- Eight Digital Inputs
- Eight Digital outputs
- The 10 pin headers include 5VDC power output from the on-board voltage regulator. Note, this is a 5VDC voltage output and not a voltage input. The 5VDC jumpers enable the 5VDC on the headers when installed
- The diagram above provides the pin designations



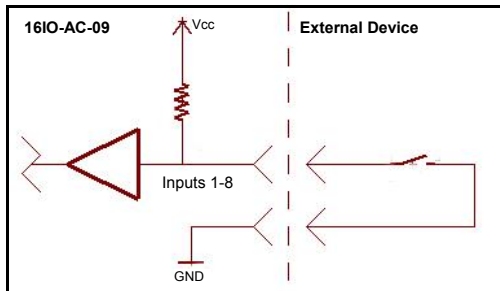
I/O Interfacing Examples



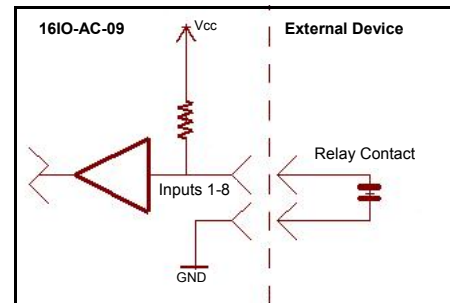
Solid State Output



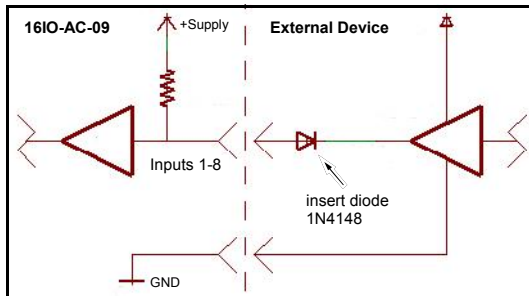
Isolated Solid State Output



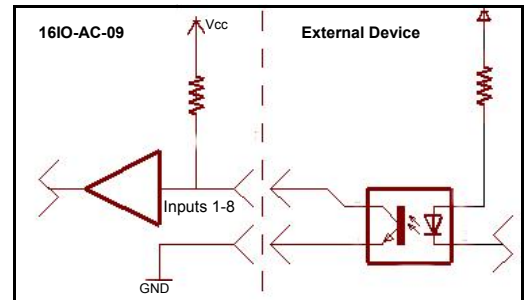
Switch Input



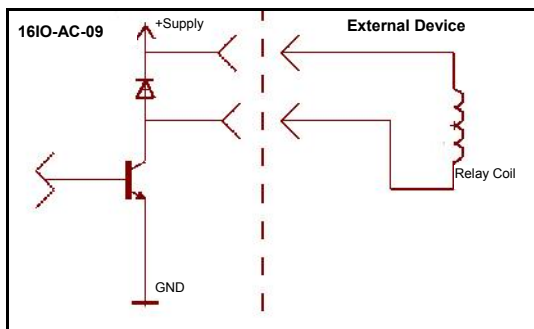
Isolated Mechanical Input



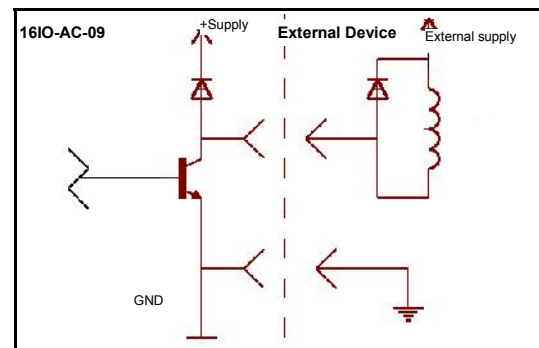
Solid State Input



Opto Isolator Solid State Input



Open Collector Output



Open Collector Output

Output Feedback Confirmation

Looping an active digital output to an unused input at the remote 16IO-AC-09 may be used to provide feedback to the local 16IO-AC-09 to provide feedback confirmation of the event. This configuration is useful in some applications and may be useful when setting up the link.

Multiple 16IO-AC-09 Deployment

- A network group can easily be set up comprising of multiple modules.
- A network group may comprise of 2, 3, 5 or 9 modules.
- Each group has 1 module configured as Master and the other modules as Slave 1 through 8. A group of 9 modules will comprise of 1 master and 8 slaves

As described below, as the number of module in a group increases, the number of usable I/O lines per slave reduces. In a two module group, ie one master and one slave, all 8 I/O line are mapped one-to-one. In a 9 module group, ie 1 master and 8 slaves, each slave has one active input and remaining 7 are masked.

2 module group:

comprises of 1 module configured as master and 1 module configured as slave. A two module group all 8 inputs and outputs are enabled. Input 1 on the master, maps to output 1 on the slave, 2 to 2, 3 to 3 and so on. Conversely, input 1 on the slave, maps to output 1 on master, 2 to 2, 3 to 3, ...and so on

3 module group:

comprises of 1 module configured as master and 2 modules configured as slaves.

A 3 module group adopts the following I/O functionality:

Inputs 1-4 on the master map to outputs 1-4 on slave1. Conversely, inputs 1-4 on slave1 map to outputs 1-4 on the master.

I/O 5-8 on slave1 are masked (not used)

Inputs 5-8 on the master map to outputs 5-8 on slave2. Conversely, inputs 5-8 on slave2 map to outputs 5-8 on the master.

I/O 1-4 on slave2 are masked (not used)

5 module group:

comprises of 1 module configured as master and 4 modules configured as slave1, slave2, slave3 and slave4.

A 5 module group adopts the following I/O functionality:

Inputs 1 and 2 on the master map to outputs 1 and 2 on slave1. Conversely, inputs 1 and 2 on slave 1 map to outputs 1 and 2 on the master.

I/O 3 to 8 are masked on slave 1 (not used)

Inputs 3 and 4 on the master map to outputs 3 and 4 on slave2. Conversely, inputs 2 and 3 on slave 2 map to outputs 2 and 3 on the master.

I/O 1,2 and 4 to 8 are masked on slave 2 (not used)

Inputs 5 and 6 on the master map to outputs 5 and 6 on slave3. Conversely, inputs 5 and 6 on slave 3 map to outputs 5 and 6 on the master.

I/O 1,2,3,4,7 and 8 are masked on slave 2 (not used)

9 module group:

comprises of 1 module configured as master and 8 modules configured as slaves1 through slave8.

A 9 module group adopts the following I/O functionality:

Input 1 on the master maps to output 1 on slave1. Conversely, input 1 on slave1 maps to output 1 on the master module

I/O 2 through 8 on slave 1 are masked (not used)

Input 2 on the master maps to output 2 on slave2. Conversely, input 2 on slave2 maps to output2 on the master module

I/O 1 and 3 through 8 on slave 2 are masked (not used)

Input 3 on the master maps to output 3 on slave3. Conversely, input 3 on slave3 maps to output3 on the master module

I/O 1 and 3 through 8 on slave 3 are masked (not used)

Input 4 on the master maps to output 4 on slave4. Conversely, input 4 on slave4 maps to output4 on the master module

I/O 1,2,3 and 5 through 8 on slave 4 are masked (not used)

Input 5 on the master maps to output 5 on slave5. Conversely, input 5 on slave5 maps to output5 on the master module

I/O 1,2,3,4 and 6 through 8 on slave 5 are masked (not used)

Input 6 on the master maps to output 6 on slave6. Conversely, input 6 on slave6 maps to output6 on the master module

I/O 1,2,3,4,5 and 7 and 8 on slave6 are masked (not used)

Input 7 on the master maps to output 7 on slave7. Conversely, input 7 on slave7 maps to output7 on the master module

I/O 1,2,3,4,5,6 and 8 on slave7 are masked (not used)

Input 8 on the master maps to output 8 on slave8. Conversely, input 8 on slave8 maps to output8 on the master module

I/O 1,through 7 on slave 8 are masked (not used)

Programming the 16IO-AC-09 modules (Important)

The application requirement will determine how many 16IO-AC-09 modules are going to be used. Before the I/O extension link can be established, it is necessary to program the modules as master and slave or master and multiple slaves. Programming is simple and is performed as follows using DIP switches 1-7 for each module being used.

1. Module is powered down
2. Set DIP switches 1-7 in the OFF position
3. Set DIP switch 7 to ON. This places the module in configuration mode
4. Set DIP switch 5 and 6 according to the table below. DIP switches 5 and 6 select the number of modules to be used for the application. Ie 5 and 6 set the number of modules in the group. For example, if it is a two module group, then switches 5 and 6 will be set to OFF
5. Set DIP switches 1 to 4 to select the function of the particular module being configured. For example, set the switches to all OFF if the module being configured is to be the master. Note, you may have only one configuration for each module in the group. Ie you may not have 2 master's or two slave 1's.
6. Apply power to the module. LED's will turn ON, and the module will adopt the configured settings
7. Remove power
8. Set all DIP switches to OFF
9. The module is now ready for normal operation. Under normal operation, DIP switches 1,2,3 and 4 assume their normal functions as described earlier in this manual. DIP switches 5,6,7 and 8 are not used.

SW6	SW5	Function	SW4	SW3	SW2	SW1	Function
OFF	OFF	2 Module Group	OFF	OFF	OFF	OFF	Master
OFF	ON	3 Module group	OFF	OFF	OFF	ON	Slave 1
ON	OFF	5 Module Group	OFF	OFF	ON	OFF	Slave 2
ON	ON	9 Module Group	OFF	OFF	ON	ON	Slave 3
			OFF	ON	OFF	OFF	Slave 4
			OFF	ON	OFF	ON	Slave 5
			OFF	ON	ON	OFF	Slave 6
			OFF	ON	ON	ON	Slave 7
			ON	OFF	OFF	OFF	Slave 8

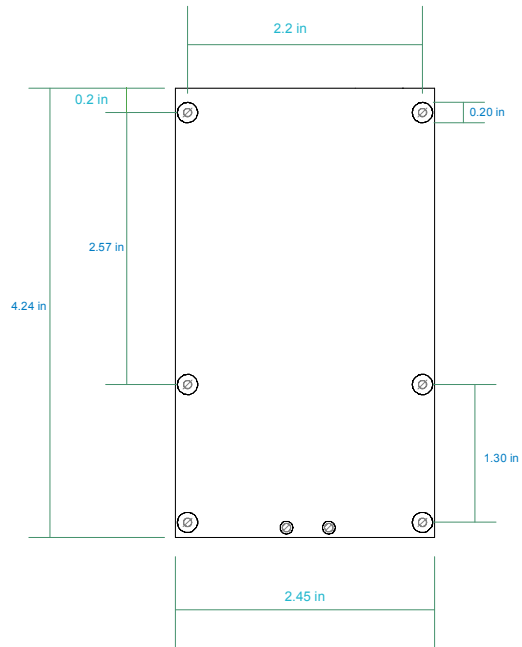
SW7	Function
ON	Configuration mode
OFF	Normal mode

Specifications

(specification may be subject to change without notification)

Parameter		Notes
Operating Frequency	902-928MHz	FM Frequency Hopping Spread Spectrum
RF Output Power	200mW	EIRP (3dBi gain antenna)
RF Sensitivity	-100dBm	
Range (Line Of Sight)	Up to 4 miles	Based on 3dBi gain antenna
Supply Voltage	7.5 to 24Vdc unregulated	
Current Consumption	50mA RX, 120mA TX	Excluding Digital and Open Collector Loads
Operating Temperature	-40°C to +80°C	
Input Connector	Screw Terminal and PinHeader	
Power Supply Input Connector	Screw Terminal	
Timeout Relay Connector	Screw Terminal	
Digital Output Connector	Pin Header	
Open Collector Output Connector	Screw Terminal	
Timeout Relay	SPST, Normally Open	
Timeout Relay Contact Rating	1A, 150VDC. Max.	
Digital Inputs	Normally Pulled High Active Low Max. input voltage 5VDC	
Digital Outputs	5V CMOS/TTL compatible. Source or sink 25mA	
Input Duration for Valid Remote Output	≥ 50ms	
Pulsed Input Frequency for Valid Remote Output	≤ 5Hz	Duty Cycle between 10% and 90%
Antenna Connector	MMCX	RPSMA option
Enclosure	-	-
Board Dimensions	4.25" x 2.5" x 0.75"	
Weight	(2.7oz) 76g	

PCB Dimensions



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