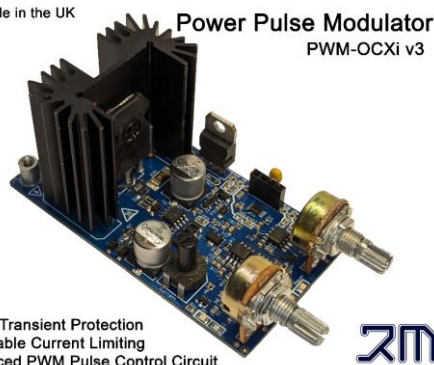


Power Pulse Modulator

PWM OCXi v3

Advanced PWM Power Control Circuit for High Voltage

 Made in the UK



Active Transient Protection
Adjustable Current Limiting
Advanced PWM Pulse Control Circuit



* Max current varies with frequency due to switching losses. (See figure 0)
** Full frequency range requires fitting capacitors (not included) to onboard socket.
No soldering required (See Table 4)
*** Duty not adjustable to 100% at the top frequency ranges unless using monostable mode.

Features and Specifications

- Advanced active voltage and current protection
- Thermal overload protection
- Wide supply voltage range (12V – 30V)
- Transient voltage tolerant to 500V
- Switching voltage from 0 to 340V
- Max output current 20A* continuous, 120A peak
- Latest low voltage drop IGBT technology
- Frequency range 0Hz to 1.5MHz **
- Pulse width adjustable between 0% and 100%***
- Adjustable current limit / constant current mode
- I/O connections for logic interfacing & External controls
- Pulse width can be set as duty %, or as a fixed time.
- Highly compact design
- High quality four-layer PTH, 2oz Copper PCB
- Dimensions: L85 x W46 x H44 mm (pots +15mm)

Example Applications

- Flyback Transformer Driver
- Ignition Coil Driver
- Induction Heating
- SSTC (Tesla Coil)
- DC-DC converters, inverters, and SMPS
- Solenoid or Valve Control
- Resonant Energy or Magnetic Pulse Experiments
- Fluorescent and Neon lighting control
- Motor or Fan Speed Control & Soft Start with stall current limiting
- Ultrasonic Transducer Driver
- And more...

Typical Usage

The OCXi v3 is designed primarily for use in high voltage circuits such as for driving high voltage coils or any circuit where a significant amount of back EMF or transient voltage must be tolerated. The built-in current limit adjustment is ideal for automatically limiting motor stall current, or transformer input current when loading is variable.

The **PWM-OCXi v3** is an advanced adjustable DC pulse generator designed for providing an easy way to adjust power to devices or to pulse them at a wide range of frequencies and pulse times. The frequency is independently adjustable to the pulse width which can be varied smoothly from 0% to 100% or set to be a fixed pulse time which is independent of frequency. It is designed to fit a wide range of applications and be fully adjustable so that it can be used for many different tasks.

Many devices such as coils will have dynamic impedance and transient feedback levels when being pulsed from an adjustable frequency circuit. The OCX v3 and OCXi v3 have advanced protection circuits that continuously monitor the output current, voltage, and transistor temperature. If any conditions are detected that might exceed the ratings of the unit, the output will be momentarily disabled or chopped so that the transient voltages or currents are reduced. During the over current or over voltage fault conditions an LED will illuminate to indicate that the protection circuit is active and affecting the output. There are also I/O ports for monitoring or manually triggering the protective circuits. The thermal protection circuit will activate when the main heatsink reaches approximately 150°C and will disable the power output until the temperature drops back a few degrees.

The PWM-OCX(i) range of PWM circuits are highly compact and have been built so that they can easily be incorporated into projects requiring some pulsed power control. The circuit is made in England on a high-quality PCB with quadruple layer design, plated thru holes (PTH), and 2oz copper per layer for durability and performance.

Glossary of Terms

Explanations of some terms used in this document

Load: The device such as a motor or light bulb that is to be pulsed by the circuit. This would be connected between L+ and L-.

Supply Voltage: This is the safe voltage range that can be applied to the input terminals GND and V+ for proper operation of the device.

Standoff Voltage: This is the maximum voltage that can be applied as a secondary supply without beginning to trigger any voltage protection circuits. The circuit does not directly generate this voltage, but inductive loads (coils) or external secondary power supplies may be capable of producing high transient feedback voltages that are much higher than your supply voltage. The OCX(i) v3 circuits will limit transients only, but will not protect against continuous over voltage.

Switching Speed: The small time taken for the transition between off and on or visa-versa when applying pulses to a load.

Quick Usage Guide

The PWM-OCX(i) v3 range are designed to be highly versatile while still remaining simple to use. This quick usage guide will help you to quickly get started with the circuit and help you to make the most of the advanced features. We also recommend that you read this datasheet in full and check out the product usage guides on our website.

Power Input

Use a power supply that is capable of delivering at least the peak current that your load device will draw from a DC supply. For example; a motor with 1 ohm DC resistance being powered from a 12V input will need a 12V PSU capable of delivering at least 12A current (calculated using ohms law). If you try to use a PSU with a lower current rating, the supply to the internal electronics of the OCX(i) v3 will be unstable and might not be able to operate correctly or protect its self from overload conditions. See our product tutorial "Power Supply Considerations" on the website for more information.

Load device

Consider Ohms Law and the maximum rating of the circuit for the frequency at which you want to operate. Inductive loads such as coils will generate significant transient feedback. These transients will activate the protection circuits and interrupt the frequency setting you might be trying to use. You can avoid this entirely by placing a fast diode in parallel with your load device. See the product tutorial "Driving Inductive Loads" for more details.

Start-up and Controls

When first using our OCX(i) v3 circuits we suggest that set the current limit adjustment to minimum (fully anticlockwise) before powering up the device. Practice adjusting the duty and frequency controls while observing the response of the HV and HC LED indicators. Ideally you should also observe the actual average current flow using a DC ammeter as this will help you to get a good feel for how your load and circuit respond to the adjustment of the controls.

The current limit should be set no higher than is needed for your application as this will offer maximum protection against accidental damage to the circuit or load device. The maximum

setting (fully clockwise) for the current limit is approximately 67A which is much more than the rated DC average current of the circuit. This high upper limit helps to allow for operation where you need a large peak current with a very low duty cycle, or for intermittent use which will not cause excessive heating in the circuit. For most situations the current limit control should be turned only slightly past minimum which should allow for a good current flow while maintaining good overload protection.

If you know the frequency range in which you wish to operate the device, choose a timing capacitor (inserted into C1) that will offer the bulk of your desired frequency at the low end of its range. In the most anticlockwise positions, the frequency adjustment control is less sensitive and allows for more precise adjustment which is why you should try to choose your capacitor to suit. You can also add a secondary potentiometer for fine adjustment if required. See page 7 for details.

Power Dissipation

The power dissipated as heat in the main switching transistor can vary significantly with different loading conditions and control settings. The device will operate much more efficiently at lower frequencies (<10kHz) and will not heat up significantly. If you need to operate at higher frequencies, you should consult the graph in *figure 2* to see the sort of current you will be able to switch before the thermal protection will activate.

ELECTRICAL CHARACTERISTICS (MAXIMUM RATINGS)

NB: Figures may vary under different loading conditions and environments. Ratings are based on test conditions of 24V input and wire wound resistor load impedance of 1 ohms, without a cooling fan.

Symbol	Parameter	Min	Max
V_{in}	Input Supply Voltage	12V ¹	30 V ²
V_{out}	Output Voltage	-	$V_{in} - V_{drop}$
V_{soff}	Maximum Standoff Voltage	0V	340V
I_{sup}	Supply Current (no load)	20 mA	500 mA
I_{out}	Continuous Output Current	0 A	20 A (higher with fan)
I_{pulse}	Pulse Current (1ms, 25°C)	-	120 A
I_{adj}	Current Limit Adjustment	500 mA	67 A
f	Frequency	DC (0 Hz)	1.5 MHz ³
t_{on} / t_{off}	Switching Speed (no load)	16 ns / 20 ns	32 ns / 52 ns
t_{on} / t_{off}	Switching Speed (load)	16ns / 20 ns	128 ns / 100 ns
V_{drop}	Output Voltage Drop (varies with output current)	1.9 V	2.4 V
SIG_{out}	Signal Output (high)	4.8 V	5 V
SIG_{in}	Signal Input	0 V	5.5 V
PWM_{out}	PWM Control Voltage Output	1.2 V	3.2 V
PWM_{in}	PWM Control Voltage Input	0 V	5 V
FM_{in}	Frequency Modulation Voltage Input	0 V	5 V
OSC_{out}	Oscillator Logic Output Voltage (high)	4.8 V	5 V

Table 1: Electrical Characteristics

¹ Units will still oscillate when powered by a supply voltage as low as 5V but the heating in the transistor will increase significantly (and therefore reduce current capacity)

² If operating at higher than 20V and at maximum frequency (or drawing >200mA unloaded), additional heatsinking will be required for 12V regulator U1.

³ The oscillator can be made to run at up to approximately 2 MHz, but doing so will risk overheating the control circuit components.

Power Ratings

Test conditions (See Fig 1):

24V input, 1 ohm load (wire wound resistor) (R1), 1000uF power capacitor (Cp).

The **PWM-OCX(i) v3** maximum average current rating is determined by the temperature increase of the components in the circuit. The maximum current rating for a frequency is based on running a test for a minimum of 10 minutes without the temperature protection being activated, or any component exceeding rated temperatures. Tests are performed at room temperature and without a cooling fan. It may be possible to run currents that are significantly higher when done so for short periods of time or by using a fan. The measured current in these tests is obtained using a clamp meter at the circuit power input which gives an approximation of the current averaged over several cycles. These values should be used only as a guide as results will vary depending on other operating conditions.

To use the circuit at full power, you need to check against this graph the maximum current you can set for your working frequency. You may also need to fit a large capacitor at the input terminals.

This graph is valid for the test conditions described. In your application, the performance may vary above or below what is shown here. Using a cooling fan allow for significantly higher operating currents than these shown.

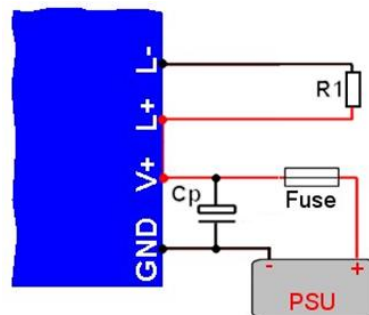


Figure 1: PWM-OCX(i) Test Circuit

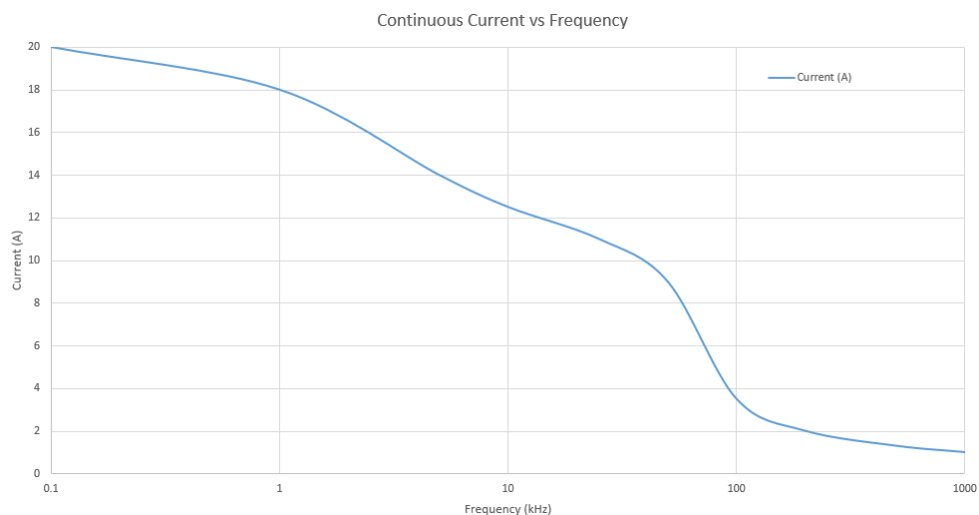


Figure 2: PWM-OCXi v3 Current vs. Frequency

Connections

The main connections to the circuit are made using the M3 screw terminals at the end of the board. The input power (V_{in}) is connected to 'GND' and 'V+', while the load is connected between L+ and L-. See the diagrams below for how to connect a secondary supply. We suggest using suitable M3 crimp ring terminals on your cables for making connections.

Some other connections such as OSC and FM can be made using the solder pads provided on the PCB. See the specs above and below for further details.

If you intend to pass large currents, ensure that the wire used is thick enough and that a sufficient capacitor is placed at the power input (see *Figure 1*). Always use a fuse to protect the circuit from accidental overloads or short circuits.

GND	Ground, Earth, 0V, or battery negative terminal.
V+	Input Supply Voltage, or battery positive terminal
L+	Load positive (internally connected to V+)
L-	Load negative

Table 2: Main Power & Output connections



Figure 3: Power Connections

Power Connections

Below you can see typical connections for the power supply and load. Make sure the cables are thick enough to carry the current you want to pass, and keep them short if possible. It is possible to use a single supply to power both the circuit and your load (see *figure 4*), or you can use a separate secondary supply for the load. This allows you to supply a different voltage to your load than what you are using to power the circuit. For the **PWM-OCXi v3**, this secondary voltage can be from 0V to 340V.

A functional diagram of the circuit is shown in *figure 7*. Here you can see how the power is switched by the circuit. The output is an “Open Collector” current sink type output which means that the transistor acts like a switch, connecting and disconnecting the load device from ground with each pulse. This is important to consider in some applications as the load is always connected to the positive supply voltage.

PCB Mounting

At each end of the PCB is an M3 hole that can be used for mounting to an enclosure. If mounting to a metal enclosure, it is important to use non-conductive mounts, or to isolate them. The hole near the potentiometers is electrically connected to GND, while the hole near the power connections is connected to V+.

Output Load Considerations

The minimum load impedance that should be connected to the device can be calculated using ohms law. Connecting loads with lower impedance could damage the circuit;

$$R_{LOAD} = V / I_{pulse}$$

For Example:

Using a 12V supply, $R_{LOAD} = 12V / 120A = 0.1 \text{ ohms}$

If you connect a load with lower impedance than calculated like this, the active current limit circuit may not be able to prevent the main transistor from being destroyed.

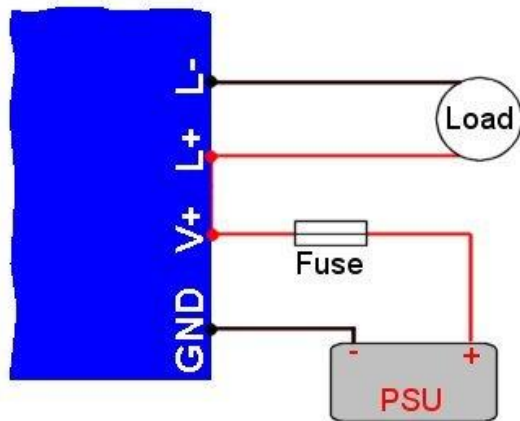


Figure 4: Typical power connections

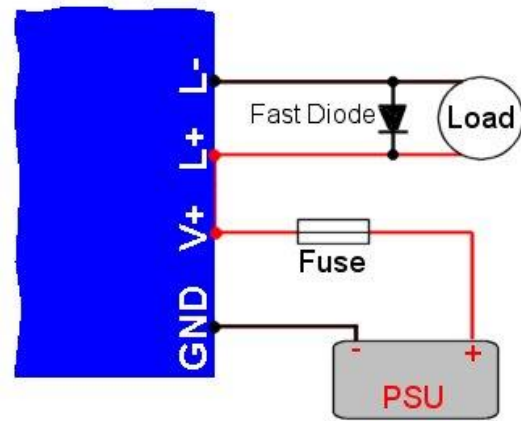


Figure 5: Typical power connections for inductive loads

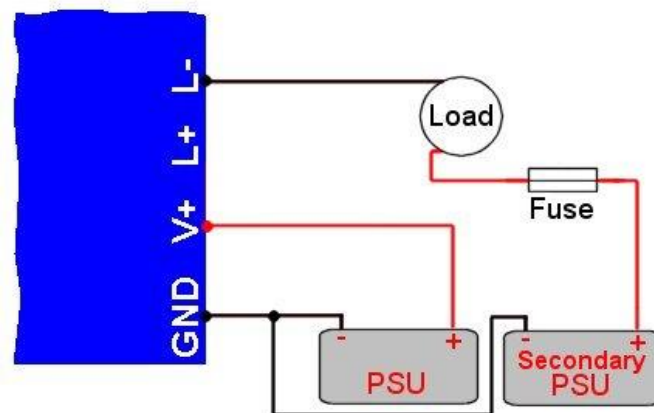


Figure 6: Typical power connections with secondary supply

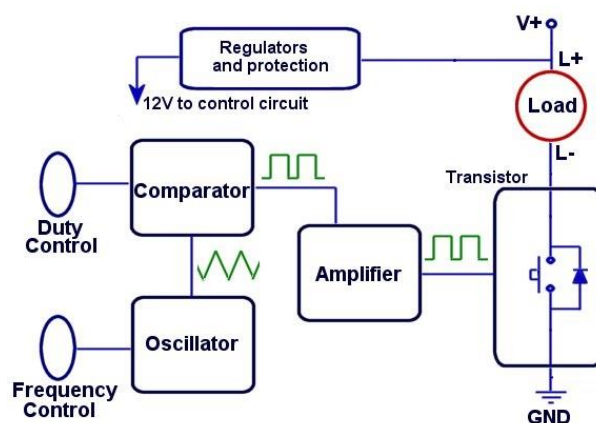


Figure 7: Functional Diagram

Active Voltage and Current Limiting

The onboard current limiter continuously measures the current flowing through the output. The measured current is averaged over about 20ms so that large, brief peak currents can be supported while keeping the overall average current within safe levels. You can adjust the current limiter using the onboard control from anywhere between around 0.5A to 67A. It is important that you consider the peak currents that could occur in your setup and to ensure that they will not exceed the rated peak current of the device. If the peak current exceeds

rated levels, the current limiter may not activate soon enough to prevent the main transistor from being destroyed. If necessary, it is possible to alter the length of time over which the current is averaged. For longer averaging time, you can connect a capacitor between HC and GND. Making modifications to the protection circuits is not recommended and is done at your own risk.

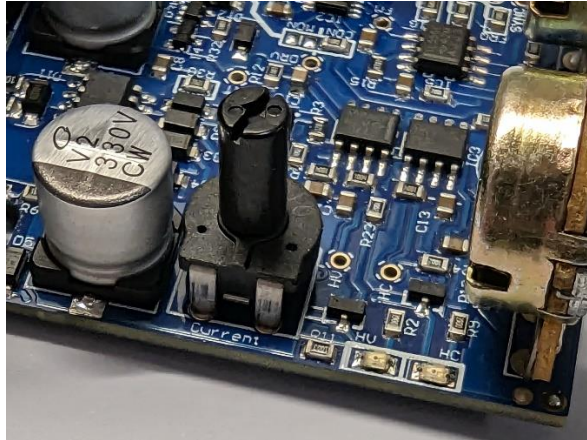


Figure 8: Active protection circuits

There are both active and passive transient voltage protection circuits in this device. The passive protection consists of a pair of TVS diodes which have very rapid response time but will dissipate transients as heat. To prevent these overheating, the active protection will measure the transient voltages and average them over about 30ms. If the averaged transient voltage level is too high then the output will be momentarily disabled until the voltage level drops down again.

When either the HV or HC protection circuits activate, the output is briefly disabled until a safe condition is established. This will have the effect of chopping or modulating the output waveform so that the averaged readings are within safe limits.

Jumper Settings & I/O connectors

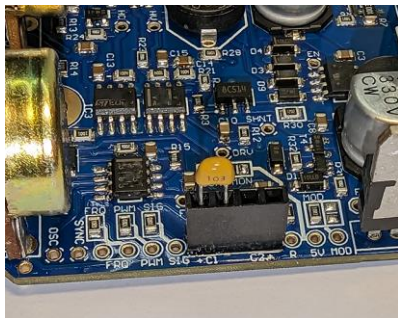


Figure 9: Jumper & Solder Connections

A range of SMD jumpers and I/O are available for customising and interfacing with the PWM circuit. An SMD jumper consists of an 0805 resistor which can be removed or replaced to alter circuit operation.

Relevant resistors are marked with a white border and a line connecting to any associated I/O solder point. The I/O solder points are spaced at 2.54mm to allow mounting of standard header pins. All signals are 0-5V except for EN which is 0-12V

I/O or Jumper	Function
OSC	Internal oscillator This is typically used for testing and making sure that the onboard oscillator is running correctly. It will output a 5V square wave with a frequency matching the power output. The duty will vary slightly but is not representative of the power output.
SYNC	Pulse synchronisation input This connection can be used to synchronise the start of the PWM pulses with an external signal. Holding it low will disable the output by stopping the onboard signal generator. When the SYNC input is pulled high again, or left floating, the oscillator will start the pulse train again.
FRQ	External Fine Tune Potentiometer For finer frequency adjustment, remove the 10R resistor and connect a potentiometer of your choice to the nearby solder points. A 100k pot will give a 10x fine adjustment, 10k would give 100x and so on.

PWM	<p>PWM voltage in/out</p> <p>The voltage at this solder point sets the output pulse width. It's value is set by the onboard potentiometer, or you can adjust it using an external source. With the 10R resistor left in place, the solder point will always be biased by the potentiometer and has a minimum impedance of 8.2k to 5V or GND. This bias can be disabled by removing the 10R resistor. The output duty is inversely proportional to this voltage with a range of 1.5V to 3.5V.</p>
SIG	<p>Oscillator signal in/out</p> <p>The signal at the solder point here is that of the internal oscillator with duty adjusted. This is the CON mode signal, for the MON signal, see DRV.</p> <p>To drive the output with the signal from an external device, remove the associated 10R resistor and apply a signal to the solder point.</p> <p>The OCX(i) units have a Schmitt trigger input which means the power output will be square wave regardless of the input waveform.</p>
FM	<p>Frequency modulation input</p> <p>This solder pad is for connecting an external control voltage for modulation of the output frequency. The voltage should be between 1.7V and 5V. When using the modulation input, the output duty may also increase when the frequency increases.</p>
DRV	<p>Drive Signal</p> <p>This solder pad can be used to monitor the internal signal before it is amplified for driving the main transistor. This point is useful for monitoring the internal signal as it will not be interrupted by any fault conditions. Note that this signal may appear more rounded than the final output pulse as it will amplify later.</p>
SHNT	<p>Shunt Voltage</p> <p>This is a direct connection to the 750uR shunt resistor which is used to monitor current flow. This can be useful for connecting to external ammeters or ADCs which are made to measure current using a 750uR shunt.</p>
EN	<p>Enable/Disable</p> <p>This connection is used to enable or disable the output power. By default, the EN terminal is held high and thus the output is enabled. The onboard protection circuits will pull this low during any fault conditions. When high, the EN terminal is held at 12V so if you need to link with a microcontroller you may need to use a small transistor or voltage divider. You can also use this for connecting a switch for easy on/off control of the output without powering down the whole circuit. The EN terminal is ideal for connection to additional sensors for protecting the circuit or your load. For example, you can connect an NTC thermistor between EN and GND so that when the temperature increases, the device output will be disabled until it cools again. For the output to be disabled, the resistance between EN and GND should fall below around 13k ohms.</p> <p>EN is pulled up to 12V via R30, a 12k resistor. A 100k thermistor also connects between EN and GND forming the thermal protection circuit. Replacing R30 with a different value resistor will adjust the temperature protection threshold accordingly.</p>
CON/MON	<p>Continuous or Monostable operation</p> <p>The placement of the 10R resistor determines the operation mode. In the default position (CON), the output duty can be adjusted using the onboard duty potentiometer and will be set as a percentage between 0 and 100% of an oscillator cycle. If the link is moved to the MON position, the length (on time) of the output pulse will always be at the value you set regardless of any frequency adjustment. To do this you must connect an external resistor or potentiometer between 5V and R so that adjusting this resistor will adjust the length of the output pulse. When using monostable mode, the onboard duty control should be set somewhere above 0% as setting this to 0% will also disable the monostable pulse. See table 4 for capacitor and resistor combinations and corresponding pulse lengths.</p>
R / 5V	<p>Monostable resistor connection</p> <p>Solder points for an external resistor / potentiometer for setting the output pulse width in monostable mode.</p>
MOD	<p>Modulation signal input</p> <p>Used for modulating the output with an external control signal. The position of the 100k jumper determines if the modulation signal is active high or active low. In the default position (active high), MOD is pulled high by the 100k jumper and therefore pulling the solder point low, disables the output PWM. Swapping the resistor to the other position will pull MOD low and therefore invert the modulation signal.</p> <p>This input is most commonly used for mixing together two different PWM frequencies to drive the output.</p>
HV	<p>High Voltage Protect</p> <p>This connection will output a voltage pulse which is proportional to the level of excess transient voltage at the power output. The voltage can vary between 0V to 4V. You can also use this terminal to disable or adjust the level of transient protection. Connecting this to GND will disable the active transient voltage protection. Pulling it high will force the protection circuit to activate and disable the output power. You can also connect a capacitor between this terminal and GND to increase the length of time over which the transient pulses are averaged. This would mean that larger transients would be allowed to occur and that the passive transient protection could increase in temperature beyond design limits.</p>

HC	High Current Protect This connection will output a voltage pulse which is proportional to the level of excess current above the limit set by the current adjustment control. The voltage could be from around 0V to 3V. Connecting this to GND will disable the active current limiting. Pulling it high will force the protection to activate and disable the output power. You can also connect a capacitor between this terminal and GND to increase the length of time over which the current is averaged.
C1	Oscillator Timing Capacitor This socket allows you to fit the timing capacitor of your choice. See table 4.
C2	Monostable Pulse Width Timing Capacitor This socket allows you to fit the timing capacitor of your choice. See table 5
FAN	Optional connection for 12V Fan This is simply a connection to the onboard 12V regulator which can be used to supply power to a fan. Note that using this may increase the temperature of the regulator if your input voltage is over 20V. You should not draw more than 200mA from this connection.

Table 3: Additional I/O

Controls

The frequency and duty cycle can be independently adjusted using the large potentiometers labelled 'Freq' and 'Duty'. The frequency is adjusted with 'Freq' while the pulse width can be adjusted with 'Duty'. Turning the control clockwise will increase the value corresponding function. The frequency range of the device depends upon the capacitor value of C1. The pre-fitted capacitor is 10nF which gives a range of medium frequency pulses which are suitable for most applications. Replacing C1 with a larger value capacitor will give a range of lower frequencies. At very low frequencies the green output LED will flash for a time that is proportional to the frequency and pulse width setting.

The small potentiometer marked 'Current' is used to set the output current limit. When fully clockwise the limit is set to a maximum of around 67A. Turning the control anticlockwise will reduce the threshold at which the output will be chopped in order to maintain the current limit. When fully anticlockwise the minimum current limit setting is around 0.5A. When the current flow is below the set threshold the duty control will operate normally. When the output current exceeds this threshold, then further increasing the duty control will increase the amount of time the chopping circuit is active but will not increase the average current.

Capacitor Values for C1 and Corresponding Frequency

By fitting different sized capacitors into the socket marked C1, a wide range of frequencies can be achieved. The table below gives some example values and the frequency range produced. Values given are approximate. You can use any other capacitance you desire to get other frequencies.

Note that the values shown will allow the unit to oscillate above the specified frequency range, but these are for reference only. As the frequency increases, the output will become more rounded and the transistor may not switch fully on during each pulse. This can lead to excessive heating which could potentially damage the unit. Using the device above its rated top frequency is done at your own risk. See *figure 2* for how frequency affects heating. If using a polarized capacitor check the markings on the PCB for the correct orientation.

Capacitance (code)	Min Frequency	Max Frequency
1uF (105)	0.8Hz	200Hz
220nF (224)	4Hz	950Hz
10nF (103)	75Hz	20kHz
470pF (471)	1.6kHz	270kHz
220pF (221)	3kHz	475kHz
22pF (22J)	17kHz	1.3MHz
none	39kHz	1.8Mhz

Table 4: Capacitor values for frequency ranges.

It is also possible to calculate an approximate frequency range using the following formula where C is the value of the capacitor fitted in pF and F is the frequency in Hz

$$F_{\min} = 420,000 \times C^{-0.9}$$

$$F_{\max} = 30,000,000 \times C^{-0.8}$$

Capacitor Values for C2 and Corresponding Pulse times in monostable mode

By using different resistor capacitor combinations for R and C2, you can set a wide range of pulse times for the monostable mode of operation. We recommend using a 10k potentiometer for R and then use the table below for selecting a suitable capacitor. You can also use other values for R. A lower value potentiometer will give a smaller adjustment range which can allow for more precision in a specific range, or a larger potentiometer will give a broader range of adjustment. If using a polarized capacitor check the markings on the PCB for the correct orientation.

Capacitance (code)	Min Pulse Width	Max Pulse Width
1uF (105)	1ms	10ms
220nF (224)	235us	2.3ms
10nF (103)	10us	0.1ms
1nF (102)	1.1us	11us
220pF (221)	312ns	2.9us
100pF (101)	160ns	1.5us
22pF (22J)	76ns	540ns

Table 5: Capacitor values for pulse widths in monostable mode (using a 10k potentiometer for R).

Driving Inductive Loads

(Motors, Solenoids, Transformers, Relays, Coils, etc)

The **PWM-OCXi v3** has advanced protection against high voltage transients from inductive loads. This unit is suitable for use with most ignition coils and other high voltage coils without the need for any additional components. The active protection circuitry will prevent transients from damaging the circuit. The protection circuits have been designed to be as robust and flexible as possible so that you can adjust the controls freely without worrying about damaging the circuit. You should still however pay attention to the warning indicators and try not to operate the device continuously with them lit. If your setup produces excess transients, it may help to add a suitable capacitor or snubber between the coil terminals.




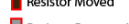
LED Indicators

The red power LED lights to indicate that power is present in the signal generation circuitry. This can also be used to indicate the overall health of your input power supply. If the LED dims when the PWM output is high, this indicates your power supply is struggling to provide enough current. This could mean a low battery or overloaded PSU. Note that running the unit in these conditions may cause it to overheat and will disrupt normal operation of the protective circuits.

The green output LED lights when the switching transistor is on and power is being delivered to the outputs. At low frequencies you will see it flashing, at higher frequencies it will appear to be on with brightness proportional to the duty setting.

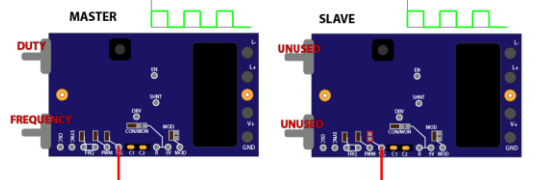
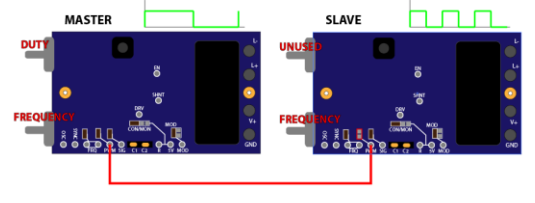
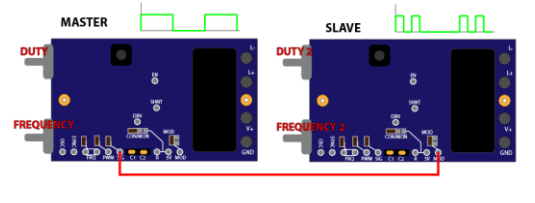
The other two surface mount LEDs marked HV and HC will illuminate red to indicate that the protection circuits are actively limiting the output current or transient voltages.

Linking Modules

KEY
 Wire link
 Default Resistor
 Resistor Moved
 Resistor Removed

Multiple PWM circuits can be linked in a number of different ways. A master/slave arrangement can be used so that both devices pulse together or at different times and rates. The diagrams below show how to link modules together or to other devices. The connections for power and load are not shown for simplicity. It is assumed each module is connected to one or more power sources with a common GND. A load can be connected to an individual module, or all modules can drive a separate load each. Any changes to the jumpers and links should be done with all power switched off.

The protection circuits will continue to work independently in each module when linked.

<p>Master / Slave with identical output <i>Removed: SIG link resistor</i> Modules linked in this way will all output the same frequency and duty which is set by the controls on the master device. You can have multiple slaves for one master.</p>	
<p>Master controlled Duty with independent Frequency control <i>Removed: PWM link resistor</i> Modules linked in this way will have independent frequency control while the duty percentage is controlled by the master device.</p>	
<p>Combined (modulated) PWM signals <i>Removed: None</i> It is possible to modulate the output of a slave unit with another signal. This is often called <i>Amplitude Modulation</i>, or <i>Gating</i>. Typically, you would set the master to a low frequency, and the slave to a higher one. When connected in this way, each time the master outputs high, the slave will be enabled. The slaves power output is therefore a sequence of high frequency pulses.</p>	

Important Usage Notes

- Always make sure the pulse width is set to minimum (pot turned fully anti-clockwise) before connecting the circuit to a load or power source.
- Use a fused power supply to protect from accidental short circuit or overload. The fuse should be rated to suit your application and up to a maximum of the units specified pulse current. Use a quick blow type fuse.
- The heat generated in the switching transistor will vary with your loading conditions and the settings for frequency and pulse width. You should use the current limit adjustment to set an acceptable limit for your application and to keep the device from overheating.
- Ensure an adequate power capacitor is fitted between V+ and GND if you are using a single power supply. *See Figure 1.*
- Do not remove the timing capacitor C1 or C2 when the unit is powered on.
- When using voltages above 30V or when driving high voltage coils, you should make sure the GND connector and the metal parts of the control pots are suitably earthed for safety. Failure to do this risks damage to the circuit and and/or electric shock. You should not touch the circuit when it attached to a high voltage source as many of the

component parts, including the heat sink will be live. You must also place plastic knobs on the controls for added safety.

- If you intend to make new connections to the I/O solder pads often, it is recommended that you fit pin headers so that the pads will not become damaged when desoldering wires.
- The PWM-OCX* range of devices are designed to hard switch the output transistor to give very fast rise and fall times. Under some conditions this may cause some unwanted ringing at the edges of the pulses delivered to your load. If you need to reduce these, you can replace the gate drive resistor (R18 & R16) in the circuit with one of a larger value. The fitted resistors are 10 ohms so replacing these with one of a higher value will slow the switching time and could reduce ringing. This reduced switching time can increase switching losses at high frequencies so the value chosen must reflect a compromise between reduced ringing and increased switching loss.
- At very high frequencies or with very low impedance loads, the green output LED may not illuminate with a brightness proportional to the output duty. It may appear to be either on or off, or might not illuminate at all. You can confirm the actual output duty using an oscilloscope.

Customisation is available for this product



We can pre-configure jumpers and make other modifications, or help integrate it into your project. Call or email to discuss your requirements.

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The information in this document is provided as-is and is not guaranteed to be free of errors.

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