

OpenGrab Electro Permanent Magnet

NicaDrone.com

EPM688-V2.5x

General Description

The EPM688-V2.5X is an Electro Permanent Magnet, combining the advantages of electro and permanent magnets.

The magnetic domains in the Alico magnets are aligned in a particular orientation as to form a magnetic circuit with a ferrous target plate. A short, 20 μ s pulse current of 300A is generated by discharging the main capacitor through a Thyristor full bridge into the copper winding generating a field of 70kAm. This field is used to align Alico domains.

The key advantage is a very strong electromagnet that does not consume energy during steady state operation only during cycling

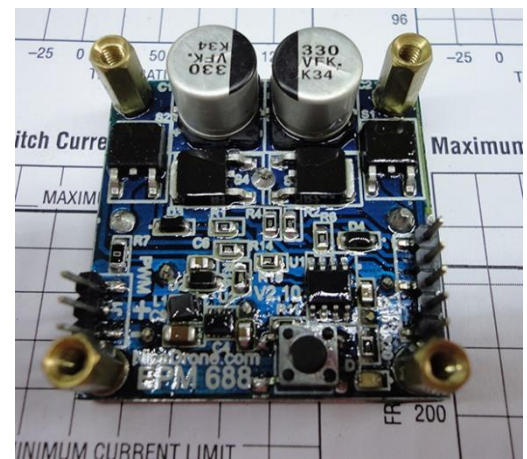
This Device comes with integrated electronics that can be operated with a 50Hz 5V PWM signal common on RC electronics. The device is designed to hold 5kg of cargo with a holding force of over 80N or 8kg.

Applications

- Cargo lifting in UAVs
- Robot work holding
- Education demonstration of magnetic properties

Features

- 5-6V Vcc
- PWM signal
- Minimal steady state power <1mW
- Water resistant conformal coating
- Short cycle time
- On board Pic12F with source code and in-circuit programming header



Recommended Operational Conditions

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Symbol	Parameter	Value	Unit
Tcycle on	Time to complete one cycle	1.25	s
Tcycle off	Time to complete one cycle	0.36	s
Fmx	Max holding force	80	N
Vin	Optimal operating voltage range	5-6V	V
Vinmax	Maximum input voltage	7	V
Imax	Maximum current draw during cycle execution	800	mA
PWM on	Minimum signal high	1.75	ms
PWM off	Maximum signal high	1.25	ms
PWM error	PWM outside this range will generate an error which is indicated by a blinking the status LED	<0.75 and >2.25	ms
Mass		35	g
Trange	Temperature range for optimal performance	-40 to +80	degC

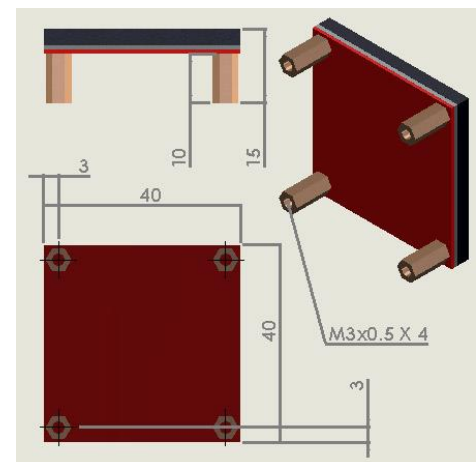


Figure 1 Drawing

Pin Functions

GND

Ground pin

Vin

5V supply

PWM

RC PWM signal input

ICSP CLK / Data

The Data pin puts out the current state of the EPM, TTL high for On and TTL low for Off.

Vpp, Vdd, Vss, ICSP Dat, ICSP CLK

These pins are broken out to provide the user with the ability to reprogram the on board PIC12F. Further information can be found in the documentation provided by Microchip

Operation

After connection VCC and GND the device will charge the capacitor.

When a on command is given either by the toggling push button or by a PWM signal the device will discharge the capacitor 6 times into the coil. This takes 1750ms

When a off command is given the device will alternately magnetize the alnico magnets repeatedly while decreasing the amplitude of the voltage thereby demagnetizing the Alnico magnet. This takes 1250ms

Push Button Mode

Pressing the Push button will toggle between an on and off command

PWM Mode

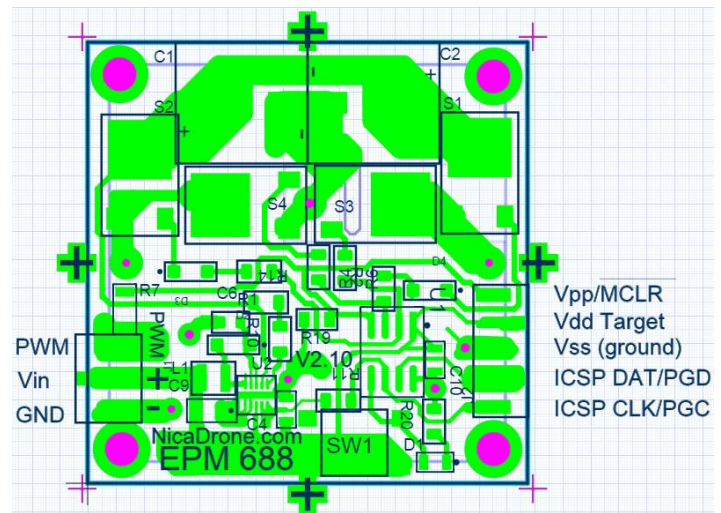
A RC Pulse Width Modulated signal can also be used. High times between 0.75 and 1.25ms are consider an Off command. 1.75-2.25ms is considered On command. Moving the signal on time from neutral, 1.25-1.75ms to either On or Off range will command the EPM to go into the respected state.

Error

The Led will blink once every 64 PWM signal errors. An error is either a missing or out time range PWM, about every 2 seconds for a missing PWM.

LED

Led goes on when the button is pressed. The Led will blink rapidly 4 times after a command has been executed, either going On or Off.



Principle of operation

U2 a boost converter creates 40V and charges the main capacitors, C1 and C2 storing 550mJ.

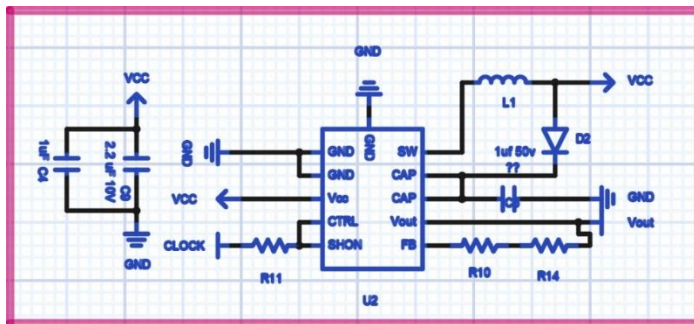


Figure 2 Boost Converter

The full bridge Thyristor discharges this energy into a copper coil making up the magnetic assembly. This creates a 300A current

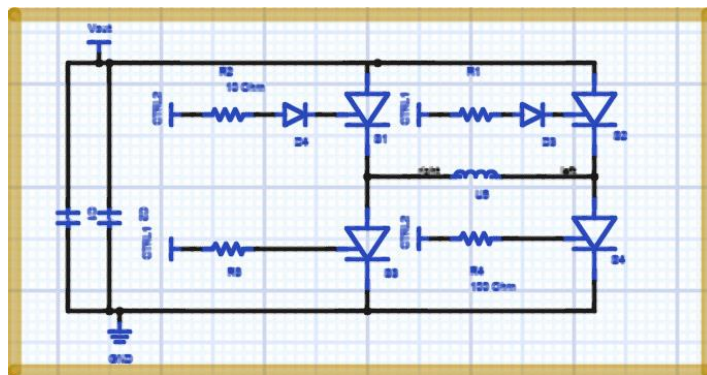


Figure 3 Full bridge Thyristor