flexar

Sticker Actuator

1. How it works?

This Do-It-Yourselve actuator is made from a FlexPCB sticker coil and an N52 Magnet. It can be easily mounted to any smooth surface, and when current flows through the planar copper windings, it can generate a magnetic field strength of up to 2.7mT. This can be used to attract or repel N52 grade neodymium magnets, to create custom actuators. These types of actuators can move lightweight objects, like thin 3d-printed plastic models or paper-origami.

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2. Applications

This PCB was design to be used as a flexible voice-coil-actuator sticker, so its intended to add motion to in-animate light-weight materials. To control the motion of this actuator, one must use an h-bridge module, like the Flexar Driver. The magnetic field strength of this coil is limited to 2.7mT (measured from the surface). The actuation distance can be improved by using the largest magnet that fits in the available area. Given that some aspects of this actuator are customizable, its motion and force will also depend on the magnet's pivoting point, mass and magnetic field strength.

The adhesive used on the backside is 3M467. It's cover can be peeled off using a pair of tweezers. Always clean the surface before sticking the actuator and it is very important to peel-off the cover before powering on the coil, otherwise the adhesive-cover might get damaged. The coil can be sticked on a curved surface, with a 18mm maximum bending radius.

One can also use this PCB coil for these other examples mentioned below. However, the PCB Actuator is more suitable for some of these other applications, as it has a stronger 12mT peek magnetic field.

- Vibrating Actuator
- Motor prototyping
- Speaker/Buzzer
- Weak electromagnets
- LC oscillator sensor
- Heating Pad

3. Specifications

PCB Specifications	
Dimensions	**24.5mm x 20.2mm**
Connector Pitch	**2.54mm**
PCB Thickness	**0.1mm**
Bare PCB Weight	**0.2 grams**
Layers	**2**
Coverlay	**Black**
Silkscreen	**White**
Copper Thickness	**0.5oz**

Coil Specifications	
Track (Width/Pitch)	**4/4mil**
Turns	**70 turns**
Resistance	**20Ω ± 3**
Inductance	**25.3uH ± 1**
Maximum Constant Power*	**0.8W**
Maximum Operating Temperature	**100°C**
Peek Magnetic Field Strength	**2.7mT**

Magnet Specifications	
Dimensions	**5mm x 2.5mm**
Shape	**Disk**
Garde	**N52**
Weight	**0.36 grams**
Coating	**Nickel-Copper-Nickel**
Pull	**950 grams**
Vertical Hold	**190 grams**
Maximum Temperature	**80°C**

*To determine the maximum constant driving voltage (100% duty cycle), one must measure the resistance of the coil and use the equation bellow:

$$V_{max} = \frac{R + 10.96}{6.22}$$

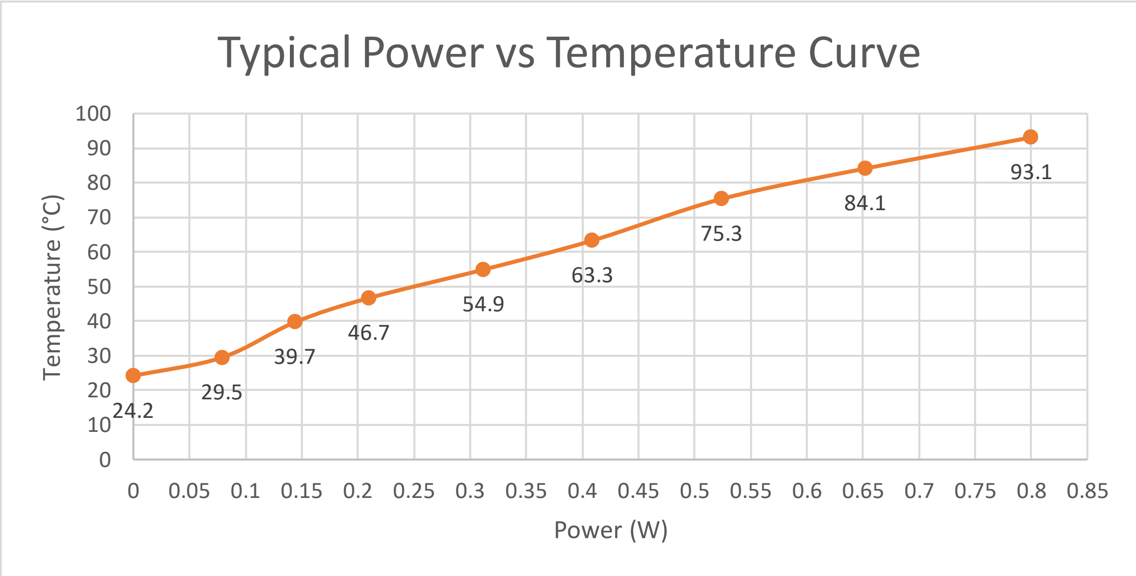
This equation will ensure that the temperature of the PCB is kept under 100°C, which typically gives a voltage value between 4.5V to 5.4V. Driving the coil with higher voltages might damage the PCB. All voltage levels underneath this range are acceptable.

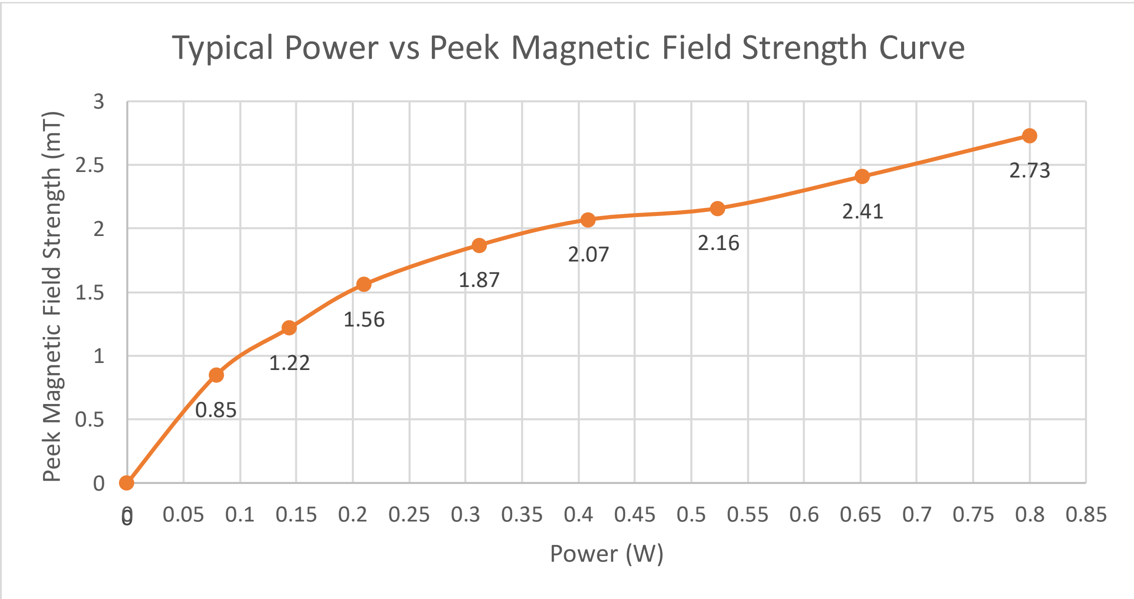
This constrain is a result of coil's resistance tolerance (20Ω ± 3) as it can vary between different manufacturing batches, given that the track's width and pitch are only 4/4mil.

4. Testing

During these tests:

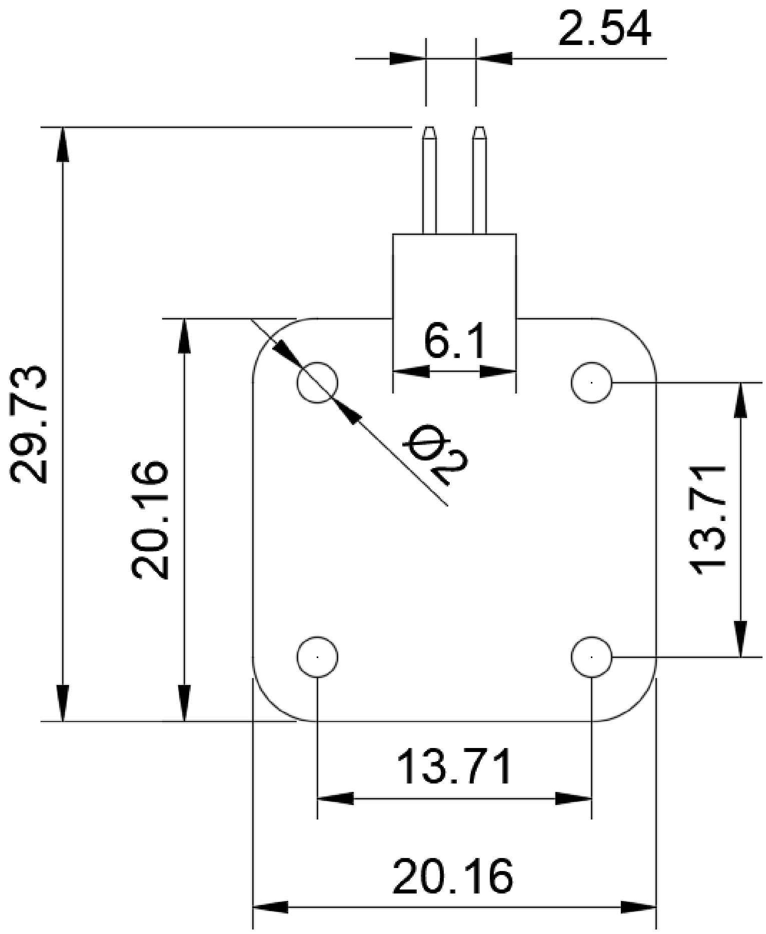
- *All temperature readings were taken from the hottest point of the board*
- *All tesla readings were taken from the center of the coil*
- *Measurements were taken at room temperature (25°C)*
- *Measurements were taken at 100% Duty Cycle (Constant Voltage)*
- *Peek Magnetic Field is tested at the surface*





Please note that by driving the coil with a constant voltage will increase its temperature. This will also increase the resistance and thus lower the current flowing through the coil. This effect can be resolved by controlling the coil with a constant driver.

5. Drawing



Other information:

- PCB is ROHS Compliance
- PCB meets IPC-A-600 II standard requirements
- Optional M20-8890245R soldered connector
- Optional 5mm x 2.5mm Disk shaped N52 magnet