

## Features

## ICE Technology\*

- +115°C Maximum Case Temperature
- -40°C Minimum Temp.
- Built-in FCC/EN55022 Class B Filter
- 2:1 Input Voltage Range
- Six Sided Shielded Enclosure
- Ribbed or Baseplate Case Styles
- Min. Efficiency 87%
- 2kVDC Isolation
- Low Quiescent Current

### Description

The RPP20 series 2:1 input range DC/DC converters are ideal for high end industrial applications and COTS Military applications where a very wide operating temperature range of -40°C to +115°C is required. Although the case size is very compact, the converter contains a built-in filter EN55022 Class B / FCC Level B without the need for any external components. The RPP20 is available in two case styles: the ribbed case for active cooling and the baseplate case for high vibration, bulkhead-mounting or for passive cooling applications. They are UL-60950-1 certified.

### Selection Guide 12V, 24V and 48V Input Types

| Part Number    | Input Range VDC | Output Voltage VDC | Output Current mA | Efficiency <sup>(2)</sup> (Typ.) |
|----------------|-----------------|--------------------|-------------------|----------------------------------|
| RPP20-123.3S** | 9-18            | 3.3                | 6000              | 88%                              |
| RPP20-1205S**  | 9-18            | 5                  | 4000              | 89%                              |
| RPP20-1212S**  | 9-18            | 12                 | 1666              | 88%                              |
| RPP20-1215S**  | 9-18            | 15                 | 1333              | 88%                              |
| RPP20-1224S**  | 9-18            | 24                 | 830               | 88%                              |
| RPP20-243.3S** | 18-36           | 3.3                | 6000              | 88%                              |
| RPP20-2405S**  | 18-36           | 5                  | 4000              | 89%                              |
| RPP20-2412S**  | 18-36           | 12                 | 1666              | 88%                              |
| RPP20-2415S**  | 18-36           | 15                 | 1333              | 89%                              |
| RPP20-2424S**  | 18-36           | 24                 | 830               | 89%                              |
| RPP20-483.3S** | 36-75           | 3.3                | 6000              | 88%                              |
| RPP20-4805S**  | 36-75           | 5                  | 4000              | 89%                              |
| RPP20-4812S**  | 36-75           | 12                 | 1666              | 89%                              |
| RPP20-4815S**  | 36-75           | 15                 | 1333              | 88%                              |
| RPP20-4824S**  | 36-75           | 24                 | 830               | 88%                              |
| RPP20-1212D**  | 9-18            | ±12                | ±833              | 88%                              |
| RPP20-1215D**  | 9-18            | ±15                | ±666              | 88%                              |
| RPP20-1224D**  | 9-18            | ±24                | ±416              | 88%                              |
| RPP20-2412D**  | 18-36           | ±12                | ±833              | 88%                              |
| RPP20-2415D**  | 18-36           | ±15                | ±666              | 89%                              |
| RPP20-2424D**  | 18-36           | ±24                | ±416              | 88%                              |
| RPP20-4812D**  | 36-75           | ±12                | ±833              | 88%                              |
| RPP20-4815D**  | 36-75           | ±15                | ±666              | 88%                              |
| RPP20-4824D**  | 36-75           | ±24                | ±416              | 87%                              |

\*\* add suffix for case options

### SUFFIX INFORMATION

none = Standard Ribbed Case  
-B = Baseplate Case

For other CTRL logic (-1), case style (-F) or low temperature options (-L, -M, -T) please contact RECOM for availability.

## POWERLINE+

DC/DC-Converter

with 3 year Warranty

RECOM

20 Watt

2:1 Single & Dual Output



UL-60950-1 Certified  
E224736

**RPP20**

### \* ICE Technology

**ICE (Innovation in Converter Excellence)** uses state-of-the-art techniques to minimise internal power dissipation and to increase the internal temperature limits to extend the ambient operating temperature range to the maximum. Refer to Application Notes

**Specifications** (typical at nominal input and 25°C unless otherwise noted)

|                                                                                            |                                        |                  |                                                             |
|--------------------------------------------------------------------------------------------|----------------------------------------|------------------|-------------------------------------------------------------|
| Input Voltage Range                                                                        | 12V nominal input                      |                  | 9-18VDC                                                     |
|                                                                                            | 24V nominal input                      |                  | 18-36VDC                                                    |
|                                                                                            | 48V nominal input                      |                  | 36-75VDC                                                    |
| Under Voltage Lockout                                                                      | 12V input                              | DC-DC ON (min.)  | 8.5VDC                                                      |
|                                                                                            |                                        | DC-DC OFF (max.) | 8VDC                                                        |
|                                                                                            | 24V input                              | DC-DC ON (min.)  | 17.5VDC                                                     |
|                                                                                            |                                        | DC-DC OFF (max.) | 17VDC                                                       |
|                                                                                            | 48V input                              | DC-DC ON (min.)  | 35VDC                                                       |
|                                                                                            |                                        | DC-DC OFF (max.) | 34VDC                                                       |
| Input Voltage Variation dv/dt (Complies with ETS300 132 part 4.4)                          |                                        |                  | 5V/ms max                                                   |
| Input Surge Voltage (100 ms max.)                                                          | 12V, 24V Input                         |                  | 50VDC                                                       |
|                                                                                            | 48V Input                              |                  | 100VDC                                                      |
| Start Up Time                                                                              | nominal Vin and constant resistor load |                  | 20ms typ., 50ms max.                                        |
| Remote ON/OFF <sup>(4)</sup>                                                               | Logic High                             |                  | Open or 3.0V < Vr < 5.5V                                    |
|                                                                                            | Logic Low                              |                  | Short or 0V < Vr < 1.2V                                     |
| Remote OFF input current                                                                   | Nominal input                          |                  | 2mA typ.                                                    |
| Output Power                                                                               |                                        |                  | 20W                                                         |
| Output Voltage Accuracy                                                                    | 50% Load and nominal Vin               |                  | ±1.5%                                                       |
| Voltage Adjustability                                                                      | Single Output only                     |                  | ±10%                                                        |
| Minimum Load                                                                               |                                        |                  | 0%                                                          |
| Line Regulation                                                                            | low line, high line at full load       |                  | ±0.3%                                                       |
| Load Regulation                                                                            | 10% to 100% full load                  |                  | ±0.5%                                                       |
| Cross Regulation (10% <>100% Load)                                                         | Dual Outputs only                      |                  | 3% typ. / 5% max.                                           |
| Ripple and Noise (20MHz bandwidth limited)<br>(measured with 1µF capacitor across outputs) | 3.3V, 5V                               |                  | 100mVp-p typ.                                               |
|                                                                                            | All others                             |                  | 1% p-p Vout typ.                                            |
| Temperature Coefficient                                                                    |                                        |                  | ±0.04%/°C max.                                              |
| Transient Response                                                                         | 25% load step change                   |                  | 800µs                                                       |
| Over Load Protection                                                                       | % of full load at nominal Vin          |                  | 120% typ.                                                   |
| Short Circuit Protection                                                                   |                                        |                  | Power Limit, automatic recovery                             |
| Output Over Voltage Protection (refer to block diagram in Application Notes)               |                                        |                  | Converter shutdown if Vout > Vout nominal + 20% typ.        |
| Isolation Voltage                                                                          |                                        |                  | Rated at 1600VDC/1 minute, Flash tested at 2000VDC/1 second |
| Isolation Resistance                                                                       |                                        |                  | 10MΩ min.                                                   |
| Isolation Capacitance (refer to block diagram in Application Notes)                        |                                        |                  | 1500pF max.                                                 |
| Operating Frequency                                                                        |                                        |                  | 260kHz ± 40kHz                                              |
| Operating Temperature Range                                                                | Ambient, Free Convection               |                  | -40°C to see Calculation (Note 7)                           |
| Maximum Case Temperature                                                                   |                                        |                  | +115°C                                                      |
| Storage Temperature Range                                                                  |                                        |                  | -55°C to +125°C                                             |
| Over Temperature Protection (refer to block diagram in Application Notes)                  |                                        |                  | internal thermistor                                         |
| Thermal Impedance<br>(Natural convection)                                                  | Ribbed Case: Vertical                  |                  | 7.5°C/Watt                                                  |
|                                                                                            | Ribbed Case: Horizontal                |                  | 11.5°C/Watt                                                 |
| Relative Humidity                                                                          |                                        |                  | 5% to 95% RH                                                |
| Case Material <sup>(7)</sup>                                                               |                                        |                  | Aluminium                                                   |
| Potting Material                                                                           |                                        |                  | Silicone (UL94-V0)                                          |

continued on next page

## Specifications (cont.)

|                                                                    |                                        |                  |
|--------------------------------------------------------------------|----------------------------------------|------------------|
| Weight                                                             | Ribbed Case                            | 26g              |
|                                                                    | Baseplate Case                         | 43g              |
| Packing Quantity                                                   | Ribbed Case                            | 5pcs per Tube    |
|                                                                    | Baseplate Case                         | 4pcs per Tube    |
| Safety Standards                                                   | certified UL-60950-1, 1st Edition      |                  |
| Thermal Cycling                                                    | complies with MIL-STD-810F             |                  |
| Vibration                                                          | 10-55Hz, 12G, 30 Min. along X, Y and Z |                  |
| Conducted Emissions                                                | EN55022                                | Class B          |
| Radiated Emissions                                                 | EN55022                                | Class B          |
| ESD                                                                | EN61000-4-2                            | Perf. Criteria B |
| Radiated Immunity                                                  | EN61000-4-3                            | Perf. Criteria A |
| Fast Transient <sup>(5)</sup>                                      | EN61000-4-4                            | Perf. Criteria B |
| Surge <sup>(5)</sup>                                               | EN61000-4-5                            | Perf. Criteria B |
| Conducted Immunity                                                 | EN61000-4-6                            | Perf. Criteria A |
| MTBF calculated according to BELLCORE TR-NWT-000332 <sup>(6)</sup> | 2195 x 10 <sup>3</sup> hours           |                  |

## Notes :

1. Typical values at nominal input voltage and no load/full load.
2. Min. values at nominal input voltage and full load.
3. The ON/OFF pin voltage is referenced to negative input. The pin is pulled high internally.  
ON/OFF control is standard with positive logic: e.g. RPP20-2405S, RPP20-4805D-B.  
Pos. logic: 0= OFF, 1 = ON. The converter will be ON if the CTRL is left open.
4. Requires an external 100µF low ESR capacitor to meet EN61000-4-4 and EN61000-4-5
5. Case I: 50% Stress, Temperature at 50°C (Ground Benign).
6. To ensure a good all-round electrical contact, the bottom plate is pressed firmly into place into the aluminium case. The hydraulic press can leave tooling marks and deformations to both the case and plate. The case is anodised aluminium, so there will be natural variations in the case colour and the aluminium is not scratch resistant. Any resultant marks, scratches and colour variations are cosmetic only and do not affect the operation or performance of the converters.
7. Example:

$$R_{th\text{case-ambient}} = 7.5^{\circ}\text{C/W (vertical)}$$

$$R_{th\text{case-ambient}} = 11.5^{\circ}\text{C/W (horizontal)}$$

$$R_{th\text{case-ambient}} = \frac{T_{\text{case}} - T_{\text{ambient}}}{P_{\text{dissipation}}}$$

$$P_{\text{dissipation}} = P_{\text{in}} - P_{\text{out}} = \frac{P_{\text{out}}}{\eta} - P_{\text{out}}$$

$$P_{\text{dissipation}} = P_{\text{in}} - P_{\text{out}} = \frac{P_{\text{out}}}{\eta} - P_{\text{out}}$$

Practical Example:

Take the RPP20-1205S with 50% load. What is the maximum ambient operating temperature? Use converter vertical in application.

$$\text{Eff}_{\text{min}} = 89\% @ V_{\text{nom}}$$

$$P_{\text{out}} = 20\text{W}$$

$$P_{\text{outapp}} = 20 \times 0.5 = 10\text{W}$$

$$P_{\text{dissipation}} = \frac{P_{\text{out}}}{\eta} - P_{\text{out}}$$

$$\eta = \sim 88\% \text{ (from Eff vs Load Graph)}$$

$$P_{\text{dissipation}} = \frac{10}{0.88} - 10 = 1.36\text{W}$$

$T_{\text{case}}$  = Case Temperature

$T_{\text{ambient}}$  = Environment Temperature

$P_{\text{dissipation}}$  = Internal losses

$P_{\text{in}}$  = Input Power

$P_{\text{out}}$  = Output Power

$\eta$  = Efficiency under given Operating Conditions

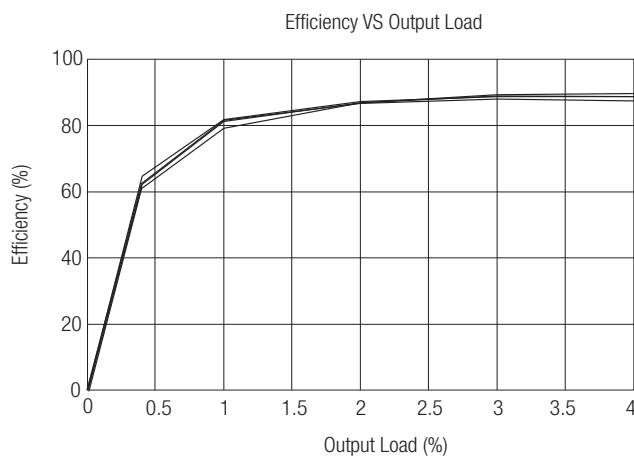
$R_{th\text{case-ambient}}$  = Thermal Impedance

$$R_{th} = \frac{T_{\text{casemax}} - T_{\text{ambient}}}{P_{\text{dissipation}}} \rightarrow 7.5^{\circ}\text{C/W} = \frac{115^{\circ}\text{C} - T_{\text{ambient}}}{1.36\text{W}}$$

$$T_{\text{ambient}} = 104.8^{\circ}\text{C}$$

## Typical Characteristics

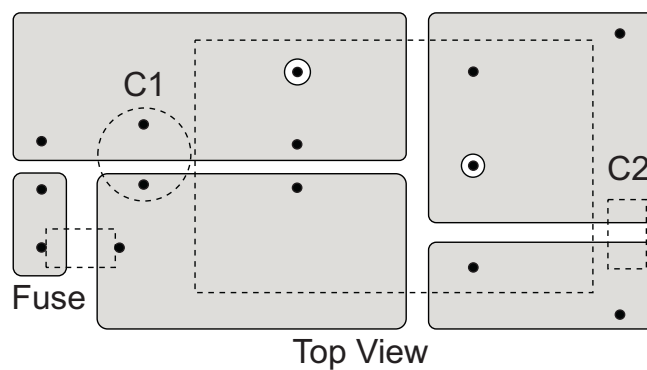
### RPP20-1209S



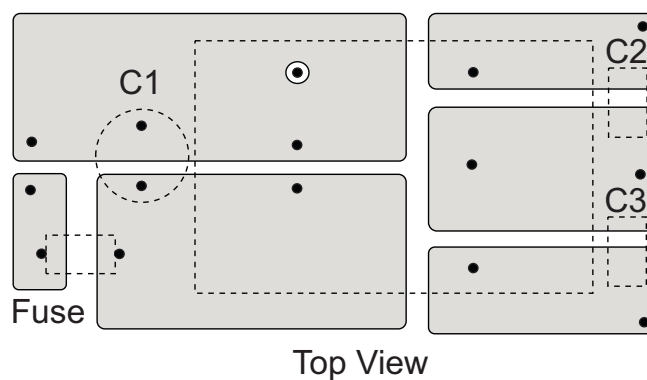
## Recommended PCB Layout

### Ribbed Case

#### Single Output



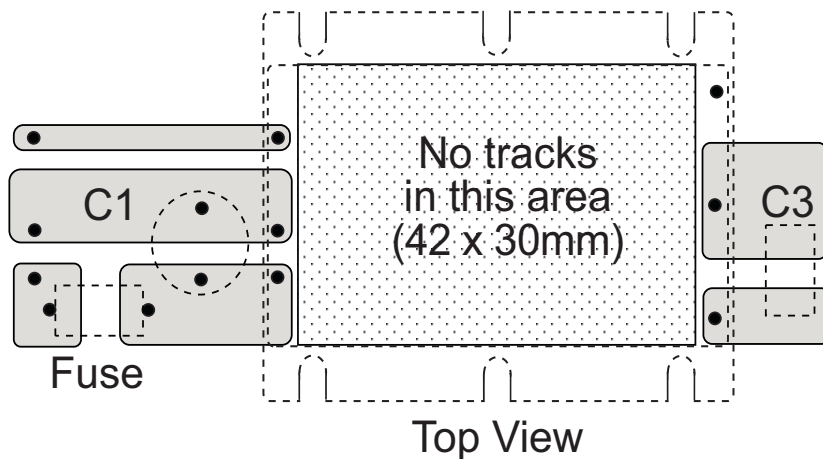
#### Dual Output



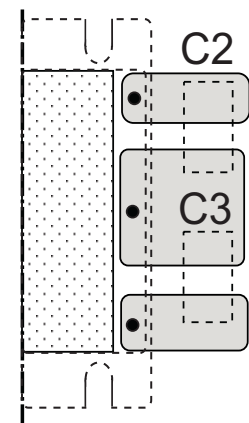
Recommended PCB Layout

Baseplate Case- suggested PCB layout

Single Output



Dual Output



Input Fuse is recommended. Recommended fuse rating = double maximum input current, time delay type.

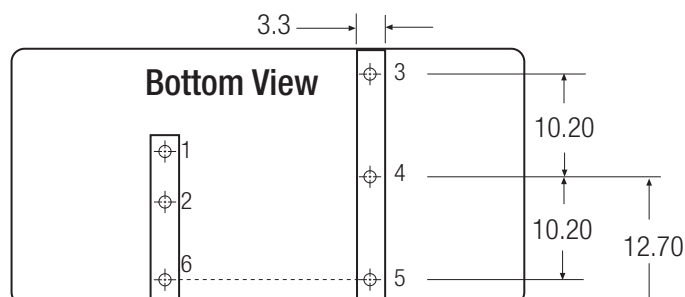
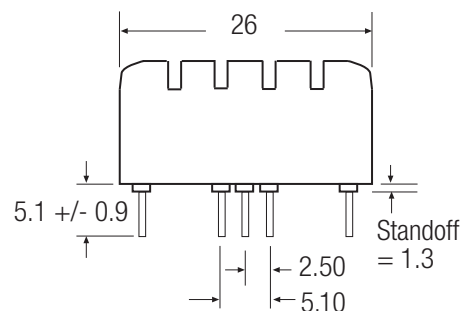
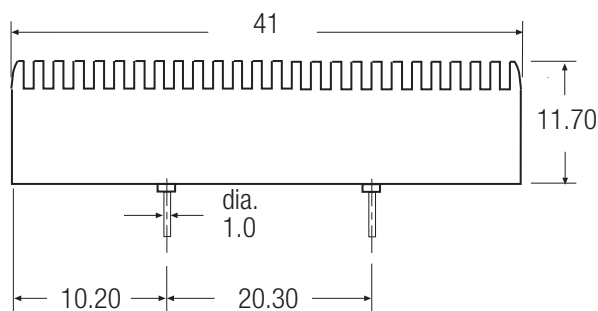
Input Capacitor, C1, is required to meet EN61000 Surge and Fast Transient, otherwise it is not required for normal operation.

Output Capacitors C2/C3 are recommended, but not required for normal operation. Typical capacitor values are 1µF MLCC

To ensure optimum thermal performance, use large areas of copper on the PCB to assist with heat dissipation and mount the converter vertically.

Package Style and Pinning (mm)

Ribbed Case (Standard - no suffix)



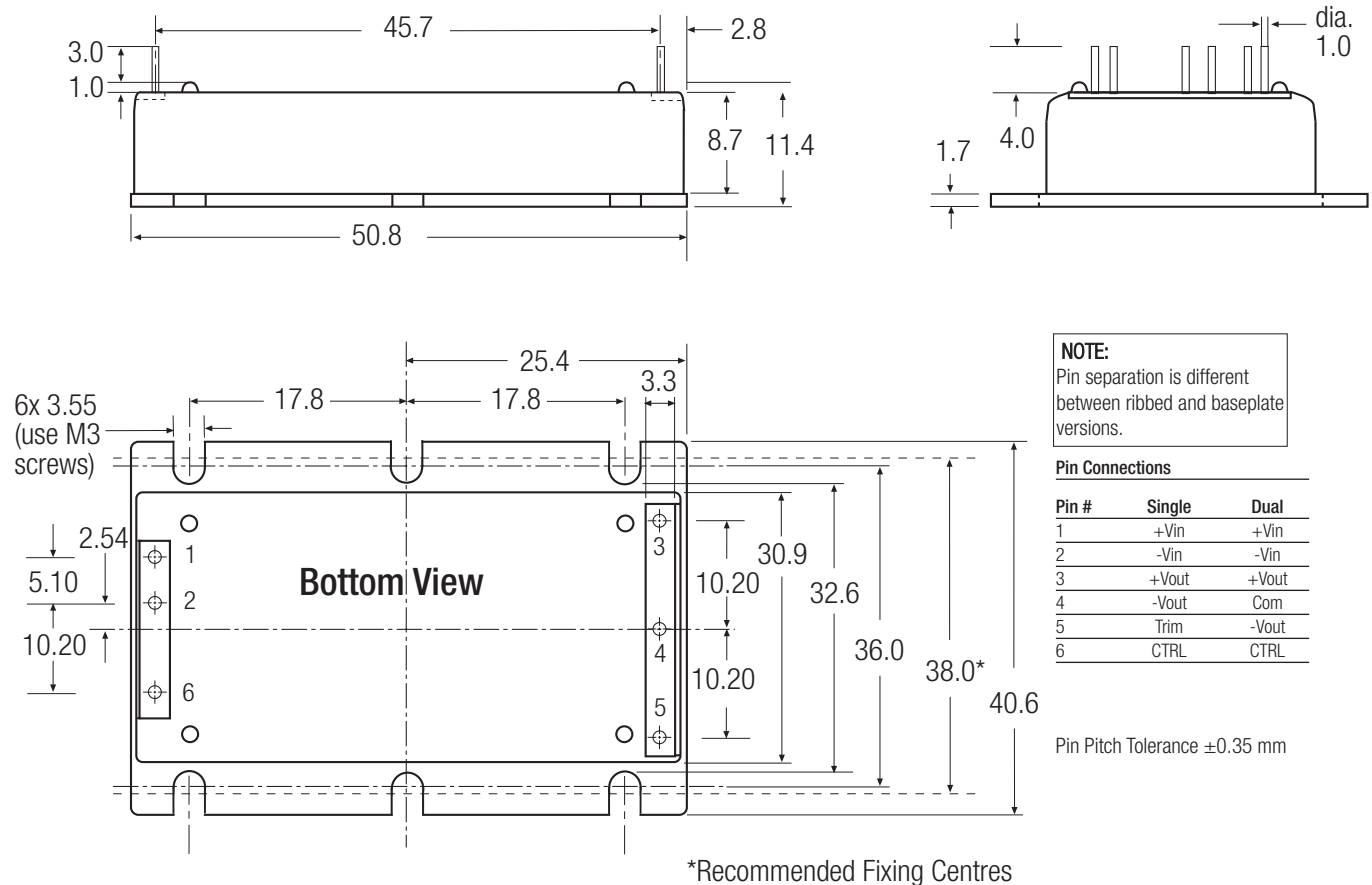
Pin Connections

| Pin # | Single | Dual  |
|-------|--------|-------|
| 1     | +Vin   | +Vin  |
| 2     | -Vin   | -Vin  |
| 3     | +Vout  | +Vout |
| 4     | Trim   | Com   |
| 5     | -Vout  | -Vout |
| 6     | CTRL   | CTRL  |

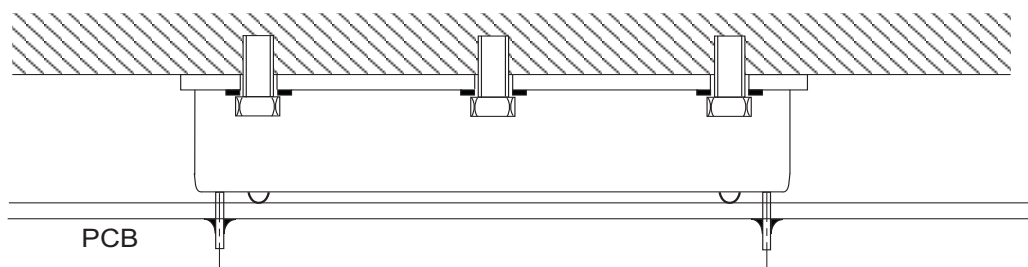
Pin Pitch Tolerance  $\pm 0.35$  mm

Package Style and Pinning (mm)

Baseplate Case (-B suffix)



Baseplate Case Fixing - Mounting onto Heatsink/Bulkhead



Baseplate Case Fixing - Anti Vibration Mounting onto PCB

