

Features

ICE Technology*

- Tx Temperature Range without Derating
- 120°C Maximum Case Temperature
- -45°C Minimum Operating Temperature
- EN 50155 Compliant
- EN 50121-3-2 Compliant
- CE Marked
- 24, 48 and 110VDC Input Ranges
- Six Sided Shielded Enclosure
- Flat, Ribbed or Baseplate Case Styles
- Efficiency to >89%
- Isolated and Fully Protected Outputs
- Low Quiescent Current

Description

The RPR20 series DC/DC converters are designed for railway rolling stock applications. Besides covering all the input voltages from 24VDC up to 110VDC, the converters have a very wide operating temperature range of -45°C to +85°C without derating. Although the case size is very compact, the converter contains a built-in EMI filter, so no active external filter components are required. The RPR20 is available in three case styles: a low profile flat top case, a ribbed case with a built-in heatsink and the baseplate case for high vibration or bulkhead mounting applications. They are EN 50155 and EN 50121-3-2 compliant.

Selection Guide 24V, 48V and 110V Input Types

| Part Number | Nominal Input VDC | Nom. Input Range VDC | Lockout Voltage VDC | Output Voltage VDC | Output Current mA |
|-----------------|-------------------|----------------------|---------------------|--------------------|-------------------|
| RPR20-243.3S** | 24 | 12-36V | 8.5V | 3.3 | 6000 |
| RPR20-2405S** | 24 | 12-36V | 8.5V | 5 | 4000 |
| RPR20-2412S** | 24 | 12-36V | 8.5V | 12 | 1666 |
| RPR20-2415S** | 24 | 12-36V | 8.5V | 15 | 1333 |
| RPR20-2424S** | 24 | 12-36V | 8.5V | 24 | 830 |
| RPR20-483.3S** | 48 | 25-75 | 17.5 | 3.3 | 6000 |
| RPR20-4805S** | 48 | 25-75 | 17.5 | 5 | 4000 |
| RPR20-4812S** | 48 | 25-75 | 17.5 | 12 | 1666 |
| RPR20-4815S** | 48 | 25-75 | 17.5 | 15 | 1333 |
| RPR20-4824S** | 48 | 25-75 | 17.5 | 24 | 830 |
| RPR20-1103.3S** | 110 | 40-160 | 36 | 3.3 | 6000 |
| RPR20-11005S** | 110 | 40-160 | 36 | 5 | 4000 |
| RPR20-11012S** | 110 | 40-160 | 36 | 12 | 1666 |
| RPR20-11015S** | 110 | 40-160 | 36 | 15 | 1333 |
| RPR20-11024S** | 110 | 40-160 | 36 | 24 | 830 |
| RPR20-2412D** | 24 | 12-36V | 8.5V | ±12 | ±833 |
| RPR20-2415D** | 24 | 12-36V | 8.5V | ±15 | ±666 |
| RPR20-2424D** | 24 | 12-36V | 8.5V | ±24 | ±416 |
| RPR20-4812D** | 48 | 25-75 | 17.5 | ±12 | ±833 |
| RPR20-4815D** | 48 | 25-75 | 17.5 | ±15 | ±666 |
| RPR20-4824D** | 48 | 25-75 | 17.5 | ±24 | ±416 |
| RPR20-11012D** | 110 | 40-160 | 36 | ±12 | ±833 |
| RPR20-11015D** | 110 | 40-160 | 36 | ±15 | ±666 |
| RPR20-11024D** | 110 | 40-160 | 36 | ±24 | ±416 |

** add suffix "-F" for low profile Flat case or "-B" for Baseplate case and no suffix is the Ribbed case.
add "1" before suffix for neg. CTRL logic e.g. -1, -1B, -1F, etc.

POWERLINE+

Railway-Converter

with 3 year Warranty

RECOM

20 Watt Single & Dual Output



EN-50155 Certified
EN-60950-1 Certified

RPR20

* 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

Railway Input Voltage Requirements

| Nominal Input Voltage | EN50155 | | | NF F 01-510 | | | RPR20 | | |
|-----------------------|-------------|-------------------|----------------|-------------|-------------------|----------------|-------------|-------------------|----------------|
| | Input Range | Min. Input (0.1s) | Max Input (1s) | Input Range | Min. Input (0.1s) | Max Input (1s) | Input Range | Min. Input (0.1s) | Max Input (1s) |
| 24V | 16.8~30V | 14.4V | 33.6V | 18~34V | 12V | 40V | 12~36V | 9V | 40V |
| 48V | 33.6~60V | 28.8V | 67.2V | | | | 25~75V | 18V | 80V |
| 72V | 50.4~90V | 43.2V | 100.8V | 50~90V | 36V | 115V | 40~160V | 36V | 176V |
| 96V | 67.2~120V | 57.6V | 134.4V | | | | 40~160V | 36V | 176V |
| 110V | 77~137.5V | 66V | 154V | 77~137V | 55V | 176V | 40~160V | 36V | 176V |

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

| | | |
|--|--|--|
| Input Voltage Range (continuous) | complies with EN50155 and NFF 01-510 (Un=24V) complies with EN50155 and NFF 01-510 (Un=48V) complies with EN50155 and NFF 01-510 (Un=72V, 96V &110V) | 12-36VDC 25-75VDC 40-160VDC |
| Low Transient operating voltage (100ms) | complies with EN50155 and NFF 01-510 | Un x 0.5 |
| High Transient operating voltage (1 second) | complies with EN50155 and NFF 01-510 | Un x 1.6 |
| Allowed Input Ripple | complies with EN50155 | 15% |
| Input Reflected Ripple | nominal Vin and full load | 20mA _{p-p} |
| Supply Interruption (Perf. Criteria B) | according to EN50155, 5.1.1.2 according to EN50155, 5.1.3 | Class S2 Class C2 |
| Start Up Time | nominal Vin and constant resistive load | 2ms typ., 5ms max. |
| Remote ON/OFF ⁽¹⁾ | Logic High Logic Low | Open or 3.0V < Vr < 5.5V Short or 0V < Vr < 1.2V |
| Remote OFF input current | Nominal input | 2mA typ. |
| 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) | (measured with 1µF capacitor across outputs) | 1% Vout typ. / 3% max. |
| 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 | | Current limit, automatic recovery |
| Output Over Voltage Protection | Single Output Dual Output | Converter shutdown if Vout > Vout nominal + 20% Converter shutdown if Vout > Vout nominal + 10% |
| Isolation Voltage | According to EN50155 12.2.9.2 | 1500VAC/1 minute |
| Isolation Resistance | According to EN50155 12.2.9.1 | 10MΩ min. |
| Isolation Capacitance | | 1500pF max. |
| Operating Frequency | | 260kHz ± 40kHz |
| Operating Temperature Range (Tx) (Ambient Air, Free Convection) | complies with EN50155: 4.1.2 and EN50125-1 with derating | -45°C to +85°C -45°C to +100°C |
| Maximum Case Temperature | | +120°C |
| Over Temperature Protection | | Internal thermistor |
| Storage Temperature Range | | -55°C to +125°C |
| Relative Humidity | | 5% to 95% RH |
| Case Material ⁽²⁾ | | Aluminium |

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DC/DC-Converter

RPR20-S_D Series

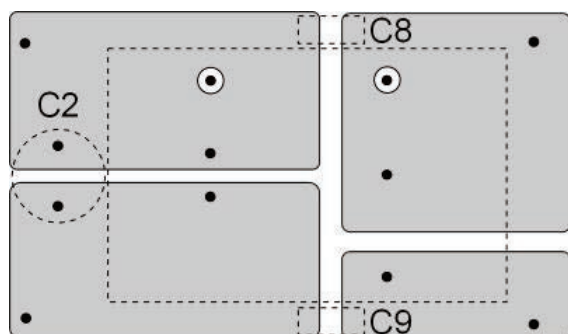
Specifications (typical at nominal input and 25°C unless otherwise noted)

| | | |
|---|---------------------|---|
| Potting Material | Silicone (UL94-V0) | |
| Weight | Flat Case | 22g |
| | Ribbed Case | 26g |
| | Baseplate Case | 43g |
| Packing Quantity | Flat, Ribbed Case | 4 pcs per Tube |
| | Baseplate Case | Single packed |
| Safety Standards | CE Marked | certified to EN-60950-1, 1st Edition |
| Thermal Performance | Cold | -40°C /16 Hours |
| | Dry Heat, Operating | -40°C/+85°C/ 5 Cycles |
| complies to EN50155: 12.2.3/4/5 | Damp Heat, Cyclic | +25°C/+55°C, 95%RH / 2 x 24 Hours |
| Vibration, Shock & Bump (complies with EN61373, Category 1 Class B) | Vibration | 5-150Hz, X:0.7m/s ² , Y:0.45m/s ² , Z:1m/s ² , 30 mins |
| | Shock | 5g/30ms/18 shocks |
| Input Filter | Built-in Pi Filter | |
| Conducted Emissions | EN50121-3-2 | Class A |
| Radiated Emissions | EN50121-3-2 | Class A |
| ESD | EN50121-3-2 | Perf. Criteria B |
| Radiated Immunity | EN50121-3-2 | Perf. Criteria A |
| Fast Transient | EN50121-3-2 | Perf. Criteria A |
| Surge | EN50121-3-2 | Perf. Criteria B |
| Conducted Immunity | EN50121-3-2 | Perf. Criteria A |
| MTBF calculated according to BELLCORE TR-NWT-000332 Case I: 50% Stress, Temperature at 50°C (Ground Benign) | | 2195 x 10 ³ hours |

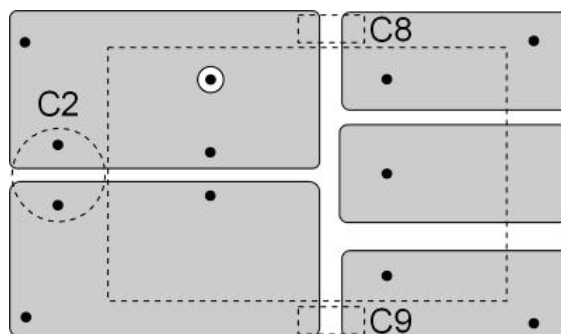
Recommended PCB Layout

Ribbed and Flat Case

Single Output

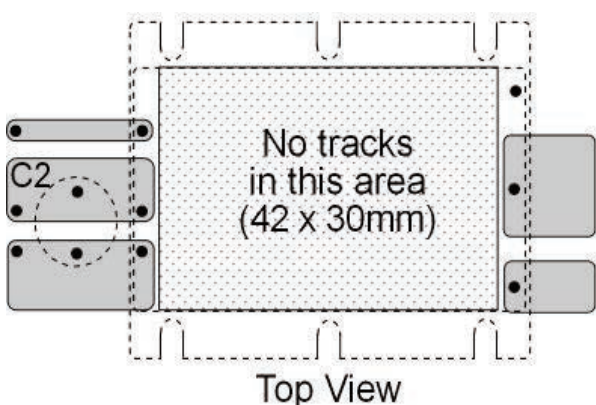


Dual Output

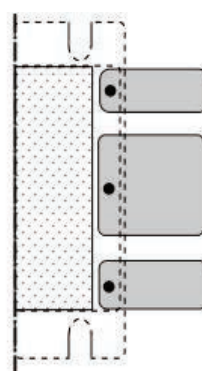


Baseplate Case- suggested PCB layout

Single Output



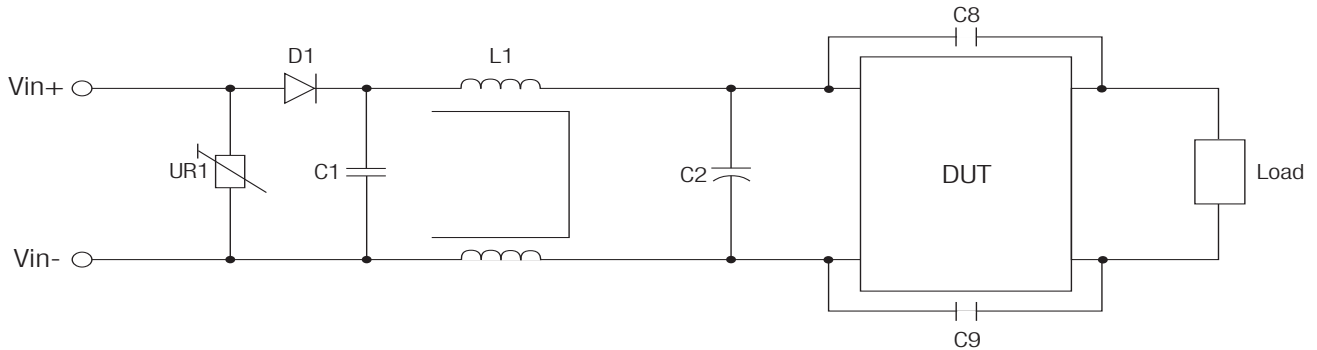
Dual Output



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

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

EN50155 / NF F 01-510 Input Filter



Table

| Module | Standard | UR1 | D1 | C1 | L1 | C2 | C8,C9 |
|--------|-----------------|----------------|---------|------------|------------------------|------------------|-----------|
| 24V | EN55011 Class A | MOV 14D361K | 100V/3A | 685pF/50V | 550 μ H \pm 20% | 680 μ F/250V | 472pF/3kV |
| 48V | EN55011 Class A | MOV 14D361K | 100V/3A | 225pF/100V | 550 μ H \pm 20% | 680 μ F/250V | 472pF/3kV |
| 110V | EN55011 Class A | MOV 14D361K | 100V/3A | 474pF/250V | 1200 μ H \pm 20% | 680 μ F/250V | 472pF/3kV |

Notes :

- 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. RPR20-2405S, RPR20-4805D-B.
Add "1" before the suffix for negative logic: e.g. RPR20-2405S-1, RPR20-11005D-1B.
Positive logic: 0= OFF, 1 = ON. The converter will be ON if the CTRL is left open.
Negative logic: 1 = OFF, 0 = ON. The converter will be OFF if the CTRL is left open..
- To ensure a good all-round electrical contact, the baseplate is pressed firmly into place within the aluminium housing. The hydraulic press can leave tooling marks and deformations to both the housing and baseplate. 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.
- The converter is supplied with a protective adhesive tape to keep the top surface clean. The tape is heat resistant and the converter can be soldered into place without removing the tape. The tape should be removed just before final installation.

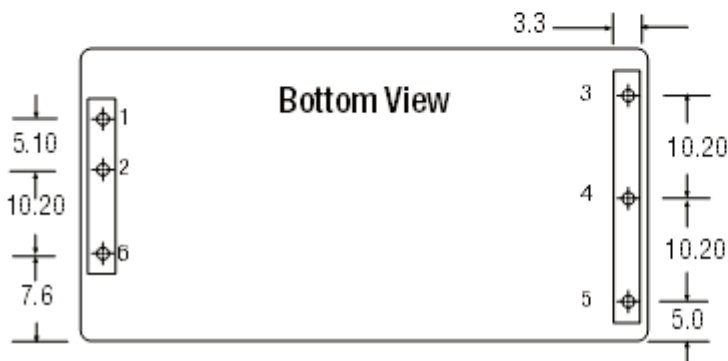
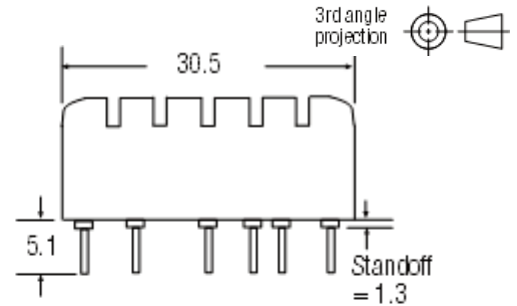
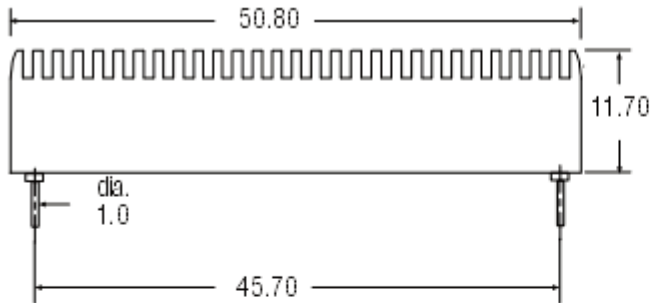
POWERLINE+

DC/DC-Converter

Package Style and Pinning (mm)

RPR20-S_D Series

Ribbed Case (No suffix)

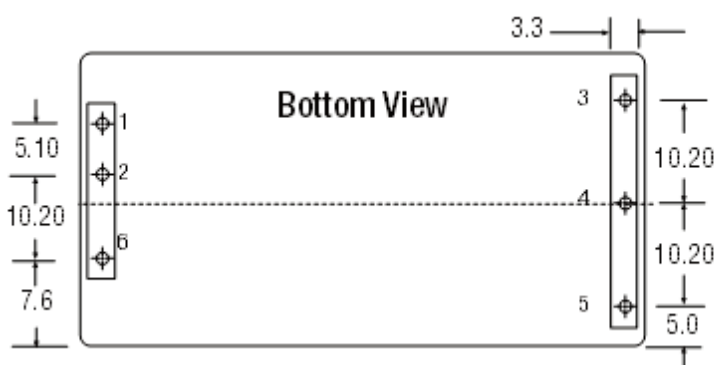
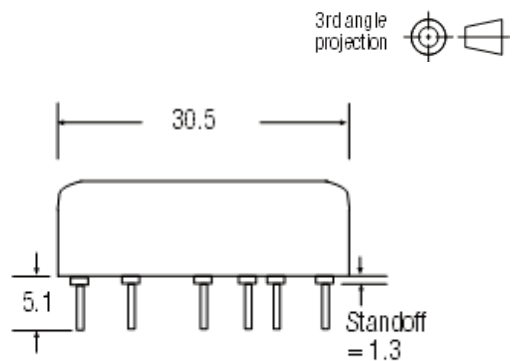
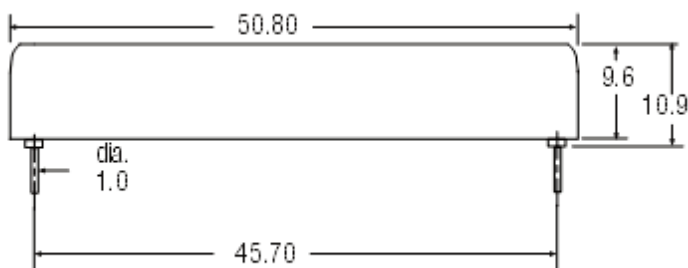


Pin Connections

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

Pin Pitch Tolerance ± 0.35 mm

Flat Case (-F suffix)



Pin Connections

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

Pin Pitch Tolerance ± 0.35 mm

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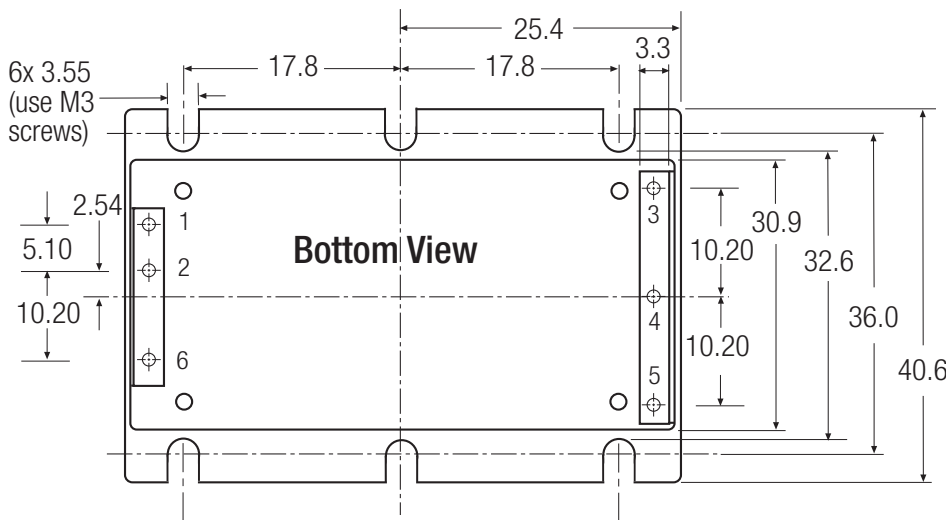
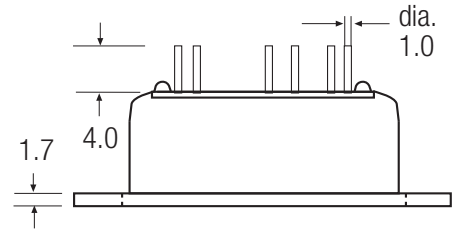
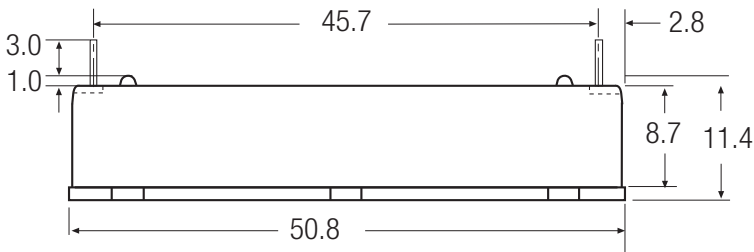
DC/DC-Converter

Package Style and Pinning (mm)

RPR20-S_D Series

Baseplate Case (-B Suffix)

3rd angle projection



NOTE: Single output pinout is different for the -B version!

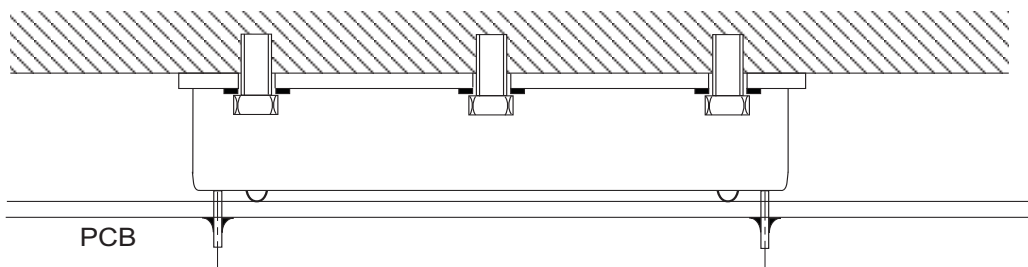
Pin Connections

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

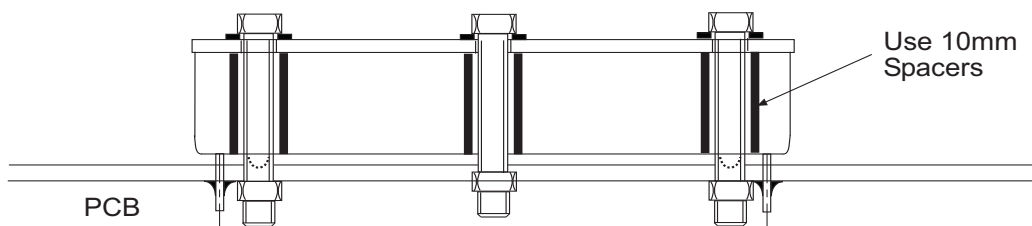
Pin Pitch Tolerance ± 0.35 mm

RPR20

Baseplate Case Fixing - Mounting onto Heatsink/Bulkhead



Baseplate Case Fixing - Anti Vibration Mounting onto PCB



Use 10mm Spacers