

Features

Evaluation Module

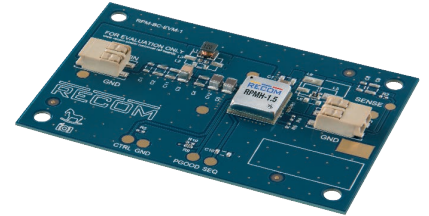
- Evaluation platform for RPMH-1.5 Power Modules
- Thermal design considerations included
- EMI Class B filter
- Easy evaluation of control, power good, sequencing and sensing functions

RECOM
Evaluation Module

RPMH-1.5-EVM-1

Description

The RPMH-1.5-EVM-1 generates a constant output voltage with an output current up to 1.5A from an external DC source. All the functions of the RPMH-1.5 like trimming, sequencing, control, and sensing can be evaluated. Also the behavior in overload or over temperature can be evaluated easily before it is designed in.



Selection Guide

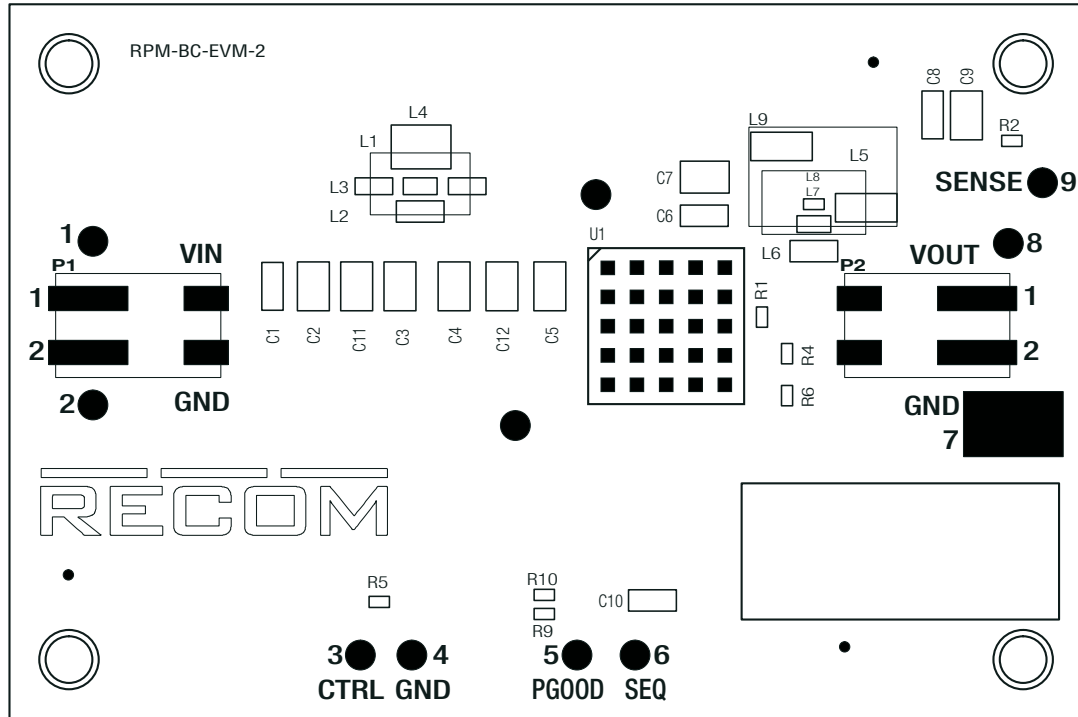
| Part Number | Input Voltage Range [VDC] | Output Voltage nom. [VDC] | Output Current max. [A] |
|-------------------|---------------------------|---------------------------|-------------------------|
| RPMH3.3-1.5-EVM-1 | 5 - 60 | 3.3 | 1.5 |
| RPMH5.0-1.5-EVM-1 | 7 - 60 | 5 | 1.5 |
| RPMH12-1.5-EVM-1 | 14 - 60 | 12 | 1.5 |
| RPMH15-1.5-EVM-1 | 17 - 60 | 15 | 1.5 |
| RPMH24-1.5-EVM-1 | 26 - 60 | 24 | 1.5 |

Quick Start Guide

- 1) Connect P1 to power supply (observe correct polarity!)
- 2) Connect P2 to a Load
- 3) Connect sense to the required potential
The sense preset is via R1 directly at the power module, so the preset voltage is very accurate at the output of the RPMH-1.5. To equalize ohmic losses of the filter, remove the resistor at R1, and solder a 0Ω resistor at R2.
- 4) Disable the device via R5
The device is preset as normally on. It can be disabled by pulling the CTRL pad to GND. Short R5 to disable the device.

Specifications (measured @ Ta= 25°C, full load after warm up unless otherwise stated)

Component Placement



Connector Description

P1

| Pin | Name | Description |
|-----|-----------------|---|
| 1 | V _{in} | Positive Output Voltage (observe correct polarity!) |
| 2 | GND | Common GND |

P2

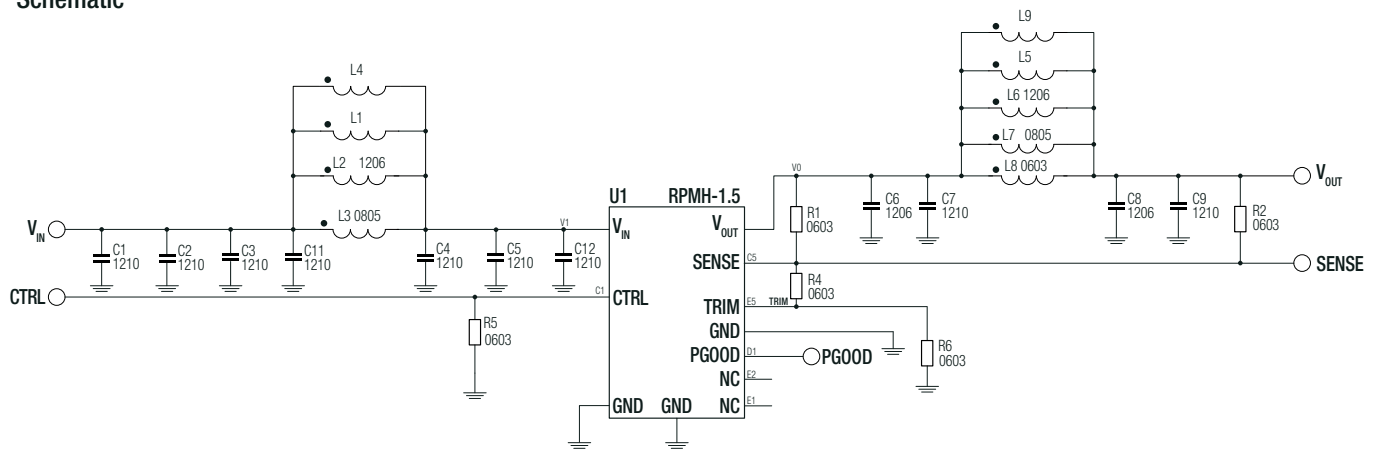
| Pin | Name | Description |
|-----|------------------|-------------------------|
| 1 | V _{out} | Positive Output Voltage |
| 2 | GND | Common GND |

PADS direct connection

| Pin | Name | Description |
|-----|------------------|--|
| 1 | V _{in} | Positive Input Voltage |
| 2 | GND | Common GND |
| 3 | CTRL | CTRL Pin (leave open if not used) |
| 4 | GND | Common GND |
| 5 | PGOOD | Power good signal |
| 6 | SEQ | Not used |
| 7 | GND | Common GND, can connect oscilloscope GND for measurement |
| 8 | V _{out} | Positive Output Voltage |
| 9 | SENSE | Output Voltage Sense Pin (leave open if not used) |

Specifications (measured @ Ta= 25°C, full load after warm up unless otherwise stated)

Schematic



Notes:

Note1: Not all components are populated. See the BOM for all EVM variants.

Description

U1: RPMH-1.5 power module.

C1,C2,C3,C11,L1,L2,L3,L4,C4,C5,C12: allow placement of various sized components to test input filter design. The populated filter is designed to meet EN55032 class B.

C6,C7,L5,L6,L7, C8,C9: allow placement of various sized components to test output filter design. The populated filter is designed to meet EN55032 class B.

R5: connect 0Ω resistor to disable the module. This resistor is not populated.

R9: optional, this resistor is not populated. PGOOD is internally pulled up to 5V. This is for output power good signal. Refer to [RPMH-1.5 datasheet](#) for more information.

R10: optional, this resistor is not populated. Refer to [RPMH-1.5 datasheet](#) for more information.

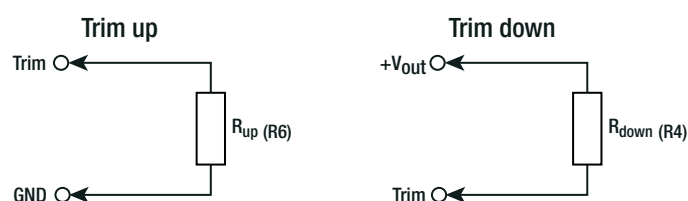
R1: populated 0Ω resistor for direct output voltage measurement. If sense is desired at a different location, for example after the filter or directly at the load, desolder R1, and connect sense to the new measurement point.

R2: sense point for output voltage after the filter. To set sense point here, remove R1 and solder a 0Ω resistor at R2.

R4 and R6: trim the output voltage. Refer to „**OUTPUT VOLTAGE TRIMMING**“.

OUTPUT VOLTAGE TRIMMING

The RPMH-series offers the feature of trimming the output voltage over a range **between -20% to +10% for lower output voltages and from -40% to +10% for higher output voltages**. This can be done by using external trim resistors. The values for the trim resistors in trim tables are according to standard E96 values; therefore, the specified voltage may slightly vary.



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Specifications (measured @ Ta= 25°C, full load after warm up unless otherwise stated)

Calculation:

$V_{out_{nom}}$ = nominal output voltage [VDC]
 $V_{out_{set}}$ = trimmed output voltage [VDC]
 R_{up} = trim up resistor [kΩ]
 R_{down} = trim down resistor [kΩ]
 R_{HI}, R_{LO} = internal resistors [kΩ]

| $V_{out_{nom}}$ | R_{HI} | R_{LO} |
|-----------------|----------|----------|
| 3.3VDC | 100kΩ | 43k2Ω |
| 5VDC | 100kΩ | 24k9Ω |
| 12VDC | 100kΩ | 9k09Ω |
| 15VDC | 100kΩ | 7k15Ω |
| 24VDC | 100kΩ | 4k32Ω |

$$R_{up} = \frac{R_{HI} \times R_{LO} \times V_{out_{nom}}}{(V_{out_{set}} - V_{out_{nom}}) \times (R_{HI} + R_{LO})}$$

$$R_{down} = R_{HI} \times \left[\frac{(V_{out_{set}} - V_{out_{nom}}) \times R_{LO} + V_{out_{set}} \times R_{HI}}{(V_{out_{nom}} - V_{out_{set}}) \times (R_{HI} + R_{LO})} \right]$$

Practical Example RPMH3.3-1.5, trim up

$V_{out_{set}} = 3.63VDC$

$$R_{up} = \frac{100k \times 43k2 \times 3.3}{(3.63 - 3.3) \times (100k + 43k2)} = \underline{\underline{301k\Omega}}$$

R_{up} according to E96 \approx 301kΩ

Practical Example RPMH3.3-1.5, trim down

$V_{out_{set}} = 2.64VDC$

$$R_{down} = 100k \times \left[\frac{(2.64 - 3.3) \times 43k2 + 2.64 \times 100k}{(3.3 - 2.64) \times (100k + 43k2)} \right] = \underline{\underline{249 k\Omega}}$$

R_{down} according to E96 \approx 249kΩ

RPMH3.3-1.5

Trim up

| | | | | | |
|--------------------------|------|-------|------|-------|-------|
| $V_{out_{set}} =$ | 3.4V | 3.45V | 3.5V | 3.63V | [VDC] |
| R_{up} (E96) \approx | 1M | 665k | 499k | 301k | [Ω] |

Trim down

| | | | | | |
|----------------------------|------|------|------|-------|-------|
| $V_{out_{set}} =$ | 3.1V | 3V | 2.8V | 2.64V | [VDC] |
| R_{down} (E96) \approx | 1M05 | 665k | 357k | 249k | [Ω] |

RPMH5.0-1.5

Trim up

| | | | | |
|--------------------------|------|------|------|-------|
| $V_{out_{set}} =$ | 5.1V | 5.3V | 5.5V | [VDC] |
| R_{up} (E96) \approx | 1M | 332k | 200k | [Ω] |

Trim down

| | | | | | |
|----------------------------|------|------|------|------|-------|
| $V_{out_{set}} =$ | 4.7V | 4.5V | 4.3V | 4V | [VDC] |
| R_{down} (E96) \approx | 1M24 | 698k | 475k | 301k | [Ω] |

RPMH12-1.5

Trim up

| | | | | | | |
|--------------------------|------|------|------|------|------|-------|
| $V_{out_{set}} =$ | 12.4 | 12.6 | 12.8 | 13 | 13.2 | [VDC] |
| R_{up} (E96) \approx | 249k | 165k | 124k | 100k | 82k5 | [Ω] |

Trim down

| | | | | | | | | |
|----------------------------|------|------|------|------|------|------|------|-------|
| $V_{out_{set}} =$ | 10 | 9.6 | 9 | 8.5 | 8 | 7.7 | 7.2 | [VDC] |
| R_{down} (E96) \approx | 453k | 357k | 267k | 215k | 174k | 154k | 130k | [Ω] |

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Specifications (measured @ Ta= 25°C, full load after warm up unless otherwise stated)

RPMH15-1.5

Trim up

| | | | | | | | |
|-------------------------|------|------|------|------|------|------|-------|
| V _{outset} = | 15.5 | 15.7 | 15.9 | 16.1 | 16.3 | 16.5 | [VDC] |
| R _{up} (E96) ≈ | 200k | 143k | 110k | 88k7 | 76k8 | 66k5 | [Ω] |

Trim down

| | | | | | |
|---------------------------|------|------|------|------|-------|
| V _{outset} = | 14.5 | 14 | 13.5 | 13 | [VDC] |
| R _{down} (E96) ≈ | 2M67 | 1M30 | 825k | 604k | [Ω] |

RPMH24-1.5

Trim up

| | | | | | | | | |
|-------------------------|------|------|------|------|------|------|------|-------|
| V _{outset} = | 24.5 | 25 | 25.5 | 26 | 26.5 | 27 | 28 | [VDC] |
| R _{up} (E96) ≈ | 200k | 100k | 66k5 | 49k9 | 40k2 | 33k2 | 24k9 | [Ω] |

Trim down

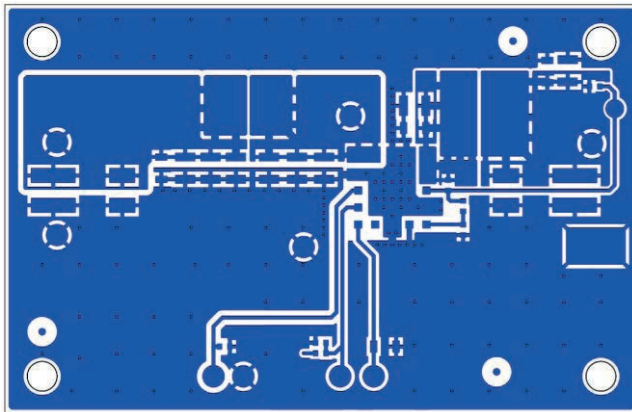
| | | | | | | | |
|---------------------------|------|------|------|------|------|------|-------|
| V _{outset} = | 20.1 | 19.6 | 18 | 17.6 | 17 | 16.5 | [VDC] |
| R _{down} (E96) ≈ | 487k | 422k | 280k | 261k | 226k | 205k | [Ω] |

DIMENSION AND PHYSICAL CHARACTERISTICS

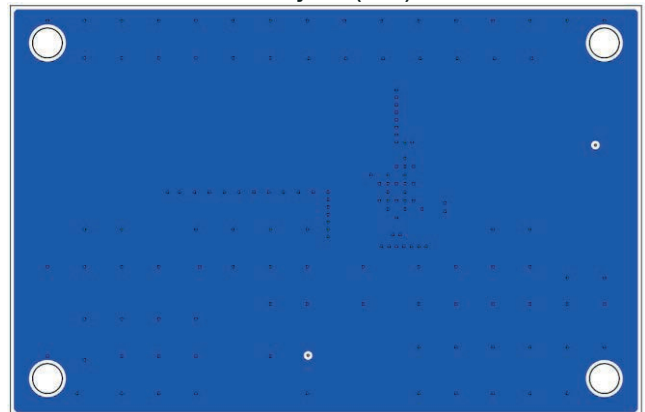
| Parameter | Type | Value |
|-------------------|------|---------------------|
| Dimension (LxWxH) | | 85.0 x 55.0 x 5.9mm |
| Weight | | 21g typ. |

Layout

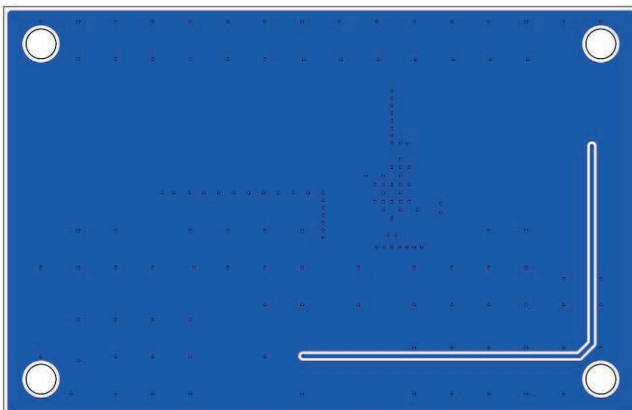
Top Layer



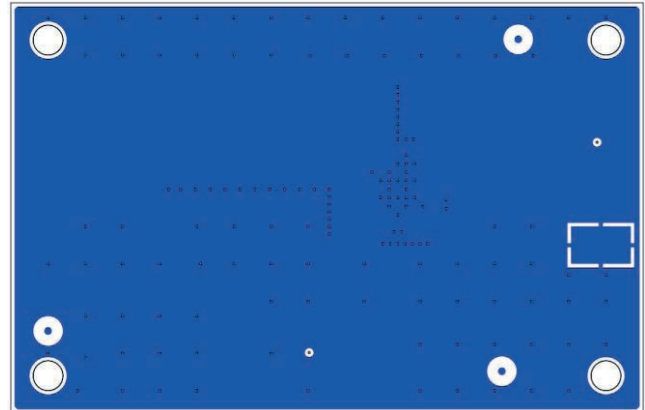
Layer 2 (GND)



Layer 3 (Single)



Bottom (GND)



Notes:

Note2: Visit www.recom-power.com/eval-ref-boards to download the Gerber files.

Specifications (measured @ Ta= 25°C, full load after warm up unless otherwise stated)

BOM

RPMH3.3-1.5-EVM-1

| Component | Description | Manufacturer Part Number | Manufacturer | Remarks |
|-----------|---------------------------|--------------------------|--------------------|------------------|
| C1 | 1206 | | | Not Mounted |
| C2 | 1210 | | | Not Mounted |
| C3 | 3.3µF 100V X7R 1210 | AVX | 12101C335K4T2A | X7S as alternate |
| C4 | 1210 | | | Not Mounted |
| C5 | 2.2µF 100V X7R 1206 | AVX | 12101C225KAT4A | X7S as alternate |
| C6 | 1206 | | | Not Mounted |
| C7 | 1210 | | | Not Mounted |
| C8 | 1206 | | | Not Mounted |
| C9 | 1210 | | | Not Mounted |
| C10 | 1206 | | | Not Mounted |
| C11 | 1210 | | | Not Mounted |
| C12 | 1210 | | | Not Mounted |
| L1 | 8.8mm x 4.75mm | | | Not Mounted |
| L2 | 1206 | | | Not Mounted |
| L3 | FIXED INDUCTOR 4.7µH 1.5A | MURATA | DFE252012F-4R7M=P2 | |
| L4 | 4.5mm x 3.2mm | | | Not Mounted |
| L5 | 8.8mm x 4.75mm | | | Not Mounted |
| L6 | 1206 | | | Not Mounted |
| L7 | 0Ω JUMPER 0805 0W125 | VISHAY | CRCW08050000Z0ECC | Use 0R 0805 |
| L8 | 0603 | | | Not Mounted |
| L9 | 11.68mm x 7.2mm | | | Not Mounted |
| P1 | CONNECTOR | WURTH | 695402400222 | |
| P2 | CONNECTOR | WURTH | 695402400222 | |
| R1 | 0Ω JUMPER 0603 0W1 | VISHAY | CRCW06030000Z0EAC | |
| R2 | 0603 | | | Not Mounted |
| R4 | 0603 | | | Not Mounted |
| R5 | 0603 | | | Not Mounted |
| R6 | 0603 | | | Not Mounted |
| R9 | 0603 | | | Not Mounted |
| R10 | 0603 | | | Not Mounted |
| U1 | RPMH3.3-1.5 MODULE | RECOM | RPMH3.3-1.5 | |

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Specifications (measured @ Ta= 25°C, full load after warm up unless otherwise stated)

RPMH5.0-1.5-EVM-1

| Component | Description | Manufacturer Part Number | Manufacturer | Remarks |
|-----------|---------------------------|--------------------------|--------------------|------------------|
| C1 | 1206 | | | Not Mounted |
| C2 | 1210 | | | Not Mounted |
| C3 | 3.3μF 100V X7R 1210 | AVX | 12101C335K4T2A | X7S as alternate |
| C4 | 1210 | | | Not Mounted |
| C5 | 2.2μF 100V X7R 1206 | AVX | 12101C225KAT4A | X7S as alternate |
| C6 | 1206 | | | Not Mounted |
| C7 | 1210 | | | Not Mounted |
| C8 | 1206 | | | Not Mounted |
| C9 | 1210 | | | Not Mounted |
| C10 | 1206 | | | Not Mounted |
| C11 | 1210 | | | Not Mounted |
| C12 | 1210 | | | Not Mounted |
| L1 | 8.8mm x 4.75mm | | | Not Mounted |
| L2 | 1206 | | | Not Mounted |
| L3 | FIXED INDUCTOR 4.7μH 1.5A | MURATA | DFE252012F-4R7M=P2 | |
| L4 | 4.5mm x 3.2mm | | | Not Mounted |
| L5 | 8.8mm x 4.75mm | | | Not Mounted |
| L6 | 1206 | | | Not Mounted |
| L7 | 0Ω JUMPER 0805 0W125 | VISHAY | CRCW08050000Z0ECC | Use 0R 0805 |
| L8 | 0603 | | | Not Mounted |
| L9 | 11.68mm x 7.2mm | | | Not Mounted |
| P1 | CONNECTOR | WURTH | 695402400222 | |
| P2 | CONNECTOR | WURTH | 695402400222 | |
| R1 | 0Ω JUMPER 0603 0W1 | VISHAY | CRCW06030000Z0EAC | |
| R2 | 0603 | | | Not Mounted |
| R4 | 0603 | | | Not Mounted |
| R5 | 0603 | | | Not Mounted |
| R6 | 0603 | | | Not Mounted |
| R9 | 0603 | | | Not Mounted |
| R10 | 0603 | | | Not Mounted |
| U1 | RPMH5.0-1.5 MODULE | RECOM | RPMH5.0-1.5 | |

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Specifications (measured @ Ta= 25°C, full load after warm up unless otherwise stated)

RPMH12-1.5-EVM-1

| Component | Description | Manufacturer Part Number | Manufacturer | Remarks |
|-----------|---------------------------|--------------------------|-------------------|------------------|
| C1 | 1206 | | | Not Mounted |
| C2 | 1210 | | | Not Mounted |
| C3 | 3.3µF 100V X7R 1210 | AVX | 12101C335K4T2A | X7S as alternate |
| C4 | 1210 | | | Not Mounted |
| C5 | 2.2µF 100V X7R 1206 | AVX | 12101C225KAT4A | X7S as alternate |
| C6 | 1206 | | | Not Mounted |
| C7 | 10µF 50V X7R 1210 | AVX | 2105C106KAT2A | X7S as alternate |
| C8 | 1206 | | | Not Mounted |
| C9 | 10µF 50V X7R 1210 | AVX | 2105C106KAT2A | X7S as alternate |
| C10 | 1206 | | | Not Mounted |
| C11 | 1210 | | | Not Mounted |
| C12 | 1210 | | | Not Mounted |
| L1 | 8.8mm x 4.75mm | | | Not Mounted |
| L2 | FIXED INDUCTOR 5.6µH 1.7A | PULSE ELECTRONICS | PA4547.562NLT | |
| L3 | 0805 | | | Not Mounted |
| L4 | 4.5mm x 3.2mm | | | Not Mounted |
| L5 | 8.8mm x 4.75mm | | | Not Mounted |
| L6 | 1206 | | | Not Mounted |
| L7 | 0Ω JUMPER 0805 0W125 | VISHAY | CRCW08050000Z0ECC | Use 0R 0805 |
| L8 | 0603 | | | Not Mounted |
| L9 | 11.68mm x 7.2mm | | | Not Mounted |
| P1 | CONNECTOR | WURTH | 695402400222 | |
| P2 | CONNECTOR | WURTH | 695402400222 | |
| R1 | 0Ω JUMPER 0603 0W1 | VISHAY | CRCW06030000Z0EAC | |
| R2 | 0603 | | | Not Mounted |
| R4 | 0603 | | | Not Mounted |
| R5 | 0603 | | | Not Mounted |
| R6 | 0603 | | | Not Mounted |
| R9 | 0603 | | | Not Mounted |
| R10 | 0603 | | | Not Mounted |
| U1 | RPMH12-1.5 MODULE | RECOM | RPMH12-1.5 | |

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Specifications (measured @ Ta= 25°C, full load after warm up unless otherwise stated)

RPMH15-1.5-EVM-1

| Component | Description | Manufacturer Part Number | Manufacturer | Remarks |
|-----------|--------------------------|--------------------------|-------------------|------------------|
| C1 | 1206 | | | Not Mounted |
| C2 | 1210 | | | Not Mounted |
| C3 | 3.3μF 100V X7R 1210 | AVX | 12101C335K4T2A | X7S as alternate |
| C4 | 1210 | | | Not Mounted |
| C5 | 3.3μF 100V X7R 1210 | AVX | 12101C335K4T2A | X7S as alternate |
| C6 | 1206 | | | Not Mounted |
| C7 | 10μF 50V X7R 1210 | AVX | 2105C106KAT2A | X7S as alternate |
| C8 | 1206 | | | Not Mounted |
| C9 | 10μF 50V X7R 1210 | AVX | 2105C106KAT2A | X7S as alternate |
| C10 | 1206 | | | Not Mounted |
| C11 | 1210 | | | Not Mounted |
| C12 | 1210 | | | Not Mounted |
| L1 | 8.8mm x 4.75mm | | | Not Mounted |
| L2 | 1206 | | | Not Mounted |
| L3 | 0805 | | | Not Mounted |
| L4 | FIXED INDUCTOR 10μH 1.5A | TDK | SPM4015T-100M-LR | |
| L5 | 8.8mm x 4.75mm | | | Not Mounted |
| L6 | 1206 | | | Not Mounted |
| L7 | 0Ω JUMPER 0805 0W125 | VISHAY | CRCW08050000Z0ECC | Use 0R 0805 |
| L8 | 0603 | | | Not Mounted |
| L9 | 11.68mm x 7.2mm | | | Not Mounted |
| P1 | CONNECTOR | WURTH | 695402400222 | |
| P2 | CONNECTOR | WURTH | 695402400222 | |
| R1 | 0Ω JUMPER 0603 0W1 | VISHAY | CRCW06030000Z0EAC | |
| R2 | 0603 | | | Not Mounted |
| R4 | 0603 | | | Not Mounted |
| R5 | 0603 | | | Not Mounted |
| R6 | 0603 | | | Not Mounted |
| R9 | 0603 | | | Not Mounted |
| R10 | 0603 | | | Not Mounted |
| U1 | RPMH15-1.5 MODULE | RECOM | RPMH15-1.5 | |

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