

RPX-1.5-EVM-1



Features Evaluation Module

- Evaluation platform for RPX-1.5 buck regulator module
- Thermal design considerations included
- EMI class B filter
- Easy evaluation of output voltage selection, control, and sensing functions

Description

The RPX-1.5-EVM-1 generates a constant output voltage selectable from 0.8V, 1.8V, 3.3V, 5V, 12V, 15V, or 24V from a DC input in the range of 4-36V. It has a maximum continuous output current of 1.5A.

All the functions of the RPX-1.5 such as output voltage selection, control, power good, trim, and output sense can be readily evaluated. Also the behavior in overload or over-temperature can be evaluated easily before it is designed in.

The evaluation board also contains the filter components to meet EMC class B levels. Alternate component positions are included to allow experimentation to optimize the EMC performance depending on operating conditions and budget.

Selection Guide

| Part Number | Input Voltage Range [VDC] | Output Voltage ⁽¹⁾ [VDC] | Output Current max. [A] |
|---------------|---------------------------|-------------------------------------|-------------------------|
| RPX-1.5-EVM-1 | 4 - 36 | 0.8, 1.8, 3.3, 5, 12, 15, 24 | 1.5 |

Notes:

Note1: refer to [SAFE OPERATING AREA](#) of RPX-1.5 datasheet

Quick Start Guide

1. Connect P3 to power supply (observe correct polarity!)
2. Connect P4 to the load (no load operation is allowed. For 0.8Vout, please refer to safe operating area in the [RPX-1.5](#) datasheet)
3. The evaluation module is preset to 5Vout.
The output voltage can be selected with values of 0.8V, 1.8V, 3.3V, 5V, 12V, 15V, and 24V by shorting a 0Ω resistor to the respective places as seen in the board silkscreen. For 0.8Vout, please refer to safe operating area in the [RPX-1.5](#) datasheet.
4. The sense pin is connected to the RPX output pin, so the preset voltage is very accurate at the output of the RPX. To compensate any losses of the filter, remove the resistor at R2, and solder a 0Ω resistor at R3.
5. CTRL
The device is preset as normally on. It can be disabled by pulling the CTRL pad to GND. Short R18 to disable the device.

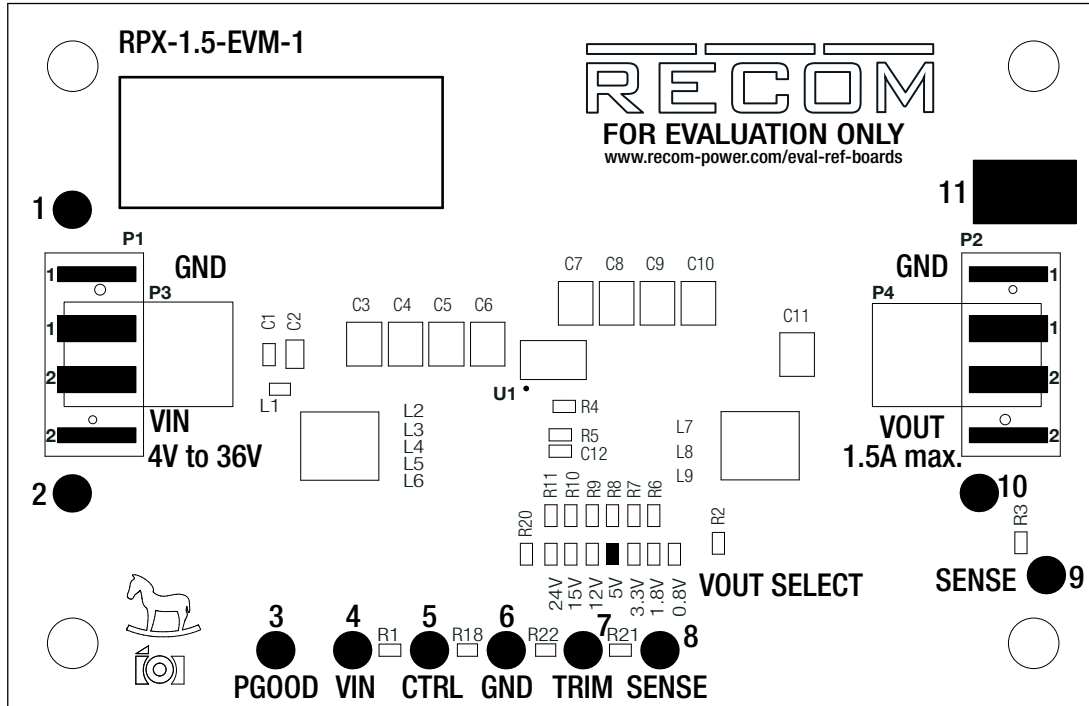


Caution:

ESD sensitive. Always follow ESD preventative procedures when handling the product!

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

Component Placement



Connector Description

P1 (Not Mounted)

| Pin | Name | Description |
|-----|------|---------------|
| 1 | NC | No Connection |
| 2 | NC | No Connection |

P2 (Not Mounted)

| Pin | Name | Description |
|-----|------|---------------|
| 1 | NC | No Connection |
| 2 | NC | No Connection |

P3

| Pin | Name | Description |
|-----|------|--|
| 1 | GND | Common GND |
| 2 | VIN | Positive Input Voltage (observe correct polarity!) |

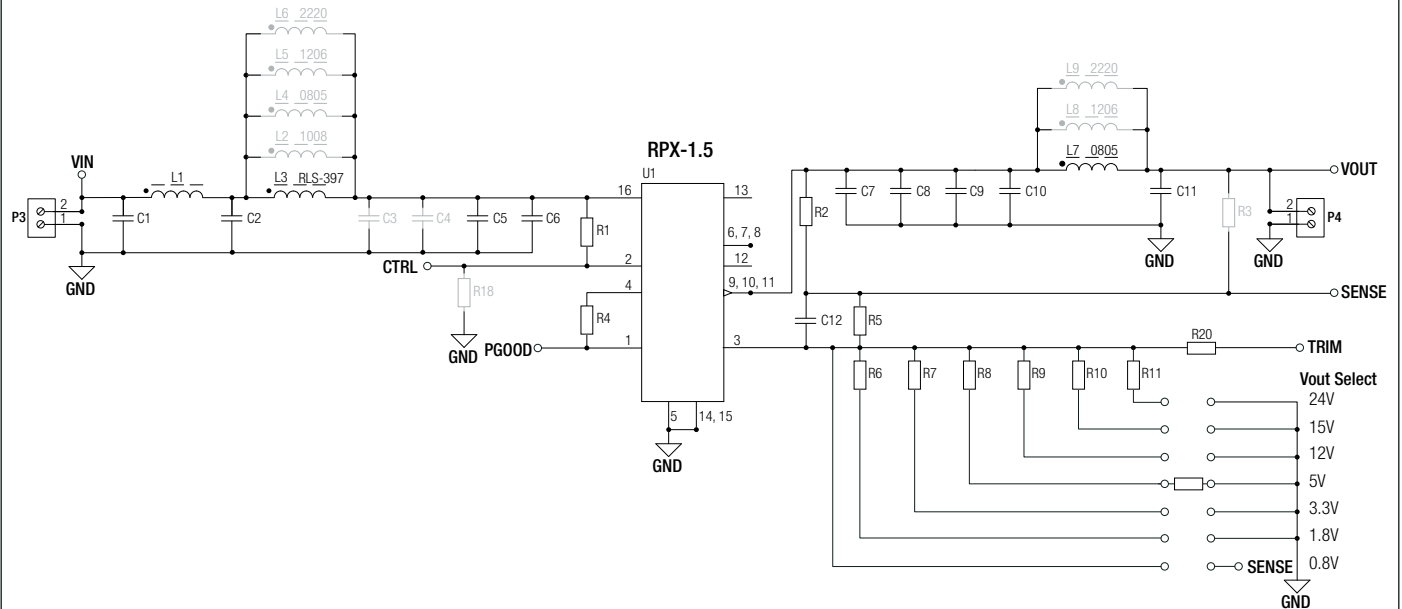
P4

| Pin | Name | Description |
|-----|------|-------------------------|
| 1 | GND | Common GND |
| 2 | VOUT | Positive Output Voltage |

Pads Direct Connection

| Pin | Name | Description |
|------|-------|---|
| 1 | GND | Negative Input Voltage (GND) |
| 2 | VIN | Positive Input Voltage |
| 3 | PGOOD | Power Good Signal |
| 4 | VIN | Positive Input Voltage |
| 5 | CTRL | CTRL Pad (leave open if not used) |
| 6 | GND | Negative Input Voltage (GND) |
| 7 | TRIM | TRIM Pad (leave open if not used) |
| 8, 9 | SENSE | Output Voltage Sense Pin (leave open if not used) |
| 10 | VOUT | Positive Output Voltage |
| 11 | GND | Negative Output Voltage (GND) |

Schematic



Notes:

Note2: Gray colored components are not mounted

Description

U1: RPX-1.5 power module.

C1,C2,L1,L2,L3,L4,L5,L6,C3,C4,C5,C6: allow placement of various sized components to test input filter design. The populated filter is designed to meet EN55022 class B.

C7,C8,C9,C10,L7,L8,L9,C11: allow placement of various sized components to test output filter design. The populated filter is designed to meet EN55022 class B.

R1 and R18: configure CTRL. R1 is populated to enable the RPX-1.5. Short R18 in order to disable the RPX-1.5.

R2: 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, unsolder R2, and connect sense to the new measurement point.

R3: sense point for output voltage after the filter. To set sense point here, remove R2, and solder a 0Ω resistor at R3.

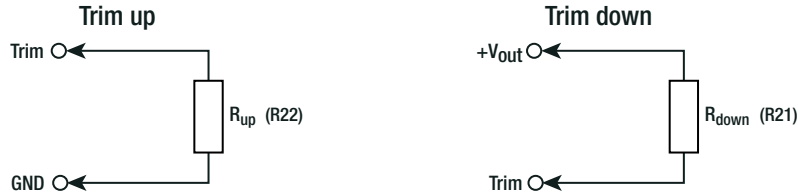
VOUT selection: the output voltage can be selected with values of 0.8V, 1.8V, 3.3V, 5V, 12V, 15V, and 24V by shorting a 0Ω resistor to the respective places as seen in the board silkscreen.

R21, R22: trim the output voltage. Refer to **"OUTPUT VOLTAGE TRIMMING"**

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

OUTPUT VOLTAGE TRIMMING

The RPX-1.5 offers the feature of trimming the output voltage by using external trim resistors. The values for trim resistors are shown in trim tables below according to E96 values; therefore, the specified voltage may slightly vary. Refer to **“Selection Guide”** for applicable Vout range.



Calculation:

Vout_{nom} = nominal output voltage [VDC]
 Vout_{set} = trimmed output voltage [VDC]
 V_{ref} = reference voltage [VDC]
 R_{up} = trim up resistor [kΩ]
 R_{down} = trim down resistor [kΩ]
 R_{Hi}, R_{Lo} = internal resistors [kΩ]

| R _{Hi} | R _{Lo} | V _{ref} |
|-----------------|-----------------|------------------|
| 60k5Ω | 75kΩ | 0.807VDC |

$$R_{up} = \left[\frac{R_{Hi}}{V_{out_set} - V_{nom}} \right] - 1k \quad R_{down} = \left[\frac{(V_{out_set} - V_{ref}) \times R_{Lo}}{V_{out_nom} - V_{set}} \right]$$

Practical Example RPX-1.5, trim up:

Vout_{set} = 5.1VDC

$$R_{up} = \left[\frac{60k5\Omega}{5.1 - 5} \right] - 1k = \underline{\underline{605k\Omega}}$$

R_{up} according to E96 ≈ 604kΩ

Practical Example RPX-1.5, trim down:

Vout_{set} = 4VDC

$$R_{down} = \left[\frac{(4 - 0.807) \times 75k\Omega}{5 - 4} \right] = \underline{\underline{239k\Omega}}$$

R_{down} according to E96 ≈ 237kΩ

Vout_{set} = 1.8V

Trim up

| | | | | | |
|-------------------------|------|------|------|------|-------|
| Vout _{set} = | 1.82 | 1.88 | 1.90 | 1.98 | [VDC] |
| R _{up} (E96) ≈ | 3M01 | 750k | 604k | 332k | [Ω] |

Trim down

| | | | | | |
|---------------------------|------|------|------|------|-------|
| Vout _{set} = | 1.7 | 1.6 | 1.5 | 1.44 | [VDC] |
| R _{down} (E96) ≈ | 665k | 294k | 174k | 133k | [Ω] |

Vout_{set} = 5V

Trim up

| | | | | | |
|-------------------------|------|------|------|------|-------|
| Vout _{set} = | 5.1 | 5.2 | 5.3 | 5.5 | [VDC] |
| R _{up} (E96) ≈ | 604k | 301k | 200k | 121k | [Ω] |

Trim down

| | | | | | |
|---------------------------|------|------|------|------|-------|
| Vout _{set} = | 4.7 | 4.5 | 4.3 | 4 | [VDC] |
| R _{down} (E96) ≈ | 976k | 549k | 374k | 237k | [Ω] |

Vout_{set} = 15V

Trim up

| | | | | | |
|-------------------------|------|-----|------|------|-------|
| Vout _{set} = | 15.5 | 16 | 16.3 | 16.5 | [VDC] |
| R _{up} (E96) ≈ | 121k | 59k | 45k3 | 39k2 | [Ω] |

Trim down

| | | | | | |
|---------------------------|----|------|------|------|-------|
| Vout _{set} = | 14 | 13 | 12.5 | 12 | [VDC] |
| R _{down} (E96) ≈ | 1M | 453k | 348k | 280k | [Ω] |

Vout_{set} = 3.3V

Trim up

| | | | | | |
|-------------------------|------|------|------|------|-------|
| Vout _{set} = | 3.4 | 3.5 | 3.6 | 3.63 | [VDC] |
| R _{up} (E96) ≈ | 604k | 301k | 200k | 182k | [Ω] |

Trim down

| | | | | | |
|---------------------------|------|------|------|------|-------|
| Vout _{set} = | 3.1 | 3 | 2.8 | 2.64 | [VDC] |
| R _{down} (E96) ≈ | 866k | 549k | 301k | 210k | [Ω] |

Vout_{set} = 12V

Trim up

| | | | | | |
|-------------------------|------|------|-----|------|-------|
| Vout _{set} = | 12.4 | 12.6 | 13 | 13.2 | [VDC] |
| R _{up} (E96) ≈ | 150k | 100k | 59k | 49k9 | [Ω] |

Trim down

| | | | | | |
|---------------------------|------|------|------|------|-------|
| Vout _{set} = | 11 | 10.6 | 10 | 9.6 | [VDC] |
| R _{down} (E96) ≈ | 768k | 523k | 348k | 274k | [Ω] |

Vout_{set} = 24V

Trim up

| | | | | | |
|-------------------------|-----|------|------|------|-------|
| Vout _{set} = | 25 | 25.5 | 26 | 26.4 | [VDC] |
| R _{up} (E96) ≈ | 59k | 39k2 | 29k4 | 24k3 | [Ω] |

Trim down

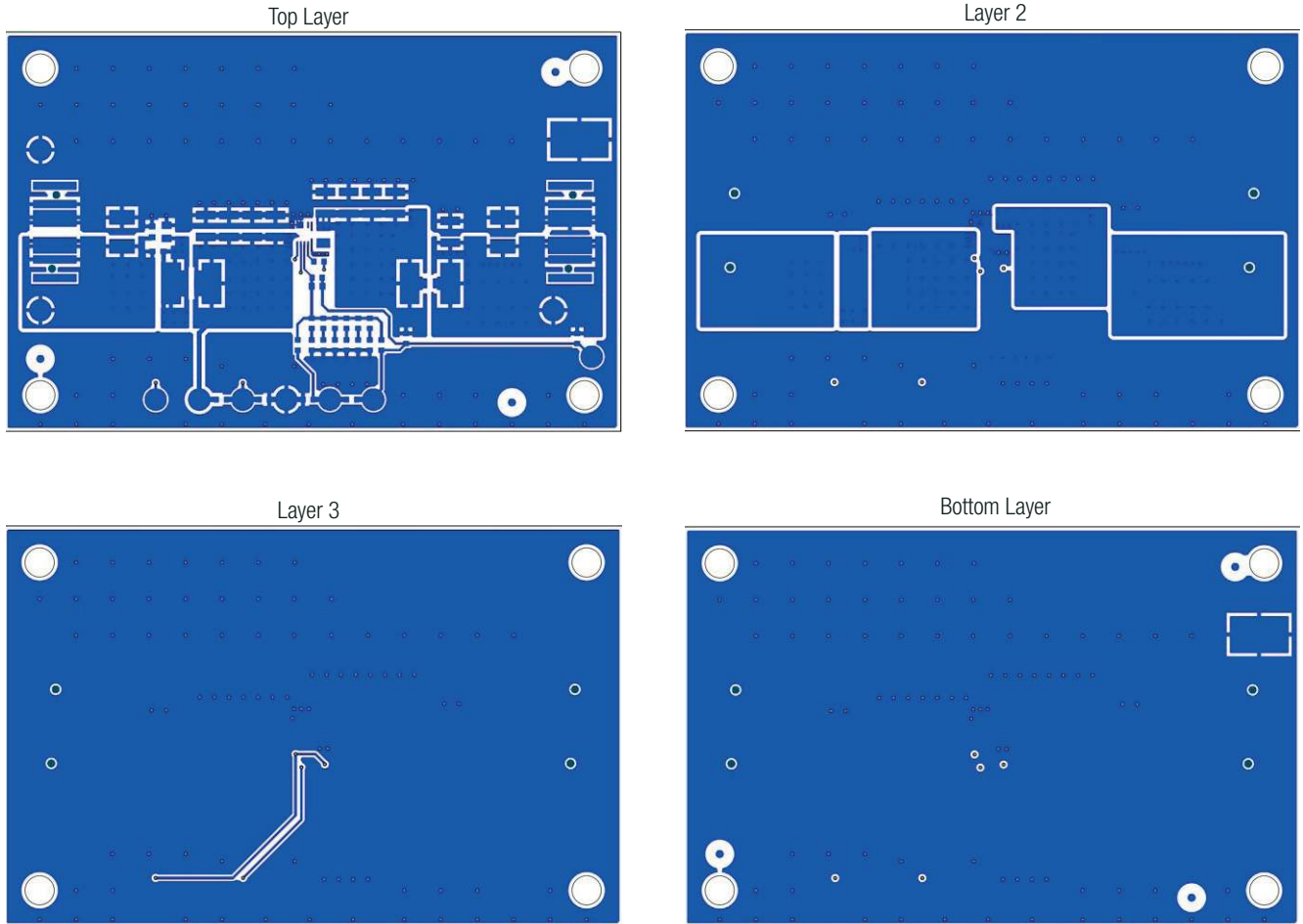
| | | | | | |
|---------------------------|------|------|------|------|-------|
| Vout _{set} = | 23 | 22 | 20 | 19.2 | [VDC] |
| R _{down} (E96) ≈ | 1M65 | 787k | 357k | 287k | [Ω] |

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

DIMENSION AND PHYSICAL CHARACTERISTICS

| Parameter | Type | Value |
|-------------------|------|---------------------|
| Dimension (LxWxH) | | 85.0 x 55.0 x 6.5mm |
| Weight | | 21.2g typ. |

Layout



Notes:

Note3: Visit www.recom-power.com/eval-ref-boards to download the Gerber files

BOM

| Comp. | Description | Manufacturer Part Number | Manufacturer | Remarks |
|-------|-------------------|--------------------------|---------------------------|-------------|
| C1 | 10nF 50V X7R 0603 | CL10B103KB8NNNC | Samsung Electro-Mechanics | |
| C2 | 1µF 50V X7R 0805 | CL21B105KBFNNNE | Samsung Electro-Mechanics | |
| C3 | 10µF 50V X7R 1210 | CL32B106KBJNNWE | Samsung Electro-Mechanics | not mounted |
| C4 | 10µF 50V X7R 1210 | CL32B106KBJNNWE | Samsung Electro-Mechanics | not mounted |
| C5 | 10µF 50V X7R 1210 | CL32B106KBJNNWE | Samsung Electro-Mechanics | |
| C6 | 10µF 50V X7R 1210 | CL32B106KBJNNWE | Samsung Electro-Mechanics | |
| C7 | 10µF 50V X7R 1210 | CL32B106KBJNNWE | Samsung Electro-Mechanics | |

continued on next page

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

| Comp. | Description | Manufacturer Part Number | Manufacturer | Remarks |
|-------|-------------------------------|--------------------------|---------------------------|-------------|
| C8 | 10µF 50V X7R 1210 | CL32B106KBJNNWE | Samsung Electro-Mechanics | |
| C9 | 10µF 50V X7R 1210 | CL32B106KBJNNWE | Samsung Electro-Mechanics | |
| C10 | 10µF 50V X7R 1210 | CL32B106KBJNNWE | Samsung Electro-Mechanics | |
| C11 | 10µF 50V X7R 1210 | CL32B106KBJNNWE | Samsung Electro-Mechanics | |
| C12 | 33pF 50V COG 0603 | CL10C330JB8NNNC | Samsung Electro-Mechanics | |
| L1 | FERRITE BEAD BLM18PG330SN1D | BLM18PG330SN1D | Murata | |
| L2 | FERRITE BEAD 1008 | | | not mounted |
| L3 | IND-3.9uH-1.32A-045x032x026 | RLS-397 | RECOM | |
| L4 | FERRITE BEAD 0805 | | | not mounted |
| L5 | FERRITE BEAD 1206 | | | not mounted |
| L6 | FERRITE BEAD 2220 | | | not mounted |
| L7 | FERRITE BEAD 600 OHM 0805 1LN | 742792040 | Würth | |
| L8 | FERRITE BEAD 1206 | | | not mounted |
| L9 | FERRITE BEAD 2220 | | | not mounted |
| P1 | CONNECTOR | XW4K-04A1-H1 | Omron Electronics Inc | not mounted |
| P2 | CONNECTOR | XW4K-04A1-H1 | Omron Electronics Inc | not mounted |
| P3 | CONNECTOR | 2060-452/998-404 | Wago | |
| P4 | CONNECTOR | 2060-452/998-404 | Wago | |
| R1 | 100kΩ 0.1W 1% 0603 | RC0603FR-07100KL | Yageo | |
| R2 | 0R 0.1W 0603 | RC0603JR-070RL | Yageo | |
| R3 | 0R 0.1W 0603 | RC0603JR-070RL | Yageo | not mounted |
| R4 | 100kΩ 0.1W 1% 0603 | RC0603FR-07100KL | Yageo | |
| R5 | 75kΩ 0.1W 1% 0603 | RC0603FR-0775KL | Yageo | |
| R6 | 60k4Ω 0.1W 1% 0603 | RC0603FR-0760K4L | Yageo | |
| R7 | 24k3Ω 0.1W 1% 0603 | RC0603FR-0724K3L | Yageo | |
| R8 | 14k3Ω 0.1W 1% 0603 | RC0603FR-0714K3L | Yageo | |
| R9 | 5k36Ω 0.1W 1% 0603 | RC0603FR-075K36L | Yageo | |
| R10 | 4k22Ω 0.1W 1% 0603 | RC0603FR-074K22L | Yageo | |
| R11 | 2k61Ω 0.1W 1% 0603 | RC0603FR-072K61L | Yageo | |
| R12 | 0R 0.1W 0603 | RC0603JR-070RL | Yageo | not mounted |
| R13 | 0R 0.1W 0603 | RC0603JR-070RL | Yageo | not mounted |
| R14 | 0R 0.1W 0603 | RC0603JR-070RL | Yageo | not mounted |
| R15 | 0R 0.1W 0603 | RC0603JR-070RL | Yageo | |
| R16 | 0R 0.1W 0603 | RC0603JR-070RL | Yageo | not mounted |
| R17 | 0R 0.1W 0603 | RC0603JR-070RL | Yageo | not mounted |
| R18 | 0R 0.1W 0603 | RC0603JR-070RL | Yageo | not mounted |
| R19 | 0R 0.1W 0603 | RC0603JR-070RL | Yageo | not mounted |
| R20 | 1kΩ 0.1W 1% 0603 | RC0603FR-071KL | Yageo | |
| R21 | 0R 0.1W 0603 | RC0603JR-070RL | Yageo | not mounted |
| R22 | 0R 0.1W 0603 | RC0603JR-070RL | Yageo | not mounted |
| U1 | RPX-1.5 MODULE | RPX-1.5 | RECOM | |

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

PACKAGING INFORMATION

| Parameter | Type | Value |
|-----------------------------|------|-----------------------|
| Packaging Dimension (LxWxH) | | 114.0 x 60.0 x 28.0mm |
| Packaging Quantity | | 1pc |

Contents

- RPX-1.5-EVM-1 Evaluation Module
- Terms and Conditions

The product information and specifications may be subject to changes even without prior written notice. The product has been designed for various applications; its suitability lies in the responsibility of each customer. The products are not authorized for use in safety-critical applications without RECOM's explicit written consent. A safety-critical application is an application where a failure may reasonably be expected to endanger or cause loss of life, inflict bodily harm or damage property. The applicant shall indemnify and hold harmless RECOM, its affiliated companies and its representatives against any damage claims in connection with the unauthorized use of RECOM products in such safety-critical applications.