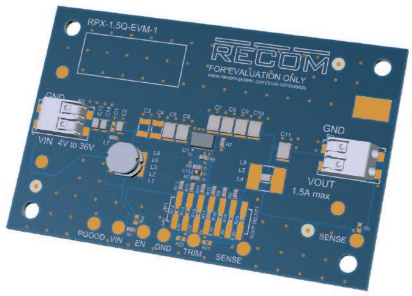
Features

- Evaluation platform for RPX-1.5Q Buck Regulator Module
- Thermal design considerations included
- EMI Class B filter
- Easy evaluation of output voltage selection, control and sensing functions

Evaluation Module

RECOM
Evaluation Module

RPX-1.5Q-EVM-1



Description

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

All the functions of the RPX-1.5Q 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-1.5Q-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-1.5Q datasheet

Quick Start Guide

1. Connect P_1 to power supply (observe correct polarity)

2. Connect P_2 to the load (no load operation is allowed. Refer to safe operating area in the RPX-1.5Q datasheet)

3. The evaluation module is preset to $5V_{OUT}$.
   The output voltage can be selected for values of 0.8VDC, 1.8VDC, 3.3VDC, 5VDC, 12VDC, 15VDC and 24VDC by shorting a 0Ω resistor to the respective places as seen in the board silkscreen. For $0.8V_{OUT}$, please refer to safe operating area in the RPX-1.5Q 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 R_2, and solder a 0Ω resistor at R_3.

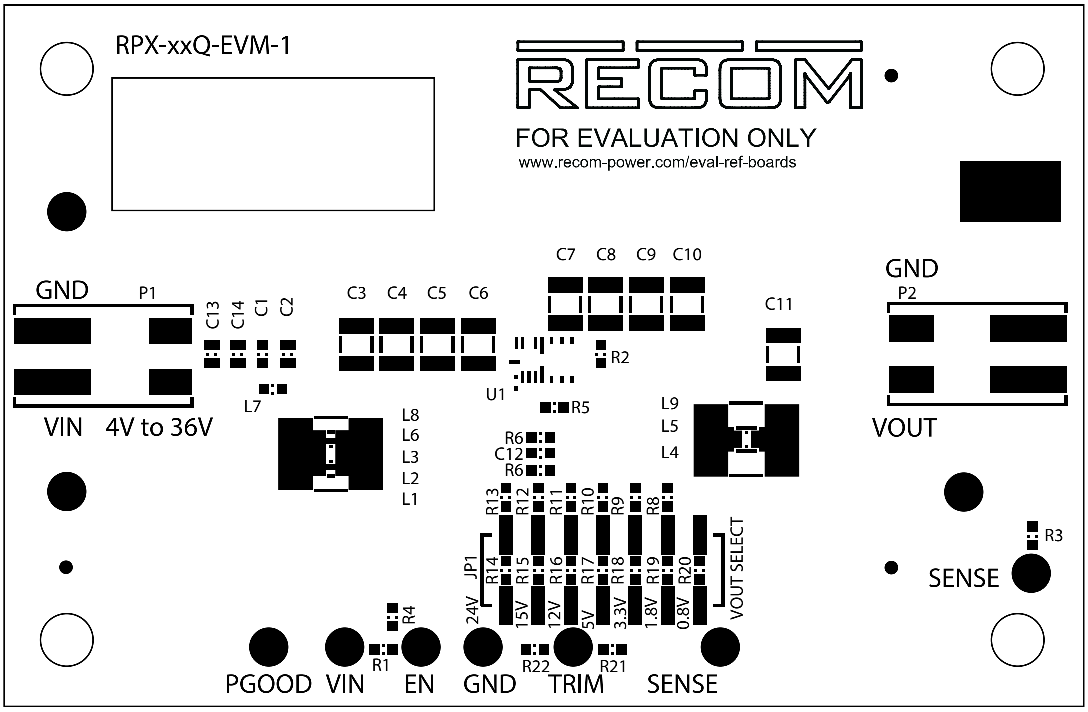
5. The device is preset as normally on. It can be disabled by pulling the CTRL pad to GND. Short R_4 to disable the device.

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

RPX-1.5Q-EVM-1

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

Component Placement



Connector Description

P1

Pin	Name	Description
1-2	GND	Common GND
3-4	VIN	Positive Input Voltage (observe correct polarity!)

P2

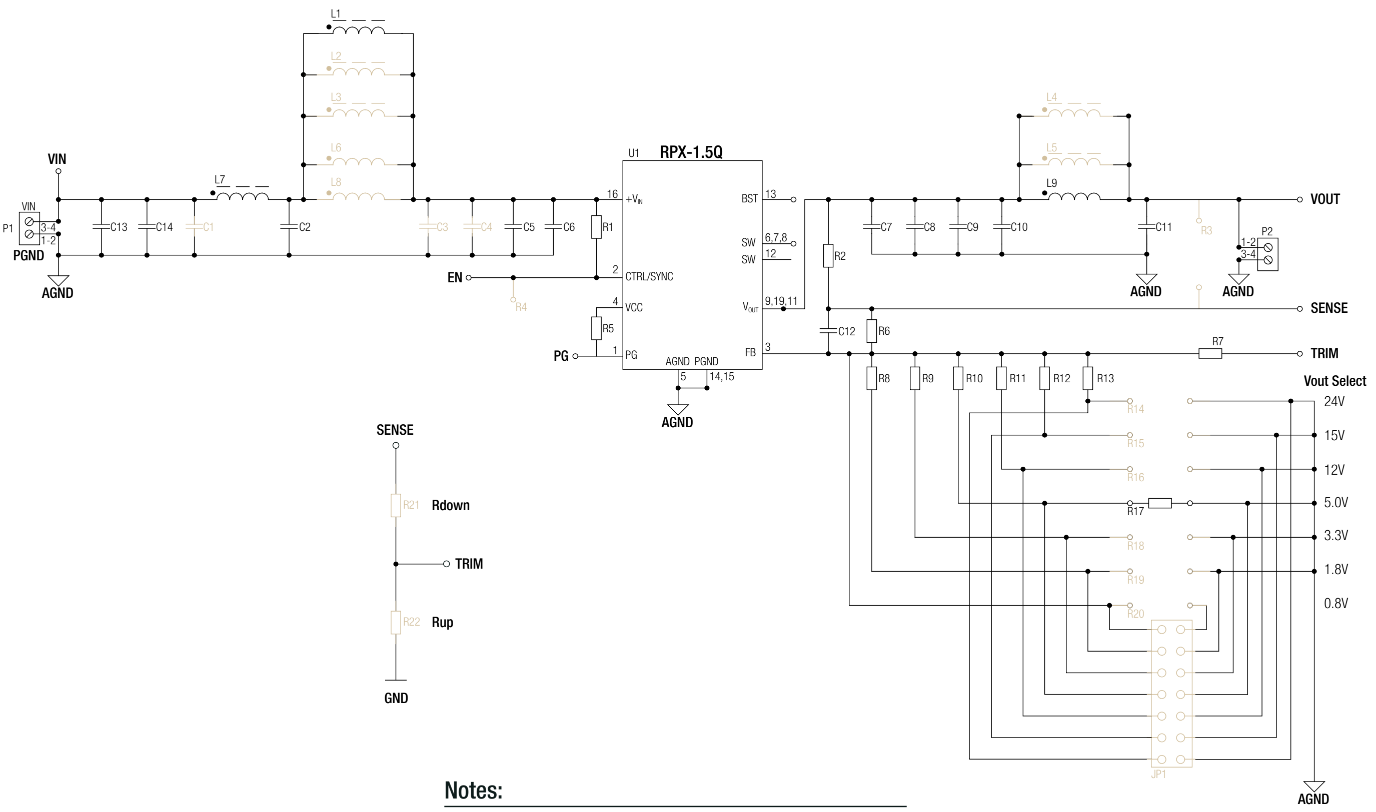
Pin	Name	Description
3-4	GND	Common GND
1-2	VOUT	Positive Output Voltage

Pads Direct Connection

Name	Description
GND	Negative Input Voltage (GND)
VIN	Positive Input Voltage
PGOOD	Power Good Signal
EN	EN Pad (leave open if not used)
TRIM	TRIM Pad (leave open if not used)
SENSE	Output Voltage Sense Pin (leave open if not used)
VOUT	Positive Output Voltage

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

Schematic



Notes:

Note2: Grey colored components are not mounted

Description

U_1: RPX-1.5Q power module.

C_1,C_2,L_1,L_2,L_3,L_6,L_7,L_8,C_3,C_4,C_5,C_6,C_{13},C_{14}: allow placement of various sized components to test input filter design. The populated filter is designed to meet EN55022 class B.

C_7,C_8,C_9,C_{10},L_4,L_5,L_9,C_{11}: allow placement of various sized components to test output filter design. The populated filter is designed to meet EN55022 class B.

R_1 and R_4: configure CTRL. R_1 is populated to enable the RPX-1.5Q. Short R_4 in order to disable the RPX-1.5Q.

R_2: 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 R_2, and connect sense to the new measurement point.

R_3: sense point for output voltage after the filter. To set sense point here, remove R_2 and solder a 0Ω resistor at R_3.

V_{OUT} Selection: the output voltage can be selected with values of 0.8VDC, 1.8VDC, 3.3VDC, 5VDC, 12VDC, 15VDC, and 24V by shorting a 0Ω resistor to the respective places as seen in the board silkscreen. Instead of R_{14}-R_{20} resistors, the JP_1 (SMT 2-row pin header) can be assembled and output voltage can be quickly set with jumper. Remove any resistor from positions R_{14}-R_{20} before installing SMT header JP_1.

Note: For 0.8VDC output voltage the placement of 0Ω resistor or the jumper is not required since the feedback is internally disconnected in the board. See the connection of R_{20} in the schematic.

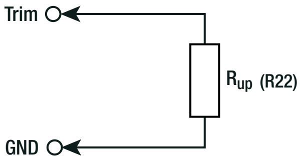
R_{21}, R_{22}: trim the output voltage. Refer to ***"OUTPUT VOLTAGE TRIMMING"***

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

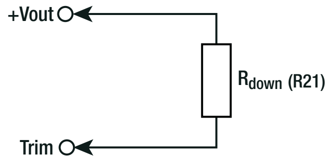
OUTPUT VOLTAGE TRIMMING

The RPX-1.5Q-EVM-1 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 V_{OUT} range.

Trim up



Trim down



Calculation:

$Vout_{nom}$	= nominal output voltage	[VDC]
$Vout_{set}$	= trimmed output voltage	[VDC]
Vref	= reference voltage	[VDC]
R_{up}	= trim up resistor	[kΩ]
R_{down}	= trim down resistor	[kΩ]
R_{FB1} (R_L), R_{FB2} (R_H)	= feedback resistors	[kΩ]

$$R_{up} = \frac{R_H \times R_L \times V_{REF}}{R_L \times (Vout_{set} - V_{REF}) - R_H \times V_{REF}} \quad [k\Omega]$$

$$R_{down} = \frac{R_H \times R_L \times (Vout_{set} - V_{REF})}{V_{REF} \times (R_H + R_L) - Vout_{set} \times R_L} \quad [k\Omega]$$

$Vout_{nom}$	R_L/R_{FB1} [kΩ]	R_H/R_{FB2} [kΩ]	Vref [VDC]
1.8VDC	60k4	75k	0.8
3.3VDC	24k3	75k	0.8
5VDC	14k3	75k	0.8
12VDC	5k36	75k	0.8
15VDC	4k22	75k	0.8
24VDC	2k61	75k	0.8

Practical Example RPX-1.5Q, trim up:

$Vout_{set}$=5.1VDC

$$R_{up} = \frac{75 \times 14.3 \times 0.8}{14.3 \times (5.1 - 0.8) - 75 \times 0.8} = \underline{\underline{575.838\Omega}}$$

R_{up} according to E96 ≈ **576kΩ**

Practical Example RPX-1.5Q, trim down:

$Vout_{set}$=4VDC

$$R_{down} = \frac{75 \times 14.3 \times (4 - 0.8)}{0.8 \times (75 + 14.3) - 4 \times 14.3} = \underline{\underline{241.011\Omega}}$$

R_{down} according to E96 ≈ **243kΩ**

$Vout_{set}$ = 1.8VDC

Trim up

$Vout_{set}$ =	1.82	1.88	1.9	2.0	[VDC]
R_{up} (E96) ≈	2M26	698k	562k	287k	[Ω]

Trim down

$Vout_{set}$ =	1.7	1.6	1.5	1.4	[VDC]
R_{down} (E96) ≈	715k	309k	178k	115k	[Ω]

$Vout_{set}$ = 3.3VDC

Trim up

$Vout_{set}$ =	3.4	3.5	3.6	3.8	[VDC]
R_{up} (E96) ≈	453k	255k	182k	113k	[Ω]

Trim down

$Vout_{set}$ =	3.1	3.0	2.8	2.6	[VDC]
R_{down} (E96) ≈	1M02	604k	316k	200k	[Ω]

$Vout_{set}$ = 5VDC

Trim up

$Vout_{set}$ =	5.1	5.2	5.3	6.0	[VDC]
R_{up} (E96) ≈	576k	294k	196k	59k0	[Ω]

Trim down

$Vout_{set}$ =	4.7	4.5	4.3	4.0	[VDC]
R_{down} (E96) ≈	976k	549k	374k	237k	[Ω]

$Vout_{set}$ = 12VDC

Trim up

$Vout_{set}$ =	12.4	12.6	13.0	13.2	[VDC]
R_{up} (E96) ≈	147k	100k	59k	49k9	[Ω]

Trim down

$Vout_{set}$ =	11	10.6	10	9.6	[VDC]
R_{down} (E96) ≈	768k	523k	348k	247k	[Ω]

continued on next page

RPX-1.5Q-EVM-1

RECOM

Evaluation Module

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

OUTPUT VOLTAGE TRIMMING

$Vout_{set}$ = 15VDC

Trim up

$Vout_{set}$ =	15.5	16	16.3	16.5	[VDC]
R_{up} (E96) ≈	124k	60k4	46k4	40k2	[Ω]

Trim down

$Vout_{set}$ =	14.5	14.0	13.5	13.0	[VDC]
R_{down} (E96) ≈	2M05	976k	634k	453k	[Ω]

$Vout_{set}$ = 24VDC

Trim up

$Vout_{set}$ =	25	25.5	26	26.4	[VDC]
R_{up} (E96) ≈	49k9	34k8	27k4	22k6	[Ω]

Trim down

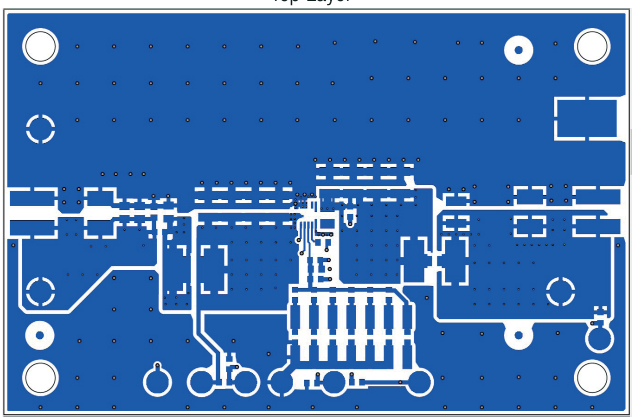
$Vout_{set}$ =	23.0	22.0	20.0	19.2	[VDC]
R_{down} (E96) ≈	2M05	887k	383k	301k	[Ω]

DIMENSION AND PHYSICAL CHARACTERISTICS

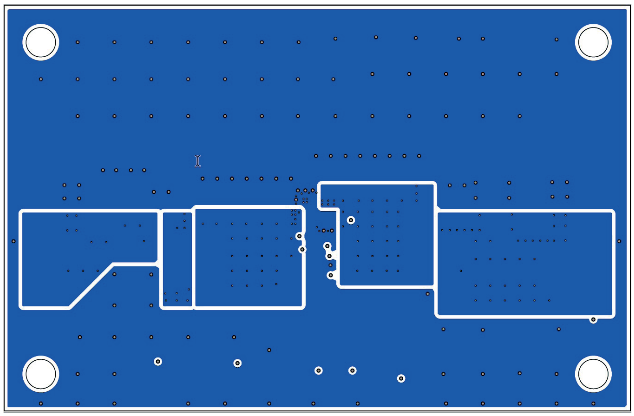
Parameter	Type	Value
Dimension (LxWxH)		85.0 x 55.0 x 6.5mm
Weight		22g

Layout

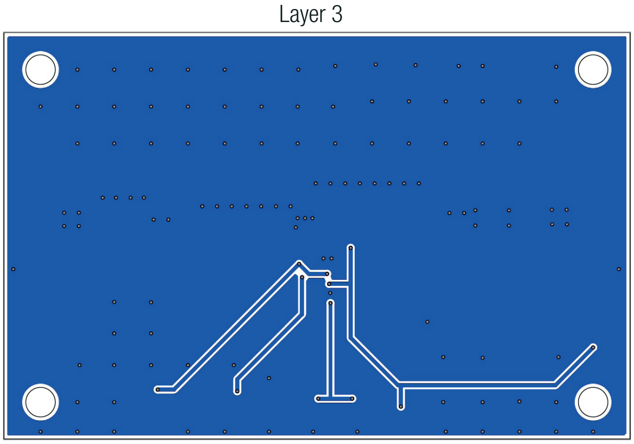
Top Layer



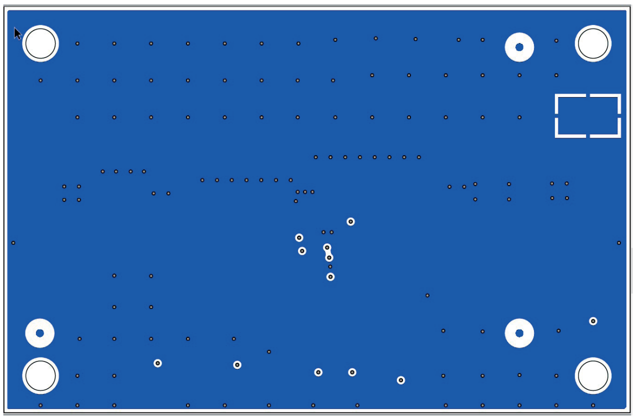
Layer 2



Layer 3



Bottom Layer



Notes: