

# Features

# Regulated Converter

- Sixteenth Brick Format
- 4:1 Input Voltage Range
- 2.25kV Basic Isolation
- Remote ON/OFF And Trim Pins
- UVLO, OTP, OVP, OCP and SCP
- Efficiency Up To 91%

## Description

The RPA50S is a low cost 50W DC/DC converter in industry standard 1/16th brick format (33mm x 23mm) and pinning. The 4:1 input range covers 24V, 28V or 48V nominal input voltages and the output voltage options are 3.3V, 5V or 12V with +10%/-20% trim. Output power is 40W from 18-75V or 50W from 36-75V. The efficiency is particularly high (88-91%) to permit full load operation from -40°C up to +54°C ambient temperature with only free air convection and up to 85°C with forced air cooling. The isolation voltage is 2.25kVDC/1 minute (basic insulation grade). Applications include demanding industrial power supplies, telecom and PoE circuits.

## Selection Guide

| Part Number      | nom. Input Voltage Range <sup>(1)</sup> [VDC] | Output Voltage [VDC] | Output Current [A] | Efficiency max. <sup>(1)</sup> [%] | Max. Capacitive typ. Load <sup>(2)</sup> [μF] |
|------------------|---|----------------------|--------------------|------------------------------------|---|
| RPA50S-483.3SW/P | 18-75   | 3.3                  | 15                 | 90.5                               | 10000   |
| RPA50S-4805SW/P  | 18-75   | 5                    | 10                 | 91                                 | 5000  |
| RPA50S-4812SW/P  | 18-75   | 12                   | 4.2                | 89                                 | 2200  |

### Notes:

Note1: Efficiency is tested at nominal input and full load at +25°C ambient

Note2: Max. Cap Load is tested at nominal input and full resistive load

## Model Numbering

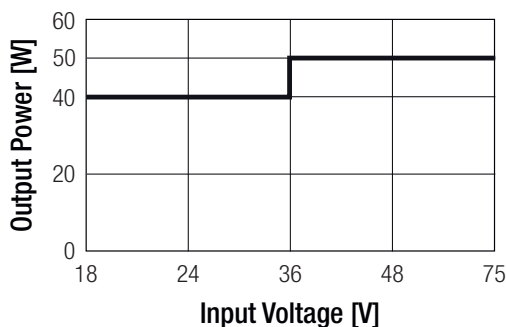


### Ordering Examples

RPA50S-4805SW/P = 48V Input, 5V Output, Single, Pos. CTRL function

## Specifications (measured @ ta = 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

| BASIC CHARACTERISTICS        |                |       |       |         |
|------------------------------|----------------|-------|-------|---------|
| Parameter                    | Condition      | Min.  | Typ.  | Max.    |
| Internal Input Filter        |                |       |       | Pi-Type |
| Input Voltage Range          | nom. Vin = 48V | 18VDC | 48VDC | 75VDC   |
| Input Surge Voltage          | 100ms          |       |       | 100VDC  |
| Under Voltage Lockout (UVLO) | DC-DC ON       | 16VDC | 17VDC | 18VDC   |
|                              | DC-DC OFF      | 15VDC | 16VDC | 17VDC   |
| Input Current Range          | 18Vin          |       |       | 3.9A    |
| Quiescent Current            | 3.3Vout        |       | 30mA  |         |
|                              | 5Vout          |       | 40mA  |         |
|                              | 12Vout         |       | 20mA  |         |

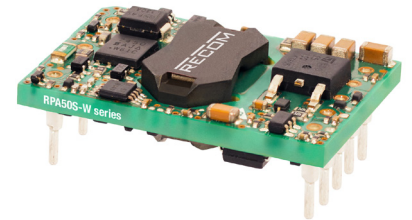


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**RECOM**  
DC/DC Converter

RPA50S-W

50Watt  
1/16 Brick  
Single Output



UL US  
TBD



UL60950-1 Pending  
IEC/EN60950-1 Pending

**Specifications** (measured @  $t_a = 25^\circ\text{C}$ , nom.  $V_{in}$ , full load and after warm-up unless otherwise stated)

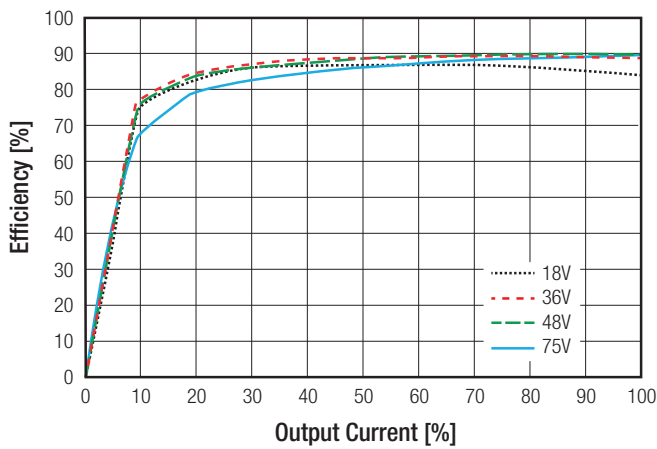
| BASIC CHARACTERISTICS                |                           |                       |                       |  |          |
|--------------------------------------|---------------------------|-----------------------|-----------------------|--|----------|
| Parameter                            | Condition                 |                       | Min.                  | Typ.   | Max.     |
| Output Voltage Trimming              |                           |                       | -20%                  |  | +10%     |
| Minimum Load                         |                           |                       | 0%                    |  |          |
| Start-up Time                        | Power up<br>Remote ON/OFF |                       |                       | 30ms<br>30ms   |          |
| ON/OFF CTRL                          | Positive Logic            | 3.3 & 5Vout           | DC-DC ON<br>DC-DC OFF | Open or $2.4\text{V} < V_r < 18\text{V}$<br>Short or $0\text{V} < V_r < 0.8\text{V}$ |          |
|                                      |                           | 12Vout                | DC-DC ON<br>DC-DC OFF | Open or $2\text{V} < V_r < 18\text{V}$<br>Short or $0\text{V} < V_r < 0.8\text{V}$   |          |
| Input Current of CTRL pin            |                           |                       |                       |  | 1mA      |
| Standby Current                      |                           |                       |                       |  | 6.5mA    |
| Internal Operating Frequency         | 3.3 & 5Vout<br>12Vout     |                       |                       | 580kHz<br>440kHz   |          |
| Output Ripple & Noise <sup>(3)</sup> | 5MHz to 20MHz BW.         | 3.3 & 5Vout<br>12Vout |                       | 60mVp-p<br>100mVp-p  | 150mVp-p |
| Remote Sense                         |                           |                       |                       |  | 10%      |

**Notes:**

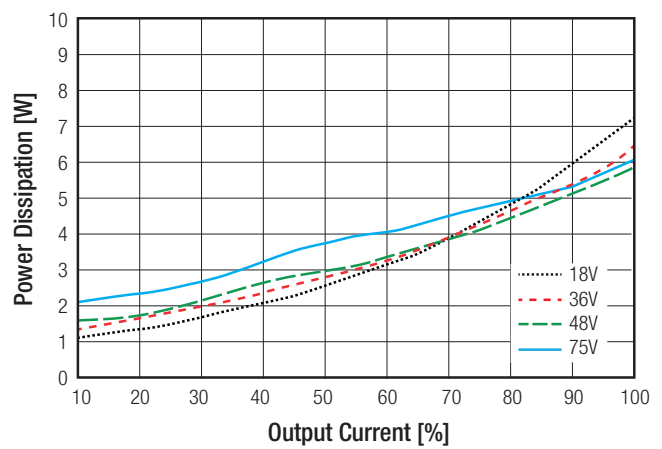
Note3: measured with 1 $\mu\text{F}$  ceramic and 10 $\mu\text{F}$  tantalum in parallel across O/P

**RPA50S-483.3SW/P**

**Efficiency vs. Output Current**

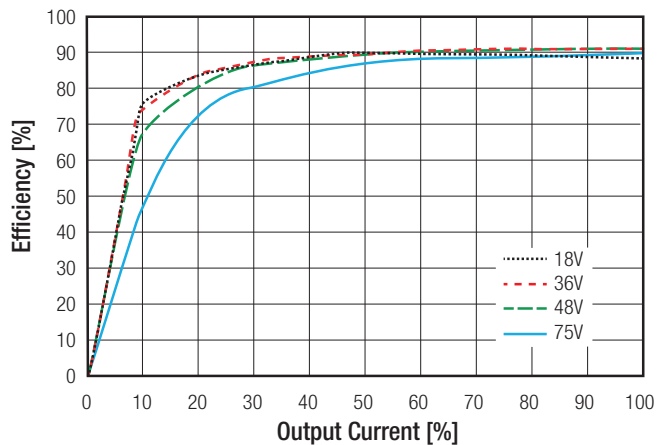


**Power Dissipation vs. Output Current**

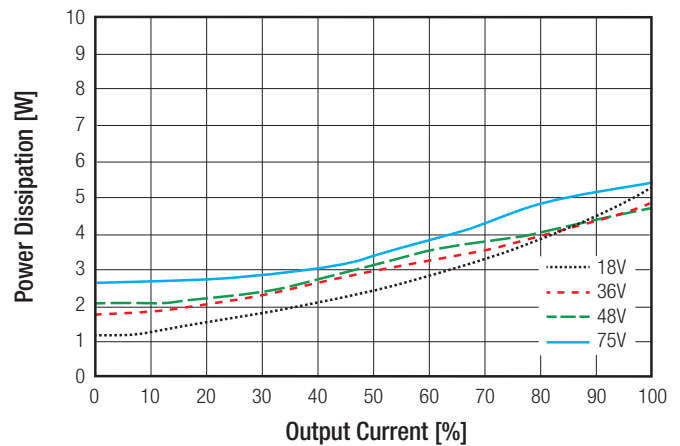


**RPA50S-4805SW/P**

**Efficiency vs. Output Current**



**Power Dissipation vs. Output Current**

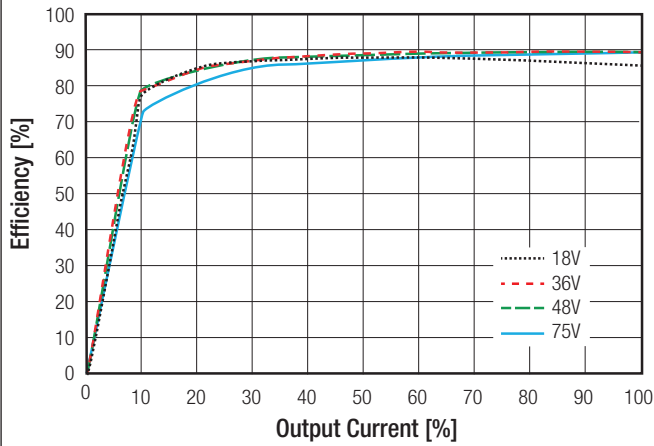


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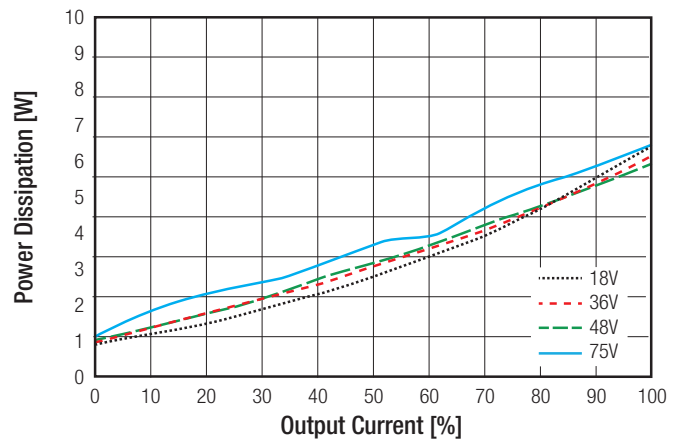
Specifications (measured @  $t_a = 25^\circ\text{C}$ , nom.  $V_{in}$ , full load and after warm-up unless otherwise stated)

RPA50S-4812SW/P

Efficiency vs. Output Current



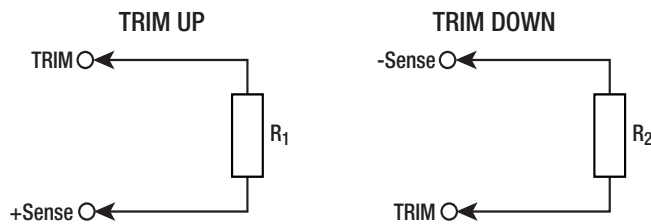
Power Dissipation vs. Output Current



**OUTPUT VOLTAGE TRIMMING**

**Output Voltage Trimming**

RPA50S-W converters offer the feature of trimming the output voltage over a certain range around the nominal value by using external trim resistors. The values for trim resistors shown in trim tables below are according to standard E96 values; therefore, the specified voltage may slightly vary; they also can be calculated with below shown equation.



**Trim Calculation**

**Trim Up:**

3.3, 5  $V_{out}$

12  $V_{out}$

$$R_1 = \frac{5.11 \cdot V_{out} \cdot (100 + \Delta V_{out})}{1.24 \cdot \Delta V_{out}} - \frac{511}{\Delta V_{out}} - 10.22 \text{ k}\Omega$$

$$R_1 = \frac{5.11 \cdot V_{out} \cdot (100 + \Delta V_{out})}{1.225 \cdot \Delta V_{out}} - \frac{511}{\Delta V_{out}} - 10.22 \text{ k}\Omega$$

$V_{out}$  = Output Voltage

$\Delta V_{out}$  = Output Voltage Change in %

$R_1$  = trim up resistor

$R_2$  = trim down resistor

**Trim Down:**

$$R_2 = \frac{511}{\Delta V_{out}} - 10.22$$

**Practical Example:**

**Trim Up:**

$V_{out} = 12\text{V}$ ,  $\Delta V_{out} = +10\%$  (13.2V)

$$R_1 = \frac{5.11 \cdot 12 \cdot (100 + 10)}{1.24 \cdot 10} - \frac{511}{10} - 10.22 = \frac{6745.2}{12.24} - 51.1 - 10.22 = 489.3 \text{ k}\Omega$$

**Trim down:**

$V_{out} = 12\text{V}$ ,  $\Delta V_{out} = -10\%$  (10.8V)

$$R_2 = \frac{511}{10} - 10.22 = 40.88 \text{ k}\Omega$$

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**Specifications** (measured @  $t_a = 25^\circ\text{C}$ , nom.  $V_{in}$ , full load and after warm-up unless otherwise stated)

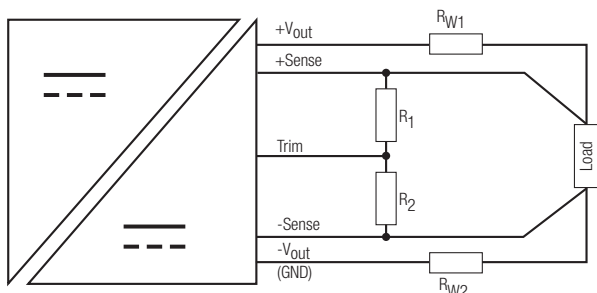
| RPA50S-483.3SW/P |      |      |      |      |      |      |      |      |       |      |       |
|------------------|------|------|------|------|------|------|------|------|-------|------|-------|
| Trim up          | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9     | 10   | %     |
| $V_{out} =$      | 3.33 | 3.37 | 3.40 | 3.43 | 3.47 | 3.50 | 3.53 | 3.57 | 3.60  | 3.63 | Volts |
| $R_1 =$          | 845  | 432  | 287  | 215  | 174  | 143  | 124  | 110  | 97.60 | 88.7 | kOhms |

| RPA50S-4805SW/P |      |      |      |      |      |      |      |     |      |      |       |
|-----------------|------|------|------|------|------|------|------|-----|------|------|-------|
| Trim up         | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8   | 9    | 10   | %     |
| $V_{out} =$     | 5.05 | 5.10 | 5.15 | 5.20 | 5.25 | 5.30 | 5.35 | 5.4 | 5.45 | 5.50 | Volts |
| $R_1 =$         | 1540 | 787  | 523  | 402  | 324  | 267  | 232  | 205 | 182  | 165  | kOhms |

| RPA50S-4812SW/P |       |       |       |       |       |       |       |       |       |       |       |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Trim up         | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | %     |
| $V_{out} =$     | 12.12 | 12.24 | 12.36 | 12.48 | 12.60 | 12.72 | 12.84 | 12.96 | 13.08 | 13.20 | Volts |
| $R_1 =$         | 4530  | 2280  | 1540  | 1150  | 931   | 787   | 681   | 604   | 536   | 487   | kOhms |

| Trim Down all $V_{out}$ 's |      |      |      |      |      |      |      |       |      |      |       |
|----------------------------|------|------|------|------|------|------|------|-------|------|------|-------|
| Trim down                  | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8     | 9    | 10   | %     |
| $R_2 =$                    | 499  | 243  | 162  | 118  | 93.1 | 75.0 | 63.4 | 53.6  | 46.4 | 41.2 | kOhms |
| Trim down                  | 11   | 12   | 13   | 14   | 15   | 16   | 17   | 18    | 19   | 20   | %     |
| $R_2 =$                    | 36.5 | 33.2 | 29.4 | 26.1 | 23.7 | 21.7 | 20.0 | 18.20 | 16.9 | 15.0 | kOhms |

## REMOTE SENSE



The output voltage can be adjusted by both trim and remote sense. The maximum combined adjustment range  $\pm 10\%$ . Derate the maximum output power if using the trim or sense function.

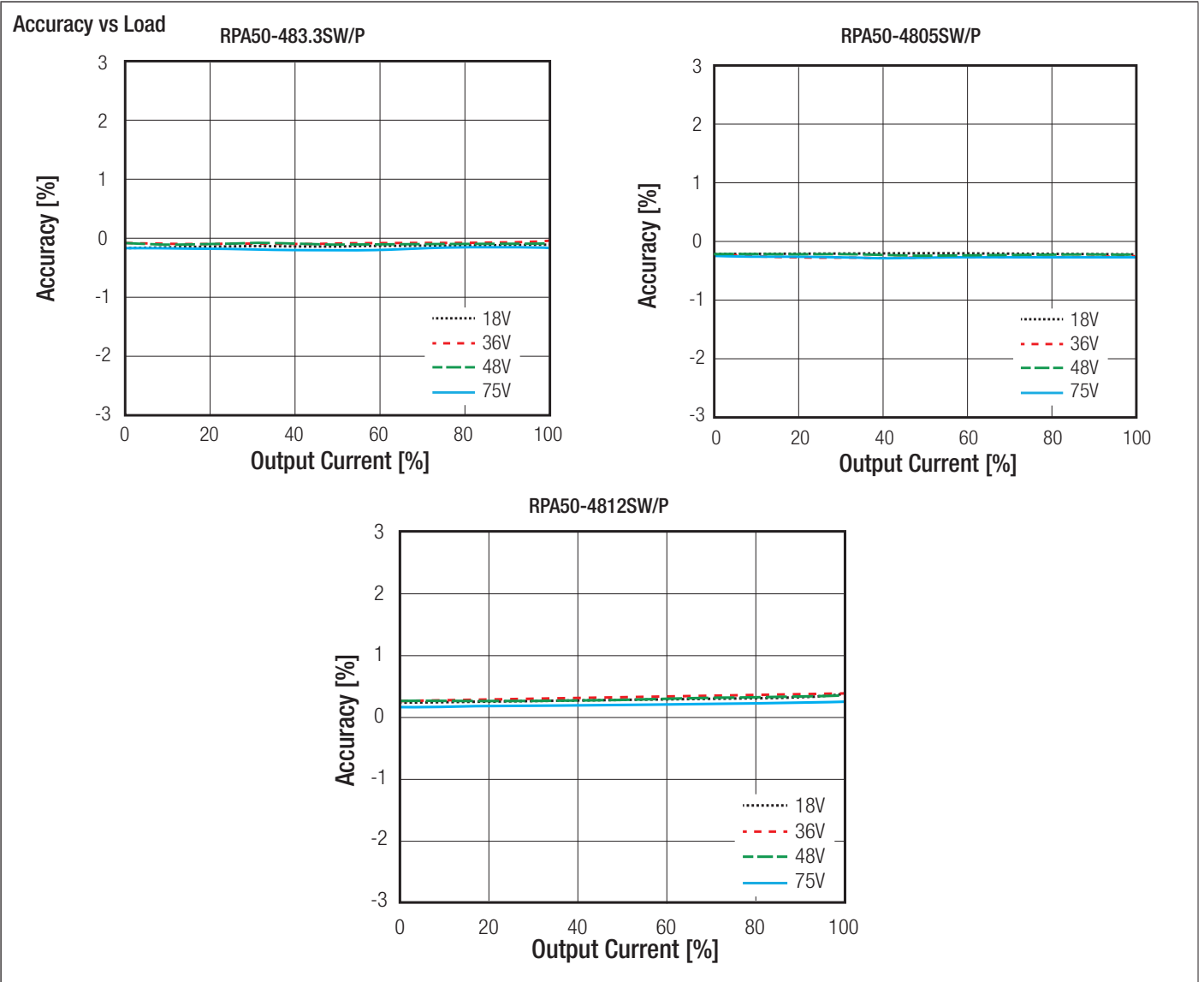
- $R_{W1}$  ... wire losses +
- $R_{W2}$  ... wire losses -
- $R_1$  ... trim up resistor
- $R_2$  ... trim down resistor

## REGULATIONS

| Parameter          | Condition                                    | Value  |
|--------------------|--|--|
| Output Accuracy    |  | $\pm 3.0\%$  |
| Line Regulation    | 3.3Vout<br>5 & 12Vout                        | $\pm 0.3\%$ max.<br>$\pm 0.1\%$ max.   |
| Load Regulation    | 0% - 100% load<br>3.3Vout<br>5Vout<br>12Vout | $\pm 0.3\%$ max.<br>$\pm 0.2\%$ max.<br>$\pm 0.1\%$ max.   |
| Transient Response | 3.3 & 5Vout                                  | 25% to 50% load step change<br>50% to 25% load step change<br>setting time<br>100mV typ.<br>100mV typ.<br>200 $\mu$ s typ. |
|                    | 12Vout                                       | 25% to 50% load step change<br>50% to 25% load step change<br>setting time<br>400mV typ.<br>400mV typ.<br>500 $\mu$ s typ. |

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Specifications (measured @  $t_a = 25^\circ\text{C}$ , nom.  $V_{in}$ , full load and after warm-up unless otherwise stated)



| PROTECTIONS  |             |                    |                            |
|--|-------------|--------------------|----------------------------|
| Parameter  | Type        |                    | Value                      |
| Short Circuit Protection (SCP)   | below 100mΩ |                    | hiccup mode, auto recovery |
| Over Voltage Protection (OVP)  | 3.3 & 5Vout |                    | 115% - 140%, hiccup mode   |
|  | 12Vout      |                    | 120% - 150%, hiccup mode   |
| Over Current Protection (OCP)  |             |                    | 110% - 140%, hiccup mode   |
| Over Temperature Protection (OTP)  |             |                    | 130°C, hiccup mode         |
| Isolation Voltage <sup>(4)</sup>   | I/P to O/P  | rated for 1 minute | 2.25kVDC                   |
| Isolation Resistance   |             |                    | 10MΩ min.                  |
| Isolation Capacitance  |             |                    | 1000pF typ.                |
| Leakage Current  |             |                    | 0.23mA max.                |
| Insulation Grade   |             |                    | Basic                      |
| <b>Notes:</b>  |             |                    |                            |
| Note4: For repeat Hi-Pot testing, reduce the time and/or the test voltage  |             |                    |                            |
| Note5: An input fuse is required if the mains supply is not over-current protected. Recommended fuse T10A slow blow type |             |                    |                            |

**Specifications** (measured @  $t_a = 25^\circ\text{C}$ , nom.  $V_{in}$ , full load and after warm-up unless otherwise stated)

| ENVIRONMENTAL               |  |   |
|-----------------------------|--|---|
| Parameter                   | Condition  | Value   |
| Operating Temperature Range | without derating (@ natural convection 0.1 m/s, see graph)   | -40°C to +54°C  |
| Over Temperature Shutdown   | @ TC   | +130°C typ.   |
| Temperature Coefficient     |  | 0.02%/°C  |
| Operating Altitude          |  | TBD   |
| Operating Humidity          | non-condensing   | 95% RH max.   |
| Pollution Degree            |  | PD2   |
| MTBF                        | according to Telcordia SR332 Issue 2 Method I standard, 25°C | 3.3Vout<br>5Vout<br>12Vout                                    |
|                             |  | 2758 x 10 <sup>3</sup> hours                                  |
|                             |  | 3757 x 10 <sup>3</sup> hours<br>10084 x 10 <sup>3</sup> hours |

### Thermal Calculation

| Thermal Impedance |                                 |
|-------------------|---------------------------------|
| airflow [m/s]     | R <sub>th</sub> with PCB [°C/W] |
| 0.1               | 11.5                            |
| 0.2               | 11.2                            |
| 0.5               | 9.9                             |
| 1.0               | 8.5                             |
| 1.5               | 7.5                             |

#### Notes:

Note6: Test PCB:160x100mm105µm (Eurocard), double layer

|                                 |
|---------------------------------|
| load = 100%                     |
| $R_{th} = 9.9^\circ\text{C/W}$  |
| $P_{Diss} = 6\text{W}$          |
| $T_{ICmax} = 122^\circ\text{C}$ |

choose your model:

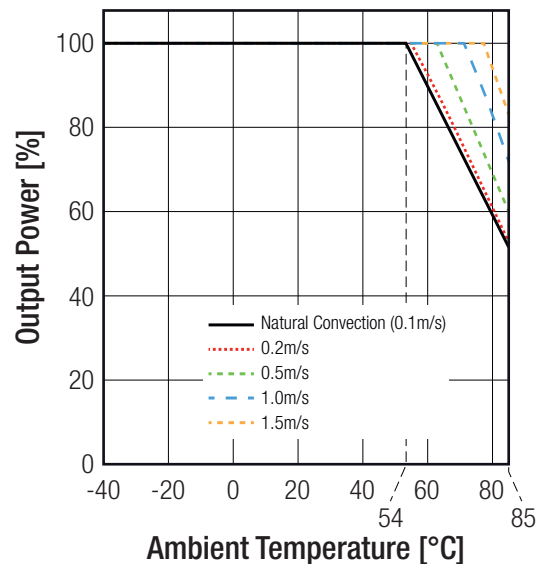
#### RPA50S-4812SW/P

- Load conditions in application (e.g. 100%)
- Airflow conditions in application (e.g. 0.5m/s)
- use R<sub>th</sub> from above shown table (9.9°C/W)

$$T_{OVER} = R_{th} \times P_{Diss} = 9.9^\circ\text{C/W} \times 6\text{W} = 59.4^\circ\text{C}$$

$$T_{AMBmax} = T_{ICmax} - T_{OVER} = 122^\circ\text{C} - 59.4^\circ\text{C} = 63^\circ\text{C}$$

RPA50S-4812SW/P



### SAFETY AND CERTIFICATIONS PENDING

| Certificate Type  | Report / File Number | Standard  |
|---|----------------------|---|
| Information Technology Equipment, General Requirements for Safety |                      | UL60950-1<br>CAN/CSA C22.2 No. 60950-1-07   |
| Information Technology Equipment, General Requirements for Safety |                      | IEC60950-1, 2nd Edition, 2005 + AM2, 2013<br>EN60950-1, 1st Edition, 2006 + AM2, 2013 |
| RoHS 2+   |                      | RoHS 2011/65/EU + AM2015/863  |

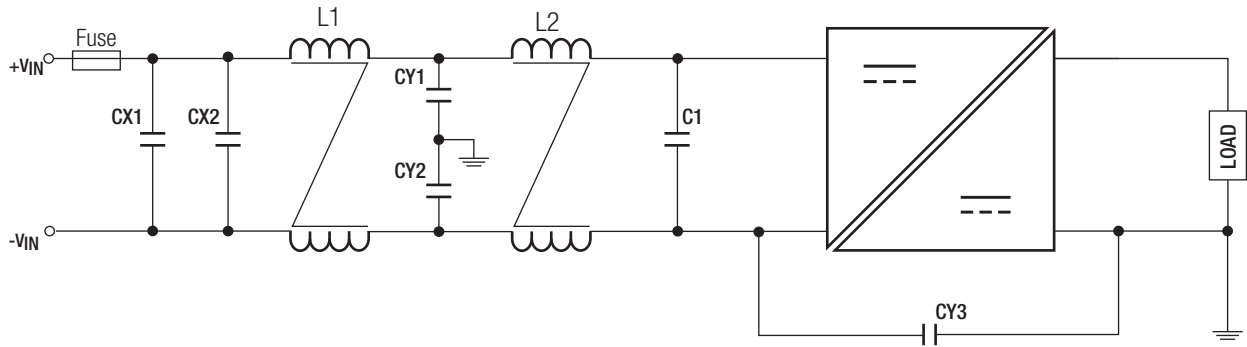
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**Specifications** (measured @  $t_a = 25^\circ\text{C}$ , nom.  $V_{in}$ , full load and after warm-up unless otherwise stated)

### SAFETY AND CERTIFICATIONS PENDING

| EMC Compliance  | Conditions           | Standard / Criterion |
|---|----------------------|----------------------|
| Electromagnetic compatibility of multimedia equipment - Emission requirements | with external filter | EN55032, Class B     |

### EMC Filtering according to EN55032 Class B

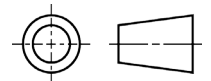
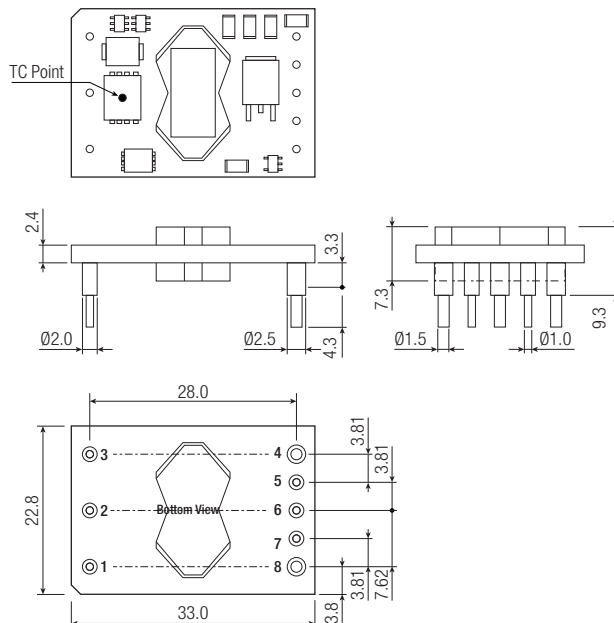


| CX1                             | CX2                               | L1                            | CY1, CY2              | L2                            | C1  | CY3                  |
|---------------------------------|-----------------------------------|-------------------------------|-----------------------|-------------------------------|---|----------------------|
| 1 $\mu\text{F}$<br>ceramic cap. | 4.7 $\mu\text{F}$<br>ceramic cap. | 0.2mH<br>common mode inductor | 4.7nF<br>ceramic cap. | 0.5mH<br>common mode inductor | 100 $\mu\text{F}$<br>low ESR aluminium cap. | 10nF<br>ceramic cap. |

### DIMENSION and PHYSICAL CHARACTERISTICS

| Parameter                 | Type | Value               |
|---------------------------|------|---------------------|
| Material                  | Base | FR4, (UL94 V-0)     |
| Package Dimension (LxWxH) |      | 33.0 x 22.8 x 9.5mm |
| Package Weight            |      | 12.1g typ.          |

### Dimension Drawing (mm)



### Pin Connections

| Pin # | Single |
|-------|--------|
| 1     | +Vin   |
| 2     | CTRL   |
| 3     | -Vin   |
| 4     | -Vout  |
| 5     | -Sense |
| 6     | Trim   |
| 7     | +Sense |
| 8     | +Vout  |

Tolerance: X.X  $\pm 0.5\text{mm}$   
X.XX  $\pm 0.25\text{mm}$

**Specifications** (measured @  $t_a = 25^\circ\text{C}$ , nom.  $V_{in}$ , full load and after warm-up unless otherwise stated)

| PACKAGING INFORMATION       |                |   |
|-----------------------------|----------------|---|
| Parameter                   | Type           | Value                                       |
| Packaging Dimension (LxWxH) | card board box | 221 x 128 x 33mm                            |
| Packaging Quantity          |                | 12pcs                                       |
| Storage Temperature Range   |                | $-55^\circ\text{C}$ to $+125^\circ\text{C}$ |
| Storage Humidity            | non-condensing | 95% RH max.                                 |