

## Features

## Regulated Converters

- 4:1 wide input voltage range
- 1.6kVDC isolation
- UL certified
- Efficiency up to 88%
- Fixed operating frequency
- Six-Sided continuous shield
- No minimum load required

**RECOM**  
DC/DC Converter

## RP15-AW

15 Watt

1" x 1"

Single & Dual Output



### Description

The RP15-AW series are ultraminiature wide input voltage range power DC/DC converters in a case half the size of industry standard 15W converters. Despite their small size, the RP15-AW converters are fully specified devices with output currents up to 4 Amps, no minimum load, 1600VDC isolation and low ripple/noise figures. The outputs are also fully protected against short circuits, overcurrent and overvoltage. The RP15-AW series will find many uses in applications where board space and/or board height is at a premium.

### Selection Guide

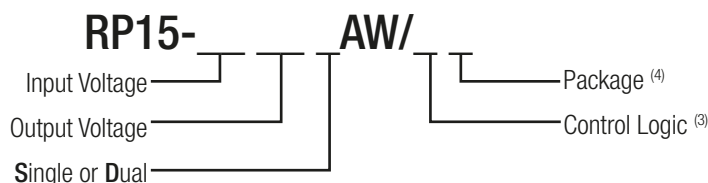
| Part Number                    | Input Voltage Range [VDC] | Output Voltage [VDC] | Output Current [mA] | Input Current [mA] <sup>(1)</sup> | Efficiency typ. [%] <sup>(1)</sup> | Max. Capacitive Load <sup>(2)</sup> [μF] |
|--------------------------------|---------------------------|----------------------|---------------------|-----------------------------------|------------------------------------|------------------------------------------|
| RP15-243.3SAW <sup>(3,4)</sup> | 9-36                      | 3.3                  | 4000                | 640                               | 86                                 | 12000                                    |
| RP15-2405SAW <sup>(3,4)</sup>  | 9-36                      | 5                    | 3000                | 727                               | 86                                 | 6000                                     |
| RP15-2412SAW <sup>(3,4)</sup>  | 9-36                      | 12                   | 1300                | 747                               | 87                                 | 1000                                     |
| RP15-2415SAW <sup>(3,4)</sup>  | 9-36                      | 15                   | 1000                | 718                               | 87                                 | 660                                      |
| RP15-483.3SAW <sup>(3,4)</sup> | 18-75                     | 3.3                  | 4000                | 320                               | 86                                 | 12000                                    |
| RP15-4805SAW <sup>(3,4)</sup>  | 18-75                     | 5                    | 3000                | 359                               | 87                                 | 6000                                     |
| RP15-4812SAW <sup>(3,4)</sup>  | 18-75                     | 12                   | 1300                | 374                               | 87                                 | 1000                                     |
| RP15-4815SAW <sup>(3,4)</sup>  | 18-75                     | 15                   | 1000                | 359                               | 87                                 | 660                                      |
| RP15-2405DAW <sup>(3,4)</sup>  | 9-36                      | ±5                   | ±1500               | 735                               | 85                                 | ±3000                                    |
| RP15-2412DAW <sup>(3,4)</sup>  | 9-36                      | ±12                  | ±625                | 718                               | 87                                 | ±520                                     |
| RP15-2415DAW <sup>(3,4)</sup>  | 9-36                      | ±15                  | ±500                | 710                               | 88                                 | ±330                                     |
| RP15-4805DAW <sup>(3,4)</sup>  | 18-75                     | ±5                   | ±1500               | 368                               | 85                                 | ±3000                                    |
| RP15-4812DAW <sup>(3,4)</sup>  | 18-75                     | ±12                  | ±625                | 363                               | 86                                 | ±520                                     |
| RP15-4815DAW <sup>(3,4)</sup>  | 18-75                     | ±15                  | ±500                | 359                               | 87                                 | ±330                                     |

#### Notes:

Note1: Measured at nominal input voltage and full load

Note2: Measured at minimum input voltage and constant resistive load

### Model Numbering



#### Ordering Examples

RP15-2405SAW/P = 24V 4:1 Input, 5V Output, Positive Logic CTRL pin and Trim pin fitted.

RP15-4805DAW-HC = 48V 4:1 Input, ±5V Output, Premounted Heat-sink (no trim pin with dual output)

#### Notes:

Note3: standard part is without suffix "P" or "N" = without CTRL & Trim function

Trim function is only available for single output with /P or /N suffix

add suffix "P" for CTRL function with positive logic (1=ON, 0=OFF) and trim pin for single output

add suffix "N" for CTRL function with negative logic (0=ON, 1=OFF) and trim pin for single output

Note4: add suffix -HC for premounted Heat-sink and clips



C **UL** US  
E196683

UL60950-1 Certified

**Specifications** (measured at  $T_a = 25^\circ\text{C}$ , nominal input voltage, full load otherwise noted)

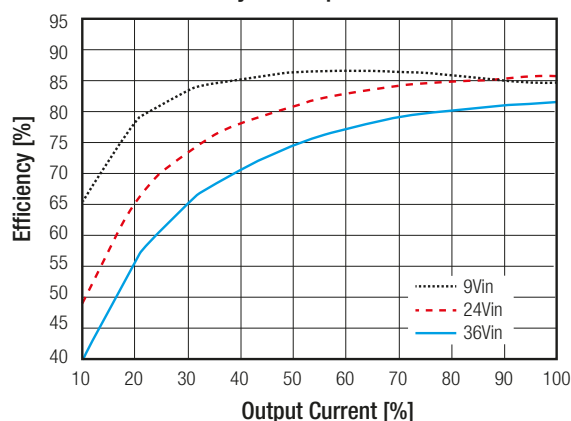
| BASIC CHARACTERISTICS                         |                             |                                                |                       |                |  |                                                    |                     |                 |
|-----------------------------------------------|-----------------------------|------------------------------------------------|-----------------------|----------------|--|----------------------------------------------------|---------------------|-----------------|
| Parameter                                     |                             | Condition                                      |                       |                |  | Min.                                               | Typ.                | Max.            |
| Internal Input Filter                         |                             | Pi-Type                                        |                       |                |  |                                                    |                     |                 |
| Input Voltage Range                           |                             | nom. Vin = 24V<br>nom. Vin = 48V               |                       |                |  | 9VDC<br>18VDC                                      | 24VDC<br>48VDC      | 36VDC<br>75VDC  |
| Input Surge Voltage                           |                             | Vin = 24V, 100ms max.<br>Vin = 48V, 100ms max. |                       |                |  |                                                    |                     | 50VDC<br>100VDC |
| Under Voltage Lockout (UVLO)                  |                             | Vin = 24V                                      | DC-DC ON<br>DC-DC OFF |                |  |                                                    | 8VDC                | 9VDC            |
|                                               |                             | Vin = 48V                                      | DC-DC ON<br>DC-DC OFF |                |  |                                                    | 16VDC               | 18VDC           |
| Input Reflected Ripple Current <sup>(5)</sup> |                             |                                                |                       |                |  |                                                    | 30mA <sub>p-p</sub> |                 |
| Output Voltage Trimming <sup>(6)</sup>        |                             | Single Output                                  |                       |                |  | ±10.0%                                             |                     |                 |
| Minimum Load                                  |                             |                                                |                       |                |  | 0%                                                 |                     |                 |
| Start-up time                                 |                             | Power up<br>ON/OFF CTRL                        |                       |                |  |                                                    |                     | 30ms<br>30ms    |
| ON/OFF Control <sup>(7)</sup>                 |                             | Positive Logic                                 | DC-DC ON<br>DC-DC OFF |                |  | Open or 3 < Vr < 15VDC<br>Short or 0 < Vr < 1.2VDC |                     |                 |
|                                               |                             | Negative Logic                                 | DC-DC ON<br>DC-DC OFF |                |  | Short or 0 < Vr < 1.2VDC<br>Open or 3 < Vr < 15VDC |                     |                 |
| Input Current of CTRL Pin                     |                             | DC-DC ON                                       |                       |                |  | -0.5mA                                             |                     | 1.0mA           |
| Standby Current                               |                             | DC-DC OFF                                      |                       |                |  |                                                    | 2.5mA               |                 |
| Internal Operating Frequency                  |                             |                                                |                       |                |  | 360kHz                                             | 400kHz              | 440kHz          |
| Ripple and Noise                              | measured by 20MHz bandwidth | with a 1μF M/C X7R and 10μF T/C                | Single                | 3.3Vout, 5Vout |  |                                                    | 75mVp-p             |                 |
|                                               |                             | with a 1μF M/C X7R and 10μF T/C                |                       | 12Vout, 15Vout |  |                                                    | 100mVp-p            |                 |
|                                               |                             | with a 1μF M/C X7R and 10μF T/C                | Dual                  | all models     |  |                                                    | 100mVp-p            |                 |

### Notes:

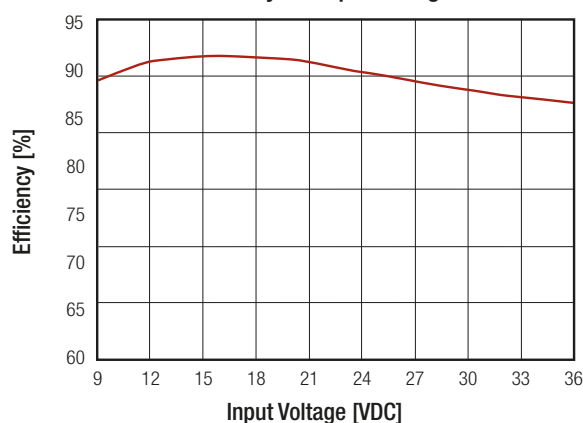
- Note5: Simulated source impedance of 12μH. 12μH inductor in series with +Vin
- Note6: Trimming allows the user to increase or decrease the output voltage set point of the module. This is accomplished by connecting an external resistor between the Trim pin and either +Vout pin or -Vout pin
- Note7: The ON/OFF control function can be positive or negative logic. The pin voltage is referenced to -Vin pin. If no suffix is specified, the control pin will be omitted

### RP15-2405SAW

Efficiency vs. Output Current



Efficiency vs. Input Voltage

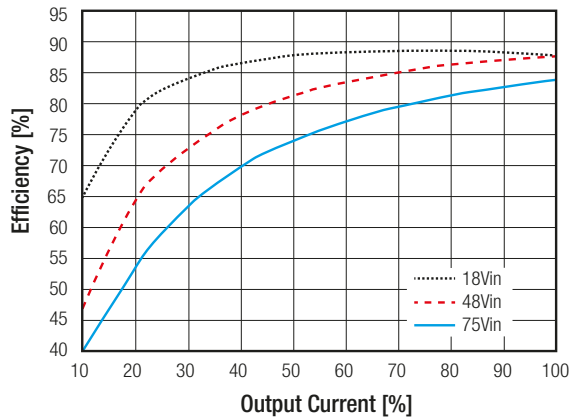


continued on next page

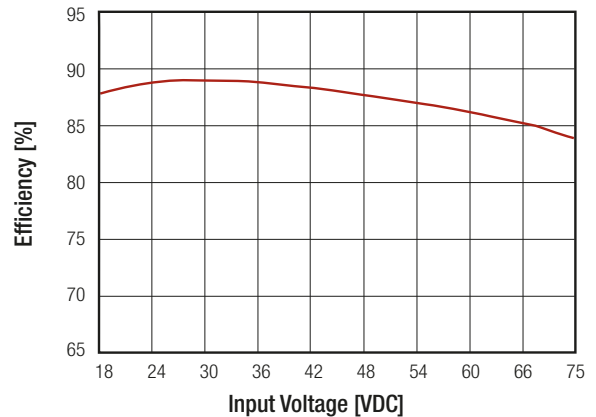
**Specifications** (measured at  $T_a = 25^\circ\text{C}$ , nominal input voltage, full load otherwise noted)

### RP15-4805SAW

Efficiency vs. Output Current



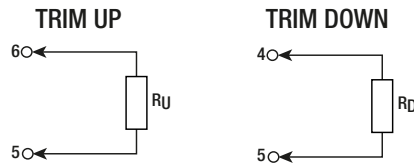
Efficiency vs. Input Voltage



### External Output Trimming

#### Output Voltage Trimming

Single output Powerline converters offer the feature of trimming the output voltage over a certain range around the nominal value by using external trim resistors. No general equation can be given for calculating the trim resistors, but the following trim tables give typical values for choosing these trimming resistors. If voltages between the given trim points are required, extrapolate between the two nearest given values to work out the resistor required or use a variable resistor to set the output voltage. Output can be externally trimmed by using the method shown below.



### RP15-xx3.3SAW

| Trim up            | 1       | 2       | 3       | 4      | 5      | 6      | 7      | 8      | 9      | 10     | %     |
|--------------------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|-------|
| V <sub>out</sub> = | 3.333   | 3.366   | 3.399   | 3.432  | 3.465  | 3.498  | 3.531  | 3.564  | 3.597  | 3.63   | Volts |
| R <sub>U</sub> =   | 385.071 | 191.511 | 126.990 | 94.730 | 75.374 | 62.470 | 53.253 | 46.340 | 40.963 | 36.662 | kOhms |

| Trim down          | 1       | 2      | 3      | 4      | 5      | 6      | 7      | 8     | 9     | 10    | %     |
|--------------------|---------|--------|--------|--------|--------|--------|--------|-------|-------|-------|-------|
| V <sub>out</sub> = | 3.267   | 3.234  | 3.201  | 3.168  | 3.135  | 3.102  | 3.069  | 3.036 | 3.003 | 2.97  | Volts |
| R <sub>D</sub> =   | 116.719 | 54.779 | 34.133 | 23.810 | 17.616 | 13.486 | 10.537 | 8.325 | 6.604 | 5.228 | kOhms |

### RP15-xx05SAW

| Trim up            | 1       | 2       | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     | %     |
|--------------------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| V <sub>out</sub> = | 5.05    | 5.10    | 5.15   | 5.20   | 5.25   | 5.30   | 5.35   | 5.4    | 5.45   | 5.50   | Volts |
| R <sub>U</sub> =   | 253.450 | 125.700 | 83.117 | 61.825 | 49.050 | 40.533 | 34.450 | 29.888 | 26.339 | 23.500 | kOhms |

| Trim down          | 1       | 2       | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     | %     |
|--------------------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| V <sub>out</sub> = | 4.95    | 4.90    | 4.85   | 4.80   | 4.75   | 4.70   | 4.65   | 4.60   | 4.55   | 4.50   | Volts |
| R <sub>D</sub> =   | 248.340 | 120.590 | 78.007 | 56.715 | 43.940 | 35.423 | 29.340 | 24.778 | 21.229 | 18.390 | kOhms |

### RP15-xx12SAW

| Trim up            | 1       | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     | %     |
|--------------------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| V <sub>out</sub> = | 12.12   | 12.24  | 12.36  | 12.48  | 12.60  | 12.72  | 12.84  | 12.96  | 13.08  | 13.20  | Volts |
| R <sub>U</sub> =   | 203.223 | 99.057 | 64.334 | 46.973 | 36.557 | 29.612 | 24.652 | 20.932 | 18.038 | 15.723 | kOhms |

| Trim down          | 1       | 2       | 3       | 4       | 5       | 6       | 7      | 8      | 9      | 10     | %     |
|--------------------|---------|---------|---------|---------|---------|---------|--------|--------|--------|--------|-------|
| V <sub>out</sub> = | 11.88   | 11.76   | 11.64   | 11.52   | 11.40   | 11.28   | 11.16  | 11.04  | 10.92  | 10.8   | Volts |
| R <sub>D</sub> =   | 776.557 | 308.723 | 248.779 | 182.807 | 143.223 | 116.834 | 97.985 | 83.848 | 72.853 | 64.057 | kOhms |

continued on next page

**Specifications** (measured at Ta = 25°C, nominal input voltage, full load otherwise noted)

| RP15-xx15SAW     |         |         |         |         |         |         |         |        |        |        |       |
|------------------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|-------|
| Trim up          | 1       | 2       | 3       | 4       | 5       | 6       | 7       | 8      | 9      | 10     | %     |
| Vout =           | 15.15   | 15.3    | 15.45   | 15.60   | 15.75   | 15.90   | 16.05   | 16.20  | 16.35  | 16.50  | Volts |
| R <sub>u</sub> = | 161.557 | 78.223  | 50.446  | 36.557  | 28.223  | 22.668  | 18.700  | 15.723 | 13.409 | 11.557 | kOhms |
| Trim down        | 1       | 2       | 3       | 4       | 5       | 6       | 7       | 8      | 9      | 10     | %     |
| Vout =           | 14.85   | 14.70   | 14.55   | 14.40   | 14.25   | 14.10   | 13.95   | 13.80  | 13.65  | 13.50  | Volts |
| R <sub>d</sub> = | 818.223 | 401.557 | 262.668 | 193.223 | 151.557 | 123.779 | 103.938 | 89.057 | 77.483 | 68.223 | kOhms |

| REGULATIONS             |                             |               |            |
|-------------------------|-----------------------------|---------------|------------|
| Parameter               | Condition                   |               | Value      |
| Output Voltage Accuracy |                             |               | ±1.0%      |
| Line Voltage Regulation | Single                      |               | ±0.2%      |
|                         | Dual                        |               | ±0.5%      |
| Load Voltage Regulation | 0% to 100% load             | Single        | ±0.2%      |
|                         |                             | Dual          | ±1.0%      |
| Cross Regulation        | asymmetrical 25%<>100% load |               | ±5.0%      |
| Transient Response      | 25% load step change        | recovery time | 250µs typ. |

| PROTECTIONS                    |                     |                   |                                      |
|--------------------------------|---------------------|-------------------|--------------------------------------|
| Parameter                      | Condition           |                   | Value                                |
| Short Circuit Protection (SCP) |                     |                   | continuous, automatic recovery       |
| Over Voltage Protection (OVP)  | Zener Diode Clamp   | 3.3Vout           | 3.7 - 5.4VDC                         |
|                                |                     | 5Vout             | 5.6 - 7.0VDC                         |
|                                |                     | 12Vout            | 13.5 - 19.6VDC                       |
|                                |                     | 15Vout            | 16.8 - 20.5VDC                       |
| Over Load Protection (OLP)     |                     |                   | Hiccup mode, 150% of rated lout typ. |
| Isolation Voltage              | tested for 1 minute | I/P to O/P        | 1.6kVDC                              |
|                                |                     | I/P (O/P) to case | 1.0kVDC                              |
| Isolation Resistance           | tested with 500VDC  |                   | 1GΩ min.                             |
| Isolation Capacitance          |                     |                   | 1000pF max.                          |

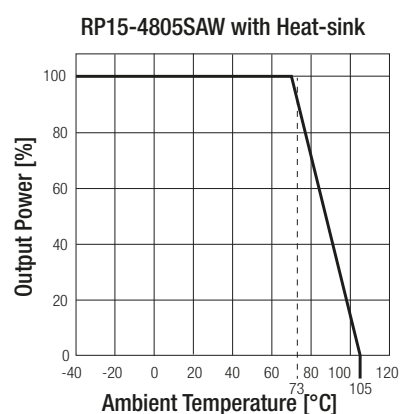
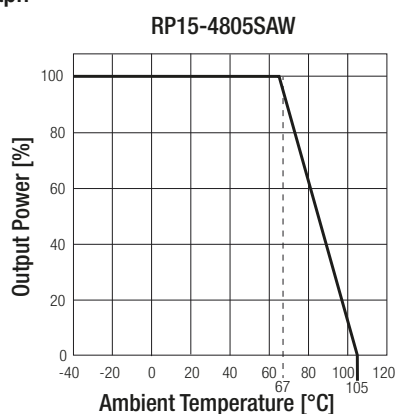
**Notes:**

Note8: This power module is not internally fused. An input line fuse must always be used. Recom suggests:  
24Vin= T3.15A; 48Vin= T1.6A slow blow types

**Specifications** (measured at  $T_a = 25^\circ\text{C}$ , nominal input voltage, full load otherwise noted)

| ENVIRONMENTAL               |                                                                           |                     |                                             |
|-----------------------------|---------------------------------------------------------------------------|---------------------|---------------------------------------------|
| Parameter                   | Condition                                                                 |                     | Value                                       |
| Operating Temperature Range | without derating                                                          |                     | $-40^\circ\text{C}$ to $+67^\circ\text{C}$  |
|                             | with derating                                                             |                     | $-40^\circ\text{C}$ to $+105^\circ\text{C}$ |
| Maximum Case Temperature    |                                                                           |                     | $+105^\circ\text{C}$                        |
| Temperature Coefficient     |                                                                           |                     | $\pm 0.02\%/^\circ\text{C}$ max.            |
| Thermal Impedance           | natural convection 0.1m/s (20LFM)                                         | without Heat-sink   | $18.2^\circ\text{C/Watt}$                   |
|                             |                                                                           | with Heat-sink      | $15.8^\circ\text{C/Watt}$                   |
| Operating Humidity          |                                                                           |                     | 5% - 95% RH                                 |
| Thermal Shock               |                                                                           |                     | according to MIL-STD-810F                   |
| Vibration                   |                                                                           |                     | according to MIL-STD-810F                   |
| MTBF                        | according to MIL-HDBK-217F, G.B.<br>Bellcore TR-NWT-000332 <sup>(9)</sup> | $+25^\circ\text{C}$ | $1459 \times 10^3$ hours                    |
|                             |                                                                           |                     | $1330 \times 10^3$ hours                    |

**Derating Graph <sup>(10)</sup>**



**Notes:**

Note9: BELLCORE TR-NWT-000332. Case I: 50% Stress,  $T_a = 40^\circ\text{C}$ . MIL-HDBK 217F Notice 2.  $T_a = 25^\circ\text{C}$ , full load, (controlled environment).

Note10: Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part number not shown here please contact our technical support service at techsupportAT@recom-power.com.

### SAFETY AND CERTIFICATIONS

| Certificate Type (Safety)                                                                                | Report / File Number                              | Standard                                                   |
|----------------------------------------------------------------------------------------------------------|---------------------------------------------------|------------------------------------------------------------|
| Information Technology Equipment, General Requirements for Safety                                        | E196683                                           | UL60950-1 1st. Ed.: 2003<br>C22.2 No. 60950 1st. Ed.: 2003 |
| EMC Compliance                                                                                           | Condition                                         | Standard / Criterion                                       |
| Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement | with external filter                              | EN55022, Class A or B                                      |
| ESD Electrostatic discharge immunity test                                                                | Air $\pm 8\text{kV}$ and Contact $\pm 6\text{kV}$ | EN61000-4-2, Criteria A                                    |
| Radiated, radio-frequency, electromagnetic field immunity test                                           | 10V/m                                             | EN61000-4-3, Criteria A                                    |
| Fast Transient and Burst Immunity <sup>(11)</sup>                                                        | $\pm 2\text{kV}$                                  | EN61000-4-4, Criteria A                                    |
| Surge Immunity <sup>(11)</sup>                                                                           | $\pm 1\text{kV}$                                  | EN61000-4-5, Criteria A                                    |
| Immunity to conducted disturbances, induced by radio-frequency fields                                    | 3Vr.m.s                                           | EN61000-4-6, Criteria A                                    |

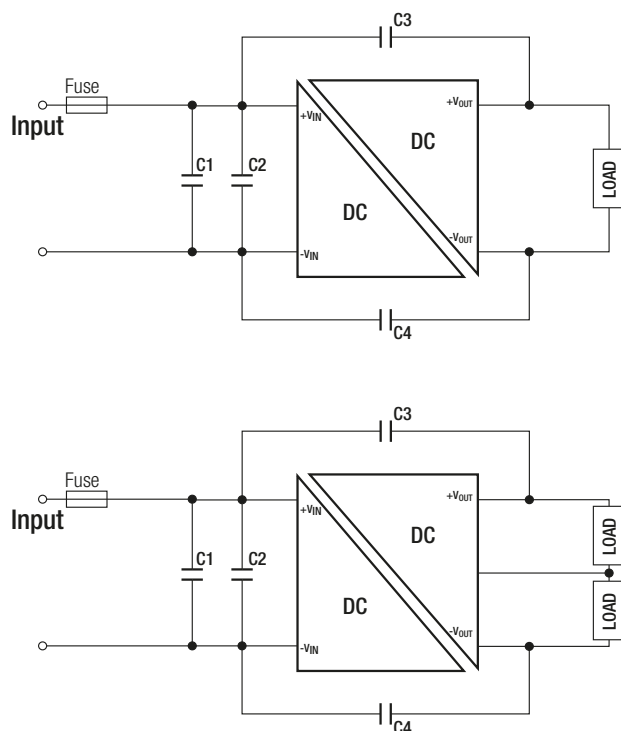
continued on next page

**Specifications** (measured at  $T_a = 25^\circ\text{C}$ , nominal input voltage, full load otherwise noted)

**Notes:**

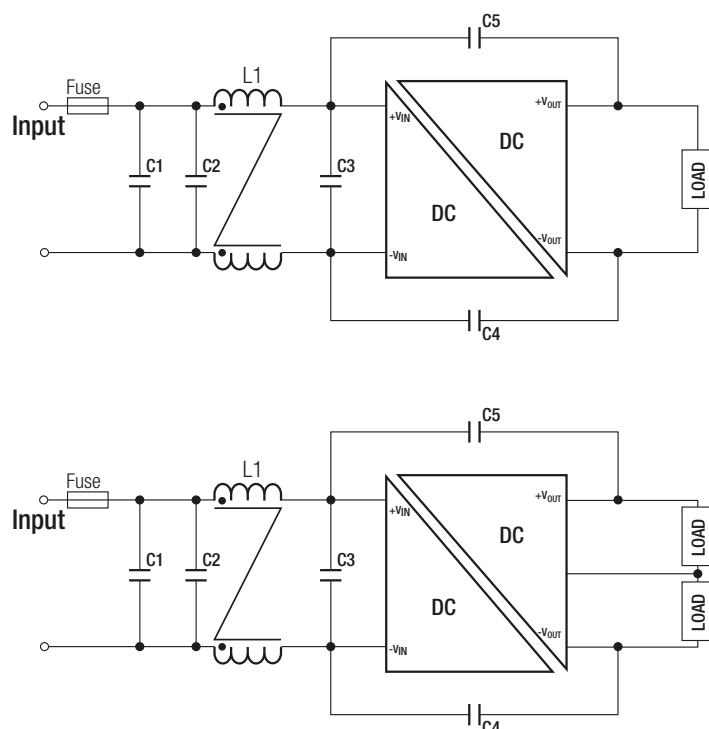
Note11: An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5. The filter capacitor Recom suggests: Nippon chemi-con KY series,  $220\mu\text{F}/100\text{V}$

**EMI Filtering Class A**



| MODEL          | C1                                         | C2                                         | C3/C4                  |
|----------------|--------------------------------------------|--------------------------------------------|------------------------|
| RP15-24xxS_DAW | 6.8 $\mu\text{F}/50\text{V}$<br>1812 MLCC  | 6.8 $\mu\text{F}/50\text{V}$<br>1812 MLCC  | 470pF/2kV<br>1808 MLCC |
| RP15-48xxS_DAW | 2.2 $\mu\text{F}/100\text{V}$<br>1812 MLCC | 2.2 $\mu\text{F}/100\text{V}$<br>1812 MLCC | 470pF/2kV<br>1808 MLCC |

**EMI Filtering Class B**



| MODEL          | C1                                         | C2                                         | C3                                         |
|----------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|
| RP15-24xxS_DAW | 6.8 $\mu\text{F}/50\text{V}$<br>1812 MLCC  | N/A                                        | 6.8 $\mu\text{F}/50\text{V}$<br>1812 MLCC  |
| RP15-48xxS_DAW | 2.2 $\mu\text{F}/100\text{V}$<br>1812 MLCC | 2.2 $\mu\text{F}/100\text{V}$<br>1812 MLCC | 2.2 $\mu\text{F}/100\text{V}$<br>1812 MLCC |

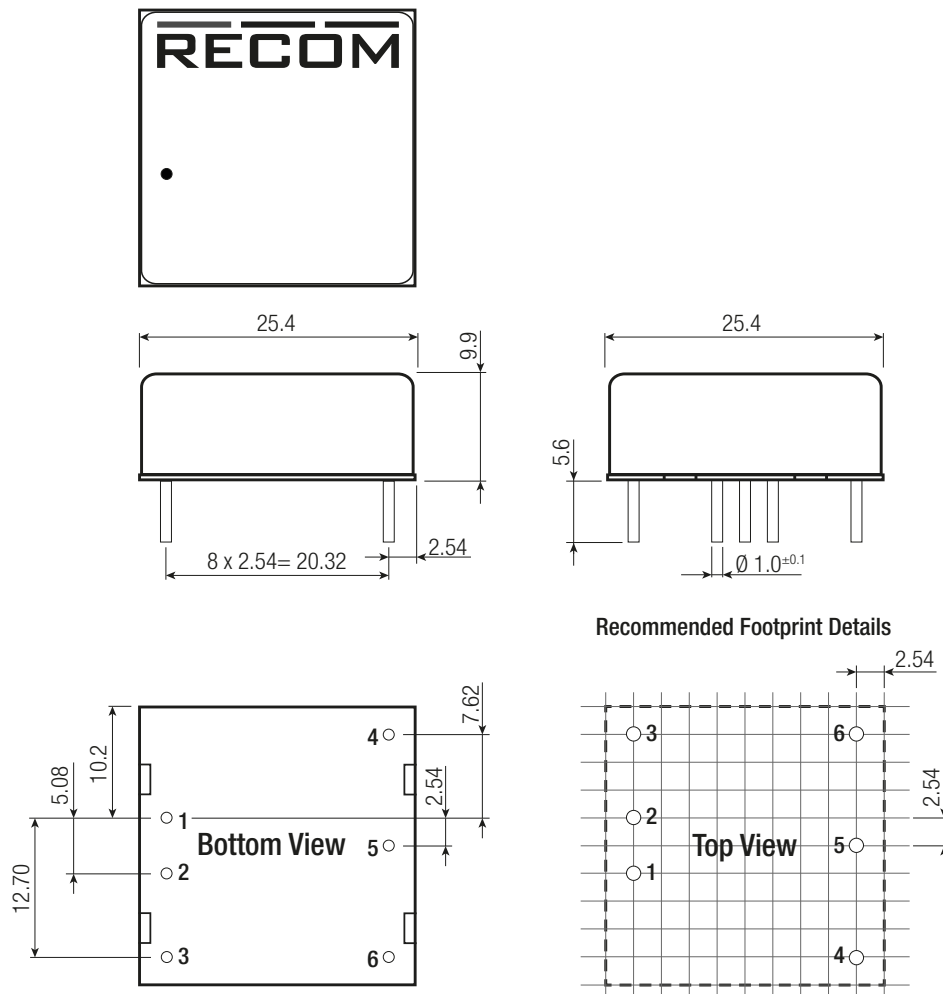
| MODEL          | C4/C5                   | L1                                                        |
|----------------|-------------------------|-----------------------------------------------------------|
| RP15-24xxS_DAW | 470pF/2kV<br>1808 MLCC  | CMC: 325 $\mu\text{H}$<br>ref: WE 744290321; ref.: CMC-06 |
| RP15-48xxS_DAW | 1000pF/2kV<br>1808 MLCC | 325 $\mu\text{H}$<br>ref: WE 744290321; ref.: CMC-06      |

**Specifications** (measured at  $T_a = 25^\circ\text{C}$ , nominal input voltage, full load otherwise noted)

### DIMENSIONS and PHYSICAL CHARACTERISTICS

| Parameter                  | Type              | Value                |
|----------------------------|-------------------|----------------------|
| Material                   | Case              | Nickel coated copper |
|                            | Base              | FR4 PCB              |
|                            | Potting           | Epoxy (UL94-V0)      |
| Package Dimensions (LxWxH) | without Heat-sink | 25.4 x 25.4 x 9.9mm  |
|                            | with Heat-sink    | 31.4 x 25.4 x 16.5mm |
| Package Weight             | without Heat-sink | 15g                  |
|                            | with Heat-sink    | 21.5g                |

### Dimension Drawing (mm)



### Pin Connections

| Pin # | Single | Single /P or /N | Dual   | Dual /P or /N |
|-------|--------|-----------------|--------|---------------|
| 1     | +Vin   | +Vin            | +Vin   | +Vin          |
| 2     | -Vin   | -Vin            | -Vin   | -Vin          |
| 3     | no Pin | CTRL            | no Pin | CTRL          |
| 4     | +Vout  | +Vout           | +Vout  | +Vout         |
| 5     | no Pin | Trim            | Com    | Com           |
| 6     | -Vout  | -Vout           | -Vout  | -Vout         |

Pin Pitch Tolerance  $\pm 0.25\text{mm}$

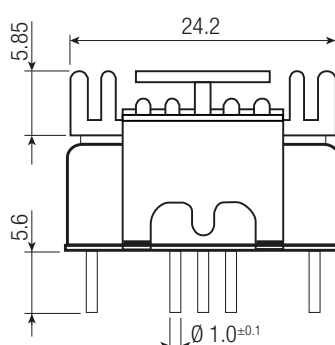
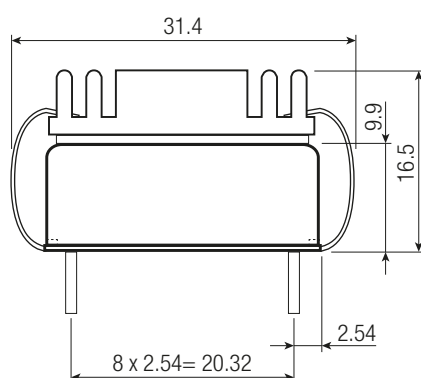
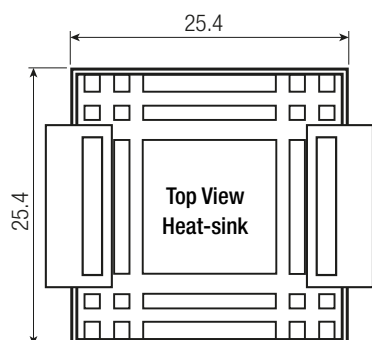
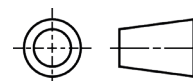
XX.X  $\pm 0.5\text{mm}$

XX.XX  $\pm 0.25\text{mm}$

continued on next page

**Specifications** (measured at Ta = 25°C, nominal input voltage, full load otherwise noted)

Dimension Drawing (mm) with Heat-sink

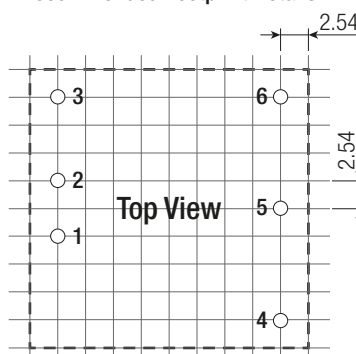
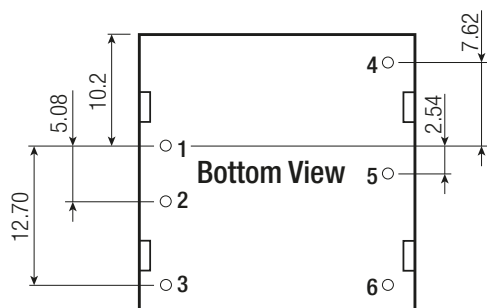


Pin Connections

| Pin # | Single | Single /P or /N | Dual   | Dual /P or /N |
|-------|--------|-----------------|--------|---------------|
| 1     | +Vin   | +Vin            | +Vin   | +Vin          |
| 2     | -Vin   | -Vin            | -Vin   | -Vin          |
| 3     | no Pin | CTRL            | no Pin | CTRL          |
| 4     | +Vout  | +Vout           | +Vout  | +Vout         |
| 5     | no Pin | Trim            | Com    | Com           |
| 6     | -Vout  | -Vout           | -Vout  | -Vout         |

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

Recommended Footprint Details



### PACKAGING INFORMATION

| Parameter                    | Type                   | Value                  |
|------------------------------|------------------------|------------------------|
| Packaging Dimensions (LxWxH) | without Heat-sink Tube | 230.0 x 180.0 x 28.0mm |
|                              | with Heat-sink Tray    | 230.0 x 180.0 x 28.0mm |
| Packaging Quantity           | without Heat-sink Tube | 8pcs                   |
|                              | with Heat-sink Tray    | 20pcs                  |
| Storage Temperature Range    |                        | -55°C to +125°C        |
| Storage Humidity             |                        | 5% - 95% RH            |

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.