

# Regulated Converters

- Wide 4:1 Input Voltage Range
- 1.6kVDC Isolation
- UL Certified
- Efficiency up to 88%
- Fixed Operating Frequency
- Six-Sided Continuous Shield



# RP15-AW

# 15 Watt 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<br>Voltage Range<br>[VDC] | Output<br>Voltage<br>[VDC] | Output<br>Current<br>[mA] | Input <sup>(1)</sup><br>Current<br>[mA] | Efficiency <sup>(1)</sup><br>typ.<br>[%] | Max. Capacitive<br>Load <sup>(2)</sup><br>[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:

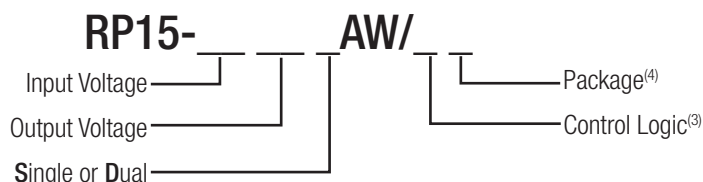
Note1: Values at nominal input voltage and full load.

Note2: Test by minimum  $V_{in}$  and constant resistor load.



**UL**<sup>®</sup>  
C **UL** US  
E196683

## 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,  $\pm 5V$  Output, Premounted Heat-sink

(no trim pin with dual output)

Notes:

Note3: Standard part is without suffixes and Trim and CTRL pins are not fitted.

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

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.            |
| Input Voltage Range                   | nom. Vin = 24V<br>nom. Vin = 48V                                                                                                                  | 9VDC<br>18VDC                              | 24VDC<br>48VDC                                                         | 36VDC<br>75VDC  |
| Under Voltage Lockout (UVLO)          | Vin = 24V<br>DC-DC ON<br>DC-DC OFF                                                                                                                |                                            | 8VDC                                                                   | 9VDC            |
|                                       | Vin = 48V<br>DC-DC ON<br>DC-DC OFF                                                                                                                |                                            | 16VDC                                                                  | 18VDC           |
| Input Filter                          | Pi-Type                                                                                                                                           |                                            |                                                                        |                 |
| Input Reflected Ripple <sup>(5)</sup> | nominal Vin and full load                                                                                                                         |                                            | 30mA <sub>p-p</sub>                                                    |                 |
| Input Surge Voltage                   | Vin = 24V, 100ms max.<br>Vin = 48V, 100ms max.                                                                                                    |                                            |                                                                        | 50VDC<br>100VDC |
| Start-up time                         | Power up<br>Remote ON/OFF                                                                                                                         |                                            |                                                                        | 30ms<br>30ms    |
| Operating Frequency Range             |                                                                                                                                                   | 360kHz                                     | 400kHz                                                                 | 440kHz          |
| Minimum Load                          |                                                                                                                                                   | 0%                                         |                                                                        |                 |
| Optional Output Trim <sup>(6)</sup>   |                                                                                                                                                   | $\pm 10.0\%$                               |                                                                        |                 |
| Ripple and Noise                      | measured by 20MHz bandwidth<br>with a 1 $\mu\text{F}$ M/C X7R and 10 $\mu\text{F}$ T/C<br>with a 1 $\mu\text{F}$ M/C X7R and 10 $\mu\text{F}$ T/C | Single<br>3.3Vout, 5Vout<br>12Vout, 15Vout | 75mV <sub>p-p</sub><br>100mV <sub>p-p</sub>                            |                 |
|                                       | measured by 20MHz bandwidth<br>with a 1 $\mu\text{F}$ M/C X7R and 10 $\mu\text{F}$ T/C for<br>each output                                         | Dual                                       | 100mV <sub>p-p</sub>                                                   |                 |
| Remote ON/OFF <sup>(6)</sup>          | Positive Logic                                                                                                                                    | DC-DC ON<br>DC-DC OFF                      | Open or $3 < V_r < 15\text{VDC}$<br>Short or $0 < V_r < 1.2\text{VDC}$ |                 |
|                                       | Negative Logic                                                                                                                                    | DC-DC ON<br>DC-DC OFF                      | Short or $0 < V_r < 1.2\text{VDC}$<br>Open or $3 < V_r < 15\text{VDC}$ |                 |
| Input current of Remote pin (CTRL)    |                                                                                                                                                   | DC-DC OFF                                  |                                                                        | 2.5mA           |
|                                       |                                                                                                                                                   | DC-DC ON                                   | -0.5mA                                                                 | 1.0mA           |

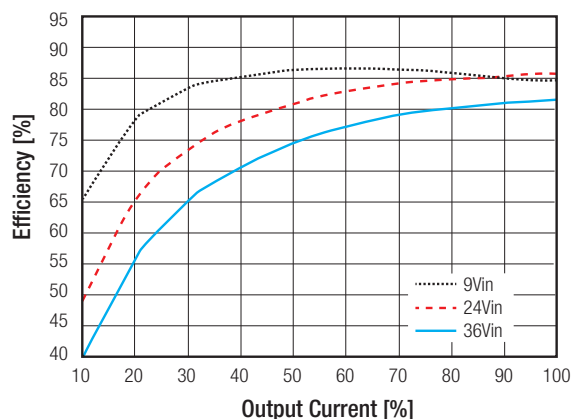
**Notes:**

Note5: Simulated source impedance of 12 $\mu\text{H}$ . 12 $\mu\text{H}$  inductor in series with +Vin.

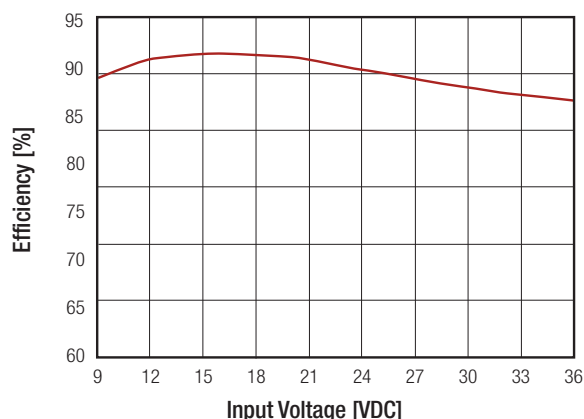
Note6: The ON/OFF control function can be positive or negative logic. The pin voltage is referenced to -Vin pin.  
If no suffix is specified, the control pin will be omitted.

### RP15-2405SAW

**Efficiency vs. Output Current**



**Efficiency vs. Input Voltage**

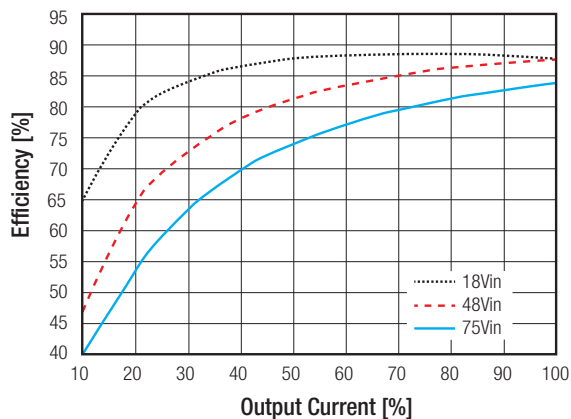


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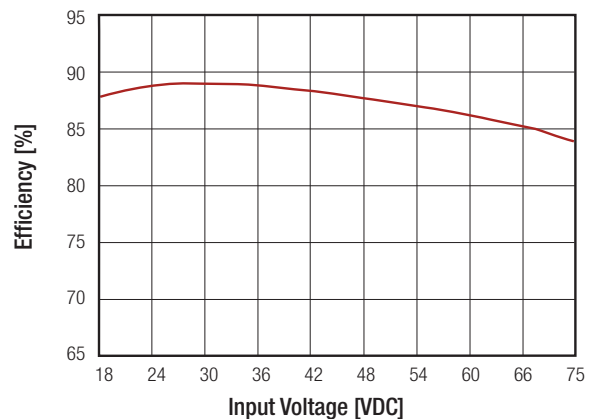
**Specifications** measured at  $T_a = 25^\circ\text{C}$ , nominal input voltage, full load otherwise noted

### RP15-4805SAW

Efficiency vs. Output Current



Efficiency vs. Input Voltage



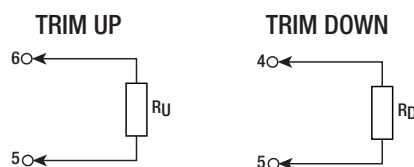
### REGULATIONS

| Parameter                        | Condition                    | Value                                        |
|----------------------------------|------------------------------|----------------------------------------------|
| Output Voltage Accuracy          | full load and nominal Vin    | $\pm 1\%$                                    |
| Voltage adjustability            | Single output                | $\pm 10\%$                                   |
| Line Voltage Regulation          | Single                       | $\pm 0.2\%$                                  |
|                                  | Dual                         | $\pm 0.5\%$                                  |
| Load Voltage Regulation          | 0% to 100% load              | Single<br>$\pm 0.2\%$<br>Dual<br>$\pm 1.0\%$ |
| Cross Regulation                 | asymmetrical 25% < 100% load | $\pm 5\%$                                    |
| Transient Response recovery time | 25% load step change         | 250 $\mu\text{s}$ typ.                       |

### 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 trimtables 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   | %     |
|------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|
| Vout =           | 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> = | 57.93 | 26.16 | 15.58 | 10.28 | 7.11  | 4.99  | 3.48  | 2.34  | 1.46  | 0.75 | KOhms |
|                  |       |       |       |       |       |       |       |       |       |      |       |
| Trim down        | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10   | %     |
| Vout =           | 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> = | 69.47 | 31.23 | 18.49 | 12.12 | 8.29  | 5.74  | 3.92  | 2.56  | 1.50  | 0.65 | KOhms |

continued on next page

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

| RP15-xx05SA        |        |        |        |       |       |       |       |       |       |       |       |
|--------------------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|
| 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> =   | 36.57  | 16.58  | 9.92   | 6.58  | 4.59  | 3.25  | 2.30  | 1.59  | 1.03  | 0.59  | 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>p</sub> =   | 45.53  | 20.61  | 12.31  | 8.15  | 5.66  | 4.00  | 2.81  | 1.92  | 1.23  | 0.68  | KOhms |
| RP15-xx12SA        |        |        |        |       |       |       |       |       |       |       |       |
| 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> =   | 367.91 | 165.95 | 98.64  | 64.98 | 44.78 | 31.32 | 21.70 | 14.49 | 8.88  | 4.39  | 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>p</sub> =   | 460.99 | 207.95 | 123.60 | 81.42 | 56.12 | 39.25 | 27.20 | 18.16 | 11.13 | 5.51  | KOhms |
| RP15-xx15SA        |        |        |        |       |       |       |       |       |       |       |       |
| Trim up            | 1      | 2      | 3      | 4     | 5     | 6     | 7     | 8     | 9     | 10    | %     |
| V <sub>out</sub> = | 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> =   | 404.18 | 180.59 | 106.06 | 68.80 | 46.44 | 31.53 | 20.88 | 12.90 | 6.69  | 1.72  | KOhms |
| Trim down          | 1      | 2      | 3      | 4     | 5     | 6     | 7     | 8     | 9     | 10    | %     |
| V <sub>out</sub> = | 14.85  | 14.70  | 14.55  | 14.40 | 14.25 | 14.10 | 13.95 | 13.80 | 13.65 | 13.50 | Volts |
| R <sub>p</sub> =   | 499.82 | 223.41 | 131.27 | 85.20 | 57.56 | 39.14 | 25.97 | 16.10 | 8.42  | 2.282 | KOhms |

### PROTECTIONS

| Parameter                      | Condition                       |                                                                                      | Value                                                  |
|--------------------------------|---------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------|
| Short Circuit Protection (SCP) |                                 |                                                                                      | continuous, automatic recovery                         |
| Over Voltage Protection (OVP)  | Zener Diode Clamp               | 3.3V <sub>out</sub><br>5V <sub>out</sub><br>12V <sub>out</sub><br>15V <sub>out</sub> | 3.7 - 5.4V<br>5.6 - 7.0V<br>13.5 - 19.6V<br>16.8-20.5V |
| Over Load Protection (OLP)     | % of I <sub>out</sub> rated     |                                                                                      | 150% typ.                                              |
| Isolation Voltage              | I/P to O/P<br>I/P (O/P) to case |                                                                                      | 1.6kVDC/1 minute<br>1.0kVDC/1 minute                   |
| Isolation Resistance           |                                 |                                                                                      | 1GΩ min.                                               |
| Isolation Capacitance          |                                 |                                                                                      | 1000pF max.                                            |

#### Notes:

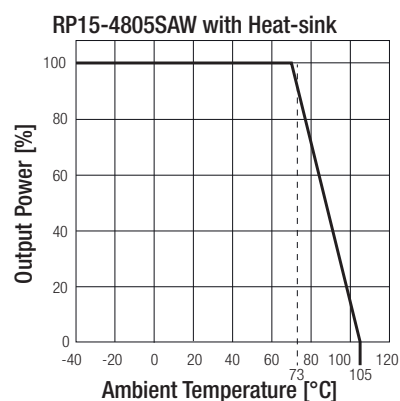
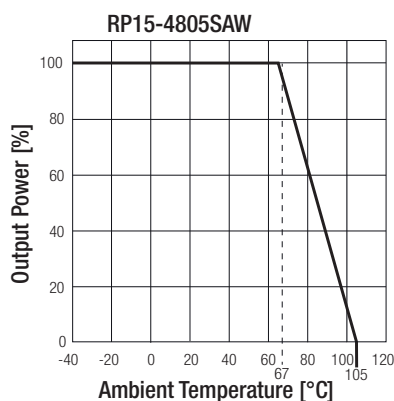
Note7: This power module is not internally fused. An input line fuse must always be used.

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

### ENVIRONMENTAL

| Parameter                   | Condition                                                               | Value                                                        |
|-----------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------|
| Operating Temperature Range | without derating<br>with derating                                       | -40°C to +67°C<br>-40°C to +105°C                            |
| Maximum Case Temperature    |                                                                         | +105°C                                                       |
| Temperature Coefficient     |                                                                         | ±0.02%/°C max.                                               |
| Thermal Impedance           | Natural convection (20LFM)<br>Natural convection (20LFM) with Heat sink | 18.2°C/Watt<br>15.8°C/Watt                                   |
| Operating Humidity          |                                                                         | 5% - 95% RH                                                  |
| Thermal Shock               |                                                                         | MIL-STD-810F                                                 |
| Vibration                   |                                                                         | MIL-STD-810F                                                 |
| MTBF                        | MIL-HDBK-217F<br>Bellcore TR-NWT-000332 <sup>(8)</sup>                  | 1459 x 10 <sup>3</sup> hours<br>1330 x 10 <sup>3</sup> hours |

### Derating Graph<sup>(9)</sup>



#### Notes:

Note8: BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C.

MIL-HDBK 217F Notice 2. Ta = 25°C, full load, (Ground, Benign, controlled environment).

Note9: 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                                                  |
|--------------------------------|----------------------------|-----------------------------------------------------------|
| UL General Safety              | E196683                    | UL60950-1 1st Ed.: 2003<br>C22.2 No. 60950 1st. Ed.: 2003 |
| EMC Compliance                 | Condition                  | Standard / Criterion                                      |
| EMI Standard <sup>(10)</sup>   | with external filter       | EN55022, Class A, Class B                                 |
| ESD                            | Air ±8kV and Contact ± 6kV | EN61000-4-2, Criteria A                                   |
| Radiated Immunity              | 10 V/m                     | EN61000-4-3, Criteria A                                   |
| Fast Transient <sup>(11)</sup> | ±2kV                       | EN61000-4-4, Criteria A                                   |
| Surge <sup>(11)</sup>          | ±1kV                       | EN61000-4-5, Criteria A                                   |
| Conducted Immunity             | 3 Vr.m.s                   | EN61000-4-6, Criteria A                                   |

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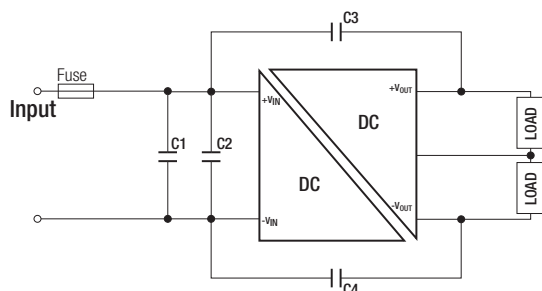
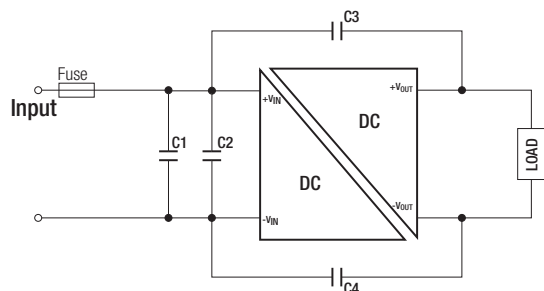
**Specifications** measured at  $T_a = 25^\circ\text{C}$ , nominal input voltage, full load otherwise noted

### Notes:

Note10: The standard modules meet EMI Class A or Class B with external components, see filter suggestions below.

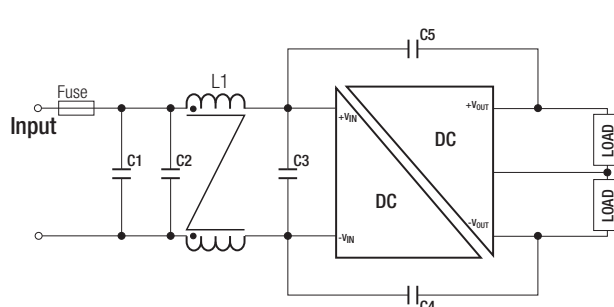
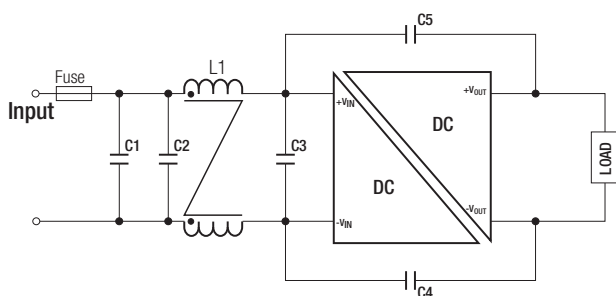
Note11: An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5. The filter capacitor Recom suggests: Nippon chemi-con KY series, 220 $\mu\text{F}$ /100V.

### EMI Filtering Class A



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

### EMI Filtering Class B



| MODEL          | C1                                   | C2                                   | C3                                   | C4/C5                   | L1                                                          |
|----------------|--------------------------------------|--------------------------------------|--------------------------------------|-------------------------|-------------------------------------------------------------|
| RP15-24xxS_DAW | 6.8 $\mu\text{F}$ /50V<br>1812 MLCC  | N/A                                  | 6.8 $\mu\text{F}$ /50V<br>1812 MLCC  | 470pF/2kV<br>1808 MLCC  | CMC: 325 $\mu\text{H}$<br>ref: WE 744290321<br>ref.: CMC-06 |
| RP15-48xxS_DAW | 2.2 $\mu\text{F}$ /100V<br>1812 MLCC | 2.2 $\mu\text{F}$ /100V<br>1812 MLCC | 2.2 $\mu\text{F}$ /100V<br>1812 MLCC | 1000pF/2kV<br>1808 MLCC | 325 $\mu\text{H}$<br>ref: WE 744290321<br>ref.: CMC-06      |

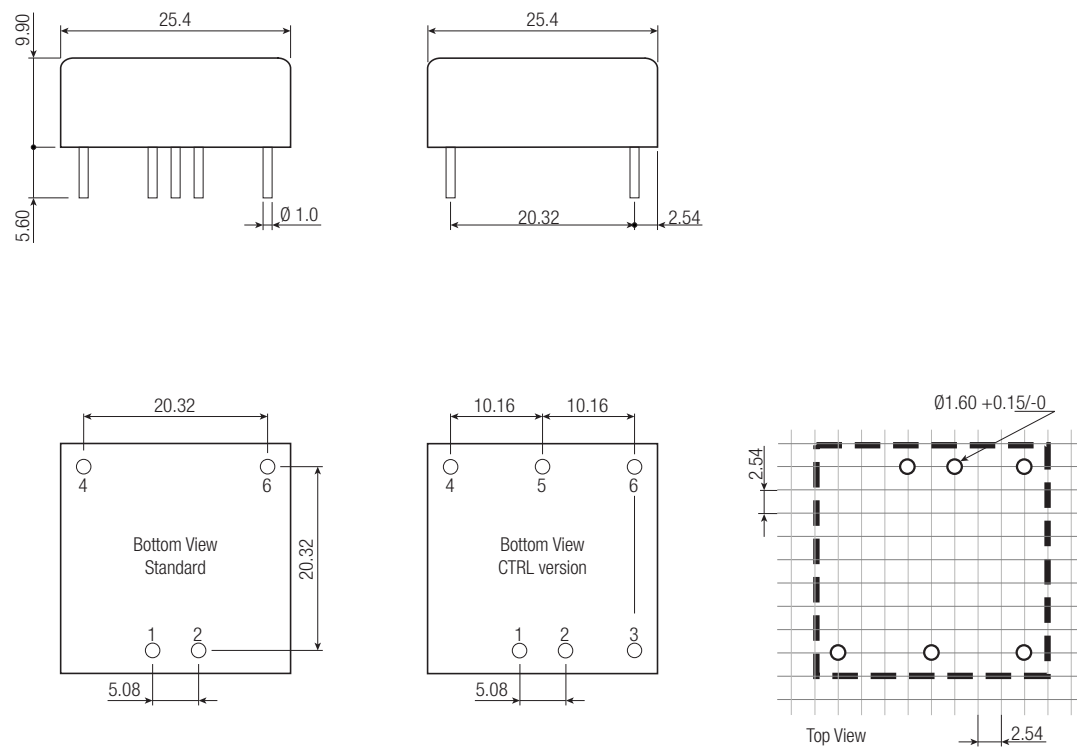
### DIMENSIONS and PHYSICAL CHARACTERISTICS

| 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    | 21.44g               |

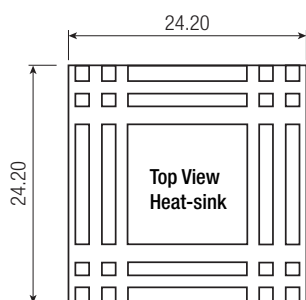
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**Specifications** measured at  $T_a = 25^\circ\text{C}$ , nominal input voltage, full load otherwise noted

Dimension Drawing (mm)



Dimension Drawing (mm) with Heat-sink



Pin Connections

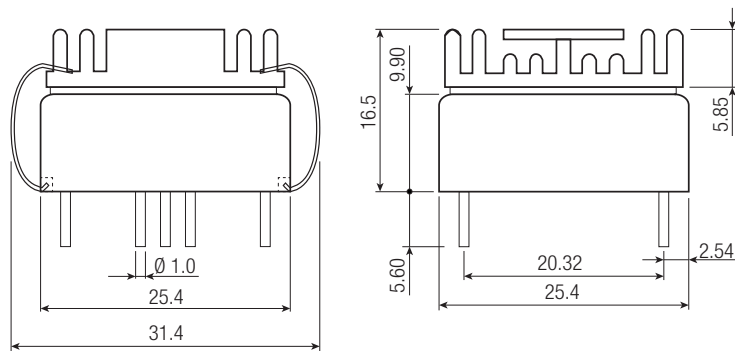
| Pin # | Single | Single /P or /N | Dual   | Dual /P or /N |
|-------|--------|-----------------|--------|---------------|
| 1     | +Vin   | +Vin            | +Vin   | +Vin          |
| 2     | -Vin   | -Vin            | -Vin   | -Vin          |
| 3     | no Pin | CTRL            | no Pin | CTRL  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

Case Tolerance  $\pm 0.5\text{mm}$

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

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

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



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

| PACKAGING INFORMATION     |                   |                 |
|---------------------------|-------------------|-----------------|
| Parameter                 | Type              | Value           |
| Packaging Quantity        | without Heat-sink | 8pcs.           |
|                           | with Heat-sink    | 20pcs.          |
| Storage Temperature Range |                   | -55°C to +125°C |
| Storage Humidity          |                   | 5% - 95% RH     |