# Features

# Regulated Converters

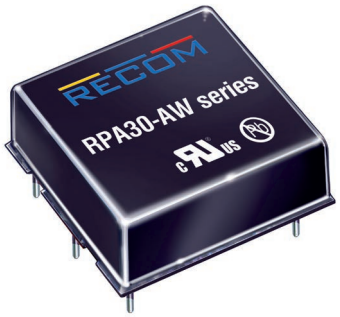
- 4:1 Wide Input Voltage Range
- 1.6kVDC Isolation
- UL, IEC/EN and EN50155 Certified
- Efficiency Up To 89%
- OVP, OCP & OTP
- +105°C max Case Temperature

RECOM
DC/DC Converter

# RPA30-AW

## 30 Watt 1"x1" Single & Dual Output

3 YEAR Warranty




RoHS 2 compliant 10 from 10 | REACH compliant | c UL us E224736

UL60950-1 Certified
IEC/EN60950 Certified
EN50155 Certified

## Description

The RPA30-AW series are high power density, wide input voltage range 30W DC/DC converters in an industry standard 1"x1" case size. Despite their small size, the RPA30-AW converters are fully specified devices with output currents up to 7.5Amps, up to 89% efficiency, no minimum load, 1600VDC isolation, tight regulation and low ripple/noise figures. The outputs are also fully protected against over-temperature, short circuits, overcurrent and overvoltage and the single output version offers a ±10% trim range. A heatsink option is available to extend the operating temperature range. The converters are UL and EN50155 certified and will find many uses in railway and industrial applications where board space is at a premium.

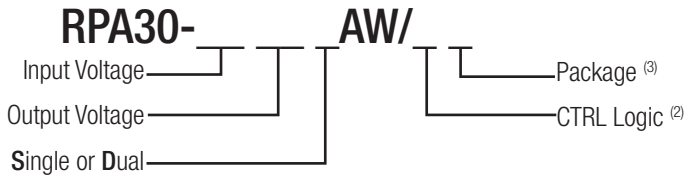
## Selection Guide

| Part Number | Input Voltage Range [VDC] | Output Voltage [VDC] | Output Current [mA] | Input[1] Current [mA] | Efficiency[1] typ. [%] | Max. Capacitive Load [µF] |
|---|---|---|---|---|---|---|
| RPA30-243.3SAW[2,3] | 9-36 | 3.3 | 7500 | 1172 | 88 | 10000 |
| RPA30-2405SAW[2,3] | 9-36 | 5 | 6000 | 1404 | 89 | 10000 |
| RPA30-2412SAW[2,3] | 9-36 | 12 | 2500 | 1420 | 88 | 1000 |
| RPA30-2415SAW[2,3] | 9-36 | 15 | 2000 | 1420 | 88 | 1000 |
| RPA30-2412DAW[2,3] | 9-36 | ±12 | ±1250 | 1420 | 88 | ±1000 |
| RPA30-2415DAW[2,3] | 9-36 | ±15 | ±1000 | 1420 | 88 | ±680 |

**Notes:**

Note1: Tested at nominal Vin, full load and at +25°C ambient

## Model Numbering




**Ordering Examples**

RPA30-243.3SAW = 24V Input, 3.3V Output, Single, no CTRL pin
RPA30-2405SAW/P = 24V Input, 5V Output, Single, Pos. CTRL function
RPA30-2415SAW-HC = 24V Input, 15V Output, Single, no CTRL pin, glued Heat-sink
RPA30-2415DAW/N-HC = 24V Input, 15V Output, Dual, Neg. CTRL function, glued Heat-sink

**Notes:**

Note2: part without suffixes is without CTRL pin, trim pin fitted
add suffix "P" for positive CTRL function (1=ON, 0=OFF), trim pin fitted
add suffix "N" for negative CTRL function (0=ON, 1=OFF), trim pin fitted
trim pin is only available for single outputs

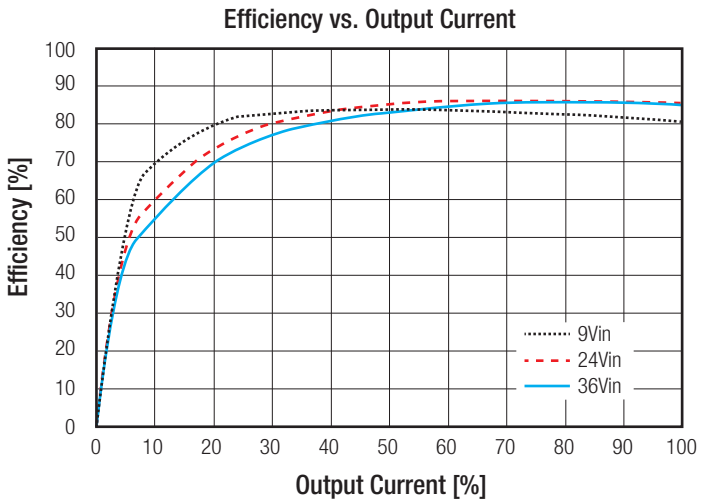
Note3: add suffix "-HC" for glued Heat-sink (compatible with all other suffixes)

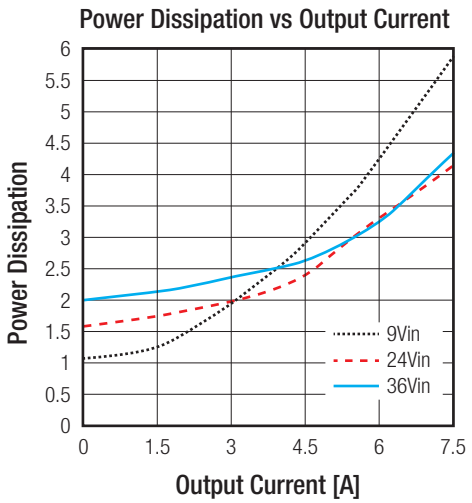
## Specifications measured @ta = 25°C, resistive load, nominal Vin and rated Iout unless otherwise noted

### BASIC CHARACTERISTICS

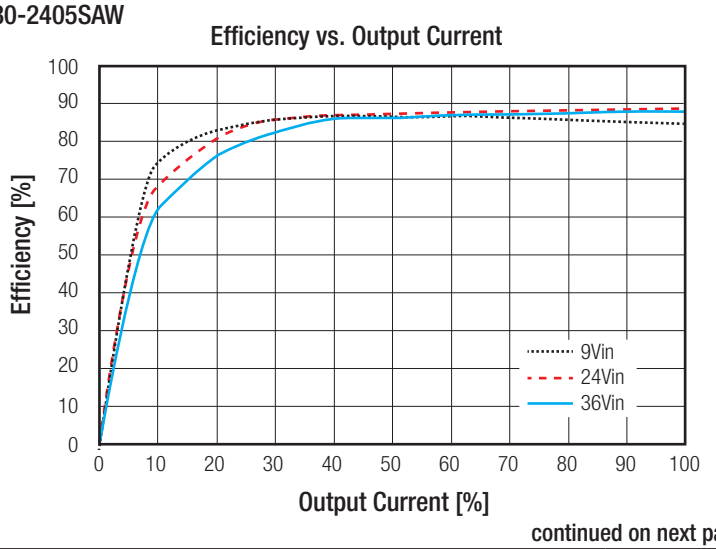
| Parameter | Condition | | Min. | Typ. | Max. |
|---|---|---|---|---|---|
| Internal Input Filter | | | | | Pi-Type |
| Input Voltage Range | | | 9VDC | 24VDC | 36VDC |
| Input Surge Voltage | 100ms max. | | | | 50VDC |
| Quiescent Current | | | | | |
| Start-up time | Power up<br>CTRL ON/OFF | | | 8ms | 16ms |
| Internal Operating Frequency | | | | 550kHz | |
| Minimum Load | | | 0% | | |
| Ripple and Noise | 20MHz BW, 10µF tantalum capacitor and 1µF ceramic capacitor | | | 50mVp-p | |
| Under Voltage Lockout (UVLO) | DC-DC ON<br>DC-DC OFF | | 8VDC<br>7VDC | 8.5VDC<br>7.5VDC | 9VDC<br>8VDC |
| ON/OFF Control | Positive Logic | DC-DC ON<br>DC-DC OFF | | | Open or 2.4 < Vr < 10VDC<br>Short or 0 < Vr < 0.8VDC |
| | Negative Logic | DC-DC ON<br>DC-DC OFF | | | Short or 0 < Vr < 0.8VDC<br>Open or 2.4 < Vr < 10VDC |
| Input current of CTRL pin | | | | 6mA | |
| Output Voltage Trimming | Single Outputs | | -10% | | +10% |

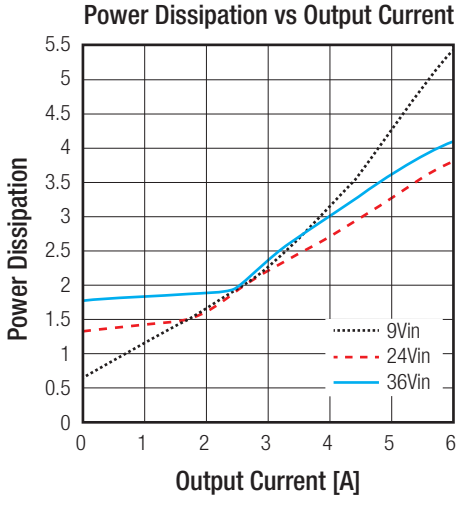
**RPA30-243.3SAW**




**RPA30-2405SAW**

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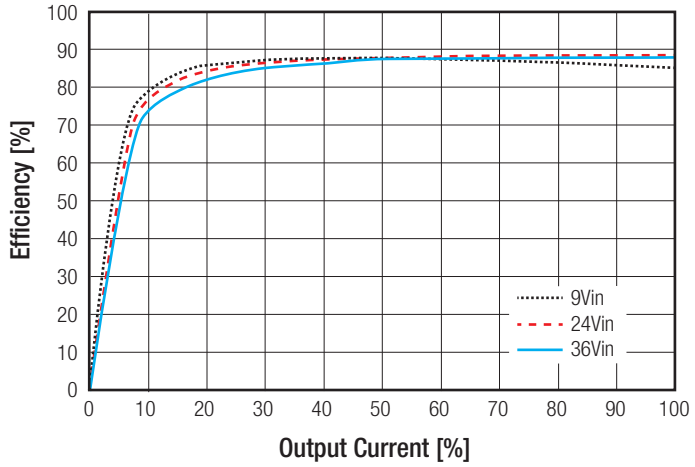
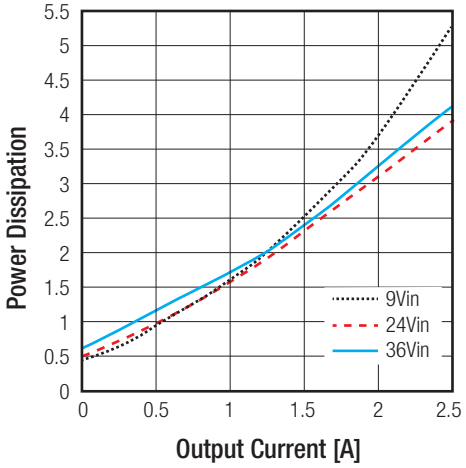
## Specifications measured @ta = 25°C, resistive load, nominal Vin and rated Iout unless otherwise noted

### RPA30-2412SAW

Efficiency vs. Output Current

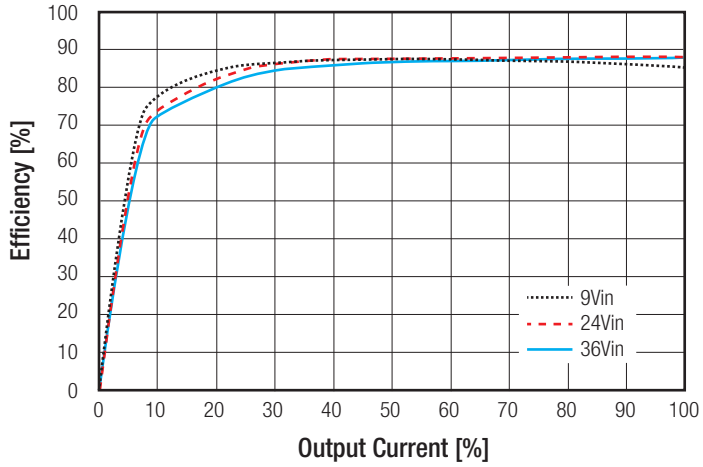



Power Dissipation vs Output Current

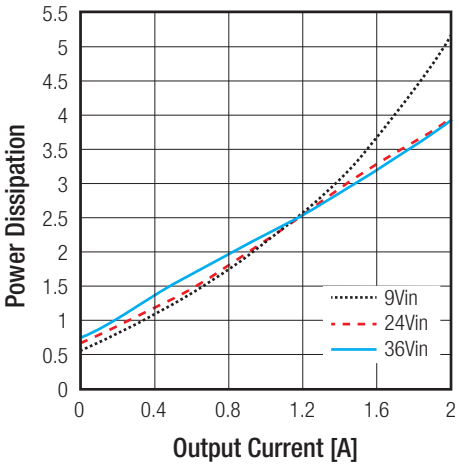



### RPA30-2415SAW

Efficiency vs. Output Current

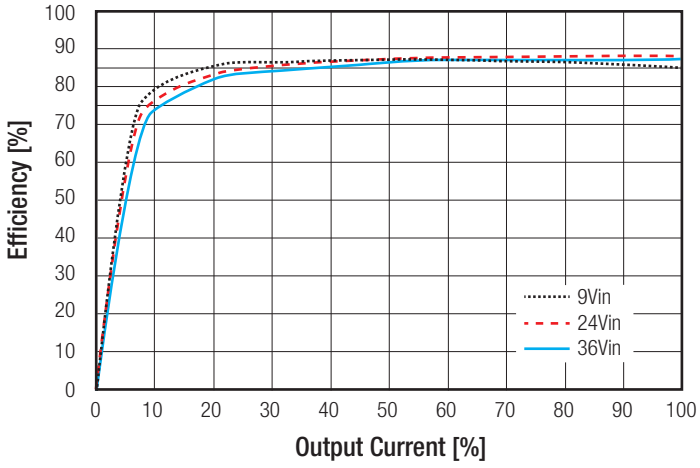



Power Dissipation vs Output Current

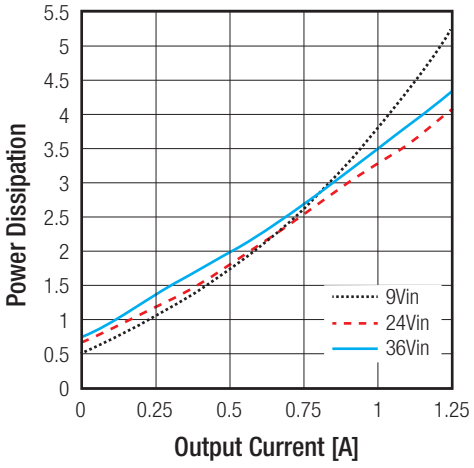



### RPA30-2412DAW

Efficiency vs. Output Current




Power Dissipation vs Output Current

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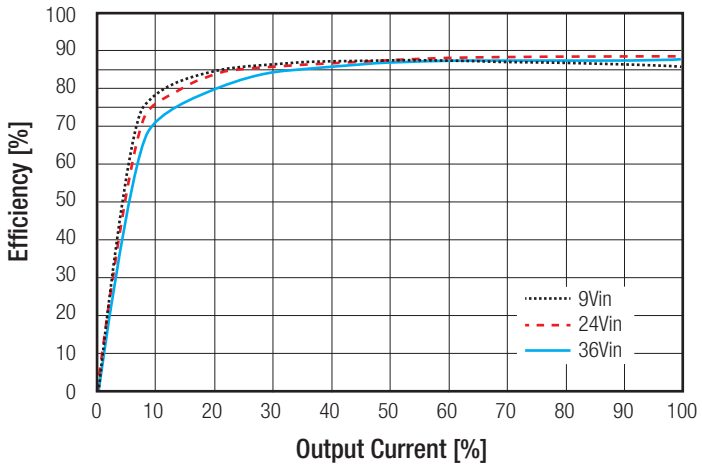
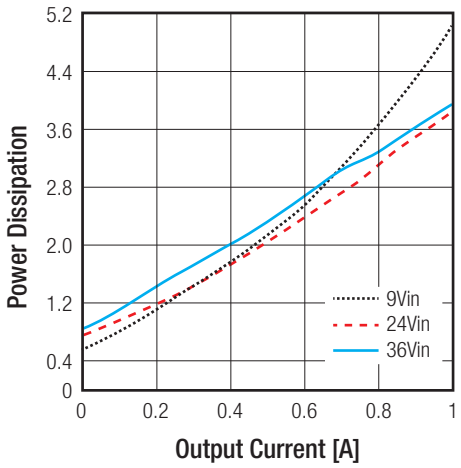
## Specifications measured @ta = 25°C, resistive load, nominal Vin and rated Iout unless otherwise noted

RPA30-2415DAW

Efficiency vs. Output Current




Power Dissipation vs Output Current

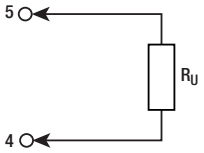



## OUTPUT TRIM

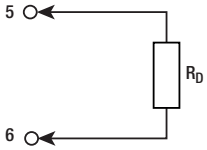
### Output Voltage Trimming

RPA30-AW 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.

TRIM UP




TRIM DOWN




RPA30-243.3SAW

| Trim up | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Vout = | 3.33 | 3.36 | 3.39 | 3.43 | 3.46 | 3.49 | 3.53 | 3.56 | 3.59 | 3.63 | Volts |
| $R_U$ = | 402 | 169 | 100 | 75 | 47.5 | 34.8 | 26.1 | 17.8 | 12.1 | 8.06 | kOhms |
| | | | | | | | | | | | |
| Trim down | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
| Vout = | 3.27 | 3.23 | 3.20 | 3.17 | 3.14 | 3.10 | 3.07 | 3.04 | 3.0 | 2.97 | Volts |
| $R_D$ = | 402 | 191 | 113 | 75 | 52.3 | 39.2 | 26.7 | 20 | 12.1 | 8.06 | kOhms |

RPA30-2405SAW

| Trim up | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Vout = | 5.05 | 5.10 | 5.15 | 5.20 | 5.25 | 5.30 | 5.35 | 5.40 | 5.45 | 5.50 | Volts |
| $R_U$ = | 604 | 243 | 147 | 95.3 | 68.1 | 39.2 | 34.8 | 22.1 | 15 | 8.06 | kOhms |
| | | | | | | | | | | | |
| Trim down | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
| Vout = | 4.95 | 4.90 | 4.85 | 4.80 | 4.75 | 4.70 | 4.65 | 4.60 | 4.55 | 4.50 | Volts |
| $R_D$ = | 604 | 287 | 169 | 124 | 105 | 78.7 | 54.9 | 39.2 | 15 | 0.5 | kOhms |

RPA30-2412SAW

| Trim up | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Vout = | 12.12 | 12.24 | 12.36 | 12.48 | 12.6 | 12.72 | 12.84 | 12.96 | 13.08 | 13.20 | Volts |
| $R_U$ = | 604 | 267 | 162 | 105 | 75 | 499 | 40.2 | 24.9 | 18.2 | 10 | kOhms |
| | | | | | | | | | | | |
| Trim down | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
| Vout = | 11.88 | 11.76 | 11.64 | 11.52 | 11.40 | 11.28 | 11.16 | 11.04 | 10.92 | 10.80 | Volts |
| $R_D$ = | 750 | 309 | 200 | 124 | 90.9 | 64.9 | 45.3 | 32.4 | 20 | 12.1 | kOhms |

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## Specifications measured @ta = 25°C, resistive load, nominal Vin and rated Iout unless otherwise noted

| RPA30-2415SAW | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Trim up | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
| Vout = | 15.15 | 15.30 | 15.45 | 15.60 | 15.75 | 15.90 | 16.05 | 16.20 | 16.35 | 16.50 | Volts |
| $R_U$ = | 1000 | 243 | 200 | 130 | 90.9 | 61.9 | 40.2 | 30.1 | 24.9 | 10 | 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 |
| $R_D$ = | 1000 | 348 | 210 | 140 | 95.3 | 68.1 | 45.3 | 30.1 | 18.2 | 8.06 | kOhms |

### REGULATION

| Parameter | Condition | | Value |
|---|---|---|---|
| Output Accuracy | Single & Dual | | ±2.0% max. |
| Line Regulation | low line to high line | Single | ±0.2% max. |
| | | Dual | ±0.5% max. |
| Load Regulation | 3.3Vout | | ±0.3% |
| | 5Vout | | ±0.2% |
| | 12Vout, 15Vout | | ±0.1% |
| | ±12Vout, ±15Vout | | ±1.0% |
| Cross Regulation | asymmetrical 25%<>100% load | | ±3.0% max. |
| Transient Response | 50-75%, full load, 0.1A/µs | | ±3.0% Vout typ. |
| | 25% load step change | | 250µs typ. |

### PROTECTION

| Parameter | Condition | | Value |
|---|---|---|---|
| Short Circuit Protection (SCP) | below 100mΩ | | continuous, auto recovery |
| Over Voltage Protection (OVP) | | | 115%-150% Output Voltage, Hiccup, auto recovery |
| Over Current Protection (OCP) | | | 110%-160% Output Current, Hiccup |
| Over Temperature Protection (OTP) | | | +115°C ±5°C |
| Isolation Voltage (5) | I/P to O/P | tested for 1 minute | 1.6kVDC |
| Isolation Resistance | | | 10MΩ min. |
| Isolation Capacitance | | | 1100pF typ. |
| Insulation Grade | | | basic |

**Notes:**

Note4: An input fuse is required if the mains supply is not over-current protected. Recommended fuse: 4A slow blow type.

Note5: For repeat Hi-Pot testing, reduce the time and/or the test voltage.

### ENVIRONMENTAL

| Parameter | Condition | Value |
|---|---|---|
| Operating Temperature Range (6) | | -40°C to [refer to thermal calculation] |
| Maximum Case Temperature | | +105°C |
| Temperature Coefficient | | 0.02%/°C |
| Thermal Impedance | | please refer to table 1 |
| Operating Altitude | | 2000m |
| Operating Humidity | | 95% RH |
| Shock | | 5G, 30ms, 6 times along X,Y and Z axis |
| Vibration | | 10-500Hz, 2.4G, 30mins along X,Y and Z axis |
| MTBF | according to Telcordia SR332 3, +25°C | 5888 x $10^3$ hours |

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## Specifications measured @ta = 25°C, resistive load, nominal Vin and rated Iout unless otherwise noted

Table 1: Thermal Impedance

| | without Heatsink | | with Heatsink | |
|---|---|---|---|---|
| airflow [m/s] | Rth without PCB [°C/W] | Rth with PCB (6) [°C/W] | Rth without PCB [°C/W] | Rth with PCB (6) [°C/W] |
| 0.1 | 17.8 | 12.5 | 16.0 | 11.3 |
| 0.2 | 16.0 | 11.2 | 14.4 | 10.1 |
| 0.5 | 14.0 | 9.7 | 12.6 | 8.7 |
| 1.0 | 10.0 | 7.1 | 9.0 | 6.4 |
| 1.5 | 8.3 | 5.8 | 7.5 | 5.2 |
| 2.0 | 6.3 | 4.4 | 5.7 | 4.0 |

**Notes:**

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

### Thermal Calculation

choose your model:

**RPA30-2405SAW (with PCB (6))**

- Load conditions in application (e.g. 50%)
- Airflow conditions in application (e.g. 0.5m/s)
- use Rth from Table1 (9.7°C/W)

Calculation:

Iout = 50%
$R_{th}$ = 9.7°C/W
$P_{DISS}$ = 2.2W
$T_{CASEmax}$ = 105°C

$T_{OVER} = R_{th} \times P_{Dis} = 9.7°C/W \times 2.2W = \mathbf{21.3°C}$

$T_{AMBmax} = T_{CASEmax} - T_{OVER} = 105°C - 21.3°C = \underline{\mathbf{83.7°C}}$

choose your model:

**RPA30-2405SAW-HC (with PCB (6))**

- Load conditions in application (e.g. 50%)
- Airflow conditions in application (e.g. 0.5m/s)
- use Rth from Table1 (8.7°C/W)

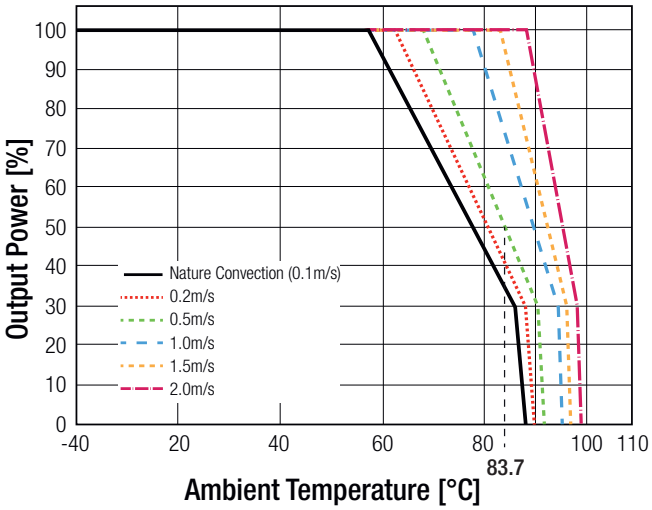
Calculation:

Iout = 50%
$R_{th}$ = 8.7°C/W
$P_{DISS}$ = 2.2W
$T_{CASEmax}$ = 105°C

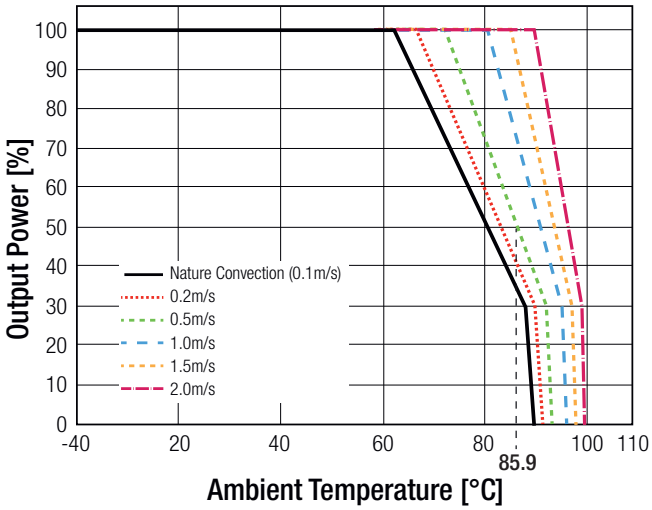
$T_{OVER} = R_{th} \times P_{Dis} = 8.7°C/W \times 2.2W = \mathbf{19.1°C}$

$T_{AMBmax} = T_{CASEmax} - T_{OVER} = 105°C - 19.1°C = \underline{\mathbf{85.9°C}}$

RPA30-2405SAW




RPA30-2405SAW-HC




| SAFETY AND CERTIFICATIONS | | |
|---|---|---|
| **Certificate Type (Safety)** | **Report / File Number** | **Standard** |
| Information Technology Equipment, General Requirements for Safety | E224736-A39 + A40 | UL60950-1, 2nd Edition, 2014<br>CSA C22.2 No. 60950, 2nd Edition, 2014 |
| IEC/EN Information Technology Equipment - General Requirments for Safety (CB Scheme) | E224736-A39-CB + A40-CB | IEC60950-1, 2nd Edition, 2005 + AM2, 2013<br>EN60950-1, 1st Edition, 2006 + AM2, 2013 |
| Railway Applications - Electrical Equipment used on rolling stock | 15100175 001, 15100176 001 | EN50155, 1st Edition, 2007, Clause 5.4 and 5.5 |
| RoHs 2+ | | RoHS 10/10, 2011/65/EU + AM-2015/863 |

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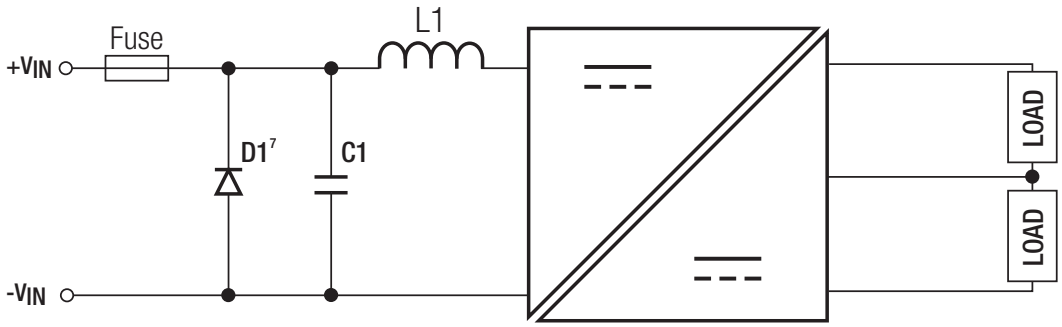
## Specifications measured @ta = 25°C, resistive load, nominal Vin and rated Iout unless otherwise noted

| EMC Compliance (designed to meet) | Condition | Standard / Criterion |
|---|---|---|
| Information technology equipment - Radio disturbance characteristics Limits and methods of measurement | with external filter | EN55022, Class A, 2010 |
| Railway applications - Electromagnetic compatibility Part 3-2: Rolling stock - Apparatus | | EN50121-3-2, 2015 |
| Specification for radio disturbance and immunity measuring apparatus and methods Part 2-1: Methods of measurement of disturbances and immunity – Conducted disturbance measurements | | EN55016-2-1, 2009 |
| Specification for radio disturbance and immunity measuring apparatus and methods Part 2-3: Methods of measurement of disturbances and immunity – Radiated disturbance measurements | | EN55016-2-3, 2010 |
| ESD Electrostatic discharge immunity test | Air ±8kV, Contact ±6kV | EN61000-4-2, 2009; Criteria A |
| Radiated, radio-frequency, electromagnetic field immunity test | 20V/m, 80-1000MHz<br>10V/m, 1.4-2.0GHz<br>5V/m, 2.0-2.7GHz<br>3V/m, 5.1-6.0GHz | EN61000-4-3, 2006; Criteria A |
| Fast Transient and Burst Immunity | ±2kV | IEC61000-4-4, 2004; Criteria A |
| Surge Immunity | ±1kV | EN61000-4-5, 2006; Criteria A |
| Immunity to conducted disturbances, induced by radio-frequency fields | 10V | EN61000-4-6, 2009; Criteria A |

### EMI Filtering according to EN50121-3-2 and EN55022 Class A




**Notes:**

Note7: Diode is only needed for EN50155.

| C1 | L1 |
|---|---|
| 47µF/50V electrolytic capacitor | 1µH Choke |

## DIMENSIONS and PHYSICAL CHARACTERISTICS

| Parameter | Type | Value |
|---|---|---|
| Material | Case<br>Baseplate<br>Potting | Al Alloy, anodize black<br>non-conductive FR4<br>Silicone |
| Package Dimensions (LxWxH) | without Heat-sink<br>with Heat-sink | 25.4 x 25.4 x 10.2mm<br>25.4 x 25.4 x 16.8mm |
| Package Weight | without Heat-sink<br>with Heat-sink | 17g typ.<br>21g typ. |

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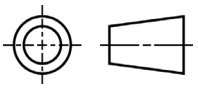
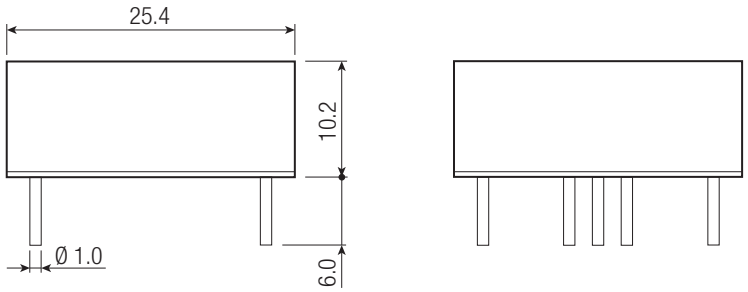
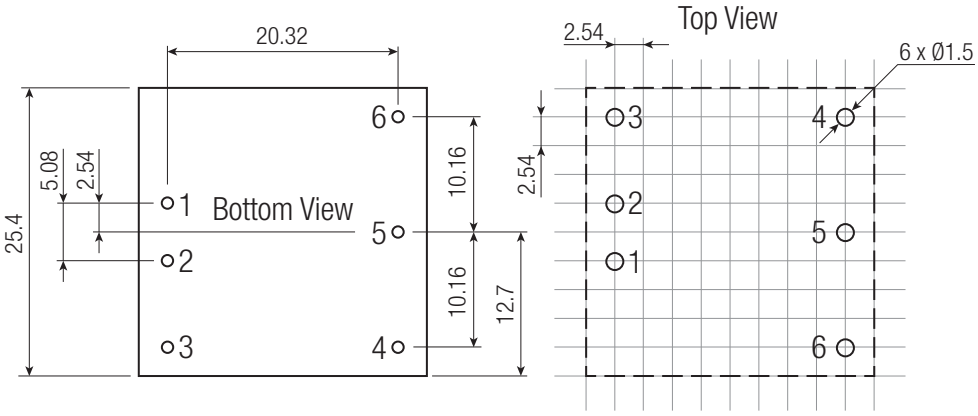
## Specifications measured @ta = 25°C, resistive load, nominal Vin and rated Iout unless otherwise noted

### Dimension Drawing (mm)

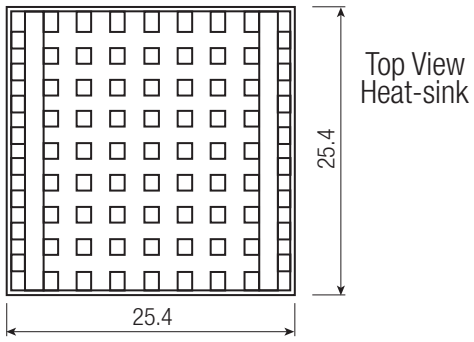


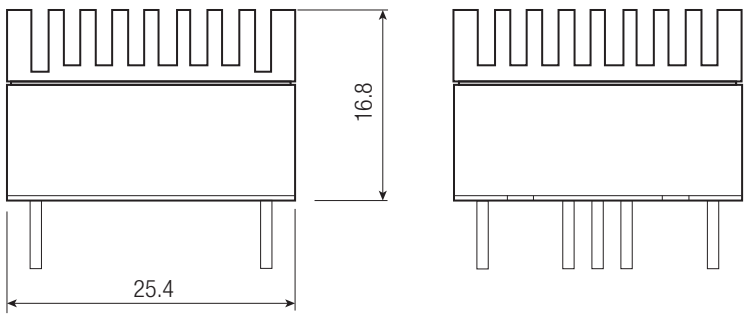



recommended Layout:




### Heat-sink Dimension Drawing (mm)




**Pin Connections**

| Pin # | Single | Dual |
|---|---|---|
| 1 | +Vin | +Vin |
| 2 | -Vin | -Vin |
| 3 | CTRL[2] | CTRL[2] |
| 4 | -Vout | -Vout |
| 5 | Trim | Com |
| 6 | +Vout | +Vout |

Pin Pitch Tolerance ±0.25mm
Pin dimension tolerance ±0.1mm
XX.X ± 0.5mm
XX.XX ± 0.25mm

## Specifications measured @ta = 25°C, resistive load, nominal Vin and rated Iout unless otherwise noted

| PACKAGING INFORMATION | | | |
|---|---|---|---|
| **Parameter** | **Type** | | **Value** |
| Packaging Dimensions (LxWxH) | without Heat-sink<br>with Heat-sink | tube | 285.0 x 27.6 x 19.0mm<br>285.0 x 27.6 x 25.8mm |
| Packaging Quantity | | | 10pcs |
| Storage Temperature Range | | | -55°C to +125°C |
| Storage Humidity | | | 5% - 95% RH |