Features

Regulated Converter

- 4:1 wide input voltage range
- 1.5kVDC / 1 minute isolation
- UL/IEC/EN60950 and EN50155 certified
- Efficiency up to 93.3%
- OVP, OCP & OTP
- +105°C max case temperature

RECOM
DC/DC Converter

RPA60-FW

60 Watt 2“ x 1“ Single Output

3 YEAR warranty



UL60950-1 certified
IEC/EN60950 certified
EN50155 certified

Description

The RPA60-FW series are high power density, wide input voltage range 60W DC/DC converters in an industry standard 2” x 1” case size. Despite their small size, the RPA60-FW converters are fully specified devices with output currents up to 12Amps, up to 93% efficiency, no minimum load, UVLO, 1500VDC / 1 minute isolation, tight regulation and low ripple/noise figures. The trimmable outputs are also fully protected against over-temperature, short circuits, overcurrent and overvoltage. The converters are UL/IEC/EN60950 and EN50155 certified and will find many uses in railway and industrial applications where board space is at a premium.

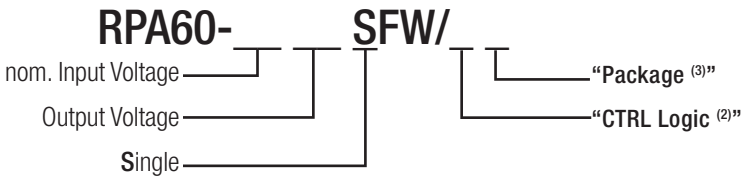
Selection Guide

Part Number	nom. Input Voltage Range [VDC]	Output Voltage [VDC]	Output Current [mA]	Input (1) Current [mA]	Efficiency (1) typ. [%]	Max. Capacitive Load [µF]
RPA60-2405SFW (2,3)	9-36	5	12000	2706	92.4	20000
RPA60-2412SFW (2,3)	9-36	12	5000	2694	92.8	6000
RPA60-2415SFW (2,3)	9-36	15	4000	2662	93.3	4000
RPA60-2424SFW (2,3)	9-36	24	2500	2688	93	2000

Notes:

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

Model Numbering



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

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

Ordering Examples

RPA60-2405SFW = 24VDC input, 5VDC output, single, no CTRL pin
RPA60-2405SFW/P = 24VDC input, 5VDC output, single, positive CTRL function
RPA60-2415SFW/N-HC = 24VDC input, 15VDC output, single, negative CTRL function, glued Heat-sink

REF DESIGN available

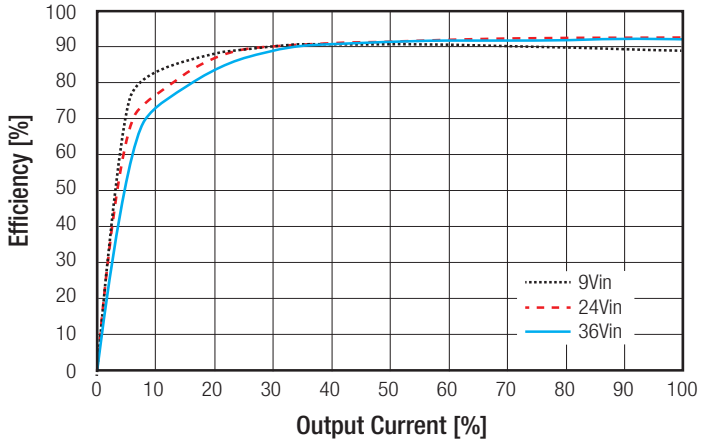
https://recom-power.com/rec-s-R-REF04-RIA12.html

Specifications (masured @Ta = 25°C, resistive load, nominal Vin and rated Iout unless otherwise noted)

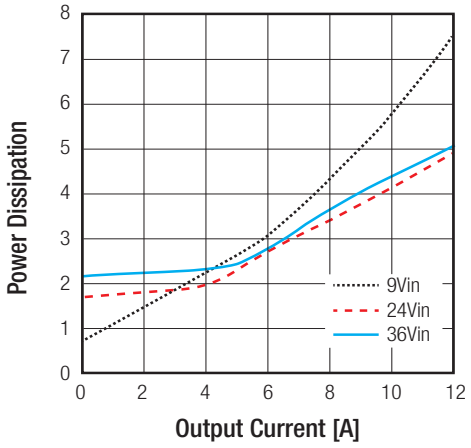
BASIC CHARACTERISTICS					
Parameter	**Condition**		**Min.**	**Typ.**	**Max.**
Internal Input Filter					LC Filter
Input Voltage Range	nom. Vin = 24VDC		9VDC	24VDC	36VDC
Input Surge Voltage	100ms max.				50VDC
Under Voltage Lockout (UVLO)	DC-DC ON DC-DC OFF		8VDC 7VDC	8.5VDC 7.5VDC	9VDC 8VDC
Quiescent Current	5Vout 12Vout & 15 Vout 24Vout			70mA 60mA 40mA	
Output Voltage Trimming	refer to **"OUTPUT VOLTAGE TRIMMING"**		-10%		+10%
Minimum Load			0%		
Start-up time	Power up Remote ON/OFF			60ms	
ON/OFF CTRL [2]	Positive Logic	DC-DC ON DC-DC OFF	Open or 2.4VDC < V_{CTRL} < 10VDC Short or 0VDC < V_{CTRL} < 0.8VDC		
	Negative Logic	DC-DC ON DC-DC OFF	Short or 0VDC < V_{CTRL} < 0.8VDC Open or 2.4VDC < V_{CTRL} < 10VDC		
Input Current of CTRL pin	DC-DC OFF			10mA	
Internal Operating Frequency				330kHz	
Ripple and Noise	20MHz BW, 10µF tantalum capacitor and 1µF ceramic capacitor			100mVp-p	

RPA60-2405SFW

Efficiency vs. Output Current

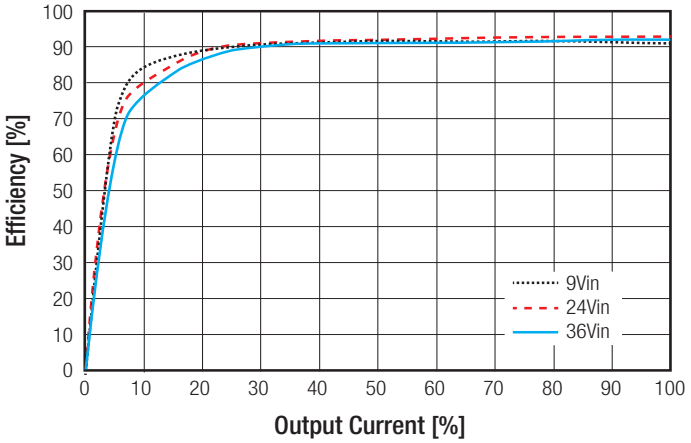


Power Dissipation vs. Output Current

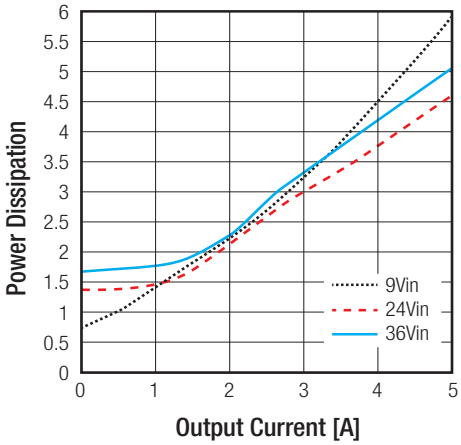


RPA60-2412SFW

Efficiency vs. Output Current



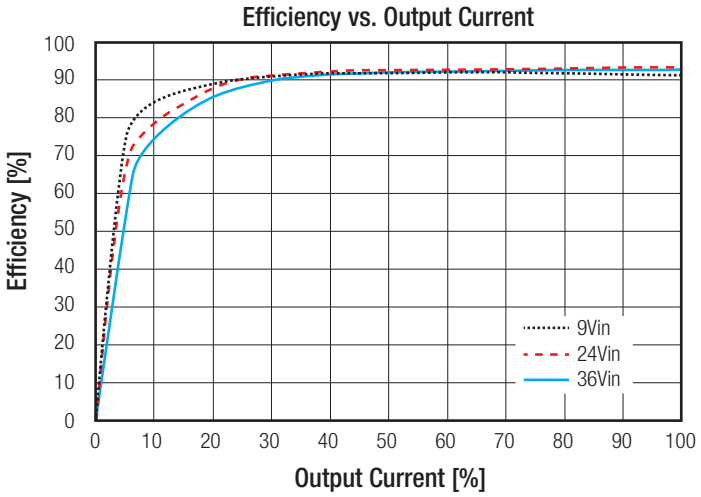
Power Dissipation vs. Output Current

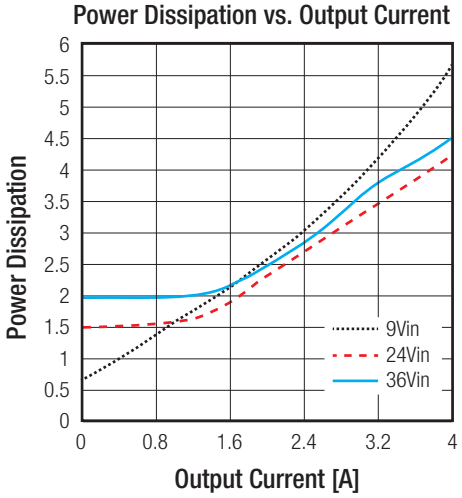


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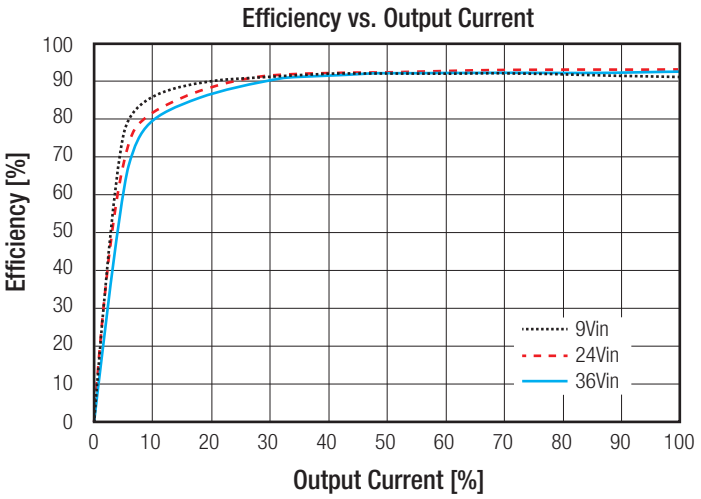
Specifications (masured @Ta = 25°C, resistive load, nominal Vin and rated Iout unless otherwise noted)

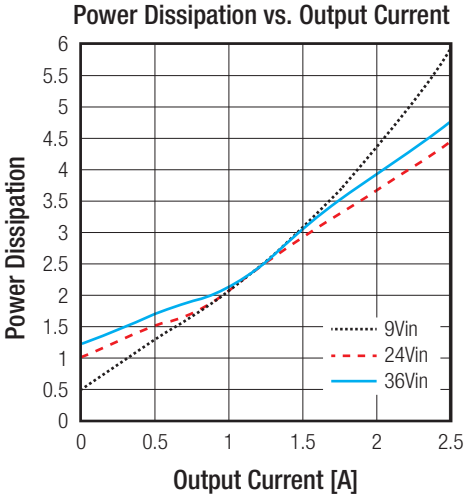
RPA60-2415SFW





RPA60-2424SFW

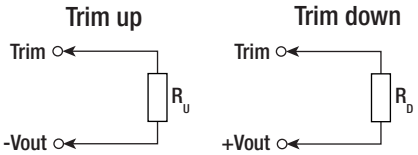




OUTPUT VOLTAGE TRIMMING

Output Voltage Trimming

RPA60-FW 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.



RPA60-2405SFW

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	[VDC]
R_U =	604	243	147	95.3	68.1	39.2	34.8	22.1	15	8.06	[kΩ]
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	[VDC]
R_D =	604	301	169	115	80.6	56.2	40.2	28	15	8.06	[kΩ]

continued on next page

Specifications (masured @Ta = 25°C, resistive load, nominal Vin and rated Iout unless otherwise noted)

RPA60-2412SFW											
Trim up	1	2	3	4	5	6	7	8	9	10	[%]
Vout =	12.12	12.24	12.36	12.48	12.60	12.72	12.84	12.96	13.08	13.20	[VDC]
R_U =	604	255	154	105	75	49.9	38.3	24.9	18.2	10	[kΩ]
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	10.8	[VDC]
R_D =	698	301	187	121	84.5	60.4	45.3	30.1	20	10	[kΩ]
RPA60-2415SFW											
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	[VDC]
R_U =	750	309	191	124	71.5	59	40.2	28	15	8.06	[kΩ]
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	[VDC]
R_D =	698	374	226	150	105	71.5	59	32.4	20	8.06	[kΩ]
RPA60-2424SFW											
Trim up	1	2	3	4	5	6	7	8	9	10	[%]
Vout =	24.24	24.48	24.72	24.96	25.2	25.44	25.68	25.92	26.16	26.4	[VDC]
R_U =	1000	511	324	221	162	121	90.9	68.1	48.7	34.8	[kΩ]
Trim down	1	2	3	4	5	6	7	8	9	10	[%]
Vout =	23.76	23.52	23.38	23.04	22.8	22.56	22.32	22.08	21.84	21.6	[VDC]
R_D =	1500	909	499	324	232	169	124	93.1	64.9	45.3	[kΩ]

REGULATION			
Parameter	**Condition**		**Value**
Output Accuracy			±1.0% max.
Line Regulation	low line to high line, full load		±0.2% max.
Load Regulation			±0.5%
Transient Response	50%-75% full load	5Vout	±5.0% Vout typ.
		others	±2.5% 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%-140% Output Voltage
Over Current Protection (OCP)			110%-150% Output Current, Hiccup mode
Over Temperature Protection (OTP)			115°C ±5°C
Isolation Voltage (4)	I/P to O/P	tested for 1 minute	1.5kVDC
Isolation Resistance			20MΩ min.
Isolation Capacitance			2200pF typ.
Insulation Grade			basic

Notes:

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: 10A slow blow type

Specifications (masured @Ta = 25°C, resistive load, nominal Vin and rated Iout unless otherwise noted)

ENVIRONMENTAL			
Parameter	**Condition**		**Value**
Operating Temperature Range [6]	with derating		-40°C to refer to **"Thermal Calculation"**
Maximum Case Temperature			+105°C
Temperature Coefficient			0.02%/K
Thermal Impedance			refer to **"Table 1: Thermal Impedance"**
Operating Altitude			4500m
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	5997 x 10^3 hours

Table 1: Thermal Impedance

	without Heatsink		with Heatsink	
airflow [m/s]	**Rth without PCB** [K/W]	**Rth with PCB** [6] [K/W]	**Rth without PCB** [K/W]	**Rth with PCB** [6] [K/W]
0.1	11.5	7.5	9.6	6.8
0.2	8.9	5.6	7.4	5.1
0.5	6.6	4.1	5.5	3.8
1.0	4.8	3.0	4.0	2.7
1.5	3.9	2.5	3.3	2.2
2.0	3.0	1.9	2.5	1.7

Notes:

Note6:Test PCB: 160x100mm 105µm (Eurocard), double layer

Thermal Calculation

choose your model:

RPA60-2405SFW (with PCB [6])

- Load conditions in application (e.g. 50%)
- Airflow conditions in application (e.g. 0.5m/s)
- use Rth from Table1 (4.1K/W)

Calculation:

Iout = 50%
R_{th} = 4.1K/W
P_{DISS} = 2.75W
$T_{CASEmax}$ = 105°C

T_{OVER} = R_{th} x P_{Dis} = 4.1K/W x 2.75W = **11.3K**

T_{AMBmax} = $T_{CASEmax}$ - T_{OVER} = 105°C - 11.3K = **93.7°C**

choose your model:

RPA60-2405SFW-HC (with PCB [6])

- Load conditions in application (e.g. 50%)
- Airflow conditions in application (e.g. 0.5m/s)
- use Rth from Table1 (3.8K/W)

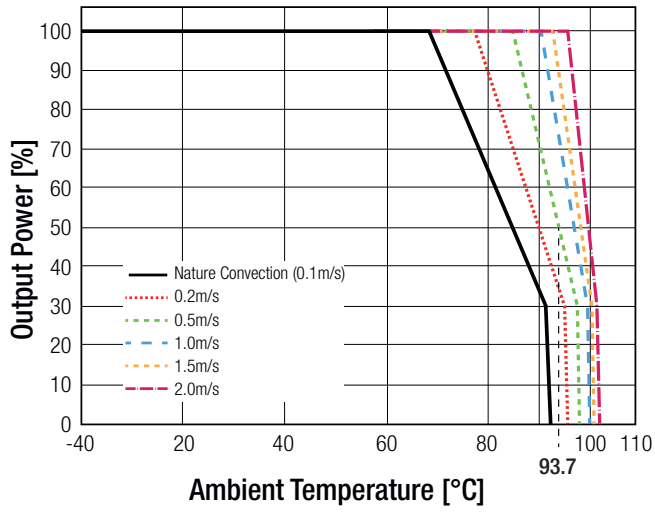
Calculation:

Iout = 50%
R_{th} = 3.8K/W
P_{DISS} = 2.75W
$T_{CASEmax}$ = 105°C

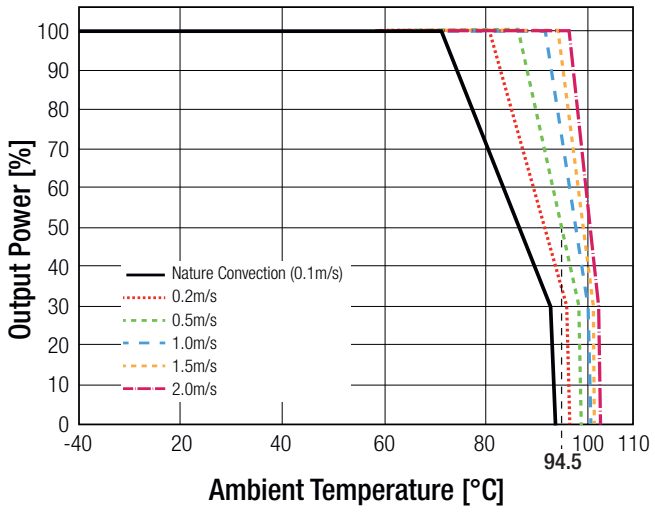
T_{OVER} = R_{th} x P_{Dis} = 3.8K/W x 3.04W = **10.5K**

T_{AMBmax} = $T_{CASEmax}$ - T_{OVER} = 105°C - 10.5K = **94.5°C**

RPA60-2405SFW



RPA60-2405SFW-HC

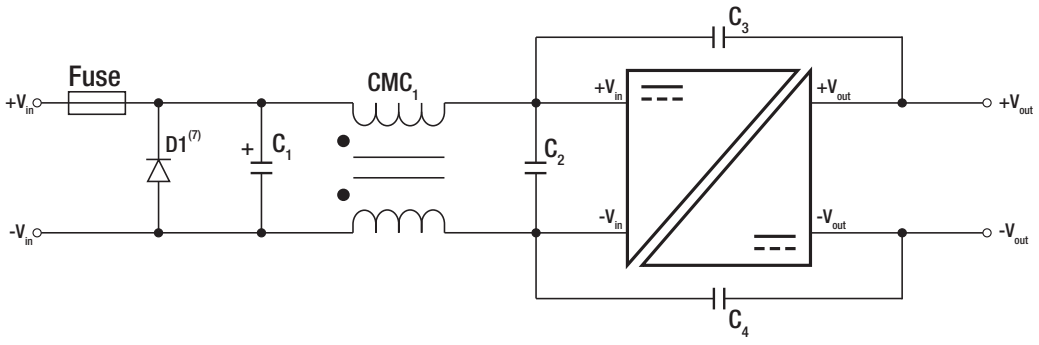


Specifications (masured @Ta = 25°C, resistive load, nominal Vin and rated Iout unless otherwise noted)

SAFETY AND CERTIFICATIONS		
Certificate Type (Safety)	**Report / File Number**	**Standard**
Information Technology Equipment, General Requirements for Safety	E224736-A41	UL60950-1:2014, 2nd Edition CSA C22.2 No. 60950-1-07: 2014, 2nd Edition
IEC/EN Information Technology Equipment - General Requirments for Safety (CB Scheme)	E224736-A41-CB-1	IEC60950-1: 2005, 2nd Edition + AM2, 2013
IEC/EN Information Technology Equipment - General Requirments for Safety		EN60950-1: 2006, + A2, 2013
Railway Applications - Electrical Equipment used on rolling stock	15100173 001	EN50155, 1st Edition, 2007, Clause 5.4 and 5.5
RoHS2		RoHS 10/10, 2011/65/EU + AM-2015/863

EMC Compliance (designed to meet)	**Condition**	**Standard / Criterion**
Electromagnetic compatibility of multimedia equipment - Emission requirements	with external filter (see filter suggestion below)	EN55032: 2015, Class A
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 10V/m, 1.4-2.0GHz 5V/m, 2.0-2.7GHz 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

EMC Filtering according to EN50121-3-2 and EN55032 Class A



C1	C2	C3/C4	CMC1
100µF/100V electrolytic	10µF/50V MLCC	6.8nF/2kV MLCC	350µH/8.5A

Notes:

Note7: Diode is only needed for EN50155

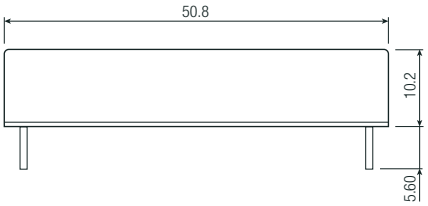
Specifications (masured @Ta = 25°C, resistive load, nominal Vin and rated Iout unless otherwise noted)

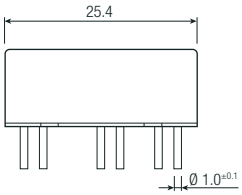
DIMENSIONS and PHYSICAL CHARACTERISTICS

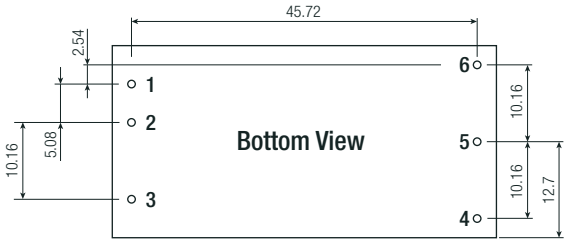
Parameter	Type	Value
Material	case baseplate potting	al alloy, anodize black non-conductive FR4 silicone (UL94-V0)
Dimensions (LxWxH)	without Heat-sink with Heat-sink	50.8 x 25.4 x 10.2mm 50.8 x 25.4 x 17.1mm
Weight	without Heat-sink with Heat-sink	35g typ. 46g typ.

Dimension Drawing (mm)

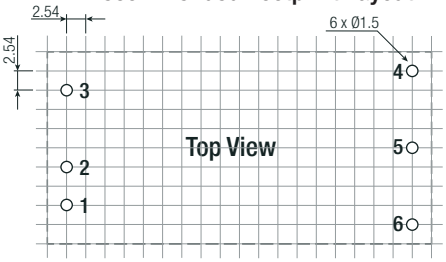


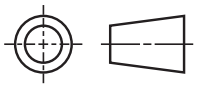






Recommended Footprint Layout



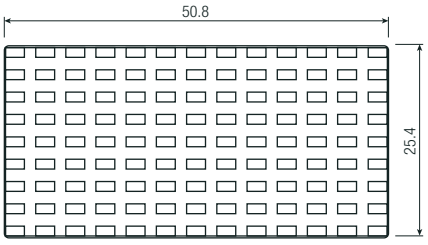


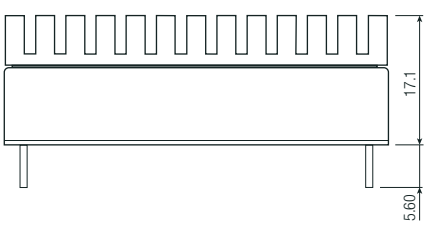
Pin Connections

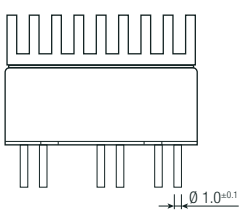
Pin #	Single
1	+Vin
2	-Vin
3	CTRL (2)
4	Trim
5	-Vout
6	+Vout

Pin Pitch Tolerance ±0.25mm
xx.x = ±0.5mm
xx.xx = ±0.25mm

Dimension Drawing (mm) with Heat-sink







Specifications (masured @Ta = 25°C, resistive load, nominal Vin and rated Iout unless otherwise noted)

PACKAGING INFORMATION			
Parameter	**Type**		**Value**
Packaging Dimensions (LxWxH)	tube	without Heat-sink with Heat-sink	285.0 x 27.6 x 19.0mm 285.0 x 27.6 x 25.8mm
Packaging Quantity			5pcs
Storage Temperature Range			-55°C to +125°C
Storage Humidity	non-condensing		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.