Technical Data Sheet

REC10K-RW Series ◊ Regulated DC-DC Converter

10W ◊ Isolated Output ◊ 4:1 Input

RECOM DC/DC Converter

FEATURES

- Industry standard 10W DIP24 package
- Derates to 100°C ambient temperature
- Wide 4:1 input
- ON/OFF control pin, UVLO, SCP
- Output voltage trimming (±10%)
- 0% minimum load
- 3 year warranty

Dimensions (LxWxH): 32.1 x 20.6 x 10.2mm (1.26 x 0.81 x 0.40 inch)
16.5g (0.036 lbs)

APPLICATIONS

SAFETY & EMC

RoHS² compliant 10 from 10 | Reach compliant | IECEE CB SCHEME | c UL us E224736

DESCRIPTION

The REC10K-RW series are high power density, wide input voltage range 10W DC/DC converters in an industry standard DIP24 case size. Despite their small size, the REC10K-RW converters are fully specified devices with output currents up to 2 amps, high efficiency, no minimum load, 4000VDC/1min isolation, tight regulation, and low ripple/noise figures. The outputs are also fully protected against short circuits, overcurrent, and overvoltage, and a ±10% trim range. These converters fit well in industrial applications where board space is at a premium.

SELECTION GUIDE

Part Number	Input Voltage Range [VDC]	nom. Output Voltage [VDC]	Output Current [mA]	Efficiency (1) typ. [%]	Output Power [W]	max. Capacitive (2) Load [µF]
REC10K-243.3SRW/H4	9-36	3.3	2000	80	6.6	4000
REC10K-2405SRW/H4	9-36	5	2000	84	10	4000
REC10K-2409SRW/H4	9-36	9	1110	86	10	2500
REC10K-2412SRW/H4	9-36	12	830	87	10	1000
REC10K-2415SRW/H4	9-36	15	670	87	10	820
REC10K-2424SRW/H4	9-36	24	420	88	10	168
REC10K-2405DRW/H4	9-36	±5	±1000	84	10	±3000
REC10K-2412DRW/H4	9-36	±12	±420	84	10	±1000
REC10K-2415DRW/H4	9-36	±15	±330	86	10	±300
REC10K-2424DRW/H4	9-36	±24	±210	87	10	±100
REC10K-483.3SRW/H4	18-75	3.3	2000	80	6.6	3000
REC10K-4805SRW/H4	18-75	5	2000	84	10	1500
REC10K-4809SRW/H4	18-75	9	1110	86	10	2500
REC10K-4812SRW/H4	18-75	12	830	88	10	3000

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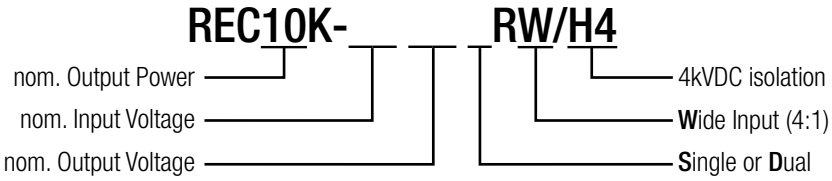
REC10K-4815SRW/H4	18-75	15	670	87	10	2200
REC10K-4824SRW/H4	18-75	24	420	84	10	1000
REC10K-4805DRW/H4	18-75	±5	±1000	84	10	±2500
REC10K-4812DRW/H4	18-75	±12	±420	84	10	±1000
REC10K-4815DRW/H4	18-75	±15	±330	84	10	±1000
REC10K-4824DRW/H4	18-75	±24	±210	85	10	±470

Note1: Efficiency is tested at nominal input and full load at +25°C ambient
Note2: Max Cap Load is tested at nominal input and full resistive load

MODEL NUMBERING



BASIC CHARACTERISTICS (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)

Parameter	Condition		Min.	Typ.	Max.
Internal Input Filter					Pi type
Input Voltage Range	nom. V_{IN}= 24VDC		9VDC		36VDC
	nom. V_{IN}= 48VDC		18VDC		75VDC
Input Under Voltage Lockout (UVLO)	nom. V_{IN}= 24VDC @ full load	DC-DC ON	7.6VDC		8.4VDC
		DC-DC OFF	6.8VDC		7.6VDC
	nom. V_{IN}= 48VDC @ full load	DC-DC ON	15.6VDC		16.4VDC
		DC-DC OFF	13.8VDC		14.7VDC
Input Current	nom. V_{IN}= 24VDC			500mA	
	nom. V_{IN}= 48VDC			300mA	
Quiescent Current				5mA	
Output Voltage Trimming	refer to **„Output Voltage Trimming“**		-10%		+10%
Minimum Load			0%		
Start-up time				10ms	25ms
ON/OFF CTRL (3)	DC-DC ON		Open or 2.5VDC< V_{CTRL} <12VDC		
	DC-DC OFF		Short to -V_{IN} or 0< V_{CTRL} <0.5VDC		
Input Current of CTRL Pin	DC-DC ON				100µA
Standby Current	nom. V_{IN}= 24VDC	DC-DC OFF		25µA	
	nom. V_{IN}= 48VDC	DC-DC OFF		55µA	
Internal Operating Frequency			230kHz		330kHz
Output Ripple and Noise (4)	20MHz BW, 25°C, @ full load	all others		100mVp-p	150mVp-p
		nom. V_{OUT}= 3.3VDC @ nom. Vin		35mVp-p	
		nom. V_{OUT}= 5VDC, ±5VDC @ nom. Vin.		50mVp-p	

Note3: The maximum voltage of CTRL pin voltage should not be over 12V, otherwise device might be damaged
Note4: Measurements are made with a 0.1µF MLCC & 10µF E-cap in parallel across output. (low ESR)
The test setup can have an impact on ripple noise values (placement of scope probe, capacitors, it's specifications, wires, PCB tracks, distances, etc.)

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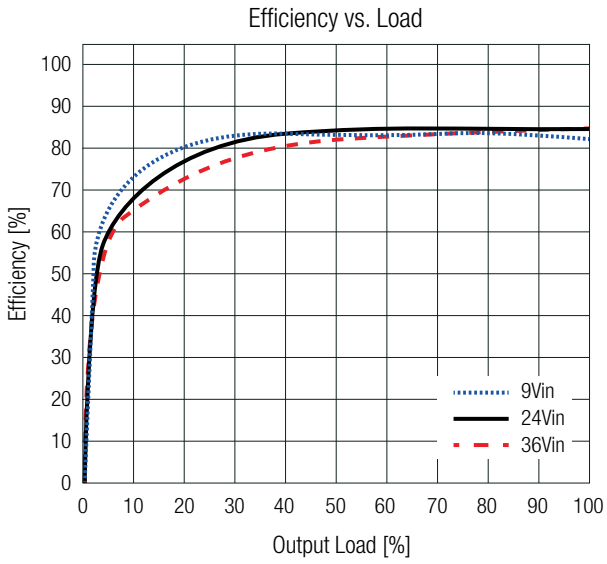
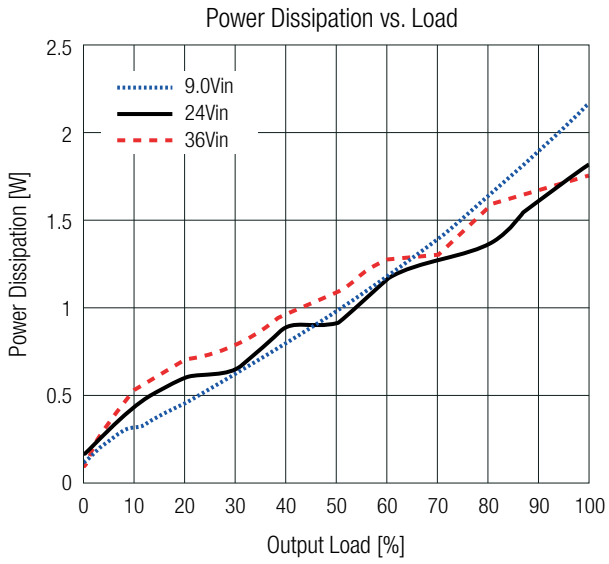
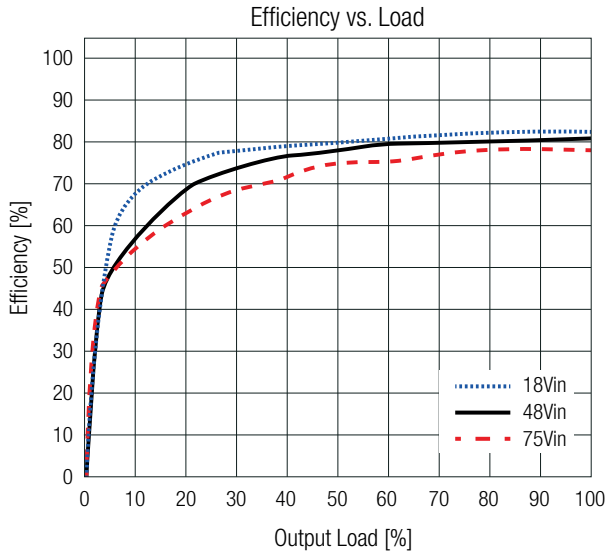
BASIC CHARACTERISTICS (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)

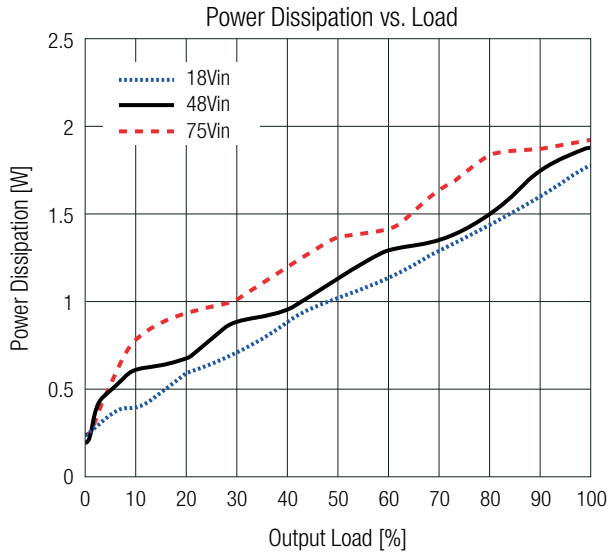
REC10K-2405SRW/H4



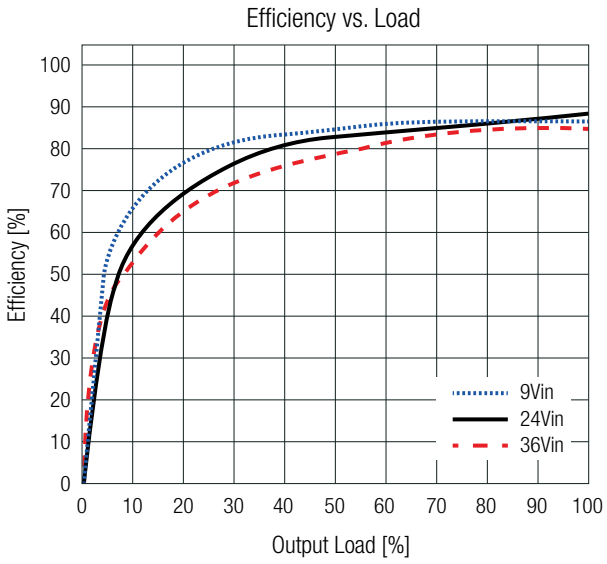


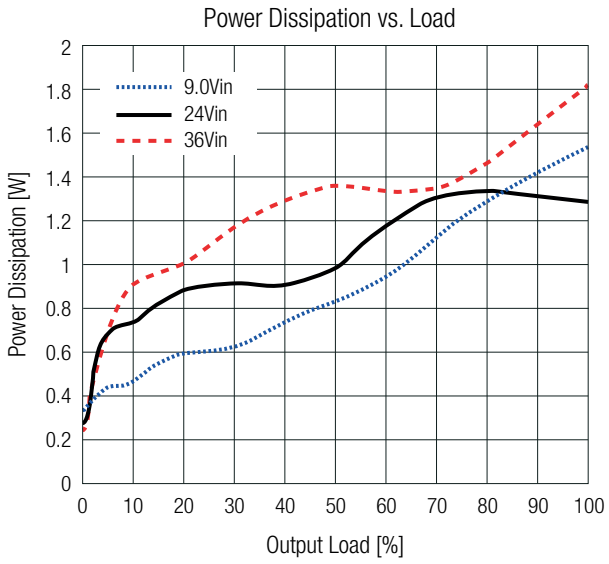
REC10K-4805SRW/H4





REC10K-2424SRW/H4





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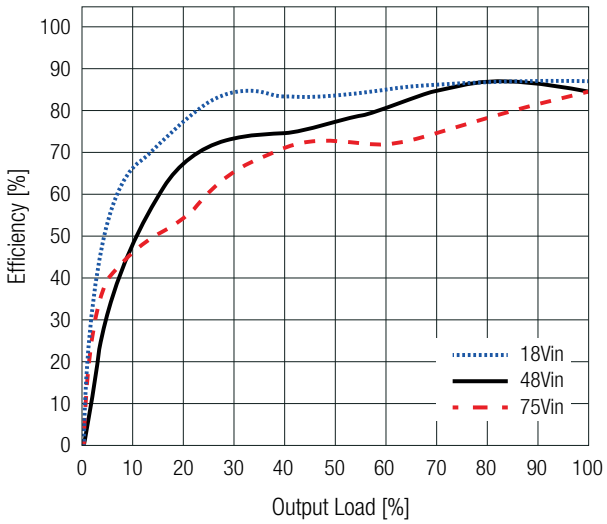
10W ◊ Isolated Output ◊ 4:1 Input

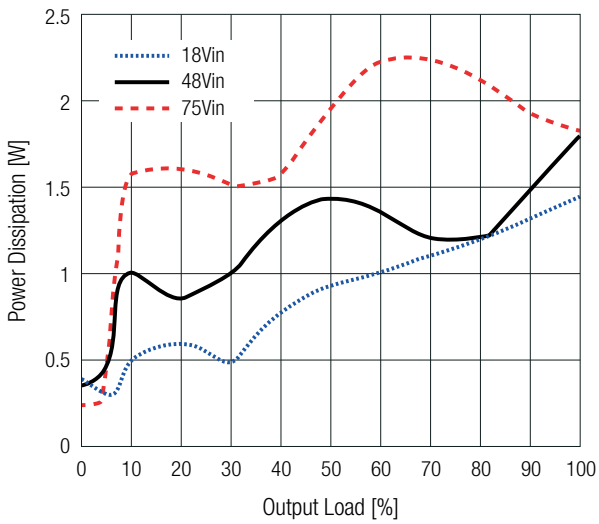
BASIC CHARACTERISTICS (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)

REC10K-4824SRW/H4

Efficiency vs. Load



Power Dissipation vs. Load

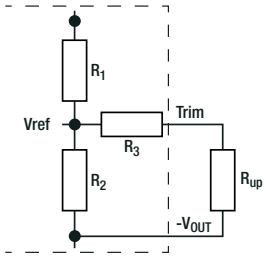


OUTPUT VOLTAGE TRIMMING

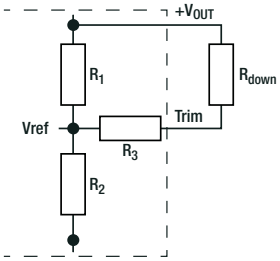
The REC10K-RW series offers the feature of trimming the output voltage over a range between ±10% by using external trim resistors. The values for trim resistors shown in trim tables below are according to standard E96 values; therefore, the specified voltage may slightly vary.

Single Output

Trim up

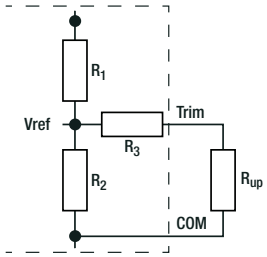


Trim down

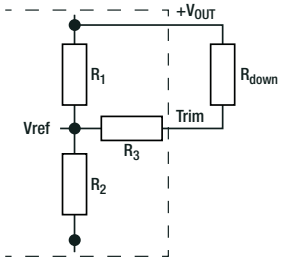


Dual Output

Trim up



Trim down



Model	$Vout_{nom}$ [VDC]	R_1 [Ω]	R_2 [Ω]	R_3 [Ω]	V_{REF} [VDC]
REC10K-243.3SRW/H4	3.3	5k48	3k3	10k	1k24
REC10K-483.3SRW/H4					
REC10K-2405SRW/H4	5	7k5	7k5		2k5
REC10K-4805SRW/H4					
REC10K-2405DRW/H4	±5				
REC10K-4805DRW/H4				20k	
REC10K-2409SRW/H4	9	6k5	2k49	10k	
REC10K-4809SRW/H4					
REC10K-2412SRW/H4	12	9k46			
REC10K-4812SRW/H4					
REC10K-2412DRW/H4	±12				
REC10K-4812DRW/H4					
REC10K-2415SRW/H4	15	25k5	5k1		
REC10K-4815SRW/H4					
REC10K-2415DRW/H4	±15				
REC10K-4815DRW/H4					
REC10K-2424SRW/H4	24	21k43	2k49		
REC10K-4824SRW/H4					
REC10K-2424DRW/H4	±24				
REC10K-4824DRW/H4					

$Vout_{nom}$	= nominal output voltage	[VDC]
$Vout_{set}$	= trimmed output voltage	[VDC]
V_{ref}	= reference voltage	[VDC]
R_{up}	= trim up resistor	[Ω]
R_{down}	= trim down resistor	[Ω]
R_1, R_2, R_3	= internal resistors	[Ω]
k_u	= trim up factor	[ ]
k_d	= trim down factor	[ ]

Calculations:

$$k_u = \left[\frac{V_{ref}}{Vout_{set} - V_{ref}}\right] \times R_1 \qquad k_d = \left[\frac{Vout_{set} - V_{ref}}{V_{ref}}\right] \times R_2$$

$$R_{up} = \left[\frac{k_u \times R_2}{R_2 - k_u}\right] - R_3 \qquad R_{down} = \left[\frac{k_d \times R_1}{R_1 - k_d}\right] - R_3$$

Practical Example REC10K-4805DRW/H4 trim up 10%:

V_{OUTnom}= 5VDC, $Vout_{set}$= 5.5VDC

$$k_u = \left[\frac{2.5VDC}{5.5VDC - 2.5VDC}\right] \times 7.5k\Omega = 6.25$$

$$R_{up} = \left[\frac{6.25 \times 7.5k\Omega}{7.5k\Omega - 6.25}\right] - 20k\Omega = 17.5k\Omega$$

R_{up} according to E96 ≈ **17k4Ω**

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OUTPUT VOLTAGE TRIMMING

$VOUT_{nom}$= 3.3VDC

Trim up

$Vout_{set}$	3.63	3.60	3.56	3.53	3.50	3.47	3.43	3.40	3.37	3.33	[VDC]
R_{up} (E96)	10k5	12k4	16k2	19k6	23k7	29k4	42k2	57k6	86k6	210k	[Ω]

Trim down

$Vout_{set}$	2.97	3.00	3.04	3.07	3.10	3.14	3.17	3.20	3.23	3.27	[VDC]
R_{down} (E96)	18k7	22k1	28k	34k	41k2	54k9	71k5	100k	147k	374k	[Ω]

$VOUT_{nom}$= 5VDC Single & Dual

Trim up

$Vout_{set}$	5.50	5.45	5.40	5.35	5.30	5.25	5.20	5.15	5.10	5.05	[VDC]
R_{up} (E96)	27k4	31k6	36k5	43k2	52k3	64k9	84k5	115k	174k	365k	[Ω]

Trim down

$Vout_{set}$	4.50	4.55	4.60	4.65	4.70	4.75	4.80	4.85	4.90	4.95	[VDC]
R_{down} (E96)	20k	24k3	29k4	35k7	45k3	57k6	76k8	107k	169k	357k	[Ω]

$VOUT_{nom}$= 5VDC (REC10K-4805DRW/H4 only)

Trim up

$Vout_{set}$	5.50	5.45	5.40	5.35	5.30	5.25	5.20	5.15	5.10	5.05	[VDC]
R_{up} (E96)	17k4	21k5	26k7	33k2	42k2	54k9	73k2	105k	169k	357k	[Ω]

Trim down

$Vout_{set}$	4.50	4.55	4.60	4.65	4.70	4.75	4.80	4.85	4.90	4.95	[VDC]
R_{down} (E96)	10k	14k	19k6	26k1	34k8	47k5	66k5	97k6	162k	348k	[Ω]

$VOUT_{nom}$= 9VDC

Trim up

$Vout_{set}$	9.90	9.81	9.72	9.63	9.54	9.45	9.36	9.27	9.18	9.09	[VDC]
R_{up} (E96)	7k5	9k31	11k8	14k7	18k7	24k3	31k6	44k2	69k8	133k	[Ω]

Trim down

$Vout_{set}$	8.10	8.19	8.28	8.37	8.46	8.55	8.64	8.73	8.82	8.91	[VDC]
R_{down} (E96)	31k6	36k5	44k2	52k3	64k9	80k6	107k	154k	249k	619k	[Ω]

$VOUT_{nom}$= 12VDC Single & Dual

Trim up

$Vout_{set}$	13.20	13.08	12.96	12.84	12.72	12.60	12.48	12.36	12.24	12.12	[VDC]
R_{up} (E96)	9k76	11k8	14k7	18k2	22k6	23k2	39k2	54k9	88k7	182k	[Ω]

Trim down

$Vout_{set}$	10.80	10.92	11.04	11.16	11.28	11.40	11.52	11.64	11.76	11.88	[VDC]
R_{down} (E96)	56k2	63k4	75k	88k7	105k	130k	169k	232k	357k	750k	[Ω]

$VOUT_{nom}$= 15VDC Single & Dual

Trim up

$Vout_{set}$	16.50	16.35	16.20	16.05	15.90	15.75	15.60	15.45	15.30	15.15	[VDC]
R_{up} (E96)	32k4	37k4	43k2	49k9	60k4	75k	95k3	130k	200k	412k	[Ω]

Trim down

$Vout_{set}$	13.50	13.65	13.80	13.95	14.10	14.25	14.40	14.55	14.70	14.85	[VDC]
R_{down} (E96)	178k	200k	232k	267k	316k	392k	499k	681k	1M02	2M1	[Ω]

$VOUT_{nom}$= 24VDC Single & Dual

Trim up

$Vout_{set}$	26.40	26.16	25.92	25.68	25.44	25.20	24.96	24.72	24.48	24.24	[VDC]
R_{up} (E96)	12k4	15k	18k2	22k2	27k4	35k7	46k4	66k5	105k	232k	[Ω]

Trim down

$Vout_{set}$	21.60	21.84	22.08	22.32	22.56	22.80	23.04	23.28	23.52	23.76	[VDC]
R_{down} (E96)	158k	182k	205k	243k	287k	348k	442k	590k	909k	1M78	[Ω]

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REGULATIONS (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)

Parameter	Condition			Value
Output Accuracy	all types			1.5% max.
Line Regulation	low line to high line		all types	±0.2% typ. / ±1.0% max.
Load Regulation	10% to 100% load		Dual type, V_{OUT} = -5VDC	±1.5% max.
			other types	±1.0% max.
Cross Regulation	dual output only 10% to 100% load	nom. V_{IN}= 24VDC	V_{OUT} = ±5VDC	±5.0% max.
			V_{OUT} = ±12, ±15VDC	±4.0% max.
			V_{OUT} = ±24VDC	±2.0% max.
		nom. V_{IN}= 48VDC	V_{OUT} = ±5VDC	±4.0% max.
			V_{OUT} = ±12, ±15VDC	±3.0% max.
			V_{OUT} = ±24VDC	±2.0% max.
Transient Response	25% load step change (75% - 100%)		nom. V_{OUT} = 3.3VDC	120mV typ.
			nom. V_{OUT} = 5VDC, ±5VDC	200mV typ.
			others	450mV typ.
			all types	500mV max.
	recovery time			500µs typ.

PROTECTIONS (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)

Parameter	Condition		Value
Short Circuit Protection (SCP)			continuous, automatic recovery, hiccup mode
Over Voltage Protection (OVP)	110%-170% of nom. V_{OUT}		zener diode clamping
Over Current Protection	@ V_{IN}= 9-36VDC		250%
	@ V_{IN}= 18-75VDC		300%
Isolation Voltage [5]	I/P to O/P	1 minute	4kVDC
Isolation Resistance	I/P to O/P	V_{ISO}= 500VDC	1GΩ min.
Isolation Capacitance	I/P to O/P	100kHz/0.1V	1200pF max.
Insulation Grade	according to 62368-1		functional

Note5: For repeat Hi-Pot testing, reduce the time and/or the test voltage
Note6: Refer to local safety regulations if input over-current protections is also required. Recommended fuse: slow blow type

ENVIRONMENTAL (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)

Parameter	Condition		Value
Operating Temperature Range	with derating	refer to **„Derating Graph“**	-40°C to +100°C
Maximum Case Temperature			+125°C
Operating Altitude	according to 62368-1		5000m
Operating Humidity	non-condensing		5% RH min.- 95% RH max.
Pollution Degree			PD2
Shock			according to MIL-STD-810F
Vibration			according to MIL-STD-810F
MTBF	according to MIL-HDBK-217F, G.B.	T_{AMB}= +25°C	800 x 10^3 hours
		T_{AMB} max. @ full load	200 x 10^3 hours

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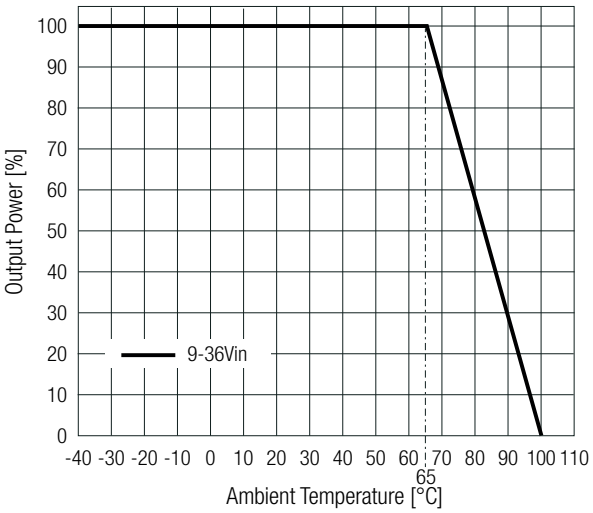
ENVIRONMENTAL (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)

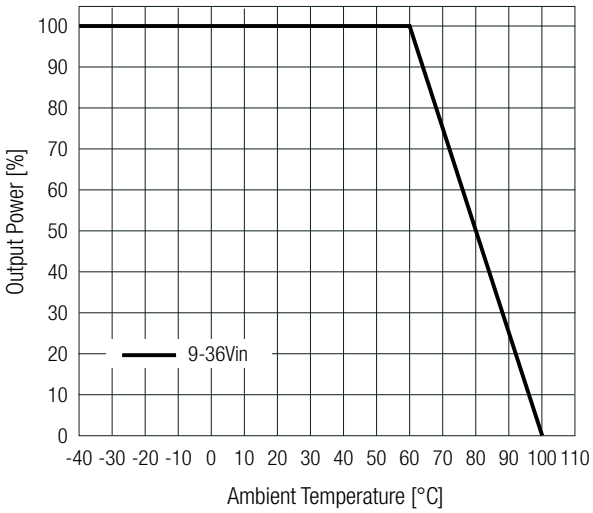
Derating Graph (9-36Vin models)

(@ Chamber and natural convection 0.1m/s)

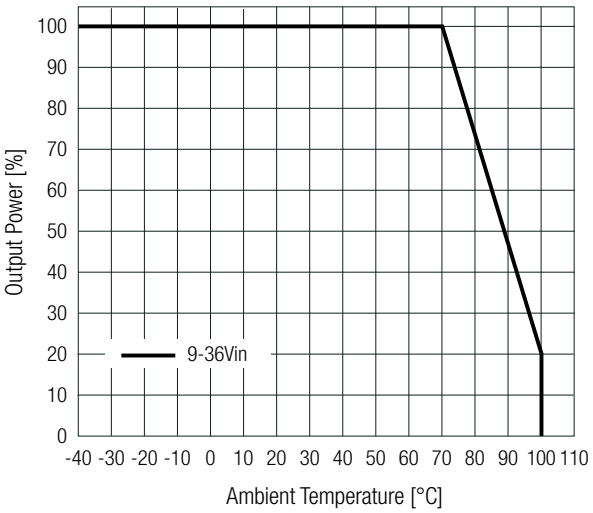
REC10K-243.3SRW/H4; REC10K-2424SRW/H4



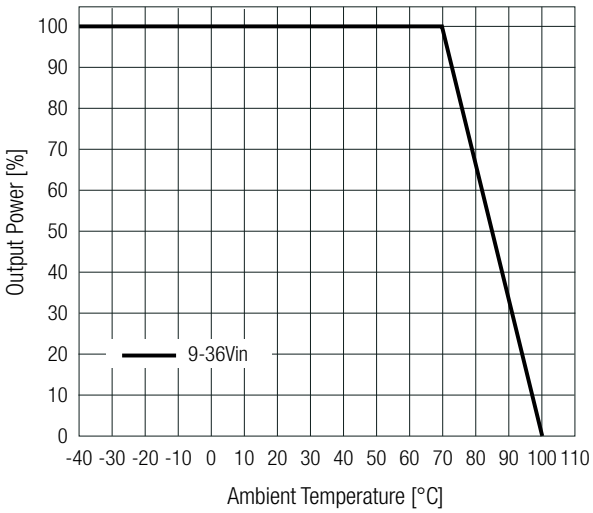
REC10K-2405SRW/H4; REC10K-2405DRW/H4



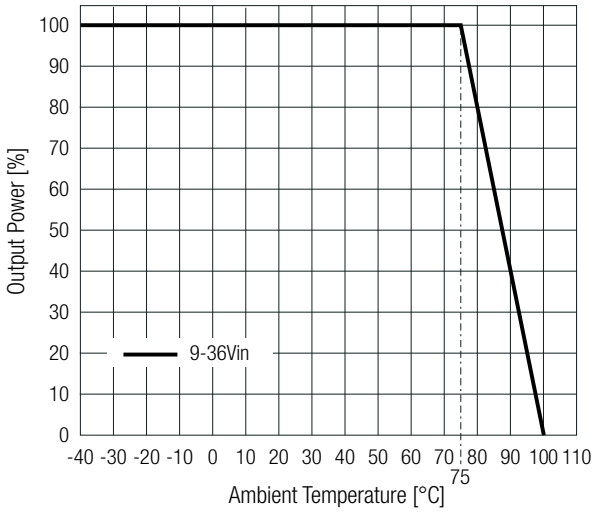
REC10K-2409SRW/H4; REC10K-2412SRW/H4;
REC10K-2415SRW/H4



REC10K-2412DRW/H4; REC10K-2415DRW/H4



REC10K-2424DRW/H4



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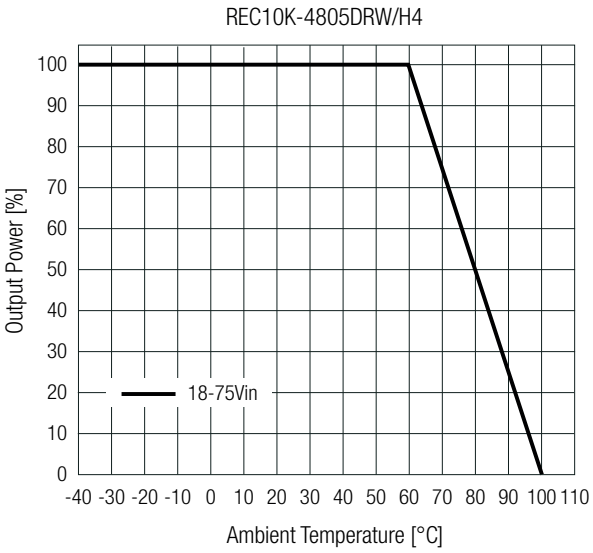
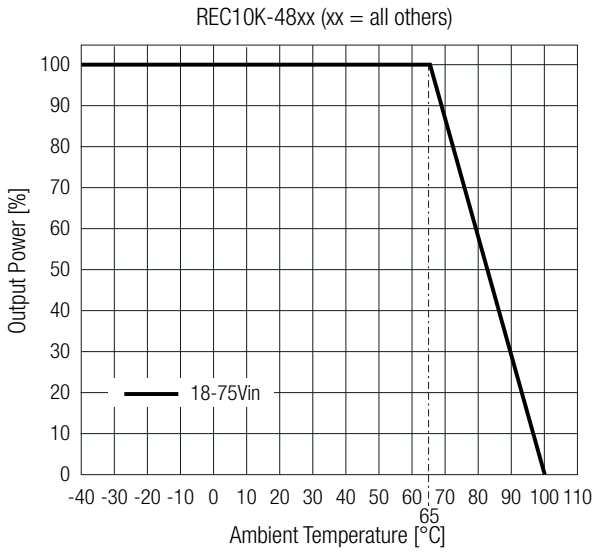
ENVIRONMENTAL (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)

Derating Graph (18-75Vin models)

(@ Chamber and natural convection 0.1m/s)





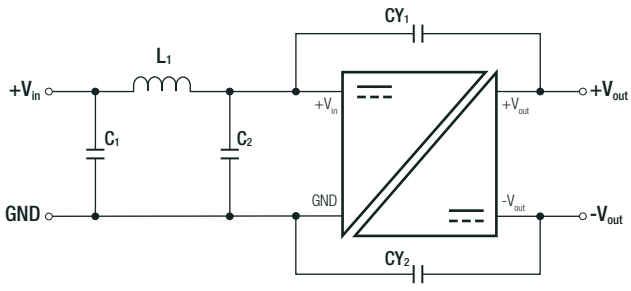
SAFETY AND CERTIFICATIONS

Certificate Type (Safety)	Report Number	Standard
Audio/Video, information and communication technology equipment - Part1: Safety requirements 3rd Edition	E491408-A6035-UL	UL62368-1:2019 3rd Edition
		CAN/CSA-C22.2 No. 62368-1-19 3rd Edition
Audio/Video, information and communication technology equipment - Part1: Safety requirements 3rd Edition (CB Scheme)	240513006	IEC62368-1:2018 3rd Edition
		EN IEC 62368-1:2020+A11:2020
RoHS2		RoHS 2011/65/EU + AM2015/863

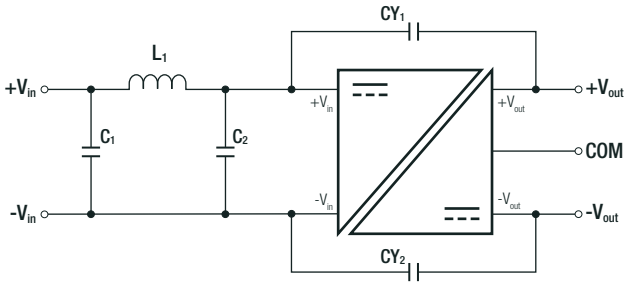
EMC Compliance	Condition	Standard/Criterion
Electromagnetic Compatibility of Multimedia Equipment - Emission Requirements	with external filter, refer to below filter suggestions	EN55032, Class B

EMC filter suggestions according to EN55032

Single Output



Dual Output



Component List Class B		
C1, C2	L1	CY1, CY2
10µF	22µH	1nF

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REC10K-RW Series ◊ Regulated DC-DC Converter

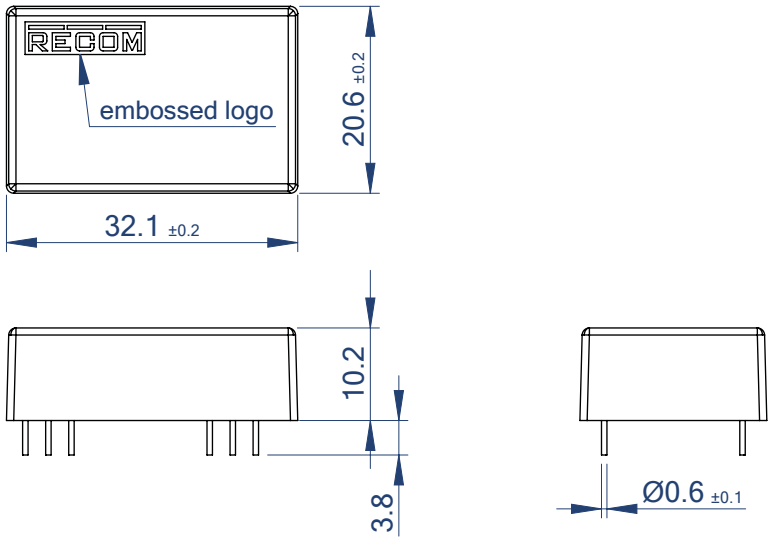
10W ◊ Isolated Output ◊ 4:1 Input

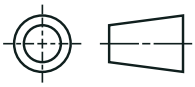
RECOM DC/DC Converter

DIMENSION & PHYSICAL CHARACTERISTICS

Parameter	Type	Value
Material	case	plastic, (UL94 V-0)
	potting	silicone, (UL94 V-0)
	PCB	FR4, (UL94 V-0)
Dimension (LxWxH)		32.1 x 20.6 x 10.2mm 1.26 x 0.81 x 0.40inch
Weight		16.5g typ. 0.036 lbs

Dimension Drawing (mm)



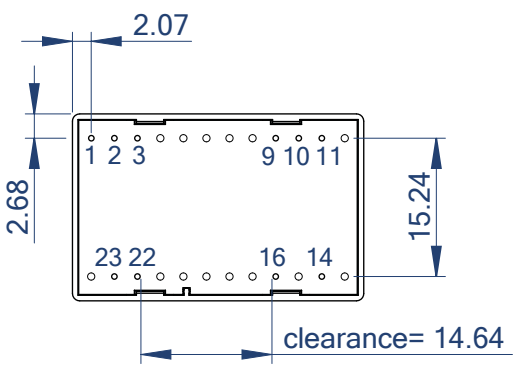


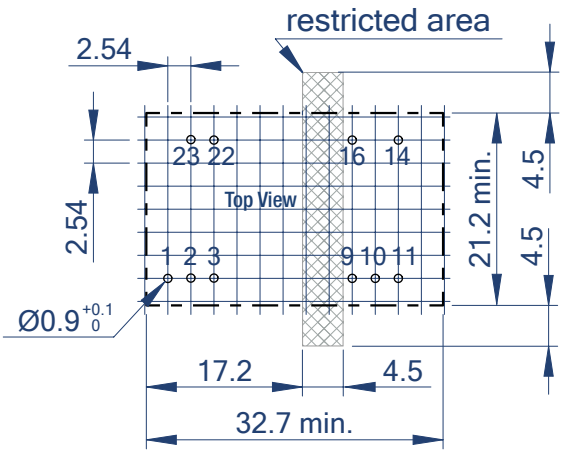
Pinning Information

Pin #	Single	Dual
1	CTRL	CTRL
2, 3	-Vin	-Vin
9	NC	COM
10	TRIM	TRIM
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	COM
22, 23	+Vin	+Vin

NC= No Connection

Recommended Footprint Details





Tolerances:
x.x= ±0.5mm
x.xx= ±0.25mm

PACKAGING INFORMATION

Parameter	Type	Value
Packaging Dimension (LxWxH)	tube	512.9 x 22.2 x 20.9mm
Packaging Quantity		14 pcs
Storage Temperature Range		-40°C to +125°C
Storage Humidity	non-condensing	95% RH max.

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.

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Hauptsitz

Simpex Electronic AG
Binzackerstrasse 33
CH-8620 Wetzikon
Telefon +41 44 931 10 10
E-Mail contact@simpex.ch
Internet www.simpex.ch

Manufaktur

Simpex Electronic SA
En Bas-le-Port 1
CH-2088 Cressier
E-Mail contact@simpex.ch
Internet www.simpex.ch

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