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Technical Data Sheet

REC10K-AW series ◊ Regulated DC-DC Converter

10W ◊ Isolated Output ◊ 4:1 Input

RECOM DC/DC Converter

FEATURES

- Industry standard 10W 1”x1” package
- Derates to 100°C ambient temperature
- Wide 4:1 input
- ON/OFF control pin, UVLO, SCP
- 3 year warranty



Dimensions (LxWxH): 25.4 x 25.4 x 10.2mm (1.0 x 1.0 x 0.40 inch)
15g (0.033 lbs)

APPLICATIONS



SAFETY & EMC

RoHS² compliant 10 from 10

Reach compliant

DESCRIPTION

The REC10K-AW series are high power density, wide input voltage range 10W DC/DC converters in an industry standard 1”x1” case size. Despite their small size, the REC10K-AW converters are fully specified devices with output currents up to 2 amps, high efficiency, no minimum load, 1600VDC/1min isolation, tight regulation, and low ripple/noise figures. The outputs are also fully protected against short circuits, overcurrent, and overvoltage, and the single output version offers 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 typ. [%]	max. Capacitive Load [µF]
REC10K-243.3SAW/H2	9-36	3.3	2000	79	5000
REC10K-2405SAW/H2	9-36	5	2000	83	4000
REC10K-2409SAW/H2	9-36	9	1111	85	2000
REC10K-2412SAW/H2	9-36	12	833	86	1000
REC10K-2415SAW/H2	9-36	15	667	87	1000
REC10K-2424SAW/H2	9-36	24	417	88	470
REC10K-2405DAW/H2	9-36	±5	±1000	83	±2000
REC10K-2412DAW/H2	9-36	±12	±417	85	±690
REC10K-2415DAW/H2	9-36	±15	±333	87	±540
REC10K-2424DAW/H2	9-36	±24	±208	86	±540
REC10K-483.3SAW/H2	18-75	3.3	2000	80	6000
REC10K-4805SAW/H2	18-75	5	2000	84	5000
REC10K-4809SAW/H2	18-75	9	1111	86	5000
REC10K-4812SAW/H2	18-75	12	833	86	5000

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Part Number	Input Voltage Range [VDC]	Output Voltage [VDC]	Output Current [mA]	Efficiency typ. [%]	max. Capacitive Load [µF]
REC10K-4815SAW/H2	18-75	15	667	87	2500
REC10K-4824SAW/H2	18-75	24	417	85	2000
REC10K-4805DAW/H2	18-75	±5	±1000	84	±4000
REC10K-4812DAW/H2	18-75	±12	±417	86	±3000
REC10K-4815DAW/H2	18-75	±15	±333	84	±1500
REC10K-4824DAW/H2	18-75	±24	±208	84	±740

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		DC-DC ON	8VDC		9VDC
			DC-DC OFF	7VDC		7.5VDC
	nom. V_{IN}= 48VDC		DC-DC ON	16VDC		18VDC
			DC-DC OFF	14VDC		15VDC
Input Current	nom. V_{IN}= 24VDC				500mA	
	nom. V_{IN}= 48VDC				300mA	
Quiescent Current					5mA	
Output Voltage Trimming	single output only, refer to **„Output Voltage Trimming“**			-10%		+10%
Minimum Load				0%		
Start-up time	REC10K-243.3SAW/H2; REC10K-2405SAW/H2; REC10K-483.3SAW/H2; REC10K-4805SAW/H2; REC10K-2405DAW/H2; REC10K-4805DAW/H2				10ms	20ms
	others				15ms	20ms
ON/OFF CTRL	DC-DC ON					Open or V_{CTRL} >1.5VDC
	DC-DC OFF					Short to -V_{IN} or <1.5VDC
Input Current of CTRL Pin	DC-DC ON					100µA
Standby Current	DC-DC OFF				50µA	
Internal Operating Frequency						350kHz
Output Ripple and Noise [3]	20MHz BW	nom. V_{IN}= 24VDC	single output		200mVp-p	
			dual output		150mVp-p	
		nom. V_{IN}= 48VDC	single output		150mVp-p	
			dual output		100mVp-p	

Note3: 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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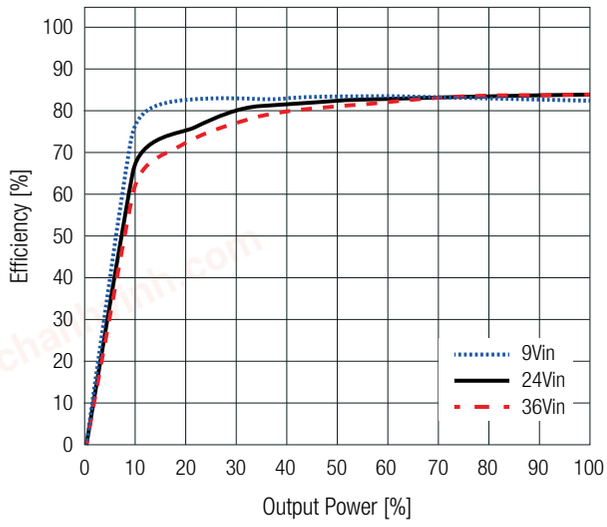
10W ◊ Isolated Output ◊ 4:1 Input

RECOM DC/DC Converter

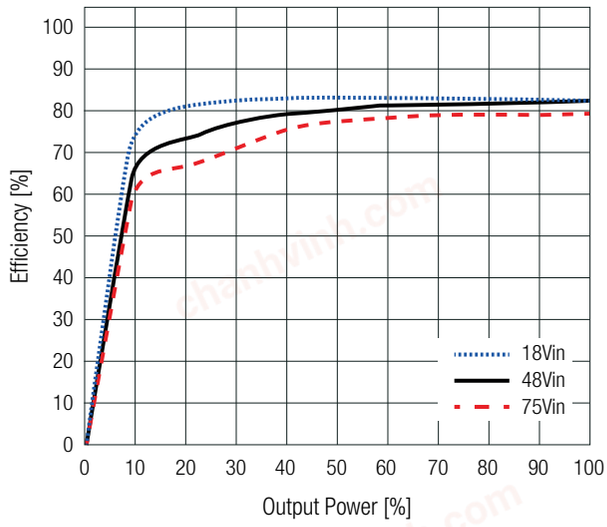
BASIC CHARACTERISTICS (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)

Efficiency vs. Load

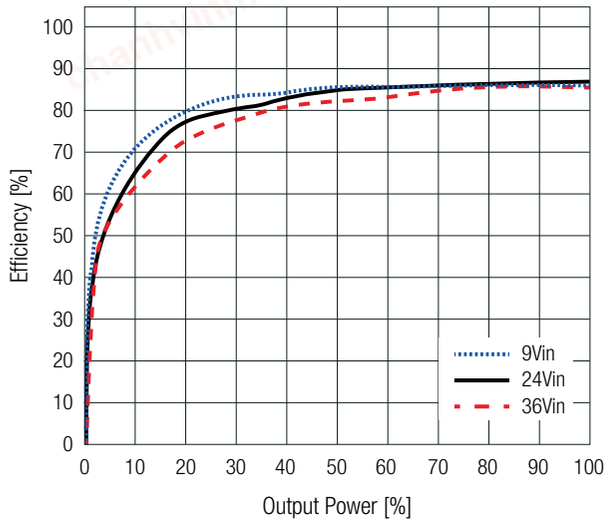
REC10K-2405SAW/H2



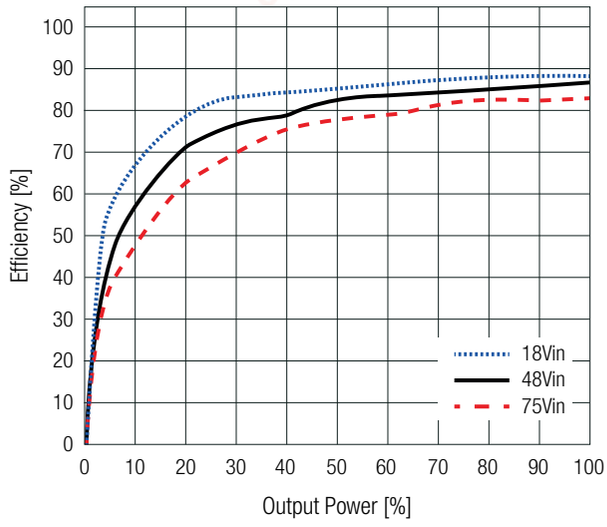
REC10K-4805SAW/H2



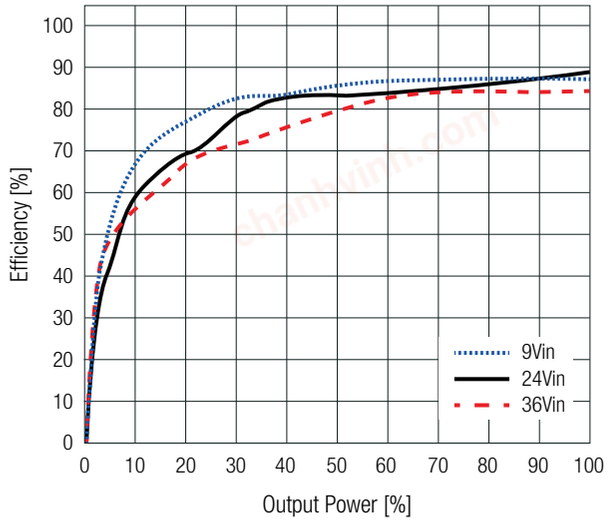
REC10K-2412SAW/H2



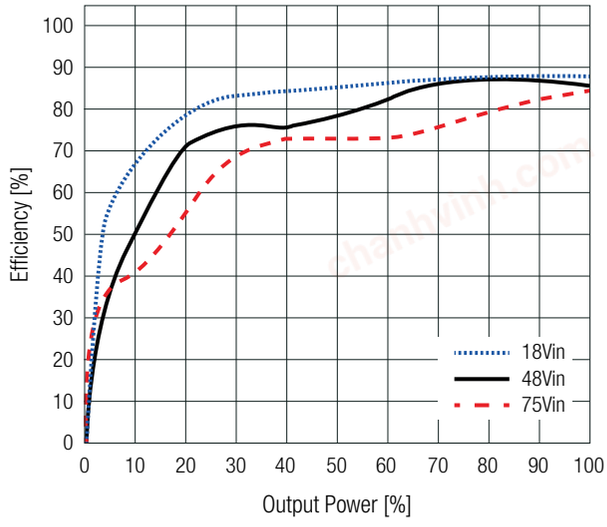
REC10K-4812SAW/H2



REC10K-2424SAW/H2



REC10K-4824SAW/H2



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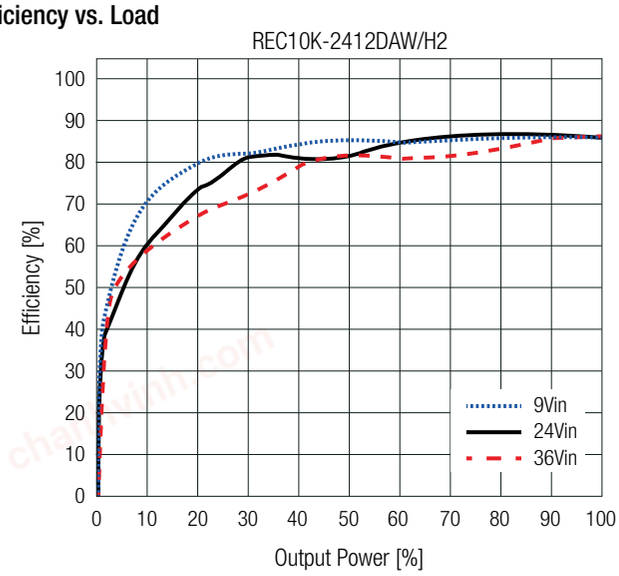
REC10K-AW Series ◊ Regulated DC-DC Converter

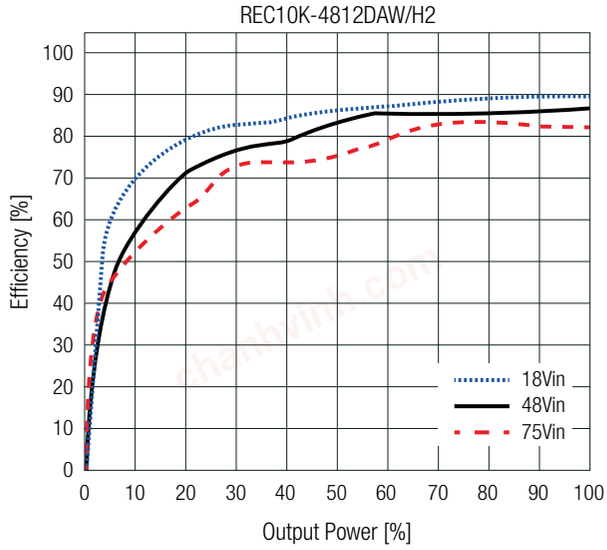
10W ◊ Isolated Output ◊ 4:1 Input

RECOM DC/DC Converter

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

Efficiency vs. Load

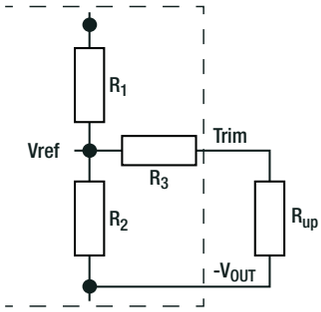




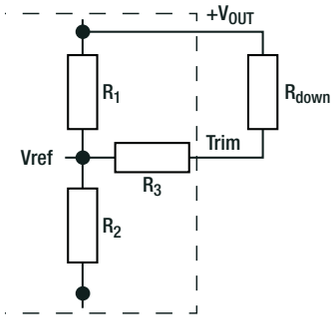
OUTPUT VOLTAGE TRIMMING

The REC10K-SAW series (single output only) 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.

Trim up



Trim down



$Vout_{nom}$	= 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	[ ]

Model	$Vout_{nom}$ [VDC]	R_1 [Ω]	R_2 [Ω]	R_3 [Ω]	V_{REF} [VDC]
REC10K-xx3.3SAW/H2	3.3	5k48	3k3	10k	1.24
REC10K-xx05SAW/H2	5	7k5	7k5	20k	2.5
REC10K-xx09SAW/H2	9	6k45	2k49	10k	
REC10K-xx12SAW/H2	12	9k46			
REC10K-xx15SAW/H2	15	25k5	5k1		
REC10K-xx24SAW/H2	24	21k43	2k49		

Calculations:

$$k_u = \left[\frac{V_{ref}}{Vout_{set} - V_{ref}}\right] \times R_1 \qquad R_{up} = \left[\frac{k_u \times R_2}{R_2 - k_u}\right] - R_3$$

$$k_d = \left[\frac{Vout_{set} - V_{ref}}{V_{ref}}\right] \times R_2 \qquad R_{down} = \left[\frac{k_d \times R_1}{R_1 - k_d}\right] - R_3$$

Practical Example REC10K-2405SAW/H2 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**

Practical Example REC10K-2405SAW/H2 trim down -10%:

V_{OUTnom}= 5VDC, $Vout_{set}$= 4.5VDC

$$k_d = \left[\frac{4.5VDC - 2.5VDC}{2.5VDC}\right] \times 7.5k\Omega = 6$$

$$R_{down} = \left[\frac{6 \times 7.5k\Omega}{7.5k\Omega - 6}\right] - 20k\Omega = 10k\Omega$$

R_{down} according to E96 ≈ **10kΩ**

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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

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

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

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

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

Parameter	Condition			Value
Output Accuracy				±1.0% typ.
Line Regulation	low line to high line, full load			±0.2% typ. / ±1.0% max.
Load Regulation [4]	10% to 100% load	single output	V_{OUT}= 3.3VDC	±0.6% typ. / ±1.0% max.
			V_{OUT}= 5VDC	±0.4% typ. / ±1.0% max.
			others	±0.15% typ. / ±1.0% max.
		dual output	+V_{OUT}= 5VDC	±0.1% typ. / ±1.0% max.
			-V_{OUT}= 5VDC	±1.0% typ. / ±1.5% max.
			+V_{OUT}, others	±0.1% typ. / ±1.0% max.
			-V_{OUT}, others	±0.2% typ. / ±1.0% max.
Cross Regulation	dual output only, 10% to 100% load		V_{OUT}= ±5, ±12, ±15VDC	±6.0% max.
			V_{OUT}= ±24VDC	±5.0% max.
Transient Response	25% load step change (75% - 100%)			500mV max.
	recovery time			300µs typ.

Note4: Operation below 10% load will not harm the converter, but specifications may not be met

PROTECTIONS [6]

Parameter	Condition		Value
Short Circuit Protection (SCP)			hiccup mode, auto recovery after faul condition removed
Over Voltage Protection (OVP)	110%-180% of nom. V_{OUT}		zener diode clamping
Over Current Protection (OCP)	automatic recovery		150% of rated I_{OUT}
Isolation Voltage [5]	I/P to O/P, according to 62368-1	1 minute	1.6kVDC
Isolation Resistance	I/P to O/P, V_{ISO}= 500VDC		1GΩ min.
Isolation Capacitance	I/P to O/P, 100kHz/0.1V		1000pF typ.
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

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			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.	all models	T_{AMB}= +25°C	800 x 10^3 hours
			T_{AMB}= +65°C	200 x 10^3 hours

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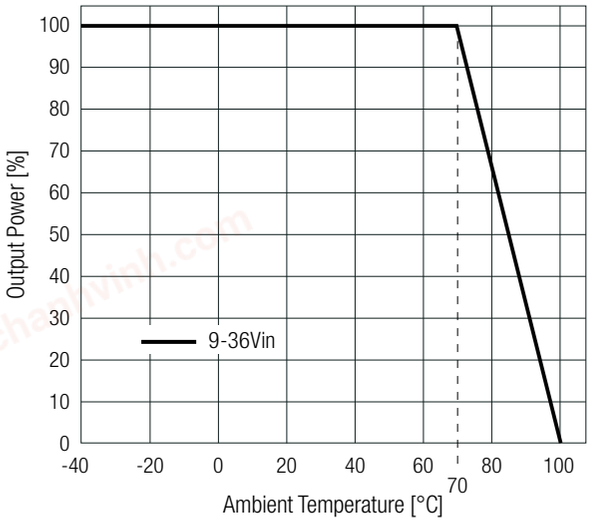
10W ◊ Isolated Output ◊ 4:1 Input

ENVIRONMENTAL

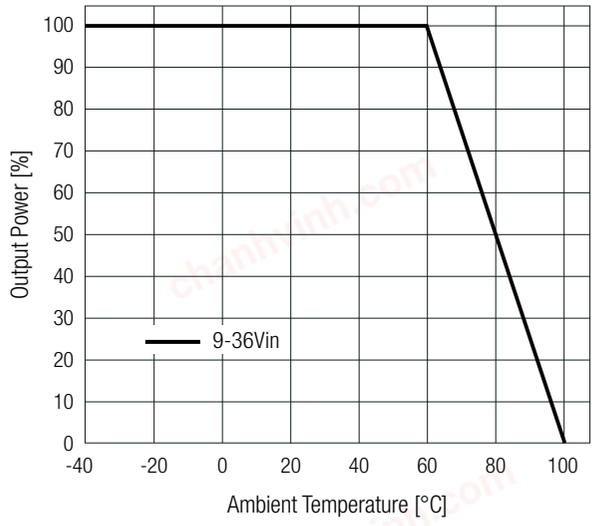
Derating Graph

(@ Chamber and natural convection 0.1m/s)

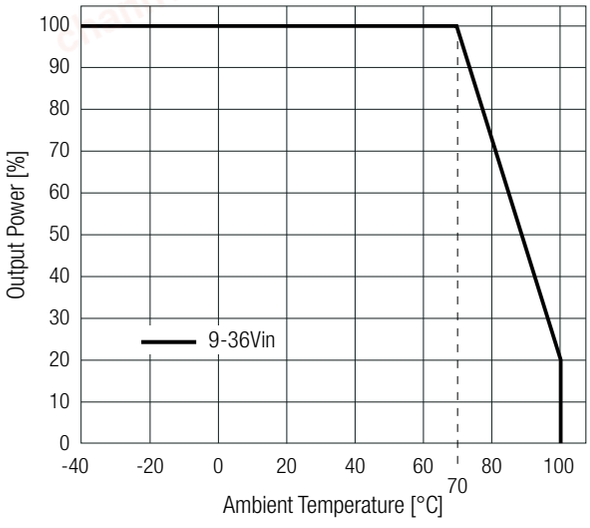
REC10K-243.3SAW/H2 & REC10K-2424SAW/H2



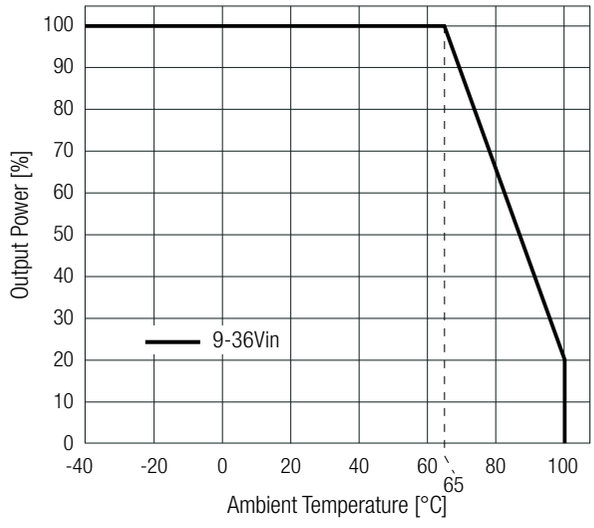
REC10K-2405SAW/H2



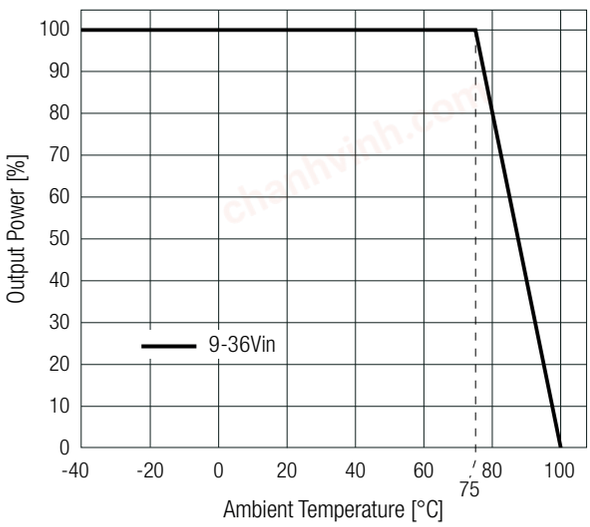
REC10K-2409SAW/H2, REC10K-2412SAW/H2
REC10K-2415SAW/H2



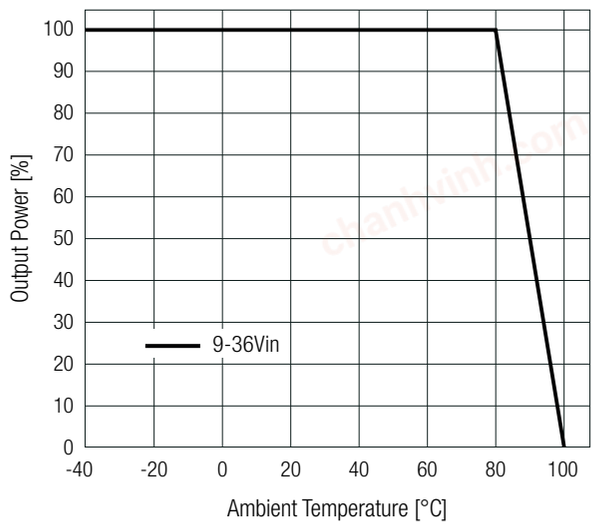
REC10K-2405DAW/H2



REC10K-2412DAW/H2 & REC10K-2415DAW/H2



REC10K-2424DAW/H2



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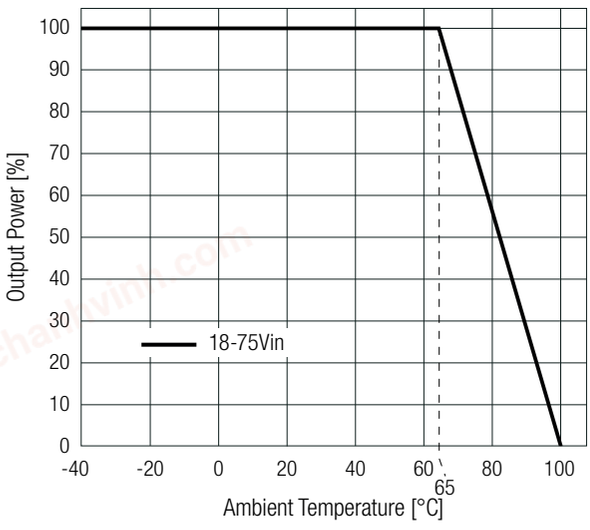
RECOM DC/DC Converter

ENVIRONMENTAL

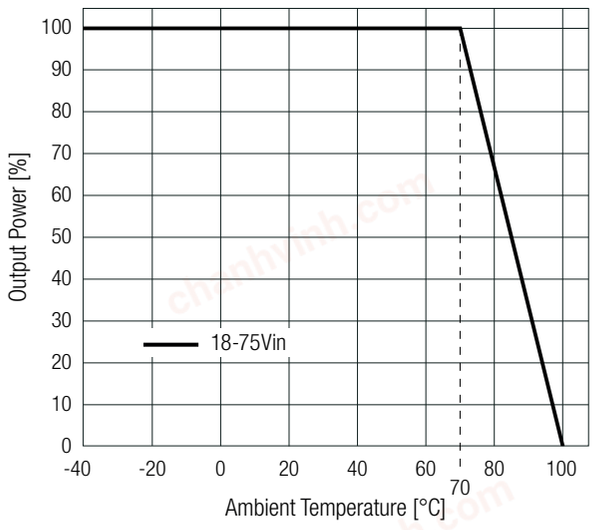
Derating Graph

(@ Chamber and natural convection 0.1m/s)

REC10K-4805SAW/H2 & REC10K-4805DAW/H2



all others

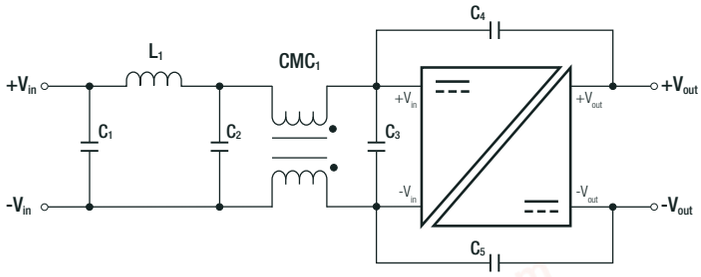


SAFETY AND CERTIFICATIONS

Certificate Type (Safety)	Report Number	Standard
Audio/Video, information and communication technology equipment - Part1: Safety requirements 3rd Edition	pending	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)	pending	IEC62368-1:2018 3rd Edition
Audio/Video, information and communication technology equipment - Part1: Safety requirements 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 (7)	EN55032, Class B

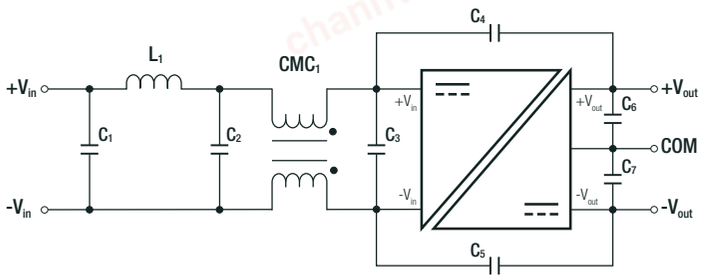
EMC filter suggsestion according to EN55032, Single Output



Component List Class B

Models	C1, C2, C3	L1	CMC1	C4, C5
REC10K-2409SAW/H2, REC10K-4812SAW/H2, REC10K-2412SAW/H2	10µF	33µH	5µH	4.7nF

EMC filter suggsestion according to EN55032, Dual Output



Component List Class B

Models	C1, C2, C3, C6, C7	L1	CMC1	C4, C5
REC10K-2412DAW/H2, REC10K-2405DAW/H2, REC10K-4824DAW/H2	10µF	10µH	5µH	4.7nF

Note7: Filter suggestions are valid for indicated part numbers only. For other part numbers, please contact RECOM for advice.

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Technical Data Sheet

REC10K-AW Series ◊ Regulated DC-DC Converter

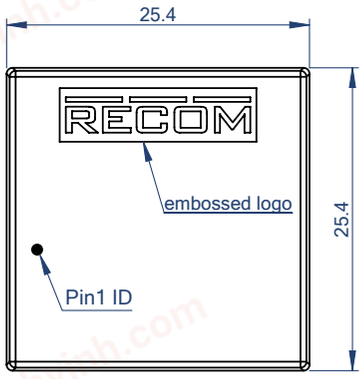
10W ◊ Isolated Output ◊ 4:1 Input

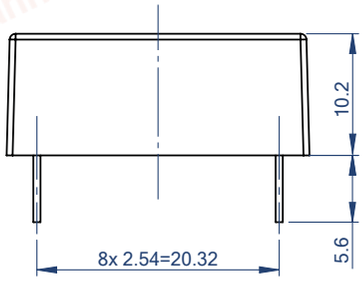
RECOM DC/DC Converter

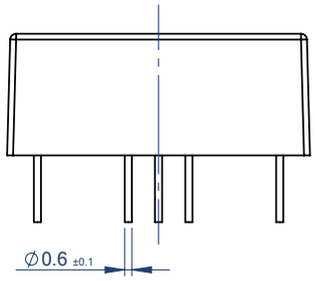
DIMENSION & PHYSICAL CHARACTERISTICS

Parameter	Type	Value
Material	case	plastic, (UL94 V-0)
	potting	silicone, (UL94 V-0)
	PCB	FR4, (UL94 V-0)
Dimension (LxWxH)		25.4 x 25.4 x 10.2mm 1.0 x 1.0 x 0.40inch
Weight		15g typ. 0.033 lbs

Dimension Drawing (mm)



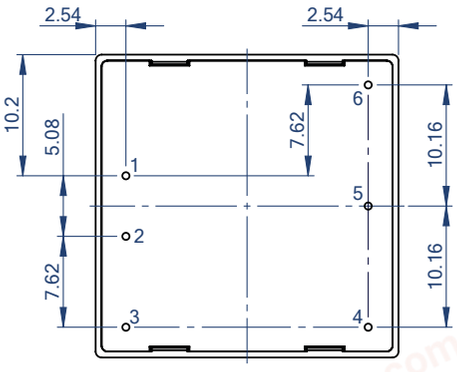


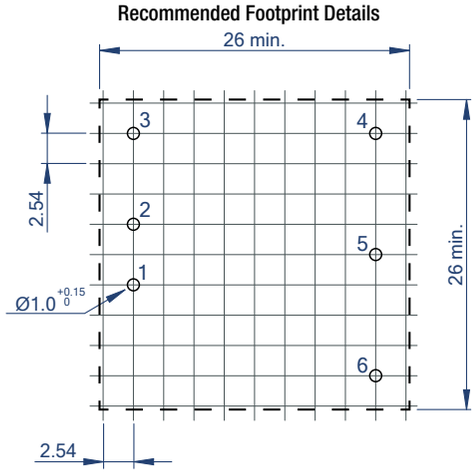


Pinning Information

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	CTRL	CTRL
4	-Vout	-Vout
5	TRIM	COM
6	+Vout	+Vout

Recommended Footprint Details





Tolerances:
x.x= ±0.5mm
x.xx= ±0.25mm

PACKAGING INFORMATION

Parameter	Type	Value
Packaging Dimension (LxWxH)	tube	520.0 x 27.5 x 19.3mm
Packaging Quantity		18pcs
Storage Temperature Range		-55°C to +125°C
Storage Humidity	non-condensing	95% RH max.

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