

REC6K-AW series \diamond Regulated DC-DC Converter

6W \diamond Isolated Output \diamond 4:1 Input

FEATURES

- Industry standard 6W 1"x1" package
- Derates to 105°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)
16.5g (0.364 lbs)

APPLICATIONS



SAFETY & EMC



DESCRIPTION

The REC6K-AW series are high power density, wide input voltage range 6W DC/DC converters in an industry standard 1"x1" case size. Despite their small size, the REC6K-AW converters are fully specified devices with output currents up to 1.5 amps, high efficiency, no minimum load, 1500VDC/1 min isolation, tight regulation, and low ripple/noise figures. The outputs are also fully protected against short circuits, overcurrent, and overvoltage, and the single output models offer a $\pm 10\%$ 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. [%]	max. Capacitive Load ⁽²⁾ [μ F]
REC6K-243.3SAW	9-36	3.3	1500	77	5000
REC6K-2405SAW	9-36	5	1200	82	5000
REC6K-2409SAW	9-36	9	667	84	3000
REC6K-2412SAW	9-36	12	500	87	2000
REC6K-2415SAW	9-36	15	400	86	1500
REC6K-2424SAW	9-36	24	250	86	100
REC6K-2405DAW	9-36	± 5	± 600	84	± 3000
REC6K-2412DAW	9-36	± 12	± 250	84	± 1000
REC6K-2415DAW	9-36	± 15	± 200	85	± 1000
REC6K-483.3SAW	9-36	3.3	1500	78	6000
REC6K-4805SAW	18-75	5	1200	83	6000
REC6K-4809SAW	18-75	9	667	82	3000
REC6K-4812SAW	18-75	12	500	85	1500
REC6K-4815SAW	18-75	15	400	85	1500

REC6K-AW Series ◇ Regulated DC-DC Converter

6W ◇ Isolated Output ◇ 4:1 Input

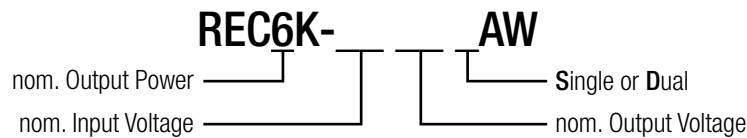
SELECTION GUIDE

Part Number	Input Voltage Range [VDC]	Output Voltage [VDC]	Output Current [mA]	Efficiency ⁽¹⁾ typ. [%]	max. Capacitive ⁽²⁾ Load [μF]
REC6K-4824SAW	18-75	24	250	85	560
REC6K-4805DAW	18-75	±5	±600	81	±6000
REC6K-4812DAW	18-75	±12	±250	82	±1500
REC6K-4815DAW	18-75	±15	±200	85	±1000

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	24VDC	36VDC
	nom. V _{IN} = 48VDC	18VDC	48VDC	75VDC
Input Under Voltage Lockout (UVLO)	nom. V _{IN} = 24VDC	DC-DC ON	8.1VDC	8.6VDC
		DC-DC OFF	7VDC	8.1VDC
	nom. V _{IN} = 48VDC	DC-DC ON	16.3VDC	17.3VDC
		DC-DC OFF	14.1VDC	15.1VDC
Input Current	nom. V _{IN} = 24VDC			320mA
	nom. V _{IN} = 48VDC			160mA
Quiescent Current				10mA
Output Power	V _{OUT} = 3.3VDC			5W
	others			6W
Output Voltage Trimming	single output only, refer to „Output Voltage Trimming“	-10%		+10%
Minimum Load		0%		
Start-up time				50ms
Rise time				15ms
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			2mA
Standby Current	DC-DC OFF		250μA	
Internal Operating Frequency		300kHz	330kHz	360kHz
Output Ripple and Noise ⁽³⁾	20MHz BW	single output		70mVp-p
		dual output		100mVp-p

Note3: Measurements are made with a 0.1μF MLCC & 10μF E-cap in parallel across output. (low ESR)

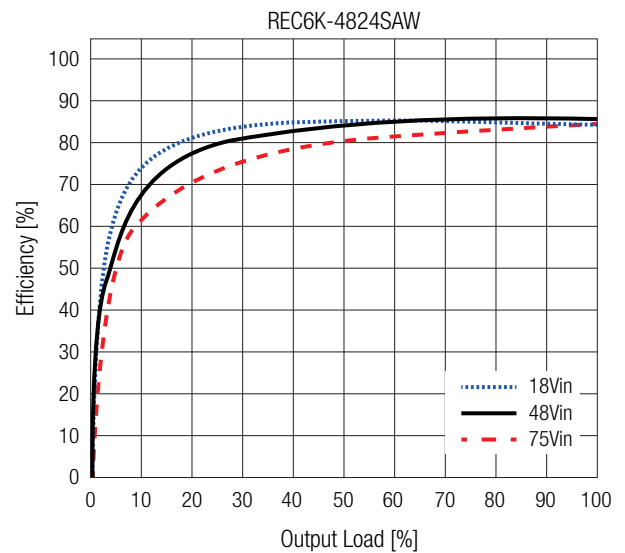
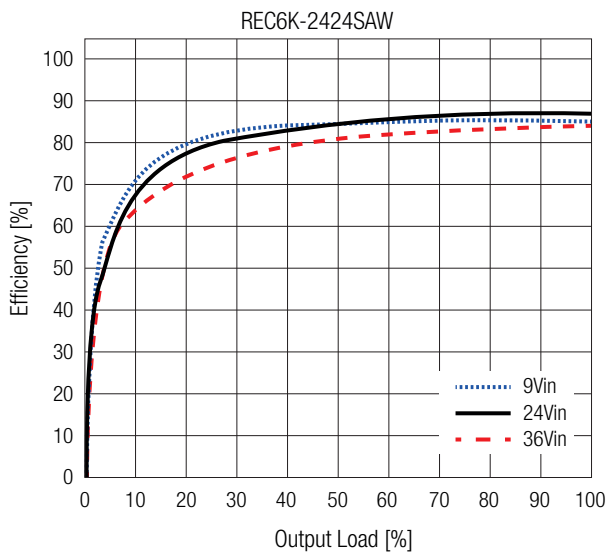
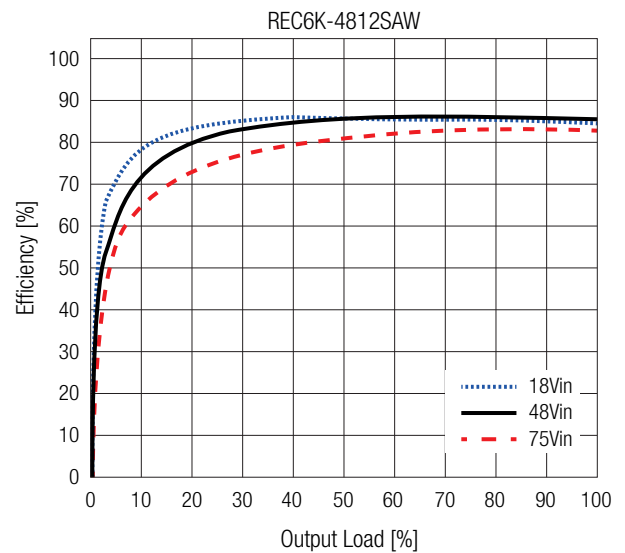
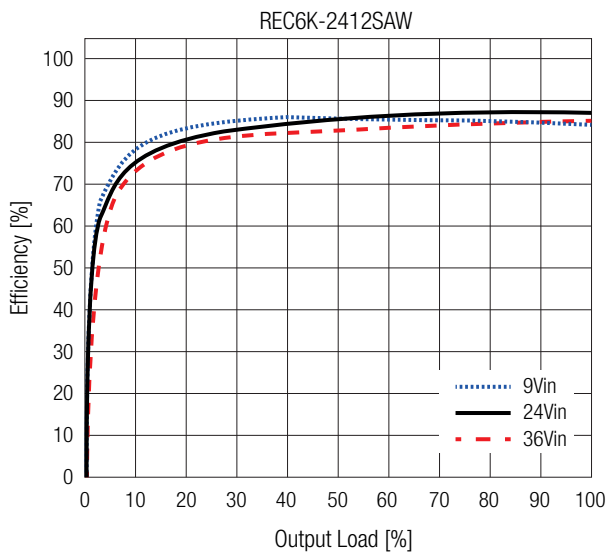
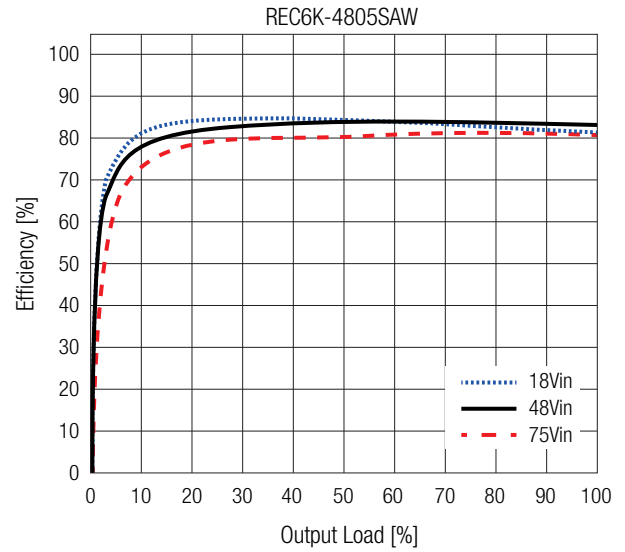
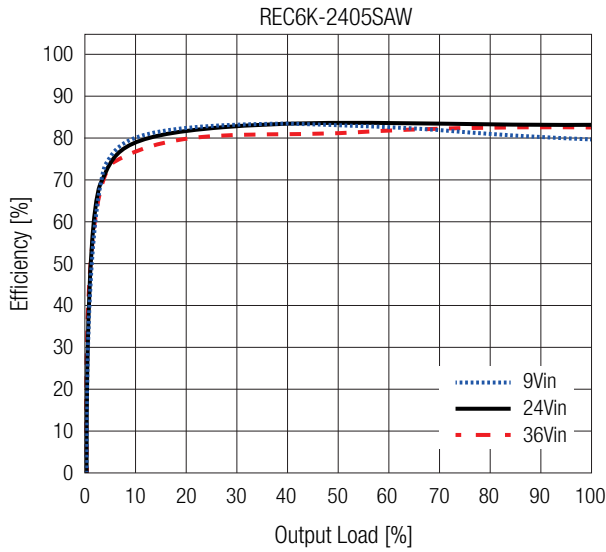
The test setup can have an impact on ripple noise values (placement of scope probe, capacitors, it's specifications, wires, PCB tracks, distances, etc.)

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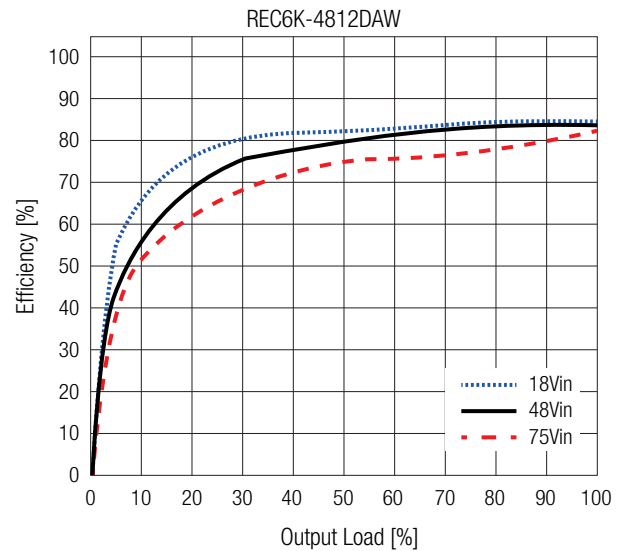
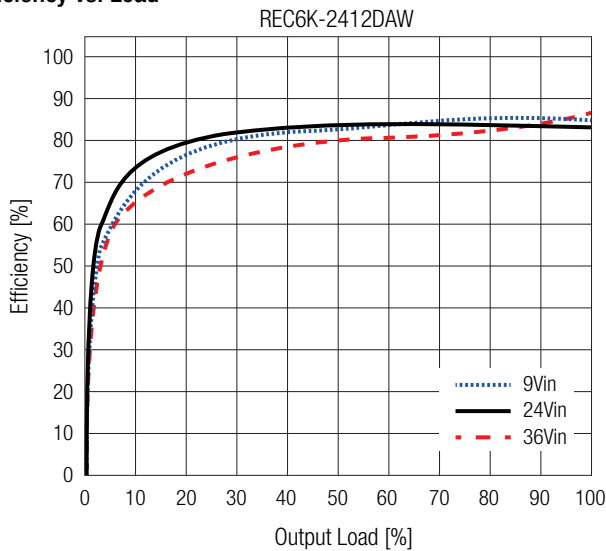
BASIC CHARACTERISTICS (measured @ $T_{AMB}= 25^{\circ}C$, nom. V_{IN} , full load and after warm-up unless otherwise stated)

Efficiency vs. Load



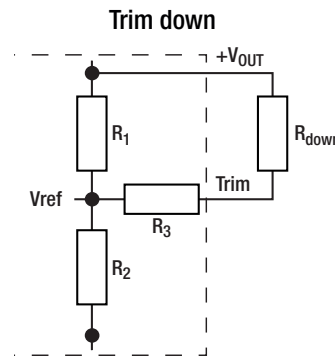
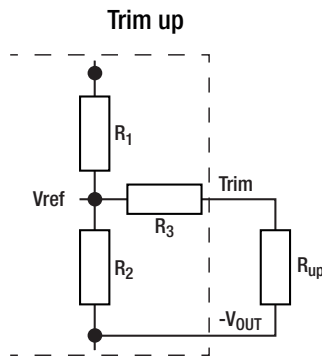
BASIC CHARACTERISTICS (measured @ $T_{AMB} = 25^{\circ}\text{C}$, nom. V_{IN} , full load and after warm-up unless otherwise stated)

Efficiency vs. Load



OUTPUT VOLTAGE TRIMMING

The REC6K-SAW series (single output only) offers the feature of trimming the output voltage over a range between $\pm 10\%$ 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.



- $V_{out_{nom}}$ = nominal output voltage [VDC]
- $V_{out_{set}}$ = 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	$V_{out_{nom}}$ [VDC]	R_1 [Ω]	R_2 [Ω]	R_3 [Ω]	V_{REF} [VDC]
REC6K-xx3.3SAW	3.3	5k48	3k3	10k	1.24
REC6K-xx05SAW	5	7k5	7k5		2.5
REC6K-xx09SAW	9	6k22	2k4		
REC6K-xx12SAW	12	9k1			
REC6K-xx15SAW	15	12k			
REC6K-xx24SAW	24	20k6			

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

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

Practical Example REC6K-2405SAW trim up 10%:

$V_{OUTnom} = 5\text{VDC}$, $V_{out_{set}} = 5.5\text{VDC}$

$$k_u = \left[\frac{2.5\text{VDC}}{5.5\text{VDC} - 2.5\text{VDC}} \right] \times 7k5\Omega = 6.25$$

$$R_{up} = \left[\frac{6.25 \times 7k5\Omega}{7k5\Omega - 6.25} \right] - 10k\Omega = 27k5\Omega$$

R_{up} according to E96 \approx **27k4 Ω**

Practical Example REC6K-2409SAW trim down -10%:

$V_{OUTnom} = 9\text{VDC}$, $V_{out_{set}} = 8.1\text{VDC}$

$$k_d = \left[\frac{8.1\text{VDC} - 2.5\text{VDC}}{2.5\text{VDC}} \right] \times 2k4\Omega = 5.376$$

$$R_{down} = \left[\frac{5.376 \times 6k22\Omega}{6k22\Omega - 5.376} \right] - 10k\Omega = 29k619\Omega$$

R_{down} according to E96 \approx **29k4 Ω**

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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)	10k7	13k	16k5	20k	24k9	30k9	43k2	60k4	90k9	243k	[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	26k7	33k2	41k2	52k3	68k1	95k3	150k	301k	[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)	27k4	31k6	36k5	43k2	52k3	64k9	84k5	115k	178k	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	36k5	45k3	57k6	76k8	107k	169k	357k	[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)	6k81	8k66	10k2	13k7	17k8	23k2	30k9	43k2	68k1	130k	[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)	29k4	34k8	41k2	49k9	61k9	76k8	102k	147k	237k	562k	[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)	8k66	10k7	13k3	16k5	20k5	26k7	35k7	49k9	76k8	150k	[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)	53k6	61k9	71k5	86k6	105k	130k	169k	237k	374k	845k	[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)	10k7	12k1	15k	18k7	23k2	30k1	40k2	56k2	90k9	191k	[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)	78k7	90k9	102k	121k	143k	178k	226k	309k	475k	976k	[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)	11k	13k3	16k2	20k	24k9	31k6	41k2	57k6	88k7	174k	[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	178k	205k	237k	287k	348k	453k	619k	976k	2M21	[Ω]

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REGULATIONS

Parameter	Condition		Value
Output Accuracy			$\pm 2.0\%$ typ.
Line Regulation	low line to high line, full load		$\pm 0.5\%$ typ.
Load Regulation ⁽⁴⁾	10% to 100% load	nom. $V_{IN} = 24VDC$	$\pm 2.0\%$ typ.
Cross Regulation			$\pm 5.0\%$ typ.
Transient Response	50% load step change (50% - 100%)		500mV max.
	recovery time		500 μ s max.

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)			continuous, automatic recovery
Over Voltage Protection (OVP)	110%-140% of nom. V_{OUT}		zener diode clamping
Over Current Protection (OCP)	250% of rated I_{OUT}		automatic recovery
Isolation Voltage ⁽⁵⁾	I/P to O/P, according to 62368-1	1 minute	1.5kVDC
Isolation Resistance	I/P to O/P, $V_{ISO} = 500VDC$		1G Ω min.
Isolation Capacitance	I/P to O/P, 100kHz/0.1V	$V_{OUT} = 3.3VDC, 5VDC, \pm 5VDC$	5000pF max.
		others	2000pF max.
Insulation Grade			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

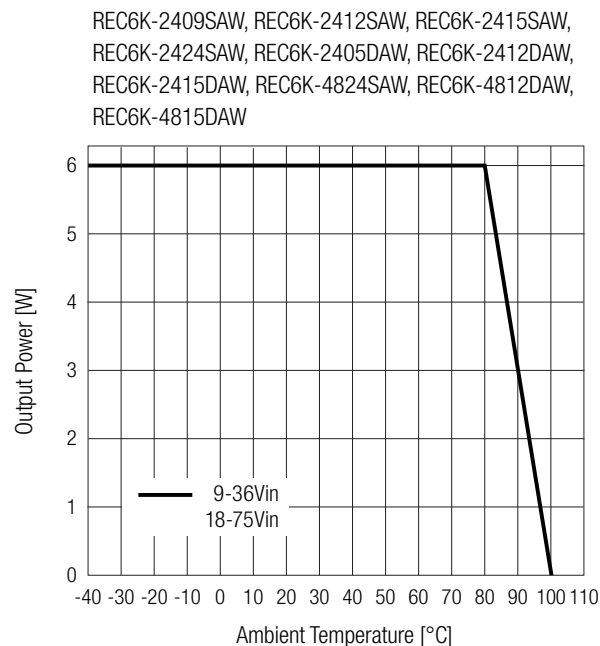
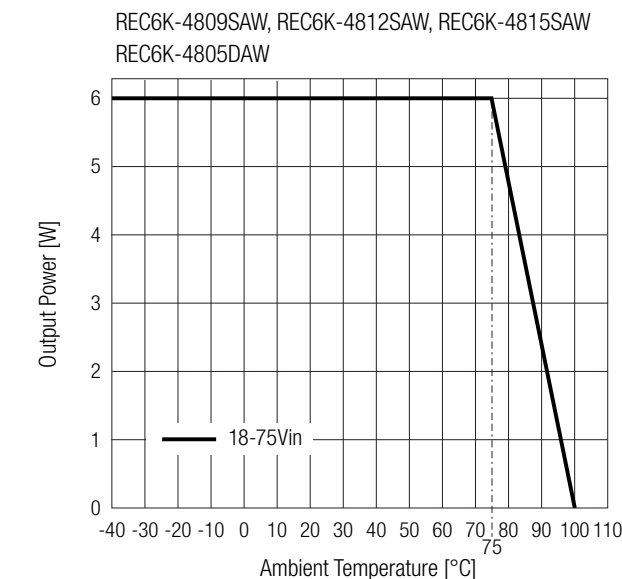
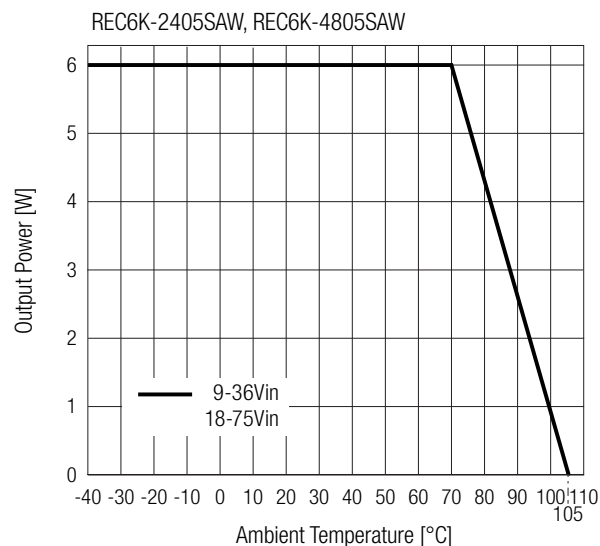
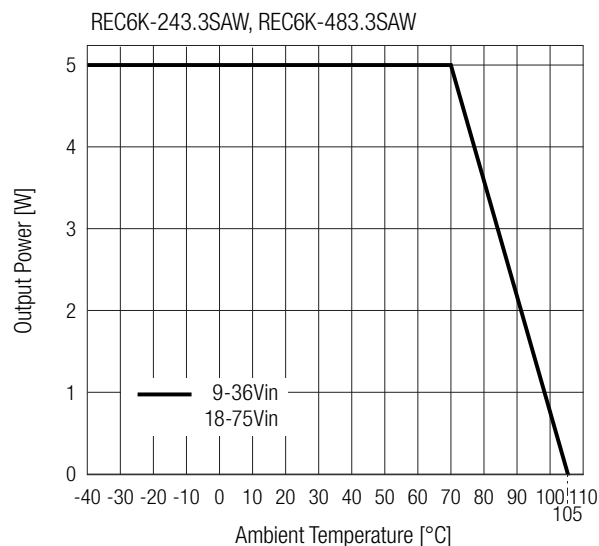
ENVIRONMENTAL

Parameter	Condition			Value		
Operating Temperature Range	with derating	refer to „Derating Graph“	nom. $V_{IN} = 24VDC$ $V_{OUT} = 09, 12, 15, 24VDC$	single	-40°C to +100°C	
				dual		
			nom. $V_{IN} = 48VDC$ $V_{OUT} = 09, 12, 15, 24VDC$	single		
				dual		
			nom. $V_{IN} = 24VDC$ nom. $V_{IN} = 48VDC$	$V_{OUT} = 3.3, 05VDC$	single	-40°C to +105°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	$T_{AMB} = +25^\circ C$	800 x 10 ³ hours		
			$T_{AMB} = +85^\circ C$	300 x 10 ³ hours		

ENVIRONMENTAL

Derating Graph

(@ 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	E518942-A6005-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)	E518942-A6005-CB-1	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

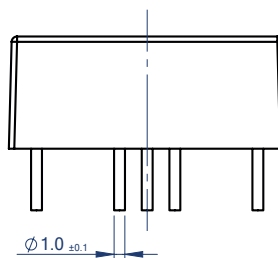
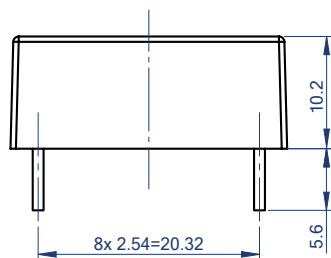
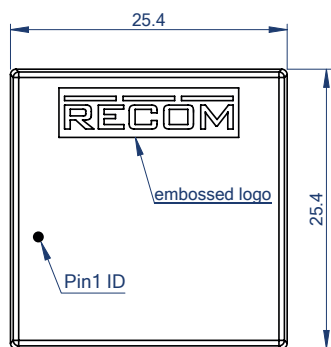
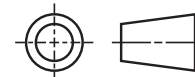
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DIMENSION & PHYSICAL CHARACTERISTICS

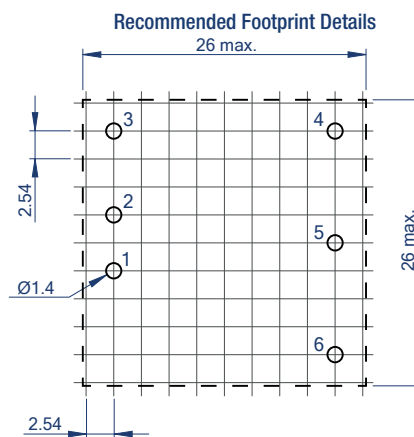
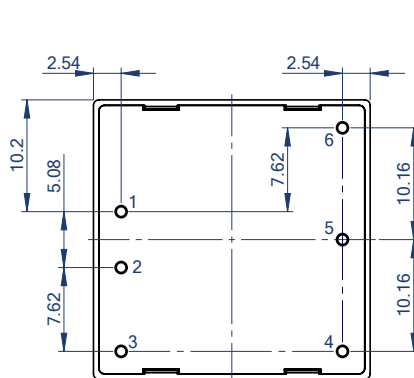
Parameter	Type	Value
Material	case	plastic, (UL94 V-0)
	potting	silicone, (UL94 V-0)
	PCB	FR4, (UL94 V-0)
Dimension (LxWxH)		25.4 x 25.4 x 10.2mm 1.0 x 1.0 x 0.40inch
Weight		16.5g typ. 0.364 lbs

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



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		-40°C to +125°C
Storage Humidity	non-condensing	95% RH max.

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