Technical Data Sheet

REC6K-AW series ◊ Regulated DC-DC Converter

6W ◊ Isolated Output ◊ 4:1 Input

RECOM DC/DC Converter

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

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

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/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 models offer 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. [%]	max. Capacitive (2) Load [µF]
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

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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

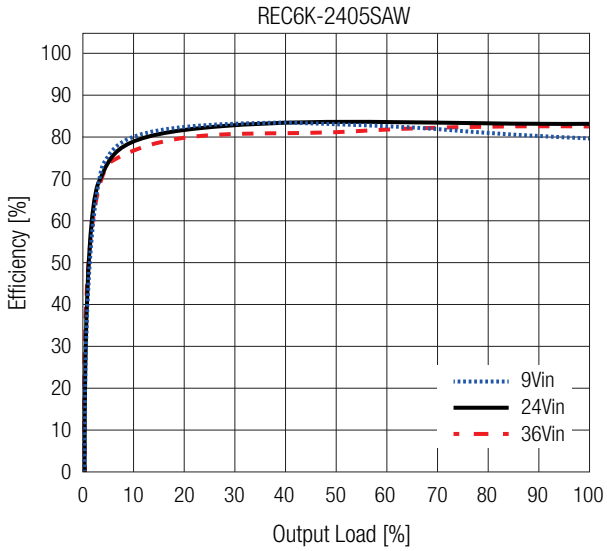
BASIC CHARACTERISTICS (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)

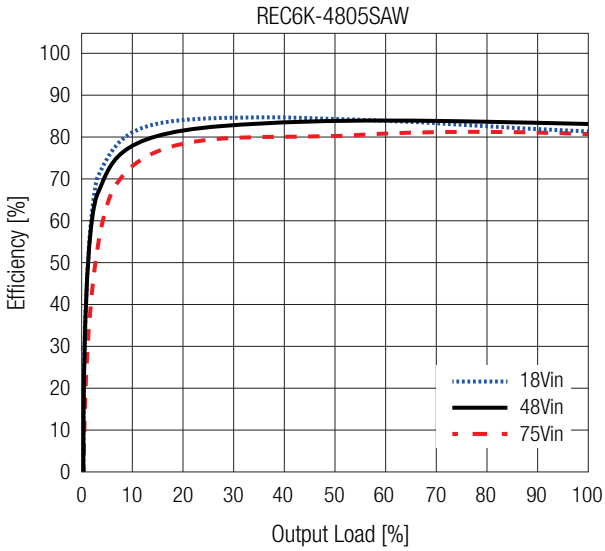
Parameter	Condition		Min.	Typ.	Max.
Internal Input Filter					Pi type
Input Voltage Range	nom. V_{IN}= 24VDC		9VDC	24VDC	36VDC
	nom. V_{IN}= 48VDC		18VDC	48VDC	75VDC
Input Under Voltage Lockout (UVLO)	nom. V_{IN}= 24VDC	DC-DC ON	8.1VDC		8.6VDC
		DC-DC OFF	7VDC		8.1VDC
	nom. V_{IN}= 48VDC	DC-DC ON	16.3VDC		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	

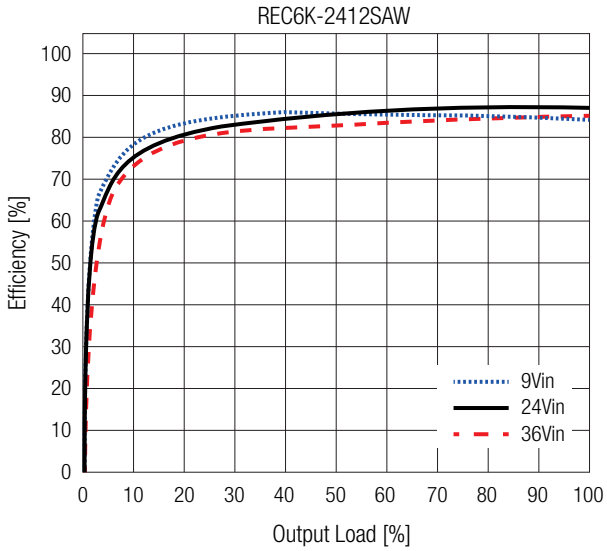
Note3: Measurements are made with a 0.1µF MLCC & 10µF E-cap in parallel across output. (low ESR)
The test setup can have an impact on ripple noise values (placement of scope probe, capacitors, it's specifications, wires, PCB tracks, distances, etc.)

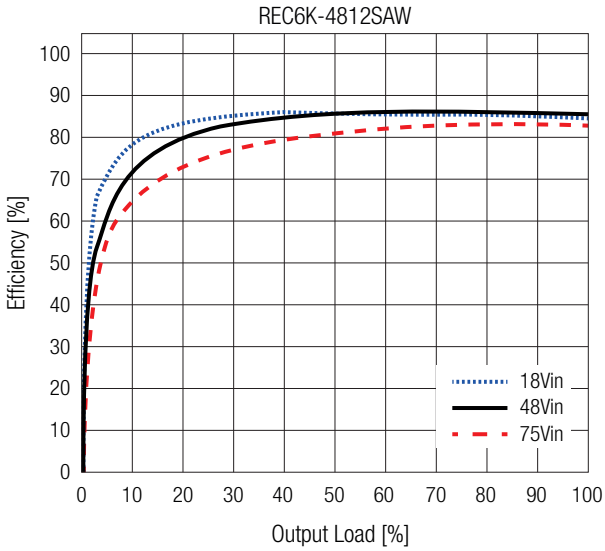
BASIC CHARACTERISTICS (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)

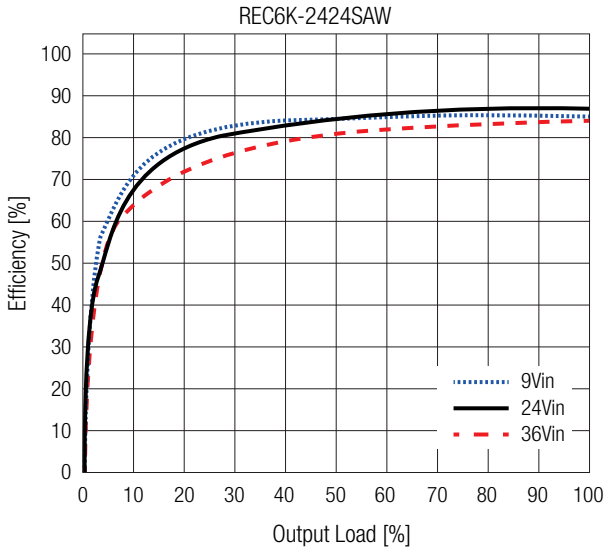
Efficiency vs. Load

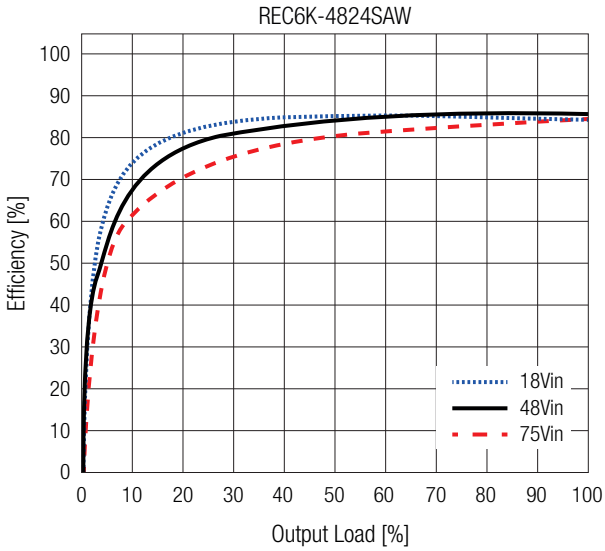












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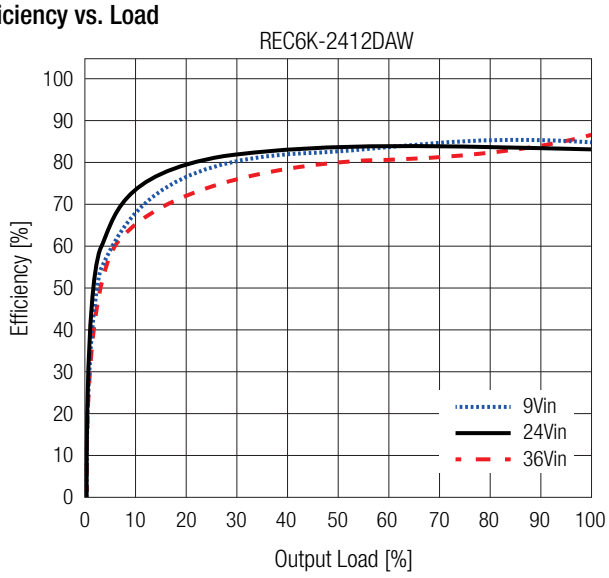
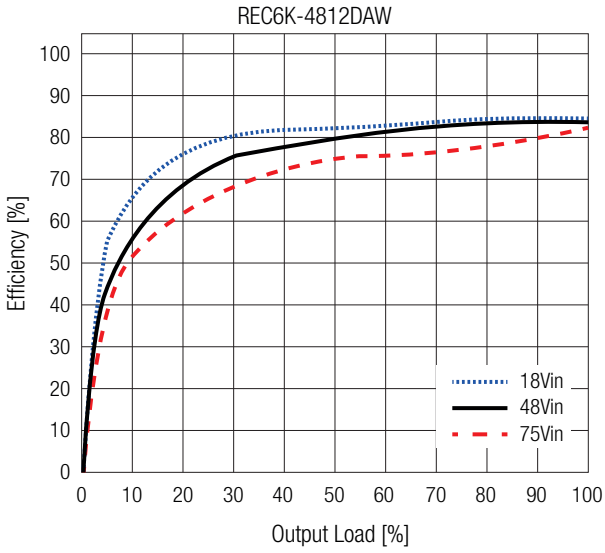
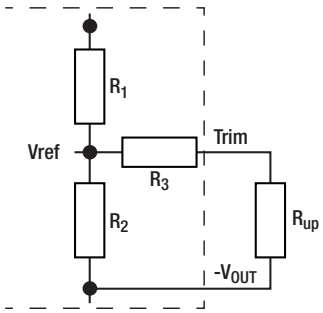




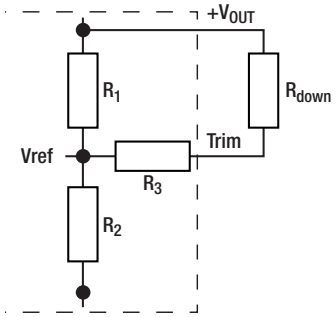
OUTPUT VOLTAGE TRIMMING

The REC6K-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]
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			

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

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

Practical Example REC6K-2405SAW trim up 10%:

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

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

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

R_{up} according to E96 ≈ **27k4Ω**

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

V_{OUTnom}= 9VDC, $Vout_{set}$= 8.1VDC

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

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

R_{down} according to E96 ≈ **29k4Ω**

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]

REGULATIONS

Parameter	Condition		Value
Output Accuracy			±2.0% typ.
Line Regulation	low line to high line, full load		±0.5% typ.
Load Regulation (4)	10% to 100% load	nom. V_{IN}= 24VDC	±2.0% typ.
Cross Regulation			±5.0% typ.
Transient Response	50% load step change (50% - 100%)		500mV max.
	recovery time		500µs 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		1GΩ min.
Isolation Capacitance	I/P to O/P, 100kHz/0.1V	V_{OUT}= 3.3VDC, 5VDC, ±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

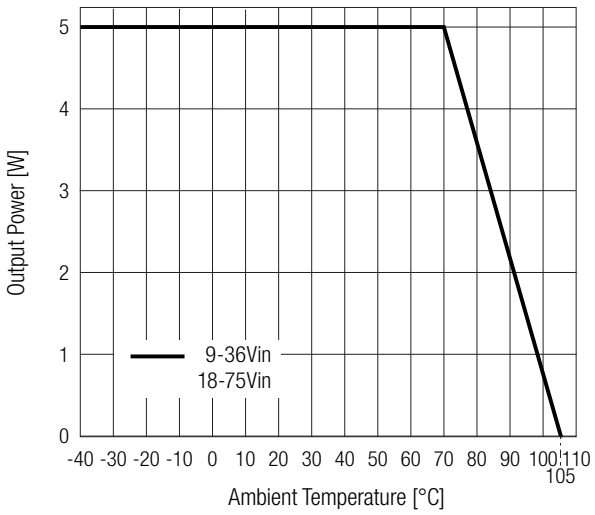
Parameter	Condition					Value
Operating Temperature Range	with derating	refer to **„Derating Graph“**	nom. V_{IN}= 24VDC	V_{OUT}= 09, 12, 15, 24VDC	single	-40°C to +100°C
				V_{OUT}= ±5, ±12, ±15VDC	dual	
			nom. V_{IN}= 48VDC	V_{OUT}= 09, 12, 15, 24VDC	single	
				V_{OUT}= ±5, ±12, ±15VDC	dual	
			nom. V_{IN}= 24VDC	V_{OUT}= 3.3, 05VDC	single	-40°C to +105°C
			nom. V_{IN}= 48VDC			
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}= +85°C		300 x 10^3 hours

ENVIRONMENTAL

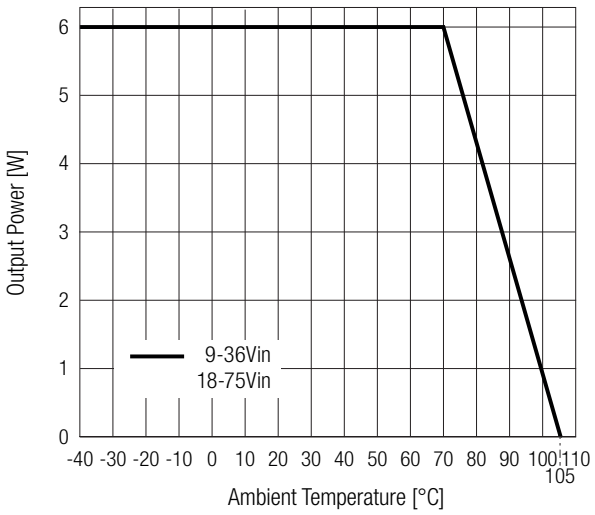
Derating Graph

(@ Chamber and natural convection 0.1m/s)

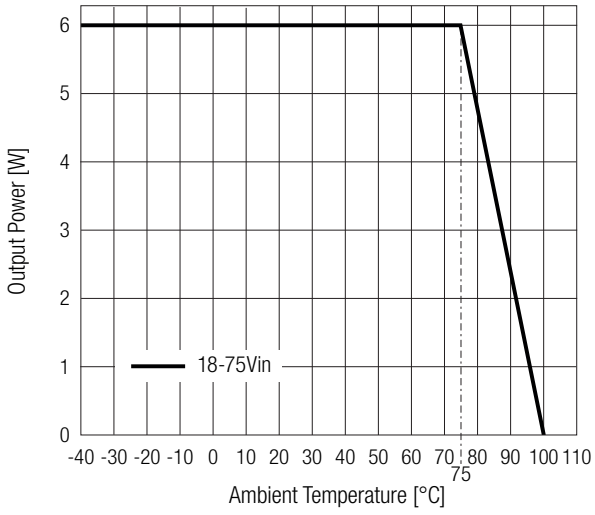
REC6K-243.3SAW, REC6K-483.3SAW



REC6K-2405SAW, REC6K-4805SAW



REC6K-4809SAW, REC6K-4812SAW, REC6K-4815SAW
REC6K-4805DAW



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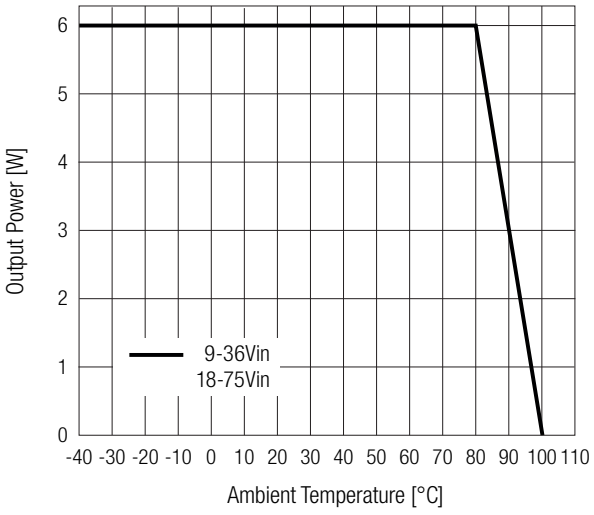

SAFETY AND CERTIFICATIONS

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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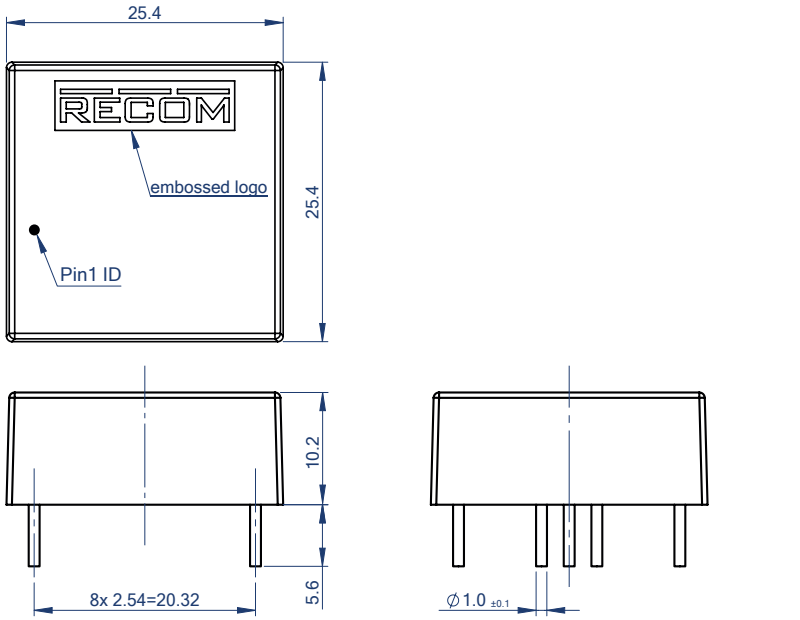
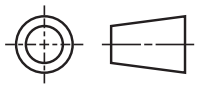
DIMENSION & PHYSICAL CHARACTERISTICS

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

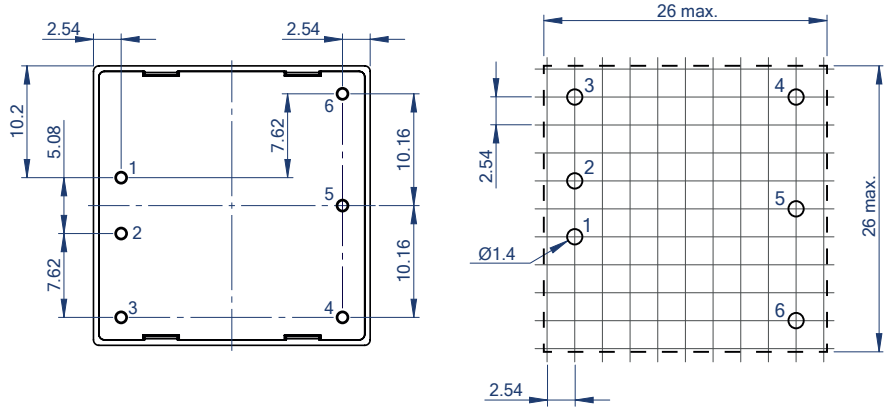
Dimension Drawing (mm)





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.