

# Features

- 2:1 Wide Input Voltage Range
- 1.6kVDC Isolation
- UL Certified
- Efficiency up to 91%
- Six-Sided Continuous Shield
- No Minimum Load Required

# Regulated Converters

## RP10-A

10 Watt  
1"x1"  
Single & Dual Output



### Description

The RP10-A series are wide input voltage range 1"x1" power DC/DC converters. Despite their small size, the RP10-A converters are fully specified devices with built-in Class B EMC filters, no minimum load, 1.6kVDC isolation, under-voltage lockout and low ripple/noise figures. The outputs are fully protected against short circuits, overcurrent and overvoltage and can be trimmed over a +/-10% range. The RP10-A series will find many uses in applications where board space is at a premium as no external components are required.

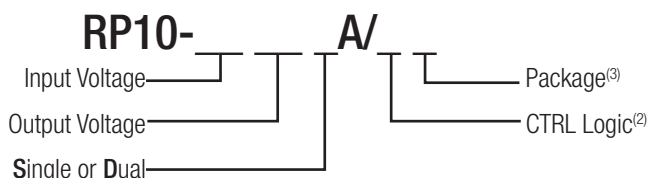
### Selection Guide

Part Number	Input Voltage Range [VDC]	Output Voltage [VDC]	Output Current [mA]	Input <sup>(1)</sup> Current [mA]	Efficiency <sup>(1)</sup> typ. [%]	Max. Capacitive Load [μF]
RP10-123.3SA <sup>(2,3)</sup>	9-18	3.3	3000	994	83	3500
RP10-1205SA <sup>(2,3)</sup>	9-18	5	2000	969	86	2500
RP10-1212SA <sup>(2,3)</sup>	9-18	12	830	933	89	430
RP10-1215SA <sup>(2,3)</sup>	9-18	15	670	931	90	350
RP10-1224SA <sup>(2,3)</sup>	9-18	24	416	914	91	125
RP10-243.3SA <sup>(2,3)</sup>	18-36	3.3	3000	485	85	3500
RP10-2405SA <sup>(2,3)</sup>	18-36	5	2000	484	86	2500
RP10-2412SA <sup>(2,3)</sup>	18-36	12	830	456	91	430
RP10-2415SA <sup>(2,3)</sup>	18-36	15	670	465	90	350
RP10-2424SA <sup>(2,3)</sup>	18-36	24	416	457	91	125
RP10-483.3SA <sup>(2,3)</sup>	36-75	3.3	3000	243	85	3500
RP10-4805SA <sup>(2,3)</sup>	36-75	5	2000	239	87	2500
RP10-4812SA <sup>(2,3)</sup>	36-75	12	830	230	90	430
RP10-4815SA <sup>(2,3)</sup>	36-75	15	670	233	90	350
RP10-4824SA <sup>(2,3)</sup>	36-75	24	416	229	91	125
RP10-1205DA <sup>(2,3)</sup>	9-18	±5	±1000	969	86	±1440
RP10-1212DA <sup>(2,3)</sup>	9-18	±12	±416	935	89	±250
RP10-1215DA <sup>(2,3)</sup>	9-18	±15	±333	925	90	±180
RP10-2405DA <sup>(2,3)</sup>	18-36	±5	±1000	484	86	±1440
RP10-2412DA <sup>(2,3)</sup>	18-36	±12	±416	462	90	±250
RP10-2415DA <sup>(2,3)</sup>	18-36	±15	±333	463	90	±180
RP10-4805DA <sup>(2,3)</sup>	36-75	±5	±1000	239	87	±1440
RP10-4812DA <sup>(2,3)</sup>	36-75	±12	±416	229	91	±250
RP10-4815DA <sup>(2,3)</sup>	36-75	±15	±333	231	90	±180

### Notes:

Note1: at nominal input voltage and full load.

### Model Numbering



### Ordering Examples

- RP10-2405SA/P = 24V Input, 5V Output, Positive Logic CTRL pin and Trim pin fitted
- RP10-4805DA/XC-HC = 48V Input, ±5V Output, without CTRL pin, with fitted Heat-sink
- RP10-2405SA/N = 24V Input, 5V Output, Negative Logic CTRL pin and Trim pin fitted

### Notes:

- Note2: standard part is with suffix "P" for positive logic (1=ON, 0=OFF) and trim pin add suffix "N" instead for negative logic (0=ON, 1=OFF) and trim pin or add suffix "XC" instead for no CTRL pin
- Note3: add suffix "-HC" for premounted Heat-sink with clamps



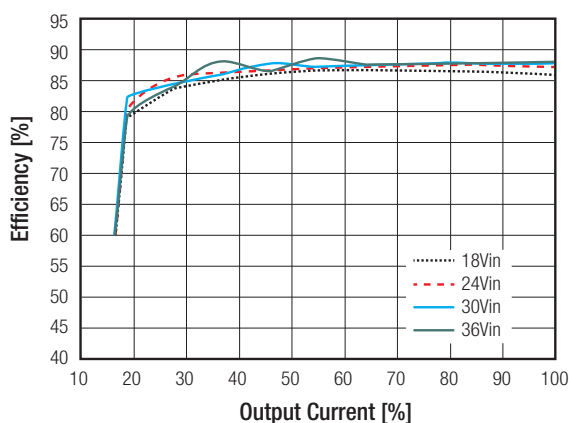
UL60950-1 Certified

**Specifications** measured at  $T_a = 25^\circ\text{C}$ , nominal input voltage, full load otherwise noted

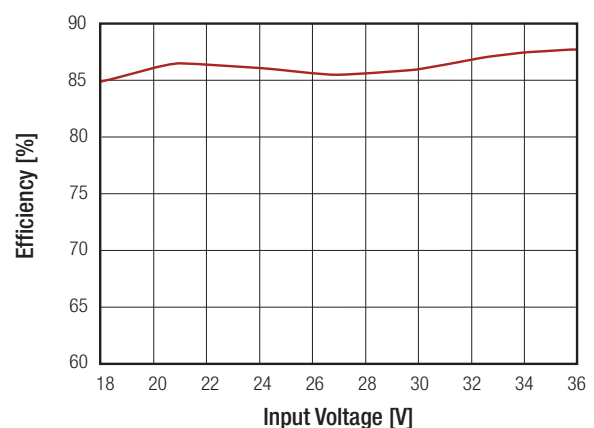
BASIC CHARACTERISTICS					
Parameter	Condition		Min.	Typ.	Max.
Input Voltage Range	nom. $V_{in} = 12\text{V}$ nom. $V_{in} = 24\text{V}$ nom. $V_{in} = 48\text{V}$		9VDC 18VDC 36VDC	12VDC 24VDC 48VDC	18VDC 36VDC 75VDC
Under Voltage Lockout (UVLO)	$V_{in} = 12\text{V}$	DC-DC ON DC-DC OFF		8VDC	9VDC
	$V_{in} = 24\text{V}$	DC-DC ON DC-DC OFF		16VDC	18VDC
	$V_{in} = 48\text{V}$	DC-DC ON DC-DC OFF		33VDC	36VDC
Input Filter					Pi-Type
Input Reflected Ripple Current	nominal $V_{in}$ and full load			30mA <sub>p-p</sub>	
Input Surge Voltage	$V_{in} = 12\text{V}$ , 1s max. $V_{in} = 24\text{V}$ , 1s max. $V_{in} = 48\text{V}$ , 1s max.				25VDC 50VDC 100VDC
Start-up time	Power up Remote ON/OFF				30ms 30ms
Operating Frequency Range			297kHz	330kHz	363kHz
Minimum Load	of full load		0%		
Optional Power	output voltage trimmed up 10% output voltage trimmed up 20%				11W 12W
Ripple and Noise	measured by 20MHz bandwidth with a 10 $\mu\text{F}/25\text{V}$ X7R 1206 MLCC	3.3V <sub>out</sub> , 5V <sub>out</sub> 12V <sub>out</sub> , 15V <sub>out</sub>		40mV <sub>p-p</sub> 60mV <sub>p-p</sub>	
	measured by 20MHz bandwidth with a 1 $\mu\text{F}/50\text{V}$ X7R 1206 MLCC	24V <sub>out</sub>		60mV <sub>p-p</sub>	
Remote ON/OFF	Positive Logic	DC-DC ON DC-DC OFF		Open or $3.0 < V_r < 15\text{VDC}$ Short or $0 < V_r < 1.2\text{VDC}$	
	Negative Logic	DC-DC ON DC-DC OFF		Short or $0 < V_r < 1.2\text{VDC}$ Open or $3.0 < V_r < 15\text{VDC}$	
Input current of Remote pin (CTRL)				2.5mA	
			DC-DC OFF DC-DC ON	-0.5 mA	1.0mA

## RP10-2405SA

Efficiency vs. Output Current



Efficiency vs. Input Voltage



**Specifications** measured at Ta = 25°C, nominal input voltage, full load otherwise noted

REGULATION		
Parameter	Condition	Value
Output Voltage Accuracy		±1%
Voltage adjustability <sup>(4)</sup>	Single 3.3Vout, 12Vout Others	±10% -10% to +20%
Line Voltage Regulation	low line to high line Single Dual	±0.2% ±0.5%
Load Voltage Regulation	0% to 100% load Single Dual	±0.2% ±1.0%
	10% to 90% load Single Dual	±0.1% ±0.8%
Cross Regulation	asymmetrical 25% <-> 100% load	±5%
Transient Response recovery time	25% load step change	250µs typ.

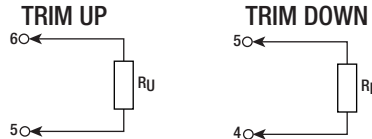
**Notes:**

Note4: Trimming allows the user to increase or decrease the output voltage set point of the module. This is accomplished by connecting an external resistor between the Trim pin and either +Vout pin or -Vout pin.

**External Output Trimming**

**Output Voltage Trimming**

Single output Powerline converters offer the feature of trimming the output voltage over a certain range around the nominal value by using external trim resistors. No general equation can be given for calculating the trim resistors, but the following trimtables give typical values for choosing these trimming resistors. If voltages between the given trim points are required, extrapolate between the two nearest given values to work out the resistor required or use a variable resistor to set the output voltage.



**RP10-xx3.3SA**

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	3.333	3.366	3.399	3.432	3.465	3.498	3.531	3.564	3.597	3.63	Volts
R <sub>u</sub> =	385.07	191.51	126.99	94.73	75.37	62.47	53.25	46.34	40.96	36.66	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	3.267	3.234	3.201	3.168	3.135	3.102	3.069	3.036	3.003	2.97	Volts
R <sub>d</sub> =	116.72	54.78	34.13	23.81	17.62	13.49	10.54	8.32	6.60	5.23	KOhms

**RP10-xx05SA**

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	5.4	5.45	5.50	Volts
R <sub>u</sub> =	253.45	125.70	83.12	61.82	49.05	40.53	34.45	29.89	26.34	23.50	KOhms
Trim up	11	12	13	14	15	16	17	18	19	20	%
Vout =	5.55	5.60	5.65	5.70	5.75	5.80	5.85	5.90	5.95	6.00	Volts
R <sub>u</sub> =	21.18	19.24	17.60	16.20	14.98	13.92	12.98	12.14	11.39	10.73	KOhms
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	Volts
R <sub>d</sub> =	248.34	120.59	78.01	56.71	43.94	35.42	29.34	24.78	21.23	18.39	KOhms

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**Specifications** measured at  $T_a = 25^\circ\text{C}$ , nominal input voltage, full load otherwise noted

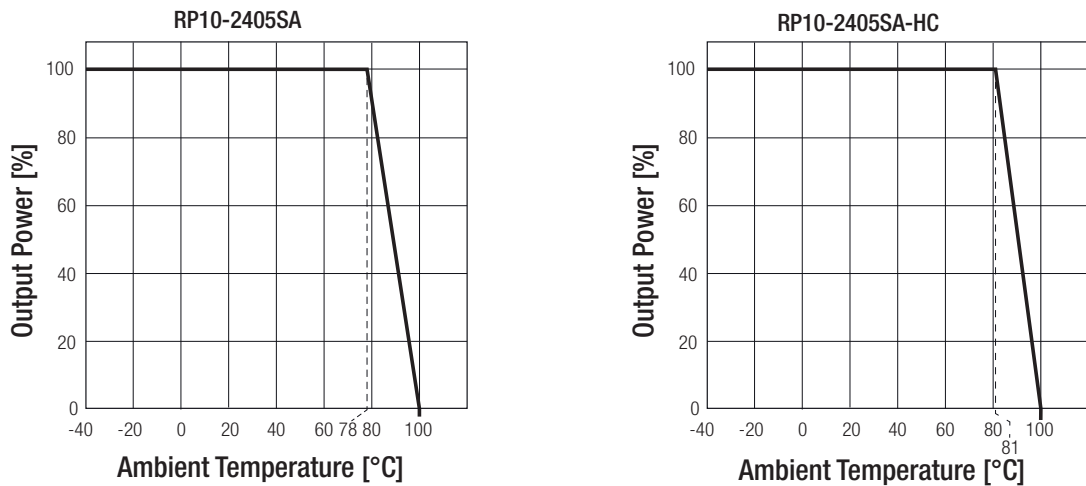
RP10-xx12SA											
Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	12.12	12.24	12.36	12.48	12.60	12.72	12.84	12.96	13.08	13.20	Volts
$R_{\text{V}}$ =	203.22	99.06	64.33	46.97	36.56	29.61	24.65	20.93	18.04	15.72	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	11.88	11.76	11.64	11.52	11.40	11.28	11.16	11.04	10.92	10.8	Volts
$R_{\text{D}}$ =	776.56	380.72	248.78	182.81	143.22	116.83	97.98	83.85	72.85	64.06	KOhms
RP10-xx15SA											
Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	15.15	15.30	15.45	15.60	15.75	15.90	16.05	16.20	16.35	16.50	Volts
$R_{\text{V}}$ =	161.56	78.22	50.45	36.56	28.22	22.67	18.70	15.72	13.41	11.56	KOhms
Trim up	11	12	13	14	15	16	17	18	19	20	%
Vout =	16.65	16.80	16.95	17.10	17.25	17.40	17.55	17.70	17.85	18.00	Volts
$R_{\text{V}}$ =	10.04	8.78	7.71	6.80	6.00	5.31	4.69	4.15	3.66	3.22	KOhms
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	Volts
$R_{\text{D}}$ =	818.22	401.56	262.67	193.22	151.56	123.78	103.94	89.06	77.48	68.22	KOhms
RP10-xx24SA											
Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	24.24	24.48	24.72	24.96	25.20	25.44	25.68	25.92	26.16	26.40	Volts
$R_{\text{V}}$ =	570.33	278.67	181.44	132.83	13.67	84.22	70.33	59.92	51.82	45.33	KOhms
Trim up	11	12	13	14	15	16	17	18	19	20	%
Vout =	26.64	26.88	27.12	27.36	27.60	27.84	28.08	28.32	28.56	28.80	Volts
$R_{\text{V}}$ =	40.03	35.61	31.87	28.67	25.89	23.46	21.31	19.41	17.70	16.17	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	23.76	23.52	23.28	23.04	22.80	22.56	22.32	22.08	21.84	21.60	Volts
$R_{\text{D}}$ =	4947.67	2439.33	1603.22	1185.17	934.33	767.11	647.67	558.08	488.41	432.67	KOhms

PROTECTION		
Parameter	Condition	Value
Short Circuit Protection (SCP)		continuous, automatic recovery
Over Voltage Protection (OVP)	3.3Vout	3.7 - 5.4V
	5Vout	6.3 - 7.4V
	12Vout	13.5 - 19.6V
	15Vout	18.3 - 22.0V
	24Vout	29.1 - 32.5V
Over Load Protection (OLP)	Hiccup mode	150% typ.
Isolation Voltage	I/P to O/P	1.6kVDC/1 minute
	I/P (O/P) to case	1.0kVDC/1 minute
Isolation Resistance	tested with 500VDC	1GΩ min.
Isolation Capacitance		1500pF max.
<b>Notes:</b> Note5: This power module is not internally fused. An input line fuse must always be used.		

**Specifications** measured at Ta = 25°C, nominal input voltage, full load otherwise noted

ENVIRONMENTAL		
Parameter	Condition	Value
Operating Temperature Range	without derating with derating	-40°C to +78°C -40°C to +100°C
Maximum Case Temperature		+105°C
Temperature Coefficient		±0.02%/°C max.
Thermal Impedance	Natural convection (20LFM) without Heat-sink Natural convection (20LFM) with Heat-sink	18.2°C/W 15.8°C/W
Operating Humidity		5% - 95% RH
Thermal Shock		MIL-STD-810F
Vibration		MIL-STD-810F
MTBF	MIL-HDBK-217F	3308 x 10 <sup>3</sup> hours

**Derating Graph<sup>(6)</sup>**



**Notes:**

Note6: Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical support service at techsupportAT@recom-power.com

SAFETY AND CERTIFICATIONS		
Certificate Type (Safety)	Report / File Number	Standard
UL General Safety	E196683	UL60950-1, 1st Ed.: 2003 C22.2 No. 60950, 1st Ed.: 2003
EMC Compliance	Condition	Standard / Criterion
EMI Standard <sup>(7)</sup>	with external filter	EN55022, Class A or B
ESD	Air ±8kV and Contact ± 6kV	EN61000-4-2, Criteria A
Radiated Immunity	10 V/m	EN61000-4-3, Criteria A
Fast Transient <sup>(8)</sup>	±2kV	EN61000-4-4, Criteria A
Surge <sup>(8)</sup>	±1kV	EN61000-4-5, Criteria A
Conducted Immunity	3 Vr.m.s	EN61000-4-6, Criteria A
Power frequency magnetic field	100A/m continuous, 1000A/m 1 second	EN61000-4-8, Criteria A

**Notes:**

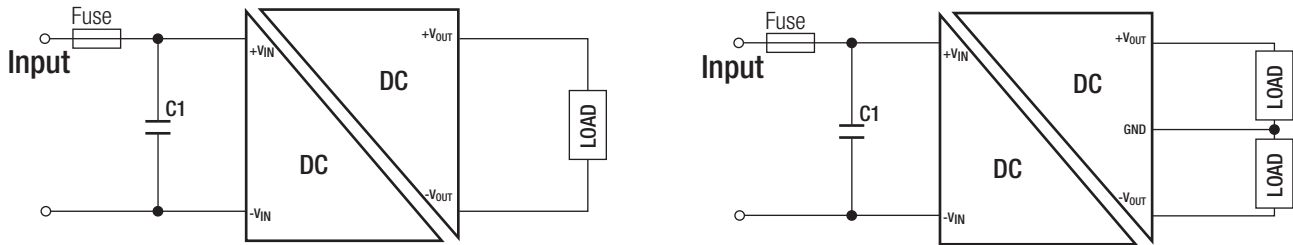
Note7: The standard modules meet EMI Class A without external components and Class B with external components; see filter suggestions below. RP10-4805SA meets EMI Class B without external components.

Note8: An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5. The filter capacitor Recom suggests: Nippon chemi-con KY series, 220µF/100V.

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**Specifications** measured at  $T_a = 25^\circ\text{C}$ , nominal input voltage, full load otherwise noted

### EMI Filtering Class B

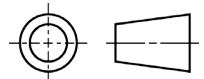
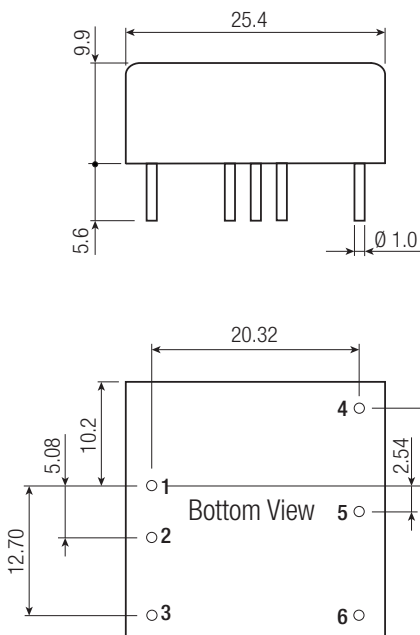


MODEL	C1
RP10-12xxS_DA	10 $\mu\text{F}$ /25V 1812 MLCC
RP10-24xxS_DA	6.8 $\mu\text{F}$ /50V 1812 MLCC
RP10-48xxS_DA	4.7 $\mu\text{F}$ /100V 1812 MLCC

### DIMENSIONS and PHYSICAL CHARACTERISTICS

Parameter	Type	Value
Material	Case	Copper Alloy C2680
	Base	FR4 PCB
	Potting	Epoxy (UL94-V0)
Package Dimensions (LxWxH)	without Heat-sink	25.4 x 25.4 x 9.9mm
	with Heat-sink	31.4 x 25.4 x 16.5mm
Package Weight	without Heat-sink	16.5g
	with Heat-sink	22.94g

### Dimension Drawing (mm)



### Pin Connections

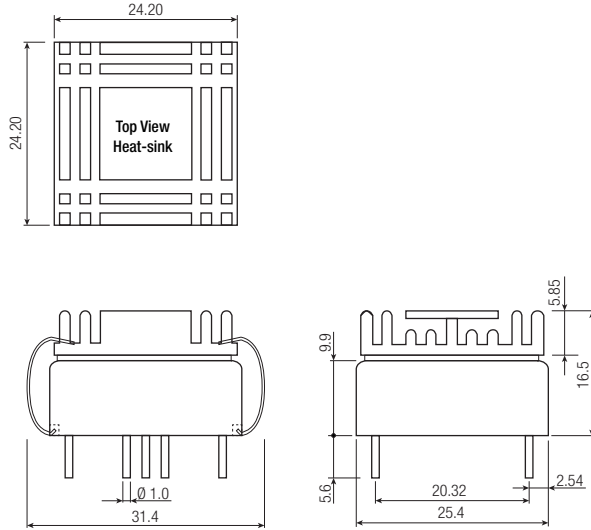
Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	CTRL <sup>(2)</sup>	CTRL <sup>(2)</sup>
4	+Vout	+Vout
5	Trim	Com
6	-Vout	-Vout

Pin Pitch Tolerance  $\pm 0.25\text{mm}$   
 Pin dimension tolerance  $\pm 0.1\text{mm}$   
 XX.X  $\pm 0.5\text{mm}$   
 XX.XX  $\pm 0.25\text{mm}$

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**Specifications** measured at Ta = 25°C, nominal input voltage, full load otherwise noted

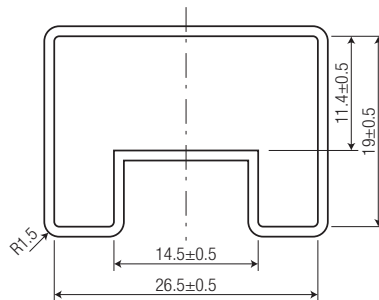
**Dimension Drawing (mm) with Heat-sink**



**PACKAGING INFORMATION**

Parameter	Type	Value
Packaging Dimensions (LxWxH)	Tube Tray	257 x 28.5 x 21mm 230 x 180 x 28mm
Packaging Quantity	without Heat-sink   Tube with Heat-sink   Tray	8pcs. 20pcs.
Storage Temperature Range		-55°C to +125°C
Storage Humidity		5% - 95% RH

**Tube Dimension Drawing (mm)**



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