

# Features

# Regulated Converters

- 2:1 Input Voltage Range
- 2.25kVDC Isolation
- UL Certified
- Efficiency up to 88%
- Ultraminiature Open Frame SMD
- No Minimum Load Required



## RP15-OF

# 15 Watt Single Output Open Frame SMD



### Description

The RP15-SOF series, are SMD open frame ultraminiature power DC/DC converters in a case half the size of industry standard 15W converters. The converters use solder ball pins to enable SMD mounting and can be reflow soldered. Despite their small size, these converters are fully specified devices with output currents up to 3.5 Amps, no minimum load, 2250VDC isolation and low ripple/noise figures. The outputs are also fully protected against short circuits, overcurrent and overvoltage. The RP15-SOF series will find many uses in telecommunications and other demanding applications where cost, board space or board height is at a premium.

### 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 <sup>(2)</sup> [µF]
RP15-243.3SOF <sup>(3)</sup>	18-36	3.3	3500	560	86	10000
RP15-2405SOF <sup>(3)</sup>	18-36	5	3000	718	87	6000
RP15-2412SOF <sup>(3)</sup>	18-36	12	1250	718	87	1000
RP15-2415SOF <sup>(3)</sup>	18-36	15	1000	710	88	660
RP15-483.3SOF <sup>(3)</sup>	36-75	3.3	3500	283	85	10000
RP15-4805SOF <sup>(3)</sup>	36-75	5	3000	359	87	6000
RP15-4812SOF <sup>(3)</sup>	36-75	12	1250	359	87	1000
RP15-4815SOF <sup>(3)</sup>	36-75	15	1000	355	88	660



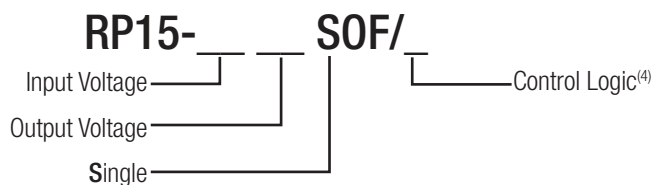
### Notes:

- Note1: Values at nominal input voltage and no load/full load.  
 Note2: Test by minimum Vin and constant resistor load.



UL60950-1 Certified

### Model Numbering



### Ordering Examples

- RP15-2405SOF = 24 Input, 5V Output, No CTRL or trim connections  
 RP15-2412SOF/P = 24V Input, 12V Output, Positive logic. CTRL and trim SMD pins fitted

### Notes:

- Note3: Standard part is without suffixes and Trim and CTRL pins are not fitted.  
 add suffix "P" for CTRL function with positive logic (1=ON, 0=OFF) and trim pin for single output  
 add suffix "N" for CTRL function with negative logic (0=ON, 1=OFF) and trim pin for single output

**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. $V_{in} = 24\text{V}$ nom. $V_{in} = 48\text{V}$	18VDC 36VDC	24VDC 48VDC	36VDC 75VDC
Under Voltage Lockout (UVLO)	$V_{in} = 24\text{V}$ DC-DC ON DC-DC OFF		14.5VDC	18VDC
	$V_{in} = 48\text{V}$ DC-DC ON DC-DC OFF		30.5VDC	36VDC
Input Filter				Pi-Type
Input Reflected Ripple <sup>(4)</sup>	nominal $V_{in}$ and full load		30mA <sub>p-p</sub>	
Input Surge Voltage	$V_{in} = 24\text{V}$ , 100ms max. $V_{in} = 48\text{V}$ , 100ms max.			50VDC 100VDC
Start-up time	Power up			30ms
	Remote ON/OFF			30ms
Operating Frequency Range	3.3V, 5V	243kHz	270kHz	297kHz
	Others	423kHz	470kHz	517kHz
Minimum Load		0%		
Optional Output Trim <sup>(5)</sup>				$\pm 10.0\%$
Ripple and Noise	measured by 20MHz bandwidth with a $1\mu\text{F}$ M/C X7R and $10\mu\text{F}$ T/C	3.3V <sub>out</sub> , 5V <sub>out</sub> 12V <sub>out</sub> , 15V <sub>out</sub>		75mV <sub>p-p</sub> 100mV <sub>p-p</sub>
Remote ON/OFF <sup>(5)</sup>	Positive Logic DC-DC ON DC-DC OFF			Open or $3.0\text{V} < V_r < 15\text{V}$ Short or $0\text{V} < V_r < 1.2\text{V}$
	Negative Logic DC-DC ON DC-DC OFF			Short or $0\text{V} < V_r < 1.2\text{V}$ Open or $3.0\text{V} < V_r < 15\text{V}$
Input current of Remote pin (CTRL)	DC-DC OFF			20mA
	DC-DC ON	-0.5mA		+1.0mA

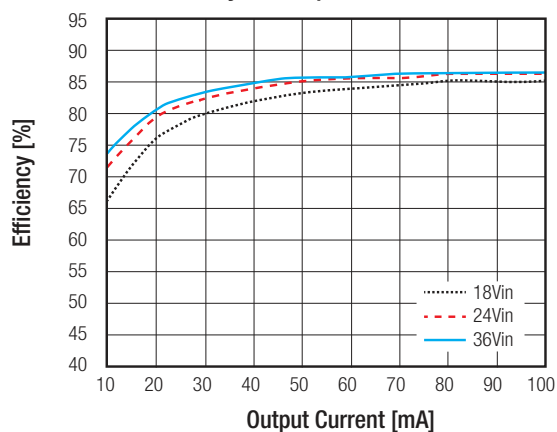
**Notes:**

Note4: Simulated source impedance of  $12\mu\text{H}$ .  $12\mu\text{H}$  inductor in series with  $+V_{in}$ .

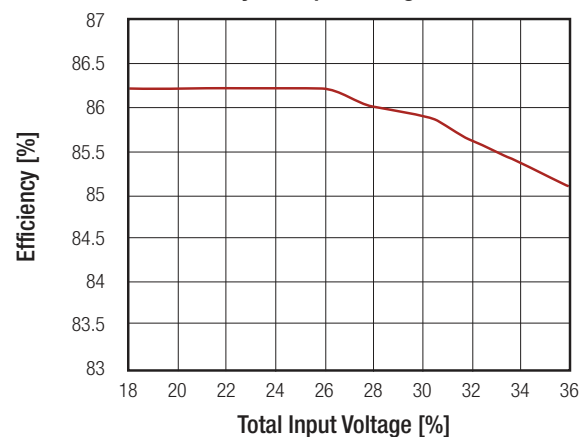
Note5: If no suffix is specified, the control pin will be omitted. If fitted, the ON/OFF control function can be positive or negative logic. The pin voltage is referenced to  $-V_{in}$ .

**RP15-2405SOF**

**Efficiency vs. Output Current**



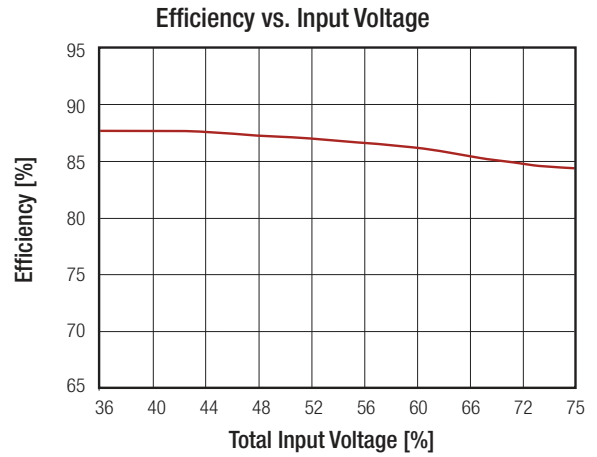
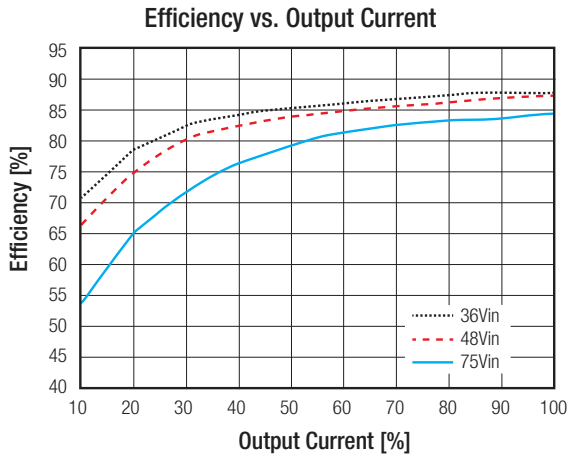
**Efficiency vs. Input Voltage**



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

**RP15-4805S0F**



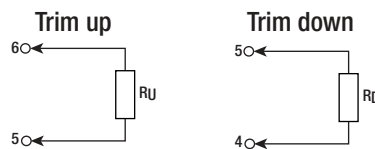
**REGULATIONS**

Parameter	Condition	Value
Output Voltage Accuracy		±1%
Voltage Adjustable		±10%
Line Voltage Regulation	low line to high line at full load	±0.2%
Output Voltage overshoot		3% typ.
Load Voltage Regulation	0% to 100% load Single	±0.2%
Cross Regulation	asymmetrical 25%<->100% load	±5%
Transient Response recovery time	25% load step change	300µs typ.

**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. Output can be externally trimmed by using the method shown below.



**RP15-xx3.3S0F**

Trim up	1	2	3	4	5	6	7	8	9	10	%
V <sub>out</sub> =	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	%
V <sub>out</sub> =	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

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

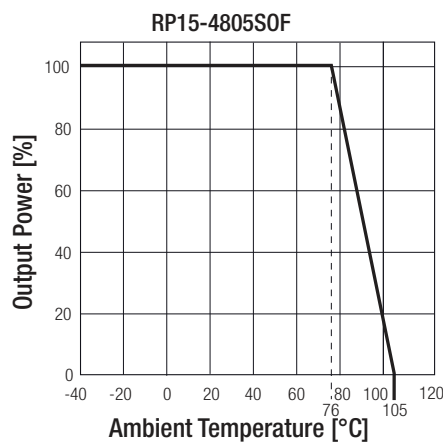
RP15-xx05S0F											
Trim up	1	2	3	4	5	6	7	8	9	10	%
V <sub>out</sub> =	5.05	5.10	5.15	5.20	5.25	5.30	5.35	5.4	5.45	5.50	Volts
R <sub>u</sub> =	253.45	125.70	83.12	61.82	49.05	40.53	34.45	29.89	26.34	23.50	kOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
V <sub>out</sub> =	4.95	4.90	4.85	4.80	4.75	4.70	4.65	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
RP15-xx12S0F											
Trim up	1	2	3	4	5	6	7	8	9	10	%
V <sub>out</sub> =	12.12	12.24	12.36	12.48	12.60	12.72	12.84	12.96	13.08	13.20	Volts
R <sub>u</sub> =	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	%
V <sub>out</sub> =	11.88	11.76	11.64	11.52	11.40	11.28	11.16	11.04	10.92	10.8	Volts
R <sub>d</sub> =	776.56	380.72	248.78	182.81	143.22	116.83	97.98	83.85	72.85	64.06	kOhms
RP15-xx15S0F											
Trim up	1	2	3	4	5	6	7	8	9	10	%
V <sub>out</sub> =	15.15	15.3	15.45	15.60	15.75	15.90	16.05	16.20	16.35	16.50	Volts
R <sub>u</sub> =	161.56	78.22	50.45	36.56	28.22	22.67	18.70	15.72	13.41	11.56	kOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
V <sub>out</sub> =	14.85	14.70	14.55	14.40	14.25	14.10	13.95	13.80	13.65	13.50	Volts
R <sub>d</sub> =	818.22	401.56	262.67	193.22	151.56	123.78	103.94	89.06	77.48	68.22	kOhms

PROTECTIONS		
Parameter	Condition	Value
Short Circuit Protection (SCP)		continuous, automatic recovery
Over Voltage Protection (OVP)	Zener Diode Clamp	3.3V <sub>out</sub>
		5V <sub>out</sub>
		12V <sub>out</sub>
		15V <sub>out</sub>
Over Load Protection (OLP)	% of lout rated, Hiccup mode	150% typ.
Isolation Voltage	I/P to O/P	2.25kVDC/1 minute
Isolation Resistance	500VDC	10M $\Omega$ min.
Isolation Capacitance		1000pF typ.
<b>Notes:</b> Note6: 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
Lead-free reflow solder process		IPC J-STD-020D
Moisture sensitivity level (MSL)		IPC J-STD-03B level 2a
Operating Temperature Range	without derating	-40°C to 76°C
	with derating	-40°C to +105°C
Temperature Coefficient		±0.02%/°C max.
Operating Humidity		5% - 95%, RH
Thermal Shock		MIL-STD-810F
Vibration		MIL-STD-810F
MTBF	MIL-HDBK-217F	3438 x 10 <sup>3</sup> hours
	Bellcore TR-NWT-000332 <sup>(7)</sup>	2200 x 10 <sup>3</sup> hours

### Derating Graph<sup>(8)</sup>



**Notes:**

- Note7: BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C. MIL-HDBK 217F Notice 2. Ta = 25°C, full load, (Ground, Benign, controlled environment).
- Note8: 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>(9)</sup>	with external filter	EN55022, Class A or B
Radiated Immunity	10 V/m	EN61000-4-3, Criteria A
Fast Transient <sup>(9)</sup>	±2kV	EN61000-4-4, Criteria B
Surge <sup>(9)</sup>	±1kV	EN61000-4-5, Criteria A
Conducted Immunity	10 Vr.m.s	EN61000-4-6, Criteria A

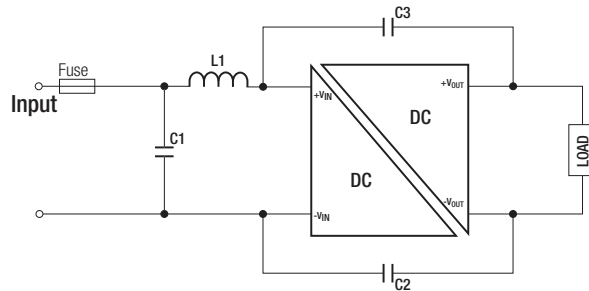
**Notes:**

- Note8: The standard modules meet EMI Class A or Class B with external components, see filter suggestions below.
- Note9: 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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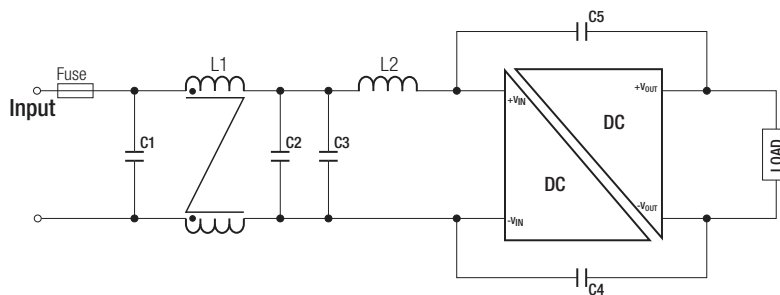
Specifications measured at Ta = 25°C, nominal input voltage, full load otherwise noted

EMI Filtering Class A



MODEL	C1	C2/C3	L1
RP15-24xxS_DOF	6.8µF/50V 1812MLCC	470pF/3kV 1808 MLCC	10iH 1.4A 0.1Ω 0504 SMD Inductor ref.: WE 744787100
RP15-48xxS_DOF	2.2µF/100V 18MLCC	470pF/3kV 1808 MLCC	18iH 1.2A 0.15Ω 0504 SMD Inductor ref.: WE 744787180

EMI Filtering Class B



MODEL	C1	C2	C3	C4/C5	L1	L2
RP15-24xxS_DOF	6.8µF/50V 1812 MLCC	6.8µF/50V 1812 MLCC	6.8µF/50V 1812 MLCC	470pF/3kV 1808 MLCC	CMC: 145µH ref.: WE 7482210002 ref.: CMC-07	10iH 1.4A 0.1Ω 0504 SMD Inductor ref.: WE 744787100
RP15-48xxS_DOF	2.2µF/100V 1812 MLCC	2.2µF/100V 1812 MLCC	2.2µF/100V 1812 MLCC	470pF/3kV 1808 MLCC	CMC: 145µH ref.: WE 7482210002 ref.: CMC-07	18iH 1.2A 0.15Ω 0504 SMD Inductor ref.: WE 744787180

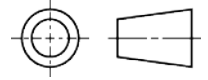
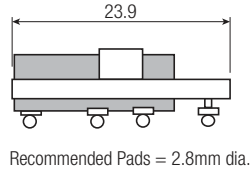
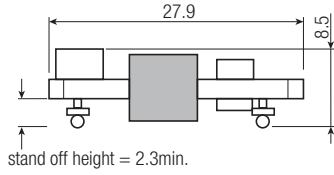
DIMENSIONS and PHYSICAL CHARACTERISTICS

Parameter	Type	Value
Material	Base	FR4 PCB
Package Dimensions (LxWxH)		27.9 x 23.9 x 8.5mm
Package Weight		10.5g

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

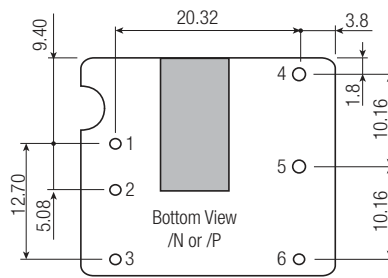
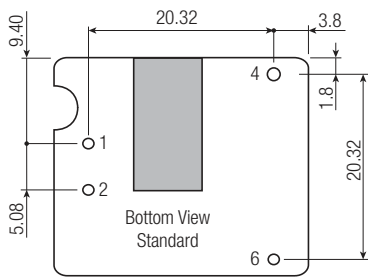
**Dimension Drawing (mm)**



**Pin Connections**

Pin #	Standard	Suffix /P or /N
1	+Vin	+Vin
2	-Vin	-Vin
3	no Pin	CTRL
4	+Vout	+Vout
5	no Pin	Trim
6	-Vout	-Vout

PCB Tolerance ±0.5mm  
SMD Pin Pitch Tolerance ±0.25mm



**PACKAGING INFORMATION**

Parameter	Type	Value
Packaging Quantity		20pcs.
Storage Temperature Range		-55°C to +125°C
Storage Humidity		5% - 95%, RH

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