

Features

Regulated Converters

- 2:1 Wide Input Voltage Range
- 1.6kVDC Isolation
- UL Certified
- Efficiency up to 90%
- Six-Sided Continuous Shield
- Available as Power Module (RPM40-G)

RECOM
DC/DC Converter

RP40-G

**40 Watt
Single,
Dual & Triple
Output**



UL60950-1 Certified

Description

The RP40-G series DC/DC converters are certified to UL 60950-1 and to cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required. The industry standard 2" x 2" package meets military standards for thermal shock and vibration tolerance.

Selection Guide

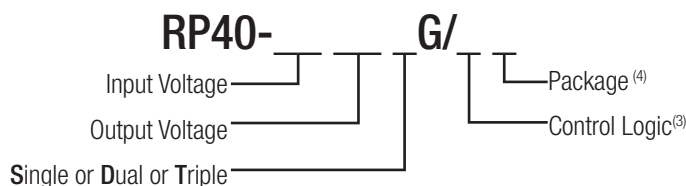
Part Number	Input Voltage Range [VDC]	Output Voltage [VDC]	Output Current [mA]	Input ⁽¹⁾ Current [mA]	Efficiency ⁽¹⁾ typ. [%]	Max. Capacitive Load ⁽²⁾ [μF]
RP40-123.3SG ^(3,4)	9-18	3.3	8000	2558	86	21000
RP40-1205SG ^(3,4)	9-18	5	8000	3876	86	13600
RP40-1212SG ^(3,4)	9-18	12	3333	3876	86	2360
RP40-1215SG ^(3,4)	9-18	15	2666	3830	87	1510
RP40-243.3SG ^(3,4)	18-36	3.3	8000	1264	87	21000
RP40-2405SG ^(3,4)	18-36	5	8000	1873	89	13600
RP40-2412SG ^(3,4)	18-36	12	3333	1894	88	2360
RP40-2415SG ^(3,4)	18-36	15	2666	1872	89	1510
RP40-483.3SG ^(3,4)	36-75	3.3	8000	625	88	21000
RP40-4805SG ^(3,4)	36-75	5	8000	926	90	13600
RP40-4812SG ^(3,4)	36-75	12	3333	936	89	2360
RP40-4815SG ^(3,4)	36-75	15	2666	936	89	1510
RP40-1212DG ^(3,4)	9-18	±12	±1800	4235	85	±1200
RP40-1215DG ^(3,4)	9-18	±15	±1400	4118	85	±750
RP40-2412DG ^(3,4)	18-36	±12	±1800	2069	87	±1200
RP40-2415DG ^(3,4)	18-36	±15	±1400	2011	87	±750
RP40-4812DG ^(3,4)	36-75	±12	±1800	1034	87	±1200
RP40-4815DG ^(3,4)	36-75	±15	±1400	1006	87	±750
RP40-120512TG ^(3,4)	9-18	5 / ±12	6000 / ±400	3837	86	6800μF/±330μF
RP40-120515TG ^(3,4)	9-18	5 / ±15	6000 / ±300	3779	86	6800μF/±110μF
RP40-240512TG ^(3,4)	18-36	5 / ±12	6000 / ±400	1897	87	6800μF/±330μF
RP40-240515TG ^(3,4)	18-36	5 / ±15	6000 / ±300	1868	87	6800μF/±110μF
RP40-480512TG ^(3,4)	36-75	5 / ±12	6000 / ±400	938	88	6800μF/±330μF
RP40-480515TG ^(3,4)	36-75	5 / ±15	6000 / ±300	923	88	6800μF/±110μF

Notes:

Note1: Maximum value at nominal input voltage and full load.

Note2: Test by minimum Vin and constant resistor load.

Model Numbering



Ordering Examples

RP40-2405SG = 24V Input, 5V Output, Positive Logic CTRL pin.

RP40-4812DG-HC = 48V Input, ±12V Output, Positive Logic CTRL pin, Heat-sink fitted

Notes:

Note3: no suffix for CTRL function with Positive Logic (1=ON, 0=OFF) and trim pin

Note4: add suffix -HC for premounted Heat-sink and clips

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

BASIC CHARACTERISTICS					
Parameter	Condition		Min.	Typ.	Max.
Input Voltage Range	nom. Vin= 12V nom. Vin= 24V nom. Vin= 48V		9VDC 18VDC 36VDC	12VDC 24VDC 48VDC	18VDC 36VDC 75VDC
Under Voltage Lockout (UVLO)	Vin = 12V	DC-DC ON DC-DC OFF		8VDC	9VDC
	Vin = 24V	DC-DC ON DC-DC OFF		16VDC	17.8VDC
	Vin = 48V	DC-DC ON DC-DC OFF		34VDC	36VDC
Input Filter	L-C Type				
Input Reflected Ripple Current ⁽⁵⁾	nominal Vin and full load			40mA _{p-p}	
Input Surge Voltage	Vin = 12V, 100ms max. Vin = 24V, 100ms max. Vin = 48V, 100ms max.				36VDC 50VDC 100VDC
Start-up time	Power up Remote ON/OFF			25ms 25ms	
			270kHz	300kHz	330kHz
Minimum Load	of full load	Single Dual and Triple	0% 10%		
Ripple and Noise	measured by 20MHz bandwidth with a 0.1μF/50V MLCC	Single	3.3Vout, 5 Vout 12Vout, 15Vout	50mV _{p-p} 75mV _{p-p}	
		Dual	12Vout 15Vout	120mV _{p-p} 150mV _{p-p}	
		Triple	3.3Vout, 5 Vout 12Vout, 15Vout	50mV _{p-p} 75mV _{p-p}	
Remote ON/OFF ⁽⁶⁾	Positive Logic	DC-DC ON DC-DC OFF	Open or 3.0V < Vr < 12V Short or 0V < Vr < 1.2V		
Input current of Remote pin (CTRL)		DC-DC OFF		2.5mA	
		DC-DC ON	-0.5mA		0.5mA

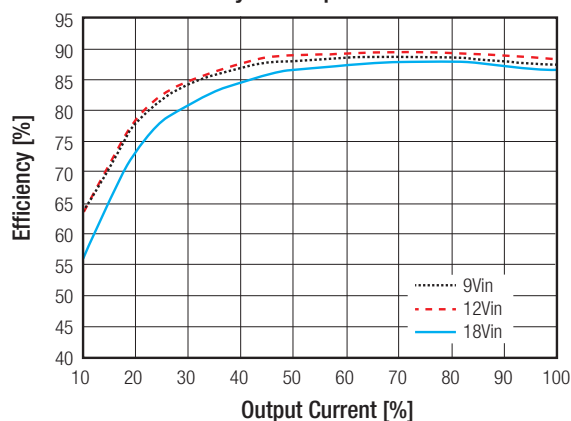
Notes:

Note5: Simulated source impedance of 12μH. 12μH inductor in series with +Vin.

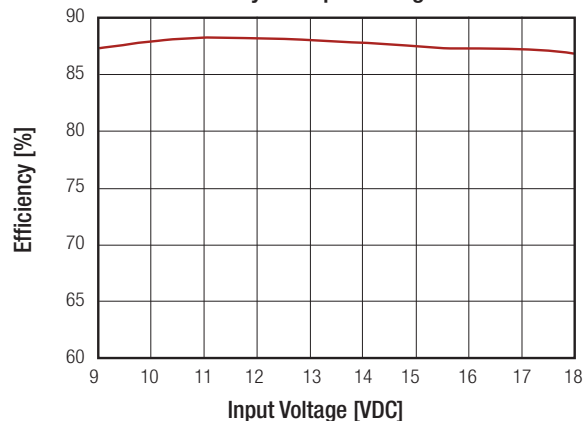
Note6: The ON/OFF control pin voltage is referenced to -Vin pin.

RP40-1205SG

Efficiency vs. Output Current



Efficiency vs. Input Voltage

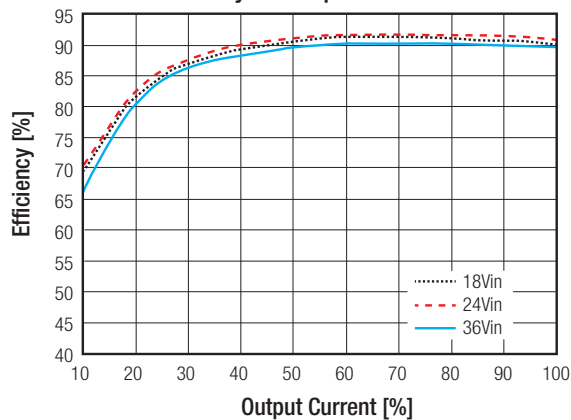


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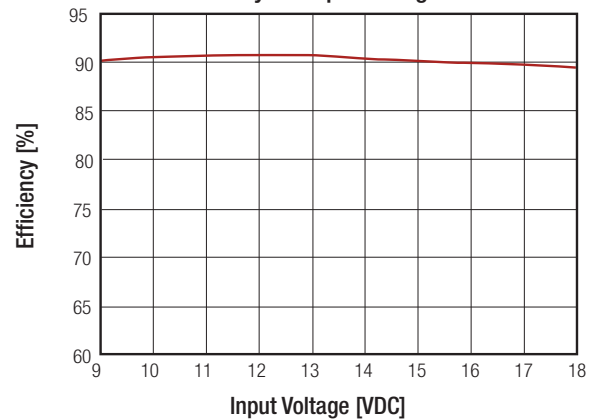
Specifications measured at $T_a = 25^\circ\text{C}$, nominal input voltage, full load otherwise noted

RP40-2405SG

Efficiency vs. Output Current

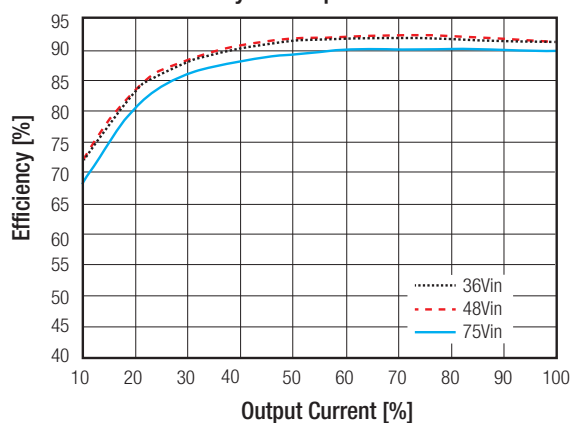


Efficiency vs. Input Voltage

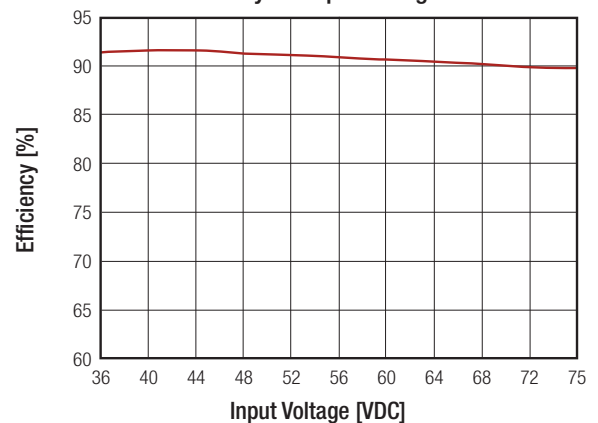


RP40-4805SG

Efficiency vs. Output Current



Efficiency vs. Input Voltage



REGULATIONS

Parameter	Condition		Value
Output Voltage Accuracy	Single & Dual		$\pm 1.0\%$ max.
	Triple Main		$\pm 1.0\%$ max.
	Triple Auxiliary		$\pm 5.0\%$ max.
Voltage Adjustability ⁽⁷⁾			$\pm 10\%$ max.
Line Voltage Regulation	low line, high line at full load	Single & Dual	$\pm 0.5\%$ max.
		Triple Main	$\pm 1.0\%$ max.
		Triple Auxiliary	$\pm 5.0\%$ max.
Load Voltage Regulation	Single/Dual min. load to full load		$\pm 0.5\%$ max. $\pm 1.0\%$ max.
	Triple: main output (3.3, 5 Vout) 10% to 100% with 10% to 100% balanced on auxiliaries.	Triple Main	$\pm 2.0\%$ max.
	Auxiliary outputs 10% to 100% balanced on all outputs	Auxiliary	$\pm 5.0\%$ max.
Cross Regulation	asymmetrical 25%/100% FL		$\pm 5.0\%$ max.
	Triple: main output (3.3, 5Vout) 100% load, auxiliary 100%, other auxiliary 25% to 100% load or main output (3.3, 5Vout) 25%, auxiliary 25%, other auxiliary 25% to 100%	Triple 3.3Vout, 5Vout	$\pm 1.0\%$ max.
		Triple 12Vout, 15Vout	$\pm 5.0\%$ max.
Transient Response recovery time	25% load step change		250 μs typ.

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

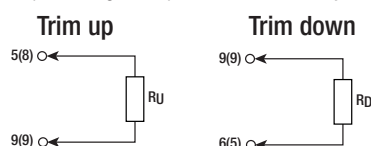
Notes:

Note7: For the single output: Maximum output deviation is 10% inclusive of remote sense and trim. If remote sense is not being use, the +Sense should be connected to its corresponding +Vout and likewise the -Sense should be conneted to its corresponding -Vout.

External Output Trimming

Output Voltage Trimming

Some single/dual 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 chosing 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.



RP40-xx3.3S

Trim up	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	3.333	3.366	3.399	3.432	3.465	3.498	3.531	3.564	3.597	3.63	Volts
R _U =	57.93	26.16	15.58	10.28	7.11	4.99	3.48	2.34	1.46	0.75	kOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	3.267	3.234	3.201	3.168	3.135	3.102	3.069	3.036	3.003	2.97	Volts
R _D =	69.47	31.23	18.49	12.12	8.29	5.74	3.92	2.56	1.50	0.65	kOhms

RP40-xx05SG

Trim up	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	5.05	5.01	5.15	5.20	5.25	5.30	5.35	5.4	5.45	5.50	Volts
R _U =	36.57	16.58	9.92	6.58	4.59	3.25	2.30	1.59	1.03	0.59	kOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	4.95	4.90	4.85	4.80	4.75	4.70	4.65	4.60	4.55	4.50	Volts
R _D =	45.53	20.61	12.31	8.15	5.66	4.00	2.81	1.92	1.23	0.68	kOhms

RP40-xx12SF

Trim up	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	12.12	12.24	12.36	12.48	12.60	12.72	12.84	12.96	13.08	13.20	Volts
R _U =	367.91	165.95	98.64	64.98	44.78	31.32	21.70	14.49	8.88	4.39	kOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	11.88	11.76	11.64	11.52	11.40	11.28	11.16	11.04	10.92	10.8	Volts
R _D =	460.99	207.95	123.60	81.42	56.12	39.25	27.20	18.16	11.13	5.51	kOhms

RP40-xx15SG

Trim up	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	15.15	15.3	15.45	15.60	15.75	15.90	16.05	16.20	16.35	16.50	Volts
R _U =	404.18	180.59	106.06	68.80	46.44	31.53	20.88	12.90	6.69	1.72	kOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	14.85	14.70	14.55	14.40	14.25	14.10	13.95	13.80	13.65	13.50	Volts
R _D =	499.82	223.41	131.27	85.20	57.56	39.14	25.97	16.10	8.42	2.282	kOhms

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

Dual Output Voltage Trim Tables

RP40-xx12DG

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 _U =	218.21	98.10	58.07	38.05	26.04	18.03	12.32	8.03	4.69	2.02	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	21.6	Volts
R _D =	273.44	123.02	72.87	47.80	32.76	22.73	15.57	10.20	6.02	2.67	kOhms

RP40-xx15DG

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	30.30	30.60	30.90	31.20	31.50	31.80	32.10	32.40	32.70	33.00	Volts
R _U =	268.29	120.64	71.43	46.82	32.06	22.21	15.10	9.91	5.81	2.53	kOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	29.70	29.40	29.10	28.80	28.50	28.20	27.90	27.60	27.30	27.00	Volts
R _D =	337.71	152.02	90.13	59.18	40.61	28.23	19.39	12.76	7.60	3.47	kOhms

PROTECTIONS

Parameter	Condition	Value
Short Circuit Protection (SCP)		continuous, automatic recovery
Over Voltage Protection (OVP)	Zener Diode Clamp	3.3Vout 5Vout 12Vout 15Vout
Over Temperature Protection (OTP)		115°C typ.
Over Load Protection (OLP)	% of Iout rated	150% typ.
Isolation Voltage	I/P to O/P I/P to O/P to case	1.6kVDC/ 1 minute 1.6kVDC/ 1 minute
Isolation Resistance	500VDC	1GΩ min.
Isolation Capacitance		1000pF max.

Notes:

Note8: This power module is not internally fused. An input line fuse must always be used.

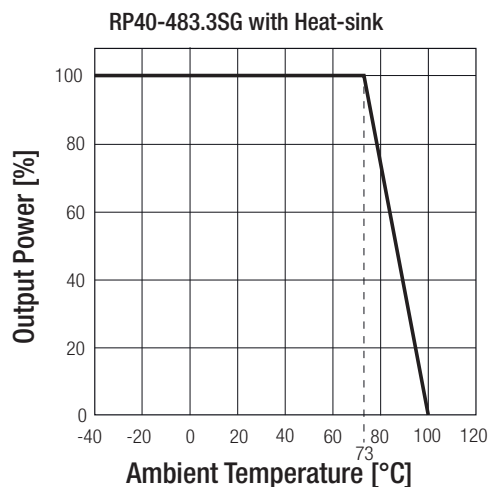
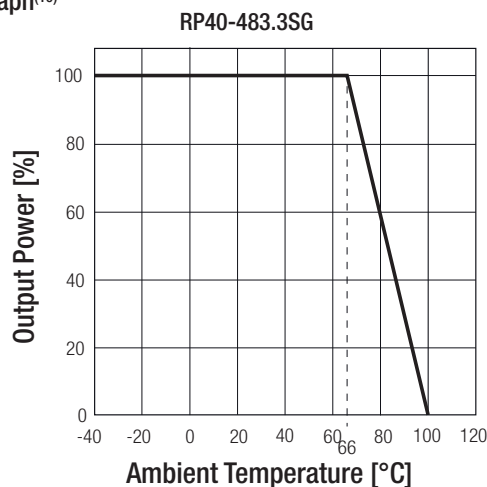
ENVIRONMENTAL

Parameter	Condition	Value
Operating Temperature Range	without derating with derating	-40°C to +66°C -40°C to +100°C
Maximum Case Temperature		+100°C max.
Temperature Coefficient		±0.02%/°C max.
Thermal Impedance	natural convection (20LFM) without Heat-sink natural convection (20LFM) with Heat-sink	9.2°C/Watt 7.6°C/Watt
Operating Humidity		5% - 95% RH
Thermal Shock		MIL-STD-810F
Vibration		MIL-STD-810F
MTBF	MIL-HDBK-217F BELLCORE TR-NWT-000332 ⁽⁹⁾	9224 x 10 ² hours 1398 x 10 ³ hours

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

Derating Graph⁽¹⁰⁾



Notes:

Note9: BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C (Ground fixed and controlled environment).

Note10: 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

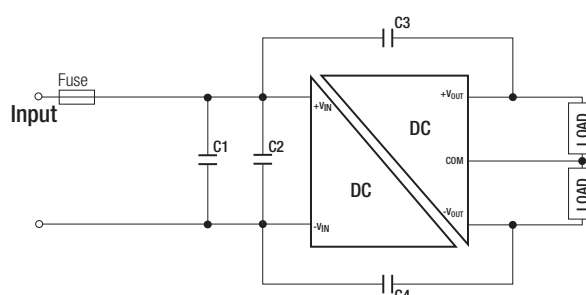
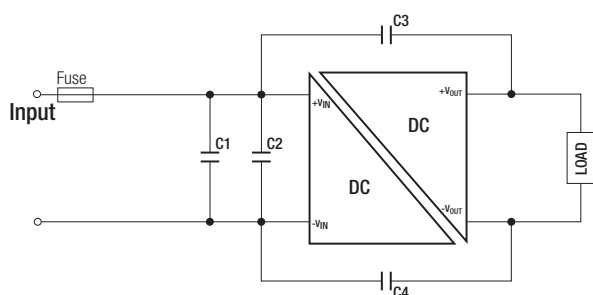
EMC Compliance	Condition	Standard / Criterion
EMI Standard ⁽¹¹⁾	with external filter	EN55022, Class A or B
ESD	Air $\pm 8\text{kV}$ and Contact $\pm 6\text{kV}$	EN61000-4-2, Criteria B
Radiated Immunity	10 V/m	EN61000-4-3, Criteria A
Fast Transient ⁽¹²⁾	$\pm 2\text{kV}$	EN61000-4-4, Criteria B
Surge ⁽¹²⁾	$\pm 1\text{kV}$	EN61000-4-5, Criteria B
Conducted Immunity	10 Vr.m.s	EN61000-4-6, Criteria A

Notes:

Note11: The standard modules meet EMI Class A or Class B with external components, see filter suggestions below.

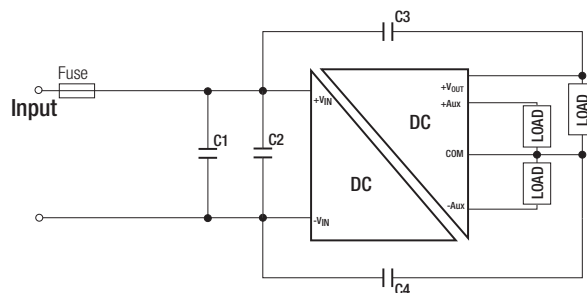
Note12: An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5. The filter capacitor Recom suggests: Nippon chemi-con KY series, $220\mu\text{F}/100\text{V}$

EMI Filtering Class A



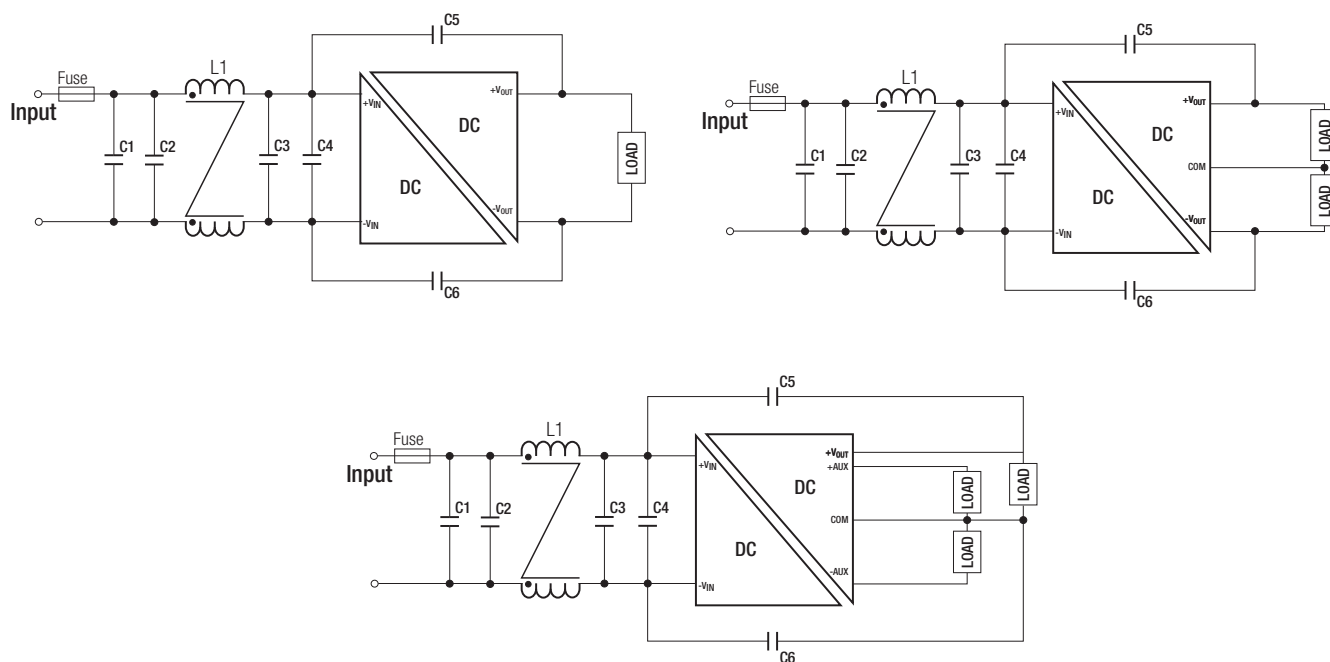
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Specifications measured at $T_a = 25^\circ\text{C}$, nominal input voltage, full load otherwise noted



MODEL	C1	C2	C3/C4
RP40-12xxSG RP40-12xxDG RP40-12xxTG	6.8 μF /50V 1812 MLCC	N/A	1000pF/2kV 1808 MLCC
RP40-24xxSG RP40-24xxDG RP40-24xxTG	6.8 μF /50V 1812 MLCC	N/A	1000pF/2kV 1808 MLCC
RP40-48xxSG RP40-48xxDG RP40-48xxTG	2.2 μF /100V 1812 MLCC	N/A	1000pF/2kV 1808 MLCC

EMI Filtering Class B



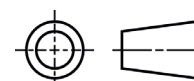
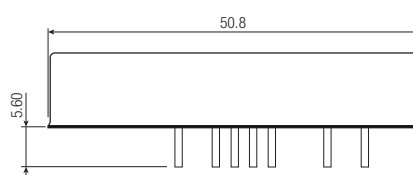
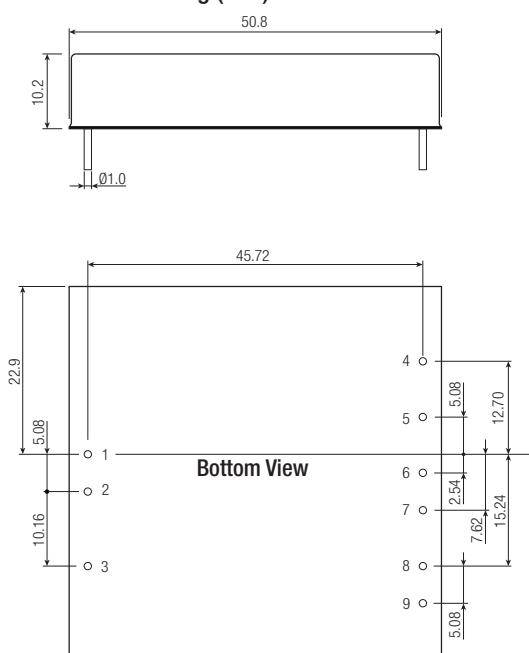
MODEL	C1	C2	C3	C4	C5/C6	L1
RP40-12xxSG RP40-12xxDG RP40-12xxTG	4.7 μF /50V 1812 MLCC	N/A	4.7F/50V 1812 MLCC	N/A	1000pF/2kV 1808 MLCC	CMC: 450 μH ref.: WE 7448227005 ref.: CMC-05
RP40-24xxSG RP40-24xxDG RP40-24xxTG	6.8 μF /50V 1812 MLCC	N/A	6.8 μF /50V 1812 MLCC	N/A	1000pF/2kV 1808 MLCC	CMC: 450 μH ref.: WE 7448227005 ref.: CMC-05
RP40-48xxSG RP40-48xxDG RP40-48xxTG	2.2 μF /100V 1812 MLCC	2.2 μF /100V 1812 MLCC	6.8 μF /50V 1812 MLCC	2.2 μF /100V 1812 MLCC	1000pF/2kV 1808 MLCC	CMC: 830 μH ref.: WE 744822301 ref.: CMC-08

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

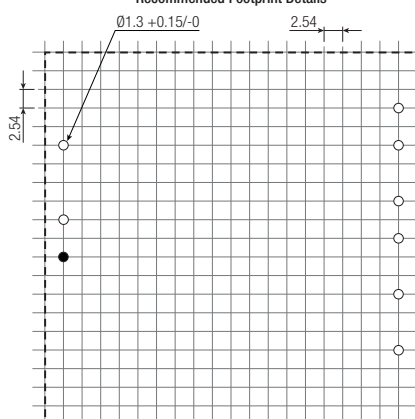
DIMENSIONS and PHYSICAL CHARACTERISTICS

Parameter	Type	Value
Material	Case	Nickel coated copper
	Base	FR4 PCB
	Potting	Epoxy (UL94-V0)
Package Dimensions (LxWxH)	without Heat-sink	50.8 x 50.8 x 10.2mm
	with Heat-sink	56.8 x 50.8 x 17.0mm
Package Weight	without Heat-sink	60g
	with Heat-sink	81g

Dimension Drawing (mm)



Recommended Footprint Details

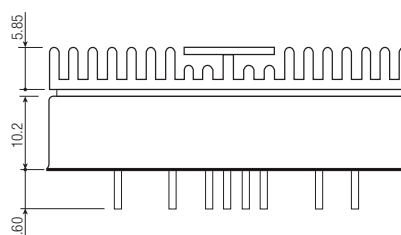
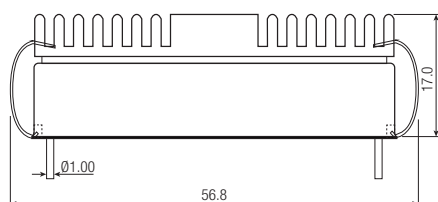
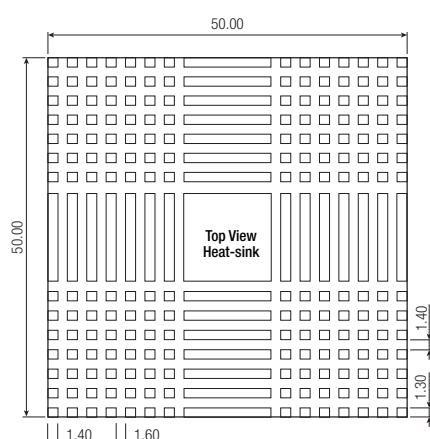


Pin Connections

Pin #	Single	Dual	Triple
1	+Vin	+Vin	+Vin
2	-Vin	-Vin	-Vin
3	CTRL	CTRL	CTRL
4	NC	No Pin	+Aux
5	-Sense ⁽⁷⁾	+Vout	Com
6	+Sense ⁽⁷⁾	Com	-Aux
7	+Vout	Com	+Vout
8	-Vout	-Vout	Com
9	Trim	Trim	NC

NC: No Connection
Pin Pitch Tolerance $\pm 0.25\text{mm}$
Pin dimension tolerance $\pm 0.1\text{mm}$
Tolerance: X.X $\pm 0.5\text{mm}$
X.XX $\pm 0.25\text{mm}$

Dimension Drawing (mm) with Heat-sink



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

PACKAGING INFORMATION		
Parameter	Type	Value
Packaging Quantity	without Heat-sink	4pcs.
	with Heat-sink	12pcs.
Storage Temperature Range		-55°C to +125°C
Storage Humidity		5% - 95% RH

The product information and specifications are subject to change without prior notice. RECOM products are not authorized for use in safety-critical applications (such as life support) without RECOM's explicit written consent. A safety-critical application is defined as an application where a failure of a RECOM product may reasonably be expected to endanger or cause loss of life, inflict bodily harm or damage property. The buyer shall indemnify and hold harmless RECOM, its affiliated companies and its representatives against any damage claims in connection with the unauthorized use of RECOM products in such safety-critical applications.