Features

Regulated Converter

- 2”x3” optional 2“x4“, low profile design
- 60W power from -40°C up to +55°C ambient
- Operating temperature up to +85°C with derating
- 4 kVAC/1min reinforced isolation
- 2MOPP medical certified, B and BF compliant
- 4000m/5000m (medical/ITE) operating altitude
- Class B EMC filter built-in

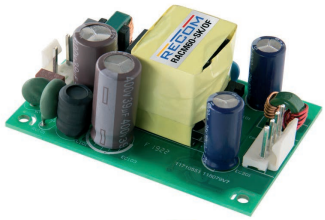
RECOM

AC/DC Converter

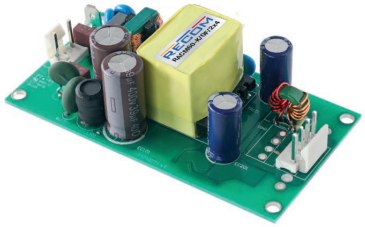
RACM60-K/OF

60 Watt Open Frame 2“x3“ & 2“x4“ Single Output

3 YEAR warranty







Description

The multi-purpose, industrial + household + medical grade AC/DC converter series RACM60-K/OF delivers 60 Watts of output power from -40°C to +55°C with natural air convection only, and up to +85°C with derating or forced cooling. With a clear focus on extended thermal performance for systems where space is limited, these 2” x 3” compact modules are designed to gain highest overall efficiency levels over the full output load range from universal AC inputs. The RACM60-K/OF has ANSI/AAMI/IEC 60601-1 medical safety and EN 60601-1-2 medical EMC certifications and offers 4kVAC/1 min isolation, 2MOPP and designed to meet B and BF requirements. It is additionally certified to IEC/EN62368-1(CB Report) and IEC61558-1/-2-16 for industrial applications and IEC/EN60335-1 for household appliances. The robust built-in Class B EMC filter has sufficient margin to allow both Installation Class II or Class I PELV with grounded output. A range of mechanical fixing options makes the RACM60 suitable for many different mounting conditions: the standard chassis mount part mates with Molex connectors and the /PCB option permits direct installation in printed circuit boards. Additionally, a 2” x 4” footprint for backwards-compatibility with legacy designs is available on request.

Selection Guide

Part Number	Input Voltage Range [VAC]	Output Voltage [VDC]	Output Current [mA]	Output Power [W]	Efficiency typ. (1) [%]
RACM60-05SK/OF (2, 3)	80-264	5	8000	40	89
RACM60-12SK/OF (2, 3)	80-264	12	5000	60	90
RACM60-15SK/OF (2, 3)	80-264	15	4000	60	90
RACM60-24SK/OF (2, 3)	80-264	24	2500	60	90
RACM60-36SK/OF (2, 3)	80-264	36	1667	60	90
RACM60-48SK/OF (2, 3)	80-264	48	1250	60	90

Notes:

Note1: Efficiency is tested at nominal input and full load at +25°C ambient

Model Numbering

RACM60- __ SK /OF/ ___ -__

- nom. Output Power
- Output Voltage
- Single
- Packaging options (3)
- Connection options (2)
- Case style (2)

Notes:

Note2: “/OF” = standard 2”x3” open frame version with standard header connectors
“/OF/PCB-T”= 2”x3” open frame with PCB mounting pins in single tray packaging (05, 12, 24Vout versions available)
“/OF/2x4” = 2”x4” open frame version with standard header connectors (12 and 24Vout versions available)
For other case/connection/footprint options, please contact RECOM technical support

Note3: without suffix, standard single pack (1pcs/cardboard box)
add suffix “-CTN” for project packaging (4 layers of tray within a carton, for “/OF” only + MOQ= 1152pcs)
for detail information, refer to ***“PACKAGING INFORMATION”***

Ordering Examples:

RACM60-05SK/OF	5Vout	2” x 3”	open frame	standard header connector	1pcs/cardboard box
RACM60-24SK/OF/PCB-T	24Vout	2” x 3”	open frame	PCB mounting pins	12pcs/tray packaging
RACM60-12SK/OF/2x4	12Vout	2” x 4”	open frame	standard header connector	1pcs/cardboard box
RACM60-12SK/OF-CTN	12Vout	2” x 4”	open frame	standard header connector	48pcs/carton (MOQ= 1152pcs)

2MOPP
250VAC

IEC/EN62368-1 (pending)
ANSI/AAMI ES60601-1 Ed. 3.1 certified
CSA/CAN-C22.2 No. 60601-1:14 certified
IEC/EN60335-1 (pending)
IEC/EN61558-1 (pending)
IEC/EN61558-2-16 (pending)
EN60601-1-2 compliant
EN55032 compliant
EN55035 compliant
CB Report (pending)

RACM60-K/OF Series

Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

BASIC CHARACTERISTICS

Parameter	Condition		Min.	Typ.	Max.
Internal Input Filter					Pi Type
Nom. Input Voltage			100VAC		240VAC
Input Voltage Range (3,4)			80VAC 120VDC		264VAC 370VDC
Input Current	115VAC 230VAC				1400mA 600mA
Inrush Current	cold start	115VAC 230VAC			30A 60A
ErP Standby Mode Conformity (Output Load Capability)	115/230VAC	Input Power: 0.5W 1.0W		0.3W 0.7W	
No load Power Consumption	230VAC			100mW	
Input Frequency Range	AC Input		47Hz		63Hz
Minimum Load			0%		
Power Factor	115VAC 230VAC		0.6 0.5		
Start-up Time				150ms	
Rise Time				100ms	
Hold-up Time	115VAC 230VAC		12ms 50ms		
Internal Operating Frequency	100% load at nominal Vin			100kHz	
Output Ripple and Noise (5)	20MHz BW	5Vout others			200mVp-p 1% of Vout

Notes:

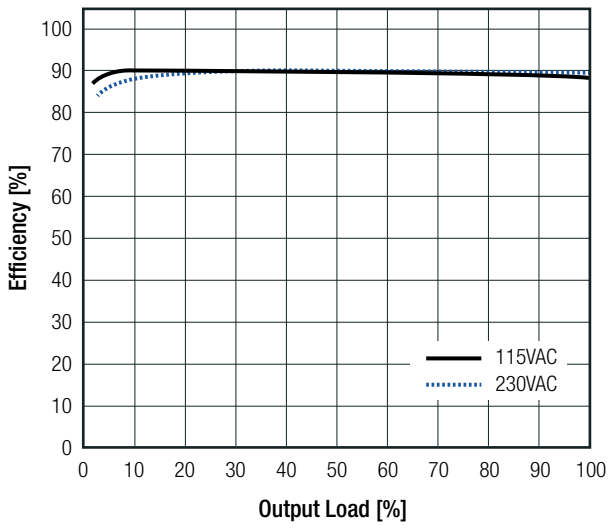
Note3: The products were submitted for safety files at AC-Input operation (90-264VAC)

Note4: Output power derating for Line-input of less than 90VAC (derate linearly from 100% at 90VAC to 80% at 80VAC)

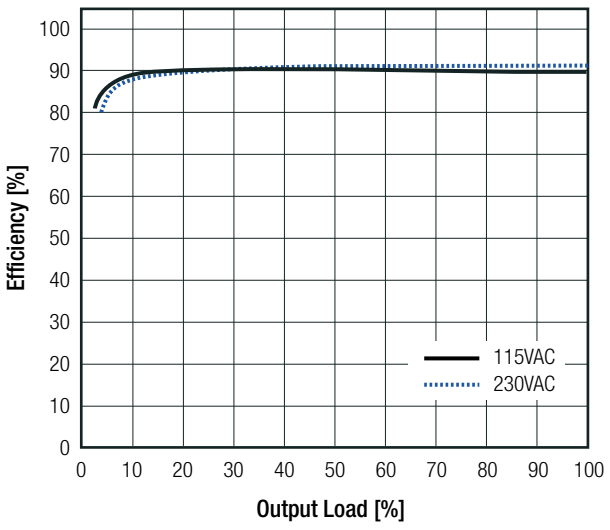
Note5: Measurements are made with a 0.1µF MLCC & 10µF E-cap in parallel across output. (low ESR)

Efficiency vs. Load

RACM60-05SK/OF



others



Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

REGULATIONS

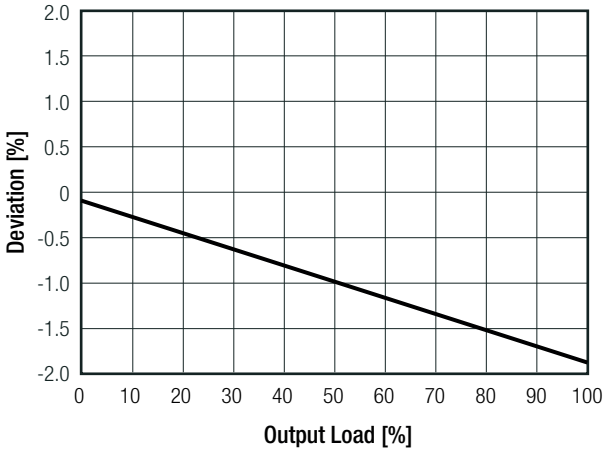
Parameter	Condition		Value
Output Accuracy	100% load		±2.0% typ.
Line Regulation	low line to high line		±0.05% typ.
Load Regulation [6]	10% to 100% load	5Vout	1.5% typ.
		12, 15Vout	0.5% typ.
		24, 36, 48Vout	0.1% typ.
Transient Response	25% load step change		3.0% max.
	recovery time		500µs max.

Notes:

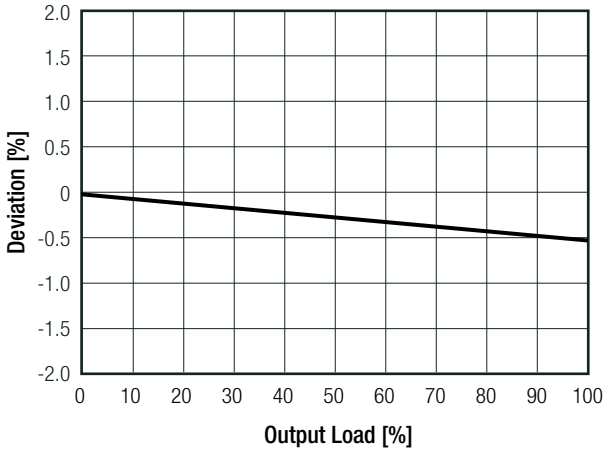
Note6: Operation below 10% load will not harm the converter, but specifications may not be met

Deviation vs. Load

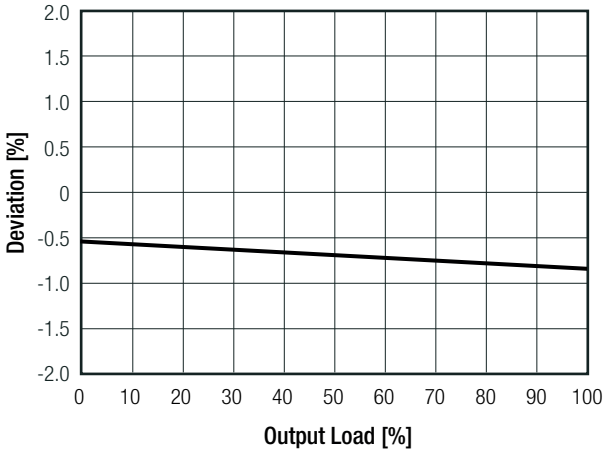
RACM60-05SK



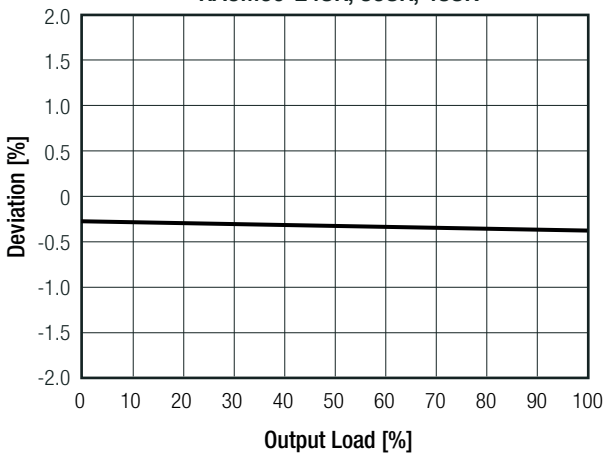
RACM60-12SK



RACM60-15SK



RACM60-24SK, 36SK, 48SK



PROTECTIONS

Parameter	Type	Value
Input Fuse	internal	T3.15A, slow blow type
Short Circuit Protection (SCP)		hiccup, auto recovery
Over Voltage Protection (OVP)		105% - 120%, auto recovery
Over Voltage Category (OVC)		OVCII
Over Current Protection (OCP)		130% - 180%, hiccup mode

continued on next page

Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

Parameter	Type		Value
Thermal Shutdown	TC point IC 101		+130°C, restart after cool down
Class of Equipment			Class II
Isolation Voltage (safety certified) (7)	I/P to O/P	1 minute	4kVAC
Isolation Resistance	I/P to O/P, V_{ISO}= 500VDC		1GΩ min.
Isolation Capacitance	I/P to O/P, 100KHz/0.1V		100pF max.
Insulation Grade			reinforced
Means of Protection	319VAC working voltage		2MOPP

Notes:

Note7: For repeat Hi-Pot testing, reduce the time and/or the test voltage

ENVIRONMENTAL

Parameter	Condition		Value
Operating Temperature Range	@ natural convection 0.1m/s	refer to ***"Derating Graph"***	-40°C to +85°C
Temperature Coefficient			±0.02%/K
Operating Altitude (8)	according to IEC60601-1 / IEC62368-1		4000m / 5000m
Operating Humidity	non-condensing		95% max.
Pollution Degree			PD2
Vibration	according to MIL-STD-202G		10-500Hz, 2G 10min./1cycle, period 60min. along x,y,z axes
MTBF	according to MIL-HDBK-217F, G.B.	+25°C +40°C	>900 x 10^3 hours >726 x 10^3 hours
Design Lifetime	nom. Vin= 230VAC, +40°C		>42 x 10^3 hours

Notes:

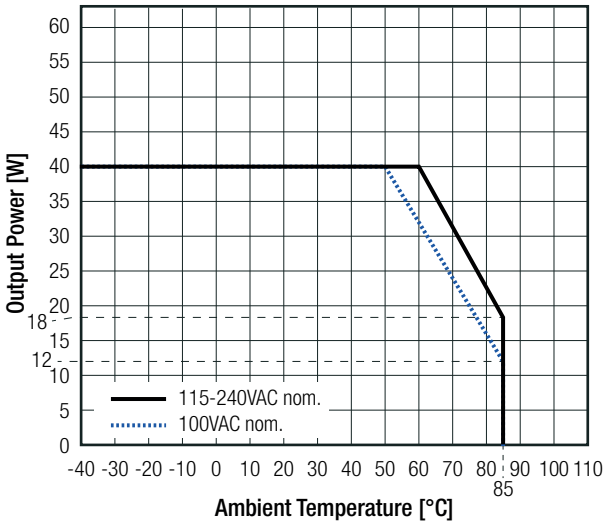
Note8: Recognized by safety agency for safe operation up to 4000/5000m. High altitude operation may impact the performance and lifetime Please contact RECOM tech support for advice

Derating Graph

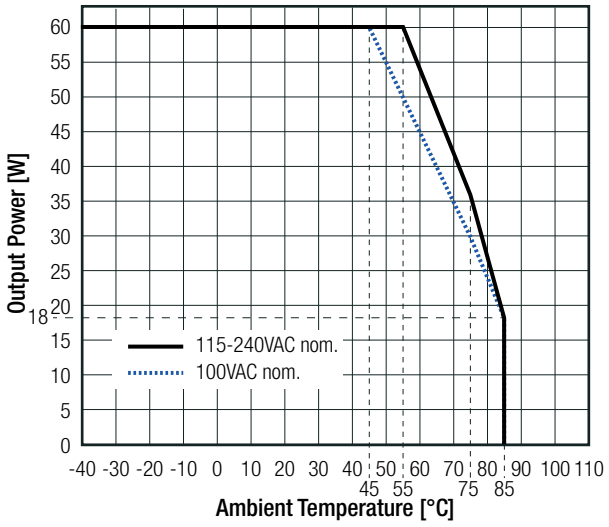
(@ Chamber and natural convection 0.1m/s)

Output power derating for Line-input of less than 90VAC
(derate linearly from 100% at 90VAC to 80% at 80VAC)

RACM60-05SK



others



Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

SAFETY AND CERTIFICATIONS		
Certificate Type (Safety)	**Report Number**	**Standard**
Medical electrical equipment Part 1: General requirements for basic safety and essential performance	E511305-D1000 -1/A0/C0-UL	CAN/CSA-C22.2 No. 60601-1:14, 3rd Ed. ANSI/AAMI ES60601-1:2005 + A2:2010/R2012
Audio/Video, information and communication technology equipment - Safety requirements (CB Scheme)	pending	IEC62368-1:2014 2nd Edition
Audio/Video, information and communication technology equipment - Safety requirements (LVD)	pending	EN62368-1
Household and similar electrical appliances – Safety – Part 1: General requirements (LVD)	pending	IEC60335-1:2010 5th Edition + AM1:2013 EN60335-1:2012 + A11:2014
Measurement methods for electromagnetic fields of household appliances and similar apparatus with regard to human exposure		EN62233:2008
Safety of power transformers, power supplies, reactors & similar products for supply voltages up to 1100 V (CB Scheme)	pending	IEC61558-1:2005 2nd Edition + A1:2009
Safety of power transformers, power supplies, reactors & similar products for supply voltages up to 1100V	pending	EN61558-1:2005 + A1:2009
Safety of power transformers, power supplies, reactors & similar products for supply voltages up to 1100 V Part 2: Particular requirements (CB Scheme)	pending	IEC61558-2-16:2009 1st Edition + A1:2013
Safety of power transformers, power supplies, reactors & similar products for supply voltages up to 1100 V Part 2: Particular requirements	pending	EN61558-2-16:2009 + A1:2013
RoHS2+		RoHS 2011/65/EU + AM2015/863

EMC Compliance (Medical)	**Condition**	**Standard / Criterion**
Medical electrical equipment - Part 1-2: General requirements for basic safety and essential performance - Collateral standard: Electromagnetic compatibility - Requirements and tests	LCS200402131BE	EN60601-1-2:2015, Class B, Group 1
ESD Electrostatic discharge immunity test	Air: ±2, 4, 8, 15kV Contact: ±2, 4, 8kV	EN61000-4-2:2009, Criteria B
Radiated, radio-frequency, electromagnetic field immunity test	9V/m (704-787MHz) 9V/m (5100-5800MHz) 10V/m (80-2700MHz) 27V/m (380-390MHz) 28V/m (430-470MHz) 28V/m (800-960MHz) 28V/m (1700-1990MHz) 28V/m (2400-2570MHz)	EN61000-4-3:2006+A2:2010, Criteria A
Fast Transient and Burst Immunity	AC Port: L-N 2kV	EN61000-4-4:2012, Criteria B
Surge Immunity	L-N: 1kV L (N)-PE: 2kV	EN61000-4-5:2014, Criteria B
Immunity to conducted disturbances, induced by radio-frequency fields	AC Port: 3Vrms: (0.15-80MHz) 6Vrms: (ISM and amateur radio bands according to table 9)	EN61000-4-6:2014, Criteria A
Power Magnetic Field Immunity	30A/m	EN61000-4-8:2010, Criteria A
Voltage Dips and Interruptions	Dips: 100% (0.5P 1.0P) 30% Interruptions: 100%	EN61000-4-11:2004, Criteria B
Limits of Voltage Fluctuations & Flicker		EN61000-3-3:2013

continued on next page

Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

EMC Compliance (Industrial according EN55032)	Condition	Standard / Criterion
Electromagnetic compatibility of multimedia equipment - Emission requirements	LCS200402130BE	EN55032:2015, Class B
Electromagnetic compatibility of multimedia equipment - Immunity requirements		EN55035:2017
ESD Electrostatic discharge immunity test	Air: ±2, 4, 8kV Contact: ±2, 4kV	EN61000-4-2:2009, Criteria B
Radiated, radio-frequency, electromagnetic field immunity test	3 V/m (80-5000MHz)	EN61000-4-3:2006+A2:2010, Criteria A
Fast Transient and Burst Immunity	AC Port: L-N 2kV	EN61000-4-4:2004+A1:2010, Criteria B
Surge Immunity	L-N: 1kV L (N)-PE: 2kV	EN61000-4-5:2014 + A1:2017, Criteria B
Immunity to conducted disturbances, induced by radio-frequency fields	AC Port: 3Vrms (0.15-80MHz) 3-1Vrms (10-30MHz) 1Vrms (30-80MHz)	EN61000-4-6:2014+A1:2015, Criteria A
Power Magnetic Field Immunity	1A/m	EN61000-4-8:2010, Criteria A
Voltage Dips and Interruptions	Dips: 100% 30% Interruptions:100%	EN61000-4-11:2004 +A1:2017, Criteria B EN61000-4-11:2004 +A1:2017, Criteria C EN61000-4-11:2004 +A1:2017, Criteria C
Limits of Voltage Fluctuations & Flicker		EN61000-3-3:2013

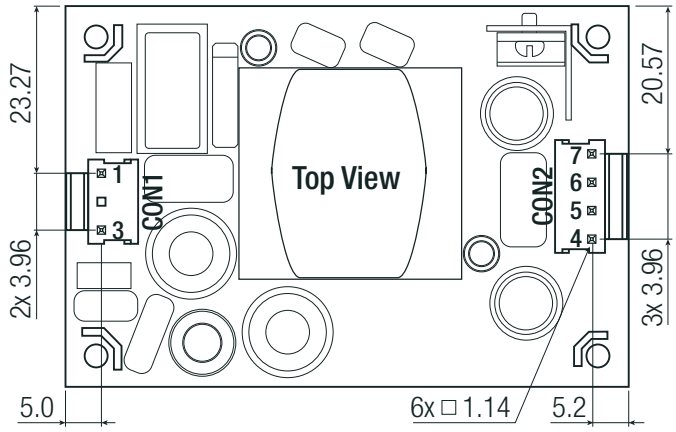
EMC Compliance (Industrial according EN61204-3)	Condition	Standard / Criterion
Low voltage power supplies, d.c. output Part 3: Electromagnetic compatibility (EMC)	LCS200402132BE	EN/IEC61204-3:2018, Class B
ESD Electrostatic discharge immunity test	Air: ±2, 4, 8kV Contact: ±2, 4kV	EN61000-4-2:2009, Criteria B
Radiated, radio-frequency, electromagnetic field immunity test	10V/m (80-1000MHz) 3V/m (1400-2000MHz) 1V/m (2000-2700MHz)	EN61000-4-3:2006+A2:2010, Criteria A
Fast Transient and Burst Immunity	AC Port: L-N 2kV	EN61000-4-4:2012, Criteria B
Surge Immunity	L-N: 1kV L (N)-PE: 2kV	EN61000-4-5:2014 + A1:2017, Criteria B
Immunity to conducted disturbances, induced by radio-frequency fields	AC Port: 10Vrms (0.15-80MHz)	EN61000-4-6:2014+A1:2015, Criteria A
Power Magnetic Field Immunity	1A/m	EN61000-4-8:2010, Criteria A
Voltage Dips and Interruptions	Dips: 100% (0.5P) 100% (1.0P) 30% or 20% Interruptions:100%	EN61000-4-11:2004 +A1:2017, Criteria B EN61000-4-11:2004 +A1:2017, Criteria B EN61000-4-11:2004 +A1:2017, Criteria C EN61000-4-11:2004 +A1:2017, Criteria C
Limits of Voltage Fluctuations & Flicker		EN61000-3-3:2013
Limitations on the amount of electromagnetic interference allowed from digital and electronic devices		FCC 47 CFR Part 15 Subpart B
Limitations on the amount of electromagnetic interference allowed from digital and electronic devices, industrial, scientific, and medical equipment		FCC 47 CFR Part 18

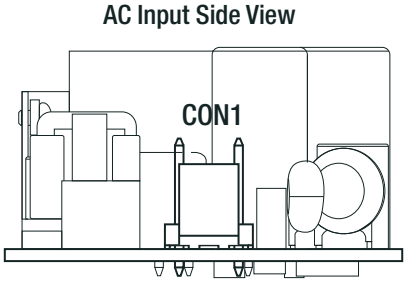
DIMENSION AND PHYSICAL CHARACTERISTICS		
Parameter	**Type**	**Value**
Material	PCB	FR4 (UL94-V0)
Dimension (LxWxH)	"/OF" type "/OF/PCB" type "/OF/2x4" type	78.4 x 53.0 x 31.5mm 78.4 x 53.0 x 35.4mm 101.6 x 53.0 x 31.5mm
Weight	"/OF" and "/OF/PCB" types "/OF/2x4" type	111g typ. 120g typ.

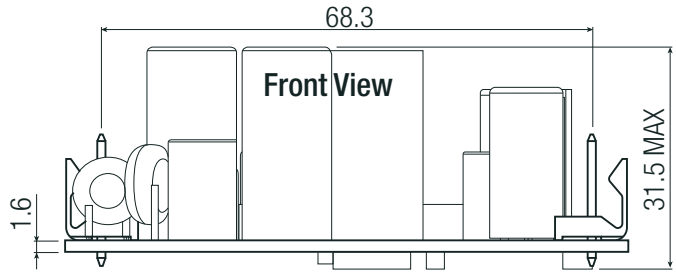
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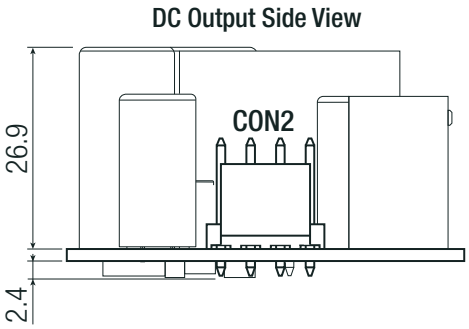
Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

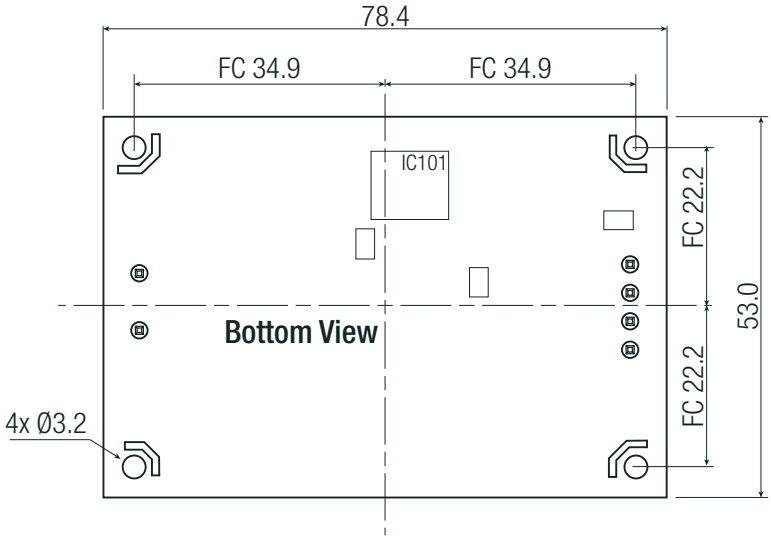
Dimension Drawing "/OF" (mm)











Connector Information

#	Function	Terminal
	AC Input (CON1)	
1	VAC in (N)	3 Pins (Pin2 removed)
3	VAC in (L)	with 3.96mm pitch
	DC Output (CON2)	
4,5	-VDC out	4 Pins
6,7	+VDC out	with 3.96mm pitch

FC= fixing centers

Compatible Connector

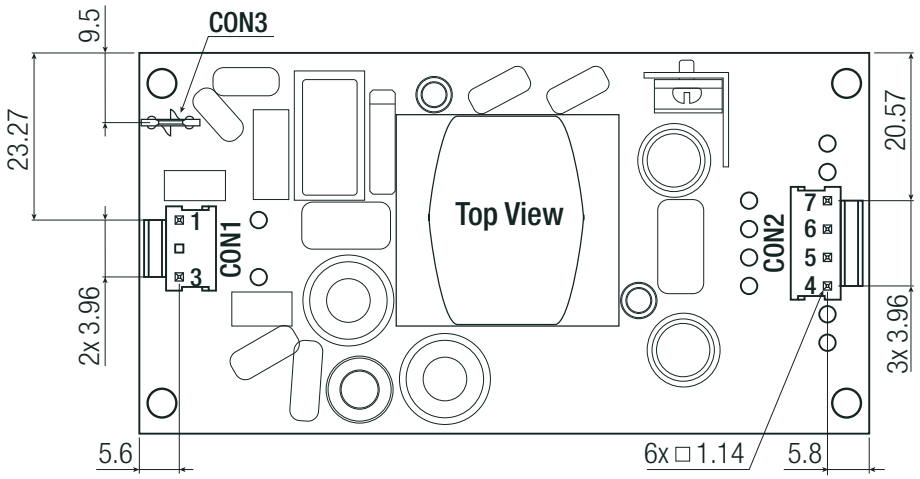
Housing
Molex 41695 Series or equivalent
Crimp Terminal
Molex 2478 Series or equivalent

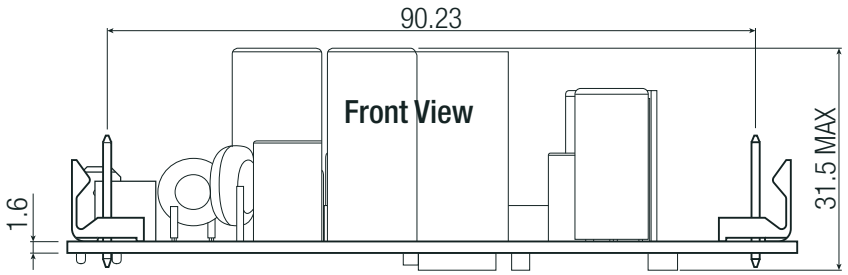
General tolerances according to ISO 2768-m (table for reference only)	
Dimension range	Tolerances
0.5 - 6 mm	±0.1 mm
6 - 30 mm	±0.2 mm
30 - 120 mm	±0.3 mm
120 - 400 mm	±0.5 mm

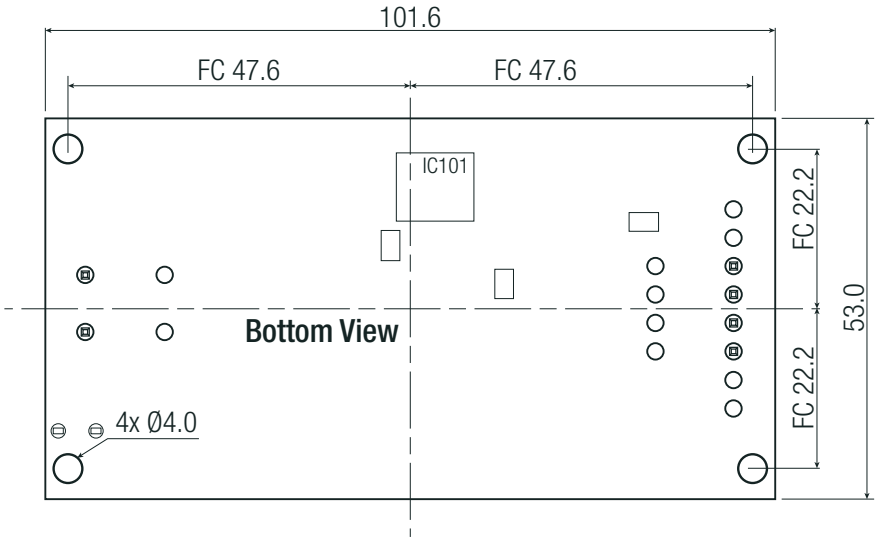
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Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

Dimension Drawing "/OF/2x4" (mm)







Connector Information

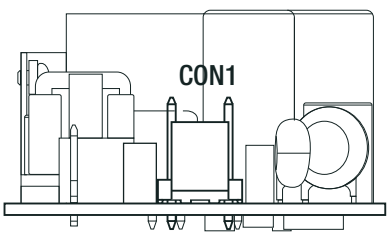
#	Function	Terminal
	AC Input (CON1)	
1	VAC in (N)	3 Pins (Pin2 removed)
3	VAC in (L)	with 3.96mm pitch
	DC Output (CON2)	
4,5	-VDC out	4 Pins
6,7	+VDC out	with 3.96mm pitch
	FE (CON3)	
8	functional earth	fast on

FC= fixing centers
Compatible connector please refer to "/OF" drawing)

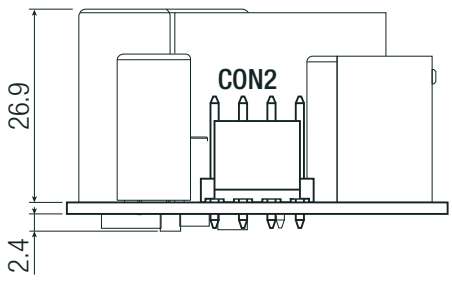
Compatible Connector

Housing
Molex 41695 Series or equivalent
Crimp Terminal
Molex 2478 Series or equivalent

AC Input Side View



DC Output Side View



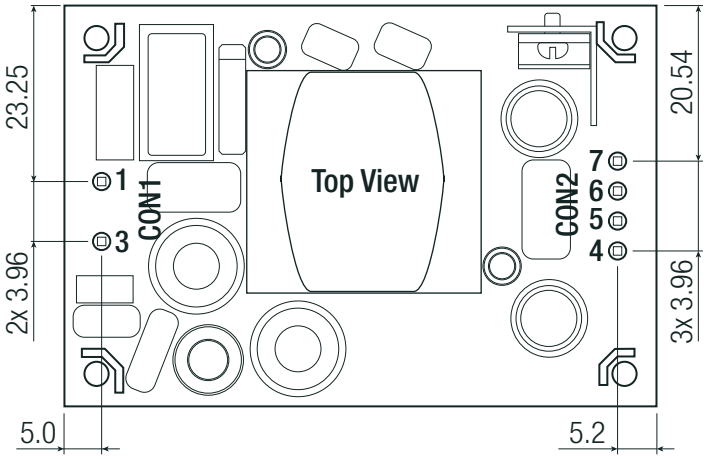
General tolerances according to ISO 2768-m
(table for reference only)

Dimension range	Tolerances
0.5 - 6 mm	±0.1 mm
6 - 30 mm	±0.2 mm
30 - 120 mm	±0.3 mm
120 - 400 mm	±0.5 mm

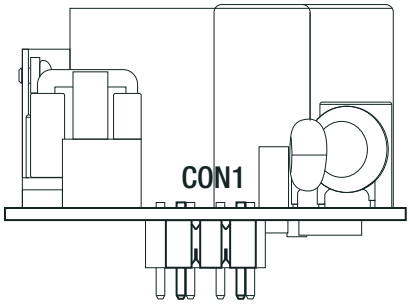
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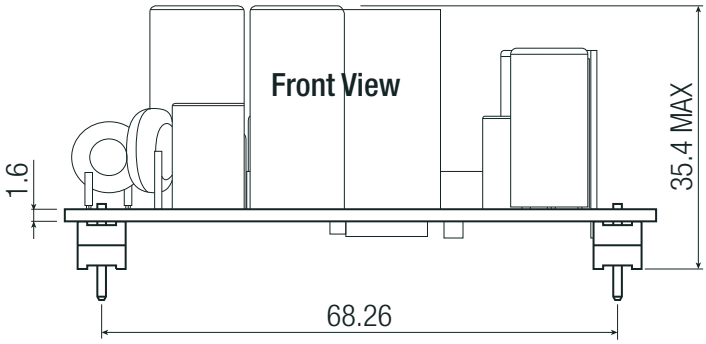
Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

Dimension Drawing "/OF/PCB" (mm)

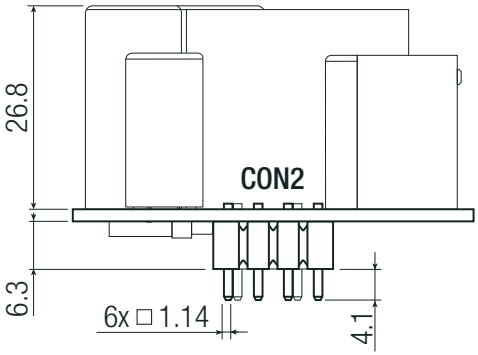


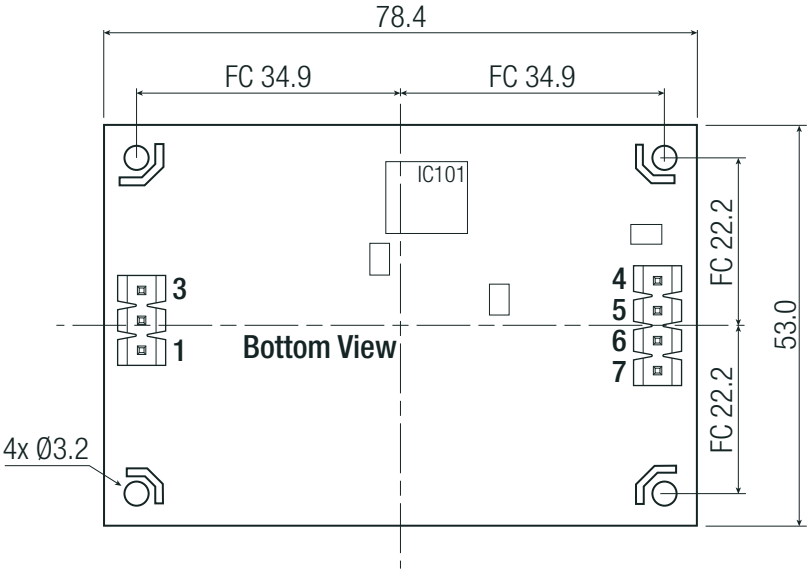
AC Input Side View





DC Output Side View





Pin-header Information

#	Function	Terminal
	AC Input (CON1)	
1	VAC in (N)	3 Pins (Pin2 removed)
3	VAC in (L)	with 3.96mm pitch
	DC Output (CON2)	
4,5	-VDC out	4 Pins
6,7	+VDC out	with 3.96mm pitch

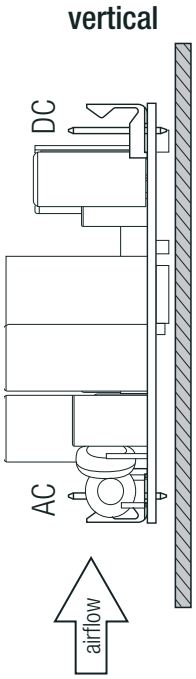
FC= fixing centers

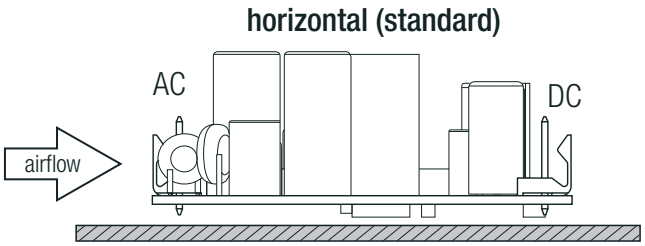
General tolerances according to ISO 2768-m (table for reference only)	
Dimension range	Tolerances
0.5 - 6 mm	±0.1 mm
6 - 30 mm	±0.2 mm
30 - 120 mm	±0.3 mm
120 - 400 mm	±0.5 mm

Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

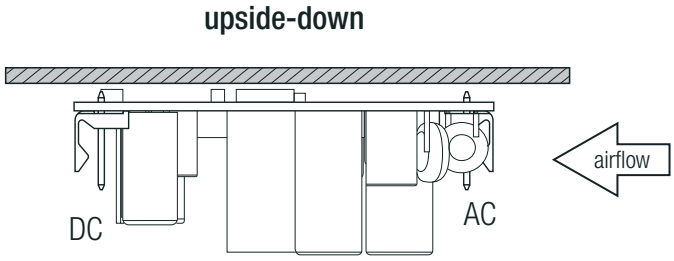
APPLICATION AND INSTALLATION

Mounting

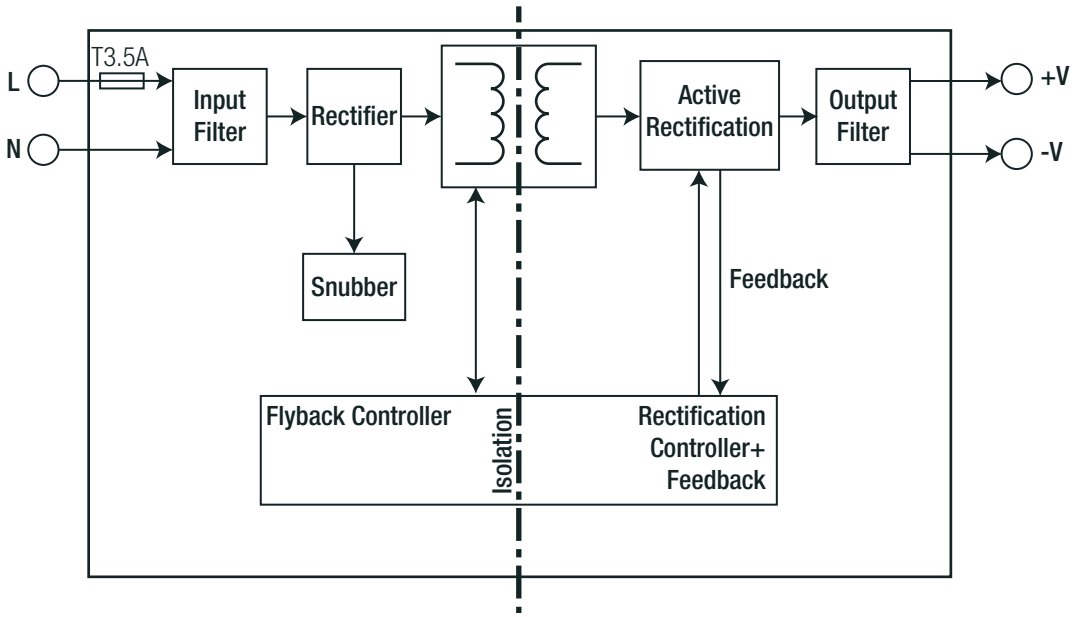




If module is mounted vertical or upside-down with natural convection cooling, the power must be derated ≥ 10%.



Blockdiagram (“/OF” and “/OF/PCB”)

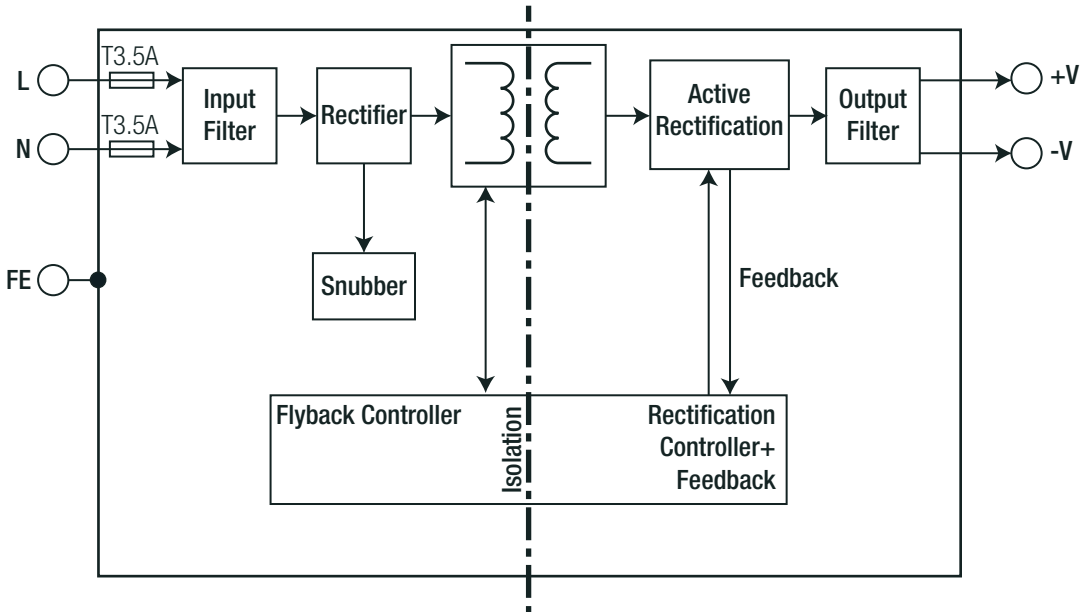


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Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

APPLICATION AND INSTALLATION

Blockdiagram ("/OF/2x4")



PACKAGING INFORMATION

Parameter	Type		Value
Packaging Dimension (LxWxH)	"/OF" type "/OF/2x4" type	cardboard box (single pack)	65.0 x 55.0 x 95.0mm 65.0 x 50.0 x 110.0mm
	"/OF/PCB-T" type	single tray (carton)	365.0 x 210.0 x 56.0mm
	"/OF-CTN" type	tray in carton (project pack)	375.0 x 220.0 x 245.0mm
Package Unit	"/OF" type and "/OF/2x4" type		1pcs
	"/OF/PCB-T" type		12pcs
	"/OF-CTN" type, MOQ= 1152pcs		48pcs
Storage Temperature Range			-40°C to +90°C
Storage Humidity	non-condensing		95% max.

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