## **Features**

# Regulated Converter

- Input Range: 80-264VAC or 80-305VAC
- Temperature rang: -40 to +85°C with derating
- Over voltage category OVC III
- 2MOPP medical certified B and BF compliant
- Class B EMC filter built-in
- 4000/5000m (medical/ITE) operating altitude

## 1000/00

## **Description**

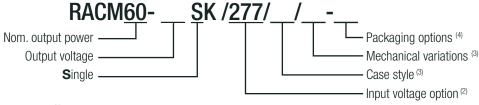
The multi-purpose, industrial + household + medical grade AC/DC converter series RACM60-K/OF delivers 60 Watts of output power from -40°C to +55°C with natural air convection only, and up to +85°C with derating or forced cooling. With a clear focus on extended thermal performance for systems where space 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.

<b>Selection Guide</b>					
Part Number	Input Voltage Range [VAC]	Output Voltage [VDC]	Output Current [mA]	Output Power [W]	Efficiency typ. <sup>(1)</sup> [%]
RACM60-05SK (2, 3, 4)	80-264/ 80-305	5	8000	40	89
RACM60-12SK (2, 3, 4)	80-264/ 80-305	12	5000	60	90
RACM60-15SK (2, 3, 4)	80-264/ 80-305	15	4000	60	90
RACM60-24SK (2, 3, 4)	80-264/ 80-305	24	2500	60	90
RACM60-36SK (2, 3)	80-264	36	1667	60	90
RACM60-48SK (2, 3, 4)	80-264/ 80-305	48	1250	60	90

#### Notes:

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

## **Model Numbering**



Notes:

Note2: Add suffix "/277/0F" for wider input voltage range (80-305VAC) without suffix= standard input range (80-264VAC), check "Model Matrix (4)" For more information, refer to "Input Voltage Range (5,6)"

Note3: "/0F" = standard 2"x3" open frame version with standard connectors

"/OF/PCB = 2"x3" open frame with PCB mounting pins

"/OF/2x4" = 2"x4" open frame version with standard connectors

"/ENC/2x4" = 2"x4" version with metal enclosure and standard connectors

Note4: for packaging details refer to last page "PACKAGING INFORMATION"

Model	/0F	/277/0F	/OF/PCB	/0F/2x4	/ENC/2x4
RACM60-05SK	Х	Х	Х	on request	on request
RACM60-12SK	Х	Х	Х	Х	Х
RACM60-15SK	Х	Х	on request	on request	on request
RACM60-24SK X X X X X					
RACM60-36SK x on request on request on request					
RACM60-48SK	х	х	on request	on request	on request



## RACM60-K

# 60 Watt Open Frame 2"x3" & 2"x4" Enclosed 2"x4"





















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



## **Series**

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

BASIC CHARACTERISTICS						
Parameter	C	Condition		Min.	Тур.	Max.
Internal Input Filter			Pi			
Nominal Input Voltage	50/60Hz	50/60Hz standard version "/277" version		100VAC		240VAC 277VAC
Innut Valtaga Danga (56)	standard version		-63Hz DC	80VAC 120VDC		264VAC 370VDC
Input Voltage Range (5.6)	"/277" version		-63Hz DC	80VAC 120VDC		305VAC 430VDC
Input Current		115VAC 230VAC 277VAC				1400mA 600mA 500mA
Inrush Current	cold start	115VAC 230VAC 277VAC				30A 60A 70A
ErP Standby Mode Conformity (Output Load Capability)	115/230/277VAC	Input Power:	0.5W 1.0W		0.3W 0.7W	
No load Power Consumption		230VAC 277VAC			100mW 120mW	
Input Frequency Range	, i	AC Input		47Hz		63Hz
Minimum Load				0%		
Power Factor		115VAC 230VAC 277VAC				
Start-up Time					150ms	
Rise Time					100ms	
Hold-up Time		115VAC 230VAC 277VAC		12ms 50ms 70ms		
Internal Operating Frequency	100% loa	ad at nominal Vi	n		100kHz	
Output Ripple and Noise (7)	20MHz BW		Vout thers			200mVp-p 1% of Vout

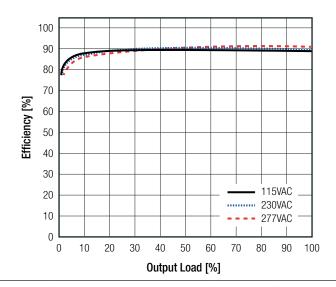
## Notes:

Note5: The products were submitted for safety files at AC-Input operation (90-264VAC)

Note6: Output power derating for Line-input of less than 90VAC (derate linearly from 100% at 90VAC to 80% at 80VAC)

Note7: Measurements are made with a 0.1µF MLCC & 10µF E-cap in parallel across output. (low ESR)

## Efficiency vs. Load





## **Series**

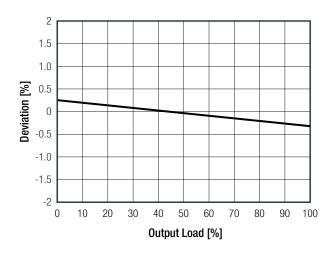
## **Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

REGULATIONS				
Parameter		Condition		Value
	standar	rd version	100% load	±2.0% typ.
Output Accuracy	"/977"	" version	5Vout	±3.0% typ.
	1211	AG121011	others	±1.0% typ.
	standar	rd version	low line to high line	±0.05% typ.
Line Regulation	"/977	" version	5Vout	±0.5% typ.
	1211	VELZIOLI	others	±0.05% typ.
	standard version		5VDC	±1.5% typ.
	Stariuaru versiori	10% to 100% load	12VDC, 15VDC	±0.5% typ.
Load Regulation (8)			24VDC, 36VDC, 48VDC	±0.1% typ.
Load negulation W			5VDC	±3.0% typ.
	"/277" version	10% to 100% load	12VDC, 15VDC	±0.8% typ.
			24VDC, 36VDC, 48VDC	±0.2% typ.
Transiant Passages		25% load step ch	nange	3.0% max.
Transient Response		recovery time		

#### Notes:

Note8: Operation below 10% load will not harm the converter, but specifications may not be met

#### Deviation vs. Load



PROTECTIONS		
Parameter	Туре	Value
Input Fuse	internal	T3.15A, slow blow type
Short Circuit Protection (SCP)		hiccup, auto recovery
Over Voltage Protection (OVP)		105 - 120%, auto recovery
Output Reverse Voltage Protection		107 - 145%, auto recovery
Over Voltage Category (OVC) (9)	according to 62368-1, 61558-2-16 & 60335-1	OVCII
	according to 61558-2-16	OVCIII (up to 2000m)
Over Current Protection (OCP)		130% - 180%, hiccup mode
Thermal Shutdown	TC point IC 101	+130°C, restart after cool down

Notes

Note9: RACM60-xxK/277/OF models were submitted to safety agency for OVC III rating.



## **Series**

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

Parameter	Туре			Value
Class of Equipment				Class II
Isolation Voltage (safety certified) (10)	1 minute	I/P to O/P	4.8kVAC	
Isolation Resistance		I/P to O/P, $V_{\rm ISO}$ =	1GΩ min.	
Isolation Capacitance		I/P to O/P, 100k	100pF max.	
Insulation Grade			reinforced	
Means of Protection		319VAC working	g voltage	2MOPP

#### Notes:

Note10: For repeat Hi-Pot testing, reduce the time and/or the test voltage

ENVIRONMENTAL					
Parameter	Conditi	on	Value		
Operating Temperature Range	@ natural convection 0.1m/s	refer to graphs below	-40°C to +85°C		
Temperature Coefficient			±0.02%/K		
Operating Altitude (11)	according to 62368-1, 61558-2-16 & 60335-1		5000m		
Operating Altitude (11)	according to 6	60601-1	4000m		
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	>900 x 10 <sup>3</sup> hours		
INITOI	according to will-HDBK-217F, G.B.	+40°C	>726 x 10 <sup>3</sup> hours		
Design Lifetime	nom. Vin= 230VAC	+40°C	>42 x 10 <sup>3</sup> hours		

#### Notes:

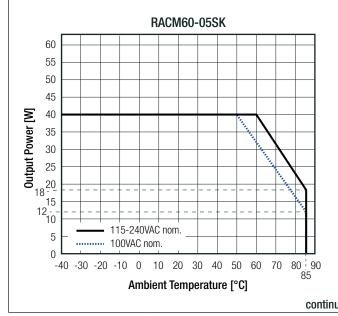
www.recom-power.com

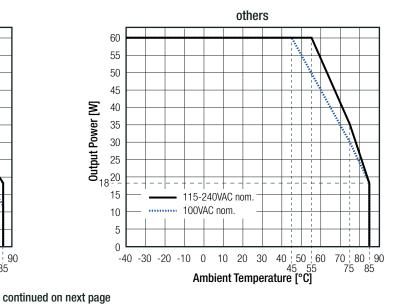
Note11: Recognized by safety agency for safe operation up to 4000/5000m. High altitude operation may impact the performance and lifetime Please contact RECOM tech support for advice

#### Derating Graph non-/277/OF Versions

(@ Chamber and natural convection 0.1m/s)

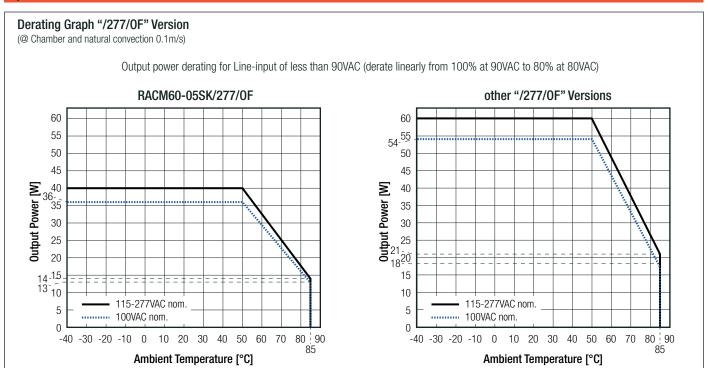
Output power derating for line-input of less than 90VAC (derate linearly from 100% at 90VAC to 80% at 80VAC)







**Series** 



Certificate Type (Safety)	Report Number	Standard
Medical electrical equipment Part 1: General requirements for basic safety and essential performance	E511305-D1000-1/A1/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)	CN21PMDW-001	IEC62368-1:2014 2nd Edition
Audio/Video, information and communication technology equipment - Safety requirements (LVD)	50355749 001	EN62368-1:2014 + A11:2017
Household and similar electrical appliances — Safety — Part 1: General requirements (LVD)	4384104.50	IEC60335-1:2010 5th Edition + A2:2016 EN60335-1:2012 + A15:2021
Safety of power transformers, power supplies, reactors & similar products for supply voltages up to 1100 V (CB Scheme)	50355750 001	IEC61558-1:2005 2nd Edition + A1:2009
Safety of power transformers, power supplies, reactors & similar products for supply voltages up to 1100 V Part 2: Particular requirements (CB Scheme)	(except /277/OF & /ENC/2x4)	IEC61558-2-16:2009 1st Edition + A1:2013
Safety of power transformers, power supplies, reactors & similar products for supply voltages up to 1100V	50355751 001	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	(except /277/OF & /ENC/2x4)	EN61558-2-16:2009 + A1:2013
Safety of power transformers, power supplies, reactors and similar products for supply voltages up to 1100 V (CB Scheme)	085-210569701-000	IEC61558-1:2017
Safety of power transformers, power supplies, reactors and similar products for supply voltages up to 1100 V Part 2: Particular requirements (CB Scheme)	(OVCIII)	IEC61558-2-16:2009 1st Edition + A1:2013
Safety of power transformers, power supplies, reactors and similar products for supply voltages up to 1100 V	64.210.21.05697.01	EN IEC 61558-1:2019
Safety of power transformers, power supplies, reactors and similar products for supply voltages up to 1100 V Part 2: Particular requirements	(OVCIII)	EN61558-2-16:2009 + A1:2013



## **Series**

Condition	Standard / Criterion
LCS220321054BE	EN60601-1-2:2015+A1:2021 Class B, Group 1
Air: ±2, 4, 8, 15kV Contact: ±2, 4, 8kV	EN61000-4-2:2009, Criteria B
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
AC Port: L-N 2kV	EN61000-4-4:2012, Criteria B
L-N: 1kV L (N)-PE: 2kV	EN61000-4-5:2014, Criteria B
AC Port: 3Vrms: (0.15-80MHz) 6Vrms: (ISM and amateur radio bands according to table 9)	EN61000-4-6:2014, Criteria A
30A/m	EN61000-4-8:2010, Criteria A
Dips: 100% (0.5P 1.0P) 30% Interruptions: 100%	EN61000-4-11:2004, Criteria B
LCS220321054BE	EN61000-3-3:2013
Condition	Standard / Criterion
	EN55032:2015+A1:2020, Class B
LCS220321053BE	EN55035:2017+A11:2020
Air: ±2, 4, 8kV Contact: ±2, 4kV	EN61000-4-2:2009, Criteria B
3 V/m (80-5000MHz)	EN61000-4-3:2006+A2:2010, Criteria A
AC Port: L-N 1kV	EN61000-4-4:2004+A1:2010, Criteria B
L-N: 1kV L (N)-PE: 2kV	EN61000-4-5:2014 + A1:2017, Criteria B
AC Port: 3Vrms (0.15-10MHz) 3-1Vrms (10-30MHz) 1Vrms (30-80MHz)	EN61000-4-6:2014+A1:2015, Criteria A
1A/m	EN61000-4-8:2010, Criteria A
Dips: 100% 30%	EN61000-4-11:2004+A1:2017, Criteria B EN61000-4-11:2004+A1:2017, Criteria C EN61000-4-11:2004+A1:2017, Criteria C
LCS220321053BE	EN61000-3-3:2013
Condition	Standard / Criterion
LCS220321055BE	EN/IEC61204-3:2018, Class B
	Air: ±2, 4, 8, 15kV Contact: ±2, 4, 8kV  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 (2400-2570MHz) AC Port: L-N 2kV  L-N: 1kV L (N)-PE: 2kV  AC Port: 3Vrms: (0.15-80MHz) 6Vrms: (ISM and amateur radio bands according to table 9) 30A/m Dips: 100% (0.5P 1.0P) 30% Interruptions: 100% LCS220321054BE  Condition  CS220321053BE  Air: ±2, 4, 8kV Contact: ±2, 4kV 3 V/m (80-5000MHz) AC Port: L-N 1kV L (N)-PE: 2kV  AC Port: 3Vrms (0.15-10MHz) 3-1Vrms (0.15-10MHz) 1-1Vrms (10-30MHz)



## **Series**

EMC Compliance (EN61204-3)	Condition	Standard / Criterion
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	30A/m	EN61000-4-8:2010, Criteria A
Voltage Dips and Interruptions	Dips: 100% (0.5P, 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
Limits of Voltage Fluctuations & Flicker	LCS220321055BE	EN61000-3-3:2013+A2:2021
Limitations on the amount of electromagnetic interference allowed from digital and electronic devices	WTD22D04060199E	FCC 47 CFR Part 15:2020 Subpart B
Limitations on the amount of electromagnetic interference allowed from digital and electronic devices, industrial, scientific, and medical equipment	WTD22D04060215E	FCC 47 CFR Part 18:2020

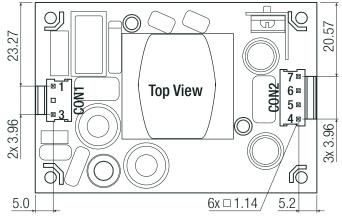
DIMENSION AND PHYSICAL CHARACTERISTICS				
Parameter	Туре	Value		
Material	PCB	FR4 (UL94-V0)		
	"/OF" and type	78.4 x 53.0 x 31.5mm		
	"/277/OF" type	76.2 x 50.8 x 32.0mm		
Dimension (LxWxH)	"/OF/PCB" type	78.4 x 53.0 x 35.4mm		
	"/OF/2x4" type	101.6 x 53.0 x 31.5mm		
	"/ENC/2x4" type	118.3 x 62.7 x 38.7mm		
Weight	"/OF"; "/277/OF" and "/OF/PCB" types	111g typ.		
	"/OF/2x4" type	120g typ.		
	"/ENC/2x4" type	167g typ.		
	continued on next page			

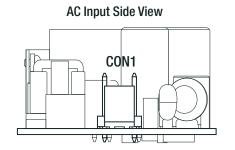


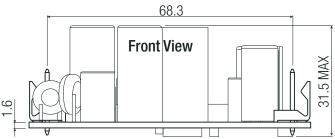
**Series** 

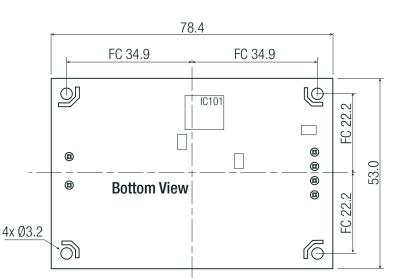
**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

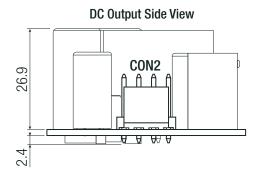
## Dimension Drawing "/OF" (mm)











#### **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= fix	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

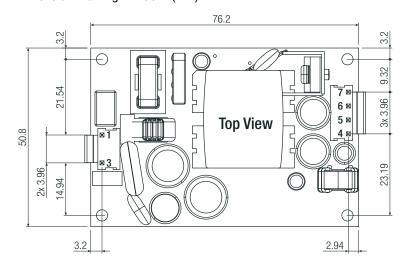
 120 - 400 mm
 ±0.5 mm



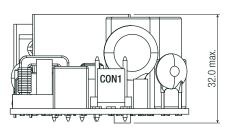
**Series** 

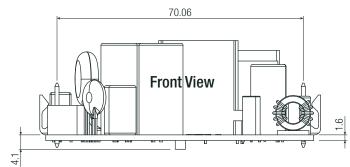
**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

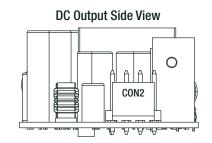
## Dimension Drawing "277/OF" (mm)

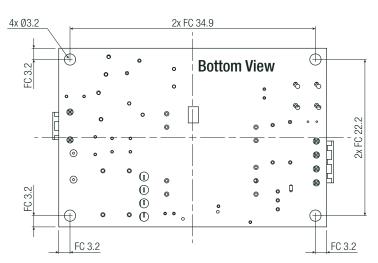


## **AC Input Side View**









## Connector Information # Function

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= fi	FC= fixing centers				

**Terminal** 

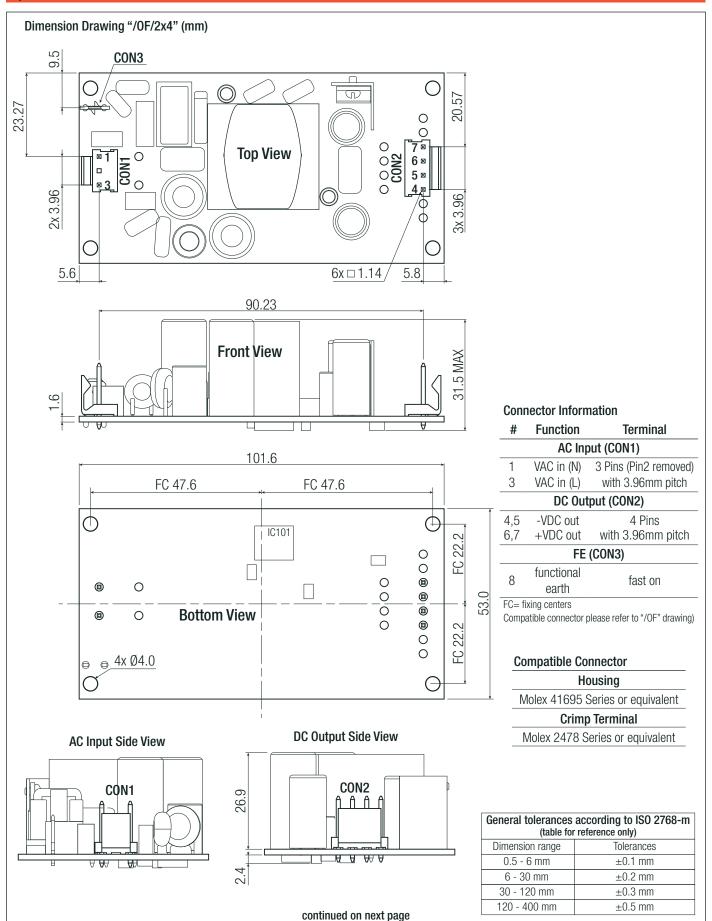
## Compatible Connector

Companio Comicotor			
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			



**Series** 





**Series** 

**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** 54 20. **Top View** ⊚1 **6** 🔍 5 © CON1 3 **4** 🗇 3x 3.96 5.2 5.0 DC Output Side View **Front View** 35.4 MAX CON<sub>2</sub> 68.26 6x □ 1.14 78.4 Pin-header Information FC 34.9 FC 34.9 **Function Terminal** AC Input (CON1) IC101 VAC in (N) 3 Pins (Pin2 removed) 1 22.2 3 VAC in (L) with 3.96mm pitch DC Output (CON2) 9 **□** 3 -VDC out 4,5 4 Pins +VDC out with 3.96mm pitch 6,7 **Bottom View 1** FC= fixing centers 4x Ø3.2 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

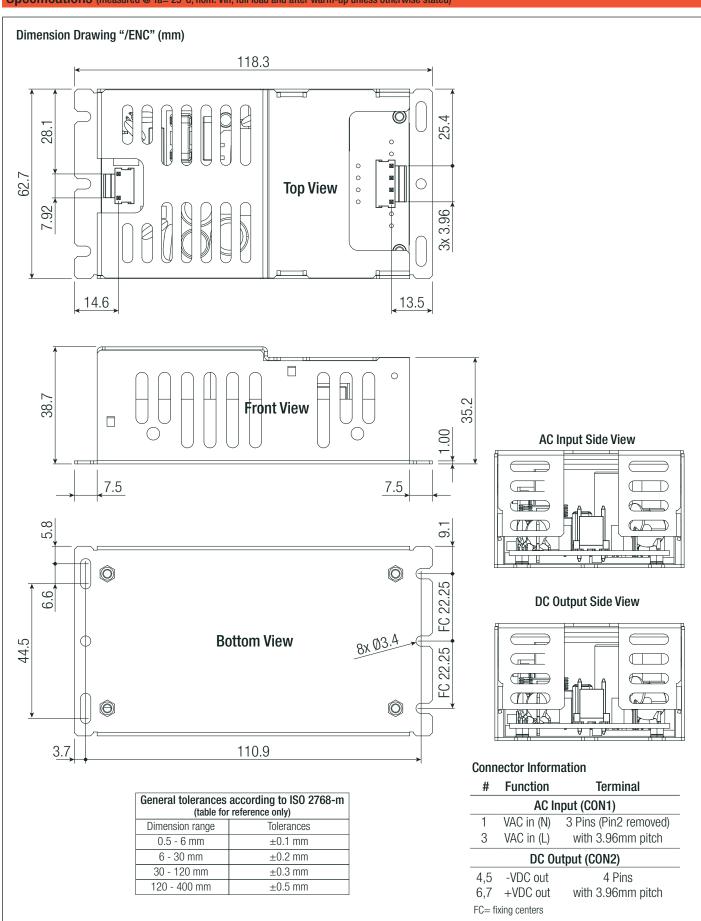
120 - 400 mm

±0.3 mm

±0.5 mm



**Series** 



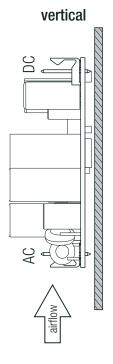


**Series** 

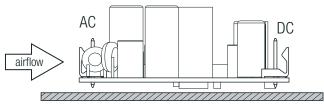
**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

#### APPLICATION AND INSTALLATION

#### Mounting

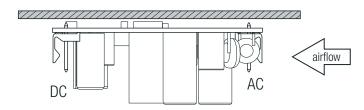


## horizontal (standard)

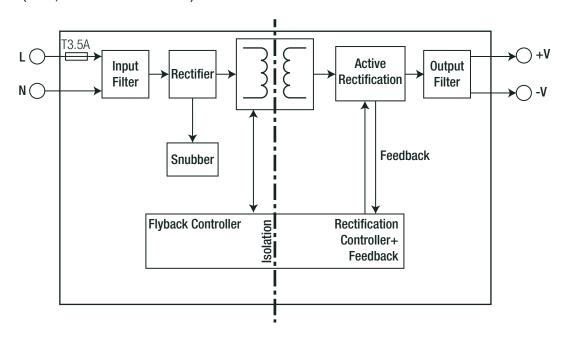


If module is mounted vertical or upside-down with natural convection cooling, the power must be derated  $\geq$  10%.

## upside-down



Blockdiagram ("/OF", "/277/OF" and "/OF/PCB")



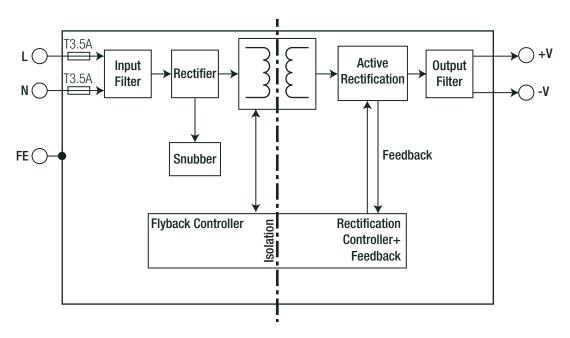


**Series** 

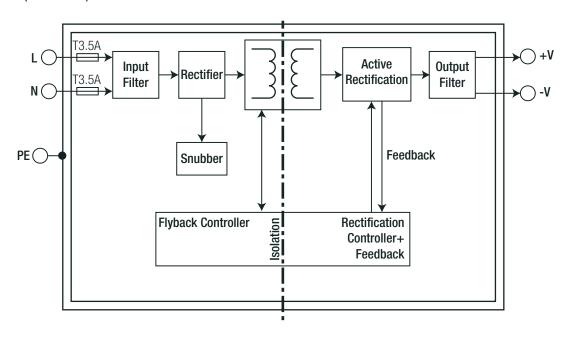
**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

## APPLICATION AND INSTALLATION

Blockdiagram ("/0F/2x4")



## Blockdiagram ("/ENC/2x4")





## **Series**

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

PACKAGING INFORMATION			
Parameter	-	Value	
	"/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
Packaging Dimension (LxWxH)	"/277/0F-T" type "/0F/PCB-T" type "/ENC/2x4" type	single tray (carton)	215.0 x 365.0 x 62.0mm 365.0 x 210.0 x 56.0mm 405.0 x 360.0 x 85.0mm
	"/OF-CTN" type	tray in carton (project pack)	375.0 x 220.0 x 245.0mm
	"/OF" type ar	1pcs	
Package Unit	"/277/0F-T" and "/0F/PCB-T" type		12pcs
	"/ENC/2x4" type		18pcs
	"/OF-CTN" typ	48pcs	
Storage Temperature Range			-40°C to +90°C
Storage Humidity	non-c	95% max.	

Model-number	Output Voltage	Input Range	Size	Туре	Connection	Quantity	Packaging Type
RACM60-05SK/0F	5Vout	80-264VAC	2" x 3"	open frame	standard connector	1pc	cardboard box
RACM60-24SK/OF/PCB-T	24Vout	80-264VAC	2" x 3"	open frame	PCB mounting pins	12pcs	tray
RACM60-12SK/0F/2x4	12Vout	80-264VAC	2" x 4"	open frame	standard connector	1pc	cardboard box
RACM60-05SK/277/0F-T	5Vout	80-305VAC	2" x 3"	open frame	standard connector	12pcs	tray
RACM60-24SK/ENC/2x4	24Vout	80-264VAC	2" x 4"	enclosed	standard connector	18pcs	tray
RACM60-12SK/0F-CTN	12Vout	80-264VAC	2" x 4"	open frame	standard connector	48pcs (MOQ= 1152pcs)	carton

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