Technical Data Sheet

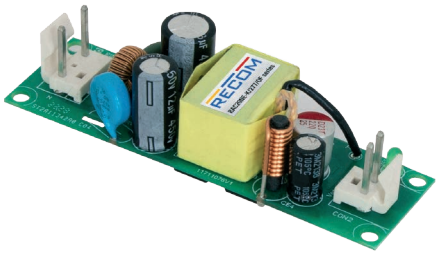
RAC20NE-K/277 Series ◊ AC/DC Power Supply

20W ◊ Input: 100V-277VAC

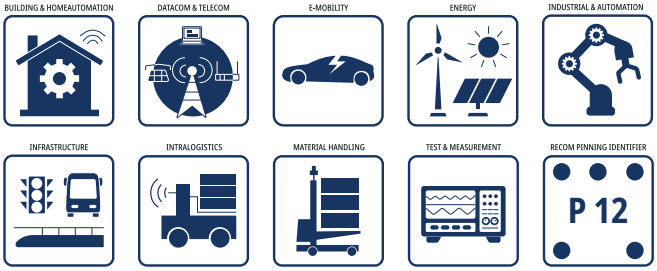
RECOM
AC/DC Converter

FEATURES

- 85-305VAC wide input range
- Full load ratings to 60°C, "/HT" to 85°C
- O/P either floating or coupled with GND, FE or PE
- Surge immunity 2kVAC: L-N &; 4kV: L; N - Earth
- OVC III over voltage category up to 5000m
- OCP: hiccup auto recovery or CV/CC regulated
- Boost power 23W (specific models) , "/HT": peak: 36W
- High efficiency
- 3 year warranty



APPLICATIONS



SAFETY & EMC

RoHS² compliant 10 from 10

Reach compliant

CE

cULus E224736

IECEE CB SCHEME

HOUSEHOLD CERTIFIED EN-60335-1

DESCRIPTION

RAC20NE-K open frame or encapsulated solder mount built in power supplies are optimized for the requirements of new energy applications such as energy management, monitoring or actuator operation. These compact AC/DC modules meet increased requirements in terms of ambient temperatures, high immunity levels against transients, adopted insulation barriers, EMC interference freedom with secondary ground or earth coupling and low power loss in full load operation as well as in standby and sleep mode. For the supply of universal input voltages of 100 to 277 VAC, the modules are available in various versions according to worldwide industrial, household and safety transformer standards at operating altitudes of up to 5000 m or up to 3000 m under OVC III approved. High effective power density and industry standard P12 pinning on a 1"x2" footprint and 1.5"x2" for "/HT" fits in space critical applications.

SELECTION GUIDE (CONSTANT VOLTAGE OPERATION)

Part Number	Input Voltage Range [VAC]	Output Voltage [VDC]	Output Current nom. [mA]	Boost Current max. (1) [mA]	Efficiency (2) typ. [%]	Output Power continuous [W]
RAC20NE-12SK/277	85-305	12	1667	1916	87	20
RAC20NE-24SK/277	85-305	24	833	958	87	20
RAC20NE-36SK/277	85-305	36	555	638	88	20
RAC20NE-12DK/277	85-305	±12	+1.58/-0.083	+3000/-0.083	88	20

SELECTION GUIDE (CONSTANT CURRENT OPERATION)

Part Number	Input Voltage Range [VAC]	Output Voltage [VDC]	Output Current rated [mA]	Efficiency (2) typ. [%]	Output Power continuous [W]
RAC20NE-12SK/277/CC	85-305	12	1667	87	20
RAC20NE-24SK/277/CC	85-305	24	833	87	20

Note1: Refer to **„Boost Power Duty Cycle"** (except "/277/OF" Version)

Note2: Efficiency is tested at 230VAC and full load at +25°C ambient.

RAC20NE-K/277 Series ◊ AC/DC Power Supply

20W ◊ Input: 100V-277VAC

RECOM AC/DC Converter

Model Numbering

RAC20NE-__ __K/277/__

- nom. Output Power
- Output Voltage
- Options [3]
- **S**ingle or **D**ual

Note3: without suffix= standard constant voltage operation
add suffix "/CC" for constant current operation
add suffix "/OF" for open frame version
add suffix "/HT" for high ambient temperature and peak power ratings

ORDERING INFORMATION

Model	Output Voltage	Package Type			
		THT-solder mount			Open Frame "/OF"
		2.1" x 1.1"		2.1" x 1.5"	3.1" x 0.9"
		"/277"	**"/277/CC"**	**"/277/HT"**	**"/277/OF"**
RAC20NE-12SK/277	12VDC	y	y	N/A	y
RAC20NE-24SK/277	24VDC	y	y	N/A	y
RAC20NE-36SK/277	36VDC	y	N/A	N/A	N/A
RAC20NE-12DK/277	±12VDC	N/A	N/A	y	N/A

y= standard portfolio; N/A= not available

ACCESSIBLE PART (ONLY VALID FOR "/277", "/277/CC" AND "/277/HT" VERSION)

Part Number	Description	Datasheet Link
RAC-ADAPT-ST-1	adapter board with screw terminals for easy connection	RAC-ADAPT-ST-1.pdf

BASIC CHARACTERISTICS (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)

Parameter	Condition		Min.	Typ.	Max.
Nominal Input Voltage	50/60Hz		100VAC		277VAC
Operating Range [4]	47-63Hz		85VAC		305VAC
	DC (pending)		120VDC		430VDC
Input Current	115VAC			350mA	450mA
	230VAC			250mA	450mA
	277VAC			200mA	450mA
Inrush Current	cold start at 25°C	115VAC			20A
		230VAC			40A
		277VAC			50A
No Load Power Consumption	115/230/277VAC			50mW	100mW
Ecodesign Standby Mode Use (Available output power for stated input power)	P_{IN}= 0.5W		0.34W		
	P_{IN}= 1.0W		0.74W		
	P_{IN}= 2.0W		1.6W		
Input Frequency Range	AC Input		47Hz		63Hz
Minimum Load			0%		
Power Factor	115VAC			0.6	
	230VAC			0.5	
	277VAC			0.4	
Start-up time					150ms
Rise time			40ms		
Hold-up time	230VAC		30ms		
	277VAC		50ms		
Internal Operating Frequency					150kHz
Output Ripple and Noise [5]	20MHz BW				1% Vout

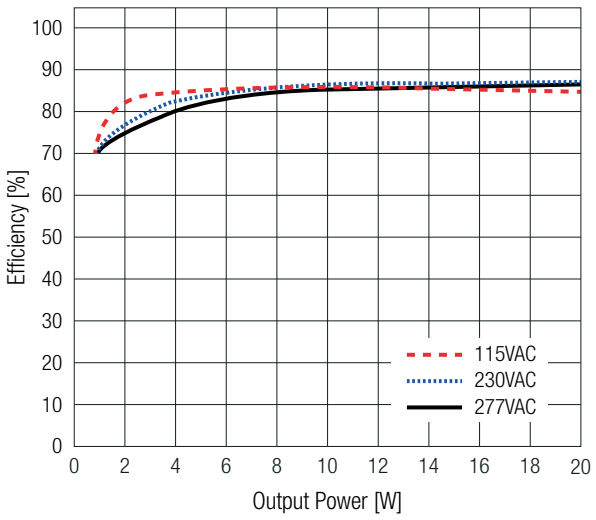
Note4: The products were submitted to all safety files at AC-operation. (90-305VAC)

Note5: Measurements are made with a 0.1µF MLCC & 10µF E-cap in parallel across output (low ESR)
The test setup can have an impact on ripple noise values (placement of scope probe, capacitors, it's specifications, wires, PCB tracks, distances, etc.)

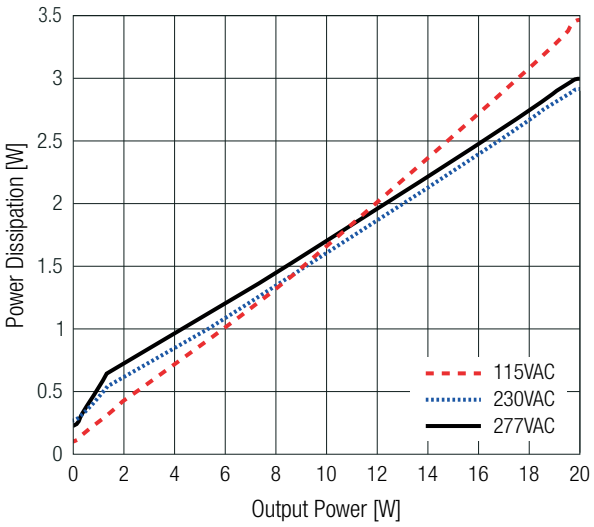
BASIC CHARACTERISTICS (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)

Valid for all Models

Efficiency vs. Output Power



Power Dissipation vs. Output Power



REGULATIONS (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)

Parameter	Condition		Value
Output Accuracy	"/277", "/277/CC" & "/277/OF"		±2.0% max.
	"/277/HT"		±3.0% max.
Line Regulation	low line to high line, full load		±1.0% max.
Load Regulation [6]	10% to 100% load	"/277", "/277/CC" & "/277/OF"	2.0% max.
		"/277/HT"	5.0% max.
Cross Regulation	"/277/HT"		±5.0% max.
Transient Response	25% load step change	"/277", "/277/CC" & "/277/OF"	4.0% max.
		"/277/HT"	500mV max.
Recovery Time	"/277", "/277/CC" & "/277/OF"		500µs max.
	"/277/HT"		3000µs max.

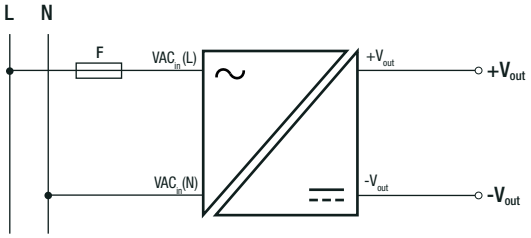
Note6: Operation below 10% load will not harm the converter, but specifications may not be met

PROTECTIONS (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)

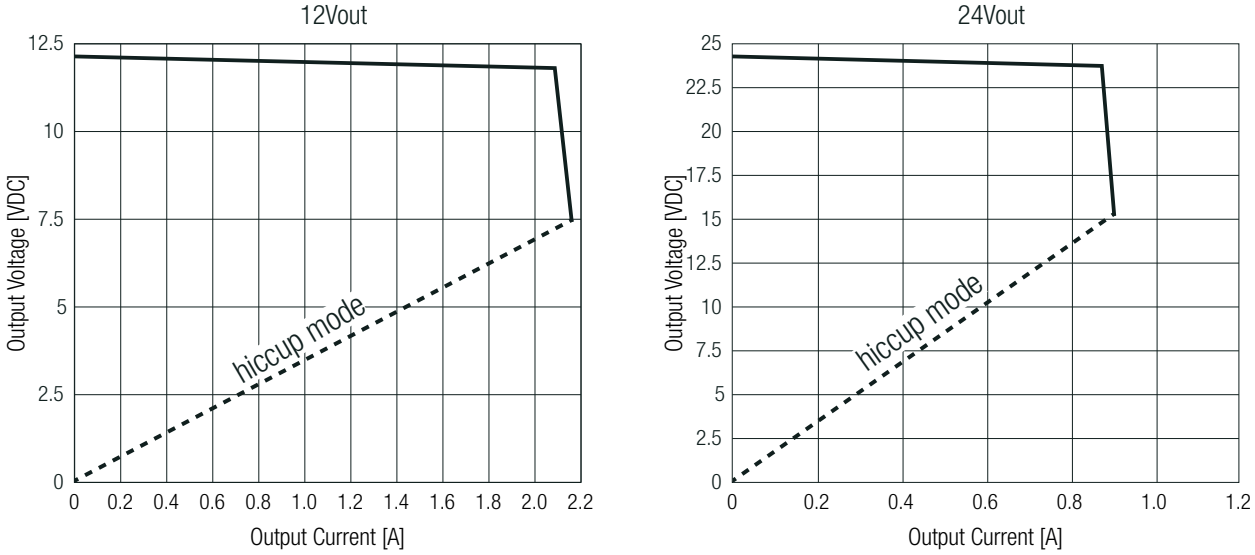
Parameter	Type			Value
Input Fuse [7]	"/277" and "/277/CC"			no internal fuse
	internal		"/277/OF"	T2A, slow blow type
			"/277/HT"	T3.15A, slow blow type
Short Circuit Protection (SCP)				hiccup mode; auto recovery
Over Current Protection (OCP)	"/277" and "/277/OF"			120% - 150%, hiccup mode
	"/277/CC"; refer to **„Output Voltage vs. Output Current"**			constant current limitation until hiccup mode
	"/277/HT"			120% - 150%, hiccup mode
Over Voltage Protection (OVP)	"/277", "/277/CC" and "/277/OF"			120% - 250%, latch off mode
	"/277/HT"			120% - 150%, latch off mode
Over Voltage Category (OVC)	"/277" and "/277/CC"			OVC III (5000m)
	"/277/OF"			OVC III (3000m)
				OVC II (5000m)
DC ON LED	only "/277/OF"			green: output voltage present
Class of Equipment				Class II
Isolation Voltage	I/P to O/P	1 minute	according to 61558	4.2kVAC
			according to 62368-1	6kVDC
Insulation Grade	I/P to O/P			reinforced

Note7: Refer to local safety regulations if input over-current protection is also required

Protection Circuit for „/277" and „/277/CC" Versions



Output Voltage vs. Output Current for „/277/CC" Versions



ENVIRONMENTAL (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)

Parameter	Condition		Value
Operating Ambient Temperature Range	@ natural convection (0.1m/s)	refer to **„Derating Graph“**	-40°C to +85°C
Maximum Case Temperature	“/277” and “/277/CC”		+95°C
Temperature Coefficient			±0.05%/K
Operating Altitude [8]	“/277” and “/277/CC”		5000m (OVC III)
	“/277/OF”		3000m (OVC III)
	“/277”, “/277/CC” and “/277/OF”		5000m (OVC II)
Operating Humidity			95% RH max.
Pollution Degree			PD2
MTBF	according to MIL-HDBK-217, G.B.	T_{AMB}= +25°C	1190 x 10^3 hours
Design Lifetime	full load	T_{AMB}= +25°C	130 x 10^3 hours

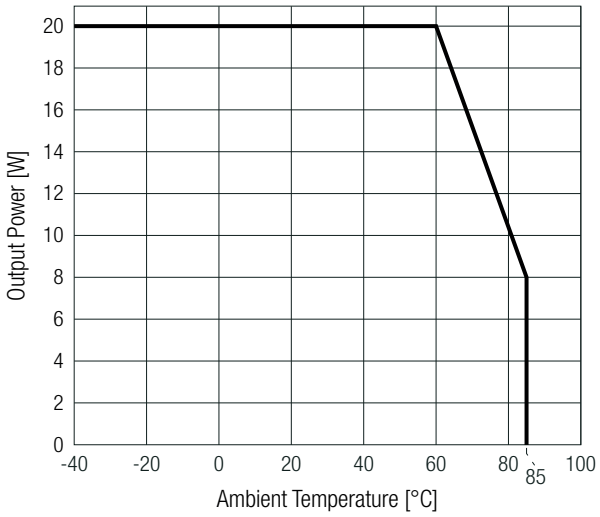
Note8: Recognized by safety agency for safe operation up to 5000m. High altitude operation may impact the performance and lifetime. Please contact RECOM tech support for advice

Derating Graph

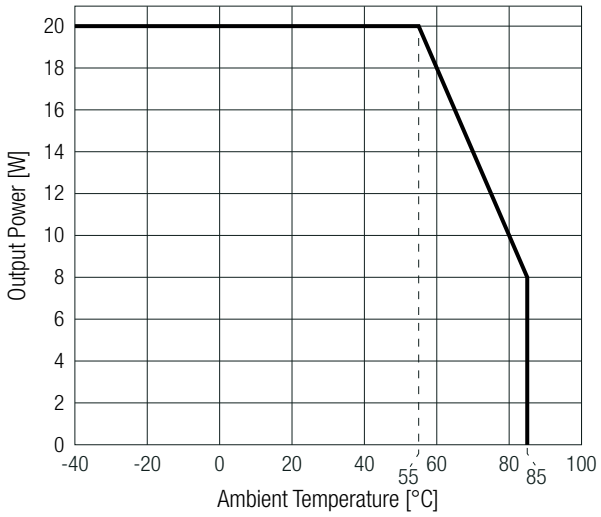
(@ Chamber and natural convection 0.1m/s)

THT-solder-mount

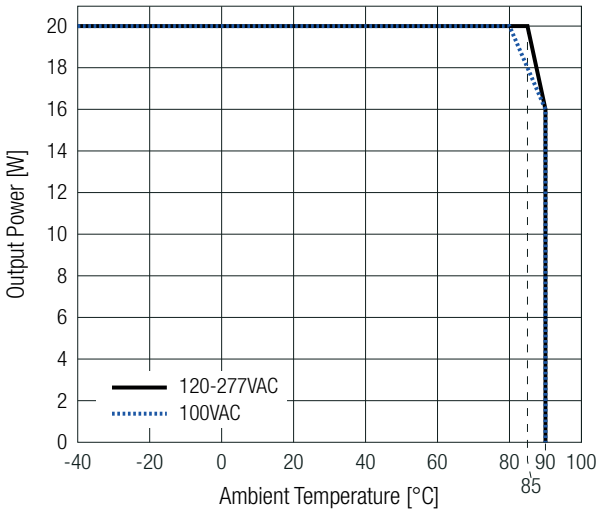
„/277“ Version



„/277/CC“ Version

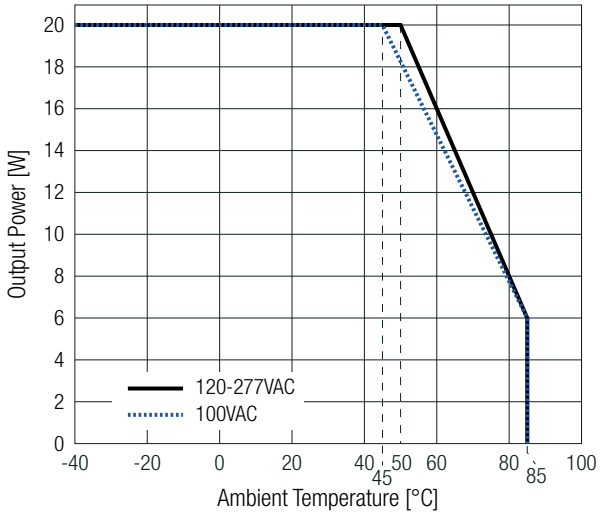


„/277/HT“ Version



Open frame / chassis mount

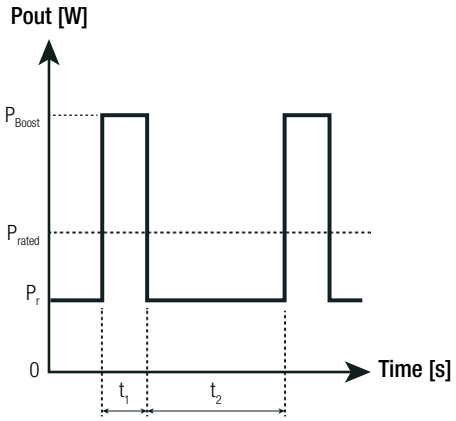
„/277/OF“ Version



BOOST POWER DUTY CYCLE (EXCEPT "/OF" AND "/CC" MODELS)

P_{rated} = refer to **„Derating Graph"** [W]
P_{Boost} = Boost power (<23W) [W]
P_r = recovery output power [W]
t_1 = Boost time set (20s max.) [s]
t_2 = recovery time (min. 2 x t_1) [s]

$$P_r = \frac{P_{rated} \times (t_1 + t_2) - (P_{Boost} \times t_1)}{t_2}$$



Practical Example (RAC20NE-12SK/277):

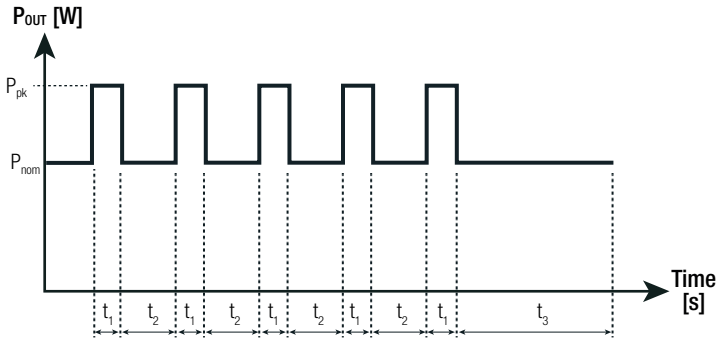
Take the RAC20NE-12SK/277at 230VAC input Voltage and full load at T_{AMB}= 80°C ,with natural convection.

P_{rated} = 10W
P_{Boost} = 23W
t_1 = 20s
t_2 = 50s

$$P_r = \frac{10W \times (20s + 50s) - (23W \times 20s)}{50s} = \underline{4.8W}$$

PEAK POWER DUTY CYCLE (ONLY FOR "/277/HT" MODEL)

P_{nom} = nom. output power = 20W
P_{pk} = peak output power = 36W
t_1 = peak time set = 100ms max.
t_2 = nom. time set = 3s min.
t_3 = recovery time set = 24hrs - (5x t_1 + 4x t_2)



SAFETY & CERTIFICATIONS

Certificate Type (Safety)	Report Number	Standard
Audio/Video, information and communication technology equipment - Part1: Safety requirements 3rd Edition	E491408-A6034-UL	UL62368-1:2019 3rd Edition
		CAN/CSA-C22.2 No. 62368-1-19 3rd Edition
Audio/Video, information and communication technology equipment - Part1: Safety requirements 3rd Edition	240408022	IEC62368-1:2018 3rd Edition
		EN IEC 62368-1:2020+A11:2020
Audio/Video, information and communication technology equipment - Part1: Safety requirements 3rd Edition	085-240223001-000	IEC62368-1:2018 3rd Edition
		EN IEC 62368-1:2020+A11:2020
Audio/Video, information and communication technology equipment - Part1: Safety requirements 3rd Edition	085-240223401-000	IEC62368-1:2018 3rd Edition
		EN IEC 62368-1:2020+A11:2020
Household and similar electrical appliances – Safety – Part 1: General requirements	64.110.24.02233.01	IEC60335-1:2010 + C1:2016 5th Edition
		EN60335-1:2012 + A15:2021
Measurement methods for electromagnetic fields of household appliances and similar apparatus with regard to human exposure	64.110.24.02233.01	EN62233:2008
Safety of power transformers, power supplies, reactors and similar products for supply voltages up to 1100 V 3rd Edition	085-240223101-000	IEC61558-1:2017 3rd Edition
		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		IEC61558-2-16:2009+A1:2013 1st Edition
		EN61558-2-16:2009+A1:2013

SAFETY & CERTIFICATIONS

Certificate Type (Safety)	Report Number	Standard
Lamp controlgear Part 1: General and safety requirements	085-240223201-000	IEC61347-1:2015+A1:2017 3rd Edition
		EN61347-1:2015+A1:2021
Lamp controlgear Part 2-13: Particular requirements for d.c. or a.c. supplied electronic controlgear for LED modules		IEC61347-2-13:2014+A1:2016 2nd Edition
		EN61347-2-13:2014+A1:2017

EMC Compliance according to EN IEC61204-3	Condition	Standard / Criterion
Low voltage power supplies, d.c. output Part 3: Electromagnetic compatibility (EMC)		EN IEC 61204-3:2018
ESD Electrostatic discharge immunity test	Air: ±2, 4, 8kV for "/277", "/277/CC" and "/277/OF" Contact: ±6kV for "/277" and "/277/CC" Contact: ±4kV for "/277/OF"	IEC61000-4-2:2008, Criteria A EN61000-4-2:2009, Criteria A
Radiated, radio-frequency, electromagnetic field immunity test	10V/m (80-1000MHz), 3V/m (1400-2000MHz), 1V/m (2000-2700MHz)	IEC/EN61000-4-3:2006 + A2:2010 Criteria A
Fast Transient and Burst Immunity	L, N, L-N ±2kV for 24V and 36Vout versions	IEC/EN61000-4-4:2012, Criteria A
	L, N, L-N ±2kV for 12Vout versions	IEC/EN61000-4-4:2012, Criteria B
	L, N, L-N ±4kV for all versions	
Surge Immunity	L-N: 0.5, 1kV; for all versions	IEC/EN61000-4-5:2014 + A1:2017, Criteria A
	L-N: 2kV; for all versions	IEC/EN61000-4-5:2014 + A1:2017, Criteria B
	L-PE, N-PE: 1, 2kV; for all versions	IEC/EN61000-4-5:2014 + A1:2017, Criteria A
	L-PE: 4kV; for all versions; O/P connected to GND	IEC/EN61000-4-5:2014 + A1:2017, Criteria B
	N-PE: 4kV; for all versions; O/P connected to GND	IEC/EN61000-4-5:2014 + A1:2017, Criteria A
Immunity to conducted disturbances, induced by radio-frequency fields	10Vrms (0.15-80MHz)	IEC61000-4-6:2013, Criteria A EN61000-4-6:2014, Criteria A
Power Magnetic Field Immunity	30A/m	IEC61000-4-8:2009 / EN61000-4-8:2010
Voltage Dips and Interruptions	Dips: 100% (0.5P, 1.0P), 60%, 30%, 20%	IEC/EN61000-4-11:2004+A1:2017, Criteria A
	Interruption: 100%	IEC/EN61000-4-11:2004+A1:2017, Criteria B
Limits of Voltage Fluctuations & Flicker		EN61000-3-3:2013+A1:2019

EMC Compliance according to EN55032	Condition	Standard / Criterion
Electromagnetic compatibility of multimedia equipment – Emission Requirements	O/P either floating or earth coupled (FE; PE or GND)	EN55032:2015+A11:2020, Criteria B

DIMENSION & PHYSICAL CHARACTERISTICS

Parameter	Type		Value
Materials	case/baseplate	except "/277/OF"	plastic, (UL94 V-0)
	potting	except "/277/OF"	silicone, (UL94 V-0)
	PCB	all versions	FR4, (UL94 V-0)
Dimension (LxWxH)	"/277" and "/277/CC"		52.5 x 27.4 x 23.0mm 2.07 x 1.07 x 0.9 inch
	"/277/HT"		52.5 x 40.0 x 25.5mm 2.06 x 1.57 x 1.0 inch
	"/277/OF"		80.0 x 23.8 x 22.5mm 3.14 x 0.93 x 0.88 inch
Weight	"/277" and "/277/CC"		60g typ. 0.13 lbs
	"/277/HT"		93g typ. 0.20 lbs
	"/277/OF"		33g typ. 0.07 lbs

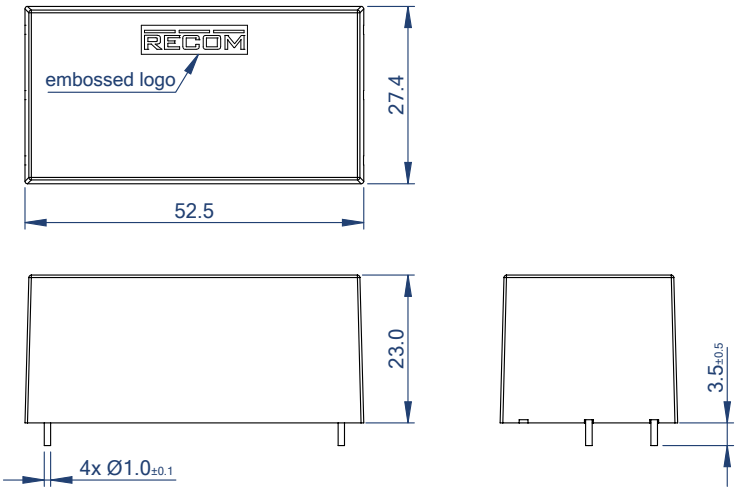
RAC20NE-K/277 Series ◊ AC/DC Power Supply

20W ◊ Input: 100V-277VAC

RECOM AC/DC Converter

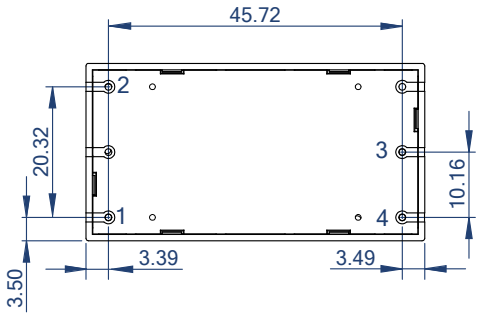
DIMENSION & PHYSICAL CHARACTERISTICS

Dimension Drawing "/277" & "/277/CC" (mm)

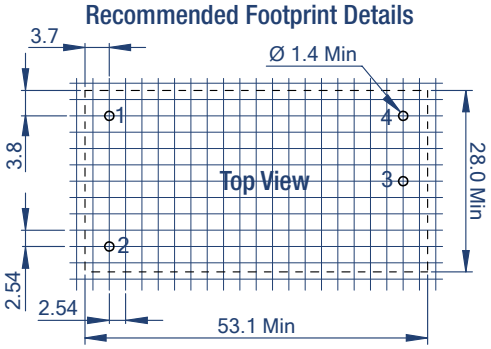


Pinning information [P12]

Pin #	Single
1	VAC in (N)
2	VAC in (L)
3	-Vout
4	+Vout

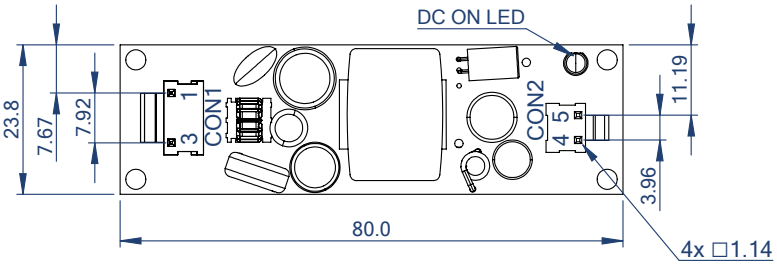


Recommended Footprint Details

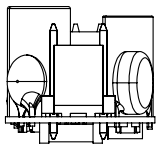


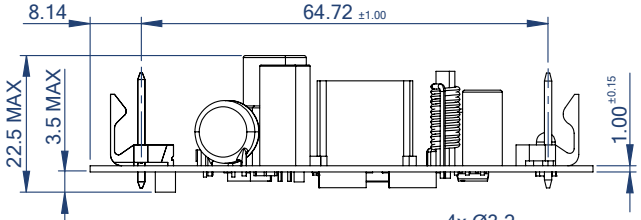
Tolerance: xx.x= ±0.5mm
xx.xx= ±0.25mm

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

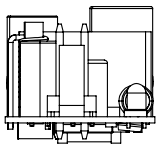


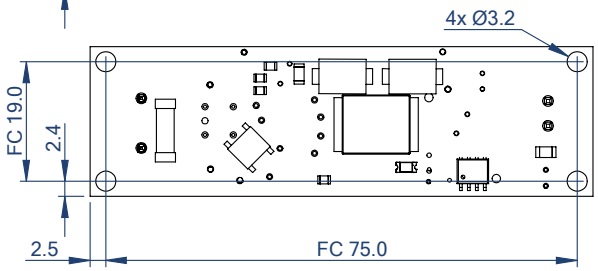
AC Input Side View





DC Output Side View





Compatible Connector

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

Connector Information

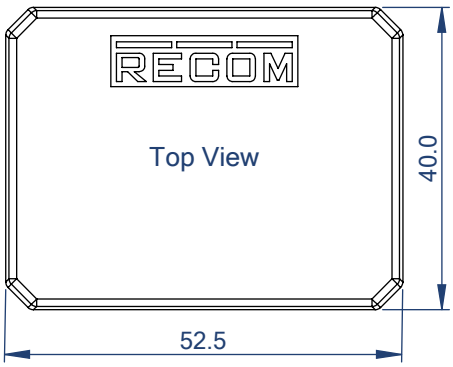
#	Function	Terminal
	AC Input (CON1)	
1	VAC in (L)	3 Pins (Pin2 removed)
3	VAC in (N)	with 3.96mm pitch
	DC Output Connector (CON2)	
4	+Vout	2 Pins
5	-Vout	with 3.96mm pitch

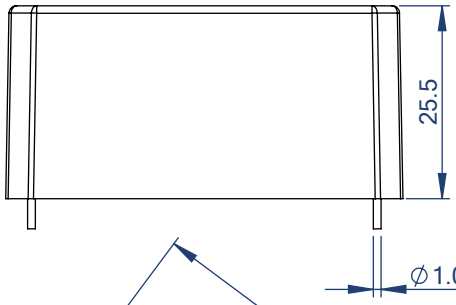
FC= fixing centers

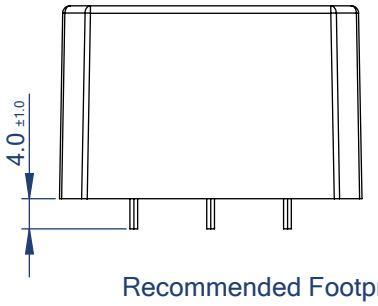
Tolerance: xx.x= ±0.5mm
xx.xx= ±0.25mm

DIMENSION & PHYSICAL CHARACTERISTICS

Dimension Drawing "/277/HT" Version (mm)

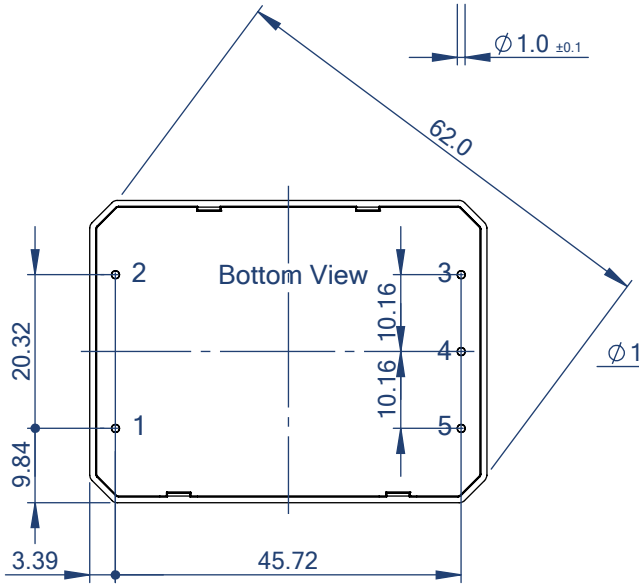




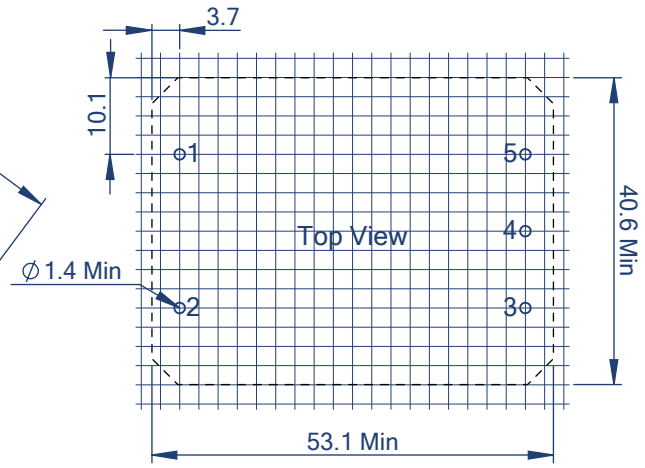


Pinning information

Pin #	Dual
1	VAC in (N)
2	VAC in (L)
3	-Vout
4	Com
5	+Vout



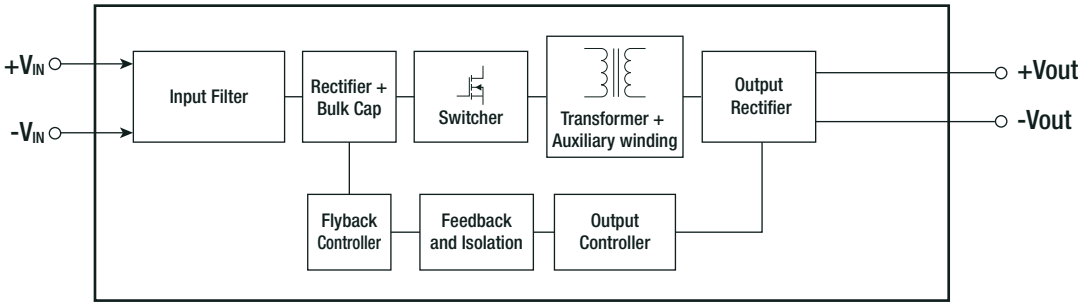
Recommended Footprint Details



Tolerance: xx.x= ±0.5mm
xx.xx= ±0.25mm

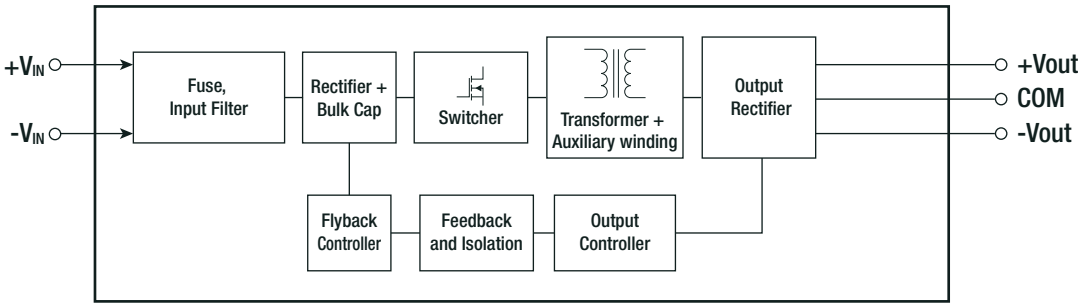
BLOCK DIAGRAMM

THT-solder-mount ("/277 & "/277/CC)

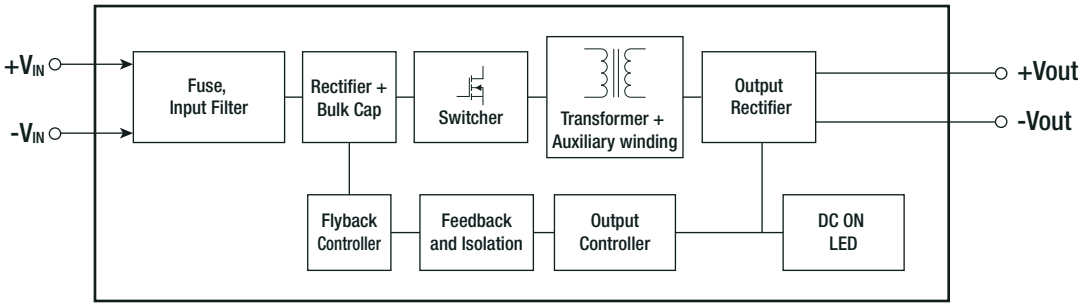


BLOCK DIAGRAMM

THT-solder-mount ("/277/HT")



Open frame / chassis mount ("/277/OF")



PACKAGING INFORMATION

Parameter	Type		Value
Packaging Dimension (LxWxH)	"/277", "/277/CC" & "/277/HT"	tube	490.0 x 56.0 x 40.0mm
	"/277/OF"	tray	365.0 x 210.0 x 46.0mm
Packaging Quantity	tube	"/277" & "/277/CC"	15pcs
		"/277/HT"	11pcs
	tray		18pcs
Storage Temperature Range			-40°C to +90°C
Storage Humidity			95% RH max.