

# Features

# Regulated Converter

- Wide input range 85-305VAC
- 5000m operating altitude
- OVCIII up to 2000m altitude
- 4kVAC isolation rated/60sec.
- EMC compliant without external components
- No load power consumption <200mW



# RAC20E-K/277

20 Watt  
2" x 1"  
Single Output



## Selection Guide

Part Number	Input Voltage Range [VAC]	nom. Output Voltage [VDC]	Output Current [mA]	Efficiency typ. <sup>(1)</sup> [%]
RAC20E-05SK/277	85-305	5	4000	80
RAC20E-12SK/277	85-305	12	1667	83
RAC20E-24SK/277	85-305	24	833	84

**Notes:**

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

## Model Numbering



UL/IEC/EN62368-1 certified  
CAN/GSA G22.2 No. 62368-1 certified  
IEC/EN62368-1 2nd Edition certified  
IEC/EN62368-1 3rd Edition certified  
IEC/EN61558-1/2-16 pending  
EN55032 compliant  
EN55035 compliant  
CB Report

## 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				CM Choke
Nominal Input Voltage	50/60Hz	100VAC		277VAC
Operating Range <sup>(2,3)</sup>	47-63Hz	85VAC	277VAC	305VAC
	DC	120VDC		430VDC
Input Current	115VAC			400mA
	230VAC			300mA
	277VAC			250mA
Inrush Current	cold start at 25°C	115VAC		20A
		230/277VAC		40A
No load Power Consumption				200mW
ErP Standby Mode Conformity (Maximum output power available for stated maximum input power)	Input Power=	0.5W		0.25W
		1.0W		0.6W
		2.0W		1.4W

**Notes:**

Note2: The products were submitted for safety files at AC-Input operation. (90-305VAC)

Note3: Refer to "Derating Graph"

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

### BASIC CHARACTERISTICS

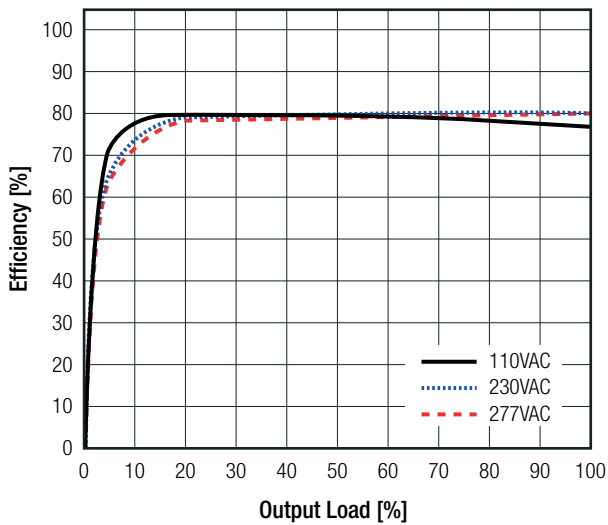
Parameter	Condition	Min.	Typ.	Max.
Input Frequency Range	AC Input	47Hz		63Hz
Minimum Load		0%		
Power Factor	115VAC 230VAC 277VAC		0.6 0.5 0.45	
Start-up Time				150ms
Rise Time				25ms
Hold-up Time	115VAC 230VAC 277VAC	25ms	10ms 40ms 60ms	
Internal Operating Frequency	100% load at nominal Vin		120kHz	
Output Ripple and Noise <sup>(4)</sup>	20MHz BW	5Vout others		150mVp-p 1% of Vout

**Notes:**

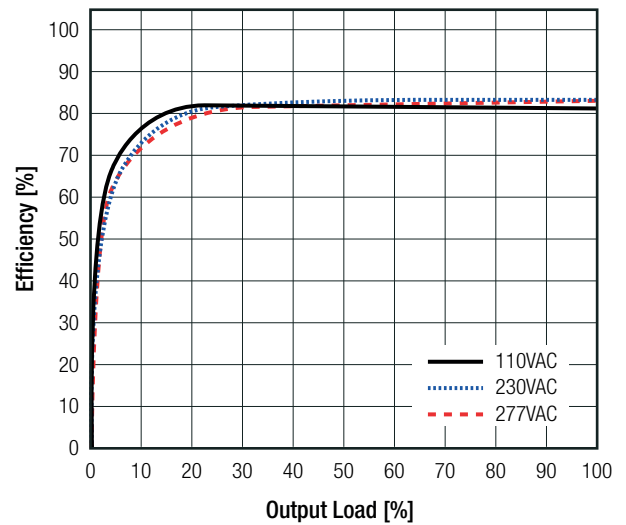
Note4: Measurements are made with a 0.1µF MLCC & 10µF E-cap in parallel across output. (low ESR)

**Efficiency vs. Load**

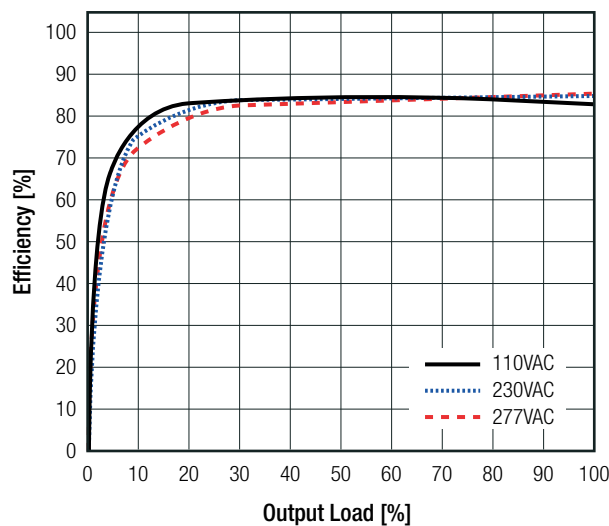
**RAC20E-05SK/277**



**RAC20E-12SK/277**



**RAC20E-24SK/277**



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

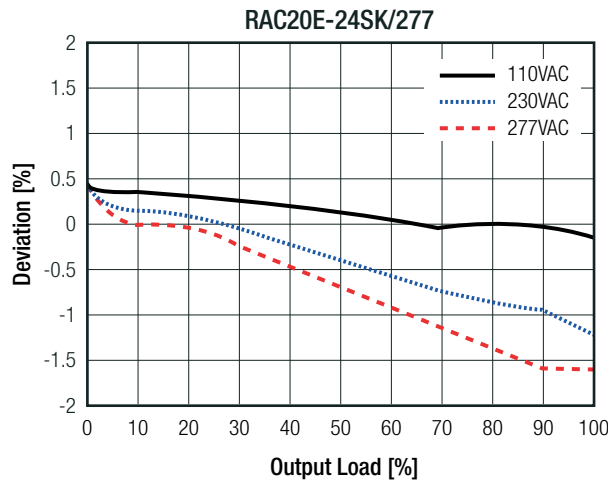
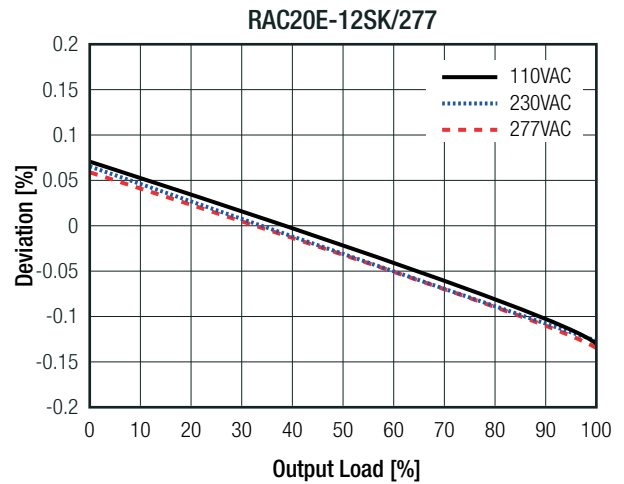
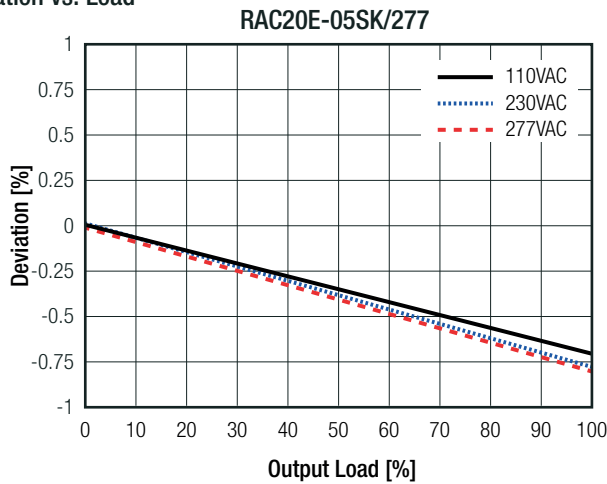
**REGULATIONS**

Parameter	Condition	Value
Output Accuracy		±2.0% typ.
Line Regulation	low line to high line, full load	±0.5% typ.
Load Regulation <sup>(5)</sup>	10% to 100% load	1.0% typ.
Transient Response	25% load step change recovery time	3.0% max. 500µs max.

**Notes:**

Note5: Operation below 10% load will not harm the converter, but specifications may not be met

**Deviation vs. Load**



**PROTECTIONS**

Parameter	Type	Value
Input Fuse	internal	slow blow
Short Circuit Protection (SCP)		hiccup mode, automatic restart
Over Voltage Protection (OVP)		105% - 120%, clamping, automatic restart
Over Load Protection (OLP)		150% - 195%, hiccup mode
Over Voltage Category (OVC)	according to 62368-1 according to 61558-2-16	OVCII (5000m) OVCIII (2000m)
Isolation Voltage <sup>(6)</sup>	I/P to O/P	1 minute 4kVAC

**Notes:**

Note6: For repeat Hi-Pot testing, reduce the time and/or the test voltage

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

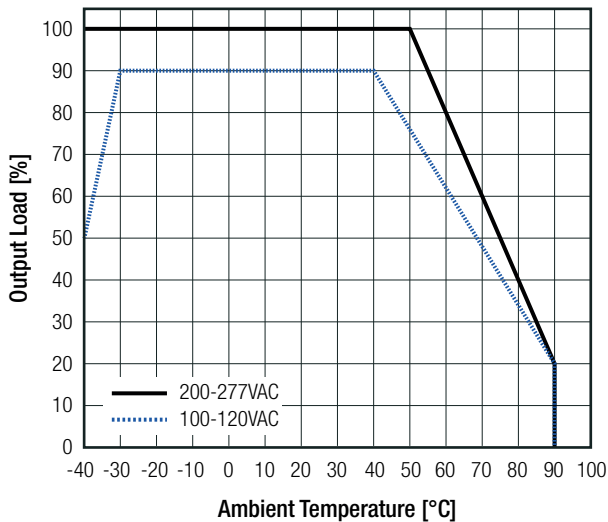
PROTECTIONS			
Parameter	Condition		Value
Isolation Resistance	I/P to O/P	V <sub>ISO</sub> = 500VDC	1GΩ min.
Isolation Capacitance		100kHz/0.1VDC	100pF max.
Leakage Current	@ 277VAC		0.25mA max.
Insulation Grade			reinforced

ENVIRONMENTAL			
Parameter	Condition		Value
Operating Temperature Range	@ natural convection 0.1m/s	refer to <b>"Derating Graph"</b>	-40°C to +90°C
Maximum Case Temperature			+95°C
Temperature Coefficient			±0.02%/K
Operating Altitude			5000m (OVCI) 2000m (OVCIII)
Operating Humidity	non-condensing		20% - 90% RH max.
Pollution Degree			PD2
Vibration			10-500Hz, 2G 10min./1cycle, period 60min. each along x,y,z axes
MTBF	according to MIL-HDBK-217F, G.B.	+25°C +40°C	830 x 10 <sup>3</sup> hours 700 x 10 <sup>3</sup> hours
Design Lifetime	230VAC/60Hz and full load	T <sub>AMB</sub> = +40°C	5Vout: 34 x 10 <sup>3</sup> hours 12Vout: 44 x 10 <sup>3</sup> hours 24Vout: 53 x 10 <sup>3</sup> hours
		T <sub>AMB</sub> = +25°C	5Vout: 89 x 10 <sup>3</sup> hours 12Vout: 115 x 10 <sup>3</sup> hours 24Vout: 132 x 10 <sup>3</sup> hours

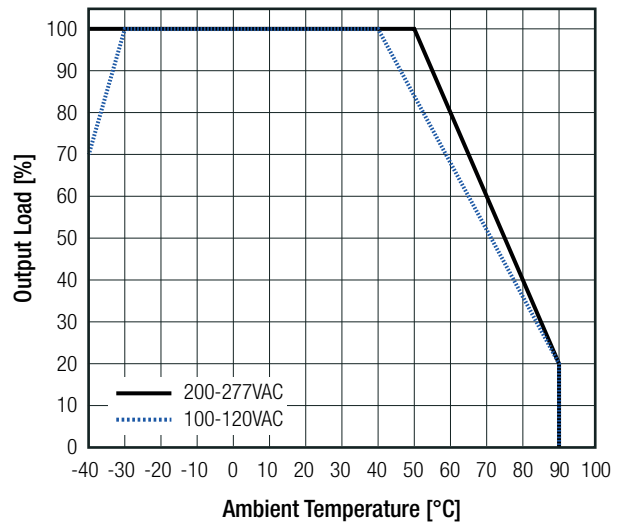
**Derating Graph**

(@ Chamber and natural convection 0.1m/s)

**RAC20E-05SK/277**



**RAC20E-12SK/277**

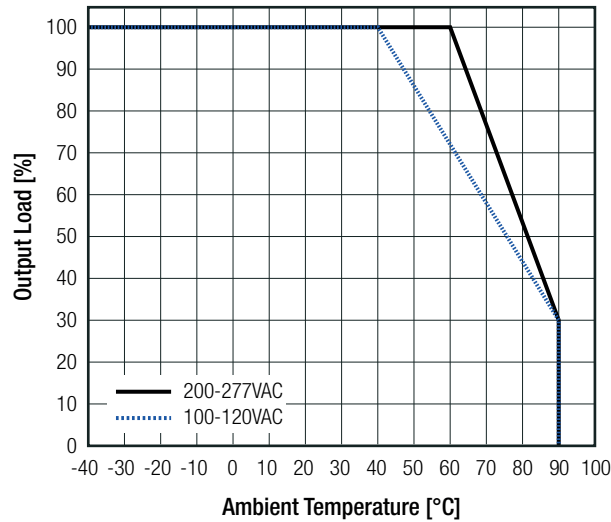


**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

**Derating Graph <sup>(7)</sup>**

(@ Chamber and natural convection 0.1m/s)

RAC20E-24SK/277



**SAFETY AND CERTIFICATIONS**

Certificate Type (Safety)	Report / File Number	Standard
Audio/Video, information and communication technology equipment - Safety requirements	E491408-A6018-UL	UL62368-1 3rd Edition CAN/CSA-C22.2 No. 62368-1 3rd Edition
Audio/Video, information and communication technology equipment - Safety requirements (CB)	210615003	IEC62368-1:2014 2nd Edition
Audio/Video, information and communication technology equipment - Safety requirements (LVD)		EN62368-1:2014 + A11:2017
Audio/Video, information and communication technology equipment - Safety requirements	210615002	IEC62368-1:2018 3rd Edition
Audio/Video, information and communication technology equipment - Safety requirements		EN IEC 62368-1:2020 + A11:2020
Safety of power transformers, power supplies, reactors and 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 and similar products for supply voltages up to 1100 V		EN61558-1:2005 + A1:2009
Safety of power transformers, power supplies, reactors and 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 and similar products for supply voltages up to 1100 V Part 2: Particular requirements		EN61558-2-16:2009 + A1:2013
RoHS2		RoHS-2011/65/EU + AM-2015/863

EMC Compliance	Condition	Standard / Criterion
ESD Electrostatic discharge immunity test	Air ±2kV, 4kV, 8kV Contact ±4kV	IEC61000-4-2:2008, Criteria A EN61000-4-2:2009, Criteria A
Radiated, radio-frequency, electromagnetic field immunity test	10V/m (8MHz-1GHz) 3V/m (1.4GHz-2GHz) 1V/m (2GHz-2.7GHz)	IEC61000-4-3:2006+A2:2010, Criteria A IEC61000-4-3:2006+A2:2010, Criteria A
Fast Transient and Burst Immunity	AC Port: ±2.0kV	IEC/EN61000-4-4:2012, Criteria A
Surge Immunity	AC Port: ±1.0kV	IEC/EN61000-4-5:2014, Criteria A
Immunity to conducted disturbances, induced by radio-frequency fields	AC Port: 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, Criteria A

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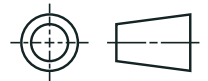
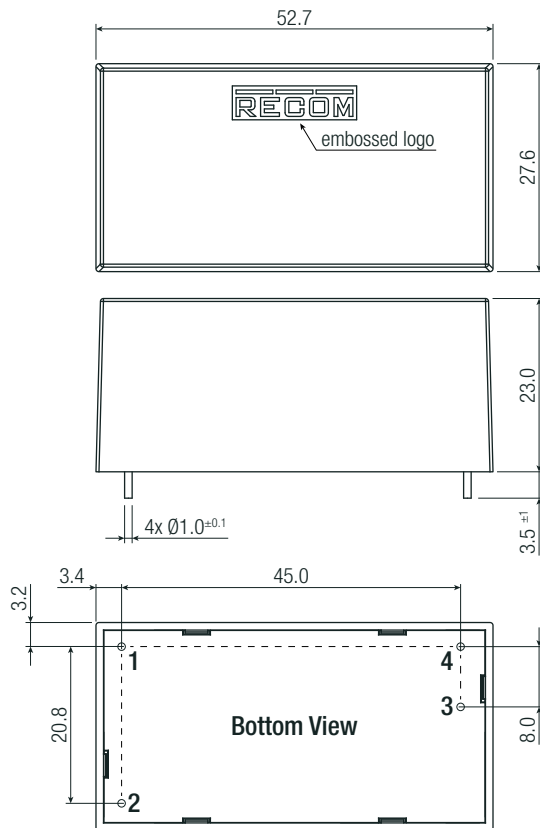
**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

EMC Compliance	Condition	Standard / Criterion
Voltage Dips and Interruptions	Voltage Dip 100% (0.5P)	IEC/EN61000-4-11:2004, Criteria A
	Voltage Dip 100% (1.0P)	IEC/EN61000-4-11:2004, Criteria A
	Voltage Dip 30%	IEC/EN61000-4-11:2004, Criteria A
	Voltage Dip 20%	IEC/EN61000-4-11:2004, Criteria A
	Voltage Interruption 100%	IEC/EN61000-4-11:2004, Criteria B
Limits of Harmonic Current Emissions		EN61000-3-2:2014
Limits of Voltage Fluctuations & Flicker		EN61000-3-3:2013
Low voltage power supplies, d.c. output Part 3: Electromagnetic compatibility (EMC)		EN IEC 61204-3:2018, Class B
Limitations on the amount of electromagnetic interference allowed from digital and electronic devices		FCC 47 CFR Part 15 Subpart B, Class B

**DIMENSION AND PHYSICAL CHARACTERISTICS**

Parameter	Type	Value
Material	case/baseplate potting PCB	black plastic, (UL94 V-0) silicone, (UL94 V-0) FR4, (UL94 V-0)
Dimension (LxWxH)		52.7 x 27.6 x 23.0mm
Weight		60g typ.

**Dimension Drawing (mm)**

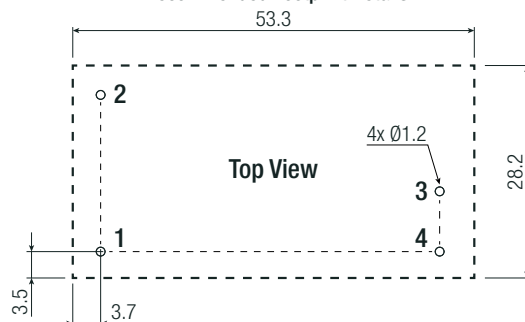


**Pinning Information**

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

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

**Recommended Footprint Details**



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

PACKAGING INFORMATION		
Parameter	Type	Value
Packaging Dimension (LxWxH)	tube	490.0 x 56.0 x 40.0mm
Packaging Quantity		15pcs
Storage Temperature Range		-40°C to +85°C
Storage Humidity	non-condensing	20% to 90% RH max.

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