

# Features

- OVC III and PD3 up to 5000m altitude
- 85-528VAC input range
- -40°C to +90°C operating temperature
- LPS limited power source
- EN55032 class "B"; floating outputs
- No load power consumption <0.3W

# Regulated Converter



## RAC15-K/480

**15 Watt**  
**2" x 1.6"**  
**Single Output**



IEC/EN62368-1 certified  
UL62368-1 certified  
CAN/CSA-C22.2 No. 62368-1-14 certified  
IEC/EN61010 certified  
IEC/EN60335-1 pending  
EN62233 pending  
EN55032 compliant  
EN55035 compliant  
CB Report



**CODICO GmbH**  
Zwingenstraße 6-8, 2380 Perchtoldsdorf, Austria  
Telefon: +43 1 86 305-0, Fax: +43 1 86 305-5000  
e-mail: office@codico.com, www.codico.com  
FN 436940i, Landesgericht Wr. Neustadt

Zertifiziert nach ISO 9001:2008

## Description

The RAC15-K/480 series AC/DC modules with ultra-wide input range of 100-480 VAC are specially designed for harsh industrial conditions of overvoltage category OVC III and pollution degree PD3 in both single-phase and phase-to-phase power connections of class II. These power supplies are capable of operating over a wide temperature range of -40° to 90°C (up to 60°C without derating) by just adding an external fuse, and offer LPS limited outputs with continuous overcurrent protection and emission class B EMC compliance in potential free configuration of the load. These silicone-free encapsulated modules are built extremely compact to fit on printed circuit boards without compromising board area. Global safety certifications ensure fast time-to-market when integrated into applications for markets such as Smart Grid, Smart Metering, Renewable Energy; Sensors and actuators or IoT applications.

## Selection Guide

Part Number	Input Voltage Range [VAC]	Output Voltage [VDC]	Output Current [mA]	Efficiency typ <sup>(1)</sup> [%]	Max. Capacitive Load <sup>(1)</sup> [µF]
RAC15-05SK/480	85-528	5	3000	86	20000
RAC15-12SK/480	85-528	12	1250	84	12000
RAC15-15SK/480	85-528	15	1000	85	10000
RAC15-24SK/480	85-528	24	625	87	6000

### Notes:

Note1: Is tested at 230VAC input and constant resistive load at +25°C ambient

## Model Numbering



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

BASIC CHARACTERISTICS				
Parameter	Condition	Min.	Typ.	Max.
Nominal Input Voltage <sup>(2)</sup>	50/60Hz	100VAC		277VAC
				480VAC
Input Voltage Range <sup>(3)</sup>	47-63HZ	85VAC		528VAC
	DC	120VDC		750VDC
Input Current	115/230VAC 480VAC			500mA 400mA
Inrush Current	cold start	115VAC		20A
		230VAC		40A
		480VAC		50A

### Notes:

Note2: 480VAC limited to L-L connections

Note3: The products were submitted for safety files at AC-Input operation

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**Specifications** (measured @  $T_a = 25^\circ\text{C}$ , nom.  $V_{in}$ , full load and after warm-up unless otherwise stated)

### BASIC CHARACTERISTICS

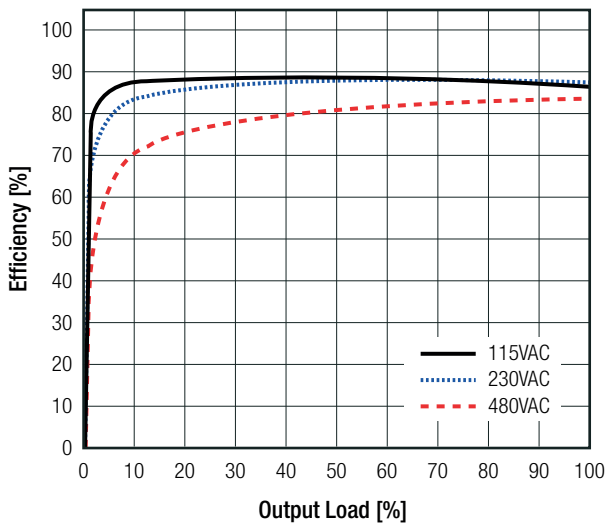
Parameter	Condition	Min.	Typ.	Max.
No Load Power Consumption	85-528VAC			300mW
Input Frequency Range	AC Input	47Hz		63Hz
Minimum Load		0%		
Power Factor	115/230VAC	0.4		
	480VAC	0.3		
Start-up Time			150ms	
Rise Time			30ms	
Hold-up Time	230VAC	30ms		
Internal Operating Frequency			50kHz	
Output Ripple and Noise <sup>(4)</sup>	20MHz BW	$V_{out} = 5\text{VDC}$		100mVp-p
		others		1% of $V_{out}$

**Notes:**

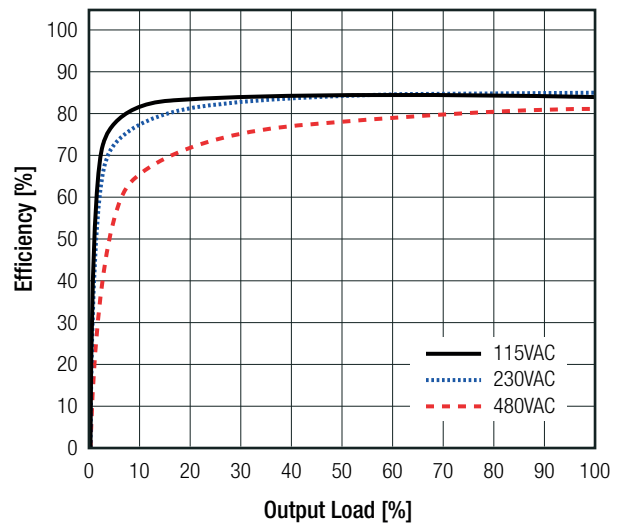
Note4: Measurements are made with a 0.1 $\mu\text{F}$  MLCC & 10 $\mu\text{F}$  E-cap in parallel across output (low ESR).

#### Efficiency vs. Load

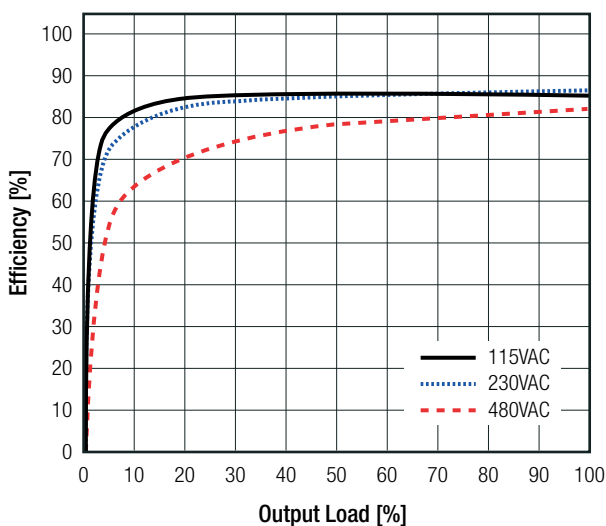
RAC15-05SK/480



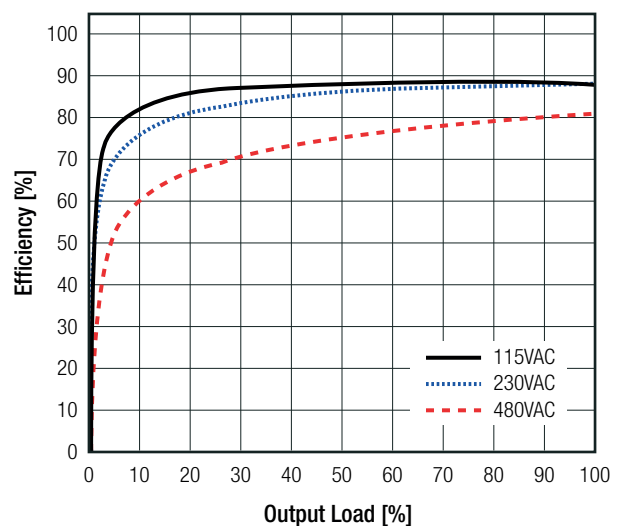
RAC15-12SK/480



RAC15-15SK/480



RAC15-24SK/480



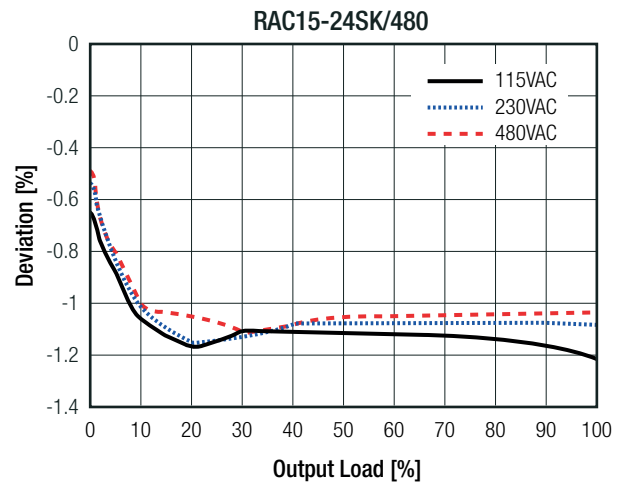
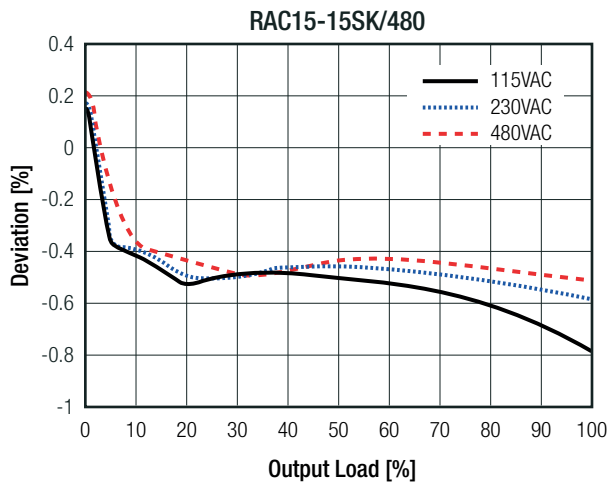
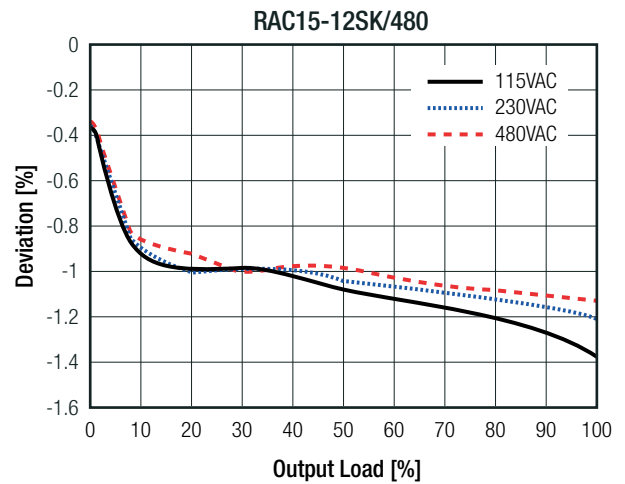
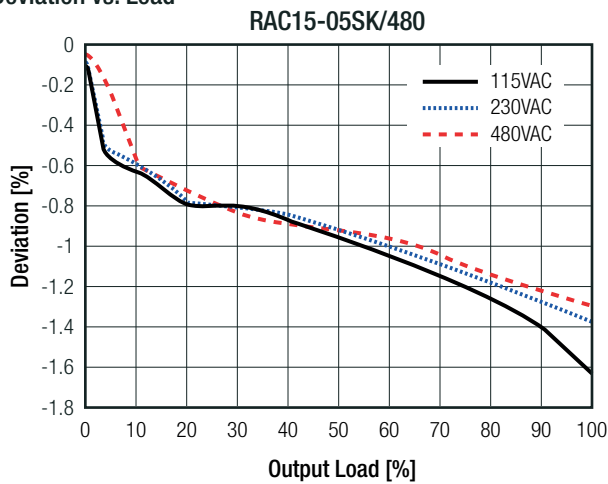
**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

REGULATIONS		
Parameter	Condition	Value
Output Accuracy		±3.0% max.
Line Regulation	low line to high line	±2.0% typ.
Load Regulation <sup>(5)</sup>	10% to 100% load	2.0% typ.
Transient Response	25% load step change	4.0% max.
	recovery time	1ms typ.

**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	external (refer to "Protection Circuit")	T2A, 600VAC min.
Limited Power Source (LPS)	according to IEC62368-1 CB Report	yes
Short Circuit Protection (SCP)	below 100mΩ	hiccup, auto recovery
Over Voltage Protection (OVP)		105% - 120%, hiccup mode
Over Current Protection (OCP)		128% - 155%, hiccup mode
Over Voltage Category	according to 61010-1	OVCIII (up to 5000m)

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

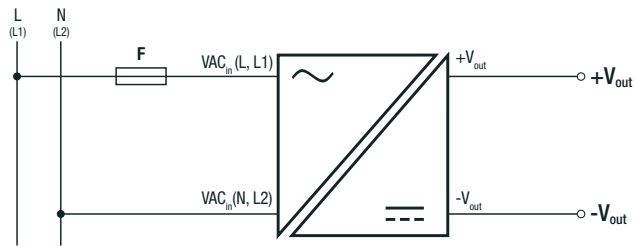
Parameter	Type		Value
Isolation Voltage <sup>(6)</sup>	tested for 1 minute	I/P to O/P	3.6kVAC
	tested for 5 seconds		5.4kVAC
Isolation Resistance			1GΩ max.
Isolation Capacitance			200pF max.
Insulation Grade			reinforced
Leakage Current			200μA max.

#### Notes:

#### Protection Circuit

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

An external fuse is mandatory in order to protect the device in addition on the AC input side. RECOM recommend: slow blow type, 600VAC, 2A

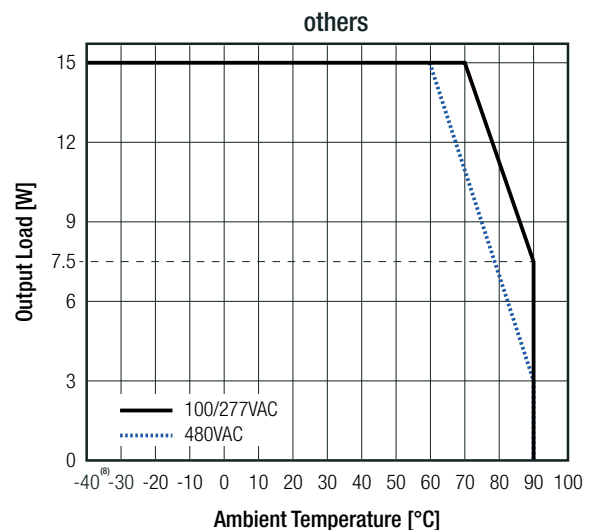
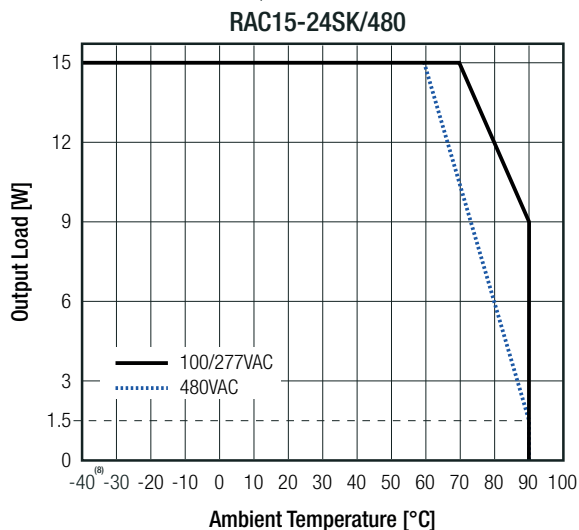


### ENVIRONMENTAL

Parameter	Condition		Value	
Operating Temperature Range <sup>(7)</sup>	refer to "Derating Graph <sup>(7)</sup> "		-40°C to +90°C	
Maximum Case Temperature			+105°C	
Temperature Coefficient			0.02%/K	
Operating Altitude			5000m	
Operating Humidity	non-condensing		95% RH max.	
Pollution Degree			PD3	
Vibration	according to MIL-STD-202G		10-500Hz, 2G 10min./1cycle, 60min. each along x,y,z axes	
Design Lifetime	230VAC/50Hz	+50°C	30 x 10 <sup>3</sup> hours	
MTBF	according to MIL-HDBK-217F, G.B.	V <sub>OUT</sub> = 5, 12VDC	+25°C	1450 x 10 <sup>3</sup> hours
		V <sub>OUT</sub> = 15, 24VDC	+25°C	1720 x 10 <sup>3</sup> hours
		V <sub>OUT</sub> = 5, 12VDC	+40°C	1310 x 10 <sup>3</sup> hours
		V <sub>OUT</sub> = 15, 24VDC	+40°C	1470 x 10 <sup>3</sup> hours

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

(@ Chamber and natural convection 0.1m/s)



#### Notes:

Note7: Maximum load for coldstart at temperatures below -25°C should be limited to 12W

**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
Audio/Video, information and communication technology equipment - Safety requirements	E491408-A6021-UL	UL62368-1, 3rd Edition, 2019 CAN/CSA C22.2 Nr. 62368-1-14, 3rd Ed. 2019
Audio/Video, information and communication technology equipment - Safety requirements (CB)	211112011	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 (CB)	211112010	IEC62368-1:2018 3rd Edition
Audio/Video, information and communication technology equipment - Safety requirements		EN/IEC62368-1:2020 + A11:2020
Electrical Equipment For Measurement, Control, and Laboratory Use; Part 1: General Requirements	085-210569501-000	IEC61010-1:2010 3rd Edition + A1:2016
Electrical Equipment For Measurement, Control, and Laboratory Use; Part 1: General Requirements	64.210.21.05695.01	EN61010-1:2010 + A1:2019
Household and similar electrical appliances – Safety – Part 1: General requirements	pending	IEC60335-1:2010 EN60335-1:2012
Measurement methods for electromagnetic fields of household appliances and similar apparatus with regard to human exposure	pending	EN62233:2008
EAC		TP TC 004/2011
RoHS2		RoHS-2011/65/EU + AM-2015/863

EMC Compliance (EN55032) <sup>(8)</sup>	Condition	Standard / Criterion
Electromagnetic compatibility of multimedia equipment - Emission requirements		EN55032:2015 + A11:2020, Class B
Electromagnetic compatibility of multimedia equipment – Immunity requirements		EN55035:2017 + A11:2020
ESD Electrostatic discharge immunity test	Air: ±2, 4, 8kV Contact: ±2, 4kV	EN61000-4-2:2009, Criteria A
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, L-N ±1kV	EN61000-4-4:2012, Criteria A
Surge Immunity	AC Port: L-N: ±1kV	EN61000-4-5:2015, Criteria A
Immunity to conducted disturbances, induced by radio-frequency fields	AC Port: 3Vrms (0.15-10MHz) 3-1Vrms (10-30MHz) 1Vrms (30-80MHz)	EN61000-4-6:2014, Criteria A
Power Magnetic Field Immunity	1A/m	EN61000-4-8:2010, Criteria A
Voltage Dips	100% (0.5P, 0.5P) 30% (25P, 30P)	EN61000-4-11:2004, Criteria A EN61000-4-11:2004, Criteria A
Voltage Interruptions	100% (250P/300P)	EN61000-4-11:2004, Criteria B

EMC Compliance (EN61204-3) <sup>(8)</sup>	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 Contact: ±4kV	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)	EN61000-4-3:2006 + A2:2010, Criteria A
Fast Transient and Burst Immunity	AC Port: L, N, L-N ±2kV	EN61000-4-4:2012, Criteria A
Surge Immunity	AC Port: L-N: ±1kV	EN61000-4-5:2014 + A1:2017, Criteria A
Immunity to conducted disturbances, induced by radio-frequency fields	AC Port: 10Vrms (0.15-80MHz)	EN61000-4-6:2014, Criteria A
Power Magnetic Field Immunity	30A/m	EN61000-4-8:2010, Criteria A
Voltage Dips	100% (0.5P, 0.5P) 100% (1.0P, 1.0P) 60% (10P, 12P) 30% (25P, 30P) 20% (250P, 300P)	EN61000-4-11:2004 + A1:2017, Criteria A

**Notes:**

Note8: With earth referenced output connections, use of an external common mode choke 45mH (E-type) may be considered at the input.

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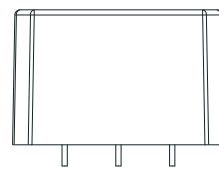
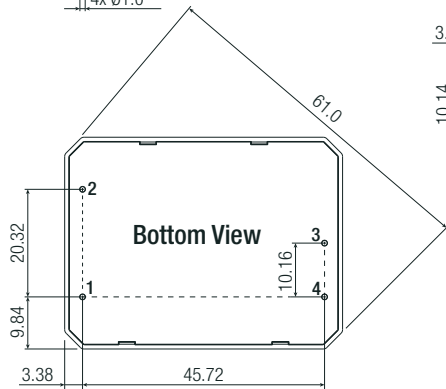
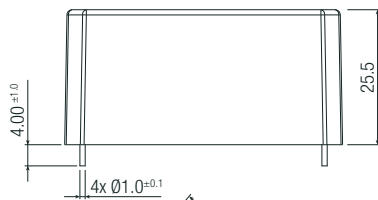
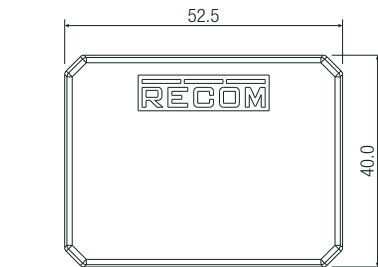
**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

EMC Compliance (EN61204-3) (6)	Condition	Standard / Criterion
Voltage Interruptions	100% (250P, 300P)	EN61000-4-11:2004 + A1:2017, Criteria B
Limits of Harmonic Current Emissions		EN IEC 61000-3-2:2019
Limits of Harmonic Current Emissions		EN61000-3-2:2014
Limits of Voltage Fluctuations & Flicker		EN61000-3-3:2013 + A1:2019

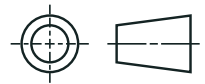
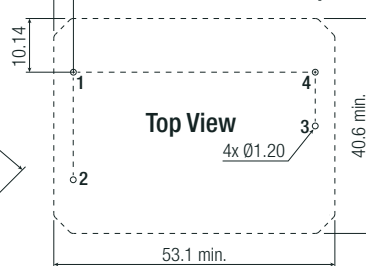
**DIMENSION AND PHYSICAL CHARACTERISTICS**

Parameter	Type	Value
Material	case/baseplate	polycarbonate, (UL94V-0)
	potting	PU, (UL94V-0)
	PCB	FR4, (UL94V-0)
Dimension (LxWxH)		52.5 x 40.0 x 25.5mm
Weight		92g typ.

**Dimension Drawing (mm)**



**Recommended Footprint Details**



**Pinning information**

Pin #	Single
1	VAC in (N) (L2)
2	VAC in (L) (L1)
3	-Vout
4	+Vout

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

**PACKAGING INFORMATION**

Parameter	Type	Value
Packaging Dimension (LxWxH)	tube	56.0 x 40.0 x 490.0mm
Packaging Quantity		11pcs
Storage Temperature Range		-40°C to +90°C
Storage Humidity	non-condensing	95%

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