# Features

# Regulated Converter

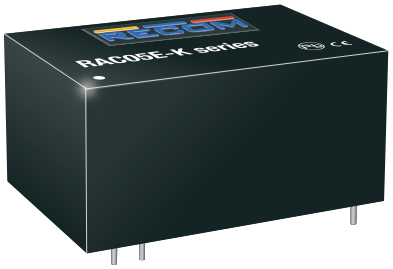
- 100-240VAC Input
- Primary side regulated
- Standard industry pinout
- Full load operation: -25 to 55°C
- No load power consumption <100mW
- Household and ITE certified

RECOM
AC/DC Converter

# RAC05E-K

## 5 Watt
## 1.46“x0.95“
## Single Output

3 YEAR Warranty




## Description

The economically priced RAC05E-K series of primary-side regulated AC/DC converters is designed to meet general purpose requirements for ITE and office use as well as household applications or light industrial automation processes, with less than 0.1W no-load power consumption. The footprint is based on the most common industry standard pinning for AC/DC modules from 3W onwards, with just slightly increased height. The AC/DC modules hold UL and CB certifications to the IEC 62368-1 standard and to EN 60335-1 for household applications. Certified for full load operation from -25°C to +55°C and worldwide input voltage ranges of nominal 100-240VAC, the modules feature semi-regulated outputs with permanent short circuit and over voltage protection. With only a few additional components EN55014 and EN55032 class B limits for electromagnetic compatibility are met.

## Selection Guide

| Part Number | Input Voltage Range [VAC] | Output Voltage [VDC] | Output Current [mA] | Efficiency typ. (1) [%] |
|---|---|---|---|---|
| RAC05E-05SK | 90-264 | 5 | 1000 | 74 |
| RAC05E-12SK | 90-264 | 12 | 417 | 78 |
| RAC05E-15SK | 90-264 | 15 | 333 | 79 |
| RAC05E-24SK | 90-264 | 24 | 208 | 80 |

**Notes:**

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

## Model Numbering

RAC05E-__ SK

- 05 = max. Output Power
- __ = nom. Output Voltage
- SK = **S**ingle

**Ordering Examples:**

| | | |
|---|---|---|
| RAC05E-05SK | 5 Watt | 5Vout |
| RAC05E-24SK | 5 Watt | 24Vout |

c UL us E224736

UL/IEC/EN62368-1 certified
CAN/CSA C22.2 No. 62368-1 certified
IEC/EN60335-1 certified
EN62233 certified
IEC/EN61558-1 certified
IEC/EN61558-2-16 certified
EN55032/EN55035 compliant
EN IEC 61204-3 compliant
CB Report

## Specifications (measured @ Ta= 25°C, nom. Vin= 230VAC, full load and after warm-up unless otherwise stated)

### BASIC CHARACTERISTICS

| Parameter | Condition | | Min. | Typ. | Max. |
|---|---|---|---|---|---|
| Internal Input Filter | | | | | Pi type |
| Nominal Input Voltage | 50/60Hz | | 100VAC | | 240VAC |
| Operating Range (2, 3) | 47-63Hz<br>DC | | 90VAC<br>130VDC | 230VAC | 264VAC<br>370VDC |
| Input Current | 115VAC<br>230VAC | | | | 250mA<br>100mA |
| Inrush Current | cold start at 25°C | 115VAC<br>230VAC | | | 20A<br>10A |
| No load Power Consumption | | | | | 100mW |
| Input Frequency Range | AC Input | | 47Hz | | 63Hz |
| ErP Standby Mode Conformity<br>(Output Load Capability) | Input power= | 0.5W<br>1.0W | | | 0.32<br>0.68 |
| Minimum Load | | | 0% | | |
| Power Factor | 115VAC<br>230VAC | | 0.55<br>0.45 | | |
| Start-up Time | | | | 20ms | |
| Rise Time | | | | 15ms | |
| Hold-up Time | 115VAC<br>230VAC | | 8ms<br>20ms | | |
| Internal Operating Frequency | 100% load at nominal Vin | | | | 130kHz |
| Output Ripple and Noise (4) | 20MHz BW | 5Vout<br>others | | | 70mVp-p<br>1% of Vout |

**Notes:**

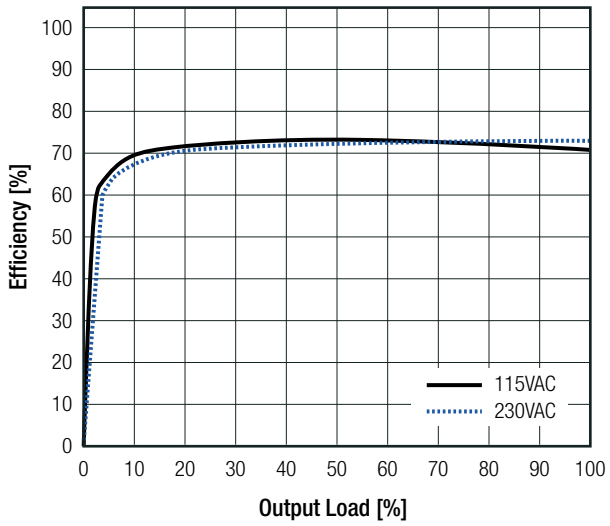
Note2: The products were submitted for safety files at AC-Input operation

Note3: Refer to ***"Line Derating"***

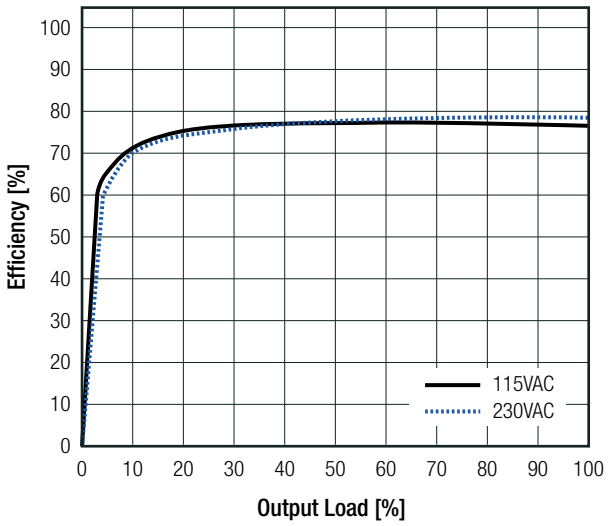
Note4: Measurements are made with a 0.1µF MLCC & 10µF E-cap in parallel across output. (low ESR)

### Efficiency vs. Load

RAC05E-05SK




RAC05E-12SK + RAC05E-15SK

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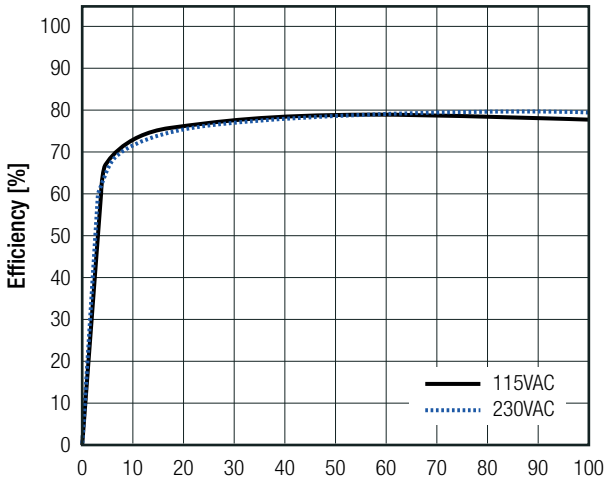
## Specifications (measured @ Ta= 25°C, nom. Vin= 230VAC, full load and after warm-up unless otherwise stated)

### Efficiency vs. Load

RAC05E-24SK




### REGULATIONS

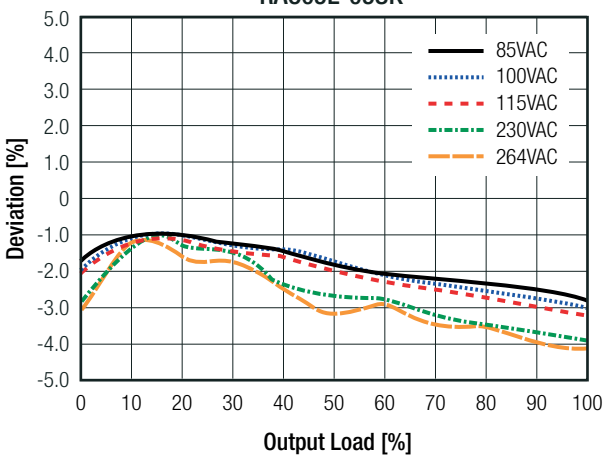
| Parameter | Condition | Value |
|---|---|---|
| Output Accuracy | | ±5.0% typ. |
| Line Regulation | | ±5.0% typ. |
| Load Regulation (5) | | 5.0% typ. |

**Notes:**

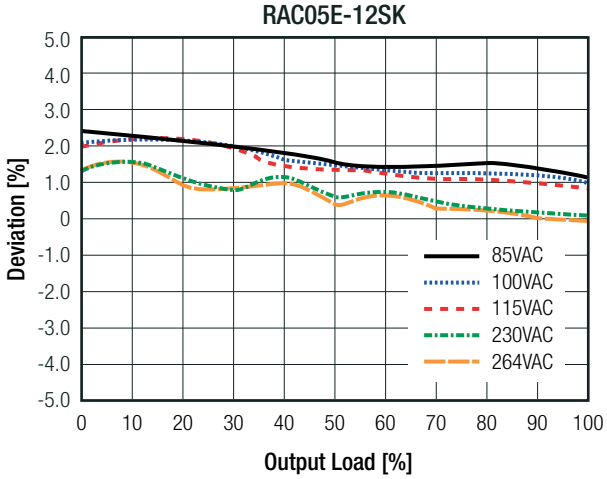
Note5: Operation below 10% load will not harm the converter, but specifications may not be met

### Deviation vs. Load

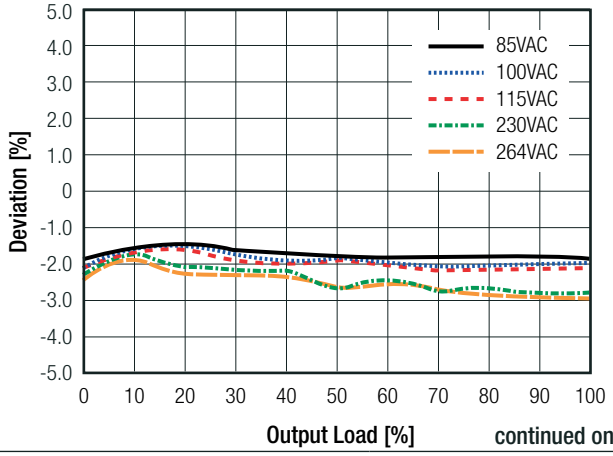
RAC05E-05SK



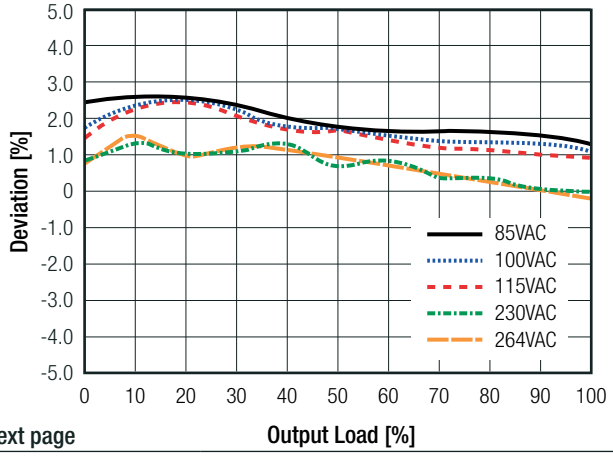

RAC05E-12SK




RAC05E-15SK




RAC05E-24SK

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## Specifications (measured @ Ta= 25°C, nom. Vin= 230VAC, full load and after warm-up unless otherwise stated)

### PROTECTIONS

| Parameter | Type | | | Value |
|---|---|---|---|---|
| Input Fuse [6] | external | | | fusible resistor 5.1Ω |
| Short Circuit Protection (SCP) | below 100mΩ | | | Hiccup mode, auto recovery |
| Over Voltage Category (OVC) | | | | OVCII |
| Over Current Protection (OCP) | | | | 120% - 180%, hiccup mode |
| Isolation Voltage (safety certified) | I/P to O/P | 1 minute | according to 60335-1<br>according to 62368-1<br>according to 61558 | 3kVAC<br>4kVDC<br>4.2kVAC |
| Insulation Grade | | | | reinforced |

**Notes:**

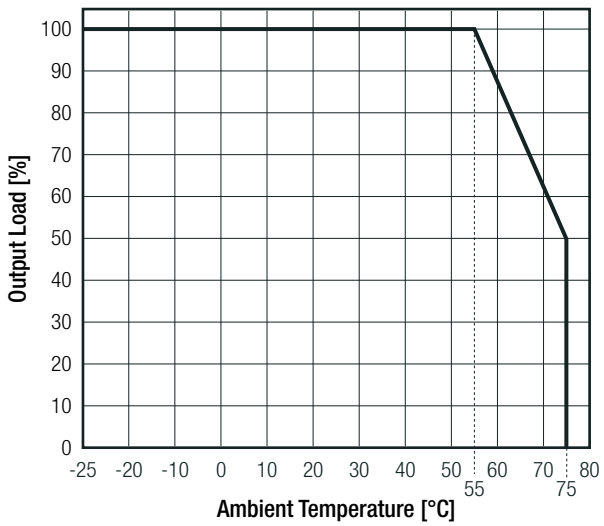
Note6: An external fuse is mandatory in order to protect the device in addition on the AC input side.

### ENVIRONMENTAL

| Parameter | Condition | | Value |
|---|---|---|---|
| Operating Temperature Range | full load refer to ***"Derating Graph"*** | | -25°C to +75°C |
| Maximum Case Temperature | | | +90°C |
| Temperature Coefficient | | | ±0.05%/K |
| Operating Altitude | according to 60335-1 | | 5000m |
| Operating Humidity | non-condensing | | 20% - 95% RH max. |
| Pollution Degree | | | PD2 |
| Vibration | | | 10-500Hz, 2G10min./1cycle, period 60min. each along x,y,z axes |
| MTBF | according to MIL-HDBK-217F, G.B. | +25°C<br>+40°C | 1680 x $10^3$ hours<br>1290 x $10^3$ hours |
| Design Lifetime | +50°C | | >40 x $10^3$ hours |

### Derating Graph

(@ Chamber and natural convection 0.1m/s)



## Specifications (measured @ Ta= 25°C, nom. Vin= 230VAC, 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 - Part 1: Safety requirements | E491408-A6016-UL | UL62368-1:2014<br>CAN/CSA-C22.2 No. 62368-1:2014 |
| Audio/Video, information and communication technology equipment - Safety requirements (CB Scheme) | E491408-A6017-CB-1 | IEC62368-1:2014 2nd Edition |
| Audio/Video, information and communication technology equipment - Safety requirements (LVD) | E491408-A6015-IT-1 | EN62368-1:2014 + A11:2017 |
| Household and similar electrical appliances – Safety – Part 1: General requirements (CB Scheme) | LCS200820072AS | IEC60335-1:2010 5th Edition + C1:2016 |
| Household and similar electrical appliances – Safety – Part 1: General requirements (LVD) | | EN60335-1:2012 + A11:2014+A13:2017+A1 :2019+A2:2019+A14:2019 |
| 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 and similar products for supply voltages up to 1100 V (CB Scheme) | NN20TGSJ-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) | | 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 | NN20UK56-001 | 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 | | EN61558-2-16:2009 + A1:2013 |
| RoHS2 | | RoHS 2011/65/EU + AM2015/863 |

| EMC Compliance (Industrial) | Condition | | Standard / Criterion |
|---|---|---|---|
| Electromagnetic compatibility of multimedia equipment - Emission requirements | | | EN55032:2015, Class A/B |
| Electromagnetic compatibility of multimedia equipment – Immunity requirements | | | EN55035:2017 |
| ESD Electrostatic Discharge Immunity Test | Air: ± 2, 4, 8kV<br>Contact: ±2, 4kV | | IEC61000-4-2:2008, Criteria B<br>EN61000-4-2:2009, Criteria B |
| Radiated, Radio-Frequency, Electromagnetic Field Immunity Test | 3V/m: 80-1000MHz<br>1800MHz, 2600MHz<br>3500MHz, 5000MHz | | IEC/EN61000-4-3:2006+A2:2010, Criteria A |
| Fast Transient and Burst Immunity | AC Port: ±1kV | | IEC/EN61000-4-4:2012, Criteria B |
| Surge Immunity | AC Power Port: ±1kV | | IEC61000-4-5:2014, Criteria B<br>EN61000-4-5:2014+A1:2017, Criteria B |
| Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields | 3Vrms: 0.15-10MHz<br>3-1Vrms: 10-30MHz<br>1Vrms: 30-80MHz | | IEC61000-4-6:2013, Criteria A<br>EN61000-4-6:2014+AC:2015, Criteria A |
| Power Magnetic Field Immunity | 1A/m | | IEC61000-4-8:2009, Criteria A<br>EN61000-4-8:2010, Criteria A |
| Voltage Dips and Interruption | Voltage Dips: | 100% | IEC61000-4-11:2004, Criteria B<br>EN61000-4-11:2004+A1:2017, Criteria B |
| | | 30% | IEC61000-4-11:2004, Criteria C<br>EN61000-4-11:2004+A1:2017, Criteria C |
| | Interruptions: | 100% | IEC61000-4-11:2004, Criteria C<br>EN61000-4-11:2004+A1:2017, Criteria C |

| EMC Compliance (Low Voltage PSU) | Condition | Standard / Criterion |
|---|---|---|
| Low voltage power supplies, d.c. output Part 3: Electromagnetic compatibility (EMC) | | EN IEC 61204-3:2018, Class A/B |
| ESD Electrostatic Discharge Immunity Test | Air: ± 2, 4, 8kV<br>Contact: ±2, 4kV | IEC61000-4-2:2008, Criteria B<br>EN61000-4-2:2009, Criteria B |

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## Specifications (measured @ Ta= 25°C, nom. Vin= 230VAC, full load and after warm-up unless otherwise stated)

| EMC Compliance (Low Voltage PSU) | Condition | | Standard / Criterion |
|---|---|---|---|
| Radiated, Radio-Frequency, Electromagnetic Field Immunity Test | 10V/m: 80-1000MHz<br>3V/m: 1400-2000MHz<br>1V/m: 2000-2700MHz | | IEC/EN61000-4-3:2006+A2:2010, Criteria A |
| Fast Transient and Burst Immunity | AC Port: ±2kV | | IEC/EN61000-4-4:2012, Criteria B |
| Surge Immunity | AC Power Port: ±1kV | | IEC61000-4-5:2014, Criteria B<br>EN61000-4-5:2014+A1:2017, Criteria B |
| Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields | 10Vrms: 0.15-80MHz | | IEC61000-4-6:2013, Criteria A<br>EN61000-4-6:2014+AC:2015, Criteria A |
| Power Magnetic Field Immunity | 30A/m | | IEC61000-4-8:2009, Criteria A<br>EN61000-4-8:2010, Criteria A |
| Voltage Dips and Interruption | Voltage Dips: | 100%<br>(0.5P; 1.0P) | IEC61000-4-11:2004, Criteria B<br>EN61000-4-11:2004+A1:2017, Criteria B |
| | | 20%, 30%,<br>60% | IEC61000-4-11:2004, Criteria C<br>EN61000-4-11:2004+A1:2017, Criteria C |
| | Interruptions: | 100% | IEC61000-4-11:2004, Criteria C<br>EN61000-4-11:2004+A1:2017, Criteria C |
| Limits of Voltage Fluctuations & Flicker | | | EN61000-3-3:2013+A1:2019 |
| Limitations on the amount of electromagnetic interference allowed from digital and electronic devices | | | FCC 47 CFR Part 15 Subpart B, Class 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 | case/baseplate<br>potting<br>PCB | black plastic, (UL94 V-0)<br>PU, (UL94 V-0)<br>FR4, (UL94 V-0) |
| Dimension (LxWxH) | | 37.0 x 24.0 x 18.0mm |
| Weight | | 26.4g typ. |

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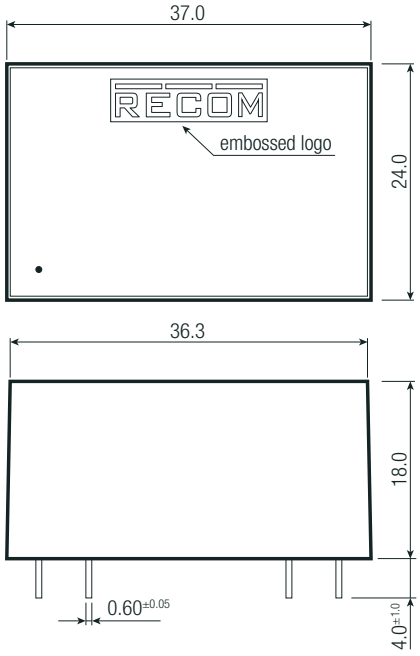
## Specifications (measured @ Ta= 25°C, nom. Vin= 230VAC, full load and after warm-up unless otherwise stated)

### Dimension Drawing (mm)

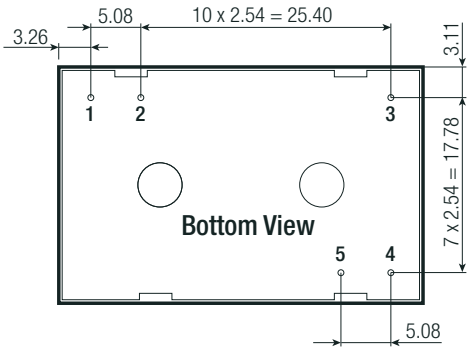



| General tolerances according to ISO 2768-m (table for reference only) | |
|---|---|
| Dimension range | Tolerances |
| 0.5 - 6 mm | ±0.1 mm |
| 6 - 30 mm | ±0.2 mm |
| 30 - 120 mm | ±0.3 mm |
| 120 - 400 mm | ±0.5 mm |

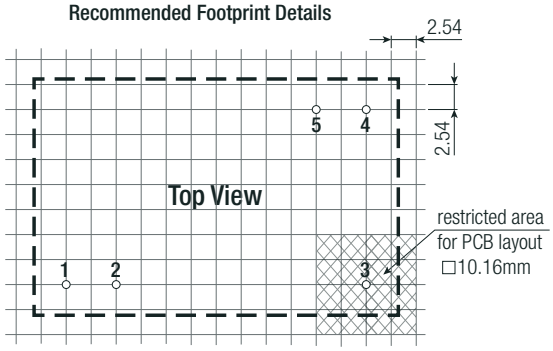
### Pinning Information

| Pin # | Single |
|---|---|
| 1 | VAC in (L) |
| 2 | VAC in (N) |
| 3 | NC |
| 4 | -Vout |
| 5 | +Vout |

NC= no connection




Recommended Footprint Details




| PACKAGING INFORMATION | | |
|---|---|---|
| **Parameter** | **Type** | **Value** |
| Packaging Dimension (LxWxH) | tube | 490.0 x 26.6 x 25.3mm |
| Packaging Quantity | | 12pcs |