

Features

Switching Regulator

- Non-isolated
- Synchronous rectification design
- Adjustable output voltage
- 2, 3, 4Amp adjustable positive step down
- Integrated switching regulator
- Over load protection
- Continuous short circuit protection
- Efficiency up to 97%



R-7xxxP_D

**2,3,4 Amp
SIP12
Vertical &
Horizontal
Single Output**



IEC/EN60950-1 certified

Description

The R-7xxx series is a high performance 2.5V to 17V, 2Amp to 4Amp, 12-Pin SIP (single in-line package), integrated switching regulator (ISR). The synchronous - rectified design yields excellent efficiencies up to 97%. Short circuit protection reduces the short circuit input current to under 50mA.

Selection Guide

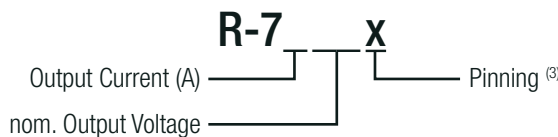
| Part Number | Input Voltage Range [VDC] | Output Voltage [VDC] | Vout Adjust Range ⁽¹⁾ [VDC] | Output Current [A] | Efficiency @ min Vin [%] | Efficiency @ max. Vin [%] | Max. Capacitive Load ⁽²⁾ [µF] |
|-------------|---------------------------|----------------------|--|--------------------|--------------------------|---------------------------|--|
| R-723.3x | 4.5 - 28 | 3.3 | 2.5 - 5.5 | 2 | 95 | 89 | 200/6800 |
| R-725.0x | 6.5 - 28 | 5.0 | 3.0 - 5.5 | 2 | 96 | 91 | 200/6800 |
| R-726.5x | 8.5 - 28 | 6.5 | 5.0 - 8.0 | 2 | 97 | 93 | 200/6800 |
| R-729.0x | 12 - 28 | 9.0 | 7.0 - 11 | 2 | 96 | 93 | 200/6800 |
| R-7212x | 15 - 28 | 12 | 10 - 14 | 2 | 97 | 95 | 200/6800 |
| R-7215x | 19 - 28 | 15 | 13 - 17 | 2 | 97 | 96 | 200/6800 |
| R-733.3x | 4.5 - 28 | 3.3 | 2.5 - 5.5 | 3 | 94 | 89 | 200/6800 |
| R-735.0x | 6.5 - 28 | 5.0 | 3.0 - 5.5 | 3 | 95 | 92 | 200/6800 |
| R-736.5x | 8.5 - 28 | 6.5 | 5.0 - 8.0 | 3 | 97 | 93 | 200/6800 |
| R-739.0x | 12 - 28 | 9.0 | 7.0 - 11 | 3 | 96 | 94 | 200/6800 |
| R-7312x | 15 - 28 | 12 | 10 - 14 | 3 | 97 | 96 | 200/6800 |
| R-7315x | 19 - 28 | 15 | 13 - 17 | 3 | 97 | 96 | 200/6800 |
| R-743.3x | 4.5 - 28 | 3.3 | 2.5 - 5.5 | 4 | 93 | 88 | 200/6800 |
| R-745.0x | 6.5 - 28 | 5.0 | 3.0 - 5.5 | 4 | 95 | 91 | 200/6800 |
| R-746.5x | 8.5 - 28 | 6.5 | 5.0 - 7.5 | 4 | 96 | 93 | 200/6800 |

Notes:

Note1: Vin-Vout ≥ 1.5V~4.0V depending on Vout if adjust function is used

Note2: Please refer to basic characteristics on page I-2

Model Numbering



Notes:

Note3: x can be „P“ = vertical through hole

x can be „D“ = bent pins for horizontal through hole mounting

Ordering Examples:

R-723.3P Iout= 2A nom. Vout= 3.3VDC P= vertical through hole
 R-7312D Iout= 3A nom. Vout= 12VDC D= horizontal through hole

Specifications (refer to standard application circuit, Ta= 25°C)

BASIC CHARACTERISTICS

| Parameter | Condition | Min. | Typ. | Max. |
|------------------------------|--|--------|---|-----------------------|
| Quiescent Current | min. Vin to max. | | | 30mA |
| Internal Power Dissipation | ta<60°C | | | 1.4W |
| Output Current Limit | R-72xxx R-73xxx R-74xxx | | 2.5A 3.75A 5.0A | 3.0A 4.25A 5.5A |
| Minimum Load | | 10% | | |
| ON/OFF CTRL ⁽⁴⁾ | DC-DC ON DC-DC OFF | | Open or high, 4.5V min. / 28V max. Low (Power OFF) 0.8V max. | |
| Input Current of CTRL Pin | DC-DC OFF | | | 100µA |
| Internal Operating Frequency | | 270kHz | 300kHz | 330kHz |
| Output Ripple and Noise | | | 40mVp-p | 70mVp-p |
| Maximum Capacitive Load | normal start-up time, no external diodes | | | 200µF |
| | <1 second start-up time + diode protection circuit | | | 6800µF |

Notes:

Note4: ON/OFF pin driven by TTL (logic gate), open-collector bipolar transistor or open-drain MOSFET

How to calculate the max. output current

The internal power dissipation (P_D) follows the equation:

$$P_D = I_{out} \times V_{out} \times (1 - \text{Eff}_{\max Vin})$$

$$I_{out} = \frac{P_D}{V_{out} \times (1 - \text{Eff}_{\max Vin})}$$

Example: R-745.0P

Calculation 1:

$$V_{in} = 28V$$

$$V_{out} = 5V$$

$$\text{Eff}_{\max Vin} = 91\%$$

$$P_D = 1.4W$$

$$T_{Ambient} = 60^\circ C$$

$$I_{out} = \frac{1.4W}{5V \times (1 - 0.91)} = 3.11A$$

Calculation 2:

$$V_{in} = 28V$$

$$V_{out} = 5V$$

$$\text{Eff}_{\max Vin} = 91\%$$

$$P_D = 1.0W$$

$$T_{Ambient} = 85^\circ C$$

$$I_{out} = \frac{1W}{5V \times (1 - 0.91)} = 2.222A$$

Calculation 3:

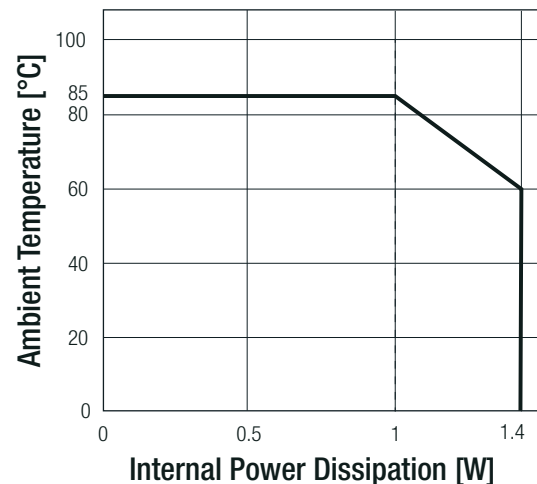
$$V_{in} = 12V$$

$$\text{Eff}_{\max Vin} = 94\%$$

$$P_D = 1.0W$$

$$T_{Ambient} = 85^\circ C$$

$$I_{out} = \frac{1W}{5V \times (1 - 0.94)} = 3.33A$$

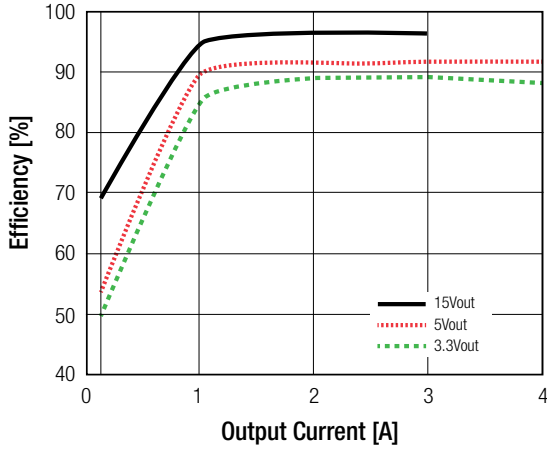


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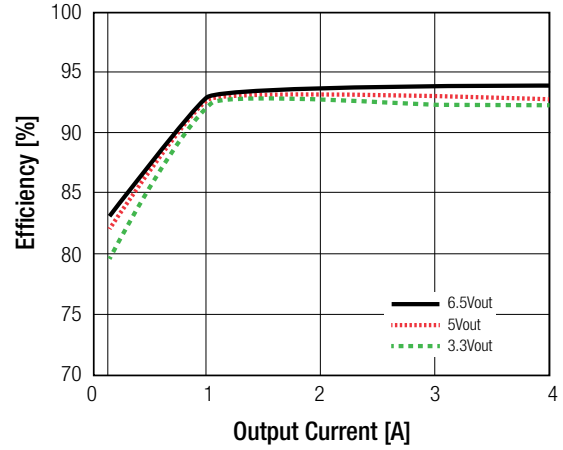
Specifications (refer to standard application circuit, Ta= 25°C)

Efficiency vs. Load

R-72xx / R-73xx / R-74xx
max. Vin

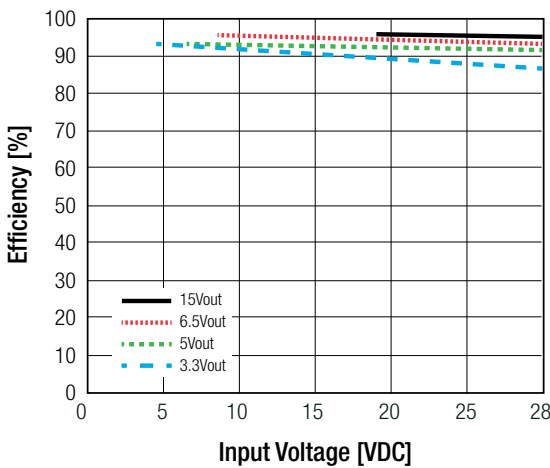


R-72xx / R-73xx / R-74xx
min. Vin

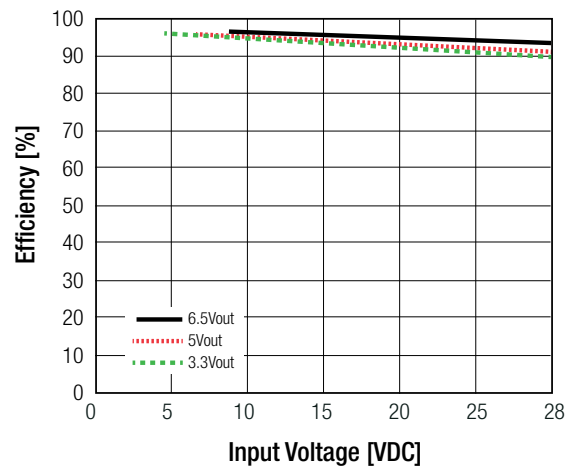


Efficiency vs. Input Voltage

R-72xx / R-73xx

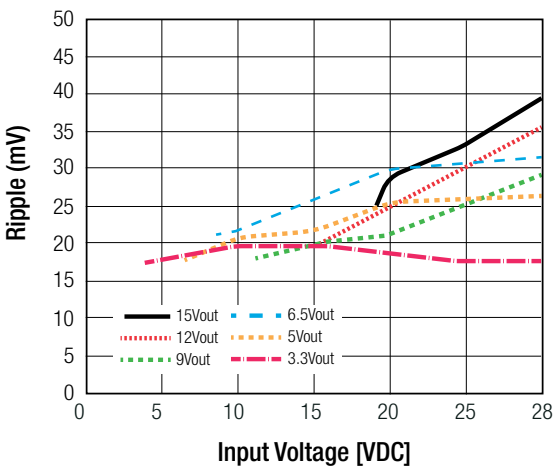


R-74xx

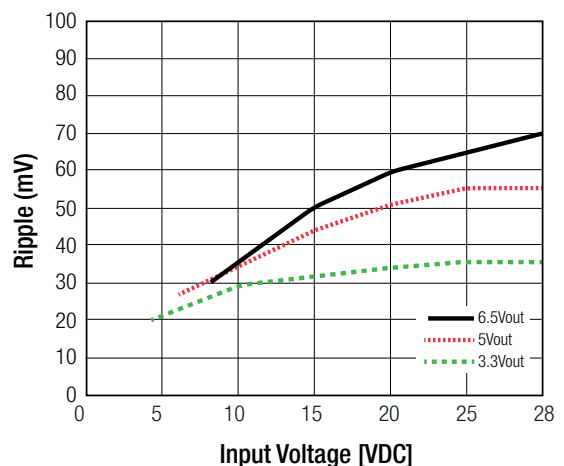


Ripple vs. Input Voltage

R-72xx / R-73xx



R-74xx



Specifications (refer to standard application circuit, Ta= 25°C)

Trim Table

| | | | | | | |
|------|------------|------------|------------|------------|-----------|-----------|
| 2ADC | R-723.3P/D | R-725.0P/D | R-726.5P/D | R-729.0P/D | R-7212P/D | R-7215P/D |
| 3ADC | R-733.3P/D | R-735.0P/D | R-736.5P/D | R-739.0P/D | R-7312P/D | R-7315P/D |
| 4ADC | R-743.3P/D | R-745.0P/D | R-746.5P/D | | | |

| Vout nom. | 3.3VDC | | 5.0VDC | | 6.5VDC | | 9.0VDC | | 12VDC | | 15VDC | |
|-----------|-------------------|-----------------|-------------------|-----------------|-------------------|-----------------|-------------------|-----------------|-------------------|-----------------|-------------------|-----------------|
| Vout adj. | R _{down} | R _{up} | R _{down} | R _{up} | R _{down} | R _{up} | R _{down} | R _{up} | R _{down} | R _{up} | R _{down} | R _{up} |
| 2.5 | 8.5kΩ | | | | | | | | | | | |
| 3.0 | 33kΩ | | 470Ω | | | | | | | | | |
| 3.2 | 110kΩ | | 1.6kΩ | | | | | | | | | |
| 3.3 | | | 2.2kΩ | | | | | | | | | |
| 3.4 | | 36kΩ | 3.0kΩ | | | | | | | | | |
| 3.6 | | 11kΩ | 4.7kΩ | | | | | | | | | |
| 3.9 | | 4.7kΩ | 8.5kΩ | | | | | | | | | |
| 4.5 | | 1.6kΩ | 30kΩ | | | | | | | | | |
| 4.9 | | 820Ω | 220kΩ | | | | | | | | | |
| 5.0 | | 680Ω | | | 11kΩ | | | | | | | |
| 5.1 | | 560Ω | | 28kΩ | 12kΩ | | | | | | | |
| 5.5 | | 190Ω | | 2.6kΩ | 20kΩ | | | | | | | |
| 6.0 | | | | | 47kΩ | | | | | | | |
| 6.5 | | | | | | | | | | | | |
| 7.0 | | | | | | 4.5kΩ | 13kΩ | | | | | |
| 7.5 | | | | | | 2.2kΩ | | | | | | |
| 8.0 | | | | | | | 31kΩ | | | | | |
| 9.0 | | | | | | | | | | | | |
| 10 | | | | | | | | 2.2kΩ | 20kΩ | | | |
| 11 | | | | | | | | 390Ω | 47kΩ | | | |
| 12 | | | | | | | | | | | | |
| 13 | | | | | | | | | | 2.4kΩ | 36kΩ | |
| 14 | | | | | | | | | | 390Ω | 76kΩ | |
| 15 | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | 2.6kΩ |
| 17 | | | | | | | | | | | | 860Ω |

REGULATIONS

| Parameter | Condition | Value |
|-----------------------------------|--|---------------------------------------|
| Output Accuracy | full load | ±1.0% typ. / ±2.0% max. |
| Line Regulation | low line to high line, full load | ± 0.5% typ. / ±1.0% max. |
| Load Regulation ⁽⁶⁾ | 10% to 100%, full load | ± 0.5% typ. / ±1.0% max. |
| Transient Response ⁽⁶⁾ | 50% load step change Vout Over / Undershoot | 100µs typ. / 200µs max. 100mV max. |

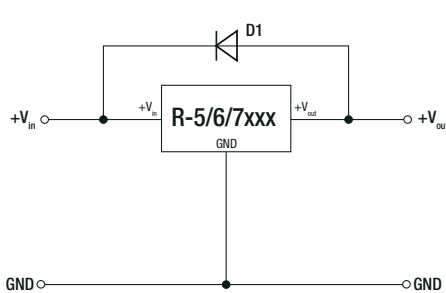
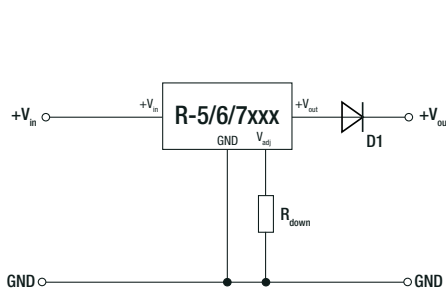
Notes:

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

Note6: Requires a 100µF electrolytic or tantalum output capacitor for proper operation in all applications (the capacitor has to be placed as close as possible to the output pins)

Specifications (refer to standard application circuit, Ta= 25°C)

| PROTECTIONS | | |
|--------------------------------|-----------|--------------------------------|
| Parameter | Condition | Value |
| Short Circuit Protection (SCP) | | continuous, automatic recovery |
| Short Circuit Input Current | | 50mA typ. / 100mA max. |

| Optional Diode Protection Circuit | |
|---|--|
| <p>Add a blocking diode to Vout if current can flow backwards into the output, as this can damage the converter when it is powered down. Protection diodes are required for high capacitive loads.</p> <p>The diode can either be fitted across the device, if the source is low impedance or fitted in series with the output (recommended).</p> | <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Optional Protection 1:</p>  </div> <div style="text-align: center;"> <p>Optional Protection :</p>  <p><i>R_{down}</i>: Trim output voltage up to 1 diode drop</p> </div> </div> |

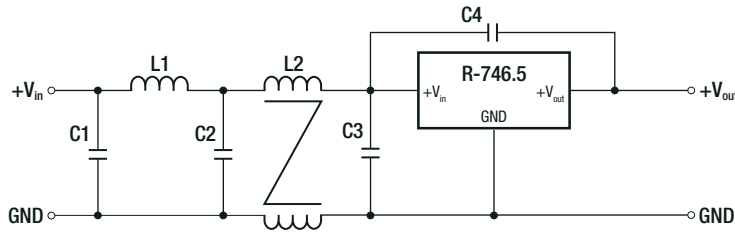
| ENVIRONMENTAL | | | |
|-----------------------------|--|----------------|-----------------------------|
| Parameter | Condition | Value | |
| Operating Temperature Range | without derating @ natural convection 0.1m/s | -40°C to +85°C | |
| Maximum Case Temperature | | +110°C | |
| Thermal Impedance | @ natural convection 0.1m/s | 25°C/W | |
| Operating Humidity | non-condensing | 95% RH max. | |
| Operating Altitude | | 2000m | |
| Pollution Degree | | PD2 | |
| MTBF | according to MIL-HDBK 217F, G.B. | +25°C | 749 x 10 ³ hours |
| | | +85°C | 150 x 10 ³ hours |

| SAFETY AND CERTIFICATIONS | | |
|---|----------------------|--|
| Certificate Type (Safety) | Report / File Number | Standard |
| Information Technology Equipment, General Requirements for Safety | 1605077-12 | IEC60950-1:2005, 2nd Edition + AM2:2013 EN60950-1:2006 + AM2:2013 |
| EAC | RU-AT.49.09571 | TP TC 004/2011 |
| RoHS 2+ | | RoHS-2011/65/EU + AM-2015/863 |

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Specifications (refer to standard application circuit, Ta= 25°C)

EMC Filtering Suggestions according to EN55032



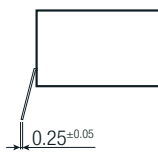
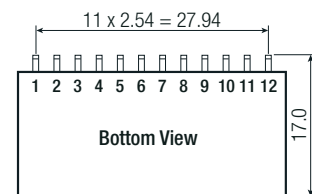
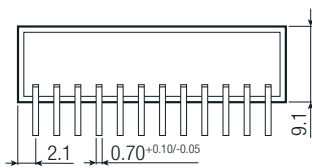
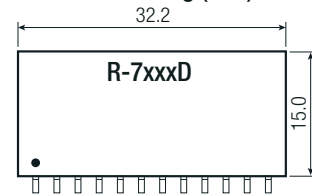
Component List

| EN55022 | C1 | C2 | C3 | C4 | L1 | L2 |
|---------|------------|------------|---------|-----|------------|------------|
| Class A | N/A | 33 μ F | N/A | N/A | N/A | 0.45mH CMC |
| Class B | 10 μ F | 33 μ F | 1nF/2kV | 2mH | 0.45mH CMC | |

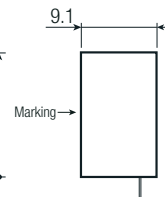
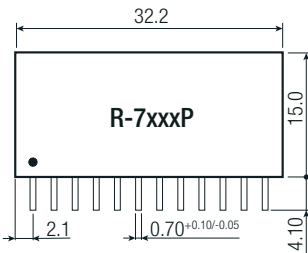
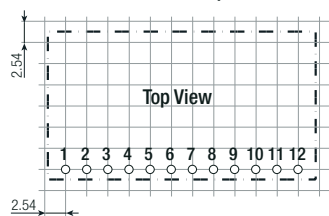
DIMENSION AND PHYSICAL CHARACTERISTICS

| Parameter | Type | Value |
|-------------------|-----------------|---|
| Material | case potting | non-conductive black plastic, (UL94 V-0) epoxy, (UL94 V-0) |
| Dimension (LxWxH) | | 32.2 x 9.1 x 15.0mm |
| Weight | | 9g typ. |

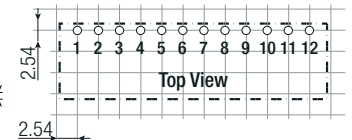
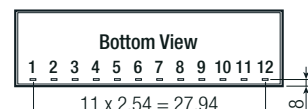
Dimension Drawing (mm)



Recommended Footprint Details



Recommended Footprint Details



Pin Connections

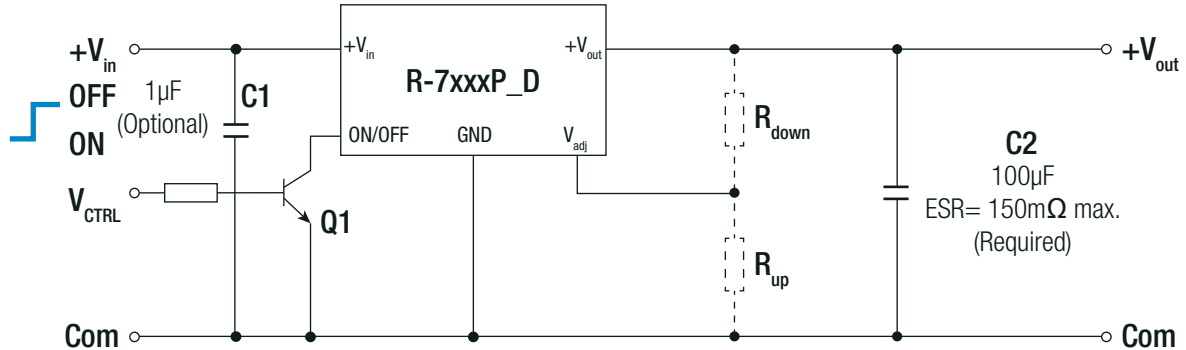
| Pin # | Single | Description |
|------------|--------|--|
| 1 | ON/OFF | Input pin: Active low (less than 0.8V) to disable the device |
| 2,3,4 | Vin | Power Input |
| 5, 6, 7, 8 | GND | Input and Output ground (common) |
| 9, 10, 11 | Vout | Power output |
| 12 | Vadj | with external resistors R1, R2 to selected output voltage |

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

Specifications (refer to standard application circuit, Ta= 25°C)

INSTALLATION AND APPLICATION

Standard Application Circuit



Add blocking diode to Vout if current can flow backwards into the output, as this can damage the converter.
(Please refer to "Optional Diode Protection Circuit" on Page I-5)

PACKAGING INFORMATION

| Parameter | Type | Value |
|------------------------------|---------|-----------------------|
| Packaging Dimensions (LxWxH) | R-7xxxD | 520.0 x 20.0 x 19.0mm |
| | R-7xxxP | 530.0 x 23.0 x 19.0mm |
| Packaging Quantity | tube | 15pcs |
| Storage Temperature Range | | -40°C to +125°C |

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