

Features

Regulated Converters

- 4:1 Input Voltage Range
- 2.25kVDC Isolation
- UL Certified
- Efficiency up to 87%
- Ultraminiature Open Frame SMD
- No Minimum Load Required



RP15-OFW

**15 Watt
Single
Output
Open Frame
SMD**



Description

The RP15-OFW series are SMD open frame ultraminiature power DC/DC converters in a case half the size of industry standard 15W converters. The converters use solder ball pins to enable SMD mounting and can be reflow soldered. Despite their small size, the RP15-OFW converters are fully specified devices with output currents up to 4 Amps, no minimum load, 2250VDC isolation and low ripple/noise figures. The outputs are also fully protected against short circuits, overcurrent and overvoltage. The RP15-OFW series will find many uses in telecommunications and other demanding applications where price, board space or board height is at a premium.

Selection Guide

| Part Number | Input Voltage Range [VDC] | Output Voltage [VDC] | Output Current [mA] | Input ⁽¹⁾ Current [mA] | Efficiency ⁽¹⁾ typ. [%] | Max. Capacitive Load ⁽²⁾ [µF] |
|-------------------------------|---------------------------|----------------------|---------------------|-----------------------------------|------------------------------------|--|
| RP15-243.3SOFW ⁽³⁾ | 9-36 | 3.3 | 4000 | 647 | 85 | 12000 |
| RP15-2405SOFW ⁽³⁾ | 9-36 | 5 | 3000 | 718 | 87 | 6000 |
| RP15-2412SOFW ⁽³⁾ | 9-36 | 12 | 1300 | 756 | 86 | 1000 |
| RP15-2415SOFW ⁽³⁾ | 9-36 | 15 | 1000 | 727 | 86 | 660 |
| RP15-483.3SOFW ⁽³⁾ | 18-75 | 3.3 | 4000 | 324 | 85 | 12000 |
| RP15-4805SOFW ⁽³⁾ | 18-75 | 5 | 3000 | 359 | 87 | 6000 |
| RP15-4812SOFW ⁽³⁾ | 18-75 | 12 | 1300 | 378 | 86 | 1000 |
| RP15-4815SOFW ⁽³⁾ | 18-75 | 15 | 1000 | 363 | 86 | 660 |

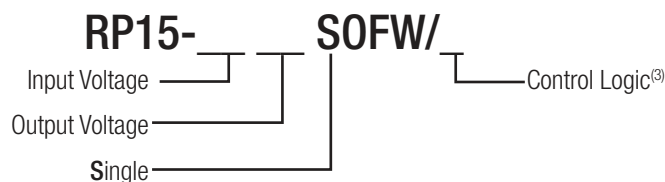
Notes:

- Note1: Values at nominal input voltage and no load/full load.
 Note2: Test by minimum Vin and constant resistor load.



UL60950-1 Certified

Model Numbering



Ordering Examples

- RP15-4805SOFW = 48V 4:1 Input, 5V Output, No CTRL pin, No Trim Pin
 RP15-4805SOFW/P = 48V 4:1 Input, 5V Output, Positive Logic CTRL pin and Trim pin fitted.
 RP15-243.3SOFW/N = 24V 4:1 Input, 3.3V Output, Negative Logic CTRL pin and Trim pin fitted

Notes:

- Note3: No suffix for standard part without Trim or CTRL
 add suffix "P" for CTRL function with positive logic (1=ON, 0=OFF) and trim pin
 add suffix "N" for CTRL function with negative logic (0=ON, 1=OFF) and trim pin

Specifications measured at $T_a = 25^\circ\text{C}$, nominal input voltage, full load otherwise noted

| BASIC CHARACTERISTICS | | | | |
|---------------------------------------|--|------------------|----------------------|--|
| Parameter | Condition | Min. | Typ. | Max. |
| Input Voltage Range | nom. $V_{in} = 24\text{V}$ nom. $V_{in} = 48\text{V}$ | 9DC 18VDC | 24VDC 48VDC | 36VDC 75VDC |
| Under Voltage Lockout (UVLO) | $V_{in} = 24\text{V}$ DC-DC ON DC-DC OFF | | 8VDC | 9VDC |
| | $V_{in} = 48\text{V}$ DC-DC ON DC-DC OFF | | 16VDC | 18VDC |
| Input Filter | | | | Pi-Type |
| Input Reflected Ripple ⁽⁴⁾ | nominal V_{in} and full load | | 30mA _{p-p} | |
| Input Surge Voltage | $V_{in} = 24\text{V}$, 100ms max. $V_{in} = 48\text{V}$, 100ms max. | | | 50VDC 100VDC |
| Start-up time | Power up | | | 30ms |
| | Remote ON/OFF | | | 30ms |
| Operating Frequency Range | 3.3V _{out} , 5V _{out} | 315kHz 360kHz | 350kHz 400kHz | 385kHz 440kHz |
| | 12V _{out} , 15V _{out} | | | |
| Minimum Load | full load | 0% | | |
| Optional Output Trim ⁽⁵⁾ | | | | $\pm 10.0\%$ |
| Ripple and Noise | 20MHz bandwidth, with $1\mu\text{F}$ M/C X7R and a $10\mu\text{F}$ T/C | | 100mV _{p-p} | |
| Remote ON/OFF ⁽⁵⁾ | Positive Logic DC-DC ON DC-DC OFF | | | Open or $3.0\text{V} < V_r < 15\text{V}$ Short or $0\text{V} < V_r < 1.2\text{V}$ |
| | Negative Logic DC-DC ON DC-DC OFF | | | Short or $0\text{V} < V_r < 1.2\text{V}$ Open or $3.0\text{V} < V_r < 15\text{V}$ |
| Input current of Remote pin (CTRL) | DC-DC OFF | | 2.5mA | |
| | DC-DC ON | -0.5mA | | +1.0mA |

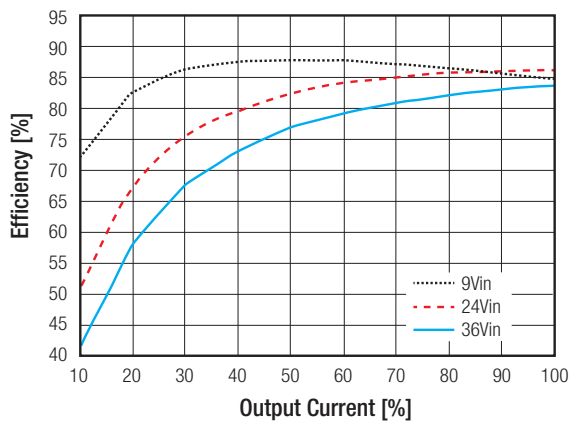
Notes:

Note4: Simulated source impedance of $12\mu\text{H}$. $12\mu\text{H}$ inductor in series with $+V_{in}$.

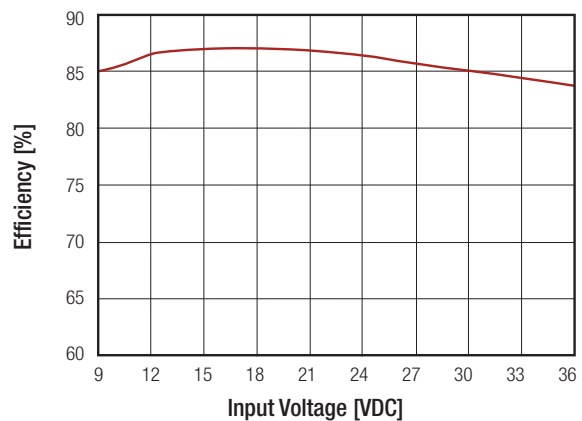
Note5: If no suffix is specified, the control and trim pins will be omitted. If fitted, the ON/OFF control function can be positive or negative logic. The pin voltage is referenced to $-V_{in}$.

RP15-2405S0FW

Efficiency vs. Output Current



Efficiency vs. Input Voltage

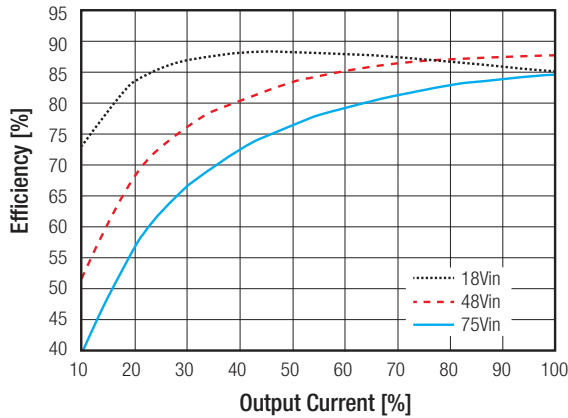


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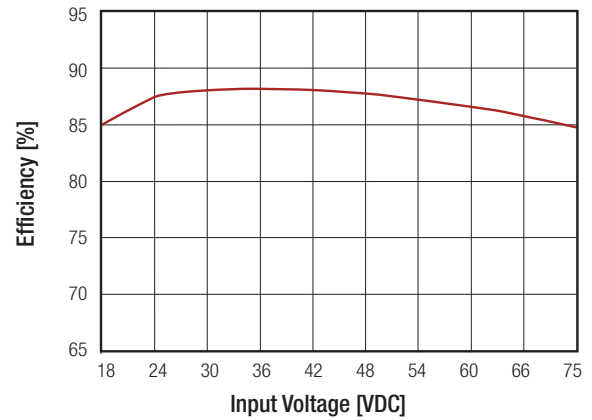
Specifications measured at Ta = 25°C, nominal input voltage, full load otherwise noted

RP15-4805S0FW

Efficiency vs. Output Current



Efficiency vs. Input Voltage



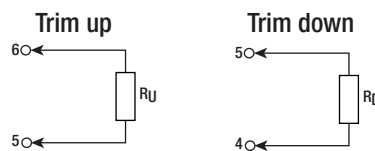
REGULATIONS

| Parameter | Condition | Value |
|----------------------------------|------------------------------------|-------|
| Output Voltage Accuracy | | ±1% |
| Voltage Adjustability | | ±10% |
| Line Voltage Regulation | low line to high line at full load | ±0.2% |
| Load Voltage Regulation | 0% to 100% load | ±0.2% |
| Transient Response recovery time | 25% load step change | 250µs |

External Output Trimming

Output Voltage Trimming

Single output Powerline Plus converters offer the feature of trimming the output voltage over a certain range around the nominal value by using external trim resistors. No general equation can be given for calculating the trim resistors, but the following trimtables give typical values for choosing these trimming resistors. If voltages between the given trim points are required, extrapolate between the two nearest given values to work out the resistor required or use a variable resistor to set the output voltage. Output can be externally trimmed by using the method shown below.



RP15-xx3.3S0F

| Trim up | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
|--------------------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|
| V _{out} = | 3.333 | 3.366 | 3.399 | 3.432 | 3.465 | 3.498 | 3.531 | 3.564 | 3.597 | 3.63 | Volts |
| R _U = | 385.07 | 191.51 | 126.99 | 94.73 | 75.37 | 62.47 | 53.25 | 46.34 | 40.96 | 36.66 | kOhms |
| Trim down | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
| V _{out} = | 3.267 | 3.234 | 3.201 | 3.168 | 3.135 | 3.102 | 3.069 | 3.036 | 3.003 | 2.97 | Volts |
| R _D = | 116.72 | 54.78 | 34.13 | 23.81 | 17.62 | 13.49 | 10.54 | 8.32 | 6.60 | 5.23 | kOhms |

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Specifications measured at Ta = 25°C, nominal input voltage, full load otherwise noted

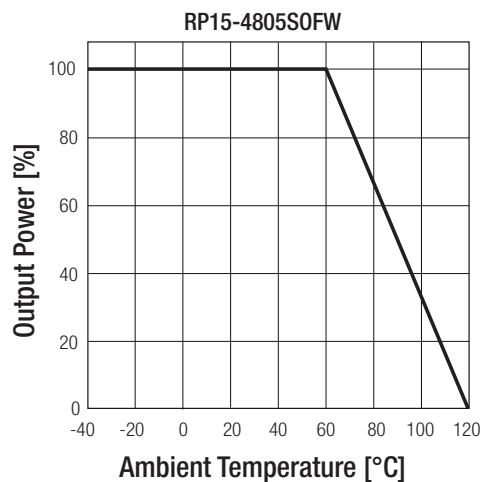
| RP15-xx05S0F | | | | | | | | | | | |
|------------------|--------|--------|--------|--------|--------|--------|--------|-------|-------|-------|-------|
| Trim up | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
| Vout = | 5.05 | 5.10 | 5.15 | 5.20 | 5.25 | 5.30 | 5.35 | 5.4 | 5.45 | 5.50 | Volts |
| R _U = | 253.45 | 125.70 | 83.12 | 61.82 | 49.05 | 40.53 | 34.45 | 29.89 | 26.34 | 23.50 | kOhms |
| | | | | | | | | | | | |
| Trim down | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
| Vout = | 4.95 | 4.90 | 4.85 | 4.80 | 4.75 | 4.70 | 4.65 | 4.60 | 4.55 | 4.50 | Volts |
| R _D = | 248.34 | 120.59 | 78.01 | 56.71 | 43.94 | 35.42 | 29.34 | 24.78 | 21.23 | 18.39 | kOhms |
| RP15-xx12S0F | | | | | | | | | | | |
| Trim up | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
| Vout = | 12.12 | 12.24 | 12.36 | 12.48 | 12.60 | 12.72 | 12.84 | 12.96 | 13.08 | 13.20 | Volts |
| R _U = | 203.22 | 99.06 | 64.33 | 46.97 | 36.56 | 29.61 | 24.65 | 20.93 | 18.04 | 15.72 | kOhms |
| | | | | | | | | | | | |
| Trim down | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
| Vout = | 11.88 | 11.76 | 11.64 | 11.52 | 11.40 | 11.28 | 11.16 | 11.04 | 10.92 | 10.8 | Volts |
| R _D = | 776.56 | 380.72 | 248.78 | 182.81 | 143.22 | 116.83 | 97.98 | 83.85 | 72.85 | 64.06 | kOhms |
| RP15-xx15S0F | | | | | | | | | | | |
| Trim up | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
| Vout = | 15.15 | 15.3 | 15.45 | 15.60 | 15.75 | 15.90 | 16.05 | 16.20 | 16.35 | 16.50 | Volts |
| R _U = | 161.56 | 78.22 | 50.45 | 36.56 | 28.22 | 22.67 | 18.70 | 15.72 | 13.41 | 11.56 | kOhms |
| | | | | | | | | | | | |
| Trim down | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
| Vout = | 14.85 | 14.70 | 14.55 | 14.40 | 14.25 | 14.10 | 13.95 | 13.80 | 13.65 | 13.50 | Volts |
| R _D = | 818.22 | 401.56 | 262.67 | 193.22 | 151.56 | 123.78 | 103.94 | 89.06 | 77.48 | 68.22 | kOhms |

| PROTECTIONS | | |
|---|------------------------------|--|
| Parameter | Condition | Value |
| Short Circuit Protection (SCP) | | continuous, automatic recovery |
| Over Voltage Protection (OVP) | Zener Diode Clamp | 3.3Vout 5Vout 12Vout 15Vout 3.7 - 5.4V 5.6 - 7.0V 13.8 - 17.5V 16.8 - 20.5V |
| Over Load Protection (OLP) | % of lout rated, Hiccup mode | 150% typ. |
| Isolation Voltage | I/P to O/P | 2.25kVDC/1 minute |
| Isolation Resistance | 500VDC | 1GΩ min. |
| Isolation Capacitance | | 1500pF typ. |
| <p>Notes: Note6: This power module is not internally fused. An input line fuse must always be used.</p> | | |

Specifications measured at Ta = 25°C, nominal input voltage, full load otherwise noted

| ENVIRONMENTAL | | |
|----------------------------------|--|--|
| Parameter | Condition | Value |
| Reflow Soldering Process | | IPC J-STD-020D |
| Moisture sensitivity level (MSL) | | IPC J-STD-03B level 2a |
| Operating Temperature Range | without derating with derating | -40°C to +70°C -40°C to +120°C |
| Temperature Coefficient | | ±0.02%/°C max. |
| Thermal Impedance | Natural convection (20LFM) | 18.2°C/Watt |
| Operating Humidity | | 5% - 95% RH |
| Thermal Shock | | MIL-STD-810F |
| Vibration | | MIL-STD-810F |
| MTBF | MIL-HDBK-217F Bellcore TR-NWT-000332 ⁽⁷⁾ | 2444 x 10 ³ hours 1322 x 10 ³ hours |

Derating Graph⁽⁸⁾



Notes:

- Note7: BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C.
MIL-HDBK 217F Notice 2. Ta = 25°C, full load, (Ground Benign, controlled environment).
- Note8: Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical support service at techsupportAT@recom-power.com

| SAFETY AND CERTIFICATIONS | | |
|--------------------------------|----------------------|---|
| Certificate Type (Safety) | Report / File Number | Standard |
| UL General Safety | E196683 | UL60950-1 1st Ed.: 2003 C22.2 No. 60950 1st. Ed.: 2003 |
| EMC Compliance | Condition | Standard / Criterion |
| EMI Standard ⁽⁹⁾ | with external filter | EN55022, Class A, Class B |
| Radiated Immunity | 10 V/m | EN61000-4-3, Criteria A |
| Fast Transient ⁽¹⁰⁾ | ±2kV | EN61000-4-4, Criteria A |
| Surge ⁽¹⁰⁾ | ±1kV | EN61000-4-5, Criteria A |
| Conducted Immunity | 10 Vr.m.s | EN61000-4-6, Criteria A |

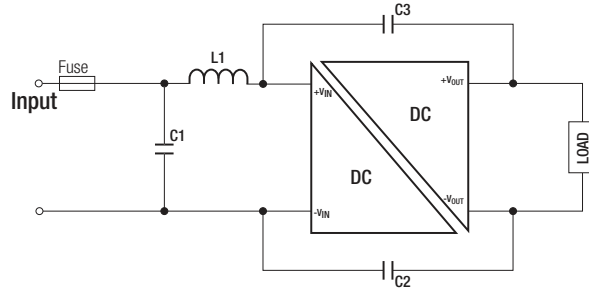
Notes:

- Note9: The standard modules meet EMI Class A or Class B with external components, see filter suggestions below.
- Note10: An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5. The filter capacitor Recom suggests: Nippon chemi-con KY series, 220µF/100V.

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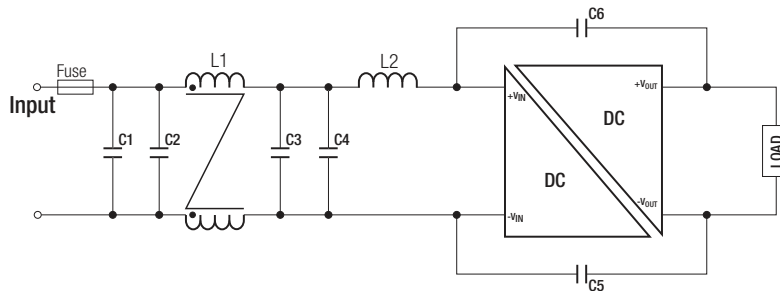
Specifications measured at Ta = 25°C, nominal input voltage, full load otherwise noted

EMI Filtering Class A



| MODEL | C1 | C2/C3 | L1 |
|---------------|-------------------------|------------------------|--|
| RP15-24xxSOFW | 6.8µF/50V 1812 MLCC | 470pF/3kV 1808 MLCC | 10µH 2.6A 0.04Ω 0705 SMD Inductor ref.: WE 744787330 |
| RP15-48xxSOFW | 2.2µF/100V 1812 MLCC | 470pF/3kV 1808 MLCC | 18µH 1.6A 0.1Ω 0705 SMD Inductor ref.: WE 744053180 |

EMI Filtering Class B



| MODEL | C1 | C2 | C3/C4 | C5/C6 | L1 | L2 |
|---------------|-------------------------|-------------------------|-------------------------|------------------------|---|--|
| RP15-24xxSOFW | N/A | 6.8µF/50V 1812 MLCC | 6.8µF/50V 1812 MLCC | 470pF/3kV 1808 MLCC | CMC: 145µH ref.: WE 7482210002 ref.: CMC-07 | 10µH 2.6A 0.04Ω 0705 SMD Inductor ref.: WE 744787330 |
| RP15-48xxSOFW | 2.2µF/100V 1812 MLCC | 2.2µF/100V 1812 MLCC | 2.2µF/100V 1812 MLCC | 470pF/3kV 1808 MLCC | CMC: 325µH ref.: WE 744290321 ref.: CMC-06 | 33µH 1.2A 0.13Ω 0504 SMD Inductor ref.: WE 744787100 |

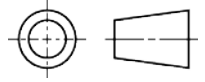
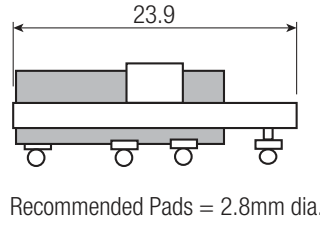
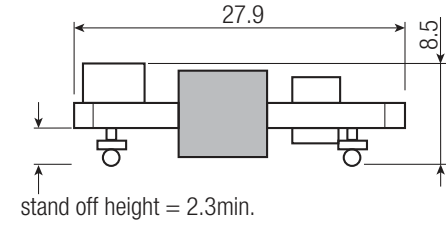
DIMENSIONS and PHYSICAL CHARACTERISTICS

| Parameter | Type | Value |
|----------------------------|------|---------------------|
| Material | Base | FR4 PCB |
| Package Dimensions (LxWxH) | | 27.9 x 23.9 x 8.5mm |
| Package Weight | | 10.5g |

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Specifications measured at Ta = 25°C, nominal input voltage, full load otherwise noted

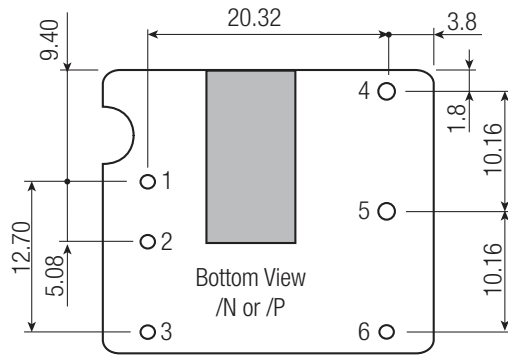
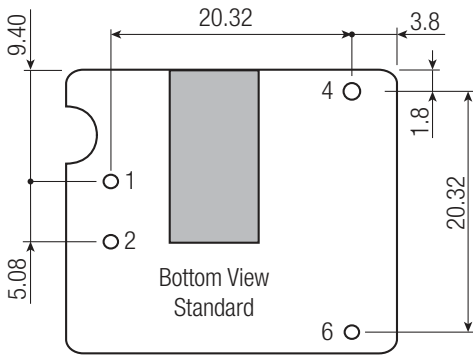
Dimension Drawing (mm)



Pin Connections

| Pin # | Single | /P or /N |
|-------|--------|----------|
| 1 | +Vin | +Vin |
| 2 | -Vin | -Vin |
| 3 | no pin | CTRL |
| 4 | +Vout | +Vout |
| 5 | no pin | Trim |
| 6 | -Vout | -Vout |

Pin Pitch Tolerance ±0.25mm
PCB Tolerance ±0.5mm
SMD Pin Pitch Tolerance ±0.25mm
X.X ±0.5mm
X.XX ±0.25mm



PACKAGING INFORMATION

| Parameter | Type | Value |
|---------------------------|------|-----------------|
| Packaging Quantity | | 20pcs. |
| Storage Temperature Range | | -55°C to +125°C |
| Storage Humidity | | 5% - 95% RH |

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