DC/DC Converter
URH_LP-20WR3 Series

20W isolated DC-DC converter in DIP package
Ultra-wide input, regulated single output

FEATURES
- Ultra-wide 4:1 input voltage range
- High efficiency up to 89%
- No-load power consumption as low as 0.12W
- Operating ambient temperature range: -40°C ~ +85°C
- Reinforced insulation, I/O isolation test voltage 5k
  VAC, rated for 250VAC working voltage
- Transformer creepage 8mm, Transformer clearance 8mm
- Low leakage current < 5 µA
- Meets CISPR32/EN55032 CLASS A, without extra components
- Input under-voltage protection, output short-circuit, over-current, over-voltage protection
- Industry standard pin-out
- Meets 2xMOPP EN60601-1 third edition medical certification standard (Pending)
- Meets EN62368 standard (Pending)

URH_LP-20WR3 series of isolated 20W DC-DC products with a 4:1 input voltage range. They feature efficiencies of up to 89%, 5000VAC input to output isolation, over-voltage, output short-circuit protection. They meet CLASS A of CISPR32/EN55032 EMI standards without extra components, meets EN60601-1 third edition medical certification standard (Pending). They are widely used in high isolation required area such as medical application.

### Selection Guide

<table>
<thead>
<tr>
<th>Certification</th>
<th>Part No.</th>
<th>Input Voltage (VDC)</th>
<th>Output</th>
<th>Full Load Efficiency (%)</th>
<th>Capacitive Load (µF)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Nominal (Range)</td>
<td>Max.*</td>
<td>Voltage (VDC)</td>
<td>Current (mA) Max./Min.</td>
</tr>
<tr>
<td>CE (Pending)</td>
<td>URH2403LP-20WR3</td>
<td>24 (9-36)</td>
<td>40</td>
<td>3.3</td>
<td>5000/0</td>
</tr>
<tr>
<td></td>
<td>URH2405LP-20WR3</td>
<td></td>
<td></td>
<td>5</td>
<td>4000/0</td>
</tr>
<tr>
<td></td>
<td>URH2412LP-20WR3</td>
<td></td>
<td></td>
<td>12</td>
<td>1666/0</td>
</tr>
<tr>
<td></td>
<td>URH2415LP-20WR3</td>
<td></td>
<td></td>
<td>15</td>
<td>1333/0</td>
</tr>
<tr>
<td></td>
<td>URH2424LP-20WR3</td>
<td></td>
<td></td>
<td>24</td>
<td>833/0</td>
</tr>
<tr>
<td></td>
<td>URH4803LP-20WR3</td>
<td>48 (18-75)</td>
<td>80</td>
<td>3.3</td>
<td>5000/0</td>
</tr>
<tr>
<td></td>
<td>URH4805LP-20WR3</td>
<td></td>
<td></td>
<td>5</td>
<td>4000/0</td>
</tr>
<tr>
<td></td>
<td>URH4812LP-20WR3</td>
<td></td>
<td></td>
<td>12</td>
<td>1666/0</td>
</tr>
<tr>
<td></td>
<td>URH4815LP-20WR3</td>
<td></td>
<td></td>
<td>15</td>
<td>1333/0</td>
</tr>
<tr>
<td></td>
<td>URH4824LP-20WR3</td>
<td></td>
<td></td>
<td>24</td>
<td>833/0</td>
</tr>
</tbody>
</table>

Note: * Exceeding the maximum input voltage may cause permanent damage.

### Input Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Operating Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Current (full load / no-load)</td>
<td>24VDC input</td>
<td>3.3V, 5V output</td>
<td>--</td>
<td>969/40</td>
<td>992/50</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>--</td>
<td>969/8</td>
<td>992/15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>48VDC input</td>
<td>3.3V, 5V output</td>
<td>--</td>
<td>479/20</td>
<td>490/30</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>--</td>
<td>478/5</td>
<td>491/10</td>
<td></td>
</tr>
<tr>
<td>Reflected Ripple Current</td>
<td>24VDC input</td>
<td>--</td>
<td>30</td>
<td>--</td>
<td>VDC</td>
</tr>
<tr>
<td></td>
<td>48VDC input</td>
<td>--</td>
<td>30</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Surge Voltage (1sec. max.)</td>
<td>24VDC input</td>
<td>-0.7</td>
<td>--</td>
<td>50</td>
<td>VDC</td>
</tr>
<tr>
<td></td>
<td>48VDC input</td>
<td>-0.7</td>
<td>--</td>
<td>100</td>
<td>VDC</td>
</tr>
</tbody>
</table>
## DC/DC Converter

**URH_LP-20WR3 Series**

### General Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Operating Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation</td>
<td>Input-output Electric Strength test for 1 minute with a leakage current of 1mA max.</td>
<td>5000</td>
<td>--</td>
<td>--</td>
<td>VAC</td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>Input-output resistance at 500VDC</td>
<td>10000</td>
<td>--</td>
<td>--</td>
<td>MΩ</td>
</tr>
<tr>
<td>Isolation Capacitance</td>
<td>Input-output capacitance at 100KHz/0.1V</td>
<td>--</td>
<td>40</td>
<td>--</td>
<td>pF</td>
</tr>
<tr>
<td>Patient Leakage Current</td>
<td>240VAC/60Hz</td>
<td>--</td>
<td>3.6</td>
<td>5</td>
<td>uA</td>
</tr>
<tr>
<td>Reinforced Insulation</td>
<td>Transformer creepage</td>
<td>8.0</td>
<td>--</td>
<td>--</td>
<td>mm</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>See Fig. 1</td>
<td>-40</td>
<td>--</td>
<td>85</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Humidity</td>
<td>Non-condensing</td>
<td>5</td>
<td>--</td>
<td>95</td>
<td>%RH</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td></td>
<td>-55</td>
<td>--</td>
<td>125</td>
<td>°C</td>
</tr>
<tr>
<td>Pin Soldering Resistance Temperature</td>
<td>Wave-soldering (Soldering time: 10s)</td>
<td>--</td>
<td>--</td>
<td>260</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soldering spot is 1.5mm away from case for 10 seconds</td>
<td>--</td>
<td>--</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>Vibration</td>
<td>10-150Hz, 5G, 0.75mm, along X, Y and Z</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Output Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Operating Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Accuracy</td>
<td></td>
<td>--</td>
<td>±1</td>
<td>±2</td>
<td>%</td>
</tr>
<tr>
<td>Linear Regulation</td>
<td>Input voltage variation from low to high at full load</td>
<td>--</td>
<td>±0.2</td>
<td>±0.5</td>
<td>%</td>
</tr>
<tr>
<td>Load Regulation</td>
<td>5%-100% load</td>
<td>--</td>
<td>±0.5</td>
<td>±1</td>
<td>%</td>
</tr>
<tr>
<td>Transient Recovery Time</td>
<td>25% load step change, nominal input voltage</td>
<td>--</td>
<td>300</td>
<td>500</td>
<td>μs</td>
</tr>
<tr>
<td>Transient Response Deviation</td>
<td>3.3V/5V output</td>
<td>--</td>
<td>±5</td>
<td>±8</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>--</td>
<td>±3</td>
<td>±5</td>
<td>%</td>
</tr>
<tr>
<td>Temperature Coefficient</td>
<td>Full load</td>
<td>--</td>
<td>--</td>
<td>±0.03</td>
<td>%/°C</td>
</tr>
<tr>
<td>Ripple &amp; Noise</td>
<td>20MHz bandwidth</td>
<td>3.3V/5V output</td>
<td>--</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>URH2415LP-20WR3</td>
<td>--</td>
<td>80</td>
<td>150</td>
<td>mVp-p</td>
</tr>
<tr>
<td></td>
<td>URH2424LP-20WR3</td>
<td>--</td>
<td>50</td>
<td>100</td>
<td>mVp-p</td>
</tr>
<tr>
<td>Over-current Protection</td>
<td></td>
<td>110</td>
<td>180</td>
<td>250</td>
<td>%Io</td>
</tr>
<tr>
<td>Over-voltage Protection</td>
<td></td>
<td>110</td>
<td>--</td>
<td>160</td>
<td>%Vo</td>
</tr>
<tr>
<td>Short-circuit Protection</td>
<td>Continuous, self-recovery</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trim</td>
<td></td>
<td>--</td>
<td>±10</td>
<td>--</td>
<td>%Vo</td>
</tr>
</tbody>
</table>

Notes:
1. Load regulation for 0%-100% load is ±5% max.;
2. Ripple & Noise of 3.3V/5VDC output converter for 0%-5% load is ±10% max; Ripple & Noise of other output converter for 0%-5% load is 5%Vo max. The "parallel cable" method is used for Ripple and Noise test, please refer to DC-DC Converter Application Notes for specific information;
3. It is required connecting an external 270uF electrolytic capacitor for 3.3V output voltage model.

### Start-up Voltage

<table>
<thead>
<tr>
<th>Voltage</th>
<th>24VDC</th>
<th>48VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>9</td>
<td>18</td>
</tr>
</tbody>
</table>

### Under-voltage Protection

<table>
<thead>
<tr>
<th>Voltage</th>
<th>24VDC</th>
<th>48VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>5.5</td>
<td>6.5</td>
</tr>
</tbody>
</table>

### Input Filter

<table>
<thead>
<tr>
<th>Type</th>
<th>Filter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pi filter</td>
</tr>
</tbody>
</table>

### Hot Plug

<table>
<thead>
<tr>
<th>Type</th>
<th>Unavailable</th>
</tr>
</thead>
</table>

### Ctrl *

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module on</td>
<td>Ctrl pin open or pulled high (3.5-12VDC)</td>
</tr>
<tr>
<td>Module off</td>
<td>Ctrl pin pulled low to GND (0-1.2VDC)</td>
</tr>
</tbody>
</table>

### Input current when off

| Current | 4 mA     |

Note: *The Ctrl pin voltage is referenced to input GND.*
Switching Frequency* | PWM mode (nominal input voltage, full load) | -- | 280 | KHz
MTBF | MIL-HDBK-217F @ 25°C | 1000 | -- | K hours

Note: *Switching frequency is measured at full load. The module reduces the switching frequency for light load (below 50%) efficiency improvement.

**Mechanical Specifications**
- **Case Material**: Black plastic; flame-retardant and heat-resistant (UL94-V0)
- **Dimensions**: 51.50 x 26.50 x 12.00 mm
- **Weight**: 27.0g (Typ.)
- **Cooling Method**: Free air convection

**Electromagnetic Compatibility (EMC)**

**Emissions**
- **CE**: URH2412LP-20WR3
  - CISPR32/EN55032 CLASS A (without extra components), CLASS B (see Fig. 3 for recommended circuit)
  - Others: CISPR32/EN55032 CLASS A (without extra components), CLASS B (see Fig. 4-② for recommended circuit)
- **RE**: URH2412LP-20WR3
  - CISPR32/EN55032 CLASS B (without extra components)
  - Others: CISPR32/EN55032 CLASS A (without extra components), CLASS B (see Fig. 4-② for recommended circuit)

**Immunity**
- **ESD**: IEC/EN61000-4-2 air ±15kV, contact ±8kV perf. Criteria B
- **RS**: IEC/EN61000-4-3 10V/m perf. Criteria A
- **EFT**: IEC/EN61000-4-4 100kHz ±2kV (see Fig. 4-① for recommended circuit) perf. Criteria B
- **Surge**: IEC/EN61000-4-5 line to line ±2kV (see Fig. 4-① for recommended circuit) perf. Criteria B
- **CS**: IEC/EN61000-4-6 10 Vrms perf. Criteria A
- **PFM**: IEC/EN61000-4-8 30 A/m, continuous perf. Criteria A

**Typical Characteristic Curves**

**Temperature Derating Curve**
- URH2403LP-20WR3, URH2405LP-20WR3 Temperature Derating Curve
- URH4803LP-20WR3, URH4805LP-20WR3 Temperature Derating Curve

**Fig. 1**
Design Reference

1. Typical application

All the DC/DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 2. Input and/or output ripple can be further reduced by appropriately increasing the input & output capacitor values Cin and Cout and/or by selecting capacitors with a low ESR (equivalent series resistance). Also make sure that the capacitance is not exceeding the specified max. capacitive load value of the product.

<table>
<thead>
<tr>
<th>Vin</th>
<th>Cin</th>
<th>Cout</th>
</tr>
</thead>
<tbody>
<tr>
<td>24VDC</td>
<td>100µF</td>
<td>270µF</td>
</tr>
<tr>
<td>48VDC</td>
<td>10µF - 47µF</td>
<td>270µF</td>
</tr>
</tbody>
</table>

2. EMC compliance circuit

Parameter description

<table>
<thead>
<tr>
<th>Model</th>
<th>URH2412LP-20WR3</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>10µF/50V</td>
</tr>
<tr>
<td>C2</td>
<td>Refer to the Cout in Fig. 2</td>
</tr>
<tr>
<td>LDM</td>
<td>4.7µH</td>
</tr>
</tbody>
</table>
3. Trim Function for Output Voltage Adjustment (open if unused)

Calculating Trim resistor values:

\[
\begin{align*}
\text{up: } R_t &= \frac{aR_3}{R_2-a} \\
\text{down: } R_t &= \frac{aR_1}{R_1-a} \\
\text{TRIM resistor connection (dashed line shows internal resistor network)}
\end{align*}
\]

\[a = \text{self-defined parameter.}\]

<table>
<thead>
<tr>
<th>Vout(V)</th>
<th>R1(Ω)</th>
<th>R2(Ω)</th>
<th>R3(Ω)</th>
<th>Vref(V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3</td>
<td>4.801</td>
<td>2.87</td>
<td>10</td>
<td>1.24</td>
</tr>
<tr>
<td>5</td>
<td>2.883</td>
<td>2.87</td>
<td>8.2</td>
<td>2.5</td>
</tr>
<tr>
<td>12</td>
<td>10.909</td>
<td>2.87</td>
<td>15</td>
<td>2.5</td>
</tr>
<tr>
<td>15</td>
<td>14.354</td>
<td>2.87</td>
<td>15</td>
<td>2.5</td>
</tr>
<tr>
<td>24</td>
<td>24.771</td>
<td>2.87</td>
<td>17.4</td>
<td>2.5</td>
</tr>
</tbody>
</table>

4. The products do not support parallel connection of their output

5. For additional information please refer to DC-DC converter application notes on www.mornsun-power.com
Notes:
1. For additional information on Product Packaging please refer to www.mornsun-power.com. The Packaging bag number: 58210039
2. The maximum capacitive load offered were tested at input voltage range and full load:
3. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25°C, humidity<75%RH with nominal input voltage and rated output load:
4. All index testing methods in this datasheet are based on company corporate standards;
5. We can provide product customization service, please contact our technicians directly for specific information;
6. Products are related to laws and regulations: see “Features” and “EMC”;
7. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

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