

The JMR10 series is a range of ultra-compact, regulated PCB-mount medical DC-DC converters which offers single and dual output voltages ranging from 5V to 15V. Housed in a ultra-compact DIP24 package, the JMR10 series features a 4:1 input voltage range and offers a  $\pm 10\%$  output trim on single output versions. Its low no load power increases efficiency and extends runtime in battery powered applications. The JMR10 series features worldwide medical approvals, 2 x MOPP 5kVAC reinforced isolation and extremely low leakage currents benefitting system designers with easy integration into a wide range of BF and CF rated medical applications including imaging, patient monitoring, surgical equipment, patient treatment and dentistry.



### Features

- ▶ Regulated single & dual outputs from 5 to 30VDC
- ▶ 4:1 input range
- ▶ Ultra-compact DIP24 PCB mount package
- ▶ Low no-load power
- ▶ 10% trim in single output versions
- ▶ IEC60601-1 medical safety agency approvals
- ▶ 5kVAC reinforced isolation
- ▶ 2 x MOPP at 250VAC
- ▶ 2 $\mu$ A patient leakage current
- ▶ Remote On/Off
- ▶ Short circuit, overload & overvoltage protection
- ▶ -40°C to +100°C operating temperature
- ▶ 3 year warranty

### Applications



Healthcare



Home  
healthcare



Medical  
Diagnostics

### Dimensions

31.8 x 20.3 x 10.2 mm (1.25" x 0.8" x 0.4")

### Models & ratings

| Model number | Input voltage    | Output voltage <sup>(1)</sup> | Output current | Efficiency <sup>(3)</sup> | Input current <sup>(4)</sup> |           | Maximum capacitive load |
|--------------|------------------|-------------------------------|----------------|---------------------------|------------------------------|-----------|-------------------------|
|              |                  |                               |                |                           | No load                      | Full load |                         |
| JMR1012S05   | 12V<br>(4.5-18V) | 5V                            | 2000mA         | 84.5%                     | 20mA                         | 987mA     | 3300 $\mu$ F            |
| JMR1012S12   |                  | 12V                           | 833mA          | 86.5%                     | 20mA                         | 964mA     | 470 $\mu$ F             |
| JMR1012S15   |                  | 15V                           | 666mA          | 87%                       | 20mA                         | 957mA     | 330 $\mu$ F             |
| JMR1012D05   |                  | $\pm 5$ V                     | $\pm 1000$ mA  | 84.5%                     | 20mA                         | 987mA     | $\pm 1470$ $\mu$ F      |
| JMR1012D12   |                  | $\pm 12$ V                    | $\pm 416$ mA   | 86.5%                     | 20mA                         | 962mA     | $\pm 680$ $\mu$ F       |
| JMR1012D15   |                  | $\pm 15$ V                    | $\pm 333$ mA   | 87%                       | 20mA                         | 957mA     | $\pm 390$ $\mu$ F       |

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#### Notes:

1. Dual output models can be used to provide a single output of 10V, 24V or 30V.
2. Specifications noted using nominal input voltage and full load at 25°C unless otherwise stated.

3. Measured at full load and nominal input voltage.
4. No load input current reduces to <3mA when module is inhibited.

## Models & ratings

| Model number | Input voltage       | Output voltage <sup>(1)</sup> | Output current | Efficiency <sup>(3)</sup> | Input current            |           | Maximum capacitive load |
|--------------|---------------------|-------------------------------|----------------|---------------------------|--------------------------|-----------|-------------------------|
|              |                     |                               |                |                           | No load <sup>(4,5)</sup> | Full load |                         |
| JMR1024S05   | 24V<br>(9.0-36.0V)  | 5V                            | 2000mA         | 85%                       | 6mA                      | 491mA     | 3300μF                  |
| JMR1024S12   |                     | 12V                           | 833mA          | 88%                       | 6mA                      | 474mA     | 470μF                   |
| JMR1024S15   |                     | 15V                           | 666mA          | 89%                       | 6mA                      | 469mA     | 330μF                   |
| JMR1024D05   |                     | ±5V                           | ±1000mA        | 85%                       | 6mA                      | 491mA     | ±1470μF                 |
| JMR1024D12   |                     | ±12V                          | ±416mA         | 88%                       | 6mA                      | 473mA     | ±680μF                  |
| JMR1024D15   |                     | ±15V                          | ±333mA         | 89%                       | 6mA                      | 468mA     | ±390μF                  |
| JMR1048S05   | 48V<br>(18.0-75.0V) | 5V                            | 2000mA         | 85%                       | 4mA                      | 246mA     | 3300μF                  |
| JMR1048S12   |                     | 12V                           | 833mA          | 88%                       | 4mA                      | 237mA     | 470μF                   |
| JMR1048S15   |                     | 15V                           | 666mA          | 88%                       | 4mA                      | 237mA     | 330μF                   |
| JMR1048D05   |                     | ±5V                           | ±1000mA        | 85%                       | 4mA                      | 246mA     | ±1470μF                 |
| JMR1048D12   |                     | ±12V                          | ±416mA         | 88%                       | 4mA                      | 237mA     | ±680μF                  |
| JMR1048D15   |                     | ±15V                          | ±333mA         | 88%                       | 4mA                      | 237mA     | ±390μF                  |

### Notes:

1. Dual output models can be used to provide a single output of 10V, 24V or 30V.
2. Specifications noted using nominal input voltage and full load at 25°C unless otherwise stated.
3. Measured at full load and nominal input voltage.
4. No load input current reduces to <3mA when module is inhibited.

## Input

| Characteristic                        | Minimum | Typical | Maximum | Units            | Notes & conditions                                                                                       |
|---------------------------------------|---------|---------|---------|------------------|----------------------------------------------------------------------------------------------------------|
| Input voltage range                   | 4.5     |         | 18      | VDC              | 12V nominal                                                                                              |
|                                       | 9       |         | 36      |                  | 24V nominal                                                                                              |
|                                       | 18      |         | 75      |                  | 48V nominal                                                                                              |
| Inrush current                        |         |         | 80      | A                | At nominal input voltage                                                                                 |
| Input reflected ripple                |         | 20      |         | mA pk-pk         | Through 12μH inductor and 47μF capacitor                                                                 |
| Input surge                           |         |         | 25      | VDC<br>for 100ms | 12V nominal                                                                                              |
|                                       |         |         | 50      |                  | 24V nominal                                                                                              |
|                                       |         |         | 100     |                  | 48V nominal                                                                                              |
| Input current remote On/Off           |         | 2.5     | 8.0     | mA               | Idle current using remote "Off". See models and ratings table for no load input current with module "On" |
| Recommended input fuse<br>(Slow blow) |         | 5.0     |         | A                | 12V nominal                                                                                              |
|                                       |         | 2.0     |         |                  | 24V nominal                                                                                              |
|                                       |         | 1.0     |         |                  | 48V nominal                                                                                              |

## Output

| Characteristic               | Minimum                                                                                                                                                                                                        | Typical | Maximum | Units    | Notes & conditions                                                                       |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|----------|------------------------------------------------------------------------------------------|
| Output voltage               | 5                                                                                                                                                                                                              |         | 30      | VDC      | See Models & ratings table                                                               |
| Output voltage adjustment    | -10                                                                                                                                                                                                            |         | +10     | %        | See application note                                                                     |
| Initial set accuracy         |                                                                                                                                                                                                                |         | ±1      | %        | At full load                                                                             |
| Minimum load                 | 0                                                                                                                                                                                                              |         |         | %        | No minimum load required                                                                 |
| Line regulation              |                                                                                                                                                                                                                |         | ±0.5    | %        | From min to max input voltage                                                            |
| Load regulation              |                                                                                                                                                                                                                |         | ±1.0    | %        | From 0-100% load                                                                         |
| Cross regulation             |                                                                                                                                                                                                                |         | ±5      | %        | Dual output, when one output at 25% load other is varied from 10% to full load           |
| Transient response deviation | 3                                                                                                                                                                                                              |         | 5       | %        | Deviation recovering to within 1% in 250µs for 25% load change at 0.1A/µs                |
| Ripple & noise               |                                                                                                                                                                                                                |         | 75/100  | mV pk-pk | 5V/12-15V outputs, 20MHz bandwidth, measured using 10µF ceramic capacitor at nominal Vin |
| Short circuit protection     | Continuous, hiccup mode with auto recovery                                                                                                                                                                     |         |         |          |                                                                                          |
| Maximum capacitive load      | See Models & Ratings table                                                                                                                                                                                     |         |         |          |                                                                                          |
| Temperature coefficient      |                                                                                                                                                                                                                |         | 0.02    | %/°C     |                                                                                          |
| Overload protection          |                                                                                                                                                                                                                | 160     |         | %        | At nominal input voltage                                                                 |
| Remote On/Off                | Output is on if pin 1 is shorted to pin 2 or with a voltage less than 1.2V is applied WRT pin 2.<br>Output is off if pin 1 is open circuit or with a voltage of 3-12V applied WRT pin 2. See application note. |         |         |          |                                                                                          |

## General

| Characteristic             | Minimum                                    | Typical      | Maximum | Units            | Notes & conditions                                             |
|----------------------------|--------------------------------------------|--------------|---------|------------------|----------------------------------------------------------------|
| Efficiency                 |                                            | 87           |         | %                | See Models & ratings table                                     |
| Isolation: Input to output | 5000                                       |              |         | VAC              | Reinforced insulation, 2 x MOPP, 60s, production test to 5kVAC |
| Working voltage            |                                            |              | 250     | VAC              |                                                                |
| Creepage and clearance     | 8                                          |              |         | mm               |                                                                |
| Isolation resistance       | 10 <sup>9</sup>                            |              |         | Ω                | Input to output                                                |
| Isolation capacitance      |                                            | 17           |         | pF               | Input to output                                                |
| Leakage current            |                                            | 2            |         | µA               | 264VAC, 60Hz                                                   |
| Power density              |                                            |              | 1.5     | Wcm <sup>3</sup> |                                                                |
| Mean time between failure  | 650                                        |              |         | khls             | MIL-HDBK-217F, +25°C GB                                        |
| Switching frequency        |                                            | 300          |         | kHz              |                                                                |
| Weight                     |                                            | 14.0 (0.003) |         | g (lb)           |                                                                |
| Solder profile             |                                            |              | 260     | °C               | Waveflow. 1.5mm (0.05") from case, 10 seconds max.             |
| Case material              | Non conductive black plastic UL94V-0 rated |              |         |                  |                                                                |
| Potting material           | Silicone, UL94V-0 rated                    |              |         |                  |                                                                |
| Pin material               | Solder coated brass dia. 0.5mm             |              |         |                  |                                                                |
| Water wash                 | Use deionized water. Dry thoroughly        |              |         |                  |                                                                |

## Environmental

| Characteristic               | Minimum            | Typical | Maximum | Units | Notes & conditions       |
|------------------------------|--------------------|---------|---------|-------|--------------------------|
| Operating temperature        | -40                |         | +100    | °C    | See derating curve       |
| Storage temperature          | -55                |         | +125    | °C    |                          |
| Case temperature             |                    |         | +110    | °C    | At nominal input voltage |
| Humidity operating & storage | 5                  |         | 95      | %RH   | Non-condensing           |
| Cooling                      | Natural convection |         |         |       |                          |
| Operating altitude           |                    |         | 5000    | m     | Transport altitude 10km  |

## Safety approvals

| Safety agency | Standard                         | Notes & conditions |
|---------------|----------------------------------|--------------------|
| UL            | ANSI/AAMI ES60601-1, UL62368-1   |                    |
| CSA           | CSA C22.2 No. 60601-1            |                    |
| TUV           | EN60601-1                        |                    |
| CB            | IEC/EN60601-1                    |                    |
| CE            | Meets all applicable directives  |                    |
| UKCA          | Meets all applicable legislation |                    |

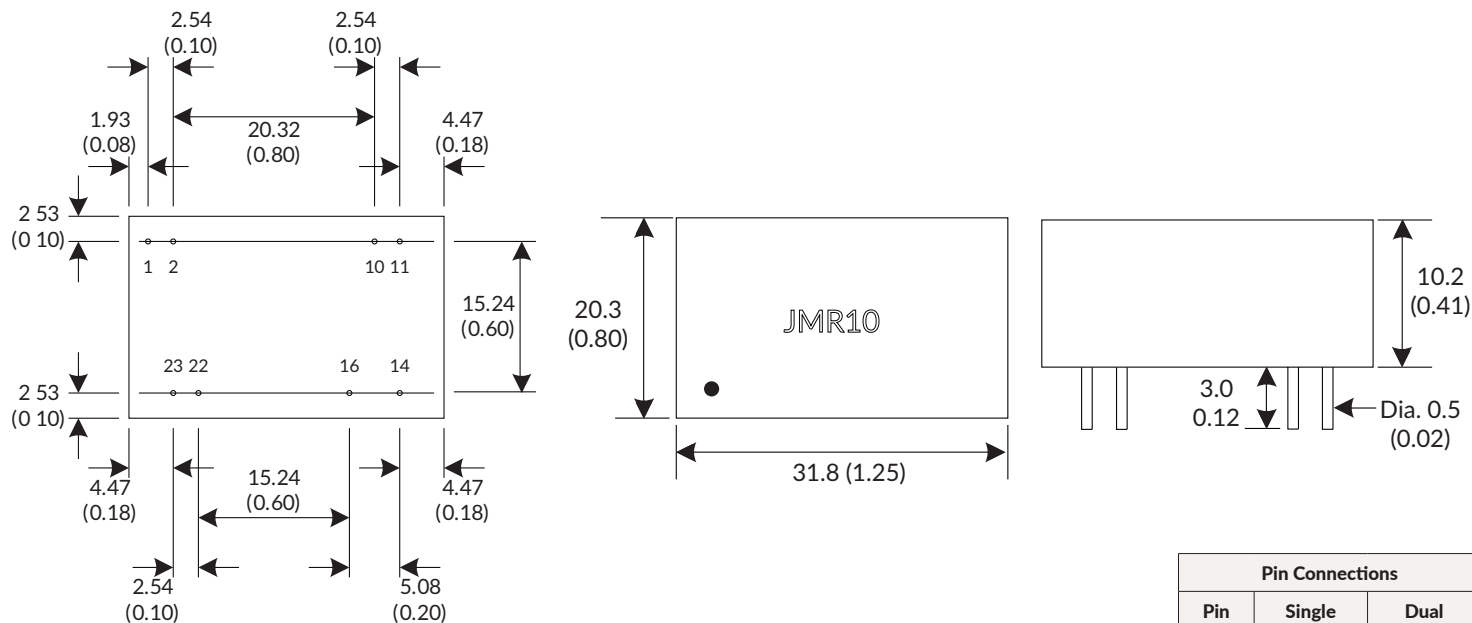
## EMC: emissions

| Phenomenon | Standard | Test level | Notes & conditions    |
|------------|----------|------------|-----------------------|
| Conducted  | EN55011  | Class B    | See Application notes |
| Radiated   | EN55011  | Class B    |                       |

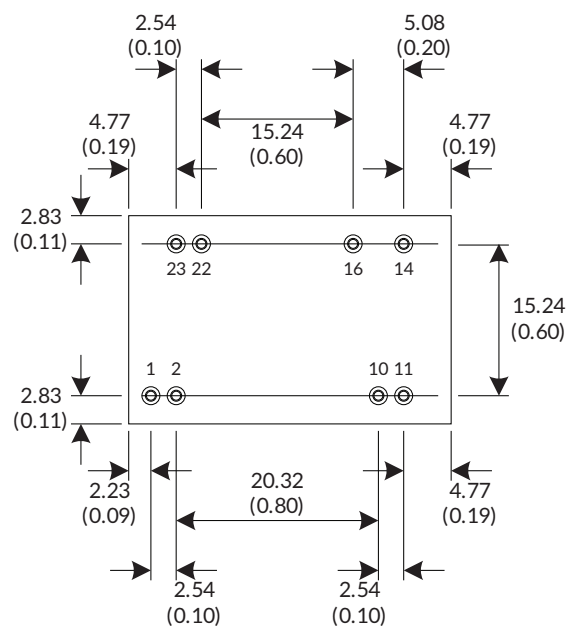
## EMC: immunity

| Phenomenon         | Standard          | Test Level | Criteria | Notes & conditions                                 |
|--------------------|-------------------|------------|----------|----------------------------------------------------|
| Medical device EMC | EN60601-1-2: 2015 |            |          | IEC60601-1-2:2014 Ed4.0                            |
| ESD immunity       | EN61000-4-2       | ±8kV       | A        | Contact                                            |
|                    |                   | ±15kV      |          | Air                                                |
| Radiated immunity  | EN61000-4-3       | 10V/m      | A        |                                                    |
| EFT/Burst          | EN61000-4-4       | ±2kV       | A        | External component required, see application notes |
| Surge              | EN61000-4-5       | ±2kV       | A        | External component required, see application notes |
| Conducted immunity | EN61000-4-6       | 10Vrms     | A        |                                                    |
| Magnetic fields    | EN61000-4-8       | 100A/m     | A        |                                                    |

## Mechanical details



## Recommended PCB footprint



There should be at least 8mm distance between primary and secondary circuit.

Through hole diameter 0.8mm (0.031")  
Pad diameter top side 1.0mm (0.039")  
Pad diameter bottom side 2.0mm (0.079")

| Pin Connections |        |       |
|-----------------|--------|-------|
| Pin             | Single | Dual  |
| 1               | CTRL   | CTRL  |
| 2               | -Vin   | -Vin  |
| 10              | Trim   | Trim  |
| 11              | NC     | -Vout |
| 14              | +Vout  | +Vout |
| 16              | -Vout  | COM   |
| 22              | +Vin   | +Vin  |
| 23              | +Vin   | +Vin  |

## Notes:

1. All dimensions are in mm (inches)
2. Weight: 14.0 (0.03) g (lbs) approx.
3. Pin diameter: 0.5 ±0.05 (0.02 ±0.002)

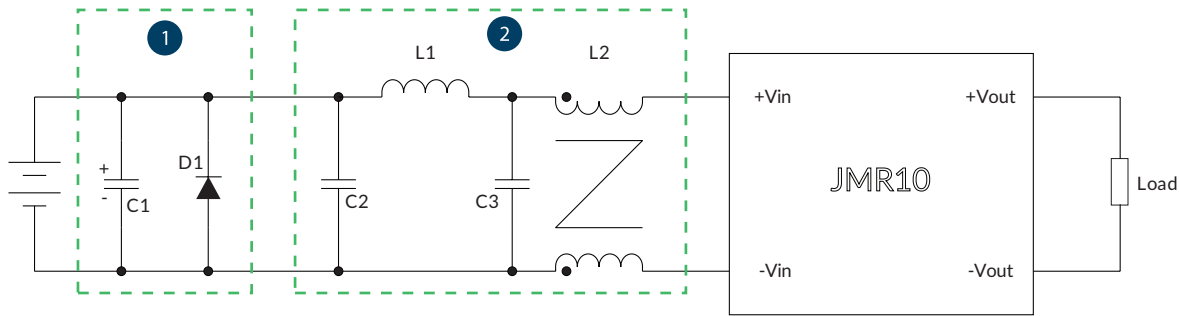
4. Pin pitch tolerance: ±0.35 (±0.014)
5. Case tolerance: ±0.5 (±0.02)

Application notes

EMC Filter

Circuit 1 for Surge & EFT, 2 for EMC class B.

Single output

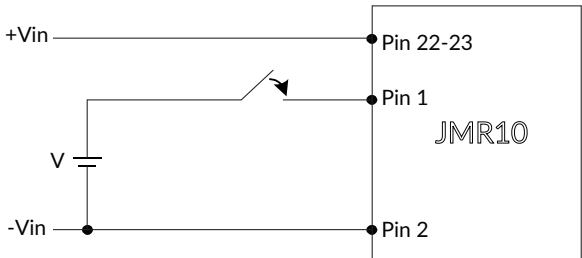


| Model Number | D1       | C1 <sup>(1)</sup> | C2, C3            | L1    | L2    |
|--------------|----------|-------------------|-------------------|-------|-------|
| JMR1012XXX   | SMDJ26A  | 470μF/100V        | MLCC, 22μF, 35V   | 2.2μH | 52μH  |
| JMR1024XXX   | SMDJ58A  | 330μF/100V        | MLCC, 4.7μF, 50V  | 4.7μH | 175μH |
| JMR1048XXX   | SMDJ120A | 330μF/100V        | MLCC, 2.2μF, 100V | 6.8μH | 419μH |

Notes:

1. Nippon CHEMI-CON KY series

Remote On/Off

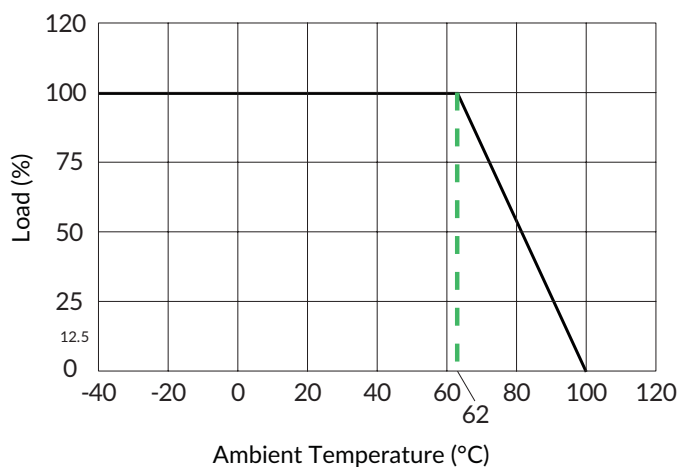


Module "On" if pin 1 is shorted to pin 2 or with a voltage (V) less than 1.2V WRT to pin 2.  
Module "Off" if pin 1 is open or with a voltage (V) of 3V to 12V WRT to pin 2.

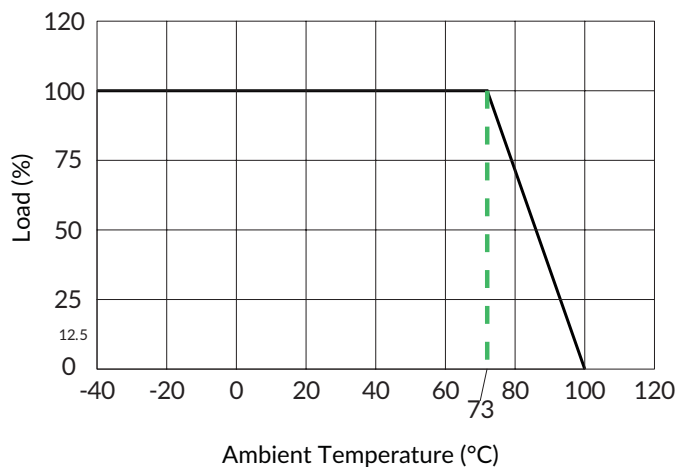
## Application notes

### Derating curves

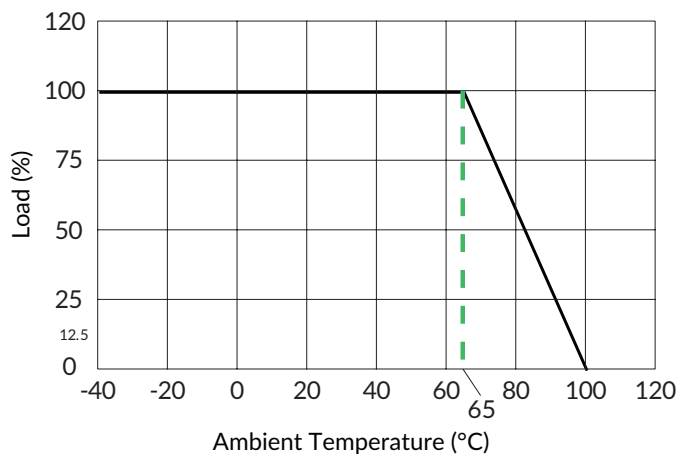
JMR1012S05, JMR1012D05, JMR1024S05, JMR1024D05



JMR1012S12, JMR1012D12, JMR12S15, JMR12D15



JMR1048S05, JMR1048D05



JMR1024S12, JMR1024S15, JMR1024D12, JMR1024D15,  
JMR1048S12, JMR1048S15, JMR1048D12, JMR1048D15

