

## 20W

DC-DC converters

The JMR20 series is a range of ultra-compact, regulated PCB-mount medical DC-DC converters which offers single and dual output voltages ranging from 5 to 15VDC. Housed in a 40.6 x 25.4mm (1" x 1.6") plastic case, the JMR20 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 JMR20 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
- ▶ Compact 40.6 x 25.4mm (1" x 1.6") PCB mount package
- ▶ Low no-load power
- ▶ 10% trim on single output versions
- ▶ IEC60601-1 medical safety 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



### Dimensions

40.6 x 25.4 x 10.2 mm (1.6" x 1.0" x 0.4")

### 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	
JMR2024S05	24V (9.0-36.0V)	5V	4000mA	88.5%	15mA	940mA	5000 $\mu$ F
JMR2024S12		12V	1670mA	88.5%	15mA	945mA	850 $\mu$ F
JMR2024S15		15V	1330mA	89.0%	15mA	935mA	700 $\mu$ F
JMR2024D05		$\pm 5V$	$\pm 2000mA$	86.0%	15mA	970mA	$\pm 2500\mu F$
JMR2024D12		$\pm 12V$	$\pm 833mA$	88.5%	15mA	940mA	$\pm 500\mu F$
JMR2024D15		$\pm 15V$	$\pm 667mA$	89.0%	15mA	935mA	$\pm 350\mu F$

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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	
JMR2048S05	48V (18.0-75.0V)	5V	4000mA	89.0%	15mA	465mA	±5000µF
JMR2048S12		12V	1670mA	88.5%	15mA	470mA	850µF
JMR2048S15		15V	1330mA	89.0%	15mA	465mA	700µF
JMR2048D05		±5V	±2000mA	86.0%	15mA	485mA	±2500µF
JMR2048D12		±12V	±833mA	88.5%	15mA	470mA	±500µF
JMR2048D15		±15V	±667mA	88.9%	15mA	470mA	±350µF

### Notes:

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## Input

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Input voltage range	9		36	VDC	24V nominal
	18		75		48V nominal
Inrush current			80	A	At nominal input voltage
Input reflected ripple		30		mA pk-pk	Through 12µH inductor and 47µF capacitor
Input surge			50	VDC for 100ms	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 (Slow blow)		4.0		A	24V nominal
		2.0			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			100/150	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	120		180	%	At nominal input voltage
Remote On/Off	Output is on if pin 6 is open circuit or with a voltage of 3-12V applied WRT pin 2. Output is off if pin 6 is shorted to pin 2 or with a voltage less than 1.2V is applied WRT pin2. See application note.				

## General

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Efficiency		89		%	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		20		pF	Input to output
Leakage current		2		µA	264VAC, 60Hz
Power density			1.9	Wcm <sup>3</sup>	
Mean time between failure		520		khrs	MIL-HDBK-217F, +25°C GB
Switching frequency		275		kHz	
Weight		22.0 (0.05)		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

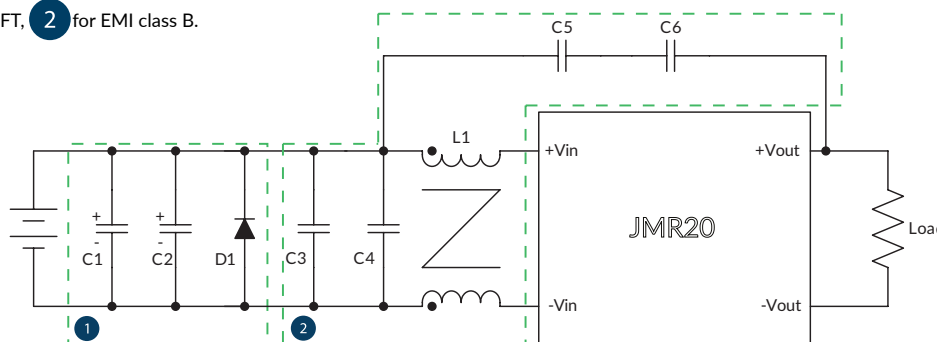
Phenomenon	Standard	Test Level	Criteria	Notes & conditions
Medical device EMC	EN60601-1-2: 2015			IEC60601-1-2:2014 Ed4.0
ESD immunity	EN61000-4-2	±6kV	A	Contact
		±8kV		Air
Radiated immunity	EN61000-4-3	10V/m	A	
EFT/Burst	EN61000-4-4	±2kV	A	External component required, see application notes
Surge	EN61000-4-5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



## Application notes

### EMC filter

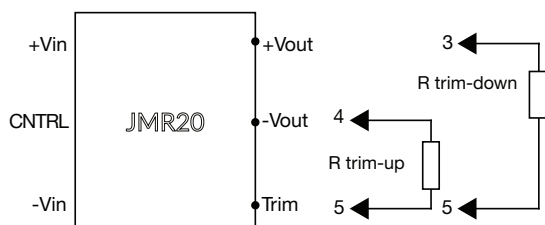
Circuit **1** for Surge & EFT, **2** for EMI class B.



Model number	C1, C2	D1	C3	C4	L1	C5, C6
JMR2024XXX	NIPPON Chemi-con KY Series, 220 $\mu$ F, 100V	SMDJ58A	MLCC, 10 $\mu$ F, 50V	Not fitted	LFTBH953-171N-5.2A	100pF/400VAC Y1
JMR2048XXX		SMDJ120A	MLCC, 2.2 $\mu$ F, 100V	MLCC, 2.2 $\mu$ F, 100V	LFTBH953-371N-3A	

### Trim

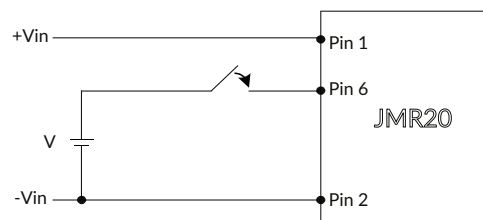
Output can be externally trimmed by using the method shown on the tables below. (single output models only)



### Remote On/Off

Module "On" if pin 6 is open or with a voltage (V) of 3V to 12V WRT to pin 2.

Module "Off" if pin 6 is shorted to pin 2 or with a voltage (V) less than 1.2V WRT to pin 2



### JMR20XXS05

Trim down	1	2	3	4	5	6	7	8	9	10%
Vout=	4.950	4.900	4.850	4.800	4.750	4.700	4.650	4.600	4.550	4.500V
Rtrim-down	214.030	98.592	60.123	40.890	29.351	21.659	16.164	12.044	8.839	6.275K $\Omega$
Trim up	1	2	3	4	5	6	7	8	9	10%
Vout=	5.050	5.100	5.150	5.200	5.250	5.300	5.350	5.400	5.450	5.500V
Rtrim-up	439.080	214.585	139.733	102.304	79.845	64.872	54.176	46.155	39.916	34.924K $\Omega$

### JMR20XXS12

Trim down	1	2	3	4	5	6	7	8	9	10%
Vout=	11.880	11.760	11.640	11.520	11.400	11.280	11.160	11.040	10.920	10.800V
Rtrim-down	210.981	111.523	72.540	51.734	38.796	29.972	23.569	18.711	14.899	11.828K $\Omega$
Trim up	1	2	3	4	5	6	7	8	9	10%
Vout=	12.120	12.240	12.360	12.480	12.600	12.720	12.840	12.960	13.080	13.200V
Rtrim-up	1275.493	527.185	330.975	240.515	188.461	154.637	130.894	113.309	99.761	89.004K $\Omega$

### JMR20XXS15

Trim down	1	2	3	4	5	6	7	8	9	10%
Vout=	14.850	14.700	14.550	14.400	14.250	14.100	13.950	13.800	13.650	13.500V
Rtrim-down	184.463	93.453	59.044	40.959	29.809	22.246	16.779	12.643	9.405	6.801K $\Omega$
Trim up	1	2	3	4	5	6	7	8	9	10%
Vout=	5.150	5.300	5.450	5.600	5.750	5.900	6.050	6.200	6.350	6.500V
Rtrim-up	1383.154	605.730	386.767	283.530	223.450	184.145	156.426	135.830	119.923	107.268K $\Omega$