JHM20 Series

DC-DC Converter

XP Power

20 Watts

- Regulated single & dual outputs from 5 to 30VDC
- Single outputs trimmable ±10%
- 2:1 Input range
- 2" x 1" footprint PCB mount
- International medical approvals
- 4kVAC reinforced isolation
- 2 x MOPP @ 250VAC working voltage
- 2.5µA Patient leakage current
- Medical approval, IEC60601-1, 3rd Edition including risk management
- EN55011 Class A with no external components
- -40°C to +80°C operating temperature
- Full power to +60°C
- 3 year warranty

Dimensions:

JHM20:
2.00 x 1.00 x 0.40" (50.8 x 25.4 x 10.2 mm)

The JHM20 series of DC-DC modules provides a compact power solution designed and certified to international medical safety standards. Features include output voltage trim as well as short circuit protection.

Models & Ratings

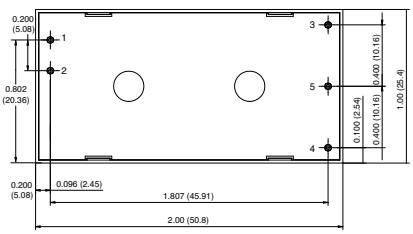
Input Voltage	Output Voltage	Output Current	Input Current		Maximum Capacitive Load[2]	Efficiency[3]	Model Number
			No Load[1]	Full Load[4]			
9-18 V	5.0 V	4000 mA	11 mA	3500 mA	4000 µF	88%	JHM2012S05
	12.0 V	1670 mA	7 mA		1660 µF	88%	JHM2012S12
	15.0 V	1333 mA	7 mA		1330 µF	89%	JHM2012S15
	±5.0 V	±2000 mA	7 mA		±2000 µF	86%	JHM2012D05
	±12.0 V	±833 mA	10 mA		±800 µF	88%	JHM2012D12
	±15.0 V	±667 mA	11 mA		±660 µF	89%	JHM2012D15
18-36 V	5.0 V	4000 mA	7 mA	1750 mA	4000 µF	89%	JHM2024S05
	12.0 V	1670 mA	5 mA		1660 µF	88%	JHM2024S12
	15.0 V	1333 mA	6 mA		1330 µF	89%	JHM2024S15
	±5.0 V	±2000 mA	5 mA		±2000 µF	86%	JHM2024D05
	±12.0 V	±833 mA	7 mA		±800 µF	88%	JHM2024D12
	±15.0 V	±667 mA	8 mA		±660 µF	89%	JHM2024D15
36-75 V	5.0 V	4000 mA	4 mA	850 mA	4000 µF	88%	JHM2048S05
	12.0 V	1670 mA	3 mA		1660 µF	88%	JHM2048S12
	15.0 V	1333 mA	4 mA		1330 µF	88%	JHM2048S15
	±5.0 V	±2000 mA	4 mA		±2000 µF	85%	JHM2048D05
	±12.0 V	±833 mA	4 mA		±800 µF	89%	JHM2048D12
	±15.0 V	±667 mA	5 mA		±660 µF	88%	JHM2048D15

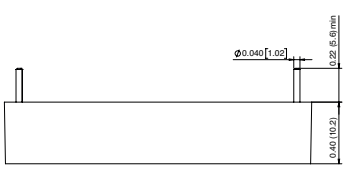
Notes

1. Input current measured at lowest input voltage.
2. Maximum capacitive load is per output.
3. Typical values at nominal input.
4. Typical values at low input voltage.

Mechanical Details

BOTTOM VIEW





Pin Connections		
Pin	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	Trim	-Vout
5	-Vout	Common

Notes

1. All dimensions are in inches (mm)
2. Weight: 0.066 lbs (30 g) approx.
3. Pin diameter: 0.04 ±0.002 (1.02 ±0.05)
4. Pin pitch tolerance: ±0.01 (±0.25)
5. Case tolerance: ±0.02 (±0.5)

Input

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Input Voltage Range	9		18	VDC	12 V nominal
	18		36	VDC	24 V nominal
	36		75	VDC	48 V nominal
Input Current					See Models and Ratings table
Inrush Current			70	A	at Maximum Input Voltage
Input Filter	Pi type				
Undervoltage Lockout	On at >8.8 V. Off <8.3 V				12 V models
	On at >17.5 V. Off <16.5 V				24 V models
	On at >34.5 V. Off <33.0 V				48 V models
Input Surge			25	VDC	12 V models for 3 s
			50	VDC	24 V models for 3 s
			100	VDC	48 V models for 3 s

Output

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Output Voltage	5		30	V	See Models and Ratings table
Output Voltage Trim			±10	%	Via external resistors, see Application Notes. Single output model only
Initial Set Accuracy			±1	%	on +Vout
			±2	%	on -Vout of dual output models
Minimum Load	0			A	No minimum load required
Start Up Delay		50		ms	
Start Up Rise Time		20		ms	
Line Regulation			±0.3	%	
Load Regulation			±2	%	0 - 10% load
			±1	%	10 - 100% load
Cross Regulation			±4	%	On dual output models with one output set to 50% load and the other varied from 10% to 100% load (D05 20% to 100%)
Transient Response			4	% deviation	Recovery to within 1% in <500 µs for a 50% load change at 0.25 A/µs
Ripple & Noise			1	% pk-pk	20 MHz bandwidth
Short Circuit Protection					Trip & Restart (hiccup mode), auto recovery
Overload Protection	120		200	%	Trip & Restart (hiccup mode)
Overvoltage Protection	115		140	%	Non latching, auto recovery
Temperature Coefficient			0.03	%/°C	

General

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Efficiency		88		%	See Models and Ratings table
Isolation	4000			VAC	For 1 min. Double/reinforced with a working voltage of 250 VAC. Meets 2 x MOPP per 3rd edition of IEC60601-1 5000 VAC for 10 ms in accordance with IEC60664-1
Leakage Current			2.5	µA	
Input to Output Capacitance			30	pF	
Switching Frequency		250		kHz	
Power Density			25	W/in^3	
Mean Time Between Failure		>1		MHrs	MIL-HDBK-217F, +25 °C GB
Weight		0.066 (30.0)		lb (g)	
Case Type	Non conductive black plastic UL94V-0				
Pin Material	Solder coated copper				
Potting Material	Silicone (UL94V-0 rated)				
Solder Profile					See application notes

Environmental

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Operating Temperature	-40		+80	°C	See derating curve
Storage Temperature	-55		+100	°C	
Case Temperature			+105	°C	
Humidity	5		95	%RH	Non-condensing
Cooling					Natural convection
Shock	±3 shocks in each plane, total 18 shocks of 30 g : 11 ms halfsine. Conforms to EN60068-2-27 & EN60068-2-47				
Vibration	10-500 Hz at 2 g sweep and endurance at resonance in all 3 planes. Conforms to EN60068-2-6				
Altitude			3,048	Metres	Operating
			10,000		Storage

EMC: Emissions

Phenomenon	Standard	Test Level	Notes & Conditions
Conducted	EN55011	Level A	
Radiated	EN55011	Level A	

EMC: Immunity

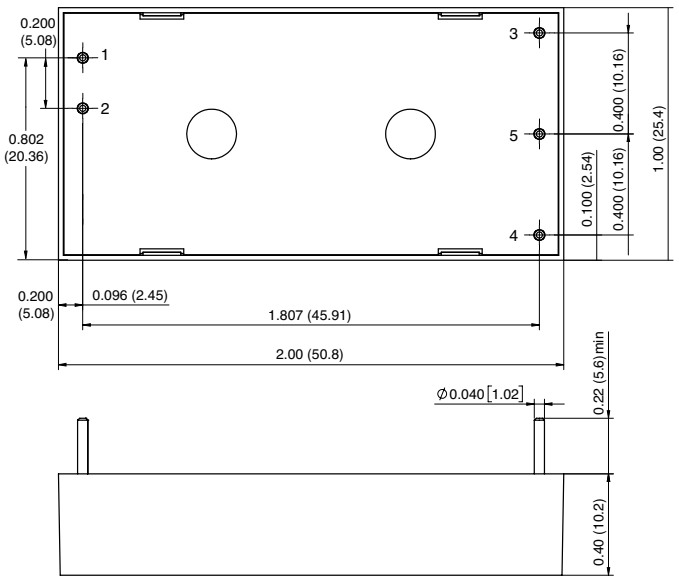
Phenomenon	Standard	Test Level	Criteria	Notes & Conditions
Immunity	IEC60601-1-2			
ESD Immunity	EN61000-4-2	2	A	
Radiated Immunity	EN61000-4-3	10 V/m	A	
EFT/Burst	EN61000-4-4	2	A	
Surges	EN61000-4-5	1	A	With external components. See application note.
Conducted Immunity	EN61000-4-6	10 V/m	A	
Magnetic Fields	EN61000-4-8	30 A/m	A	

Safety Approvals

Safety Agency	Safety Standard	Notes & Conditions
CB Report	IEC60601-1 Including Risk Management	Medical
UL	ANSI/AAMI ES60601-1 & CSA C22.2, No.60601-1	Medical
TUV	EN60601-1	Medical

Mechanical Details

BOTTOM VIEW



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3. Pin diameter: 0.04 ±0.002 (1.02 ±0.05)
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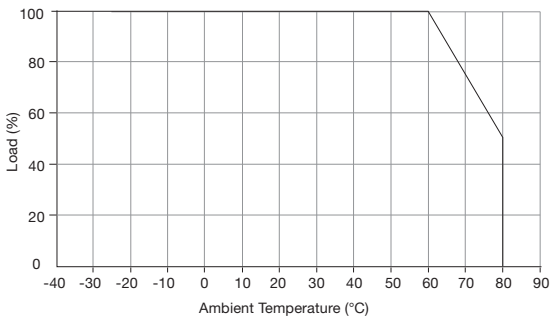
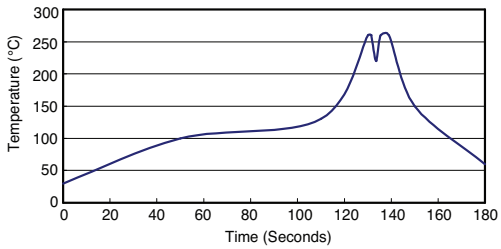
Application Notes

Derating Curve



Lead Free Wave Soldering Profile

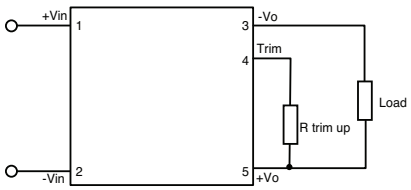


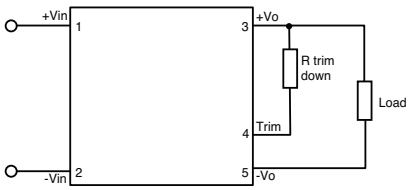
Notes

1. Soldering Materials: Sn/Cu/Ni
2. Ramp up rate during preheat: 1.4 °C/Sec (From 50°C to 100°C)
3. Soaking temperature: 0.5 °C/Sec (From 100°C to 130°C), 60±20 seconds
4. Peak temperature: 260°C, above 250°C 3~6 Seconds
5. Ramp up rate during cooling: -10.0 °C/Sec (From 260°C to 150°C)

Single Output Voltage Adjustment

In order to trim the voltage up or down, connect the trim resistor either between the trim pin and -Vo for trim-up and between trim pin and +Vo for trim-down. The output voltage trim range is ±10%. This is shown to the right.





The value of Rtrim-up defined as:

$$\text{Rtrim–up} = \left(\frac{(Vr \times R1 \times (R2+R3))}{(Vo–Vo,nom) \times R2} \right) – Rt\ (K\Omega)$$

Where
R trim-up is the external resistor in Kohm.
VO, nom is the nominal output voltage.
VO is the desired output voltage.
R1, Rt, R2, R3 and Vr are internal to the unit and are defined in the table to the right.

For example, to trim-up the output voltage of 5.0V module (JHM2012S05) by 10% to 5.5V, R trim-up is calculated as follows:

Vo –Vo,nom =5.5–5.0=0.5V
R1 = 2.32 KΩ
R2 = 2.32 KΩ
R3 = 0 KΩ
Rt = 8.2 KΩ, Vr= 2.5 V

$$\text{Rtrim–up} = \left(\frac{2.5 \times 2.32 \times (2.32 + 0)}{0.5 \times 2.32} \right) - 8.2 = 3.4\ (K\Omega)$$

Model Number	Output Voltage (V)	R1 (KΩ)	R2 (KΩ)	R3 (KΩ)	Rt (KΩ)	Vr (V)
JHM2012S05	5.0	2.32	2.32	0	8.20	2.50
JHM2024S05						
JHM2048S05						
JHM2012S12	12.0	6.80	2.40	2.32	22	2.50
JHM2024S12						
JHM2048S12						
JHM2012S15	15.0	8.06	2.40	3.90	27	2.50
JHM2024S15						
JHM2048S15						

The value of Rtrim-down defined as:

$$\text{Rtrim–down} = R1 \times \left(\frac{Vr \times R1}{(Vo,\ nom - Vo) \times R2} - 1 \right) – Rt\ (K\Omega)$$

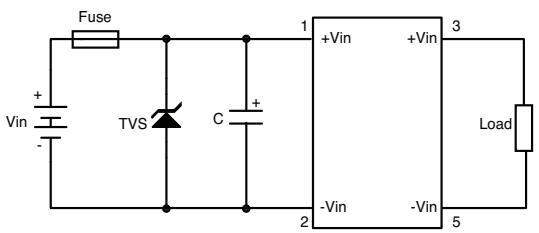
R1, Rt, R2, R3 and Vr are internal to the unit and are defined in the above table.
For example, to trim-down the output voltage of 5.0V module (JHM2012S05) by 10% to 4.5V, R trim-down is calculated as follows:
VO,nom –Vo=5.0–4.5=0.5V
R1 = 2.32 KΩ R2 = 2.32 KΩ R3 = 0 KΩ
Rt = 8.2 KΩ Vr= 2.5 V

Where
R trim-up is the external resistor in Kohm.
VO, nom is the nominal output voltage.
VO is the desired output voltage.
R1, Rt, R2, R3 and Vr are internal to the unit and are defined in the table above.

Input Fusing and Safety Considerations

Model	Fuse	TVS Specification
JHM2012SXX	5 AT	1500W 24V
JHM2024DXX	3.15 AT	1500W 47V
JHM2048SXX	2 AT	1500W 91V

Recommended circuit layout with time delay fuse. C = 100 µF, 100 V aluminium electrolytic



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