

P R B X

POWERBOX *Medline* PMM20 Series 20W 2:1 & 4:1 Single and Dual Output Medical DC/DC Converter

Preliminary

Features

IEC 60601-1 safety approved
20 watts output power in a compact 1.6"x1" mechanical package
4:1 & 2:1 input range
2MOPP, 8mm clearance & creepage
5000VAC isolation voltage
5000m operating altitude
5 Years warranty

Input

Operating voltage range	2:1	12Vin(nom)	9~18VDC	
		24Vin(nom)	18~36VDC	
		48Vin(nom)	36~75VDC	
	4:1 (W)	24V(nom)	9~36VDC	
		48V(nom)	18~75VDC	
Start-up voltage	2:1	12Vin(nom)	9VDC max	
		24Vin(nom)	18VDC max	
		48Vin(nom)	36VDC max	
	4:1 (W)	24V(nom)	9VDC max	
		48V(nom)	18VDC max	
Shutdown voltage	2:1	12Vin(nom)	8VDC typ	
		24Vin(nom)	16VDC typ	
		48Vin(nom)	33VDC typ	
	4:1 (W)	24V(nom)	8VDC typ	
		48V(nom)	16VDC typ	
Start up time	Power up		30ms typ, 60 ms max	
			30ms typ, 60 ms max	
		(Constant resistive load)		
Input surge voltage	3 seconds max.	2:1	12Vin(nom)	25VDC max
			24Vin(nom)	50VDC max
			48Vin(nom)	100VDC max
		4:1 (W)	24V(nom)	50VDC max
			48V(nom)	100VDC max
Input filter		Pi type.		
Remote On/Off (option)	Referenced to -Vin pin			
	Positive logic:			
	DC-DC ON	Open or 3.5~12VDC		
	DC-DC OFF	Short or 0~1.2VDC		
	Negative logic:			
	DC-DC ON	Open or 0~1.2VDC		
	DC-DC OFF	Short or 3.5~12VDC		
	Input current of CTRL pin -0.5 min, 1mA max			
	Remote off input current 2.5mA typ			



Output

Voltage accuracy	±1%.	
Line regulation	Single ±0.2%. Dual ±0.5%.	
	Low line to high line at full load.	
Load regulation	Single ±0.2%. Dual ±1.0%.	
	No load to full load.	
Cross regulation (dual)	±5.0%, assymetrical load 25%/100% FL.	
Voltage adjustability	Single: 5, 12Vout	±10%
	15, 24Vout	-10/+20%
Ripple and noise	Measured by 20Mhz bandwidth.	
With a 10µF/25V X7R MLCC	Single: 5Vout	50mVp-p
With a 10µF/25V X7R MLCC	12Vout	75mVp-p
With a 10µF/25V X7R MLCC	15Vout	75mVp-p
With a 4.7µF/50V X7R MLCC	24Vout	100mVp-p
With a 10µF/25V X7R MLCC	Dual: ±5Vout	50mVp-p
With a 10µF/25V X7R MLCC	±12Vout	75mVp-p
With a 10µF/25V X7R MLCC	±15Vout	75mVp-p
Temperature coefficient	±0.02%/ °C.	
Transient response	250µs recovery time at 25% load step change.	
Over voltage protection	5Vout	6.2VDC
	12Vout	15VDC
	15Vout	20VDC
	24Vout	30VDC
Over load protection	150% typ, 185% max of lout rated; hiccup mode.	
Short circuit protection	Continuous, automatics recovery.	

Environmental

Operating ambient temp.	-40°C to +105°C with derating.	
Max case temperature	+105°C.	
Overtemp. protection	+115°C	
Storage temperature	-55°C to +125°C.	
Thermal impedance	14.36°C/W.	
Operating altitude	5000m.	
Thermal shock	MIL-STD-810F.	
Vibration	MIL-STD-810F.	
Relative humidity	5-95% RH.	

POWERBOX **Medline**
PMM20 Series
20W 2:1 & 4:1 Single and Dual Output
Medical DC/DC Converter

General

Isolation voltage	Input to output 5000VAC, 1 minute.
Isolation capacitance	20pF typ.
Leakage current	2.5µA max at 240VAC, 60Hz.
Switching frequency	250KHz typ.
Clearance/creepage	8mm min.
Case material	Non-conductive black plastic.
Base material	Non-conductive black plastic.
Potting material	Silicon (UL94-V0).
Weight	24g.
MTBF	1.712 khrs, MIL-HDBK-217F, 25°C, full load.

Standards

Safety standards	IEC/ EN/ ANSI/AAMI ES 60601-1.
------------------	--------------------------------

EMC Parameter	Conditions	Level
EMI	EN55011, EN55032 and FCC Part 18	Without external components
		With external components
ESD	Air ± 15kV and Contact ± 8kV	Class A
Radiated immunity	10 V/m	Class B
Fast transient	EN61000-4-3	Perf. Criteria A
	EN61000-4-4	Perf. Criteria A
	PMM20-12□□□□	With 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220µF/100V) and a TVS (SMDJ36A, 36V, 3000 Watt peak pulse power) in parallel.
	PMM20-24□□□□	With 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220µF/100V) and a TVS (SMDJ58A, 58V, 3000 Watt peak pulse power) in parallel.
Surge	PMM20-48□□□□	With 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220µF/100V) and a TVS (SMDJ120A, 120V, 3000 Watt peak pulse power) in parallel.
	EN61000-4-5	± 2kV
	PMM20-12□□□□	With 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220µF/100V) and a TVS (SMDJ36A, 36V, 3000 Watt peak pulse power) in parallel.
	PMM20-24□□□□	With 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220µF/100V) and a TVS (SMDJ58A, 58V, 3000 Watt peak pulse power) in parallel.
Conducted immunity	PMM20-48□□□□	With 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220µF/100V) and a TVS (SMDJ120A, 120V, 3000 Watt peak pulse power) in parallel.
	EN61000-4-6	10 Vr.m.s
	EN61000-4-8	100A/m continuous; 1000A/m 1 second
	Power freq. magnetic field	

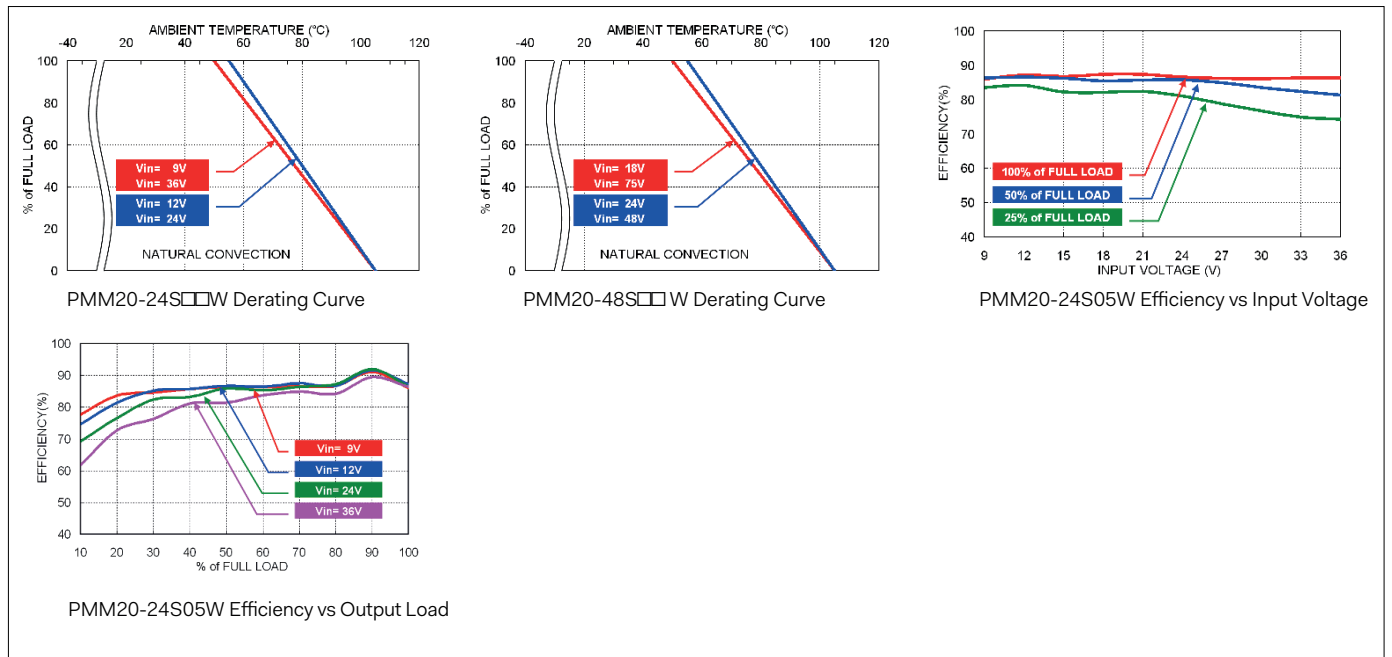
CAUTION: This power module is not internally fused. An input line fuse must always be used.

Model Number	Input Range	Output Voltage	Output Current @ Full Load	Input Current @ No Load	Efficiency	Max Capacitor Load
PMM20-12S05	9 ~ 18 VDC	5 VDC	4000 mA	8 mA	88.5%	5000 µF
PMM20-12S12	9 ~ 18 VDC	12 VDC	1670 mA	12 mA	88.5%	850 µF
PMM20-12S15	9 ~ 18 VDC	15 VDC	1330 mA	13 mA	89%	700 µF
PMM20-12S24	9 ~ 18 VDC	24 VDC	833 mA	11 mA	89%	220 µF
PMM20-12D05	9 ~ 18 VDC	±5 VDC	±2000 mA	11 mA	86%	±2500 µF
PMM20-12D12	9 ~ 18 VDC	±12 VDC	±833 mA	11 mA	89%	±500 µF
PMM20-12D15	9 ~ 18 VDC	±15 VDC	±667 mA	14 mA	89%	±350 µF
PMM20-24S05	18 ~ 36 VDC	5 VDC	4000 mA	8 mA	90%	5000 µF
PMM20-24S12	18 ~ 36 VDC	12 VDC	1670 mA	9 mA	90%	850 µF
PMM20-24S15	18 ~ 36 VDC	15 VDC	1330 mA	9 mA	90%	700 µF
PMM20-24S24	18 ~ 36 VDC	24 VDC	833 mA	9 mA	90%	220 µF
PMM20-24D05	18 ~ 36 VDC	±5 VDC	±2000 mA	11 mA	86%	±2500 µF
PMM20-24D12	18 ~ 36 VDC	±12 VDC	±833 mA	9 mA	90%	±500 µF
PMM20-24D15	18 ~ 36 VDC	±15 VDC	±667 mA	11 mA	90%	±350 µF
PMM20-48S05	36 ~ 75 VDC	5 VDC	4000 mA	9 mA	89.5%	5000 µF
PMM20-48S12	36 ~ 75 VDC	12 VDC	1670 mA	9 mA	88.5%	850 µF
PMM20-48S15	36 ~ 75 VDC	15 VDC	1330 mA	9 mA	89%	700 µF
PMM20-48S24	36 ~ 75 VDC	24 VDC	833 mA	9 mA	88.5%	220 µF
PMM20-48D05	36 ~ 75 VDC	±5 VDC	±2000 mA	9 mA	86%	±2500 µF
PMM20-48D12	36 ~ 75 VDC	±12 VDC	±833 mA	9 mA	88.5%	±500 µF
PMM20-48D15	36 ~ 75 VDC	±15 VDC	±667 mA	9 mA	89%	±350 µF
PMM20-24S05W	9 ~ 36 VDC	5 VDC	4000 mA	8 mA	88.5%	5000 µF
PMM20-24S12W	9 ~ 36 VDC	12 VDC	1670 mA	11 mA	88.5%	850 µF
PMM20-24S15W	9 ~ 36 VDC	15 VDC	1330 mA	10 mA	89%	700 µF
PMM20-24S24W	9 ~ 36 VDC	24 VDC	833 mA	10 mA	88.5%	220 µF
PMM20-24D05W	9 ~ 36 VDC	±5 VDC	±2000 mA	9 mA	86%	±2500 µF
PMM20-24D12W	9 ~ 36 VDC	±12 VDC	±833 mA	10 mA	88.5%	±500 µF
PMM20-24D15W	9 ~ 36 VDC	±15 VDC	±667 mA	11 mA	89%	±350 µF
PMM20-48S05W	18 ~ 75 VDC	5 VDC	4000 mA	9 mA	89.5%	5000 µF
PMM20-48S12W	18 ~ 75 VDC	12 VDC	1670 mA	9 mA	88.5%	850 µF
PMM20-48S15W	18 ~ 75 VDC	15 VDC	1330 mA	9 mA	89%	700 µF
PMM20-48S24W	18 ~ 75 VDC	24 VDC	833 mA	9 mA	88.5%	220 µF
PMM20-48D05W	18 ~ 75 VDC	±5 VDC	±2000 mA	9 mA	86%	±2500 µF
PMM20-48D12W	18 ~ 75 VDC	±12 VDC	±833 mA	9 mA	88.5%	±500 µF
PMM20-48D15W	18 ~ 75 VDC	±15 VDC	±667 mA	9 mA	89%	±350 µF

Part Number Structure

PMM20	-	48	S	05	W	-	P
Series Name		Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)	Input Range		Remote On/Off Option
		12: 9-18 24: 18-36 48: 36-75	S: Single	05: 5 12: 12 15: 15 24: 24	<input type="checkbox"/> 2:1		<input type="checkbox"/> No pin P: Positive logic N: Negative logic
			D: Dual	05: ±5 12: ±12 15: ±15			
		24: 9-36 48: 18-75	S: Single	05: 5 12: 12 15: 15 24: 24	W: 4:1		<input type="checkbox"/> No pin P: Positive logic N: Negative logic
			D: Dual	05: ±5 12: ±12 15: ±15			

Derating Curve



Fuse Consideration

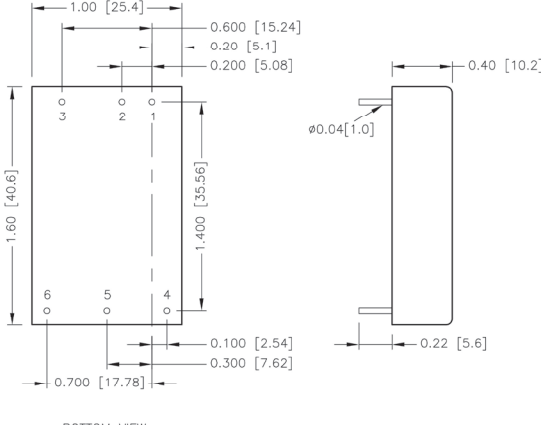
This power module is not internally fused. An input line fuse must always be used. This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture. To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse. The input line fuse suggest shown in table:

Model	Fuse Rating (A)	Fuse Type
PMM20-12□□□□ ` 24□□□□W	4A	Slow-blow
PMM20-24□□□□ ` 48□□□□W	2A	Slow-blow
PMM20-48□□□□	1A	Slow-blow

The table based on the information provided in this data sheet on inrush energy and maximum DC input current at low V_{in} .

POWERBOX Medline
PMM20 Series
20W 2:1 & 4:1 Single and Dual Output
Medical DC/DC Converter

Mechanical

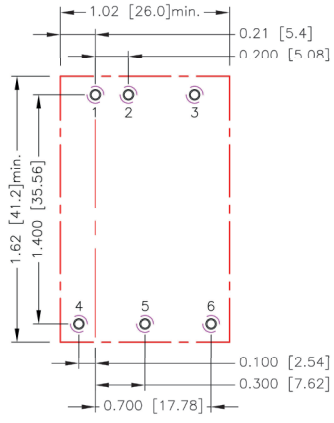


Pin Connection

Pin	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	Ctrl (Option)	Ctrl (Option)
4	+Vout	+Vout
5	-Vout	Common
6	Trim	-Vout

1. All dimensions in Inch (mm)
2. Tolerance: X.XX±0.02 (X.X±0.5)
X.XXX±0.01 (X.XX±0.25)
3. Pin dimension tolerance ±0.004 (0.10)

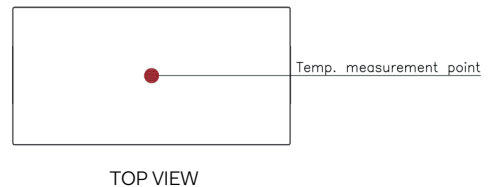
Recommended Pad Layout



All dimensions in inch[mm]
Pad size(lead free recommended)
Through hole 1.2.3.4.5.6: $\phi 0.051[1.30]$
Top view pad 1.2.3.4.5.6: $\phi 0.064[1.63]$
Bottom view pad 1.2.3.4.5.6: $\phi 0.102[2.60]$

Thermal Consideration

The power module operates in a variety of thermal environments. However, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding Environment. Proper cooling can be verified by measuring the point as the figure below. The temperature at this location should not exceed "Maximum case temperature". When Operating, adequate cooling must be provided to maintain the test point temperature at or below "Maximum case temperature". You can limit this Temperature to a lower value for extremely high reliability.



Thermal test condition with vertical direction by natural convection (20LFM).

Output Voltage Adjustment

It allows the user to increase or decrease the output voltage of the module. This is accomplished by connecting an external resistor between the Trim pin and either the +Vout or -Vout pins. With an external resistor between the Trim and -Output pin, the output voltage increases. With an external resistor between the Trim and +Output pin, the output voltage decreases. The external Trim resistor needs to be at least 1/16W of rated power.

Trim Constants

Model	G	H	K	L
PMM20-□□S05 ` □□S05W	5110	2050	2.5	2.5
PMM20-□□S12 ` □□S12W	10000	5110	2.5	2.5
PMM20-□□S15 ` □□S15W	10000	5110	12.5	2.5
PMM20-□□S24 ` □□S24W	56000	13000	21.5	2.5

Trim Up

□□S05 ` □□S05W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	5.05	5.1	5.15	5.2	5.25	5.3	5.35	5.4	5.45	5.5
RU (kΩ)	253.450	125.700	83.117	61.825	49.050	40.533	34.450	29.888	26.339	23.500

□□S12 ` □□S12W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	12.12	12.24	12.36	12.48	12.6	12.72	12.84	12.96	13.08	13.2
RU (kΩ)	203.223	99.057	64.334	46.973	36.557	29.612	24.652	20.932	18.038	15.723

□□S15 ` □□S15W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	15.15	15.3	15.45	15.6	15.75	15.9	16.05	16.2	16.35	16.5
RU (kΩ)	161.557	78.223	50.446	36.557	28.223	22.668	18.700	15.723	13.409	11.557

ΔV (%)	11	12	13	14	15	16	17	18	19	20
Vout (V)	16.65	16.8	16.95	17.1	17.25	17.4	17.55	17.7	17.85	18
RU (kΩ)	10.042	8.779	7.711	6.795	6.001	5.307	4.694	4.149	3.662	3.223

□□S24 ` □□S24W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	24.24	24.48	24.72	24.96	25.2	25.44	25.68	25.92	26.16	26.4
RU (kΩ)	570.333	278.667	181.444	132.833	103.667	84.222	70.333	59.917	51.815	45.333

ΔV (%)	11	12	13	14	15	16	17	18	19	20
Vout (V)	26.64	26.88	27.12	27.36	27.6	27.84	28.08	28.32	28.56	28.8
RU (kΩ)	40.030	35.611	31.872	28.667	25.889	23.458	21.314	19.407	17.702	16.167

Trim Up Equation

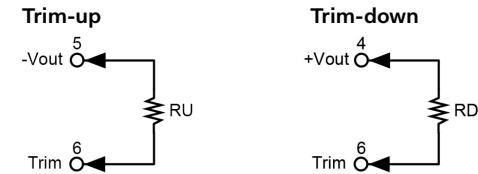
$$R_U = \left[\frac{G \times L}{(V_{O,up} - L - K)} - H \right] \Omega$$

Trim Down Equation

$$R_D = \left[\frac{(V_{o,down} - L) \times G}{(V_o - V_{o,down})} - H \right] \Omega$$

External Output Trimming

Output can be externally trimmed by using the method shown below.



POWERBOX **Medline**
PMM20 Series
20W 2:1 & 4:1 Single and Dual Output
Medical DC/DC Converter

Trim Down

□□S05W

ΔV	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	4.95	4.9	4.85	4.8	4.75	4.7	4.65	4.6	4.55	4.5
RD	(k Ω)	248.340	120.590	78.007	56.715	43.940	35.423	29.340	24.778	21.229	18.390

□□S12W

ΔV	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	11.88	11.76	11.64	11.52	11.4	11.28	11.16	11.04	10.92	10.8
RD	(k Ω)	776.557	380.723	248.779	182.807	143.223	116.834	97.985	83.848	72.853	64.057

□□S15W

ΔV	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	14.85	14.7	14.55	14.4	14.25	14.1	13.95	13.8	13.65	13.5
RD	(k Ω)	818.223	401.557	262.668	193.223	151.557	123.779	103.938	89.057	77.483	68.223

□□S24W

ΔV	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	23.76	23.52	23.28	23.04	22.8	22.56	22.32	22.08	21.84	21.6
RD	(k Ω)	4947.667	2439.333	1603.222	1185.167	934.333	767.111	647.667	558.083	488.407	432.667