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POWERBOX **Medline**
PMM15 Series
15W 2:1 & 4:1 Single and Dual Output
Medical DC/DC Converter

Preliminary

Features

IEC 60601-1 safety approved
15 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	
	Remote on/off	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%.	
Voltage 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 Iout 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	15.30°C/W.
Operating altitude	5000m.
Thermal shock	MIL-STD-810F.
Vibration	MIL-STD-810F.
Relative humidity	5-95% RH.

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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	2.080 khrs, MIL-HDBK-217F, 25°C, full load.

Standards

Safety standards	IEC/ EN/ ANSI/AAMI ES 60601-1.
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EMC Parameter		Conditions	Level
EMI	EN55011, EN55032 and FCC Part 18	Without external components	Class A
		With external components	Class B
ESD	EN61000-4-2	Air ± 15kV and Contact ± 8kV	Perf. Criteria A
Radiated immunity	EN61000-4-3	10 V/m	Perf. Criteria A
Fast transient	EN61000-4-4	± 2kV	Perf. Criteria A
		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.	
	PMM15-12□□□□	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.	
		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.	
	PMM15-24□□□□	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.	
		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.	
	PMM15-48□□□□	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.	
		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.	
	PMM15-48□□□□	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.	
		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.	
Surge	EN61000-4-5	± 2kV	Perf. Criteria A
		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.	
	PMM15-12□□□□	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.	
		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.	
	PMM15-24□□□□	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.	
		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.	
Conducted immunity	EN61000-4-6	10 Vr.m.s	Perf. Criteria A
		100A/m continuous; 1000A/m 1 second	Perf. Criteria A

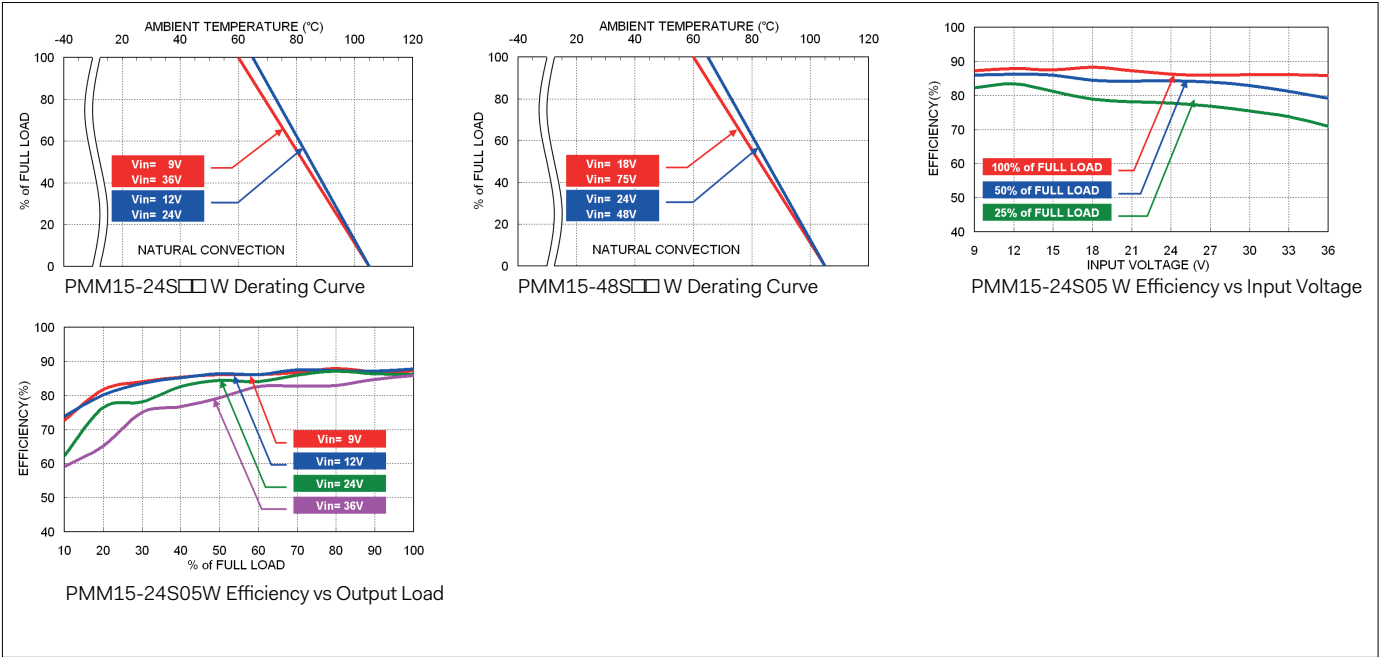
CAUTION: This power module is not internally fused. An input line fuse must always be used.

Model Number	Input Range	Output Voltage	Output Current @ Full Load	Input Current @ No Load	Efficiency	Max Capacitor Load
PMM15-12S05	9 ~ 18 VDC	5 VDC	3000 mA	8 mA	89%	3800 μ F
PMM15-12S12	9 ~ 18 VDC	12 VDC	1250 mA	12 mA	88.5%	650 μ F
PMM15-12S15	9 ~ 18 VDC	15 VDC	1000 mA	12 mA	89%	530 μ F
PMM15-12S24	9 ~ 18 VDC	24 VDC	625 mA	12 mA	89%	190 μ F
PMM15-12D05	9 ~ 18 VDC	$\pm$ 5 VDC	$\pm$ 1500 mA	11 mA	86%	$\pm$ 1900 μ F
PMM15-12D12	9 ~ 18 VDC	$\pm$ 12 VDC	$\pm$ 625 mA	12 mA	89%	$\pm$ 380 μ F
PMM15-12D15	9 ~ 18 VDC	$\pm$ 15 VDC	$\pm$ 500 mA	14 mA	89%	$\pm$ 270 μ F
PMM15-24S05	18 ~ 36 VDC	5 VDC	3000 mA	8 mA	90%	3800 μ F
PMM15-24S12	18 ~ 36 VDC	12 VDC	1250 mA	9 mA	90%	650 μ F
PMM15-24S15	18 ~ 36 VDC	15 VDC	1000 mA	10 mA	90%	530 μ F
PMM15-24S24	18 ~ 36 VDC	24 VDC	625 mA	9 mA	90%	190 μ F
PMM15-24D05	18 ~ 36 VDC	$\pm$ 5 VDC	$\pm$ 1500 mA	11 mA	86%	$\pm$ 1900 μ F
PMM15-24D12	18 ~ 36 VDC	$\pm$ 12 VDC	$\pm$ 625 mA	9 mA	90%	$\pm$ 380 μ F
PMM15-24D15	18 ~ 36 VDC	$\pm$ 15 VDC	$\pm$ 500 mA	11 mA	90%	$\pm$ 270 μ F
PMM15-48S05	36 ~ 75 VDC	5 VDC	3000 mA	9 mA	89.5%	3800 μ F
PMM15-48S12	36 ~ 75 VDC	12 VDC	1250 mA	9 mA	88%	650 μ F
PMM15-48S15	36 ~ 75 VDC	15 VDC	1000 mA	9 mA	89%	530 μ F
PMM15-48S24	36 ~ 75 VDC	24 VDC	625 mA	9 mA	88.5%	190 μ F
PMM15-48D05	36 ~ 75 VDC	$\pm$ 5 VDC	$\pm$ 1500 mA	9 mA	86%	$\pm$ 1900 μ F
PMM15-48D12	36 ~ 75 VDC	$\pm$ 12 VDC	$\pm$ 625 mA	9 mA	88.5%	$\pm$ 380 μ F
PMM15-48D15	36 ~ 75 VDC	$\pm$ 15 VDC	$\pm$ 500 mA	9 mA	89%	$\pm$ 270 μ F
PMM15-24S05W	9 ~ 36 VDC	5 VDC	3000 mA	9 mA	88%	3800 μ F
PMM15-24S12W	9 ~ 36 VDC	12 VDC	1250 mA	10 mA	88.5%	650 μ F
PMM15-24S15W	9 ~ 36 VDC	15 VDC	1000 mA	11 mA	89%	530 μ F
PMM15-24S24W	9 ~ 36 VDC	24 VDC	625 mA	10 mA	88%	190 μ F
PMM15-24D05W	9 ~ 36 VDC	$\pm$ 5 VDC	$\pm$ 1500 mA	10 mA	86%	$\pm$ 1900 μ F
PMM15-24D12W	9 ~ 36 VDC	$\pm$ 12 VDC	$\pm$ 625 mA	10 mA	88%	$\pm$ 380 μ F
PMM15-24D15W	9 ~ 36 VDC	$\pm$ 15 VDC	$\pm$ 500 mA	12 mA	89%	$\pm$ 270 μ F
PMM15-48S05W	18 ~ 75 VDC	5 VDC	3000 mA	9 mA	89.5%	3800 μ F
PMM15-48S12W	18 ~ 75 VDC	12 VDC	1250 mA	9 mA	88%	650 μ F
PMM15-48S15W	18 ~ 75 VDC	15 VDC	1000 mA	9 mA	89%	530 μ F
PMM15-48S24W	18 ~ 75 VDC	24 VDC	625 mA	9 mA	88.5%	190 μ F
PMM15-48D05W	18 ~ 75 VDC	$\pm$ 5 VDC	$\pm$ 1500 mA	9 mA	86%	$\pm$ 1900 μ F
PMM15-48D12W	18 ~ 75 VDC	$\pm$ 12 VDC	$\pm$ 625 mA	9 mA	88.5%	$\pm$ 380 μ F
PMM15-48D15W	18 ~ 75 VDC	$\pm$ 15 VDC	$\pm$ 500 mA	9 mA	89%	$\pm$ 270 μ F

Part Number Structure

PMM15	-	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	☐ 2:1		☐ No pin P: Positive logic N: Negative logic
			D: Dual	05: $\pm$ 5 12: $\pm$ 12 15: $\pm$ 15			
		24: 9-36 48: 18-75	S: Single	05: 5 12: 12 15: 15 24: 24	W: 4:1		☐ No pin P: Positive logic N: Negative logic
			D: Dual	05: $\pm$ 5 12: $\pm$ 12 15: $\pm$ 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
PMM15-12□□□ ` 24□□□W	3.15A	Slow-blow
PMM15-24□□□ ` 48□□□W	1.6A	Slow-blow
PMM15-48□□□	0.8A	Slow-blow

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

PMM15 Series

15W 2:1 & 4:1 Single and Dual Output

Medical DC/DC Converter

BOTTOM VIEW

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±0.010 (X.XX±0.25)
3. Pin dimension tolerance ±0.004 (0.10)

1.02 [26.0]min.

0.21 [5.4]

0.200 [5.08]

1.62 [41.2]min.

1.400 [35.56]

0.100 [2.54]

0.300 [7.62]

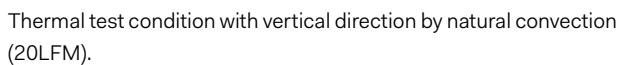
0.700 [17.78]

1 2 3

4 5 6

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]

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.



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
PMM15-□□S05 ` □□S05W	5110	2050	2.5	2.5
PMM15-□□S12 ` □□S12W	10000	5110	2.5	2.5
PMM15-□□S15 ` □□S15W	10000	5110	12.5	2.5
PMM15-□□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

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

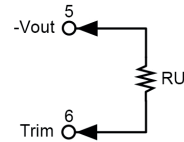
Trim Down Equation

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

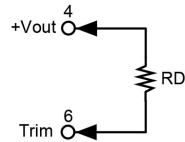
External Output Trimming

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

Trim-up



Trim-down



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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