

MPQ60W Series

60 Watts

- 5000VAC Isolation 2x MOPP rated 250VAC working voltage
- Suitable for Cardiac Floating (CF) rated applied parts <4.5uA leakage
- EN/IEC/ES 60601-1 Medical certification
- Wide 4:1 input
- -40 to 105°C Operation
- 5 Year warranty



The wide input 4:1 MPQ60W medical series of CF rated DC/DC converters come in a 1/4 brick package. They have a nominal input of 24 and 48V and single outputs from 5 to 24V, dual 12V and 15V. The EN/IEC/ES 60601-1 certified units operate from -40 to +105°C and come complete with remote on/off function, sense lines for voltage drop and output trim. All models have a Fidus 5 year warranty.

Dimensions:

2.28 x 1.45 x 0.5" (57.9 x 36.8 x 12.7mm)
Heatsink version 1.19" (30.2mm) high

Models & Ratings

Model Number ⁽¹⁾	Input Voltage	Output Voltage	Output Current	No Load Current	Maximum Capacitive Load	Efficiency
MPQ60-24S05W	9-36V	5V	12.00A	15mA	17000uF	89.5%
MPQ60-24S5P1W		5.1V	12.00A	15mA	17000uF	89.5%
MPQ60-24S12W		12V	5.00A	15mA	3000uF	91.5%
MPQ60-24S15W		15V	4.00A	15mA	1900uF	90%
MPQ60-24S24W		24V	2.50A	15mA	730uF	90%
MPQ60-24D12W		±12V	±2.50A	15mA	±1500uF	90%
MPQ60-24D15W		±15V	±2.00A	15mA	±940uF	90%
MPQ60-48S05W	18-75V	5V	12.00A	10mA	17000uF	89.5%
MPQ60-48S5P1W		5.1V	12.00A	10mA	17000uF	89.5%
MPQ60-48S12W		12V	5.00A	10mA	3000uF	92%
MPQ60-48S15W		15V	4.00A	10mA	1900uF	92.5%
MPQ60-48S24W		24V	2.50A	10mA	730uF	90%
MPQ60-48D12W		±12V	±2.50A	15mA	±1500uF	90%
MPQ60-48D15W		±15V	±2.00A	15mA	±940uF	90%

Notes

1. For heatsink options add **-HS**. For negative logic add **-N**. e.g. MPQ60-24S24W-NHS
2. All specifications are typical at nominal input, full load and 25°C unless otherwise noted

Input

Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Input voltage range	9	24	36	VDC	24V Nominal
	18	48	75		48V Nominal
Start up voltage			9	VDC	24V Nominal
			18		48V Nominal
Shut down voltage	7.8	8	8.6	VDC	24V Nominal
	15.8	16	17.4		48V Nominal
Startup time		30	60	ms	For both start up and remote on off
Input filter					Pi type
Input surge voltage			50	VDC	24V Nominal
			100		48V Nominal
Remote ON/OFF Negative logic (add -N)	0		1.2	VDC	Or short for ON
	3		12		Or open for OFF
Remote ON/OFF Positive logic (standard)	3		12	VDC	Or open for ON
	0		1.2		Or short for OFF
Control pin current	-0.5		0.5	mA	
Remote off input current		3		mA	
Input fuse requirement	6.3		10	A	6.3A slow for 48V and 10A fast for 24V inputs

General

Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Efficiency	89.5		92.5	%	See Model & Ratings table
Isolation	5000			VDC	Input to output. 1min. 250VAC working voltage
Isolation resistance	10000			M Ohm	At 500VDC
Isolation capacitance		40		pF	
Leakage current		4	4.5	uA	240VAC 60Hz
Switching frequency	225	250	275	kHz	
Power density			36.3	W/In ³	
MTBF		1.064		MHrs	As per MIL-HDBK-217F, 25°C GB Full laod
Weight			51	g	
Case material	Non conductive black plastic				
Base material	Non conductive black plastic				
Potting material	Silicone (UL94 V-0)				
Safety approvals	IEC/ EN/ UL 62368-1 (UL: E193009)				
Standards	EN/IEC/ES 60601-1, EN60601-1-2, EN/UL/IEC 62368-1				

Output

Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Output voltage	5		24	VDC	See Model & Ratings table
Set point accuracy			±1	%	
Line regulation	±0.2		±0.5	%	Low line to High line. ±0.5 for dual outputs only
Load regulation	±0.1		±1	%	0 to 100% load change. ±1 for dual outputs only
Output voltage adjustability	-10	+10	+20	%	Trim and remote sense see application note. +20% for 15 and 24V output models
Remote sense			±10	%	If sense lines not used they must be connected to Vout
Ripple & Noise (20MHz bandwidth)		75		mV pk-pk	5/5.1V -10uF/25V X7R MLCC
		100			12/15V -10uF/25V X7R MLCC
		150			24V -4.7uF/50V X7R MLCC
		100			Dual output -10uF/25V X7R MLCC
Overvoltage protection (Automatic recovery)		120		%	5/5.1 & 12V
		130			15 & 24V
		120			Dual
Overload protection	150		195	%	Automatic recovery
Short circuit protection					Continuous with automatic recovery
Transient response		250		us	For a 25% load change
Output voltage trim	See applications pages 3 and 4				

EMC: Emissions

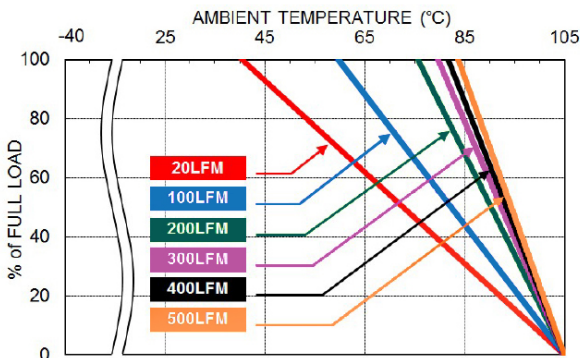
	Standard	Notes & Conditions
Conducted	EN55011/32 A/B	See application note
Radiated	EN55011/32 A/B	See application note

EMC: Immunity

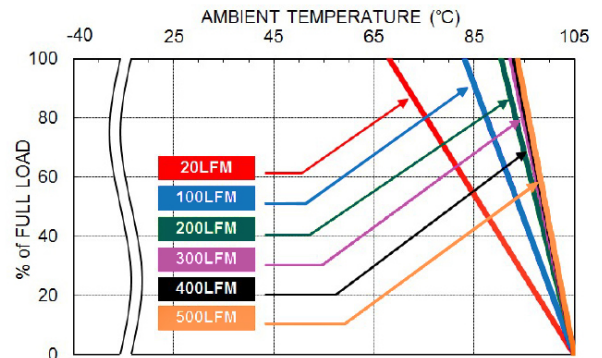
	Standard	Criteria	Notes & Conditions
ESD	EN61000-4-2	A	Air ±15kV, Contact ±8kV
Radiated	EN61000-4-3	A	10V/m
EFT/Burst	EN61000-4-4	A	2kV 24V:Capacitors required: 2x in parallel 220uF/100V, TVS SMDJ58A 48V: Capacitors required 2x in parallel 150uF/200V,TVS SMDJ120A
Surges	EN61000-4-5	A	2kV 24V:Capacitors required: 2x in parallel 220uF/100V, TVS SMDJ58A 48V: Capacitors required 2x in parallel 150uF/200V,TVS SMDJ120A
Conducted	EN61000-4-6	A	10Vrms
Magnetic fields	EN61000-4-8	A	100A/m continuous. 1000A/m 1 sec

Environmental

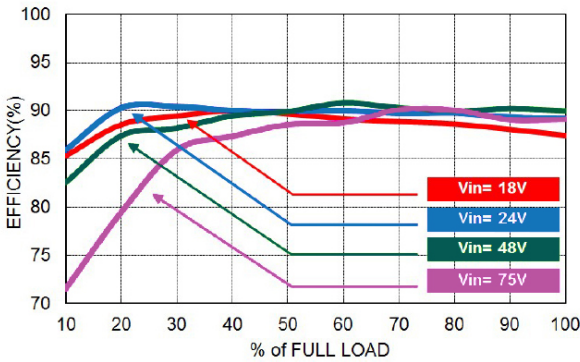
Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Operating temperature	-40		105	°C	Base-plate temp. See de-rating curve
Max case temp			105	°C	
Over temp protection			115	°C	
Storage temperature	-55		125	°C	
Thermal impedance		9.7		°C/W	DC-DC module
		5.5			With heatsink
Humidity	5		95	% RH	Non-condensing
Thermal shock and vibration	MIL-STD-810F				
Temperature coefficient	-0.02		+0.02	%/°C	



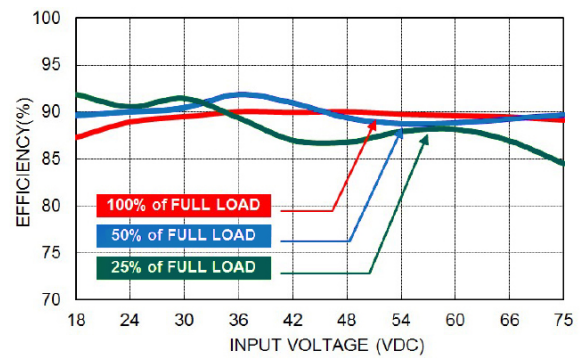
MPQ60-48S24W Derating Curve



MPQ60-48S24W Derating Curve With Heat-sink

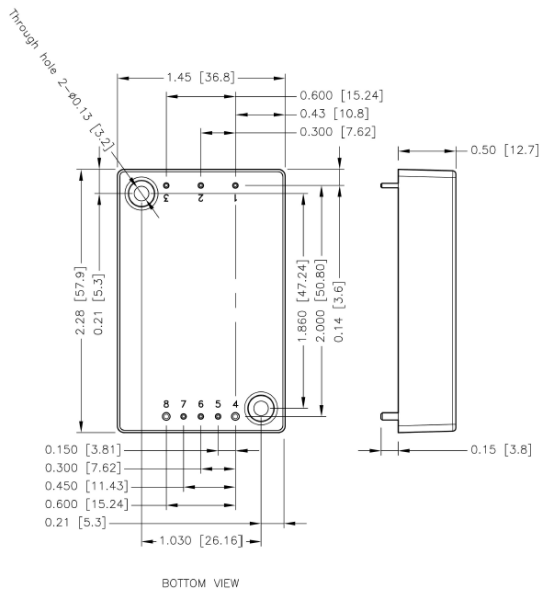


MPQ60-48S24W Efficiency vs. Output Load

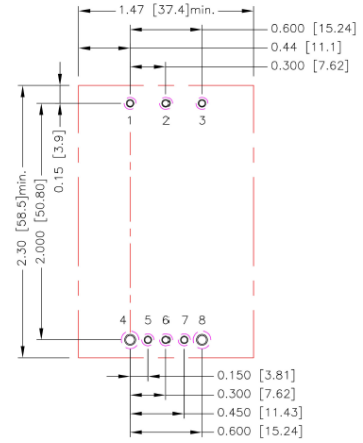


MPQ60-48S24W Efficiency vs. Input Voltage

Mechanical Details



Suggested pad layout

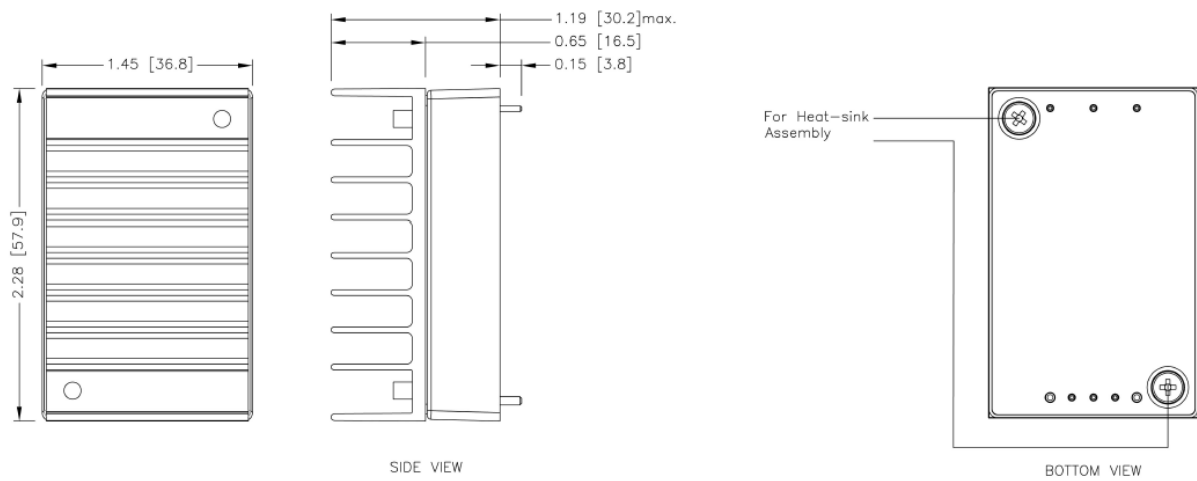


Pin	Single	Dual	Diameter
1	-Vin	-Vin	0.04"
2	CTRL	CTRL	0.04"
3	+Vin	+Vin	0.04"
4	-Vout	-Vout	0.06"
5	-Sense	-Sense	0.04"
6	Trim	Common	0.04"
7	+Sense	+Sense	0.04"
8	+Vout	+Vout	0.06"

Notes

- All dimensions shown in inches [mm]
- Through hole 1,2,3,5,6,7: $\varnothing 0.051$ [1.3]
- Through hole 4,8: $\varnothing 0.75$ [1.9]
- Through hole mounting 2pc M3x5
- Top view pad 1,2,3,5,6,7 $\varnothing 0.064$ [1.63]
- Top view pad 4,8 $\varnothing 0.094$ [2.38]
- Bottom view pad 1,2,3,5,6,7: $\varnothing 0.102$ [2.6]
- Bottom view pad 4,8: $\varnothing 0.15$ [3.8]

Heat sink version

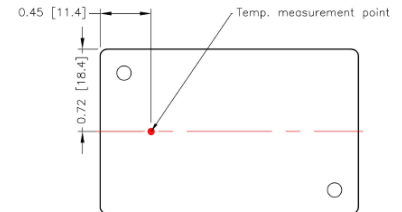


Application notes

Thermal Considerations

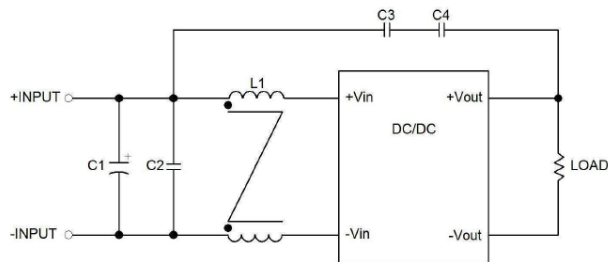
Sufficient cooling should be provided to ensure reliable operation. Sufficient cooling is monitored by measuring the temperature of the centre point on the bottom of the unit as shown. This temperature should not exceed max case temperature.

Thermal conditions (from which graphs are derived) utilise 20LFM from above.

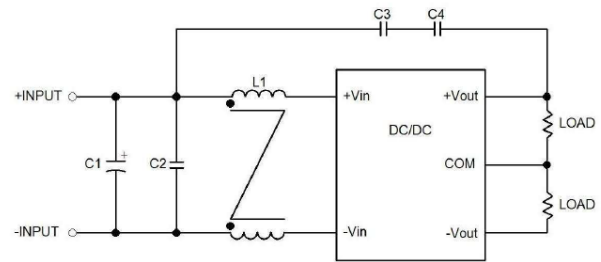


EMC Circuit

EMC filter for level A



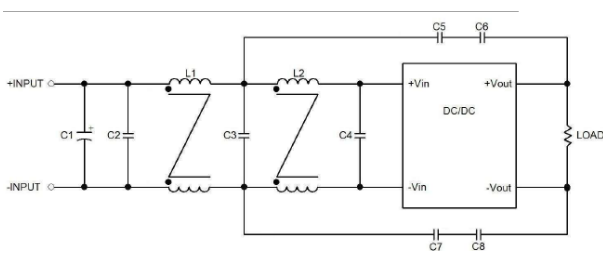
Single output



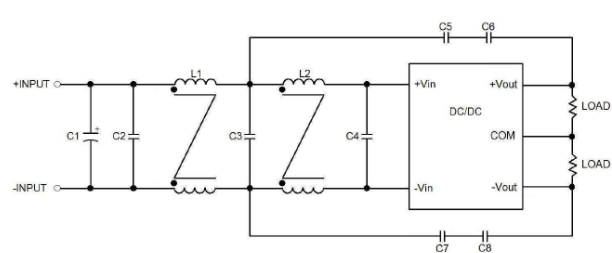
Dual output

C1	C2	C3,C4	L1
100uF/100V Al cap (lie down) Rubycon ZLH	2.2uF/100V 1210 MLCC	100pF/Y1 TDK CD45 series	285uH PMT-103

EMC filter for level B



Single output



Dual output

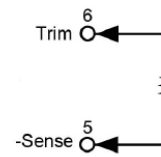
C1	C2,C3,C4	C5, C6	C7, C8	L1, L2
100uF/100V Al cap (lie down) Rubycon ZLH	2.2uF/100V 1210MLCC	47pF/Y1 TDK CD45	33pF/Y1 TDK CD45	285uH PMT-103

Trim Tables

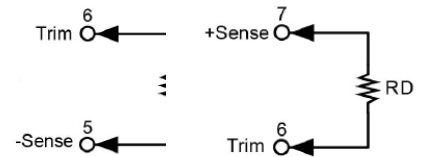
Output voltage trim function allows the user to increase or decrease the output voltage set point. The module may be connected with an external resistor (Rtrim) between TRIM pin and either +Vsense or -Vsense. By adjusting Rtrim, the output voltage can be changed.

The resistor should be 1/8W or rated power

Trim up (RU)



Tim Down (RD)



5V OUTPUT TRIM UP

$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	5.05	5.10	5.15	5.20	5.25	5.30	5.35	5.40	5.45	5.50	Volts
RU	35.36	16.244	9.752	6.483	4.514	3.198	2.257	1.55	1	0.559	kOhms

5.1V OUTPUT TRIM UP

$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	5.151	5.202	5.253	5.304	5.355	5.406	5.457	5.508	5.559	5.610	Volts
RU	36.753	16.7	10.001	6.649	4.637	3.295	2.337	1.618	1.059	0.611	kOhms

12V OUTPUT TRIM UP

$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	12.12	12.24	12.36	12.48	12.60	12.72	12.84	12.96	13.08	13.20	Volts
RU	392.864	172.175	101.446	66.591	45.837	32.068	22.264	14.929	9.234	4.685	kOhms

15V OUTPUT TRIM UP

$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	15.15	15.30	15.45	15.60	15.75	15.90	16.05	16.20	16.35	16.50	Volts
RU	413.163	198.115	125.754	89.445	67.618	53.05	42.636	34.82	28.739	23.872	kOhms
$\Delta V\%$	11	12	13	14	15	16	17	18	19	20	%
Vout	16.65	16.8	16.95	17.1	17.25	17.4	17.55	17.7	17.85	18	Volts
RU	19.888	16.568	13.759	11.35	9.262	7.434	5.822	4.389	3.106	1.951	kOhms

24V OUTPUT TRIM UP

$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	24.24	24.48	24.72	24.96	25.20	25.44	25.68	25.92	26.16	26.40	Volts
RU	947.146	472.772	303.499	216.605	163.724	128.153	102.589	83.329	68.298	56.24	kOhms
$\Delta V\%$	11	12	13	14	15	16	17	18	19	20	%
Vout	26.64	26.88	27.12	27.36	27.6	27.84	28.08	28.32	28.56	28.8	Volts
RU	46.353	38.099	31.104	25.101	19.892	15.33	11.302	7.718	4.509	1.619	kOhms

5V OUTPUT TRIM DOWN

$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	4.95	4.9	4.85	4.8	4.75	4.7	4.65	4.6	4.55	4.50	Volts
RD	46.686	20.817	12.36	8.162	5.653	3.984	2.794	1.903	1.21	0.656	kOhms

5.1V OUTPUT TRIM DOWN

$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	5.049	4.998	4.947	4.896	4.845	4.794	4.743	4.692	4.641	4.59	Volts
RD	47.801	21.688	13.003	8.663	6.061	4.326	3.088	2.159	1.436	0.859	kOhms

12V OUTPUT TRIM DOWN

$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	11.88	11.76	11.64	11.52	11.4	11.28	11.16	11.04	10.92	10.8	Volts
RD	435.294	201.116	120.429	79.573	54.894	38.371	26.535	17.639	10.709	5.157	kOhms

15V OUTPUT TRIM DOWN

$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	14.85	14.7	14.55	14.4	14.25	14.1	13.95	13.8	13.65	13.5	Volts
RD	302.154	132.978	78.547	51.685	35.68	25.055	17.489	11.826	7.429	3.916	kOhms

24V OUTPUT TRIM DOWN

$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	23.76	23.52	23.28	23.04	22.8	22.56	22.32	22.08	21.84	21.6	Volts
RD	736.063	326.672	192.473	125.79	85.913	59.383	40.459	25.282	15.263	6.454	kOhms