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Medical



PV



Automation



Datacom



IPC



Industry



Measurement



Telecom



Automobile



Boat



Charger



Railway

UL US CB CE UK CA

- 2
x
MOPP
- 5000
VAC
Reinforced
Insulation
- 4 : 1
Wide
Input
Range
- LOW
Standby
Power
- NO
Min. Load
Required
- Operating
Altitude
5000
meter
- REMOTE
ON
OFF
- OCP
- OTP
- OVP
- SCP
- UVP

PART NUMBER STRUCTURE

MPQ60 -	48	S	05	W	-	N	HS
Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)	Input Range		Remote On/Off Options	Assembly Options
	24: 9~36 48: 18~75	S:Single D: Dual	05:5 5P1:5.1 12:12 15:15 24:24 12:±12 15:±15	W: 4:1		□:Positive logic N:Negative logic	□: None HS: 7GA0131P01-F; H=0.65"

TECHNICAL SPECIFICATION All specifications are typical at nominal input, full load and 25°C unless otherwise noted

Model Number	Input Range	Output Voltage	Output Current @Full Load	Input Current @No Load	Efficiency	Maximum Capacitor Load
	VDC	VDC	A	mA	%	µF
MPQ60-24S05W	9 ~ 36	5	12	15	89.5	17000
MPQ60-24S5P1W	9 ~ 36	5.1	12	15	89.5	17000
MPQ60-24S12W	9 ~ 36	12	5	15	91.5	3000
MPQ60-24S15W	9 ~ 36	15	4	15	90	1900
MPQ60-24S24W	9 ~ 36	24	2.5	15	90	730
MPQ60-24D12W	9 ~ 36	±12	±2.5	15	90	±1500
MPQ60-24D15W	9 ~ 36	±15	±2	15	90	±940
MPQ60-48S05W	18 ~ 75	5	12	10	89.5	17000
MPQ60-48S5P1W	18 ~ 75	5.1	12	10	89.5	17000
MPQ60-48S12W	18 ~ 75	12	5	10	92	3000
MPQ60-48S15W	18 ~ 75	15	4	10	92.5	1900
MPQ60-48S24W	18 ~ 75	24	2.5	10	90	730
MPQ60-48D12W	18 ~ 75	±12	±2.5	15	90	±1500
MPQ60-48D15W	18 ~ 75	±15	±2	15	90	±940

INPUT SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Operating input voltage range	24Vin(nom)		9	24	36	VDC
	48Vin(nom)		18	48	75	
Start up voltage	24Vin(nom)				9	VDC
	48Vin(nom)				18	
Shutdown voltage	24Vin(nom)		7.8	8	8.6	VDC
	48Vin(nom)		15.8	16	17.4	
Start up time	Constant resistive load	Power up		30	60	ms
		Remote ON/OFF		30	60	
Input surge voltage	3 second, max.	24Vin(nom)			50	VDC
		48Vin(nom)			100	
Input filter						Pi type
Remote ON/OFF (Option)	Referred to - Vin pin	Positive logic	DC-DC ON			Open or 3 ~ 12VDC
		(Standard)	DC-DC OFF			Short or 0 ~ 1.2VDC
		Negative logic	DC-DC ON			Short or 0 ~ 1.2VDC
		(Option)	DC-DC OFF			Open or 3 ~ 12VDC
		Input current of Ctrl pin		-0.5		0.5
Remote off input current				3	mA	

OUTPUT SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Voltage accuracy			-1.0		+1.0	%
Line regulation	Low Line to High Line at Full Load	Single Dual	-0.2 -0.5		+0.2 +0.5	%
Load regulation	No Load to Full Load	Single Dual	-0.2 -1.0		+0.2 +1.0	%
Cross regulation	Asymmetrical load 25%/100% FL	Dual	-5.0		+5.0	%
Voltage adjustability	Single output	5Vout, 5.1Vout, 12Vout 15Vout, 24Vout	-10 -10		+10 +20	%
Remote sense	Maximum output deviation is inclusive of remote sense % of Vout(nom) If remote sense is not being used, Sense pins should be connected to corresponding polarity OUTPUT pins.				10	%
Ripple and noise	Measured by 20MHz bandwidth					
		Single				
	With a 10µF/25V X7R MLCC	5Vout, 5.1Vout		75		
	With a 10µF/25V X7R MLCC	12Vout, 15Vout		100		mVp-p
	With a 4.7µF/50V X7R MLCC	24Vout		150		
		Dual				
	With a 10µF/25V X7R MLCC	±12Vout, ±15Vout		100		
Temperature coefficient			-0.02		+0.02	%/°C
Transient response recovery time	25% load step change			250		µs
Over voltage protection	% of Vout(nom); Hiccup mode	Single 5Vout, 5.1Vout, 12Vout, 15Vout, 24Vout Dual ±12Vout, ±15Vout		120 130 120		%
Over load protection	% of Iout rated; Hiccup mode			150	195	%
Short circuit protection			Continuous, automatics recovery			
MTBF	MIL-HDBK-217F, Full load					1.064 x 10 ⁶ hrs

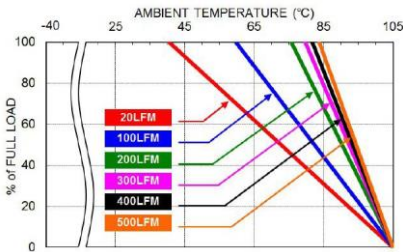
GENERAL SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Isolation voltage	1 minute	Input to Output	5000			VAC
Isolation resistance	Reinforced insulation for 250VAC working voltage		10			GΩ
Isolation capacitance	500VDC		40			pF
Leakage current	240VAC,60Hz		4		4.5	µA
Switching frequency			225	250	275	kHz
Clearance / Creepage			8			mm
Safety approvals	IEC/ EN/ ANSI/AAMI ES 60601-1 IEC/ EN/ UL 62368-1				UL:E360199 UL:E193009 CB:UL(Demko)	
Case material			Non-conductive black plastic			
Base material			Non-conductive black plastic			
Potting material			Silicone (UL94 V-0)			
Weight			51g (1.80oz)			

ENVIRONMENTAL SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Operating ambient temperature	With derating		-40		+105	°C
Maximum case temperature					105	°C
Over temperature protection				115		°C
Storage temperature range			-55		+125	°C
Thermal impedance	Natural convection	Without Heat-sink		9.7		°C/W
		With Heat-sink		5.5		
Operating altitude					5000	m
Thermal shock					MIL-STD-810F	
Vibration					MIL-STD-810F	
Relative humidity					5% to 95% RH	

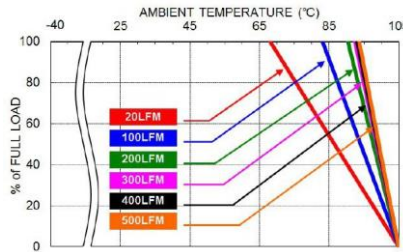
EMC SPECIFICATIONS			
Parameter	Conditions		Level
EMI	EN55011, EN55032, EN60601-1-2	With external components	Class A, Class B
EMS	EN55024 and EN60601-1-2		
ESD	EN61000-4-2	Air ± 15kV and Contact ± 8kV	Perf. Criteria A
Radiated immunity	EN61000-4-3	10 V/m	Perf. Criteria A
Fast transient	EN61000-4-4	± 2kV	Perf. Criteria A
	MPQ60-24□□□W	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.	
	MPQ60-48□□□W	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
	MPQ60-24□□□W	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.	
	MPQ60-48□□□W	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
Power frequency magnetic field	EN61000-4-8	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.

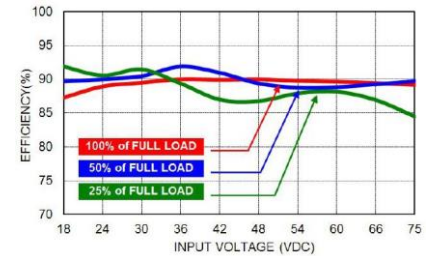
CHARACTERISTIC CURVE



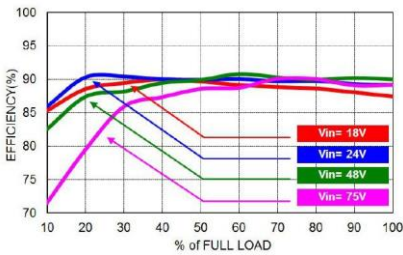
MPQ60-48S24W Derating Curve



MPQ60-48S24W Derating Curve With Heat-sink



MPQ60-48S24W Efficiency vs. Input Voltage



MPQ60-48S24W Efficiency vs. Output Load

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.

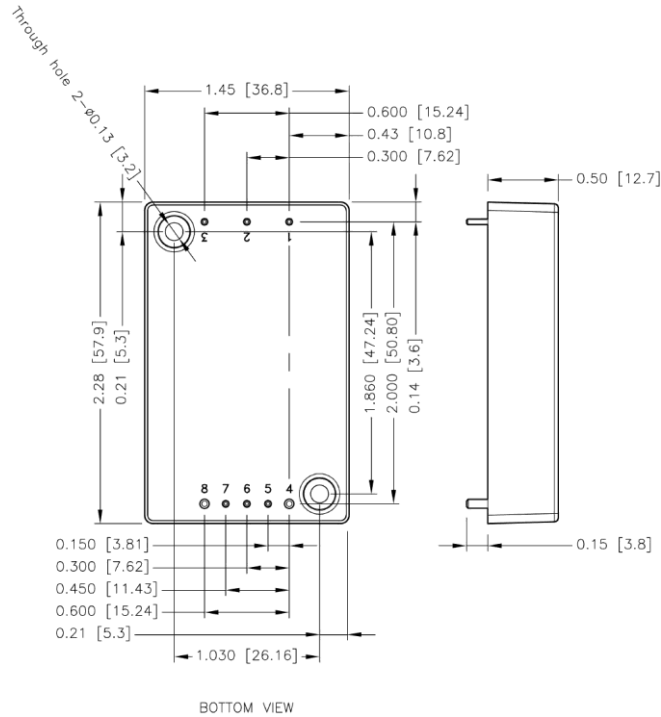
To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.

The input line fuse suggest as below :

Model	Fuse Rating (A)	Fuse Type
MPQ60-24□□□W	10	Fast-Acting
MPQ60-48□□□W	6.3	Slow-Blow

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

MECHANICAL DRAWING

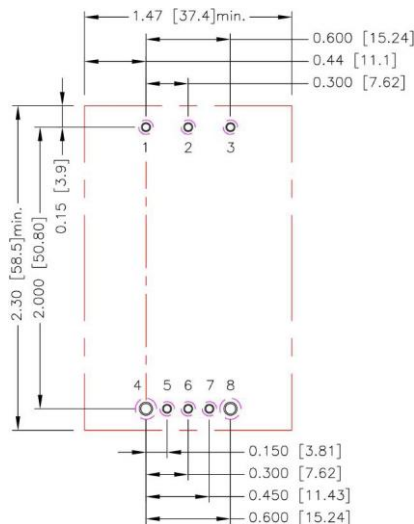


PIN CONNECTION

PIN	SINGLE	DUAL	Diameter
1	- Vin	- Vin	0.04 Inch
2	Ctrl	Ctrl	0.04 Inch
3	+ Vin	+ Vin	0.04 Inch
4	- Vout	- Vout	0.06 Inch
5	- Sense	- Sense	0.04 Inch
6	Trim	Common	0.04 Inch
7	+ Sense	+ Sense	0.04 Inch
8	+ Vout	+ Vout	0.06 Inch

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]
4. The through hole used 2 PCS M3X0.5
5. The screw locked torque: MAX 3.5kgf-cm [0.34N-m]

RECOMMENDED PAD LAYOUT

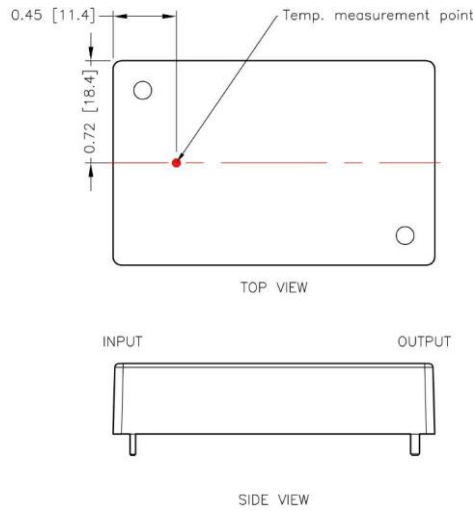


- All dimensions in inch[mm]
- Pad size(lead free recommended)
- Through hole 1.2.3.5.6.7: $\varnothing 0.051[1.30]$
- Through hole 4.8: $\varnothing 0.075[1.90]$
- Top view pad 1.2.3.5.6.7: $\varnothing 0.064[1.63]$
- Top view pad 4.8: $\varnothing 0.094[2.38]$
- Bottom view pad 1.2.3.5.6.7: $\varnothing 0.102[2.60]$
- Bottom view pad 4.8: $\varnothing 0.150[3.80]$

THERMAL CONSIDERATIONS

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.

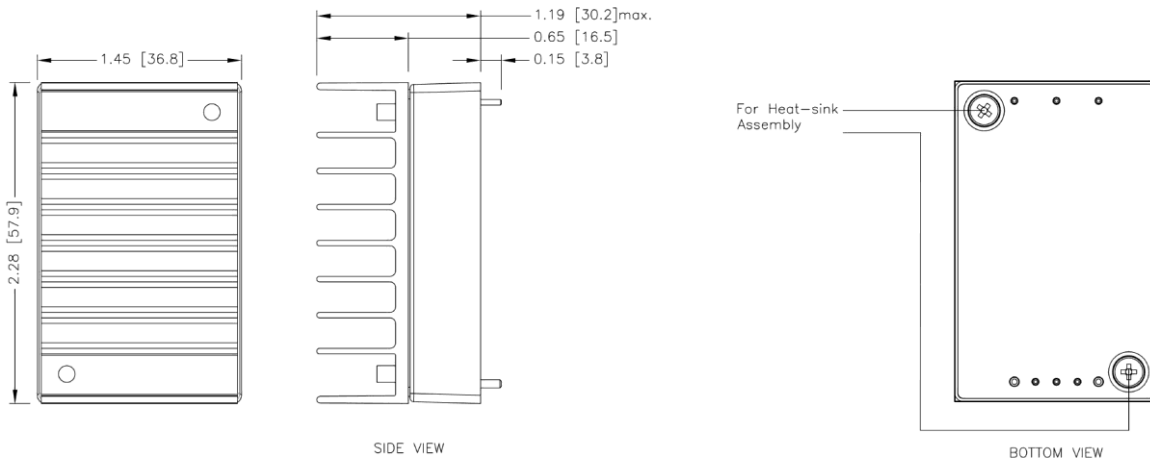
- Thermal test condition with vertical direction by natural convection (20LFM).



HEAT-SINK TYPE OPTIONS

MPQ60-□□□W -HS
7GA0131P01-F

ASSEMBLY INSTRUCTION



- All dimensions in inch [mm]
- Tolerance :x.xx±0.02 [x.x±0.5]

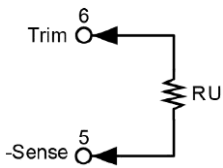
OUTPUT VOLTAGE ADJUSTMENT

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 +Sense or -Sense pins.
 With an external resistor between the Trim and -Sense pin, the output voltage increases.
 With an external resistor between the Trim and +Sense pin, the output voltage decreases.
 The external Trim resistor needs to be at least 1/8W of rated power.

EXTERNAL OUTPUT TRIMMING

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

Trim-up



□□S05W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	5.05	5.10	5.15	5.20	5.25	5.30	5.35	5.40	5.45	5.50
RU (kΩ)	35.360	16.244	9.752	6.483	4.514	3.198	2.257	1.550	1.000	0.559

□□S5P1W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	5.151	5.202	5.253	5.304	5.355	5.406	5.457	5.508	5.559	5.610
RU (kΩ)	36.753	16.700	10.001	6.649	4.637	3.295	2.337	1.618	1.059	0.611

□□S12W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	12.12	12.24	12.36	12.48	12.60	12.72	12.84	12.96	13.08	13.20
RU (kΩ)	392.864	172.175	101.446	66.591	45.837	32.068	22.264	14.929	9.234	4.685

□□S15W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	15.15	15.30	15.45	15.60	15.75	15.90	16.05	16.20	16.35	16.50
RU (kΩ)	413.163	198.115	125.754	89.445	67.618	53.050	42.636	34.820	28.739	23.872

ΔV (%)	11	12	13	14	15	16	17	18	19	20
Vout (V)	16.65	16.80	16.95	17.10	17.25	17.40	17.55	17.70	17.85	18.00
RU (kΩ)	19.888	16.568	13.759	11.350	9.262	7.434	5.822	4.389	3.106	1.951

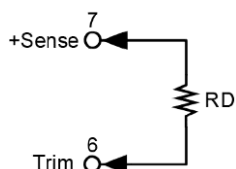
□□S24W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	24.24	24.48	24.72	24.96	25.20	25.44	25.68	25.92	26.16	26.40
RU (kΩ)	947.146	472.772	303.499	216.605	163.724	128.153	102.589	83.329	68.298	56.240

ΔV (%)	11	12	13	14	15	16	17	18	19	20
Vout (V)	26.64	26.88	27.12	27.36	27.60	27.84	28.08	28.32	28.56	28.80
RU (kΩ)	46.353	38.099	31.104	25.101	19.892	15.330	11.302	7.718	4.509	1.619

OUTPUT VOLTAGE ADJUSTMENT(CONTINUED)

Trim-down



□□S05W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	4.95	4.90	4.85	4.80	4.75	4.70	4.65	4.60	4.55	4.50
RD (k Ω)	46.686	20.817	12.360	8.162	5.653	3.984	2.794	1.903	1.210	0.656

□□S5P1W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	5.049	4.998	4.947	4.8960	4.845	4.794	4.743	4.692	4.641	4.590
RD (k Ω)	47.801	21.688	13.003	8.663	6.061	4.326	3.088	2.159	1.436	0.859

□□S12W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	11.88	11.76	11.64	11.52	11.40	11.28	11.16	11.04	10.92	10.80
RD (k Ω)	435.294	201.116	120.429	79.573	54.894	38.371	26.535	17.639	10.709	5.157

□□S15W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	14.85	14.70	14.55	14.40	14.25	14.10	13.95	13.80	13.65	13.50
RD (k Ω)	302.154	132.978	78.547	51.685	35.680	25.055	17.489	11.826	7.429	3.916

□□S24W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	23.76	23.52	23.28	23.04	22.80	22.56	22.32	22.08	21.84	21.60
RD (k Ω)	736.063	326.672	192.473	125.790	85.913	59.383	40.459	26.282	15.263	6.454