



# P-DUKE POWER

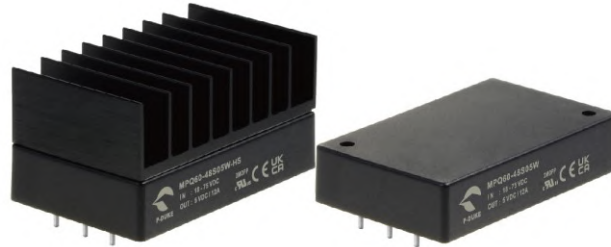
## MPQ60W Series

QUARTER-BRICK DC-DC Converter  
Up to 60 Watts

**5**  
YEARS  
WARRANTY

ROHS  
COMPLIANT

REACH  
COMPLIANT



Medical



PV



Automation



Datacom



IPC



Industry



Measurement



Telecom



Automobile



Boat



Charger



Railway

UL US CB CE UK CA

<b>2</b> x MOPP	<b>5000</b> VAC Reinforced Insulation	<b>4 : 1</b> Wide Input Range	<b>LOW</b> Standby Power	<b>NO</b> Min. Load Required	Operating Altitude <b>5000</b> meter	<b>REMOTE</b> <b>ON</b> <b>OFF</b>	<b>OCP</b>	<b>OTP</b>	<b>OVP</b>	<b>SCP</b>	<b>UVP</b>
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### 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			ms
		Remote ON/OFF		30			
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			mA
		(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					
	With a 10µF/25V X7R MLCC	Single 5Vout, 5.1Vout		75		
	With a 10µF/25V X7R MLCC	12Vout, 15Vout		100		mVp-p
	With a 4.7µF/50V X7R MLCC	24Vout		150		
	With a 10µF/25V X7R MLCC	Dual ±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		%
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 <sup>6</sup> 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**

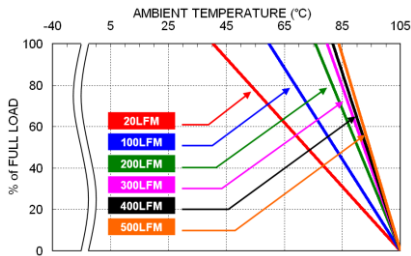
Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating ambient temperature	With derating	-40		+105	°C
Maximum case temperature				105	°C
Over temperature protection			115		°C
Storage temperature range		-55		+125	°C
Thermal impedance	Natural convection		9.7		°C/W
	Without Heat-sink With Heat-sink		5.5		
Operating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

**EMC SPECIFICATIONS**

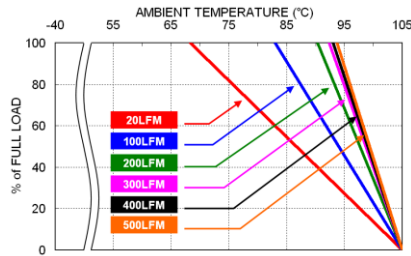
Parameter	Conditions	Level
EMI	EN55011, EN55032, EN60601-1-2 With external components	Class A, Class B
EMS	EN55035 and EN60601-1-2	
ESD	EN61000-4-2 Air ± 15kV and Contact ± 8kV	Perf. Criteria A
Radiated immunity	EN61000-4-3 10 V/m	Perf. Criteria A
Fast transient	EN61000-4-4 ± 2kV	Perf. Criteria A
	MPQ60-24□□□W 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.

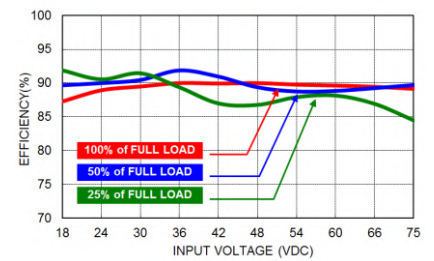
**CHARACTERISTIC CURVE**



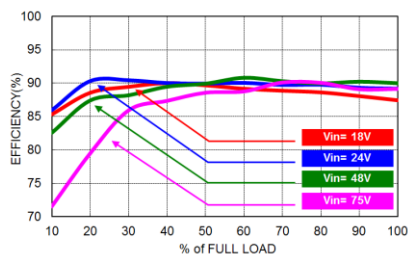
MPQ60-48S24W Derating Curve



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.

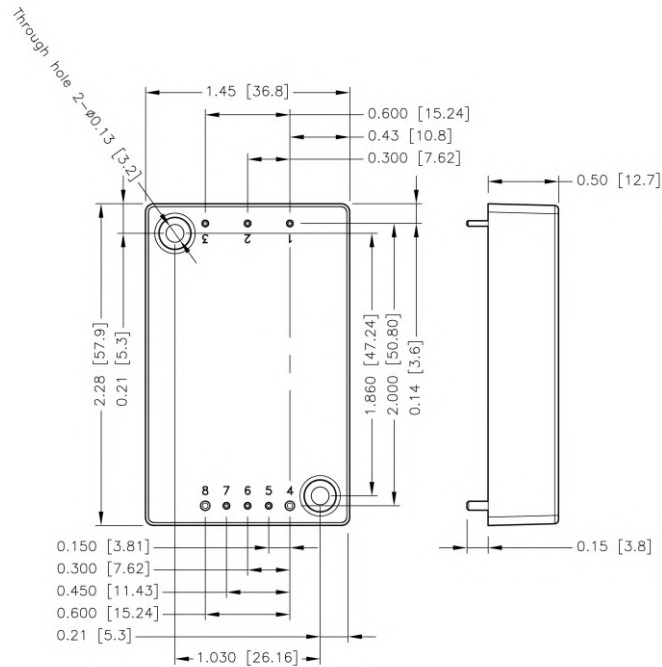
This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture.

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.

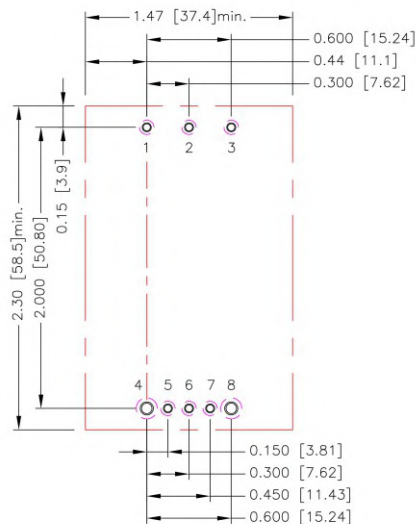
**MECHANICAL DRAWING**


BOTTOM VIEW

**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

- All dimensions in inch [mm]
- Tolerance :x.xx±0.02 [x.x±0.5]  
x.xxx±0.010 [x.xx±0.25]
- Pin dimension tolerance ±0.004[0.10]
- The through hole used 2 PCS M3X0.5
- The screw locked torque: MAX 3.5kgf-cm [0.34N-m]

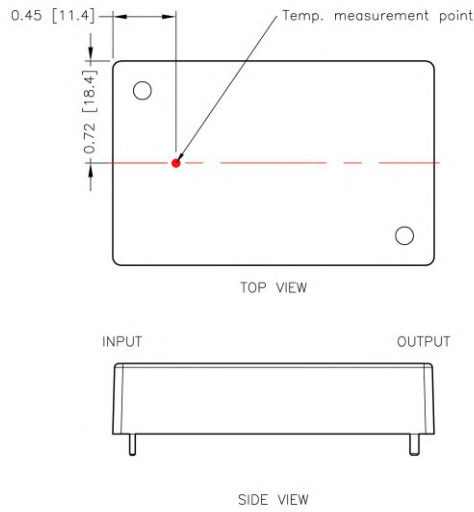
**RECOMMENDED PAD LAYOUT**


- All dimensions in inch[mm]  
 Pad size(lead free recommended)  
 Through hole 1.2.3.5.6.7: Ø0.051[1.30]  
 Through hole 4.8: Ø0.075[1.90]  
 Top view pad 1.2.3.5.6.7: Ø0.064[1.63]  
 Top view pad 4.8: Ø0.094[2.38]  
 Bottom view pad 1.2.3.5.6.7: Ø0.102[2.60]  
 Bottom view pad 4.8:Ø0.150[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.

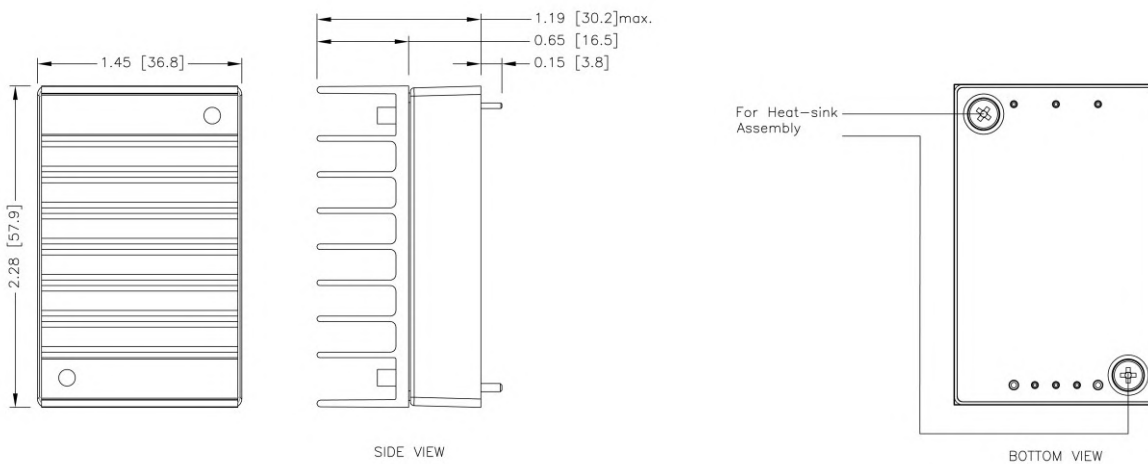
- Thermal test condition with vertical direction by natural convection (20LFM).



**HEAT-SINK TYPE OPTIONS**

MPQ60-□□□□W -HS  
7GA0131P01-F

**ASSEMBLY INSTRUCTION**



1. All dimensions in inch [mm]
2. 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.

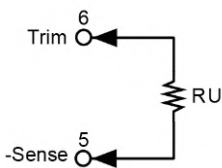
With an external resistor between the Trim and +Sense pin, the output voltage decreases.

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

$\Delta V$ (%)	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 (k $\Omega$ )	35.360	16.244	9.752	6.483	4.514	3.198	2.257	1.550	1.000	0.559

#### □□S5P1W

$\Delta V$ (%)	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 (k $\Omega$ )	36.753	16.700	10.001	6.649	4.637	3.295	2.337	1.618	1.059	0.611

#### □□S12W

$\Delta V$ (%)	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 (k $\Omega$ )	392.864	172.175	101.446	66.591	45.837	32.068	22.264	14.929	9.234	4.685

#### □□S15W

$\Delta V$ (%)	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 (k $\Omega$ )	413.163	198.115	125.754	89.445	67.618	53.050	42.636	34.820	28.739	23.872

$\Delta V$ (%)	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 (k $\Omega$ )	19.888	16.568	13.759	11.350	9.262	7.434	5.822	4.389	3.106	1.951

#### □□S24W

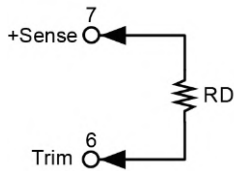
$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	24.24	24.48	24.72	24.96	25.20	25.44	25.68	25.92	26.16	26.40
RU (k $\Omega$ )	947.146	472.772	303.499	216.605	163.724	128.153	102.589	83.329	68.298	56.240

$\Delta V$ (%)	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 (k $\Omega$ )	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

$\Delta V$ (%)	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 $\Omega$ )	46.686	20.817	12.360	8.162	5.653	3.984	2.794	1.903	1.210	0.656

## □□S5P1W

$\Delta V$ (%)	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 $\Omega$ )	47.801	21.688	13.003	8.663	6.061	4.326	3.088	2.159	1.436	0.859

## □□S12W

$\Delta V$ (%)	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 $\Omega$ )	435.294	201.116	120.429	79.573	54.894	38.371	26.535	17.639	10.709	5.157

## □□S15W

$\Delta V$ (%)	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 $\Omega$ )	302.154	132.978	78.547	51.685	35.680	25.055	17.489	11.826	7.429	3.916

## □□S24W

$\Delta V$ (%)	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 $\Omega$ )	736.063	326.672	192.473	125.790	85.913	59.383	40.459	26.282	15.263	6.454