

MOP06 MOP06W SERIES

DC-DC CONVERTER
2:1 & 4:1 WIDE INPUT RANGE
UP TO 6 WATTS



FEATURES

- REINFORCED INSULATION FOR 300VAC WORKING VOLTAGE
- CLEARANCE AND CREEPAGE DISTANCE :6.6mm/2MOOP
- 3000VAC INPUT TO OUTPUT 2MOOP ISOLATION
- BUILT-IN EMI CLASS A FILTER
- 2 μ A PATIENT LEAKAGE CURRENT
- ANSI/AAMI ES60601-1, EN60601-1, IEC60601-1, UL60950-1, EN60950-1, & IEC60950-1 SAFETY APPROVALS
- CE MARKED
- COMPLIANT TO RoHS II & REACH

APPLICATIONS

MEDICAL EQUIPMENT
TELECOM/DATACOM
INDUSTRY CONTROL SYSTEM
MEASUREMENT EQUIPMENT
SEMICONDUCTOR EQUIPMENT
PV POWER SYSTEM
IGBT GATE DRIVER

3000VAC ISOLATION	UVP	OCP	SCP	OVP	LOW STANDBY POWER
----------------------	-----	-----	-----	-----	-------------------------

TECHNICAL SPECIFICATION

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

Model Number	Input Range VDC	Output Voltage VDC	Output Current @ Full Load mA	Input Current @ No Load mA	Efficiency %	Maximum Capacitor Load μ F
MOP06-05S3P3A/B	4.5 ~ 9	3.3	1800	10	81.5	2100
MOP06-05S05A/B	4.5 ~ 9	5	1200	10	86	1500
MOP06-05S12A/B	4.5 ~ 9	12	500	15	86	260
MOP06-05S15A/B	4.5 ~ 9	15	400	15	87.5	210
MOP06-05S24A/B	4.5 ~ 9	24	250	20	87	75
MOP06-05D05A/B	4.5 ~ 9	± 5	± 600	25	84	± 860
MOP06-05D12A/B	4.5 ~ 9	± 12	± 250	25	86.5	± 150
MOP06-05D15A/B	4.5 ~ 9	± 15	± 200	25	87.5	± 110
MOP06-12S3P3A/B	9 ~ 18	3.3	1800	10	83.5	2100
MOP06-12S05A/B	9 ~ 18	5	1200	10	86	1500
MOP06-12S12A/B	9 ~ 18	12	500	10	89	260
MOP06-12S15A/B	9 ~ 18	15	400	10	88.5	210
MOP06-12S24A/B	9 ~ 18	24	250	10	88.5	75
MOP06-12D05A/B	9 ~ 18	± 5	± 600	10	85	± 860
MOP06-12D12A/B	9 ~ 18	± 12	± 250	10	89	± 150
MOP06-12D15A/B	9 ~ 18	± 15	± 200	10	88	± 110
MOP06-24S3P3A/B	18 ~ 36	3.3	1800	6	83	2100
MOP06-24S05A/B	18 ~ 36	5	1200	6	86.0	1500
MOP06-24S12A/B	18 ~ 36	12	500	6	89	260
MOP06-24S15A/B	18 ~ 36	15	400	6	89	210
MOP06-24S24A/B	18 ~ 36	24	250	6	88.5	75
MOP06-24D05A/B	18 ~ 36	± 5	± 600	6	85	± 860
MOP06-24D12A/B	18 ~ 36	± 12	± 250	6	88.5	± 150
MOP06-24D15A/B	18 ~ 36	± 15	± 200	6	88.5	± 110
MOP06-48S3P3A/B	36 ~ 75	3.3	1800	4	82.5	2100
MOP06-48S05A/B	36 ~ 75	5	1200	4	86.5	1500
MOP06-48S12A/B	36 ~ 75	12	500	4	88	260
MOP06-48S15A/B	36 ~ 75	15	400	4	88.5	210
MOP06-48S24A/B	36 ~ 75	24	250	4	88	75
MOP06-48D05A/B	36 ~ 75	± 5	± 600	4	85	± 860
MOP06-48D12A/B	36 ~ 75	± 12	± 250	4	88	± 150
MOP06-48D15A/B	36 ~ 75	± 15	± 200	4	87	± 110

Model Number	Input Range	Output Voltage	Output Current @ Full Load	Input Current @ No Load	Efficiency	Maximum Capacitor Load
	VDC	VDC	mA	mA	%	μF
MOP06-24S3P3WA/B	9 ~ 36	3.3	1800	6	83	2100
MOP06-24S05WA/B	9 ~ 36	5	1200	6	86.0	1500
MOP06-24S12WA/B	9 ~ 36	12	500	6	89	260
MOP06-24S15WA/B	9 ~ 36	15	400	6	89	210
MOP06-24S24WA/B	9 ~ 36	24	250	6	88.5	75
MOP06-24D05WA/B	9 ~ 36	±5	±600	6	85	± 860
MOP06-24D12WA/B	9 ~ 36	±12	±250	6	88.5	± 150
MOP06-24D15WA/B	9 ~ 36	±15	±200	6	88.5	± 110
MOP06-48S3P3WA/B	18 ~ 75	3.3	1800	4	82.5	2100
MOP06-48S05WA/B	18 ~ 75	5	1200	4	86.5	1500
MOP06-48S12WA/B	18 ~ 75	12	500	4	88	260
MOP06-48S15WA/B	18 ~ 75	15	400	4	88.5	210
MOP06-48S24WA/B	18 ~ 75	24	250	4	88	75
MOP06-48D05WA/B	18 ~ 75	±5	±600	4	85	± 860
MOP06-48D12WA/B	18 ~ 75	±12	±250	4	88	± 150
MOP06-48D15WA/B	18 ~ 75	±15	±200	4	87	± 110

PART NUMBER STRUCTURE

MOP06	-	48	S	05	A	-	P	T
Series name		Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)	Input Range	Pin Connection Option	Remote On/Off Option	Trim Option
		05: 4.5~9 12: 9~18 24: 18~36 48: 36~75	S: Single	3P3: 3.3 05: 5 12: 12 15: 15 24: 24	□: 2:1 W: 4:1	A: A type(Standard) B: B type	□: No On/Off control P: Remote On/Off (Only for B type Pin connection)	□: No Trim T: Trim (Only for B type Pin connection)
			D: Dual	05: ±5 12: ±12 15: ±15				

MOP06	-	48	S	05	W	A	-	P	T
Series name		Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)	Input Range	Pin Connection Option		Remote On/Off Option	Trim Option
		24: 9~36 48: 18~75	S: Single	3P3: 3.3 05: 5 12: 12 15: 15 24: 24	□: 2:1 W: 4:1	A: A type(Standard) B: B type		□: No On/Off control P: Remote On/Off (Only for B type Pin connection)	□: No Trim T: Trim (Only for B type Pin connection)
			D: Dual	05: ±5 12: ±12 15: ±15					

INPUT SPECIFICATIONS

Parameter	Conditions	Min.	Typ.	Max.	Unit
-----------	------------	------	------	------	------

Operating input voltage range	2:1	5Vin(nom) 12Vin(nom) 24Vin(nom) 48Vin(nom)	4.5 9 18 36	5 12 24 48	9 18 36 75	VDC
		(W) 4:1 24Vin(nom) 48Vin(nom)	9 18	24 48	36 75	
Start-up voltage	2:1	5Vin(nom) 12Vin(nom) 24Vin(nom) 48Vin(nom)			4.5 9 18 36	VDC
		(W) 4:1 24Vin(nom) 48 Vin(nom)			9 18	
Shutdown voltage	2:1	5Vin(nom) 12Vin(nom) 24Vin(nom) 48Vin(nom)		4 8 16 33		VDC
		(W) 4:1 24Vin(nom) 48Vin(nom)		8 16		
Start up time		Constant resistive load	Power up Remote ON/OFF	30 30		ms
Input surge voltage	2:1	5Vin(nom) 12Vin(nom) 24Vin(nom) 48Vin(nom)			16 25 50 100	VDC
		3 second, max. (W) 4:1 24Vin(nom) 48Vin(nom)			50 100	
Input filter					Pi type	
Remote ON/OFF (Only for B-type Pin connection option)		Referenced to - Vin pin	DC-DC ON DC-DC OFF		OPEN or 0 ~ 1.2VDC 2.2 ~ 12VDC	
		Input current of Ctrl pin Remote off input current		-0.5 2.5	1 mA	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 (Only for B-type Pin connection option)	Single output	3.3Vout, 5Vout, 12Vout 15Vout, 24Vout	-10 -10		+10 +20	%
	Dual output	±5Vout, ±12Vout, ±15Vout	-10		+10	%
Ripple and noise	Measured by 20MHz bandwidth With a 10μF/25V X7R MLCC	3.3Vout, 5Vout 12Vout, 15Vout		30 40 50		mVp-p
	With a 4.7μF/50V X7R MLCC	24Vout				
Temperature coefficient			-0.02		+0.02	%/°C
Transient response recovery time	25% load step change			250		μs
Over voltage protection	Single	3.3Vout 5Vout 12Vout 15Vout 24Vout	3.7 5.6 13.5 18.3 29.1		5 7.0 16 22.0 34.5	VDC
	Dual	5Vout 12Vout 15Vout	5.6 13.5 17.0		7.0 18.2 22.0	VDC
Over load protection	% of lout rated; Hiccup mode			150		%
Short circuit protection				Continuous, automatic recovery		

GENERAL SPECIFICATIONS

Parameter	Conditions		Min.	Typ.	Max.	Unit
Isolation voltage	1 minute	Input to Output	3000			VAC
Isolation capacitance				12	17	pF
Leakage current	240VAC, 60Hz				2	μA
Switching frequency			225	250	275	kHz

Clearance/Creepage		6.6	mm
Safety approvals			ANSI/AAMI ES60601-1 EN60601-1 IEC60601-1 UL60950-1 EN60950-1 IEC60950-1
Case material			Non-conductive black plastic
Base material			Non-conductive black plastic
Potting material			Silicone (UL94 V-0)
Weight			14g (0.48oz)
MTBF	MIL-HDBK-217F, Full load		4.718 x 10 ⁶ hrs

ENVIRONMENTAL SPECIFICATIONS

Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating ambient temperature	Without derating	-40		+88	°C
	With derating	+88		+105	°C
Storage temperature range		-55		+125	°C
Thermal impedance	Natural convection (20LFM)		18		°C/W
Thermal shock					MIL-STD-810F
Vibration					MIL-STD-810F
Relative humidity					5% to 95% RH

EMC SPECIFICATIONS

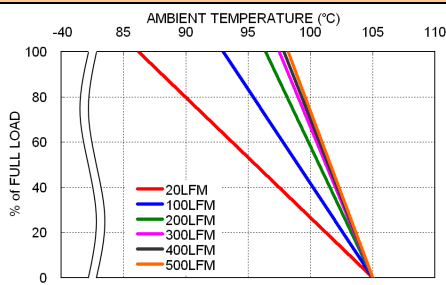
Parameter	Conditions	Level
EMI ⁽¹⁾	EN55011, EN55022 and FCC Part 18	Class A, Class B
ESD	EN61000-4-2 Air ± 8kV Contact ± 6kV	Perf. Criteria A
Radiated immunity	EN61000-4-3 10 V/m	Perf. Criteria A
Fast transient ⁽²⁾	EN61000-4-4 ± 2kV	Perf. Criteria A
Surge ⁽²⁾	EN61000-4-5 ± 2kV	Perf. Criteria A
Conducted immunity	EN61000-4-6 10 Vr.m.s	Perf. Criteria A

Note:

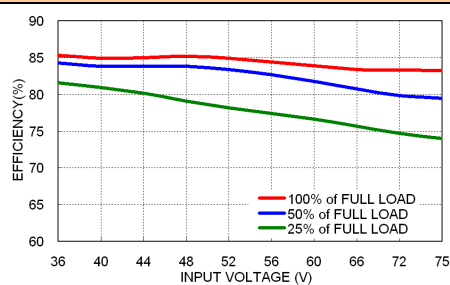
- The MOP06 (W) series can meet EMI Class A with no external filter. And Class B only with external components. For further information, please contact with P-DUKE.
- An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5.
The MOP06-05□□□□□ recommended an aluminum electrolytic capacitor (Nippon Chemi-con KY series, 1000μF/25V). And a reverse diode (Vishay V10P45) to connect in parallel.
The MOP06-12&24□□□□□ recommended an aluminum electrolytic capacitor (Nippon Chemi-con KY series, 470μF/50V).
The MOP06-48□□□□□ recommended an aluminum electrolytic capacitor (Nippon Chemi-con KY series, 330μF/100V).

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

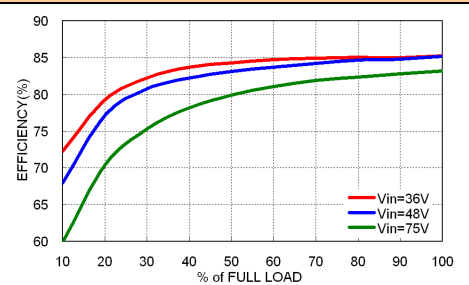
CHARACTERISTIC CURVE



MOP06-48S05WA Derating Curve



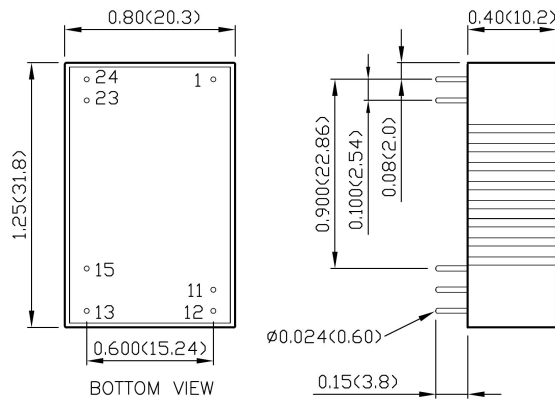
MOP06-48S05WA Efficiency vs. Input Voltage



MOP06-48S05WA Efficiency vs. Output Load

MECHANICAL DRAWING

A TYPE

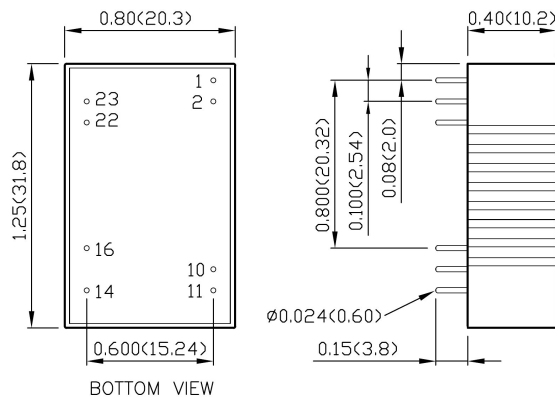


1. All dimensions in Inch (mm)
2. Tolerance: $X.XX \pm 0.02$ ($X.X \pm 0.5$)
 $X.XXX \pm 0.01$ ($X.XX \pm 0.25$)
3. Pin pitch tolerance ± 0.01 (0.25)
4. Pin dimension tolerance ± 0.004 (0.1)

PIN CONNECTION

PIN	SINGLE	DUAL
1	+ Vin	+ Vin
11	No pin	Common
12	-Vout	No pin
13	+Vout	-Vout
15	No pin	+Vout
23	- Vin	- Vin
24	- Vin	- Vin

B TYPE



1. All dimensions in Inch (mm)
2. Tolerance: $X.XX \pm 0.02$ ($X.X \pm 0.5$)
 $X.XXX \pm 0.01$ ($X.XX \pm 0.25$)
3. Pin pitch tolerance ± 0.01 (0.25)
4. Pin dimension tolerance ± 0.004 (0.1)

PIN CONNECTION

PIN	SINGLE	DUAL
1	CtrlL (Option) / No pin*	Ctrl (Option) / No pin*
2	- Vin	- Vin
10	Trim (Option) / No pin*	Trim (Option) / No pin*
11	No pin / NC **	-Vout
14	+Vout	+Vout
16	-Vout	Common
22	+Vin	+Vin
23	+Vin	+Vin

* If don't choose Ctrl or Trim option, there is no pin on the corresponding pin number.

** Pin 11 is "No pin" for

MOP06-□□S□□□**B-T**

MOP06-□□S□□□**B-PT**

Pin 11 is "NC" for

MOP06-□□S□□□**B**

MOP06-□□S□□□**B-P**

EXTERNAL OUTPUT TRIMMING

Output can be externally trimmed by using the method shown below. () for dual output trim.

