

# MOP10 MOP10W SERIES

DC-DC CONVERTER  
2:1 & 4:1 WIDE INPUT RANGE  
UP TO 10.05 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
- LOW LEAKAGE CURRENT UNDER 2 $\mu$ A
- ANSI/AAMI ES60601-1, EN60601-1, IEC60601-1 3<sup>rd</sup> EDITION, 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
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## TECHNICAL SPECIFICATION

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

Model Number	Input Range	Output Voltage	Output Current @ Full Load	Input Current @ No Load	Efficiency	Maximum Capacitor Load
	VDC	VDC	mA	mA	%	$\mu$ F
MOP10-05S3P3A/B	4.5 ~9	3.3	2500	10	80	3000
MOP10-05S05A/B	4.5 ~9	5	2000	10	84	2500
MOP10-05S12A/B	4.5 ~9	12	830	20	86.5	430
MOP10-05S15A/B	4.5 ~9	15	670	20	87	350
MOP10-05S24A/B	4.5 ~9	24	416	20	85.5	125
MOP10-05D05A/B	4.5 ~9	$\pm$ 5	$\pm$ 1000	25	83	$\pm$ 1440
MOP10-05D12A/B	4.5 ~9	$\pm$ 12	$\pm$ 416	25	85.5	$\pm$ 250
MOP10-05D15A/B	4.5 ~9	$\pm$ 15	$\pm$ 333	25	86.5	$\pm$ 180
MOP10-12S3P3A/B	9 ~ 18	3.3	2500	10	83	3000
MOP10-12S05A/B	9 ~ 18	5	2000	10	85.5	2500
MOP10-12S12A/B	9 ~ 18	12	830	10	88	430
MOP10-12S15A/B	9 ~ 18	15	670	10	89	350
MOP10-12S24A/B	9 ~ 18	24	416	10	89	125
MOP10-12D05A/B	9 ~ 18	$\pm$ 5	$\pm$ 1000	10	84	$\pm$ 1440
MOP10-12D12A/B	9 ~ 18	$\pm$ 12	$\pm$ 416	10	89	$\pm$ 250
MOP10-12D15A/B	9 ~ 18	$\pm$ 15	$\pm$ 333	10	88	$\pm$ 180
MOP10-24S3P3A/B	18 ~ 36	3.3	2500	6	83	3000
MOP10-24S05A/B	18 ~ 36	5	2000	6	86.5	2500
MOP10-24S12A/B	18 ~ 36	12	830	6	89	430
MOP10-24S15A/B	18 ~ 36	15	670	6	89	350
MOP10-24S24A/B	18 ~ 36	24	416	6	89	125
MOP10-24D05A/B	18 ~ 36	$\pm$ 5	$\pm$ 1000	6	85	$\pm$ 1440
MOP10-24D12A/B	18 ~ 36	$\pm$ 12	$\pm$ 416	6	89	$\pm$ 250
MOP10-24D15A/B	18 ~ 36	$\pm$ 15	$\pm$ 333	6	88	$\pm$ 180
MOP10-48S3P3A/B	36 ~ 75	3.3	2500	4	82.5	3000
MOP10-48S05A/B	36 ~ 75	5	2000	4	86.5	2500
MOP10-48S12A/B	36 ~ 75	12	830	4	89	430
MOP10-48S15A/B	36 ~ 75	15	670	4	89	350
MOP10-48S24A/B	36 ~ 75	24	416	4	88.5	125
MOP10-48D05A/B	36 ~ 75	$\pm$ 5	$\pm$ 1000	4	85	$\pm$ 1440
MOP10-48D12A/B	36 ~ 75	$\pm$ 12	$\pm$ 416	4	88	$\pm$ 250
MOP10-48D15A/B	36 ~ 75	$\pm$ 15	$\pm$ 333	4	88	$\pm$ 180

Model Number	Input Range	Output Voltage	Output Current @ Full Load	Input Current @ No Load	Efficiency	Maximum Capacitor Load
	VDC	VDC	mA	mA	%	μF
MOP10-24S3P3WA/B	9 ~ 36	3.3	2500	6	83	3000
MOP10-24S05WA/B	9 ~ 36	5	2000	6	86.5	2500
MOP10-24S12WA/B	9 ~ 36	12	830	6	89	430
MOP10-24S15WA/B	9 ~ 36	15	670	6	89	350
MOP10-24S24WA/B	9 ~ 36	24	416	6	89	125
MOP10-24D05WA/B	9 ~ 36	±5	±1000	6	85	± 1440
MOP10-24D12WA/B	9 ~ 36	±12	±416	6	89	± 250
MOP10-24D15WA/B	9 ~ 36	±15	±333	6	88	± 180
MOP10-48S3P3WA/B	18 ~ 75	3.3	2500	4	82.5	3000
MOP10-48S05WA/B	18 ~ 75	5	2000	4	86.5	2500
MOP10-48S12WA/B	18 ~ 75	12	830	4	89	430
MOP10-48S15WA/B	18 ~ 75	15	670	4	89	350
MOP10-48S24WA/B	18 ~ 75	24	416	4	88.5	125
MOP10-48D05WA/B	18 ~ 75	±5	±1000	4	85	± 1440
MOP10-48D12WA/B	18 ~ 75	±12	±416	4	88	± 250
MOP10-48D15WA/B	18 ~ 75	±15	±333	4	88	± 180

**PART NUMBER STRUCTURE**

MOP10	-	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  D: Dual	3P3: 3.3 05: 5 12: 12 15: 15 24: 24 05: ±5 12: ±12 15: ±15	□: 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)

MOP10	-	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  D: Dual	3P3: 3.3 05: 5 12: 12 15: 15 24: 24 05: ±5 12: ±12 15: ±15	□: 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)	

**INPUT SPECIFICATIONS**

Parameter	Conditions		Min.	Typ.	Max.	Unit
Operating input voltage range	2:1	5Vin(nom)	4.5	5	9	VDC
		12Vin(nom)	9	12	18	
24Vin(nom)	18	24	36			
48Vin(nom)	36	48	75			
	(W) 4:1	24Vin(nom)	9	24	36	VDC
		48Vin(nom)	18	48	75	
Start-up voltage	2:1	5Vin(nom)			4.5	VDC
		12Vin(nom)			9	
24Vin(nom)			18			
48Vin(nom)			36			
	(W) 4:1	24Vin(nom)			9	VDC
		48 Vin(nom)			18	
Shutdown voltage	2:1	5Vin(nom)		4		VDC
		12Vin(nom)		8		
24Vin(nom)		16				
48Vin(nom)		33				
	(W) 4:1	24Vin(nom)		8		VDC
		48Vin(nom)		16		
Start up time	Constant resistive load	Power up		30		ms
		Remote ON/OFF		30		
Input surge voltage	3 second, max.	2:1	5Vin(nom)		16	VDC
			12Vin(nom)		25	
24Vin(nom)		50				
48Vin(nom)		100				
	3 second, max.	(W) 4:1	24Vin(nom)		50	VDC
			48Vin(nom)		100	
Input filter					Pi type	
Remote ON/OFF (Only for B-type Pin connection option)	Referenced to -Vin pin				OPEN or 0 ~ 1.2VDC 2.2 ~ 12VDC	
		DC-DC ON				
		DC-DC OFF				
		Input current of Ctrl pin	-0.5		1	mA
		Remote off input current		2.5		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	-0.2		+0.2	%
		Dual	-0.5		+0.5	
Load regulation	No Load to Full Load	Single	-0.2		+0.2	%
		Dual	-1.0		+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	-10		+10	%
		15Vout, 24Vout	-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		30		mVp-p
		12Vout, 15Vout		40		
		24Vout		50		
Temperature coefficient			-0.02		+0.02	%/°C
Transient response recovery time	25% load step change			250		µs
Over voltage protection	Single	3.3Vout	3.7		5	VDC
		5Vout	5.6		7.0	
		12Vout	13.5		16	
	15Vout	18.3		22.0		
	24Vout	29.1		34.5		
	Dual	5Vout	5.6		7.0	
12Vout	13.5		18.2			
15Vout	17.0		22.0			
Over load protection	% of Iout 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		270	300	330	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				3.849 x 10 <sup>6</sup> hrs

**ENVIRONMENTAL SPECIFICATIONS**

Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating ambient temperature	Without derating	-40		+77	°C
	With derating	+77		+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

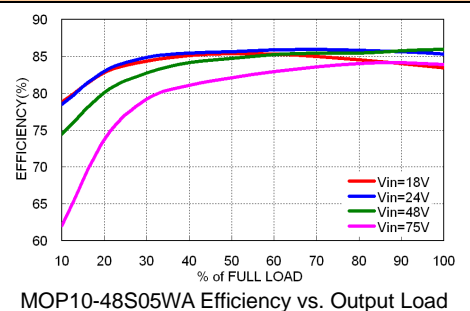
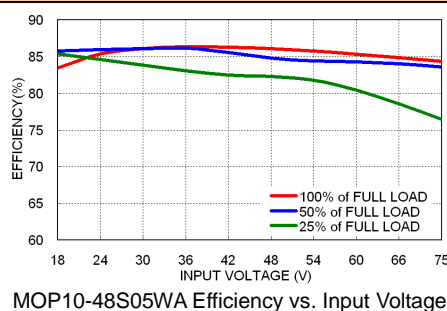
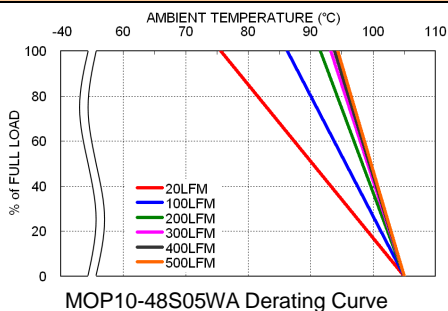
**EMC SPECIFICATIONS**

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
Power frequency magnetic field	EN61000-4-8 100A/m continuous; 1000A/m 1 second	Perf. Criteria A

**Note:**

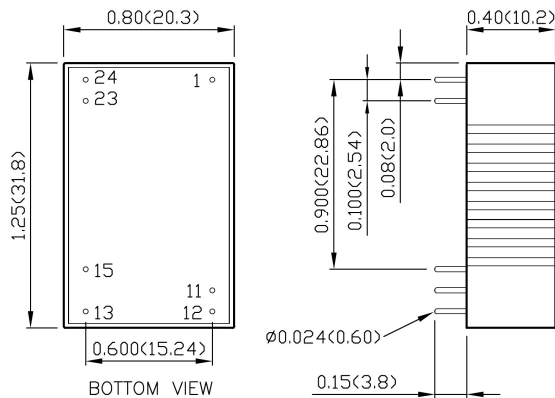
- The MOP10 (W) series can meet EMI Class A with no external filter. And Class B only with external components. For further information, please contact with P-DUKE.
- An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5. The MOP10-05□□□□□ recommended an aluminum electrolytic capacitor (Nippon Chemi-con KY series, 1000µF/25V). And a reverse diode (Vishay V10P45) to connect in parallel. The MOP10-12&24□□□□□□ recommended an aluminum electrolytic capacitor (Nippon Chemi-con KY series, 470µF/50V). The MOP10-48□□□□□□ 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**


**MECHANICAL DRAWING**

**A TYPE**

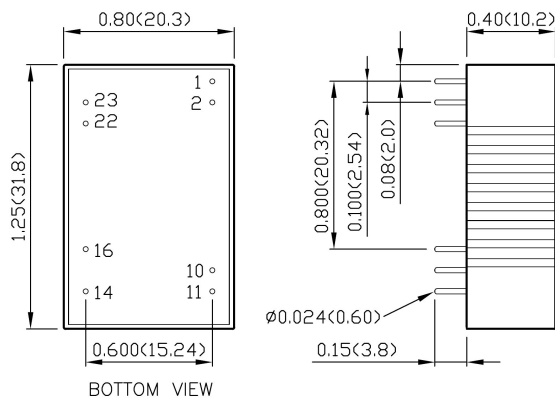


1. All dimensions in Inch (mm)
2. Tolerance: X.XX±0.02 (X.X±0.5)  
X.XXX±0.01 (X.XX±0.25)
3. Pin pitch tolerance ±0.01 (0.25)
4. Pin dimension tolerance ±0.004 (0.1)

**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±0.02 (X.X±0.5)  
X.XXX±0.01 (X.XX±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

MOP10-□□S□□□**B-I**  
MOP10-□□S□□□**B-PI**

Pin 11 is "NC" for

MOP10-□□S□□□**B**  
MOP10-□□S□□□**B-P**

**EXTERNAL OUTPUT TRIMMING**

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

