FEATURES

- ▶ **Industrial Standard 2" X 1" Package**
- ▶ **Wide 2:1 Input Voltage Range**
- ▶ **Fully Regulated Output Voltage**
- ▶ **I/O Isolation 4200VAC with Reinforced Insulation, rated for 1000Vrms Working Voltage**
- ▶ **Low I/O Leakage Current < 10μA**
- ▶ **Operating Ambient Temp. Range -40℃ to +75℃**
- ▶ **Under-voltage, Overload and Short Circuit Protection**
- ▶ **EMI Emission EN 55011 Class A Approved**
- ▶ **Medical EMC Standard with 4th Edition of EMI EN 55011 and EMS EN 60601-1-2 Approved**
- ▶ **Medical Safety with 1xMOPP & 2xMOOP per 3.2 Edition of IEC/EN 60601-1 & ANSI/AAMI ES60601-1 Approved**
- ▶ **Risk Management Report Acquisition according to ISO 14971**
- ▶ **UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval & CE Marking**

PRODUCT OVERVIEW

Introducing the MINMAX MKW10M series - High performance isolated DC-DC converter modules equipped with a reinforced insulation system. The I/O isolation voltage is specified at 4200VAC with reinforced insulation, rated for a robust 1000Vrms working voltage. Housed in a compact 2"x1" industry-standard package, all 15 models feature a wide 2:1 input voltage range and fully regulated output voltage. The MKW10M DC-DC converters provide a cost-effective solution for demanding applications in industrial and medical instrumentation that require a certified supplementary or reinforced insulation system to comply with the latest industrial or medical safety standards.

The MKW10M series is approved to IEC/EN/ES 60601-1 3.2 Edition for 1xMOPP & 2xMOOP and comes with an ISO 14971 Medical Device risk management file, ensuring not only adherence to high-performance standards but also compliance with strict safety benchmarks.

In summary, the MKW10M series offers an economical solution for a range of applications. Elevate your devices with the MINMAX MKW10M series - where performance meets safety, all backed by meticulous Medical Device Risk Management Report Acquisition.

Model Selection Guide

Model Number	Input Voltage (Range)	Output Voltage	Output Current	Input Current		Reflected Ripple Current	Max. capacitive Load	Efficiency (typ.)
			Max.	@Max. Load	@No Load			@Max. Load
	VDC	VDC	mA	mA(typ.)	mA (typ.)	mA(typ.)	μF	%
MKW10-12S05M	12 (9 ~ 18)	5	1600	907	30	100	1000	74
MKW10-12S051M		5.1	1600	907				75
MKW10-12S12M		12	835	1044			470	80
MKW10-12D12M		±12	±417	1042			220#	80
MKW10-12D15M		±15	±333	1028				81
MKW10-24S05M	24 (18 ~ 36)	5	2000	559	20	50	1000	75
MKW10-24S051M		5.1	2000	559				76
MKW10-24S12M		12	835	516			470	81
MKW10-24D12M		±12	±417	516			220#	81
MKW10-24D15M		±15	±333	508				82
MKW10-48S05M	48 (36 ~ 75)	5	2000	280	10	25	1000	75
MKW10-48S051M		5.1	2000	280				76
MKW10-48S12M		12	835	258			470	81
MKW10-48D12M		±12	±417	258			220#	81
MKW10-48D15M		±15	±333	254				82

For each output

Input Specifications

Parameter	Model	Min.	Typ.	Max.	Unit
Input Surge Voltage (1 sec. max.)	12V Input Models	-0.7	---	25	VDC
	24V Input Models	-0.7	---	50	
	48V Input Models	-0.7	---	100	
Start-Up Threshold Voltage	12V Input Models	7	8	9	
	24V Input Models	13	15	18	
	48V Input Models	30	33	36	
Under Voltage Shutdown	12V Input Models	---	---	8.5	
	24V Input Models	---	---	16	
	48V Input Models	---	---	34	
Short Circuit Input Power	All Models	---	---	3000	mW
Input Filter		Internal Pi Type			

Output Specifications

Parameter	Conditions / Model		Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy			---	---	±1.0	%Vnom.
Output Voltage Balance	Dual Output, Balanced Loads		---	±0.5	±2.0	%
Line Regulation	Vin=Min. to Max. @Full Load		---	±0.3	±0.5	%
Load Regulation	Io=15% to 100%		---	±0.5	±1.0	%
	Io=5% to 100%		---	±0.6	±1.2	%
Ripple & Noise	0-20 MHz Bandwidth	5V & 5.1V Output Models	---	---	100	mV_{P-P}
		Other Output Models	---	---	150	mV_{P-P}
Minimum Load	No minimum Load Requirement					
Over Load Protection			120	150	---	%
Transient Recovery Time	25% Load Step Change		---	300	600	μs
Transient Response Deviation			---	±3	±5	%
Temperature Coefficient			---	±0.02	±0.05	%/°C
Short Circuit Protection	Continuous, Automatic Recovery					

Isolation, Safety Standards

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	Reinforced Insulation, Rated For 60 Seconds	4200	---	---	VAC
	300Vrms working voltage according to IEC/EN 60601-1				
	1000Vrms working voltage according to IEC/EN 62368-1, 60950-1				
Leakage Current	240VAC, 60Hz	---	---	10	μA
I/O Isolation Resistance	500 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100kHz, 1V	---	60	80	pF
Safety Standards	UL/cUL 62368-1, 60950-1, CSA C22.2 No. 60950-1				
	ANSI/AAMI ES60601-1, CAN/CSA-C22.2 No. 60601-1				
	IEC/EN 62368-1, 60950-1, IEC/EN 60601-1 3.2 Edition 1xMOPP & 2xMOOP				
Safety Approvals	UL/cUL 60950-1 recognition(UL certificate), IEC/EN 60950-1(CB-report)				
	UL/cUL 62368-1 recognition(UL certificate), IEC/EN 62368-1(CB-report)				
	ANSI/AAMI ES60601-1 1xMOPP & 2xMOOP recognition(UL certificate), IEC/EN 60601-1 3.2 Edition(CB-report)				

General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Switching Frequency		120	150	180	kHz
MTBF(calculated)	MIL-HDBK-217F@25°C, Ground Benign	1,000,000	---	---	Hours

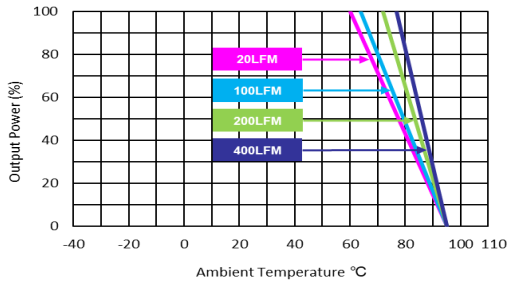
EMC Specifications

Parameter	Standards & Level			Performance
EMI	Conduction	EN 55011	Without external components	Class A
	Radiation			
EMS (5)	EN 60601-1-2 4th			
	ESD	EN 61000-4-2 Air ± 15kV , Contact ± 8kV		A
	Radiated immunity	EN 61000-4-3 10V/m		A
	Fast transient	EN 61000-4-4 ±2kV		A
	Surge	EN 61000-4-5 ±1kV		A
	Conducted immunity	EN 61000-4-6 10Vrms		A
	PFMF	EN 61000-4-8 30A/m		A

Environmental Specifications

Parameter	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-40	+75	℃
Case Temperature	---	+95	℃
Storage Temperature Range	-50	+125	℃
Humidity (non condensing)	---	95	% rel. H
Altitude	---	4000	m
Lead Temperature (1.5mm from case for 10Sec.)	---	260	℃

Power Derating Curve

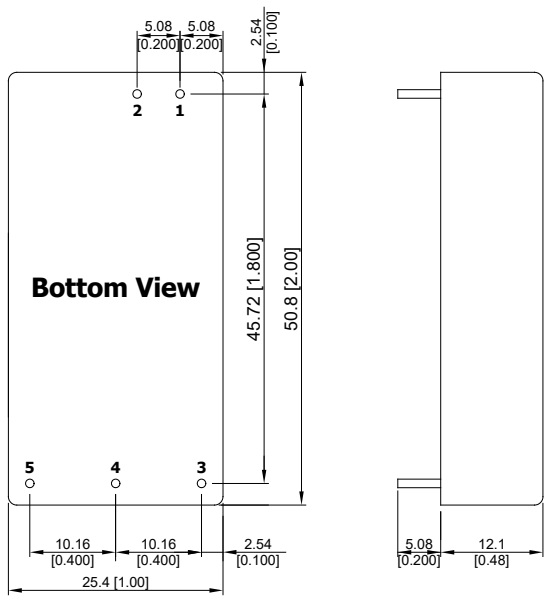


Notes

1 Specifications typical at Ta=+25℃, resistive load, nominal input voltage and rated output current unless otherwise noted.
2 Transient recovery time is measured to within 1% error band for a step change in output load of 75% to 100%.
3 We recommend to protect the converter by a slow blow fuse in the input supply line.
4 Other input and output voltage may be available, please contact MINMAX.
5 The external components might be required to meet EMS standard for some of test items. Please contact MINMAX for the solution in detail.
6 Specifications are subject to change without notice.
7 The repeated high voltage isolation testing of the converter can degrade isolation capability, to a lesser or greater degree depending on materials, construction, environment and reflow solder process. Any material is susceptible to eventual chemical degradation when subject to very high applied voltages thus implying that the number of tests should be strictly limited. We therefore strongly advise against repeated high voltage isolation testing, but if it is absolutely required, that the voltage be reduced by 20% from specified test voltage. Furthermore, the high voltage isolation capability after reflow solder process should be evaluated as it is applied on system.

Package Specifications

Mechanical Dimensions



Pin Connections

Pin	Single Output	Dual Output	Diameter mm (inches)
1	+Vin	+Vin	Ø 1.0 [0.04]
2	-Vin	-Vin	Ø 1.0 [0.04]
3	+Vout	+Vout	Ø 1.0 [0.04]
4	No Pin	Common	Ø 1.0 [0.04]
5	-Vout	-Vout	Ø 1.0 [0.04]

- All dimensions in mm (inches)
- Tolerance: X.X±0.5 (X.XX±0.02)
  X.XX±0.25 (X.XXX±0.01)
- Pin diameter tolerance: X.X±0.05 (X.XX±0.002)

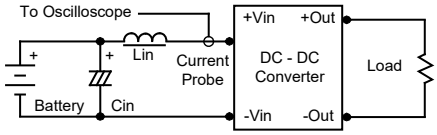
Physical Characteristics

Case Size	:	50.8x25.4x12.1mm (2.0x1.0x0.48 inches)
Case Material	:	Plastic resin (flammability to UL 94V-0 rated)
Pin Material	:	Copper Alloy
Weight	:	24.5g

Test Setup

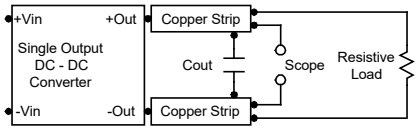
Input Reflected-Ripple Current Test Setup

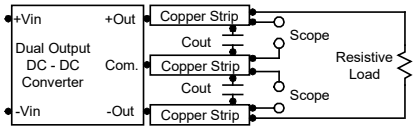
Input reflected-ripple current is measured with a inductor Lin (4.7μH) and Cin (220μF, ESR < 1.0Ω at 100 kHz) to simulate source impedance. Capacitor Cin, offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is 0-500 kHz.



Peak-to-Peak Output Noise Measurement Test

Refer to the output specifications or add 4.7μF capacitor if the output specifications undefine Cout. Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20 MHz. Position the load between 50 mm and 75 mm from the DC-DC Converter.

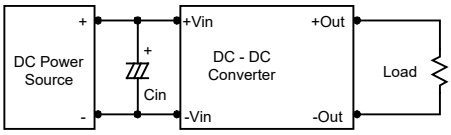




Technical Notes

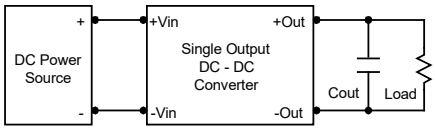
Input Source Impedance

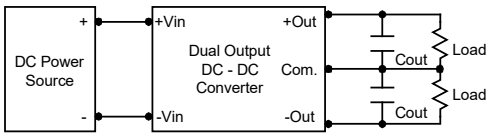
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor on the input to insure startup. By using a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 kHz) capacitor of a 10μF for the 12V input devices and a 4.7μF for the 24V input devices and a 2.2μF for the 48V devices, capacitor mounted close to the power module helps ensure stability of the unit.



Output Ripple Reduction

A good quality low ESR capacitor placed as close as practicable across the load will give the best ripple and noise performance. To reduce output ripple, it is recommended to use 3.3μF capacitors at the output.





Maximum Capacitive Load

The MKW10M series has limitation of maximum connected capacitance on the output. The power module may operate in current limiting mode during start-up, affecting the ramp-up and the startup time. Connect capacitors at the point of load for best performance. The maximum capacitance can be found in the data sheet.

Thermal Considerations

Many conditions affect the thermal performance of the power module, such as orientation, airflow over the module and board spacing. To avoid exceeding the maximum temperature rating of the components inside the power module, the case temperature must be kept below 95°C. The derating curves are determined from measurements obtained in a test setup.