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 Leakage Current < 10μA**
- ▶ **Operating Ambient Temp. Range -40℃ to +75℃**
- ▶ **Overload and Short Circuit Protection**
- ▶ **Designed-in EMI Emission meets EN55011/22 Class A & FCC Level A**
- ▶ **Medical EMC Standard meets 4th Edition of EMI EN55011 and EMS EN60601-1-2**
- ▶ **Medical Safety meets 1xMOPP & 2xMOOP per 3rd Edition of IEC/EN 60601-1 & ANSI/AAMI ES60601-1**
- ▶ **UL/cUL/IEC/EN 60950-1 Safety Approval & CE Marking**

PRODUCT OVERVIEW

The MINMAX MKW10M series is a new range of high performance DC/DC converter modules with a reinforced insulation system. The I/O- isolation voltage is specified for 4200VACrms. The product comes in a compact 2"x1" industry standard package. All 15 models features wide 2:1 input voltage range and fully regulated output voltage. The MKW10M DC/DC converters offer an economical solution for demanding applications in industrial and medical instrumentation requesting a certified supplementary or reinforced insulation system to comply with industrial or latest medical safety standards.

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	µsec
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	---	---	VACrms
	300Vrms working voltage according to IEC/EN 60601-1				
	1000Vrms working voltage according to IEC/EN 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 60950-1, CSA C22.2 No. 60950-1				
	ANSI/AAMI ES60601-1, CAN/CSA-C22.2 No. 60601-1				
	IEC/EN 60950-1, IEC/EN 60601-1 3rd Edition 1xMOPP & 2xMOOP				
Safety Approvals	UL/cUL 60950-1 recognition (UL certificate), IEC/EN 60950-1 (CB-report)				
	ANSI/AAMI ES60601-1 1xMOPP & 2xMOOP recognition (UL certificate), IEC/EN 60601-1 3rd 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

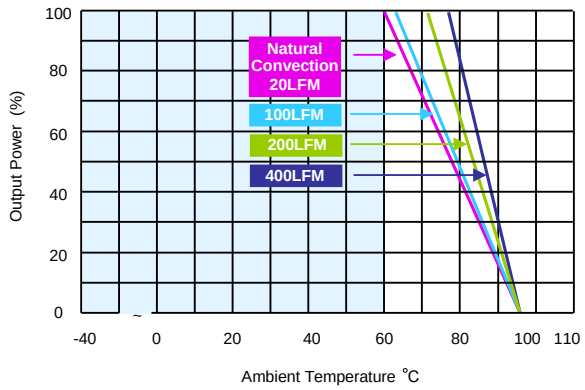
Environmental Specifications

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

EMC Specifications

Parameter	Standards & Level		Performance
EMI	Conduction & Radiation	EN 55011, EN 55022, FCC part 15	Class A
EMS	EN 60601-1-2 4th, EN 55024		
	ESD	EN 61000-4-2 Air ± 15kV , Contact ± 8kV	A
	Radiated immunity	EN 61000-4-3 10V/m	A
	Fast transient (5)	EN 61000-4-4 ±2kV	A
	Surge (5)	EN 61000-4-5 ±1kV	A
	Conducted immunity	EN 61000-4-6 10Vrms	A
	PFMF	EN 61000-4-8 30A/m	A

Power Derating Curve

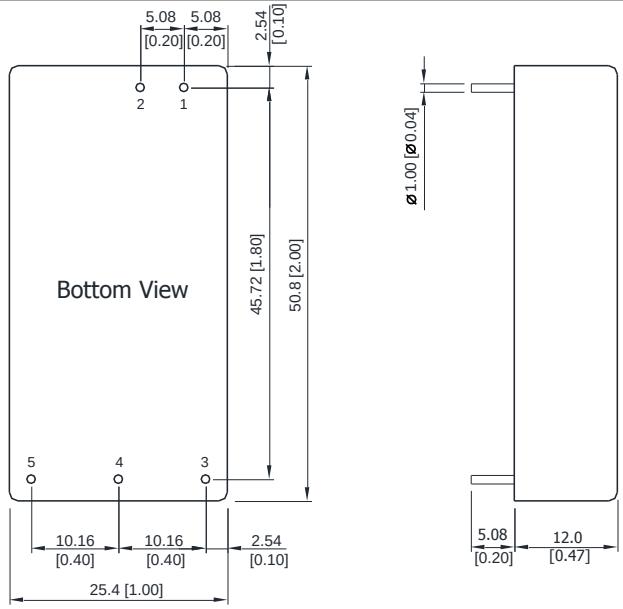


Notes

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 factory.
5 To meet EN61000-4-4 & EN61000-4-5, an external capacitor across the input pins is required. Suggested capacitor: 330μF/100V.
6 That "natural convection" is about 20LFM but is not equal to still air (0 LFM).
7 Specifications are subject to change without notice.

Package Specifications

Mechanical Dimensions



Pin Connections

Pin	Single Output	Dual Output
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	No Pin	Common
5	-Vout	-Vout

- All dimensions in mm (inches)
- Tolerance: X.X±0.25 (X.XX±0.01)
  X.XX±0.13 (X.XXX±0.005)
- Pin diameter ∅ 1.0 ±0.05 (0.04±0.002)

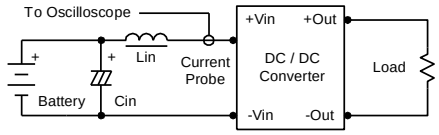
Physical Characteristics

Case Size	:	50.8x25.4x12.0mm (2.0x1.0x0.47 inches)
Case Material	:	Non-Conductive Black Plastic (flammability to UL 94V-0 rated)
Pin Material	:	Copper Alloy with Gold Plate Over Nickel Subplate
Weight	:	24.5g

Test Setup

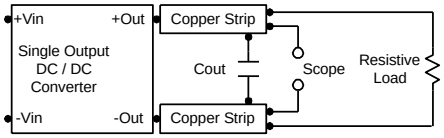
Input Reflected-Ripple Current Test Setup

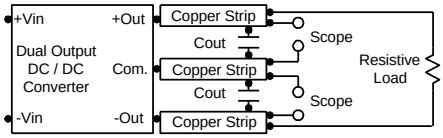
Input reflected-ripple current is measured with a inductor Lin (4.7μH) and Cin (220μF, ESR < 1.0Ω at 100 KHz) to simulate source impedance. Capacitor Cin, offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is 0-500 KHz.



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.

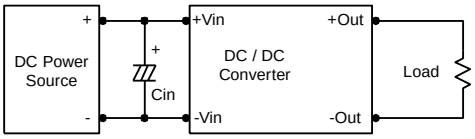




Technical Notes

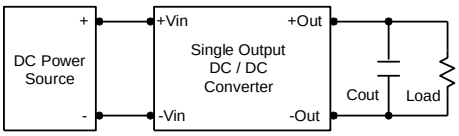
Input Source Impedance

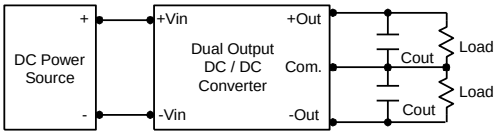
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor on the input to insure startup. 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.