DC/DC CONVERTER 15W, Reinforced Insulation, Medical Safety

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 300Vrms Working Voltage
- ►Low Leakage Current < 5μA
- ►Operating Ambient Temp. Range -40℃ to +85℃
- ►No Min. Load Requirement
- ►Overload/Voltage and Short Circuit Protection
- ►Designed-in EMI Emission meets EN55011 Class A & FCC Level A
- ►Medical EMC Standard meets 4th Edition of EMI EN55011 and EMS EN60601-1-2
- ►Medical Safety meets 2xMOPP per 3rd Edition of IEC/EN 60601-1 & ANSI/AAMI ES60601-1(Pending) with CE Marking

NEW

PRODUCT OVERVIEW

The MINMAX MKW15M series is a new range of high performance 15W medical approved dc-dc converter within encapsulated 2''x1'' package which specifically design for medical applications. There are 21 models available for input voltage of 12, 24, 48VDC with wide 2:1 input range and tight output voltage. The I/O isolation is specified for 4200VAC with reinforced insulation, which rated for 300Vrms working voltage. Further features include overload, short circuit protection, no min. load requirement, EMI conduction meets EN55011 Class A, low leakage current 5μA max. and operating ambient temp. range by -40℃ to 85℃ by high efficiency up to 90%. MKW15M series conform to 4th edition medical EMC standard, medical safety approval meets 2xMOPP (Means Of Patient Protection) per 3rd edition of IEC/EN 60601-1 & ANSI/AAMI ES60601-1.

The MKW15M series offer a economical solution for demanding application in medical instrument requesting a certified supplementary and reinforced insulation system to comply with latest medcial safety approval for 2xMOPP requirement.

Model Selection Guide

Model Number	Input Voltage (Range)	Output Voltage	Output Current	Input Current		Reflected Ripple Current	Over Voltage Protection	Max. capacitive Load	Efficiency (typ.)
			Max.	@Max. Load	@No Load				@Max. Load
	VDC	VDC	mA	mA(typ.)	mA (typ.)	mA(typ.)	VDC	μF	%
MKW15-12S05M	12 (9 ~ 18)	5	3000	1453	20	100	6.2	5100	86
MKW15-12S051M		5.1	3000	1483			6.2		86
MKW15-12S12M		12	1250	1404			15	870	89
MKW15-12S15M		15	1000	1420			18	560	88
MKW15-12S24M		24	625	1420			27	220	88
MKW15-12D12M		±12	±625	1420			±15	440#	88
MKW15-12D15M		±15	±500	1404			±18	280#	89
MKW15-24S05M	24 (18 ~ 36)	5	3000	710	15	50	6.2	5100	88
MKW15-24S051M		5.1	3000	724			6.2		88
MKW15-24S12M		12	1250	702			15	870	89
MKW15-24S15M		15	1000	702			18	560	89
MKW15-24S24M		24	625	694			27	220	90
MKW15-24D12M		±12	±625	694			±15	440#	90
MKW15-24D15M		±15	±500	702			±18	280#	89
MKW15-48S05M	48 (36 ~ 75)	5	3000	355	10	30	6.2	5100	88
MKW15-48S051M		5.1	3000	362			6.2		88
MKW15-48S12M		12	1250	355			15	870	88
MKW15-48S15M		15	1000	347			18	560	90
MKW15-48S24M		24	625	351			27	220	89
MKW15-48D12M		±12	±625	351			±15	440#	89
MKW15-48D15M		±15	±500	355			±18	280#	88

For each output

Input Specifications

Parameter	Conditions / Model	Min.	Typ.	Max.	Unit
Input Surge Voltage (100 ms 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	---	---	9	
	24V Input Models	---	---	18	
	48V Input Models	---	---	36	
Under Voltage Shutdown	12V Input Models	---	7.5	---	
	24V Input Models	---	15	---	
	48V Input Models	---	33	---	
Start Up Time (Power On)	Nominal Vin and Constant Resistive Load	---	---	30	ms
Input Filter	All Models	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				---	---	±2.0	%
Line Regulation	Vin=Min. to Max. @Full Load				---	---	±0.5	%
Load Regulation	Io=0% to 100%			Single Output	---	---	±0.5	%
				Dual Output	---	---	±1.0	%
Minimum Load	No minimum Load Requirement							
Ripple & Noise	0-20 MHz Bandwidth	5V & 5.1Vo		Measured with a MLCC : 4.7µF	---	50	---	mV P-P
		12V,15V, ±12V, ±15Vo			---	100	---	mV P-P
		24Vo			---	150	---	mV P-P
Transient Recovery Time	25% Load Step Change (2)				---	---	300	µsec
Transient Response Deviation					---	±3	±5	%
Temperature Coefficient					---	---	±0.02	%/°C,
Over Load Protection	Hiccup				---	150	---	%
Short Circuit Protection	Hiccup Mode 0.7Hz typ., Automatic Recovery							

Isolation, Safety Standards

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds Reinforced insulation, rated for 300Vrms working voltage	4200	---	---	VACrms
Leakage Current	240VAC, 60Hz	---	---	5	µA
I/O Isolation Resistance	500 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100KHz, 1V	---	---	80	pF
Safety Standards	ANSI/AAMI ES60601-1, CAN/CSA-C22.2 No. 60601-1				
	IEC/EN 60601-1 3rd Edition 2xMOPP				
Safety Approvals (Pending)	ANSI/AAMI ES60601-1 2xMOPP recognition (UL certificate), IEC/EN 60601-1 3rd Edition (CB-report)				

General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Switching Frequency		---	285	---	KHz
MTBF(calculated)	MIL-HDBK-217F@25°C, Ground Benign	1,428,181	---	---	Hours

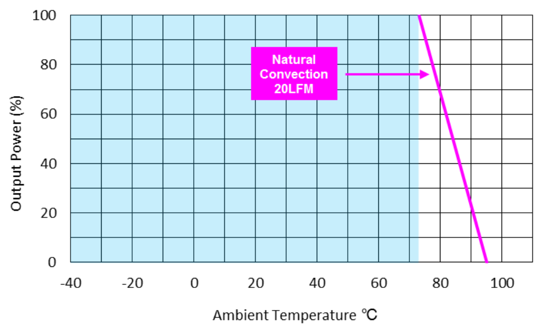
Environmental Specifications

Parameter	Conditions / Model	Min.	Max.	Unit
Operating Ambient Temperature Range Natural Convection (6) Nominal Vin, Load 100% Inom. (for Power Derating see relative Derating Curves)	MKW15-24S24M, MKW15-24D12M, MKW15-48S15M	-40	73	℃
	MKW15-12S12M, MKW15-12D15M, MKW15-24S12M MKW15-24S15M, MKW15-24D15M, MKW15-48S24M MKW15-48D12		70	
	MKW15-12S15M, MKW15-12S24M, MKW15-12D12M MKW15-24S05M, MKW15-24S051M, MKW15-48S05M MKW15-48S051M, MKW15-48S12M, MKW15-48D15M		67	
	MKW15-12S05M, MKW15-12S051M		62	
Thermal Impedance	Natural Convection	13	---	℃/W
Case Temperature		---	+95	℃
Storage Temperature Range		-50	+125	℃
Humidity (non condensing)		---	95	% rel. H
Altitude		---	4000	M
Cooling	Natural Convection			
Lead Temperature (1.5mm from case for 10Sec.)		---	260	℃

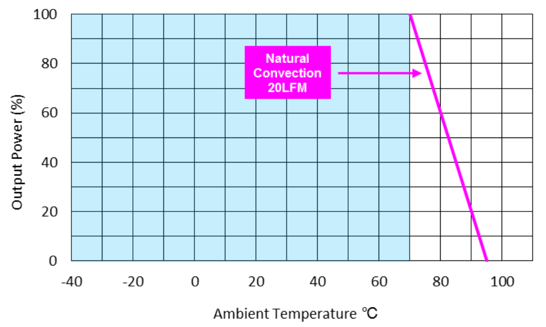
EMC Specifications

Parameter	Standards & Level		Performance
EMI	Conduction & Radiation	EN55011, FCC part 15	Class A
EMS	EN60601-1-2 4th		
	ESD	EN61000-4-2 Air ± 15kV , Contact ± 8kV	A
	Radiated immunity	EN61000-4-3 10V/m	A
	Fast transient (5)	EN61000-4-4 ±2kV	A
	Surge (5)	EN61000-4-5 ±1kV	A
	Conducted immunity	EN61000-4-6 10Vrms	A
	PFMF	EN61000-4-8 30A/m	A

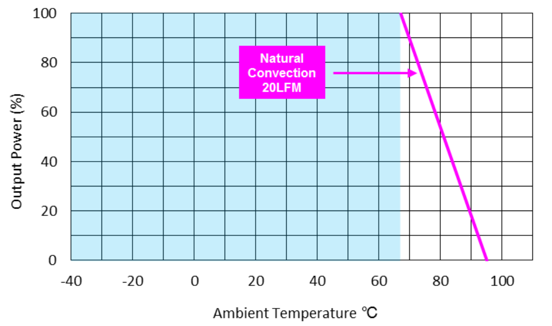
Power Derating Curve



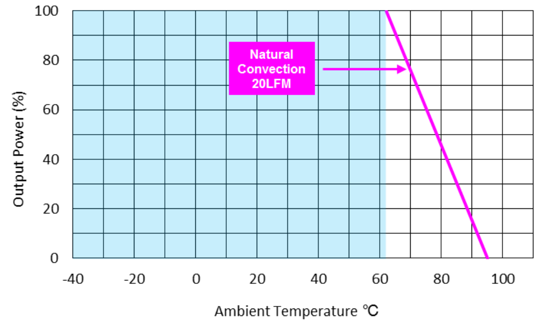
MKW15-24S24M, MKW15-24D12M, MKW15-48S15M



MKW15-12S12M, MKW15-12D15M, MKW15-24S12M
MKW15-24S15M, MKW15-24D15M, MKW15-48S24M, MKW15-48D12M



MKW15-12S15M, MKW15-12S24M, MKW15-12D12M, MKW15-24S05M
MKW15-24S051M, MKW15-48S05M, MKW15-48S051M, MKW15-48S12M
MKW15-48D15M



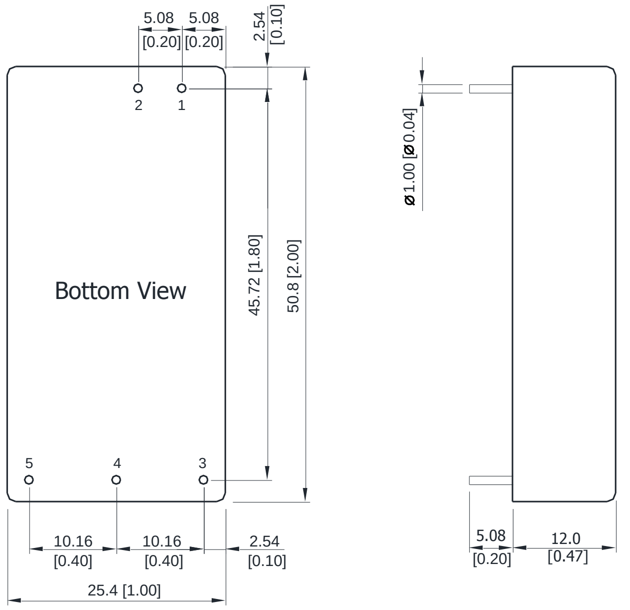
MKW15-12S05M, MKW15-12S051M

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±0.5 (X.XX±0.02)
  X.XX±0.25 (X.XXX±0.01)
- Pin diameter ∅ 1.0 ±0.05 (0.04±0.002)

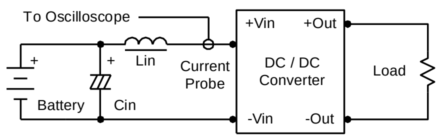
Physical Characteristics

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	:	Tinned Copper
Weight	:	30g

Test Setup

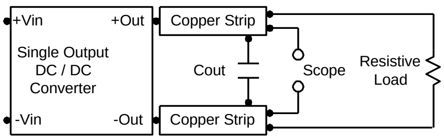
Input Reflected-Ripple Current Test Setup

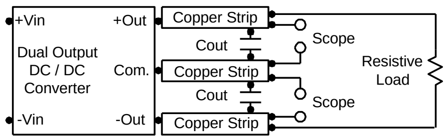
Input reflected-ripple current is measured with a inductor Lin (4.7µH) and Cin (220µF, ESR < 1.0Ω at 100 KHz) to simulate source impedance. Capacitor Cin, offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is 0-500 KHz.



Peak-to-Peak Output Noise Measurement Test

Use a Cout 4.7µF ceramic capacitor. 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

Overload Protection

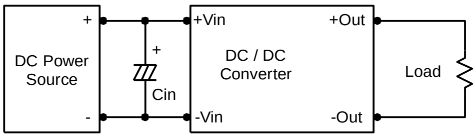
To provide hiccup mode protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure overload for an unlimited duration.

Overvoltage Protection

The output overvoltage clamp consists of control circuitry, which is independent of the primary regulation loop, that monitors the voltage on the output terminals. The control loop of the clamp has a higher voltage set point than the primary loop. This provides a redundant voltage control that reduces the risk of output overvoltage. The OVP level can be found in the output data.

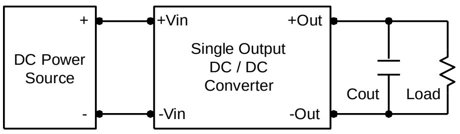
Input Source Impedance

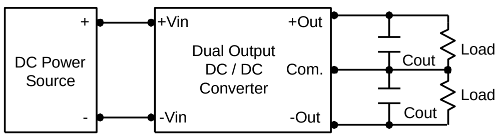
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor on the input to insure startup. 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 4.7µF capacitors at the output.





Maximum Capacitive Load

The MKW15M 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.