FEATURES

- 2”x 1”x 0.4” Metal Package
- Ultra-wide 4:1 Input Range
- Operating Temp. Range –40°C to +85°C
- Short Circuit Protection
- I/O-isolation 1500 VDC
- Input Filter meets EN 55022,class A and FCC, level A
- 3 Years Product Warranty

UL 60950-1 CB Scheme RoHS Compliant 3 year warranty

PRODUCT OVERVIEW

The MINMAX MKW2000 series is a range of isolated 12W DC/DC converter modules featuring fully regulated output voltages and ultra-wide 4:1 input voltage ranges.The product comes in a 2”x 1”x 0.4” metal package with industry standard pinout. An excellent efficiency allows an operating temperature range of –40° to +85°C (with derating).

Typical applications for these converters are in battery operated equipment and instrumentation, distributed power systems, data communication and general industrial electronics.

Model Selection Guide

Model Number	Input Voltage (Range)	Output Voltage	Output Current		Input Current		Over Voltage Protection	Max. capacitive Load	Efficiency (typ.)
			Max.	Min.	@Max. Load	@No Load			@Max. Load
	VDC	VDC	mA	mA	mA(typ.)	mA(typ.)	VDC(typ.)	μF	%
MKW2021	24 (9 ~ 36)	3.3	2400	240	423	10	3.9	470	78
MKW2022		5	2000	200	508		6.8		82
MKW2023		12	1000	100	595		15		84
MKW2024		15	800	80	595		18		84
MKW2025		±5	±1000	±100	508		±6.8	150#	82
MKW2026		±12	±500	±50	595		±15		84
MKW2027		±15	±400	±40	595		±18		84
MKW2031	48 (18 ~ 75)	3.3	2400	240	212	5	3.9	470	78
MKW2032		5	2000	200	254		6.8		82
MKW2033		12	1000	100	298		15		84
MKW2034		15	800	80	298		18		84
MKW2035		±5	±1000	±100	254		±6.8	150#	82
MKW2036		±12	±500	±50	298		±15		84
MKW2037		±15	±400	±40	298		±18		84

For each output

Input Specifications

Parameter	Model	Min.	Typ.	Max.	Unit
Input Surge Voltage (1 sec. max.)	24V Input Models	-0.7	---	42	VDC
	48V Input Models	-0.7	---	84	
Start-Up Threshold Voltage	24V Input Models	8	8.5	9	
	48V Input Models	14	16	18	
Under Voltage Shutdown	24V Input Models	7	8	8.5	
	48V Input Models	13	15	17	
Reverse Polarity Input Current	All Models	---	---	1	A
Short Circuit Input Power		---	---	3500	mW
Internal Power Dissipation		---	---	5000	mW
Conducted EMI		Compliance to EN 55022,class A and FCC part 15,class A			

Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy	At 50% Load and Nominal Vin	---	---	±1.0	%Vom.
Output Voltage Balance	Dual Output, Balanced Loads	---	±0.5	±2.0	%
Line Regulation	Vin=Min. to Max.	---	±0.1	±0.5	%
Load Regulation	Io=10% to 100% (3.3Vo)	---	±0.8	±1.0	%
	Io=10% to 100%	---	±0.2	±0.5	%
Ripple & Noise (20MHz)		---	50	75	mV_{P-P}
Transient Recovery Time	25% Load Step Change	---	150	250	µsec
Transient Response Deviation		---	±1.5	±2.5	%
Temperature Coefficient		---	±0.01	±0.02	%/℃
Over Load Protection	Foldback	120	TBD	---	%
Short Circuit Protection	Continuous				

General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage (rated)	60 Seconds	1500	---	---	VDC
I/O Isolation Resistance	500 VDC	1000	---	---	MΩ
I/O Isolation Capacitance	100KHz, 1V	---	500	650	pF
Switching Frequency		300	350	400	KHz
MTBF (calculated)	MIL-HDBK-217F@25℃, Ground Benign	700,000	---	---	Hours
Safety Approvals	UL/cUL 60950-1 recognition(UL certificate), IEC/EN 60950-1				

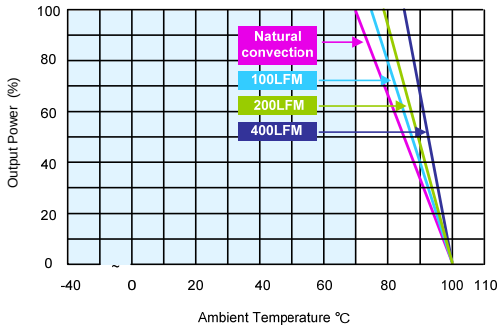
Input Fuse

24V Input Models	48V Input Models
1500mA Slow-Blow Type	750mA Slow-Blow Type

Environmental Specifications

Parameter	Conditions	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	Natural Convection	-40	+85	℃
Case Temperature		---	+90	℃
Storage Temperature Range		-50	+125	℃
Humidity (non condensing)		---	95	% rel. H
Cooling	Free-Air convection			
Lead Temperature (1.5mm from case for 10Sec.)		---	260	℃

Power Derating Curve

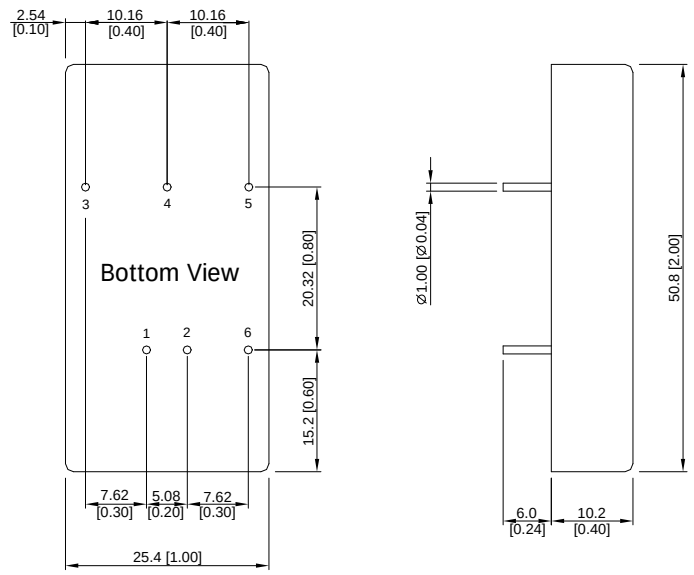


Notes

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 Ripple & Noise measurement bandwidth is 0-20MHz.
4 These power converters require a minimum output loading to maintain specified regulation, operation under no-load conditions will not damage these modules; however they may not meet all specifications listed.
5 All DC/DC converters should be externally fused at the front end for protection.
6 Other input and output voltage may be available, please contact factory.
7 To order the converter with Remote On/Off function, add **suffix RC** (e.g. MKW2021-RC) to order code.
8 That "natural convection" is about 20LFM but is not equal to still air (0 LFM).
9 Specifications 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
6	Remote On/Off	Remote On/Off

NC: No Connection

- 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)

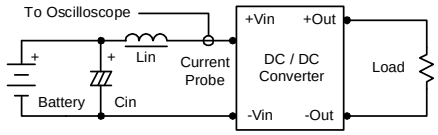
Physical Characteristics

Case Size	:	50.8x25.4x10.2mm (2.0x1.0x0.4 inches)
Case Material	:	Metal with Non-Conductive Baseplate
Pin Material	:	Copper Alloy with Gold Plate Over Nickel Underplate
Weight	:	31.7g

Test Setup

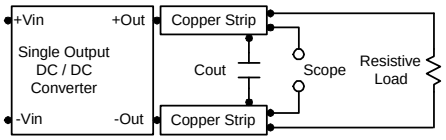
Input Reflected-Ripple Current Test Setup

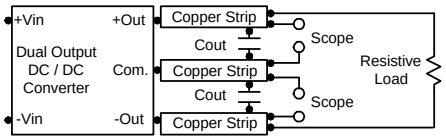
Input reflected-ripple current is measured with a inductor Lin (4.7μH) and Cin (220μF, ESR < 1.0Ω at 100 KHz) to simulate source impedance.
Capacitor Cin, offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is 0-500 KHz.



Peak-to-Peak Output Noise Measurement Test

Use a Cout 0.47μF 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

Remote On/Off

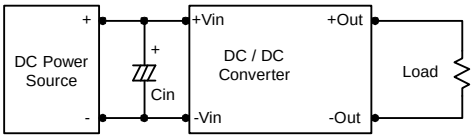
Positive logic remote on/off turns the module on during a logic high voltage on the remote on/off pin, and off during a logic low. Negative logic remote on/off turns the module off during a logic low and on during a logic high. To turn the power module on and off, the user must supply a switch to control the voltage between the on/off terminal and the -Vin terminal. The switch can be an open collector or equivalent. A logic low is -0.7V to 0.8V. A logic high is 2.5V to 5.5V.
The maximum sink current at on/off terminal during a logic low is 100 μA. The maximum allowable leakage current of the switch at on/off terminal = 2.5 to 5.5V is 50μA.

Overcurrent Protection

To provide protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure current limiting for an unlimited duration. At the point of current-limit inception, the unit shifts from voltage control to current control. The unit operates normally once the output current is brought back into its specified range.

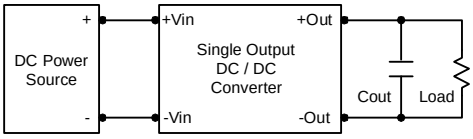
Input Source Impedance

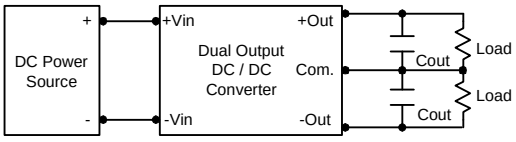
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module.
In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.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



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 3.9μF capacitors at the output.





Maximum Capacitive Load

The MKW2000 series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. For optimum performance we recommend 150μF maximum capacitive load for dual outputs and 470μF capacitive load for single outputs. 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 90°C.
The derating curves are determined from measurements obtained in a test setup.