MKW5000 Series

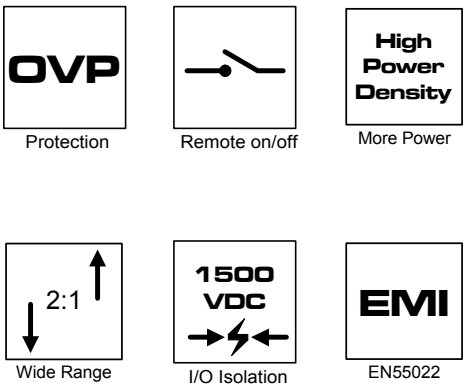
25-30W, Wide Input Range, Single Output DC/DC Converters

Key Features

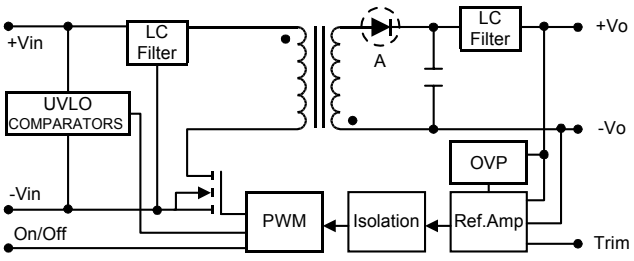
- *Efficiency up to 88%*
- *1500VDC Isolation*
- *MTBF > 600,000 Hours*
- *2:1 Wide Input Range*
- *UL1950 Safety Approval*
- *Complies with EN55022 Class A*
- *Six−Sided Shielding*
- *Remote On/Off Control*
- *Soft Start*
- *Over Voltage Protection*
- *Output Trim*

Minmax's MKW5000-Series power modules are low-profile dc-dc converters that operate over input voltage ranges of 18-36VDC and 36-75VDC which provide precisely regulated output voltages of 2.5V, 3.3V, 5V, 5.1V, 12V and 15VDC, specially addressing data communication equipments, mobile battery driven equipments, distributed power systems, telecommunication equipments, mixed analog/digital subsystems, process/machine control equipments, computer peripheral systems and industrial robot systems.

Packing up to 30W of power into a 2x1x0.4inch package, with efficiencies as high as 88%, the MKW5000 includes continuous short circuit protection, overvoltage protection, output trim function, remote on/off, six-sided shielded case and EN55022 Class A conducted noise compliance minimize design-in time, cost and eliminate the need for external filtering.



Block Diagram



A: 2.5V, 3.3V, 5V and 5.1V−output models use the synchronous−rectifier configuration shown as above.
12V and 15V−output models employ a standard, diode−rectification architecture.

Model Selection Guide

Model Number	Input Voltage	Output Voltage	Output Current		Input Current		Reflected Ripple Current	Over Voltage Protection	Efficiency
			Max.	Min.	@Max. Load	@No Load			@Max. Load
	VDC	VDC	mA	mA	mA (Typ.)	mA (Typ.)	mA (Typ.)	VDC	% (Typ.)
MKW5030	24 (18 ~ 36)	2.5	6000	0	744	50	100	3	84
MKW5031		3.3	6000	0	959	50		3.9	86
MKW5032		5	5000	0	1185	70		6.8	88
MKW5033		12	2500	166	1420	20		15	88
MKW5034		15	2000	133	1420	20		18	88
MKW5039		5.1	5000	0	1207	70		6.8	88
MKW5040	48 (36 ~ 75)	2.5	6000	0	372	40	50	3	84
MKW5041		3.3	6000	0	480	40		3.9	86
MKW5042		5	5000	0	604	50		6.8	88
MKW5043		12	2500	166	710	10		15	88
MKW5044		15	2000	133	710	10		18	88
MKW5049		5.1	5000	0	604	50		6.8	88

Absolute Maximum Ratings

Parameter		Min.	Max.	Unit
Input Surge Voltage (1000 mS)	24VDC Input Models	−0.7	50	VDC
	48VDC Input Models	−0.7	100	VDC
Lead Temperature (1.5mm from case for 10 Sec.)		−−−	260	℃
Internal Power Dissipation		−−−	5500	mW

Exceeding the absolute maximum ratings of the unit could cause damage. These are not continuous operating ratings.

Environmental Specifications

Parameter	Conditions	Min.	Max.	Unit
Operating Temperature	Ambient	−40	+50	℃
Operating Temperature	Case	−40	+105	℃
Storage Temperature		−50	+125	℃
Humidity		−−−	95	%
Cooling	Free−Air Convection			
RFI	Six−Sided Shielded, Metal Case			
Conducted EMI	EN55022 Class A			

Notes :

1. Specifications typical at Ta=+25℃, resistive load, nominal input voltage, 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 0−20 MHz.
4. These power converters require a minimum output loading to maintain specified regulation.
5. Operation under no−load conditions will not damage these modules; however, they may not meet all specifications listed.
6. All DC/DC converters should be externally fused at the front end for protection.
7. Other input and output voltage may be available, please contact factory.
8. To order the converter with Remote On/Off function, please add a suffix −RC (e.g. MKW5030−RC).
9. To order the converter with EN55022 Class A function, please add a suffix A (e.g. MKW5030A).
10. Specifications subject to change without notice.

Input Specifications

Parameter	Model	Min.	Typ.	Max.	Unit
Start Voltage	24V Input Models	17	17.5	18	VDC
	48V Input Models	34	35	36	
Under Voltage Shutdown	24V Input Models	16	16.5	17	
	48V Input Models	32	33	34	
Over Voltage Shutdown	24V Input Models	40	42	44	
	48V Input Models	80	82	84	
Reverse Polarity Input Current	All Models	---	---	2	A
Short Circuit Input Power		---	---	4500	mW
Input Filter		Pi Filter			

Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Accuracy		---	±0.5	±1.0	%
Line Regulation	Vin=Min. to Max.	---	±0.1	±0.3	%
Load Regulation (2.5/3.3/5/5.1Vout)	Io=0% to 100%	---	±0.5	±1.0	%
Load Regulation (12/15Vout)	Io=10% to 100%	---	±0.5	±1.0	%
Ripple & Noise (20MHz)		---	75	100	mV P-P
Ripple & Noise (20MHz)	Over Line, Load & Temp.	---	---	120	mV P-P
Ripple & Noise (20MHz)		---	---	10	mV rms
Over Power Protection		110	---	160	%
Transient Recovery Time	25% Load Step Change	---	200	500	uS
Transient Response Deviation		---	±2	±5	%
Temperature Coefficient		---	±0.01	±0.02	%/°C
Output Short Circuit	Continuous				

General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Isolation Voltage Rated	60 Seconds	1500	---	---	VDC
Isolation Voltage Test	Flash Tested for 1 Second	1650	---	---	VDC
Isolation Resistance	500VDC	1000	---	---	MΩ
Isolation Capacitance	100KHz,1V	---	1200	1500	pF
Switching Frequency		280	350	400	KHz
MTBF	MIL-HDBK-217F @ 25°C, Ground Benign	600	---	---	K Hours

Remote On/Off Control

Parameter	Conditions	Min.	Typ.	Max.	Unit
Supply On	2.5 to 100VDC or Open Circuit				
Supply Off		-1	---	1	VDC
Device Standby Input Current		---	2	5	mA
Control Input Current (on)	Vin-RC=5.0V	---	---	5	uA
Control Input Current (off)	Vin-RC=0V	---	---	-100	uA
Control Common	Referenced to Negative Input				

Capacitive Load

Models by Vout	2.5V	3.3V	5V	5.1V	12V	15V	Unit
Maximum Capacitive Load	6800	6800	6800	6800	680	680	uF

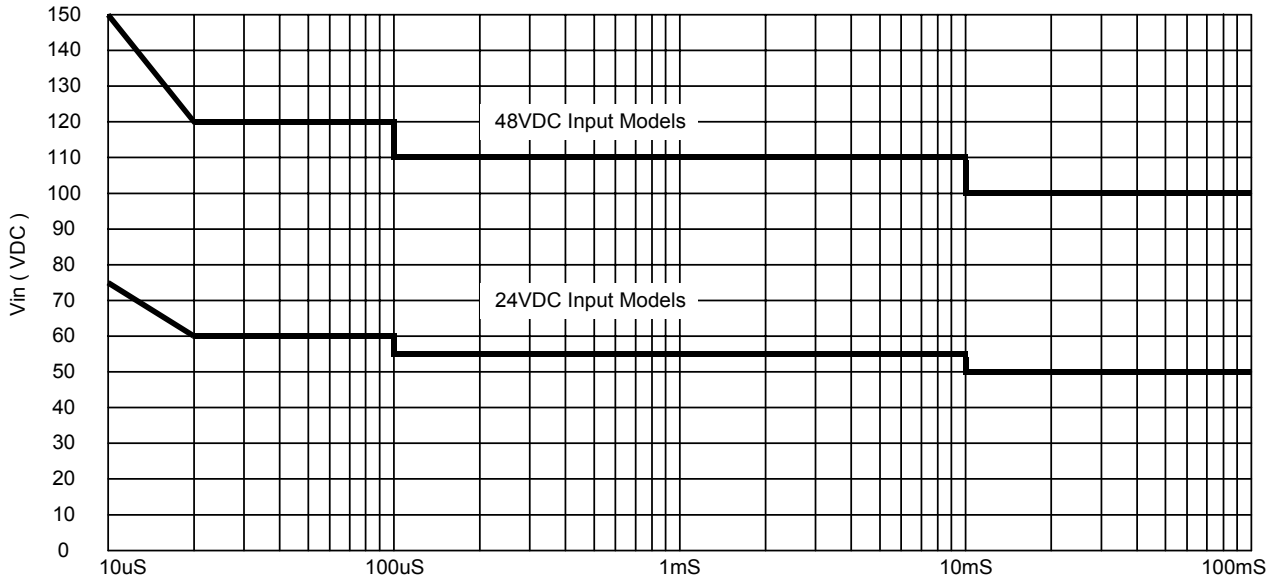
Input Fuse Selection Guide

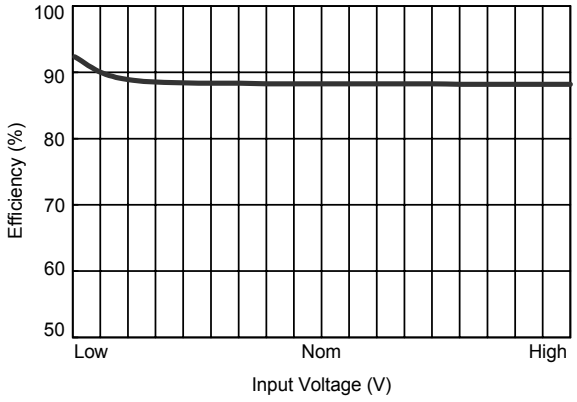
24V Input Models	48V Input Models
3000mA Slow − Blow Type	1500mA Slow − Blow Type

Output Voltage Trim

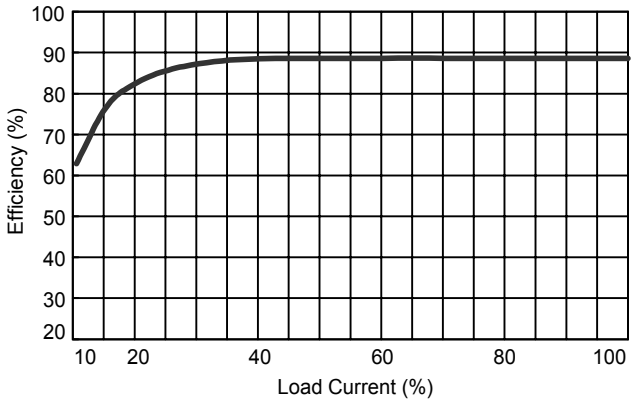
Parameter	Conditions	Min.	Typ.	Max.	Unit
Trim Up / Down Range	% of nominal output voltage	±9.0	±10.0	±11.0	%

Input Voltage Transient Rating

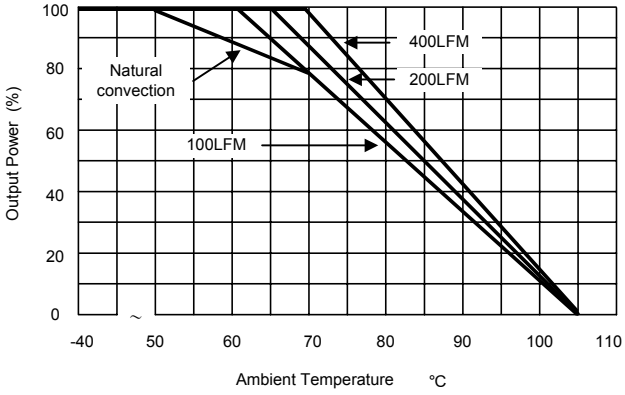




Efficiency vs Input Voltage



Efficiency vs Output Load



Derating Curve

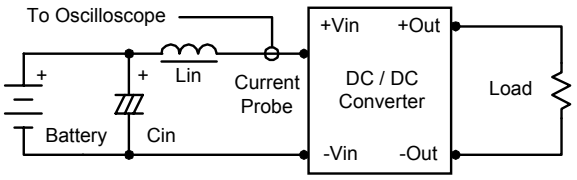
Test Configurations

Input Reflected-Ripple Current Test Setup

Input reflected−ripple current is measured with a inductor Lin (4.7uH) and Cin (220uF, ESR < 1.0Ω at 100 KHz) to simulate source impedance.

Capacitor Cin, offsets possible battery impedance.

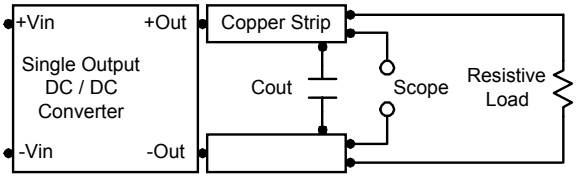
Current ripple is measured at the input terminals of the module, measurement bandwidth is 0−500 KHz.



Peak-to-Peak Output Noise Measurement Test

Use a Cout 1.0uF 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.



Design & Feature Considerations

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.

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 −1V to 1.0V.

A logic high is 2.5V to 100V.

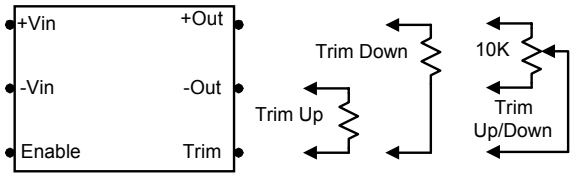
The maximum sink current at the on/off terminal (Pin 3) during a logic low is −100uA.

The maximum allowable leakage current of a switch connected to the on/off terminal (Pin 3) at logic high (2.5V to 100V) is 5uA.

Output Voltage Trim

Output voltage trim allows the user to increase or decrease the output voltage set point of a module.

The output voltage can be adjusted by placing an external resistor (Radj) between the Trim and +Vout or −Vout terminals. By adjusting Radj, the output voltage can be change by ±10% of the nominal output voltage.



A 10K, 1 or 10 Turn trimpot is usually specified for continuous trimming. Trim pin may be safely left floating if it is not used.

Connecting the external resistor (Radj−up) between the Trim and −Vout pins increases the output voltage to set the point as defined in the following equation:

$$Radj{-}up = \frac{(33{\times}Vout) - (30{\times}Vadj)}{Vadj - Vout}$$

Connecting the external resistor (Radj−down) between the Trim and +Vout pins decreases the output voltage set point as defined in the following equation:

$$Radj{-}down = \frac{(36.667{\times}Vadj) - (33{\times}Vout)}{Vout{-}Vadj}$$

Vout : Nominal Output Voltage

Vadj : Adjusted Output Voltage

Units : VDC/ KΩ

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.

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.

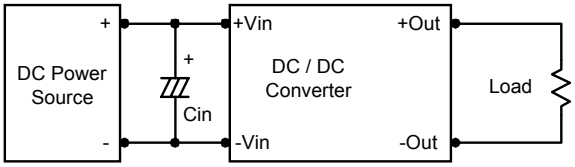
The OVP level can be found in the output data.

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 at the input to ensure startup.

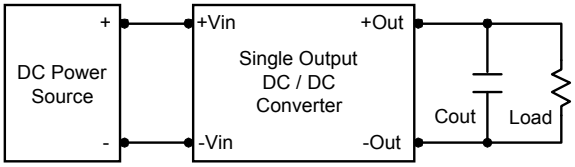
Capacitor mounted close to the power module helps ensure stability of the unit, it is recommended to use a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 KHz) capacitor of a 33uF for the 12V input devices and a 10uF for the 24V and 48V devices.



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 4.7uF capacitors at the output.



Maximum Capacitive Load

The MKW5000 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.

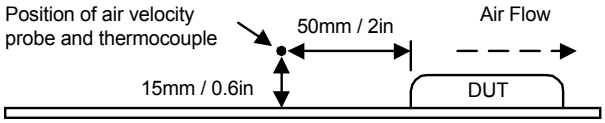
For optimum performance we recommend 680uF maximum capacitive load for 12V & 15V outputs and 6800uF capacitive load for the other outputs.

The maximum capacitance can be found in the data sheet.

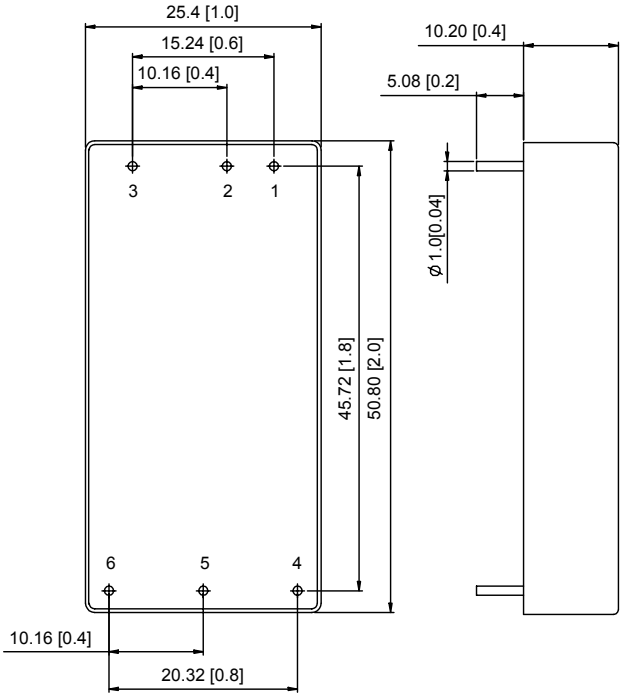
Thermal Considerations

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 105°C.

The derating curves are determined from measurements obtained in an experimental apparatus.



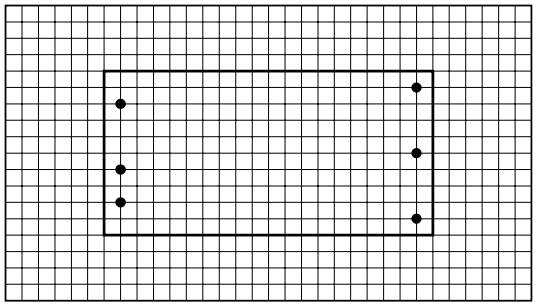
Mechanical Dimensions



Tolerance	Millimeters	Inches
	X.X±0.25	X.XX±0.01
	X.XX±0.13	X.XXX±0.005
Pin	±0.05	±0.002

Connecting Pin Patterns

Top View (2.54 mm / 0.1 inch grids)



Pin Connections

Pin	Function
1	+Vin
2	−Vin
3	Remote On/Off
4	+Vout
5	−Vout
6	Trim

Physical Characteristics

Case Size : 50.8×25.4×10.2 mm
2.0×1.0×0.4 inches

Case Material : Aluminum Anodizing Treatment in Black

Weight : 32g

The MKW5000 converter is encapsulated in a low thermal resistance molding compound that has excellent resistance/electrical characteristics over a wide temperature range or in high humidity environments.
The encapsulant and unit case are both rated to UL 94V−0 flammability specifications.
Leads are tin plated for improved solderability.