FEATURES

- 2"x 1"x 0.4" Metal Package
- Wide 2:1 Input Range
- High Efficiency up to 86%
- Operating Temp. Range –40°C to +80°C
- Short Circuit Protection
- I/O-isolation 1500 VDC
- Input Filter to meet EN55022,class A (Option)
- Heatsink (Option)
- Cost optimized Design
- 3 Years Product Warranty

PRODUCT OVERVIEW

The MINMAX MKW2500 series is a range of isolated 15W DC/DC converter modules featuring fully regulated output voltages and wide 2:1 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°C to +80°C. They feature as option input filter to meet EN55022,class A and remote On/Off input.
These DC/DC converters offer an economical solution for many cost critical applications in battery-powered equipment and instrumentation.

Model Selection Guide

Model Number	Input Voltage (Range)	Output Voltage	Output Current		Input Current		Reflected Ripple Current	Max. capacitive Load	Efficiency (typ.)
			Max.	Min.	@Max. Load	@No Load			@Max. Load
	VDC	VDC	mA	mA	mA(typ.)	mA(typ.)	mA(typ.)	uF	%
MKW2521	12 (9 ~ 18)	3.3	3000	300	1057	30	50	470	78
MKW2522		5	3000	300	1524				82
MKW2529		5.1	3000	300	1574				81
MKW2523		12	1250	125	1452				86
MKW2524		15	1000	100	1452				86
MKW2526		±12	±625	±62.5	1452			220#	86
MKW3267		±15	±500	±50	1452				86
MKW2531	24 (18 ~ 36)	3.3	3000	300	528	20	40	470	78
MKW2532		5	3000	300	762				82
MKW2539		5.1	3000	300	787				81
MKW2533		12	1250	125	726				86
MKW2534		15	1000	100	726				86
MKW2536		±12	±625	±62.5	726			220#	86
MKW2537		±15	±500	±50	726				86
MKW2541	48 (36 ~ 75)	3.3	3000	300	264	10	30	470	78
MKW2542		5	3000	300	381				82
MKW2549		5.1	3000	300	393				81
MKW2543		12	1250	125	363				86
MKW2544		15	1000	100	363				86
MKW2546		±12	±625	±62.5	363			220#	86
MKW2547		±15	±500	±50	363				86

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 Voltage	12V Input Models	8	8.5	9	
	24V Input Models	15	17	18	
	48V Input Models	30	33	36	
Under Voltage Shutdown	12V Input Models	7	8	8.5	
	24V Input Models	13	15	17	
	48V Input Models	25	29	34	
Reverse Polarity Input Current	All Models	---	---	1	A
Short Circuit Input Power		---	---	3500	mW
Internal Power Dissipation		---	---	5000	mW
Conducted EMI (with **suffix A** only)		Compliance to EN 55022,class A and FCC part 15,class A			

Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Accuracy		---	±1.0	±2.0	%
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%	---	±0.5	±1.0	%
Ripple & Noise (20MHz)		---	55	80	mV_{P-P}
Ripple & Noise (20MHz)	Over Line, Load & Temp.	---	---	100	mV_{P-P}
Ripple & Noise (20MHz)		---	---	15	mV rms
Transient Recovery Time	25% Load Step Change	---	300	500	uS
Transient Response Deviation		---	±2	±4	%
Temperature Coefficient		---	±0.01	±0.02	%/℃
Over Load Protection	Foldback	120	150	---	%
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	---	1200	1500	pF
Switching Frequency		290	330	400	KHz
MTBF (calculated)	MIL-HDBK-217F@25℃, Ground Benign	700,000	---	---	Hours
Safety Approvals	UL/cUL 60950-1 recognition(CSA certificate), IEC/EN 60950-1(CB-scheme)				

Input Fuse

12V Input Models	24V Input Models	48V Input Models
2500mA Slow-Blow Type	1250mA Slow-Blow Type	750mA Slow-Blow Type

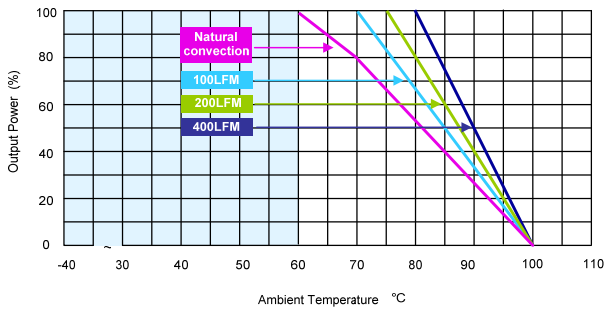
Remote On/Off Control

Parameter	Conditions	Min.	Typ.	Max.	Unit
Converter On	2.5V ~ 5.5V or Open Circuit				
Converter Off	-0.7V ~ 0.8V or Short Circuit				
Control Input Current (on)	Vctrl = 5.0V	---	---	50	uA
Control Input Current (off)	Vctrl = 0V	---	---	-1	mA
Control Common	Referenced to Negative Input				
Standby Input Current	Nominal Vin	---	---	10	mA

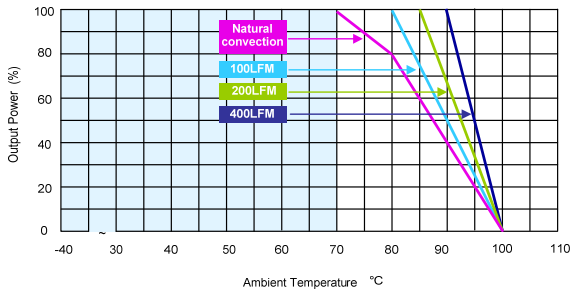
Environmental Specifications

Parameter	Conditions	Min.	Max.	Unit
Operating Temperature Range (with Derating)	Ambient	-40	+80	℃
Case Temperature		---	+100	℃
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



Derating Curve without Heatsink



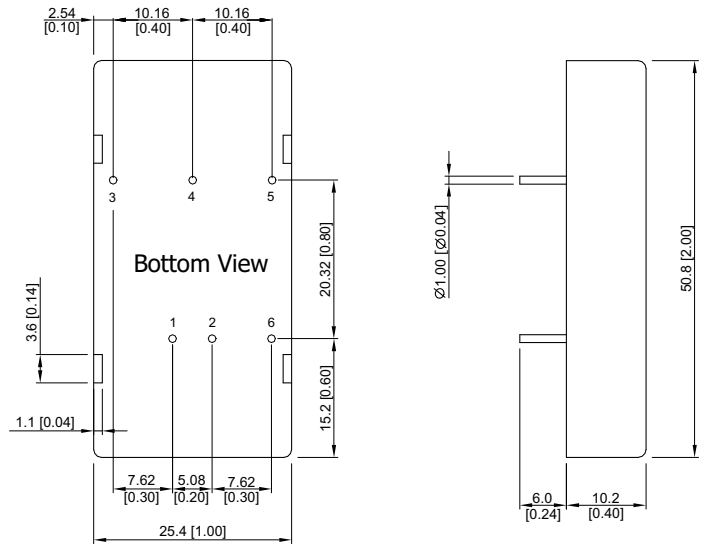
Derating Curve with Heatsink

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. MKW2521-RC) to order code.
8. To order the converter with input filter meeting EN55022, Class A , add **suffix A** (e.g. MKW2521A) to order code.
9. To order the converter with heatsink, add **suffix H** (e.g. MKW2521H) to order code.
10. 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 (Optional)	

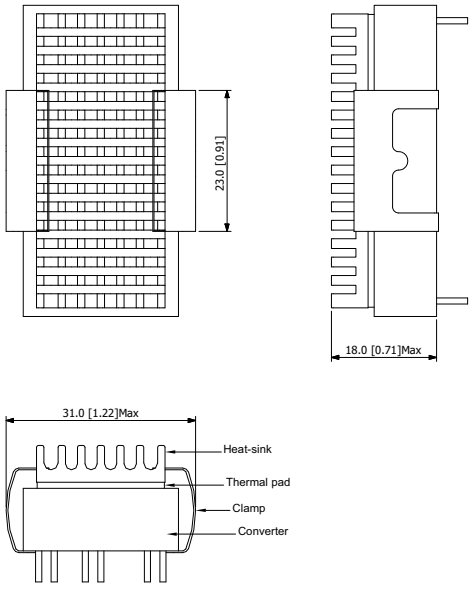
NC: No Connection

- 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 (2.0x1.0x0.40 Inches)
Case Material	:	Metal With Non-Conductive Baseplate
Base Material	:	FR4 PCB (flammability to UL 94V-0 rated)
Weight	:	32g

Heatsink (Option –H)



Physical Characteristics

Heatsink Material	:	Aluminum
Finish	:	Black Anodized Coating
Weight	:	9g

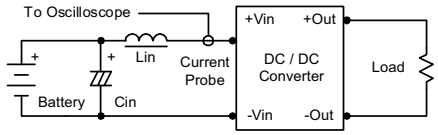
- The advantages of adding a heatsink are:

1. To help heat dissipation and increase the stability and reliability of DC/DC converters at high operating temperature atmosphere.
2. To upgrade the operating temperature of DC/DC converters, please refer to Derating Curve.

Test Configurations

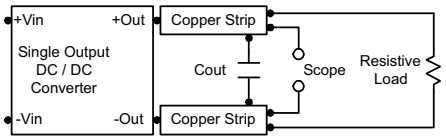
Input Reflected-Ripple Current Test Setup

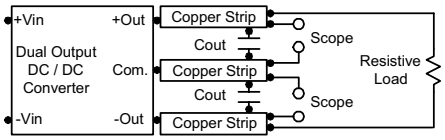
Input reflected-ripple current is measured with a inductor Lin (4.7uH) and Cin (220uF, ESR < 1.0Ω at 100 KHz) to simulate source impedance.
Capacitor Cin, offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is 0-500 KHz.



Peak-to-Peak Output Noise Measurement Test

Use a Cout 0.47uF 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

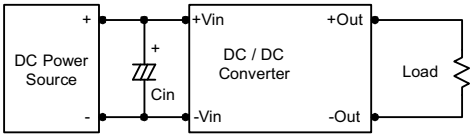
Positive logic remote on/off turns the module on during a logic high voltage on the remote on/off pin, and off during a logic low. To turn the power module on and off, the user must supply a switch to control the voltage between the on/off terminal and the -Vin terminal. The switch can be an open collector or equivalent.
A logic low is -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 -1 mA. The maximum allowable leakage current of the switch at on/off terminal (2.5 to 5.5V) is 50uA.

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.

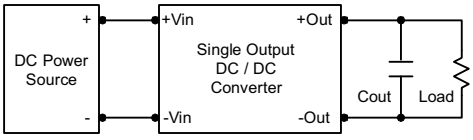
Input Source Impedance

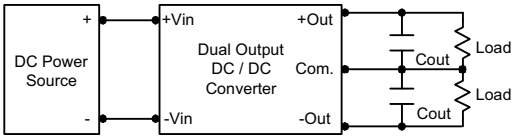
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module.
In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.
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 22uF for the 12V input devices and a 6.8uF 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 MKW2500 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 220uF maximum capacitive load for dual outputs and 470uF 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 100°C.
The derating curves are determined from measurements obtained in a test setup.