FEATURES

- ▶2"x 1"x 0.4" Metal Package
- ▶Wide 2:1 Input Range
- ▶Very high Efficiency up to 89%
- ▶Operating Ambient Temp. Range –40℃ to +80℃
- ▶Short Circuit Protection
- ▶I/O-isolation 1500VDC
- ▶Remote On/Off (Option)

CSA 60950-1 CB Scheme

PRODUCT OVERVIEW

The MINMAX MKW3000 series is a range of isolated 20W 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. MKW3000 series also offer remote On/Off control for flexible use.

Typical applications for these converters are 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		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.)	μF	%
MKW3021	12 (9 ~ 18)	3.3	4000	240	1358	30	50	6800	81
MKW3022		5	4000	240	1984				84
MKW3023		12	1670	100	1898			680	88
MKW3024		15	1340	80	1903				88
MKW3026		±12	±835	±50	1898			270#	88
MKW3027		±15	±670	±40	1903				88
MKW3031	24 (18 ~ 36)	3.3	4000	240	671	17	30	6800	82
MKW3032		5	4000	240	980				85
MKW3033		12	1670	100	938			680	89
MKW3034		15	1340	80	941				89
MKW3036		±12	±835	±50	938			270#	89
MKW3037		±15	±670	±40	941				89
MKW3041	48 (36 ~ 75)	3.3	4000	240	335	10	20	6800	82
MKW3042		5	4000	240	490				85
MKW3043		12	1670	100	469			680	89
MKW3044		15	1340	80	471				89
MKW3046		±12	±835	±50	469			270#	89
MKW3047		±15	±670	±40	471				89

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	8.6	8.8	9	
	24V Input Models	17	17.5	18	
	48V Input Models	34	35	36	
Under Voltage Shutdown	12V Input Models	8.1	8.3	8.5	
	24V Input Models	16	16.5	17	
	48V Input Models	32	33	34	
Short Circuit Input Power	All Models	---	---	3500	mW
Input Filter		Internal LC Type			
Conducted EMI		Compliance to EN 55022, class A			

Remote On/Off Control

Parameter	Conditions	Min.	Typ.	Max.	Unit
Converter On	2.5V ~ 100V or Open Circuit				
Converter Off	0V ~ 1V or Short Circuit				
Control Input Current (on)	Vctrl = 5.0V	---	---	5	μA
Control Input Current (off)	Vctrl = 0V	---	---	-100	μA
Control Common	Referenced to Negative Input				
Standby Input Current	Nominal Vin	---	2	5	mA

Output Specifications

Parameter	Conditions		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		---	±0.1	±0.3	%
Load Regulation	Io=10% to 100%	3.3Vout Models	---	±0.5	±1.0	%
		Other Models	---	±0.1	±0.5	%
Ripple & Noise	0-20 MHz Bandwidth		---	55	80	mV_{P-P}
Transient Recovery Time	25% Load Step Change		---	150	300	μsec
Transient Response Deviation			---	±2	±4	%
Temperature Coefficient			---	±0.01	±0.02	%/°C
Over Load Protection	Foldback		110	---	160	%
Short Circuit Protection	Continuous, Automatic Recovery					

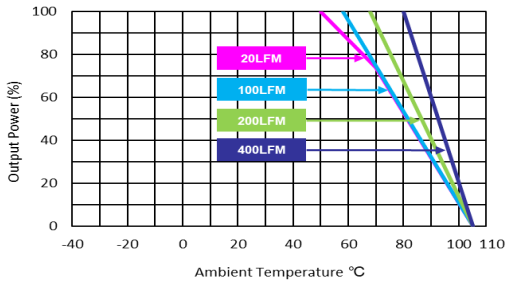
General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds	1500	---	---	VDC
	1 Second	1800	---	---	VDC
I/O Isolation Resistance	500 VDC	1000	---	---	MΩ
I/O Isolation Capacitance	100kHz, 1V	---	1200	1500	pF
Switching Frequency		290	330	360	kHz
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	800,000			Hours
Safety Approvals	UL/cUL 60950-1 recognition (CSA certificate), IEC/EN 60950-1(CB-report)				

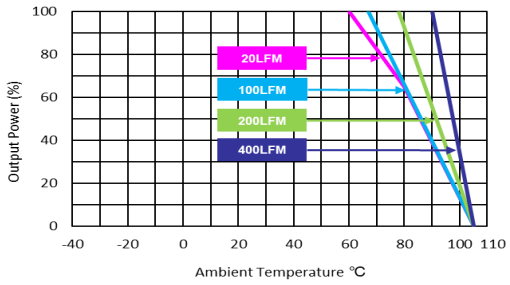
Environmental Specifications

Parameter	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-40	+80	℃
Case Temperature	---	+105	℃
Storage Temperature Range	-50	+125	℃
Humidity (non condensing)	---	95	% rel. H
Lead Temperature (1.5mm from case for 10Sec.)	---	260	℃

Power Derating Curve



Derating Curve without Heatsink



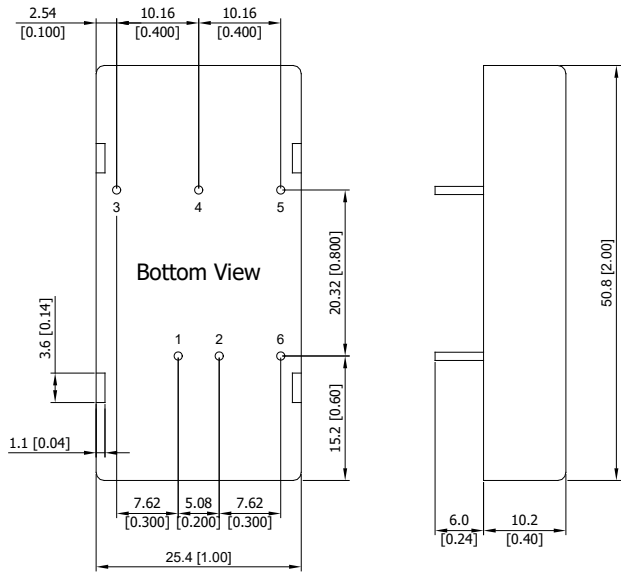
Derating Curve with Heatsink

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 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.
4 We recommend to protect the converter by a slow blow fuse in the input supply line.
5 Other input and output voltage may be available, please contact MINMAX.
6 Specifications are subject to change without notice.

Package Specifications

Mechanical Dimensions



Pin Connections

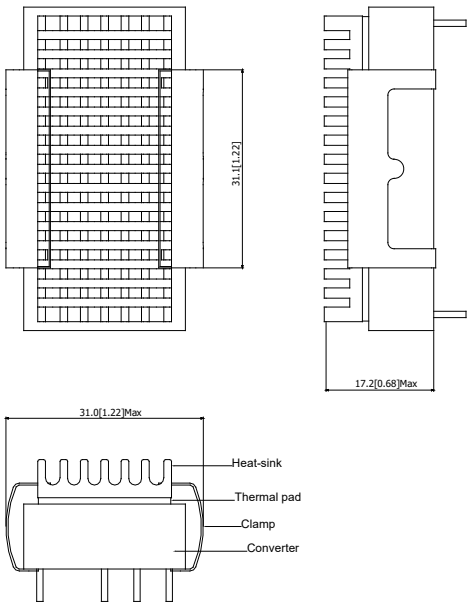
Pin	Single Output	Dual Output	Diameter mm (inches)
1	+Vin	+Vin	Ø 1.0 [0.04]
2	-Vin	-Vin	Ø 1.0 [0.04]
3	+Vout	+Vout	Ø 1.0 [0.04]
4	No Pin	Common	Ø 1.0 [0.04]
5	-Vout	-Vout	Ø 1.0 [0.04]
6	Remote On/Off		Ø 1.0 [0.04]

- ▶ All dimensions in mm (inches)
- ▶ Tolerance: X.X±0.25 (X.XX±0.01)
  X.XX±0.13 (X.XXX±0.005)
- ▶ Pin diameter tolerance: X.X±0.05 (X.XX±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)
Pin Material	:	Copper Alloy
Weight	:	32g

Heatsink (Option –H)



Physical Characteristics

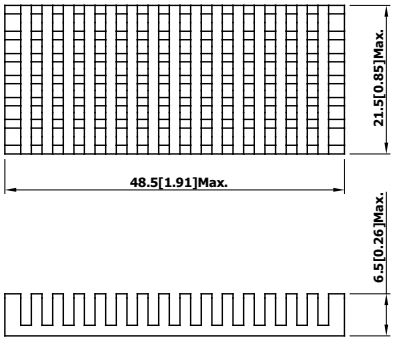
Heatsink Material	:	Aluminum
Finish	:	Black Anodized Coating
Weight	:	9g

▶ The advantages of adding a heatsink are:

1. To improve heat dissipation and increase the stability and reliability of the DC-DC converters at high operating temperatures.
2. To increase operating temperature of the DC-DC converter, please refer to Derating Curve.

Order Code Table			
Standard	With heatsink	Without Remote On/Off	Without Remote On/Off & With heatsink
MKW3021	MKW3021H	MKW3021-N	MKW3021H-N
MKW3022	MKW3022H	MKW3022-N	MKW3022H-N
MKW3023	MKW3023H	MKW3023-N	MKW3023H-N
MKW3024	MKW3024H	MKW3024-N	MKW3024H-N
MKW3026	MKW3026H	MKW3026-N	MKW3026H-N
MKW3027	MKW3027H	MKW3027-N	MKW3027H-N
MKW3031	MKW3031H	MKW3031-N	MKW3031H-N
MKW3032	MKW3032H	MKW3032-N	MKW3032H-N
MKW3033	MKW3033H	MKW3033-N	MKW3033H-N
MKW3034	MKW3034H	MKW3034-N	MKW3034H-N
MKW3036	MKW3036H	MKW3036-N	MKW3036H-N
MKW3037	MKW3037H	MKW3037-N	MKW3037H-N
MKW3041	MKW3041H	MKW3041-N	MKW3041H-N
MKW3042	MKW3042H	MKW3042-N	MKW3042H-N
MKW3043	MKW3043H	MKW3043-N	MKW3043H-N
MKW3044	MKW3044H	MKW3044-N	MKW3044H-N
MKW3046	MKW3046H	MKW3046-N	MKW3046H-N
MKW3047	MKW3047H	MKW3047-N	MKW3047H-N

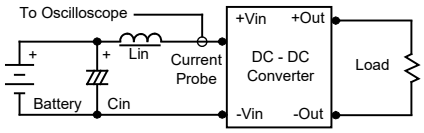
Order Code For Heatsink kit (including: Heatsink x1, Clamp x 2, Thermal Pad x1)
HS-K001



Test Setup

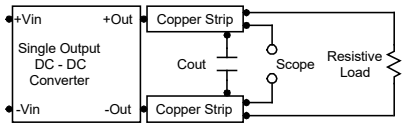
Input Reflected-Ripple Current Test Setup

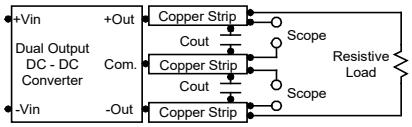
Input reflected-ripple current is measured with a inductor Lin (4.7μH) and Cin (220μF, ESR < 1.0Ω at 100 kHz) to simulate source impedance.
Capacitor Cin, offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is 0-500 kHz.



Peak-to-Peak Output Noise Measurement Test

Use a Cout 1.0μF 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. 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 -0V to 1.0V. A logic high is 2.5V to 100V. The maximum sink current at on/off terminal during a logic low is -100μA. The maximum allowable leakage current of the switch at on/off terminal (2.5 to 100V) is 5μA.

Overload Protection

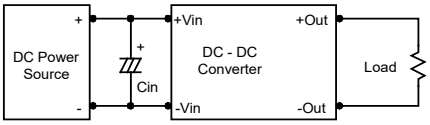
To provide protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure current limiting for an unlimited duration. At the point of current-limit inception, the unit shifts from voltage control to current control. The unit operates normally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

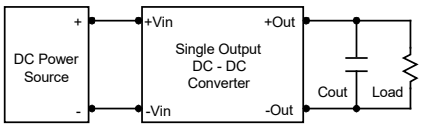
Input Source Impedance

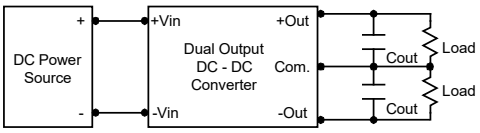
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module.
In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.
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 22μF for the 12V input devices and a 6.8μF 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 4.7μF capacitors at the output.





Maximum Capacitive Load

The MKW3000 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 270μF maximum capacitive load for dual outputs, 680μF capacitive load for 12V & 15V outputs and 6800μF capacitive load for 3.3V & 5V 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℃.
The derating curves are determined from measurements obtained in a test setup.