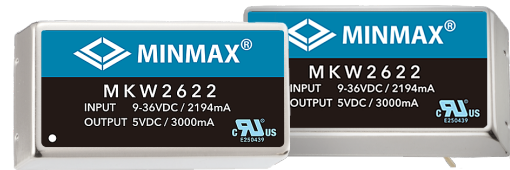


FEATURES

- ▶ 2"x 1"x 0.4" Metal Package
- ▶ Ultra-wide 4:1 Input Range
- ▶ High Efficiency up to 86%
- ▶ Operating Ambient Temp. Range -40°C to +80°C
- ▶ Short Circuit Protection
- ▶ I/O-isolation 1500VDC
- ▶ Remote On/Off (Option)


PRODUCT OVERVIEW

The MINMAX MKW2600 series is a range of isolated 15W 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°C to +80°C. MKW2600 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) VDC	Output Voltage VDC	Output Current		Input Current		Reflected Ripple Current mA(typ.)	Max. capacitive Load μF	Efficiency (typ.) %	
			Max.	Min.	@Max. Load	@No Load				
			mA	mA	mA(typ.)	mA(typ.)			@Max. Load	
MKW2621	24 (9 ~ 36)	3.3	3000	300	528	25	40	470	78	
MKW2622		5	3000	300	762				82	
MKW2629		5.1	3000	300	787				81	
MKW2623		12	1250	125	726				85	
MKW2624		15	1000	100	726				86	
MKW2625		±5	±1500	±150	771				220#	81
MKW2626		±12	±625	±62.5	726					85
MKW2627		±15	±500	±50	726					86
MKW2631	48 (18 ~ 75)	3.3	3000	300	264	15	30	470	78	
MKW2632		5	3000	300	381				82	
MKW2639		5.1	3000	300	393				81	
MKW2633		12	1250	125	363				85	
MKW2634		15	1000	100	363				86	
MKW2635		±5	±1500	±150	386				220#	81
MKW2636		±12	±625	±62.5	363					85
MKW2637		±15	±500	±50	363					86

For each output

Input Specifications

Parameter	Model	Min.	Typ.	Max.	Unit
Input Surge Voltage (1 sec. max.)	24V Input Models	-0.7	---	50	VDC
	48V Input Models	-0.7	---	100	
Start-Up Threshold Voltage	24V Input Models	8	8.5	9	
	48V Input Models	15	17	18	
Under Voltage Shutdown	24V Input Models	7	8	8.5	
	48V Input Models	13	15	17	
Short Circuit Input Power	All Models	---	---	3500	mW
Input Filter		Internal LC Type			
Conducted EMI (with suffix A only)		Compliance to EN 55022, class A			

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	μA
Control Input Current (off)	Vctrl = 0V	---	---	-1	mA
Control Common	Referenced to Negative Input				
Standby Input Current	Nominal Vin	---	---	10	mA

Output Specifications

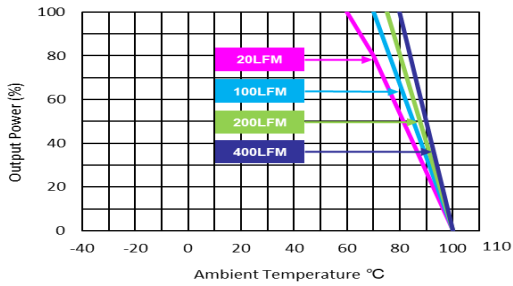
Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy		---	---	±2.0	%Vnom.
Output Voltage Balance	Dual Output, Balanced Loads	---	±0.5	±2.0	%
Line Regulation	Vin=Min. to Max. @Full Load	---	±0.1	±0.5	%
Load Regulation	Io=10% to 100%	---	±0.5	±1.0	%
Ripple & Noise	0-20 MHz Bandwidth	---	55	80	mV _{P-P}
Transient Recovery Time	25% Load Step Change	---	300	500	μsec
Transient Response Deviation		---	±2	±4	%
Temperature Coefficient		---	±0.01	±0.02	%/°C
Over Load Protection	Foldback	120	150	---	%
Short Circuit Protection	Continuous, Automatic Recovery				

General Specifications

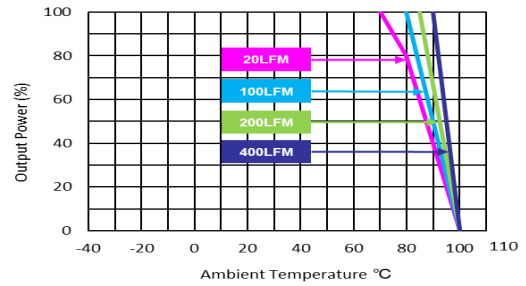
Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds	1500	---	---	VDC
	1 Second	1800	---	---	VDC
I/O Isolation Resistance	500 VDC	1000	---	---	MΩ
I/O Isolation Capacitance	100kHz, 1V	---	1200	1500	pF
Switching Frequency		290	330	400	kHz
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	700,000			Hours
Safety Approvals	UL/cUL 60950-1 recognition (UL certificate)				

Environmental Specifications

Parameter	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-40	+80	°C
Case Temperature	---	+100	°C
Storage Temperature Range	-50	+125	°C
Humidity (non condensing)	---	95	% rel. H
Lead Temperature (1.5mm from case for 10Sec.)	---	260	°C

Power Derating Curve


Derating Curve without Heatsink



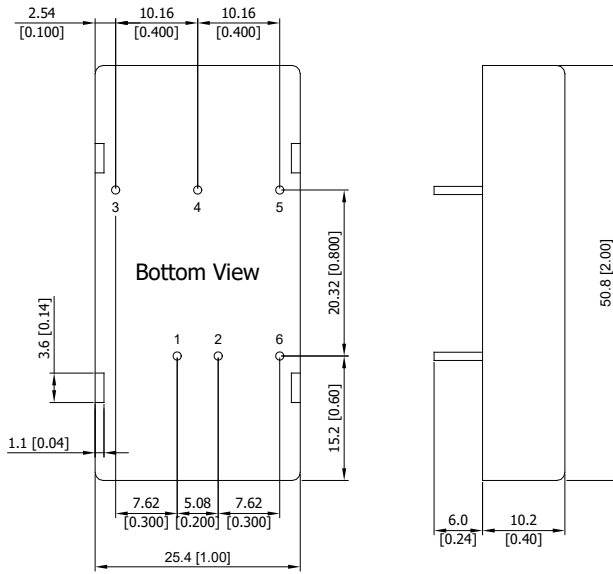
Derating Curve with Heatsink

Notes

- 1 Specifications typical at $T_a = +25^\circ\text{C}$, 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.
- 7 The repeated high voltage isolation testing of the converter can degrade isolation capability, to a lesser or greater degree depending on materials, construction, environment and reflow solder process. Any material is susceptible to eventual chemical degradation when subject to very high applied voltages thus implying that the number of tests should be strictly limited. We therefore strongly advise against repeated high voltage isolation testing, but if it is absolutely required, that the voltage be reduced by 20% from specified test voltage. Furthermore, the high voltage isolation capability after reflow solder process should be evaluated as it is applied on system.

Package Specifications

Mechanical Dimensions



Pin Connections

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

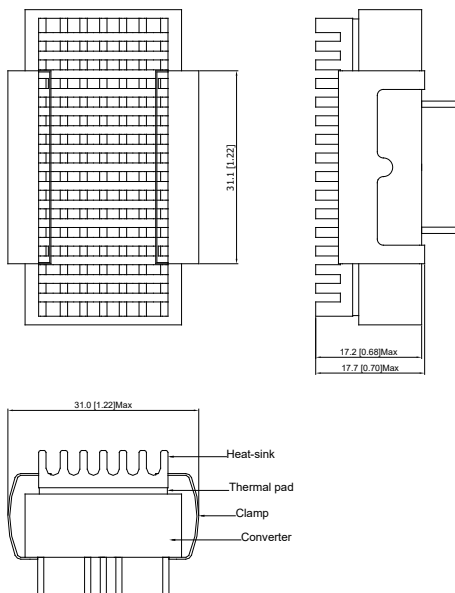
NC: No Connection

- ▶ All dimensions in mm (inches)
- ▶ Tolerance: X.X±0.5 (X.XX±0.02)
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

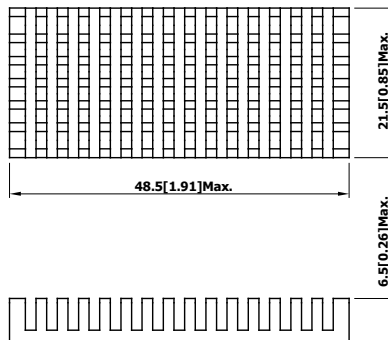
- ▶ The advantages of adding a heatsink are:
 1. To improve heat dissipation and increase the stability and reliability of the DC-DC converters at high operating temperatures.
 2. To increase operating temperature of the DC-DC converter, please refer to Derating Curve.

Order Code Table

Standard	With EMI	With heatsink	With Remote On/Off	With EMI & heatsink	With EMI & Remote On/Off	With heatsink & Remote On/Off	With EMI, heatsink & Remote On/Off
MKW2621	MKW2621A	MKW2621H	MKW2621-RC	MKW2621AH	MKW2621A-RC	MKW2621H-RC	MKW2621AH-RC
MKW2622	MKW2622A	MKW2622H	MKW2622-RC	MKW2622AH	MKW2622A-RC	MKW2622H-RC	MKW2622AH-RC
MKW2629	MKW2629A	MKW2629H	MKW2629-RC	MKW2629AH	MKW2629A-RC	MKW2629H-RC	MKW2629AH-RC
MKW2623	MKW2623A	MKW2623H	MKW2623-RC	MKW2623AH	MKW2623A-RC	MKW2623H-RC	MKW2623AH-RC
MKW2624	MKW2624A	MKW2624H	MKW2624-RC	MKW2624AH	MKW2624A-RC	MKW2624H-RC	MKW2624AH-RC
MKW2625	MKW2625A	MKW2625H	MKW2625-RC	MKW2625AH	MKW2625A-RC	MKW2625H-RC	MKW2625AH-RC
MKW2626	MKW2626A	MKW2626H	MKW2626-RC	MKW2626AH	MKW2626A-RC	MKW2626H-RC	MKW2626AH-RC
MKW2627	MKW2627A	MKW2627H	MKW2627-RC	MKW2627AH	MKW2627A-RC	MKW2627H-RC	MKW2627AH-RC
MKW2631	MKW2631A	MKW2631H	MKW2631-RC	MKW2631AH	MKW2631A-RC	MKW2631H-RC	MKW2631AH-RC
MKW2632	MKW2632A	MKW2632H	MKW2632-RC	MKW2632AH	MKW2632A-RC	MKW2632H-RC	MKW2632AH-RC
MKW2639	MKW2639A	MKW2639H	MKW2639-RC	MKW2639AH	MKW2639A-RC	MKW2639H-RC	MKW2639AH-RC
MKW2633	MKW2633A	MKW2633H	MKW2633-RC	MKW2633AH	MKW2633A-RC	MKW2633H-RC	MKW2633AH-RC
MKW2634	MKW2634A	MKW2634H	MKW2634-RC	MKW2634AH	MKW2634A-RC	MKW2634H-RC	MKW2634AH-RC
MKW2635	MKW2635A	MKW2635H	MKW2635-RC	MKW2635AH	MKW2635A-RC	MKW2635H-RC	MKW2635AH-RC
MKW2636	MKW2636A	MKW2636H	MKW2636-RC	MKW2636AH	MKW2636A-RC	MKW2636H-RC	MKW2636AH-RC
MKW2637	MKW2637A	MKW2637H	MKW2637-RC	MKW2637AH	MKW2637A-RC	MKW2637H-RC	MKW2637AH-RC

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

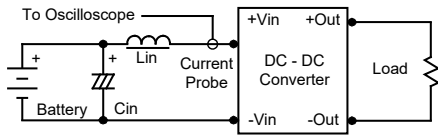
HS-K001



Test Setup

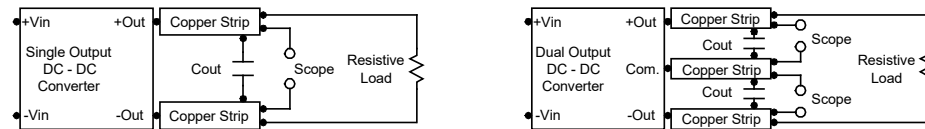
Input Reflected-Ripple Current Test Setup

Input reflected-ripple current is measured with an inductor L_{in} ($4.7\mu H$) and C_{in} ($220\mu F$, $ESR < 1.0\Omega$ at 100 kHz) to simulate source impedance. Capacitor C_{in} , offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is $0\text{--}500\text{ kHz}$.



Peak-to-Peak Output Noise Measurement Test

Use a C_{out} $0.47\mu F$ ceramic capacitor. Scope measurement should be made by using a BNC socket, measurement bandwidth is $0\text{--}20\text{ MHz}$. Position the load between 50 mm and 75 mm from the DC-DC Converter.



Technical Notes

Remote On/Off

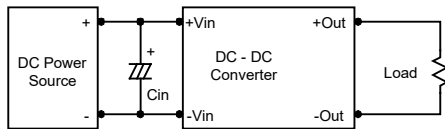
Positive logic remote on/off turns the module on during a logic high voltage on the remote on/off pin, and off during a logic low. To turn the power module on and off, the user must supply a switch to control the voltage between the on/off terminal and the $-Vin$ terminal. The switch can be an open collector or equivalent. A logic low is $-0.7V$ 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 $50\mu A$.

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 ($ESR < 1.0\Omega$ at 100 kHz) capacitor of a $6.8\mu F$ 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 $4.7\mu F$ capacitors at the output.



Maximum Capacitive Load

The MKW2600 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 $220\mu F$ maximum capacitive load for dual outputs and $470\mu F$ 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 $100^\circ C$. The derating curves are determined from measurements obtained in a test setup.

