FEATURES

- Industrial SMD Package
- Wide 2:1 Input Voltage Range
- Fully Regulated Output Voltage
- I/O Isolation 1500 VDC
- Operating Ambient Temp. Range -40℃ to +85℃
- Overload and Short Circuit Protection
- Remote On/Off Control
- Qualified for Lead-free Reflow Solder Process According to IPC/JEDEC J-STD-020D.1
- Tape & Reel Package Available
- UL/cUL/IEC/EN 60950-1 Safety Approval

UL 60950-1

PRODUCT OVERVIEW

The MINMAX MSKW2000 series is a range of isolated 5W DC-DC converter modules featuring fully regulated output voltages and wide 2:1 input voltage ranges.

These products are in a low profile SMD package with dimensions of 33.4 x 20.8 x 9.8 mm. All models are qualified for lead free reflow solder processes according IPC J-STD-020D.1. An excellent efficiency allows an operating temperature range of –40°C to +85°C (with derating).

Typical applications for these converters are battery operated equipment and instrumentation, 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	%
MSKW2021	12 (9 ~ 18)	3.3	1200	120	434	45	25	680	76
MSKW2022		5	1000	100	521				80
MSKW2023		12	417	41.7	502				83
MSKW2024		15	333	33.3	502				83
MSKW2025		±5	±500	±50	521			100#	80
MSKW2026		±12	±208	±20.8	501				83
MSKW2027		±15	±167	±16.7	503				83
MSKW2031	24 (18 ~ 36)	3.3	1200	120	212	15	15	680	78
MSKW2032		5	1000	100	254				82
MSKW2033		12	417	41.7	245				85
MSKW2034		15	333	33.3	245				85
MSKW2035		±5	±500	±50	254			100#	82
MSKW2036		±12	±208	±20.8	245				85
MSKW2037		±15	±167	±16.7	246				85
MSKW2041	48 (36 ~ 75)	3.3	1200	120	106	6	10	680	78
MSKW2042		5	1000	100	127				82
MSKW2043		12	417	41.7	123				85
MSKW2044		15	333	33.3	122				85
MSKW2045		±5	±500	±50	127			100#	82
MSKW2046		±12	±208	±20.8	122				85
MSKW2047		±15	±167	±16.7	123				85

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	7.5	8	9	
	24V Input Models	14	16	18	
	48V Input Models	30	33	36	
Under Voltage Shutdown	12V Input Models	6.5	7	8	
	24V Input Models	13	15	17	
	48V Input Models	28	31	34	
Short Circuit Input Power	All Models	---	1000	3000	mW
Internal Power Dissipation		---	---	2500	mW
Input Filter		Internal Pi Type			
Conducted EMI		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				
Control Input Current (on)	Vctrl = Min. to Max.	---	---	-200	μA
Control Input Current (off)	Vctrl = Min. to Max.	---	---	-300	μA
Control Common	Referenced to Negative Input				
Standby Input Current		---	---	10	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.	---	±0.1	±0.3	%
Load Regulation	Io=20% to 100%	---	±0.3	±1.0	%
Ripple & Noise	0-20 MHz Bandwidth	---	---	85	mV_{P-P}
Transient Recovery Time	25% Load Step Change	---	250	500	μsec
Transient Response Deviation		---	±2	±6	%
Temperature Coefficient		---	±0.01	±0.02	%/℃
Over Load Protection	Foldback	115	140	165	%
Short Circuit Protection	Continuous, Automatic Recovery				

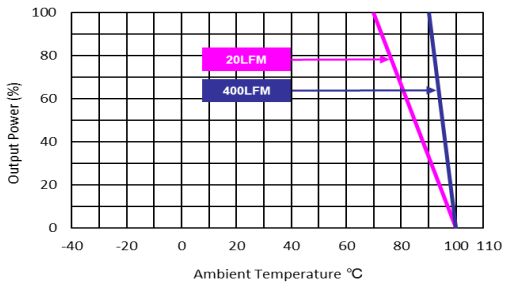
General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds	1500	---	---	VDC
	1 Seconds	1800	---	---	VDC
I/O Isolation Resistance	500 VDC	1000	---	---	MΩ
I/O Isolation Capacitance	100kHz, 1V	---	650	750	pF
Switching Frequency		200	260	350	kHz
MTBF (calculated)	MIL-HDBK-217F@25℃, Ground Benign	1,000,000			Hours
Moisture Sensitivity Level (MSL)	IPC/JEDEC J-STD-020D.1	Level 2			
Safety Approvals	UL/cUL 60950-1 recognition(CSA certificate)				

Environmental Specifications

Parameter	Conditions	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)		-40	+85	℃
Case Temperature		---	+100	℃
Storage Temperature Range		-50	+125	℃
Humidity (non condensing)		---	95	% rel. H
Lead-free Reflow Solder Process	IPC/JEDEC J-STD-020D.1			

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 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.

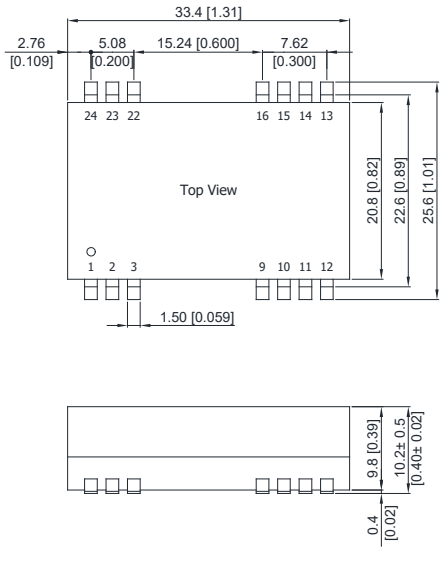
5 Other input and output voltage may be available, please contact MINMAX.

6 Specifications are subject to change without notice.

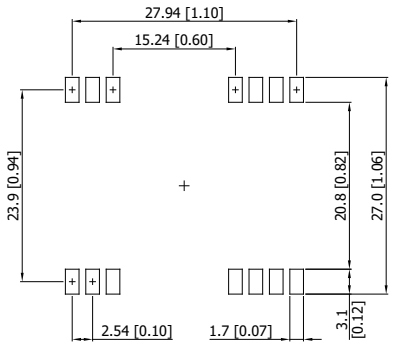
7 The repeated high voltage isolation testing of the converter can degrade isolation capability, to a lesser or greater degree depending on materials, construction, environment and reflow solder process. Any material is susceptible to eventual chemical degradation when subject to very high applied voltages 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



Connecting Pin Patterns



- All dimensions in mm (inches)
- Tolerance: X.X±0.25 (X.XX±0.01)
  X.XX±0.13 (X.XXX±0.005)
- Pins ±0.05 (±0.002)

Pin Connections

Pin	Single Output	Dual Output
1	Remote On/Off	Remote On/Off
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Common
10	NC	NC
11	NC	-Vout
12	NC	NC
13	NC	NC
14	+Vout	+Vout
15	NC	NC
16	-Vout	Common
22	+Vin	+Vin
23	+Vin	+Vin
24	NC	NC

NC : No Connection

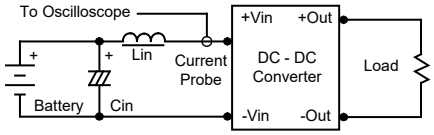
Physical Characteristics

Case Size	:	33.4x20.8x10.2mm (1.31x0.82x0.4 inches)
Case Material	:	Plastic resin (flammability to UL 94V-0 rated)
Pin Material	:	Phosphor Bronze
Weight	:	14g

Test Setup

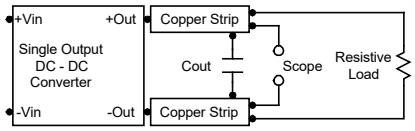
Input Reflected-Ripple Current Test Setup

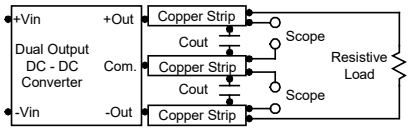
Input reflected-ripple current is measured with a inductor Lin (4.7μH) and Cin (220μF, ESR < 1.0Ω at 100 kHz) to simulate source impedance.
Capacitor Cin, offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is 0-500 kHz.



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

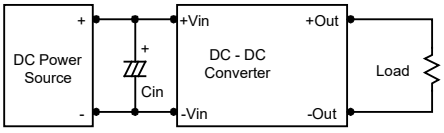
Positive logic remote on/off turns the module on during a logic high voltage on the remote on/off pin, and off during a logic low. To turn the power module on and off, the user must supply a switch to control the voltage between the on/off terminal and the -Vin terminal. The switch can be an open collector or equivalent.
A logic low is -0.7V to 0.8V. A logic high is 2.5V to 5.5V.
The maximum sink current of the switch at on/off terminal during a logic low is 300μA. The maximum sink current of the switch at on/off terminal = 2.5 to 5.5V is 200μA or open.

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.

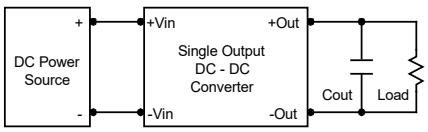
Input Source Impedance

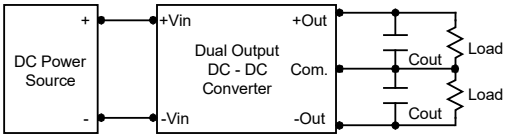
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module.
In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.
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 3.3μF for the 12V input devices and a 2.2μF 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 3.3μF capacitors at the output.





Maximum Capacitive Load

The MSKW2000 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 100μF maximum capacitive load for dual outputs and 680μF 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.