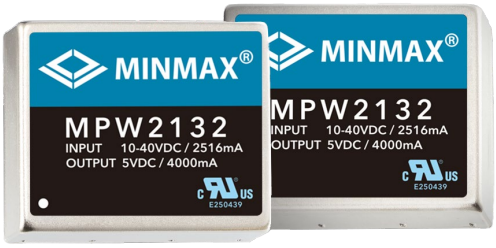
FEATURES

- ▶ **Efficiency up to 87%**
- ▶ **1500VDC Isolation**
- ▶ **MTBF > 1,000,000 Hours**
- ▶ **Six-Sided Shielding**
- ▶ **Remote On/Off Control**
- ▶ **Over Voltage Protection**
- ▶ **Output Trim**
- ▶ **Low Profile: 0.37"(9.3mm)**
- ▶ **Soft Start**
- ▶ **UL60950-1 Safety Approval**
- ▶ **3 Years Product Warranty**



UL 60950-1 CB Scheme

3 YEAR WARRANTY RoHS Compliant

PRODUCT OVERVIEW

Minmax's MPW2100-Series power modules are low-profile dc-dc converters that operate over input voltage ranges of 10-40VDC and 18-75VDC which provide precisely regulated output voltages of 3.3V, 5V, 12V, 15V, ±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 20W of power into a 2x1.6x0.37inch package, with efficiencies as high as 87%, the MPW2100 includes continuous short circuit protection, overvoltage protection, output trim function, remote on/off and six-sided shielded cas. and EN 55032 Class A conducted noise compliance minimize design-in time, cost and eliminate the need for external filtering.

Model Selection Guide

Model Number	Input Voltage (Range)	Output Voltage	Output Current		Input Current		Reflected Ripple Current	Over Voltage Protection	Max. capacitive Load	Efficiency (typ.)
			Max.	Min.	@Max. Load	@No Load				@Max. Load
	VDC	VDC	mA	mA	mA(typ.)	mA(typ.)	mA (typ.)	VDC	μF	%
MPW2131	24 (10 ~ 40)	3.3	4000	240	688	20	50	3.9	5000	80
MPW2132		5	4000	240	1004			6.8	5000	83
MPW2133		12	1670	100	960			15	500	87
MPW2134		15	1340	80	962			18	500	87
MPW2136		±12	±835	±50	960			±15	330#	87
MPW2137		±15	±670	±40	962			±18	330#	87
MPW2141	48 (18 ~ 75)	3.3	4000	240	344	10	25	3.9	5000	80
MPW2142		5	4000	240	502			6.8	5000	83
MPW2143		12	1670	100	480			15	500	87
MPW2144		15	1340	80	481			18	500	87
MPW2146		±12	±835	±50	480			±15	330#	87
MPW2147		±15	±670	±40	481			±18	330#	87

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	9.4	9.7	10	
	48V Input Models	17	17.5	18	
Under Voltage Shutdown	24V Input Models	9	9.3	9.5	
	48V Input Models	16	16.5	17	
Short Circuit Input Power	All Models	---	---	4500	mW
Internal Power Dissipation		---	---	4500	mW
Conducted EMI		Compliance to EN 55022, class A			

Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy	At 50% Load and Nominal Vin	---	---	±1.0	%Vom.
Output Voltage Balance	Dual Output, Balanced Loads	---	±0.5	±2.0	%
Line Regulation	Vin=Min. to Max.	---	±0.2	±0.5	%
Load Regulation	Io=50% to 100%	---	±0.3	±1.0	%
Ripple & Noise (20MHz)		---	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	%/℃
Over Load Protection		120	---	220	%
Output Short Circuit	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	360	kHz
MTBF (calculated)	MIL-HDBK-217F@25℃, Ground Benign	1,000,000	---	---	Hours
Safety Approvals	UL/cUL 60950-1 recognition(UL certificate), IEC/EN 60950-1(CB-scheme)				

Input Fuse

24V Input Models	48V Input Models
5000mA Slow-Blow Type	3000mA Slow-Blow Type

Remote On/Off Control

Parameter	Conditions	Min.	Typ.	Max.	Unit
Converter On	2.5V ~ 50V or Open Circuit				
Converter Off	-1V ~ 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

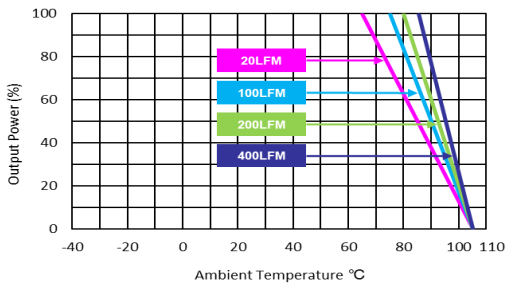
Output Voltage Trim

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

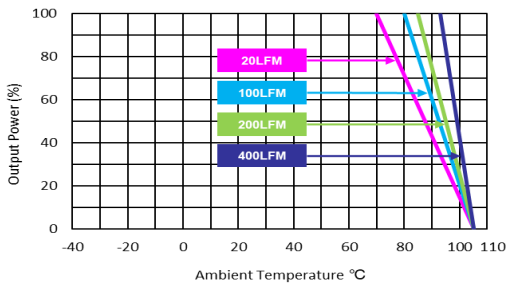
Environmental Specifications

Parameter	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-40	+85	℃
Case Temperature Range	---	+105	℃
Storage Temperature Range	-50	+125	℃
Humidity (non condensing)	---	95	% rel. H
Cooling	Free-Air convection		
RFI	Six-Sided Shielded, Metal Case		
Lead Temperature (1.5mm from case for 10Sec.)	---	260	℃

Power Derating Curve



Derating Curve without Heatsink



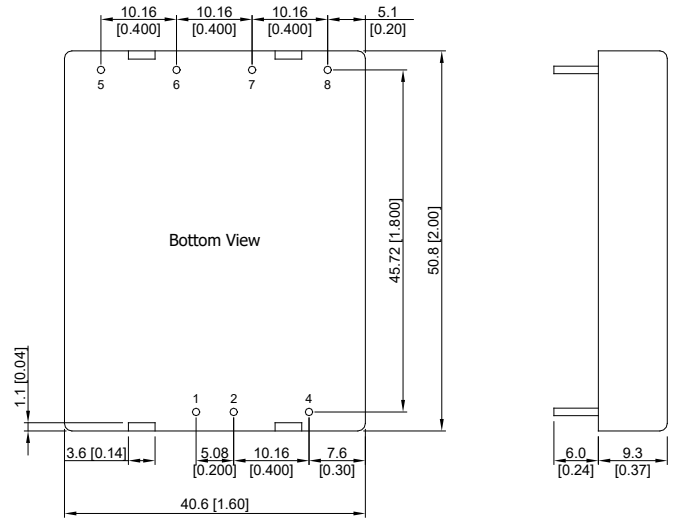
Derating Curve with Heatsink

Notes

1 Specifications typical at Ta=+25℃, resistive load, nominal input voltage, 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 MINMAX.
8 To order the converter with heatsink, please add a **suffix H**. (e.g. MPW2131H).
9 Specifications are subject to change without notice.
10 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

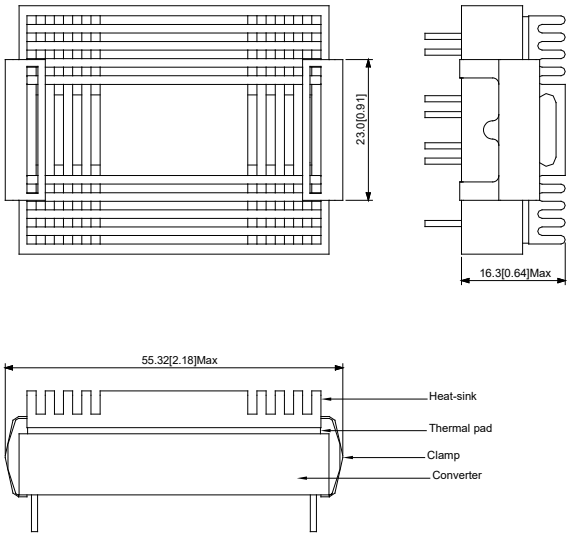
Pin	Single Output	Dual Output	Diameter mm (inches)
1	+Vin	+Vin	Ø 1.0 [0.04]
2	-Vin	-Vin	Ø 1.0 [0.04]
4	Remote On/Off	Remote On/Off	Ø 1.0 [0.04]
5	No Pin	+Vout	Ø 1.0 [0.04]
6	+Vout	Common	Ø 1.0 [0.04]
7	-Vout	-Vout	Ø 1.0 [0.04]
8	Trim	Trim	Ø 1.0 [0.04]

- All dimensions in mm (inches)
- Tolerance: X.X±0.5 (X.XX±0.01)
  X.XX±0.25 (X.XXX±0.005)
- Pin diameter tolerance: X.X±0.05 (X.XX±0.002)

Physical Characteristics

Case Size	:	50.8x40.6x9.3mm (2.0x1.6x0.37 inches)
Case Material	:	Metal With Non-Conductive Baseplate
Base Material	:	FR4 PCB (flammability to UL 94V-0 rated)
Pin Material	:	Copper Alloy
Weight	:	48g

Heatsink (Option H)



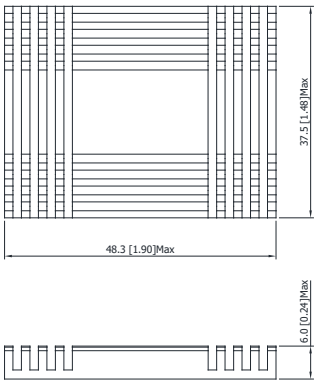
Physical Characteristics

Heatsink Material	:	Aluminum
Finish	:	Black Anodized Coating
Weight	:	15g

- 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.

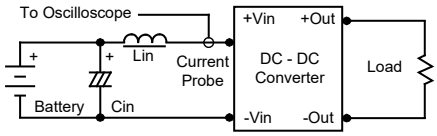
Order Code Table	
Standard	With heatsink
MPW2131	MPW2131H
MPW2132	MPW2132H
MPW2133	MPW2133H
MPW2134	MPW2134H
MPW2136	MPW2136H
MPW2137	MPW2137H
MPW2141	MPW2141H
MPW2142	MPW2142H
MPW2143	MPW2143H
MPW2144	MPW2144H
MPW2146	MPW2146H
MPW2147	MPW2147H

Order Code For Heatsink kit (including: Heatsink x1, Clamp x 2, Thermal Pad x1)
HS-P001


Test Setup

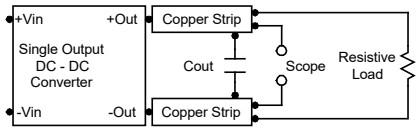
Input Reflected-Ripple Current Test Setup

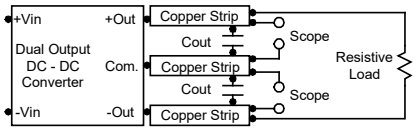
Input reflected-ripple current is measured with a inductor Lin (4.7μH) and Cin (220μF, ESR < 1.0Ω at 100 kHz) to simulate source impedance. Capacitor Cin, offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is 0-500 kHz.



Peak-to-Peak Output Noise Measurement Test

Use a 1μF ceramic capacitor and a 10μF tantalum 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

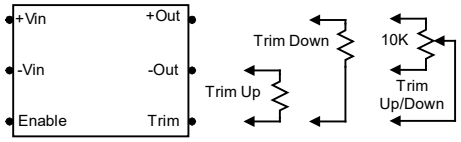
Positive logic remote on/off turns the module on during a logic high voltage on the remote on/off pin, and off during a logic low. To turn the power module on and off, the user must supply a switch to control the voltage between the on/off terminal and the -Vin terminal.

The switch can be an open collector or equivalent. A logic low is -1V to 1.0V. A logic high is 2.5V to 100V.

The maximum sink current at the on/off terminal (Pin 4) during a logic low is -100 μA. The maximum allowable leakage current of a switch connected to the on/off terminal (Pin 4) at logic hight (2.5V to 100V) is 5μA.

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:

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

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

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

Vout: Nominal Output Voltage

Vadj: Adjusted Output Voltage

Units: VDC/kΩ

Overcurrent Protection

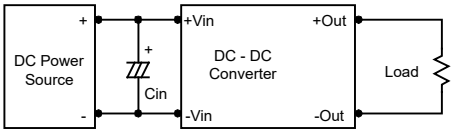
To provide protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure current limiting for an unlimited duration. At the point of current-limit inception, the unit shifts from voltage control to current control. The unit operates normally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

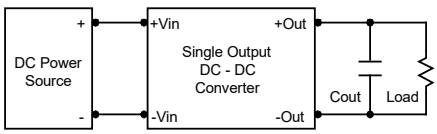
Input Source Impedance

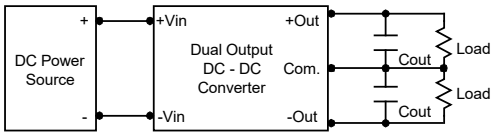
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup. 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 33μF for the 24V input devices and a 10μF for the 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 MPW2100 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 330μF maximum capacitive load for dual outputs, 500μF capacitive load for 12V & 15V outputs and 5000μF 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.