FEATURES

- ▶ **Industrial Standard DIP-24 Package**
- ▶ **Wide 2:1 Input Voltage Range**
- ▶ **Fully Regulated Output Voltage**
- ▶ **Ultra-high I/O Isolation 9000VDC with Reinforced Insulation, rate for 1000Vrms Working Voltage**
- ▶ **Common Mode Transient Immunity: 15kV/μS**
- ▶ **Qualified for IGBT and High Isolation Applications**
- ▶ **Operating Ambient Temp. Range -40℃ to +95℃**
- ▶ **No Min. Load Requirement**
- ▶ **Under-Voltage, Overload/Voltage and Short Circuit Protection**
- ▶ **Conducted EMI EN 55032 Class A & FCC Level A Approved**
- ▶ **UL/cUL/IEC/EN 62368-1 (60950-1) Safety Approval & CE Marking**

PRODUCT OVERVIEW

The MINMAX MIE06-HI series is a new range of high performance 6W DC-DC converter within encapsulated DIP-24 package which specifically design for high isolation applications where reinforced insulation and high working voltage are required. There are 18 models available for input voltage of 12, 24, 48VDC with wide 2:1 input range and tight output voltage. The I/O isolation is specified for 9000VDC with reinforced insulation, which rated for 1000Vrms working voltage. Further features include overload, short circuit protection, no min. load requirement, EMI conduction EN 55032 Class A approved, low I/O capacitance 40pF max. and operating ambient temp. range by -40°C to 95°C by high efficiency up to 89%. MIE06-HI series conform to common mode transient immunity testing by 15kV/μS and UL/cUL/IEC/EN 62368-1 (60950-1) safety approvals.

The MIE06-HI series offer a superior solution for demanding application in requesting a certified supplementary and high I/O isolation with reinforced insulation system to comply with 1000Vrms working voltage.

Model Selection Guide

Model Number	Input Voltage (Range)	Output Voltage	Output Current	Input Current		Over Voltage Protection	Max. capacitive Load	Efficiency (typ.)
			Max.	@Max. Load	@No Load			@Max. Load
	VDC	VDC	mA	mA(typ.)	mA(typ.)	VDC	μF	%
MIE06-12S05HI	12 (9 ~ 18)	5	1200	602	10	6.2	1500	83
MIE06-12S12HI		12	500	581		15	260	86
MIE06-12S15HI		15	400	581		18	210	86
MIE06-12S24HI		24	250	581		30	75	86
MIE06-12D12HI		±12	±250	575		±15	150#	87
MIE06-12D15HI		±15	±200	575		±18	110#	87
MIE06-24S05HI	24 (18 ~ 36)	5	1200	301	8	6.2	1500	83
MIE06-24S12HI		12	500	291		15	260	86
MIE06-24S15HI		15	400	287		18	210	87
MIE06-24S24HI		24	250	294		30	75	85
MIE06-24D12HI		±12	±250	291		±15	150#	86
MIE06-24D15HI		±15	±200	287		±18	110#	87
MIE06-48S05HI	48 (36 ~75)	5	1200	151	5	6.2	1500	83
MIE06-48S12HI		12	500	145		15	260	86
MIE06-48S15HI		15	400	140		18	210	89
MIE06-48S24HI		24	250	145		30	75	86
MIE06-48D12HI		±12	±250	144		±15	150#	87
MIE06-48D15HI		±15	±200	142		±18	110#	88

For each output

Input Specifications

Parameter	Conditions / 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	---	---	9	
	24V Input Models	---	---	18	
	48V Input Models	---	---	36	
Under Voltage Shutdown	12V Input Models	---	8	---	
	24V Input Models	---	16	---	
	48V Input Models	---	34	---	
Start Up Time (Power On)	Nominal Vin and Constant Resistive Load	---	---	30	ms
Input Filter	All Models	Internal Pi Type			

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		---	---	±0.5	%
Load Regulation	Io=0% to 100%	Single Output	---	---	±0.5	%
		Dual Output	---	---	±1.0	%
Load Cross Regulation (Dual Output)	Asymmetrical Load 25%/100% Full Load		---	---	±5.0	%
Minimum Load	No minimum Load Requirement					
Ripple & Noise	0-20 MHz Bandwidth	Measured with a 1μF/25V MLCC	---	---	70	mV_{P-P}
Transient Recovery Time	25% Load Step Change		---	300	---	μsec
Transient Response Deviation			---	±3	±5	%
Temperature Coefficient			---	±0.01	---	%/°C
Over Load Protection			---	150	---	%
Short Circuit Protection	Continuous, Automatic Recovery (Hiccup Mode 0.5Hz typ.)					

Isolation, Safety Standards

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds Reinforced insulation, rated for 1000Vrms working voltage	5000	---	---	VACrms
	Tested for 1 second	9000	---	---	VDC
I/O Isolation Resistance	500 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100kHz, 1V	---	---	40	pF
Common Mode Transient Immunity		15	---	---	kV/μs
Safety Approvals	UL/cUL 60950-1 recognition (UL certificate), IEC/EN 60950-1 (CB-report)				
	UL/cUL 62368-1 recognition (UL certificate), IEC/EN 62368-1 (CB-report)				

General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Switching Frequency		---	330	---	kHz
MTBF(calculated)	MIL-HDBK-217F@25°C, Ground Benign	4,612,491	---	---	Hours

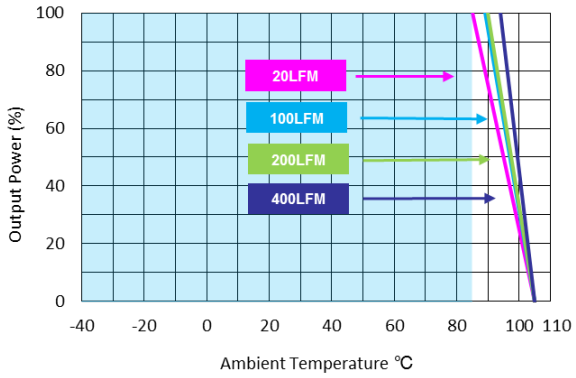
Environmental Specifications

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

EMC Specifications

Parameter	Standards & Level			Performance
EMI	Conduction	EN 55032, FCC part 15		Class A
EMS	EN 55024			
	ESD	Direct discharge	Indirect discharge HCP & VCP	
		EN 61000-4-2 Air ± 15kV	Contact ± 8kV	A
	Radiated immunity	EN 61000-4-3 10V/m		A
	Fast transient (5)	EN 61000-4-4 ±2kV		A
	Surge (5)	EN 61000-4-5 ±2kV		A
	Conducted immunity	EN 61000-4-6 10Vrms		A
	PFMF	EN 61000-4-8 100A/m		A

Power Derating Curve

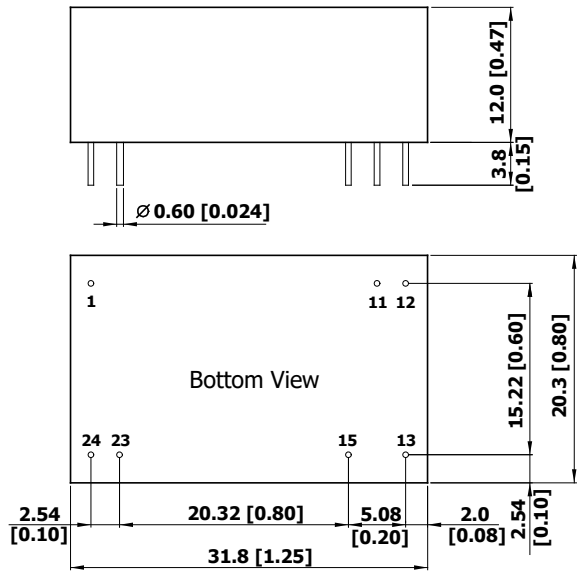


Notes

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. We recommend to protect the converter by a slow blow fuse in the input supply line.
4. Other input and output voltage may be available, please contact factory.
5. To meet EN 61000-4-4 & EN 61000-4-5 an external filter requested, please contact MINMAX.
6. Specifications are subject to change without notice.

Package Specifications

Mechanical Dimensions



Pin Connections

Pin	Single Output	Dual Output
1	+Vin	+Vin
11	No Pin	Common
12	-Vout	No Pin
13	+Vout	-Vout
15	No Pin	+Vout
23	-Vin	-Vin
24	-Vin	-Vin

- All dimensions in mm (inches)
- Tolerance: X.X±0.5 (X.XX±0.02)
  X.XX±0.25 (X.XXX±0.01)
- Pin diameter ⌀ 0.5 ±0.05 (0.02±0.002)

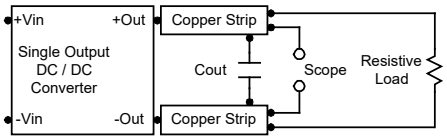
Physical Characteristics

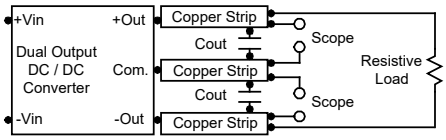
Case Size	:	31.8x20.3x12.0mm (1.25x0.80x0.47 inches)
Case Material	:	Non-Conductive Black Plastic (flammability to UL 94V-0 rated)
Pin Material	:	Tinned Copper
Weight	:	15.5g

Test Setup

Peak-to-Peak Output Noise Measurement Test

Refer to the output specifications or add 4.7μF capacitor if the output specifications undefine Cout. 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

Overload Protection

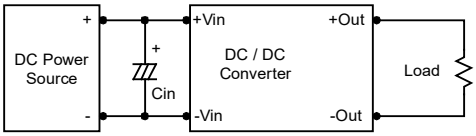
To provide hiccup mode protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure overload for an unlimited duration.

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.

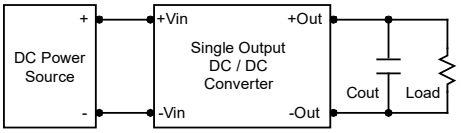
Input Source Impedance

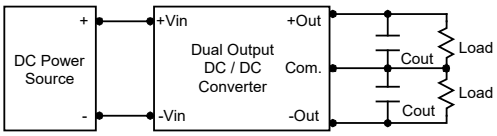
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor on the input to insure startup. By using a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 kHz) capacitor of a 10μF for the 12V input devices and a 4.7μF for the 24V input devices and a 2.2μF for the 48V devices, capacitor mounted close to the power module helps ensure stability of the unit.



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 1μF capacitors at the output.





Maximum Capacitive Load

The MIE06-HI series has limitation of maximum connected capacitance on the output. The power module may operate in current limiting mode during start-up, affecting the ramp-up and the startup time. Connect capacitors at the point of load for best performance. 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°C. The derating curves are determined from measurements obtained in a test setup.