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°C to +97°C**
- ▶ **No Min. Load Requirement**
- ▶ **Overload/Voltage and Short Circuit Protection**
- ▶ **Designed-in Conducted EMI meets EN 55032 Class A & FCC Level A**
- ▶ **UL/cUL/IEC/EN 62368-1 (60950-1) Safety Approval & CE Marking**

NEW

UL 62368-1
UL 60950-1
CB Scheme
CONFLICT FREE Minerals Policy
REACH COMPLIANT
3 YEAR WARRANTY
RoHS Compliant

PRODUCT OVERVIEW

The MINMAX MIE03-HI series is a new range of high performance 3.5W 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 21 models available for input voltage of 5, 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 meets EN 55032 Class A, low I/O capacitance 40pF max. and operating ambient temp. range by -40°C to 97°C by high efficiency up to 87%. MIE03-HI series conform to common mode transient immunity testing by 15KV/μS and UL/cUL/IEC/EN 62368-1 (60950-1) safety approvals.
The MIE03-HI series offer a economical 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	%
MIE03-05S05HI	5 (4.5 ~ 9)	5	700	854	20	6.2	750	82
MIE03-05S058HI		5.8	600	849		6.2	560	82
MIE03-05S12HI		12	290	839		15	130	83
MIE03-05S15HI		15	235	839		18	100	84
MIE03-05D12HI		±12	±145	829	35	±15	75#	84
MIE03-05D15HI		±15	±115	821		±18	56#	84
MIE03-12S05HI	12 (9 ~ 18)	5	700	356	8	6.2	750	82
MIE03-12S12HI		12	290	337		15	130	86
MIE03-12S15HI		15	235	338		18	100	87
MIE03-12D12HI		±12	±145	333	13	±15	75#	87
MIE03-12D15HI		±15	±115	330		±18	56#	87
MIE03-24S05HI	24 (18 ~ 36)	5	700	178	6	6.2	750	82
MIE03-24S12HI		12	290	171		15	130	85
MIE03-24S15HI		15	235	169		18	100	87
MIE03-24D12HI		±12	±145	167		±15	75#	87
MIE03-24D15HI		±15	±115	167		±18	56#	86
MIE03-48S05HI	48 (36 ~75)	5	700	89	4	6.2	750	82
MIE03-48S12HI		12	290	85		15	130	85
MIE03-48S15HI		15	235	86		18	100	85
MIE03-48D12HI		±12	±145	86		±15	75#	84
MIE03-48D15HI		±15	±115	86		±18	56#	84

For each output

Input Specifications

Parameter	Conditions / Model	Min.	Typ.	Max.	Unit
Input Surge Voltage (1 sec. max.)	5V Input Models	-0.7	---	15	VDC
	12V Input Models	-0.7	---	25	
	24V Input Models	-0.7	---	50	
	48V Input Models	-0.7	---	100	
Start-Up Threshold Voltage	5V Input Models	---	---	4.5	
	12V Input Models	---	---	9	
	24V Input Models	---	---	18	
	48V Input Models	---	---	36	
Under Voltage Shutdown	5V Input Models	---	4	---	
	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%		---	---	±0.5	%
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	---	%/℃
Over Load Protection			---	150	---	%
Short Circuit Protection	Hiccup Mode 0.5Hz typ., Automatic Recovery					

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℃, Ground Benign	5,815,448	---	---	Hours

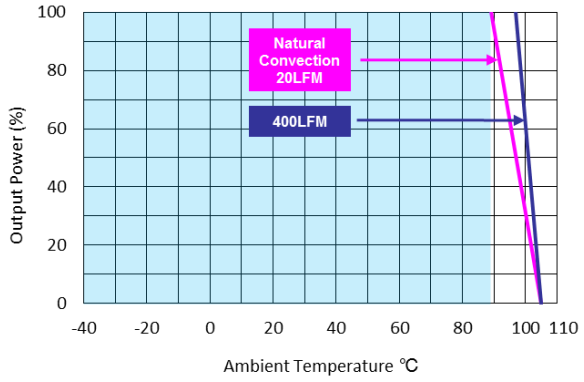
Environmental Specifications

Parameter	Conditions	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	Natural Convection	-40	+97	℃
Case Temperature		---	+105	℃
Storage Temperature Range		-50	+125	℃
Humidity (non condensing)		---	95	% rel. H
Cooling	Natural Convection			
Lead Temperature (1.5mm from case for 10Sec.)		---	260	℃

EMC Specifications

Parameter	Standards & Level		Performance
EMI	Conduction	EN 55032, FCC part 15	Class A
EMS	EN 55024		
	ESD	EN 61000-4-2 Air ± 8kV , Contact ± 6kV	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 3A/m	A

Power Derating Curve

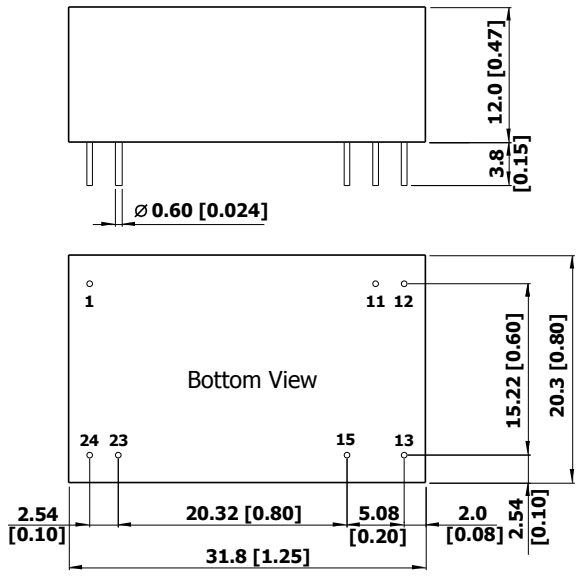


Notes

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 EN61000-4-4 & EN 61000-4-5 an external capacitor across the input pins is required.
Suggested capacitor: 05XXX: CHEMI-CON KY Series 1000μF/100V // Diode (V10P45)
12XXX: CHEMI-CON KY Series 470μF/100V
24XXX: CHEMI-CON KY Series 330μF/100V
48XXX: CHEMI-CON KY Series 220μF/100V
6 That "natural convection" is about 20LFM but is not equal to still air (0 LFM).
7 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)

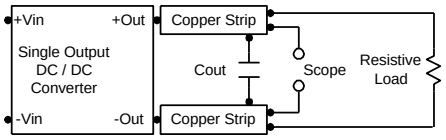
Physical Characteristics

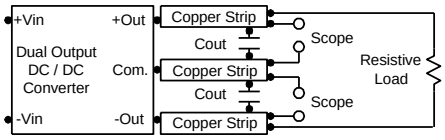
Case Size	:	31.8x20.3x12.0mm (1.25x0.80x0.47 inches)
Case Material	:	Non-Conductive Black Plastic (flammability to UL 94V-0 rated)
Pin Material	:	Tinned Copper
Weight	:	15.5g

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

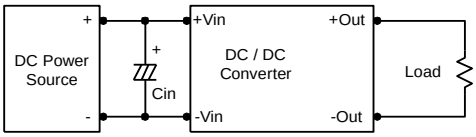
To provide hiccup mode protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure overload for an unlimited duration.

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.

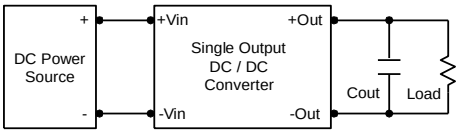
Input Source Impedance

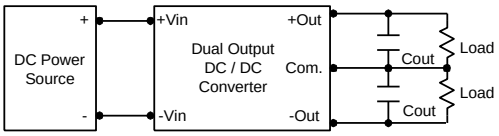
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor on the input to insure startup. By using a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 kHz) capacitor of a 22μF for the 5V input devices and 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 4.7μF capacitors at the output.





Maximum Capacitive Load

The MIE03-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℃. The derating curves are determined from measurements obtained in a test setup.