FEATURES

- **Industrial Standard 2"×1" Package**
- **Wide 2:1 Input Voltage Range**
- **Fully Regulated Output Voltage**
- **Ultra-high I/O Isolation 8000VDC 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 +75℃**
- **No Min. Load Requirement**
- **Overload and Short Circuit Protection**
- **EMI Emission EN55032 Class A & FCC Level A Approved**
- **UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval & CE Marking**

UL 62368-1
UL 60950-1
CB Scheme

PRODUCT OVERVIEW

The MINMAX MKE10-HI series is a range of isolated 10W DC-DC converter modules in 2"×1" package which feature a wide input range, fully regulated output and Ultra-high I/O Isolation voltage rated for 8000VDC with reinforced insulation. A very high common mode transient immunity with 15kV/μs qualifies these product for IGBT driver applications. Further features include overload protection, short circuit protection and no min. load requirement as well as EN 55032 class A compliant. There are 15 Models available for 12, 24 and 48VDC input. These converters offer a cost-effective solution for wind turbine, solar panel, transporation systems, industrial control equipments and some IGBT driver applications where a very high I/O-isolation is required.

Model Selection Guide

Model Number	Input Voltage (Range)	Output Voltage	Output Current	Input Current		Reflected Ripple Current	Max. capacitive Load	Efficiency (typ.)
			Max.	@Max. Load	@No Load			@Max. Load
	VDC	VDC	mA	mA(typ.)	mA (typ.)	mA(typ.)	μF	%
MKE10-12S05HI	12 (9 ~ 18)	5	1600	889	30	100	1000	75
MKE10-12S051HI		5.1	1600	919				74
MKE10-12S12HI		12	835	1057			470	79
MKE10-12D12HI		±12	±417	1042			220#	80
MKE10-12D15HI		±15	±333	1028				81
MKE10-24S05HI	24 (18 ~ 36)	5	2000	548	20	50	1000	76
MKE10-24S051HI		5.1	2000	567				75
MKE10-24S12HI		12	835	522			470	80
MKE10-24D12HI		±12	±417	516			220#	81
MKE10-24D15HI		±15	±333	508				82
MKE10-48S05HI	48 (36 ~ 75)	5	2000	274	10	25	1000	76
MKE10-48S051HI		5.1	2000	283				75
MKE10-48S12HI		12	835	261			470	80
MKE10-48D12HI		±12	±417	258			220#	81
MKE10-48D15HI		±15	±333	254				82

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	8	9	
	24V Input Models	13	15	18	
	48V Input Models	30	33	36	
Under Voltage Shutdown	12V Input Models	---	---	8.5	
	24V Input Models	---	---	16	
	48V Input Models	---	---	34	
Short Circuit Input Power	All Models	---	---	3000	mW
Input Filter		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		---	±0.3	±0.5	%
Load Regulation	Io=15% to 100%		---	±0.5	±1.0	%
	Io=5% to 100%		---	±0.6	±1.2	%
Ripple & Noise	0-20 MHz Bandwidth	5V & 5.1V Output Models	---	---	100	mV_{P-P}
		Other Output Models	---	---	150	mV_{P-P}
Minimum Load	No minimum Load Requirement					
Over Load Protection			120	150	---	%
Transient Recovery Time	25% Load Step Change		---	300	600	µsec
Transient Response Deviation			---	±3	±5	%
Temperature Coefficient			---	±0.02	±0.05	%/°C
Short Circuit Protection	Continuous, Automatic Recovery					

Isolation, Safety Standards

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds Reinforced insulation, rated for 1000Vrms working voltage	4200	---	---	VACrms
	Tested for 1 second	8000	---	---	VDC
I/O Isolation Resistance	500 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100kHz, 1V	---	60	80	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		120	150	180	kHz
MTBF(calculated)	MIL-HDBK-217F@25°C, Ground Benign		1,000,000		Hours

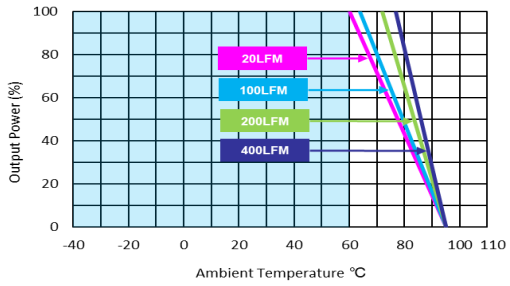
EMC Specifications

Parameter	Standards & Level			Performance
EMI	Conduction	EN 55032, FCC part 15	Without external components	Class A
	Radiation			
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 ±1kV		A
	Conducted immunity	EN 61000-4-6 10Vrms		A
	PFMF	EN 61000-4-8 100A/m		A

Environmental Specifications

Parameter	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-40	+75	℃
Case Temperature	---	+95	℃
Storage Temperature Range	-50	+125	℃
Humidity (non condensing)	---	95	% rel. H
Altitude	---	4000	m
Lead Temperature (1.5mm from case for 10Sec.)	---	260	℃

Power Derating Curve

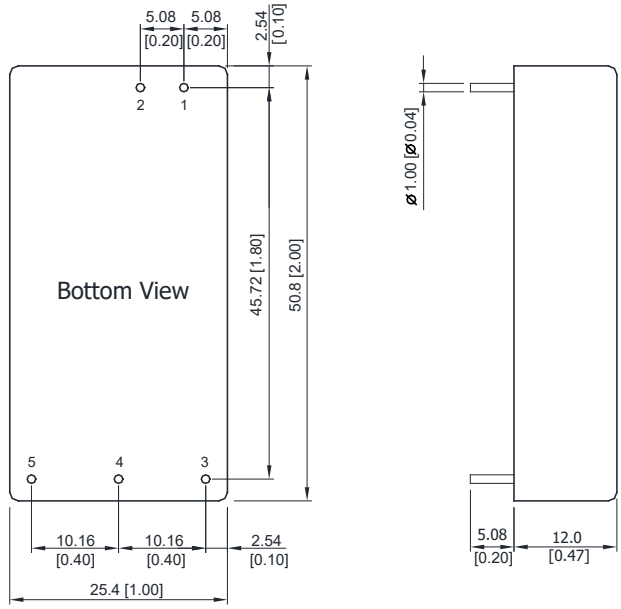


Notes

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
2	-Vin	-Vin
3	+Vout	+Vout
4	No Pin	Common
5	-Vout	-Vout

- All dimensions in mm (inches)
- Tolerance: X.X±0.5 (X.XX±0.02)
  X.XX±0.25 (X.XXX±0.01)
- Pin diameter ∅ 1.0 ±0.05 (0.04±0.002)

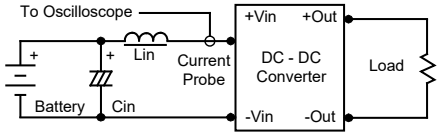
Physical Characteristics

Case Size	:	50.8x25.4x12.0mm (2.0x1.0x0.47 inches)
Case Material	:	Non-Conductive Black Plastic (flammability to UL 94V-0 rated)
Pin Material	:	Copper Alloy with Gold Plate Over Nickel Subplate
Weight	:	24.5g

Test Setup

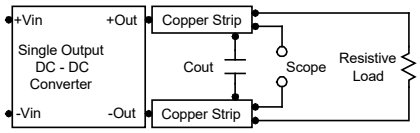
Input Reflected-Ripple Current Test Setup

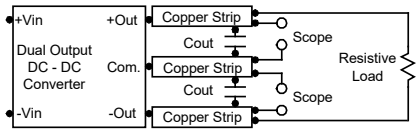
Input reflected-ripple current is measured with a inductor Lin (4.7μH) and Cin (220μF, ESR < 1.0Ω at 100 kHz) to simulate source impedance. Capacitor Cin, offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is 0-500 kHz.



Peak-to-Peak Output Noise Measurement Test

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.

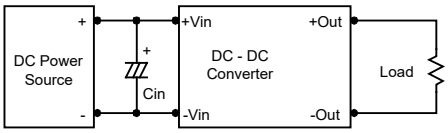




Technical Notes

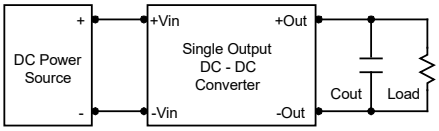
Input Source Impedance

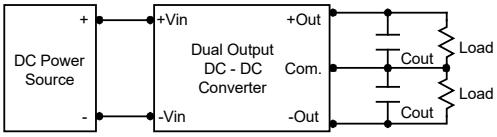
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor on the input to insure startup.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





Maximum Capacitive Load

The MKE10-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 95°C. The derating curves are determined from measurements obtained in a test setup.