

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°C to +75°C
- ▶ No Min. Load Requirement
- ▶ Overload and Short Circuit Protection
- ▶ Designed-in Conducted EMI meets EN 55032 Class A & FCC Level A
- ▶ UL/cUL/IEC/EN 60950-1 Safety Approval & CE Marking


PRODUCT OVERVIEW

The MINMAX MKE10-HI series is a new 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, transportation 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) VDC	Output Voltage VDC	Output Current Max. mA	Input Current		Reflected Ripple Current mA(typ.)	Max. capacitive Load μF	Efficiency (typ.) @Max. Load %
				@Max. Load mA(typ.)	@No Load mA (typ.)			
MKE10-12S05HI	12 (9 ~ 18)	5	1600	889	30	100	1000	75
MKE10-12S051HI		5.1	1600	919				74
MKE10-12S12HI		12	835	1057				79
MKE10-12D12HI		±12	±417	1042				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				80
MKE10-24D12HI		±12	±417	516				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				80
MKE10-48D12HI		±12	±417	258				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		---	---	3000	mW
Input Filter	All Models	Internal Pi Type			
Conducted EMI		Compliance to EN 55032, class A and FCC part 15, class A			

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

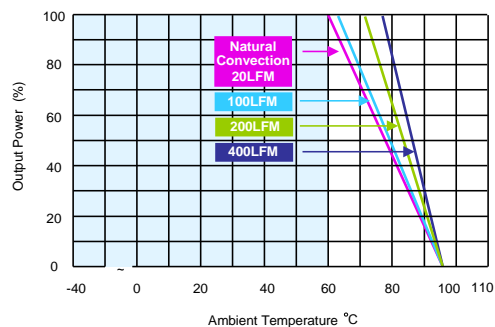
Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds	4200	---	---	VACrms
	Reinforced insulation, rated for 1000Vrms working voltage	---	---	---	---
	Tested for 1 second	8000	---	---	VDC
I/O Isolation Resistance	500 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100KHz, 1V	---	60	80	pF
Common Mode Transient Immunity		15	---	---	KV/μs
Safety Approvals	UL/cUL 60950-1 recognition(UL certificate), IEC/EN 60950-1(CB-report)				

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

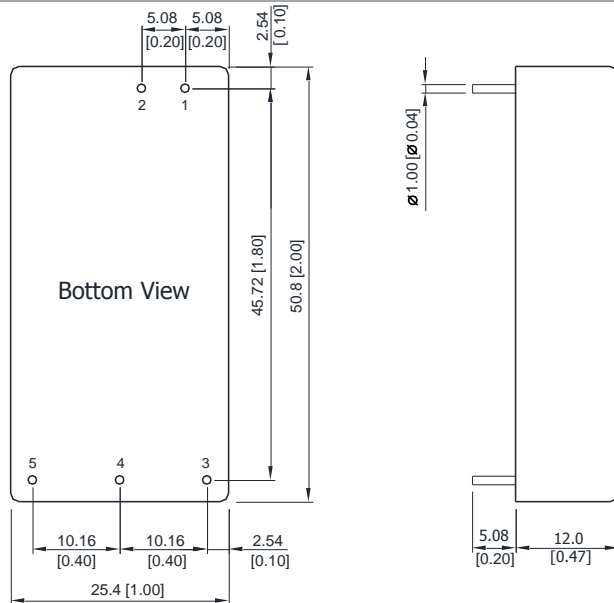
Environmental Specifications

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

Power Derating Curve


Notes

- 1 Specifications typical at Ta=+25°C, 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 That "natural convection" is about 20LFM but is not equal to still air (0 LFM).
- 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 $\varnothing 1.0 \pm 0.05$ (0.04±0.002)

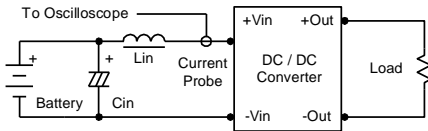
Physical Characteristics

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

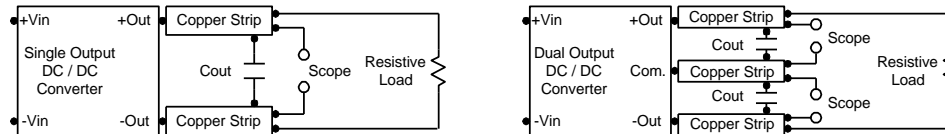
Input Reflected-Ripple Current Test Setup

Input reflected-ripple current is measured with an inductor L_{in} ($4.7\mu\text{H}$) and C_{in} ($220\mu\text{F}$, $\text{ESR} < 1.0\Omega$ at 100KHz) to simulate source impedance. Capacitor C_{in} offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is $0\text{-}500\text{KHz}$.



Peak-to-Peak Output Noise Measurement Test

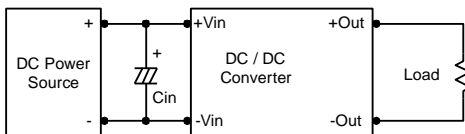
Refer to the output specifications or add $4.7\mu\text{F}$ capacitor if the output specifications undefine C_{out} . Scope measurement should be made by using a BNC socket, measurement bandwidth is $0\text{-}20\text{MHz}$. Position the load between 50mm and 75mm from the DC-DC Converter.



Technical Notes

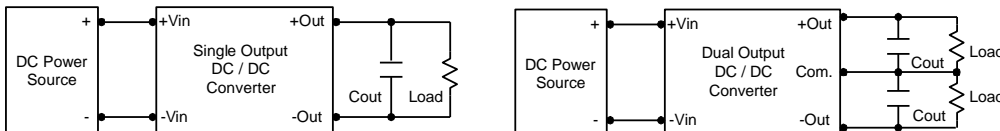
Input Source Impedance

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 ($\text{ESR} < 1.0\Omega$ at 100kHz) capacitor of a $10\mu\text{F}$ for the 12V input devices and a $4.7\mu\text{F}$ for the 24V input devices and a $2.2\mu\text{F}$ 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 $3.3\mu\text{F}$ 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.

