

FEATURES

- Cost-effective
- 2:1 standard input range: 9-18/18-36/36-75VDC
- Single & bipolar outputs: 3.3, 5, 12, 15, 24, ±5, ±12, ±15Volts DC
- 10W isolated outputs
- Efficiency up to 89%
- Fixed switching frequency
- 1600VDC I/O isolation
- Standard 1.25"×0.8"×0.4" footprint, Din-rail & wall mount type options
- Extensive self-protection, UVLO, OTP, OVP, OCP and short protection
- Operation temperature range: -40°C to +85°C
- Fully encapsulated, high reliability
- MTBF ≥ 3.5 MHrs
- Compliance with RoHS



PRODUCT OVERVIEW

The EKC10D12/24/48 series are highly reliable, and efficient isolated DC/DC converter. Standard input range of 9-18V (12V nominal)/18-36V (24V nominal)/36-75V (48V nominal) is ideal for automation, power grid, semiconductor equipment, instrumentation, test and measurement, and distribution power system.

A wealth of self-protection features included input under-voltage lockout, over temperature shutdown; overcurrent protection with "hiccup" autorestart technique, provides short-circuit protection, along with output OVP.

Advanced fully encapsulated package technology provides outstanding EMC and thermal performance, which is ideal for ruggedized applications involving harsh environments. Wall mount and Din-rail mount type are available for maximum design-in flexibility.

The EKC10D12/24/48 series are designed to safety standards IEC/EN 62368-1.

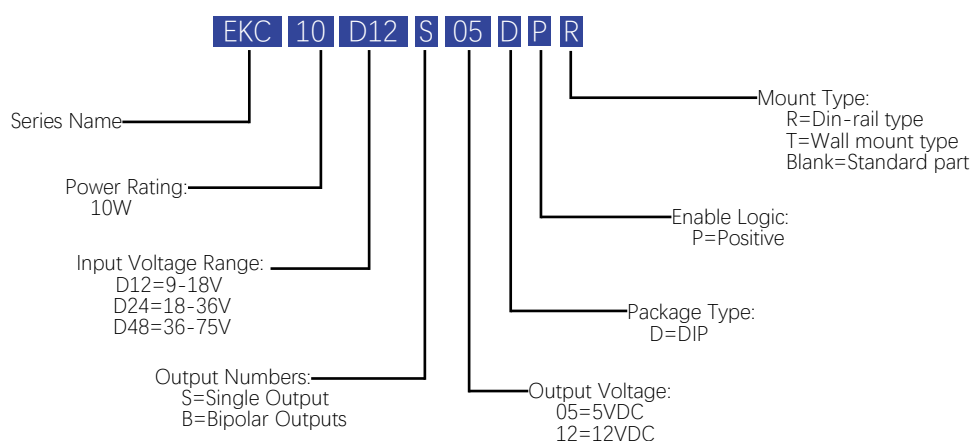
Models Selections

Basic Models	Input Voltage [VDC]	Input Voltage Range [VDC]	Output Voltage [VDC]	Output Current [A]	Efficiency Typ. [%]	Capacitive Load Max. [μF]	Package [inch]
EKC10D12S03	12	9-18	3.3	2.7	85	1200	1.25"×0.8"×0.4" DIP
EKC10D12S05	12	9-18	5	2	85	1000	
EKC10D12S12	12	9-18	12	0.833	85	470	
EKC10D12S15	12	9-18	15	0.666	85	330	
EKC10D12S24	12	9-18	24	0.416	86	100	
EKC10D12B05	12	9-18	±5	±1	81	±1000	
EKC10D12B12	12	9-18	±12	±0.416	85	±470	
EKC10D12B15	12	9-18	±15	±0.333	89	±330	

Models Selections

Basic Models	Input Voltage [VDC]	Input Voltage Range [VDC]	Output Voltage [VDC]	Output Current [A]	Efficiency Typ. [%]	Capacitive Load Max. [μF]	Package [inch]
EKC10D24S03	24	18-36	3.3	2.7	85	1200	1.25"×0.8"×0.4" DIP
EKC10D24S05	24	18-36	5	2	86	1000	
EKC10D24S12	24	18-36	12	0.833	85	470	
EKC10D24S15	24	18-36	15	0.666	85	330	
EKC10D24S24	24	18-36	24	0.416	86	100	
EKC10D24B05	24	18-36	±5	±1	81	±1000	
EKC10D24B12	24	18-36	±12	±0.416	85	±470	
EKC10D24B15	24	18-36	±15	±0.333	85	±330	
EKC10D48S03	48	36-75	3.3	2.7	85	1200	
EKC10D48S05	48	36-75	5	2	86	1000	
EKC10D48S12	48	36-75	12	0.833	85	470	
EKC10D48S15	48	36-75	15	0.666	85	330	
EKC10D48S24	48	36-75	24	0.416	86	100	
EKC10D48B05	48	36-75	±5	±1	81	±1000	
EKC10D48B12	48	36-75	±12	±0.416	85	±470	
EKC10D48B15	48	36-75	±15	±0.333	85	±330	

Model Numbering



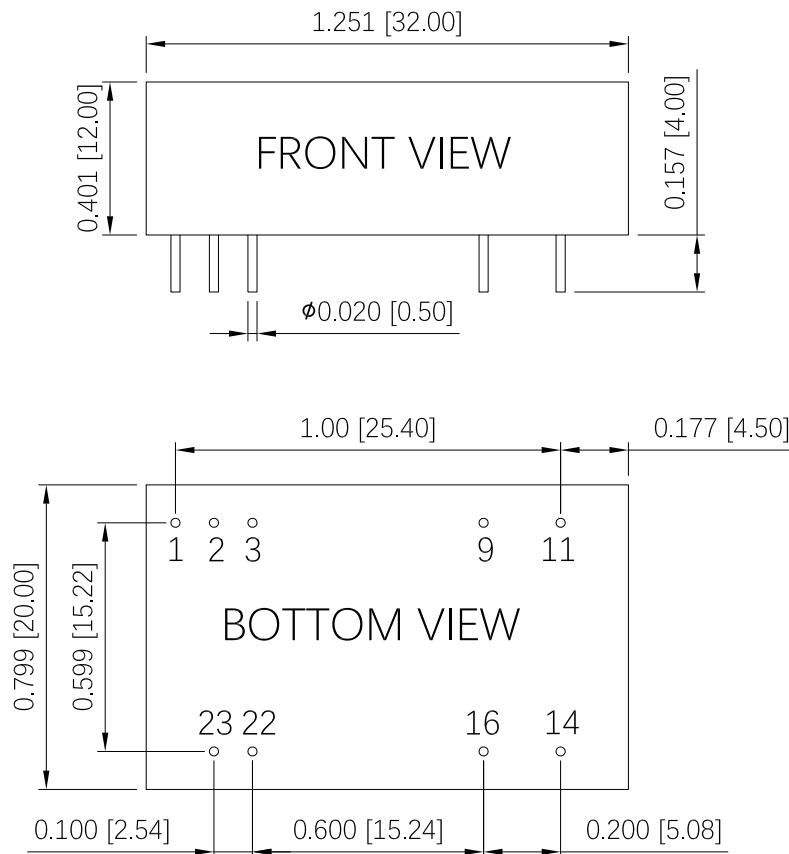
Absolute Maximum Ratings					
Parameters	Conditions	Min.	Typ.	Max.	Units
Input Voltage Continuous	12 Vin type	-0.7		20	VDC
	24 Vin type	-0.7		40	VDC
	48 Vin type	-0.7		80	VDC
Input Voltage Transient	<100ms, 12 Vin type			25	VDC
	<100ms, 24 Vin type			50	VDC
	<100ms, 48 Vin type			100	VDC
Operating Environment Temperature	>71°C with derating	-40		85	°C
Storage Temperature Range		-55		125	°C
Soldering Temperature	Wave soldering < 10s			260	°C
Cooling	Free air convection				
Input Specifications					
Parameters	Conditions	Min.	Typ.	Max.	Units
Operating Voltage Range	See "Models Selections".				
Start-up Threshold	12 Vin type			9	VDC
	24 Vin type			18	VDC
	48 Vin type			36	VDC
Under Voltage Shutdown	12 Vin type	5.5	6.5		VDC
	24 Vin type	12	15.5		VDC
	48 Vin type	25	30.5		VDC
Input Current @ No Load	12 Vin type		30		mA
	24 Vin type		25		mA
	48 Vin type		20		mA
Input Current @ Min. Line	12 Vin type		1.5		A
	24 Vin type		0.72		A
	48 Vin type		0.4		A
Reflected Ripple Current	12 Vin type		50		mA
	24 Vin type		41		mA
	48 Vin type		30		mA
Recommended Input Fuse	12 Vin type		3		A
	24 Vin type		2		A
	48 Vin type		1		A
Recommended External Input Capacitance	1μF CBB and 100μF E-cap used in combination		100		μF

General Specifications					
Parameters	Conditions	Min.	Typ.	Max.	Units
On/Off Remote Control	Positive Logic, On state	Open or $2.7 \leq V_r \leq 9$			
	Positive Logic, Off state	Short or $0 \leq V_r \leq 1.2$			
Isolation Voltage (1 minute, 1mA)	Input to output	1600			VDC
	Input to case	1000			VDC
	Output to case	1000			VDC
Isolation Resistance	Input to output, Viso=500VDC	1000			MΩ
Isolation Capacitance	Input to output		2000		pF
Switching Frequency			310		KHz
Start-up Delay	From undervoltage shutdown recovery to 10% Vout		30		mS
Rise Time	From 10% Vout to 90% Vout capacitive load		30		mS
Vibration	IEC 60068-2-64, Environmental testing - Part 2				
Shock (Operational)	IEC 60068-2-27, Environmental Testing- Part 2.27				
Safety and EMC Compliance					
Conducted Emission	EN55032	Class B (With external filter)			
Radiated Emission	EN55032	Class B (With external filter)			
Conducted Susceptibility	IEC6100-4-6	10Vrms Criteria A			
Radiated Susceptibility	IEC6100-4-3	10V/m Criteria A			
EFT	IEC6100-4-4	±2KV Criteria B (With external filter)			
Surge	IEC6100-4-5	±2KV Criteria B (With external filter)			
ESD	IEC6100-4-2	Contact: ±4KV Air: ±6KV Criteria B			
Isolation Safety Rating	Basic insulation				

Output Specifications					
Parameters	Conditions	Min.	Typ.	Max.	Units
Vout Accuracy	Positive output	-2		+2	%
	Negative output	-3		+3	%
Line Regulation (Min. line to max. line, Full load)	Positive output	-0.5		+0.5	%
	Negative output	-1		+1	%
Load Regulation (5%-100% load, Vin=nom.line)	Positive output	-1		+1	%
	Negative output	-1.5		+1.5	%
Temperature Coefficient	From -40°C to 85°C	-0.03		+0.03	% of Vout /°C
Over Current Protection	3.3V/5V outputs	110		230	%
	Other outputs	110		190	%
Over Voltage Protection		110		160	%
Output Short Protection	Hiccup, auto-recover				
Ripple & Noise Max. ①	3.3V/5V outputs		40	80	mV Pk-Pk
	Other outputs		40	100	mV Pk-Pk
Dynamic Load Peak Deviation ②	3.3V/5V outputs	-8		+8	% of Vout
	Other outputs	-5		+5	% of Vout
Dynamic Load Response	Within 1% band of Vout deviation		300	500	μS
Minimum Load	No minimum load required				
Notes					
① Ripple & noise is tested with certain filter parameters, please see output ripple & noise in technical notes on page 10 for more details.					
② Load is set from 50%-75%-50% of full load, di/dt=0.1A/μS.					

All specifications are tested at 25 °C ambient temperature, nominal input voltage, rated output current conditions unless otherwise specified.

Mechanical Specifications



PIN:

PIN1, PIN2, PIN3, PIN9, PIN11, PIN14, PIN16, PIN22,
PIN23: $\phi 0.020$ inch

Force: Applied force not exceed 4.9N

Material: Copper alloy

Finish: Tin over nickel

Tolerance:

X.XXX=±0.02 (0.5)

Dimensions are in inches [mm]

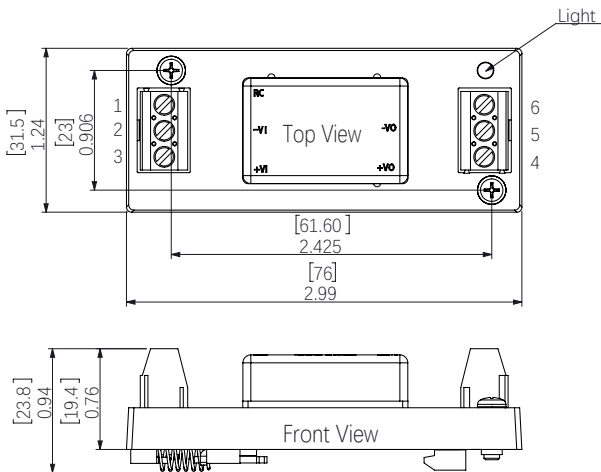
Weight: ~13g.

*Note: Pin marked with NC means the module is equipped with Pin, but the Pin has no electrical function and is not allowed to connect any circuit.

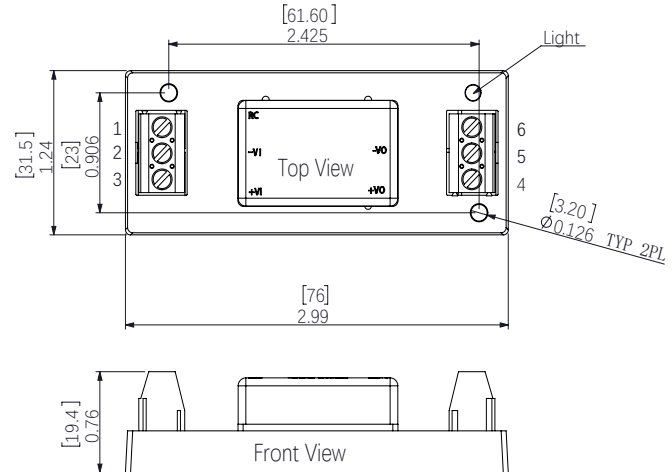
PIN CONNECTIONS			
Single Output		Bipolar Outputs	
Pin	Function	Pin	Function
1	RC	1	RC
2	-Vin	2	-Vin
3	-Vin	3	-Vin
9	No Pin	9	Common
11	NC*	11	-Vout
14	+Vout	14	+Vout
16	-Vout	16	Common
22	+Vin	22	+Vin
23	+Vin	23	+Vin

Mechanical Specifications

EKC10D12/24/48 SERIES: DIN-RAIL TYPE



EKC10D12/24/48 SERIES: WALL MOUNT TYPE



Hole screw locked torque: 0.4N·m Max
Terminal screw locked torque: 0.25N·m Max

Tolerance:
X.XXX=±0.02 (0.5)

Dimensions are in inches [mm]

Weight:

Din-rail type: ~58g

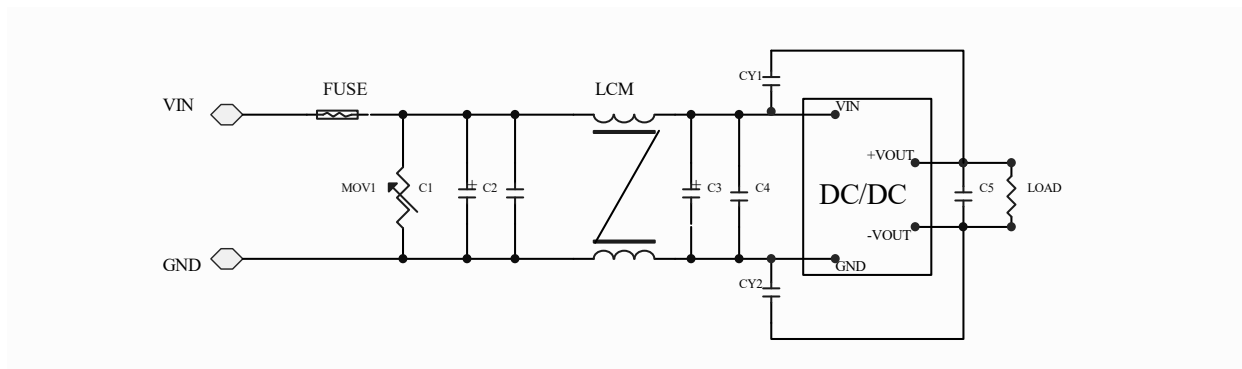
Wall mount type: ~38g

PIN CONNECTIONS

Single Output		Bipolar Outputs	
Pin	Function	Pin	Function
1	RC	1	RC
2	-Vi	2	-Vi
3	+Vi	3	+Vi
4	+Vo	4	+Vo
5	-Vo	5	-Vo
6	No Pin	6	Common

Emissions Performance

Density Power measures its products for conducted emissions against the EN50121-3-2 standards. The common mode filter is added at the output of the module, and the maximum output power of the module is 10W. Input voltage is 12/24/48VDC, EMI filter is added outside the modules and the conduction limit can meet standards.



Conducted Emissions Test Circuit

Recommended Filter Parameters

Reference	Description For 12 Vin	Description For 24 Vin	Description For 48 Vin
Mov1	20D470K	20D470K	14D101K
C1, C4	470 μ F/35V	330 μ F/50V	330 μ F/100V
C2, C3	10 μ F/50V		10 μ F/100V
C5	10 μ F	10 μ F	10 μ F
LCM	For 3.3V/5V outputs, 1.4-1.7mH; For other outputs, 10 μ H		
CY1, CY2	1nF/2KV		

Technical Notes

INPUT FUSING

Certain applications may require fuse at the inputs of power conversion components. Fuses should also be used when there is possibility of sustained input voltage reversal which is not current limited. The EKC10D12/24/48 modules are not internally fused. We strongly recommend a slow-blown fuse to be used in the ungrounded input supply line. For safety agency approvals, the installer must install the converter in compliance with the end user safety standard.

TYPICAL APPLICATION CONNECTION

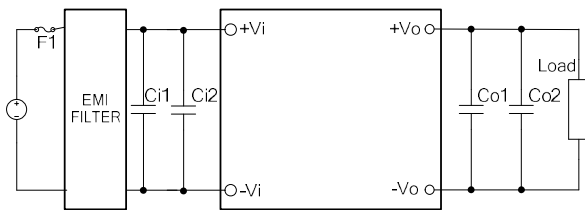


Figure 1: Typical Application Connection Single Output

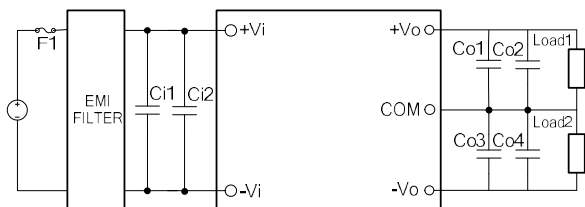


Figure 2: Typical Application Connection Bipolar Outputs

In order to prevent the input line from causing the input oscillation, it is recommended to add the input capacitor close to the input of the module. Similarly, the output capacitor is added to the output of the module. Specific recommended parameters: input capacitance $Ci1=100\mu F$ electrolytic capacitor, $Ci2 = 1\mu F$ CBB capacitor. Output Capacitance $Co1=10\mu F$ tantalum capacitor, $Co2 ESR < 0.1\Omega$. For bipolar outputs, $Co3$ & $Co4$ are the same as $Co1$ & $Co2$. Please refer to capacitive load for details.

REFLECTED RIPPLE CURRENT

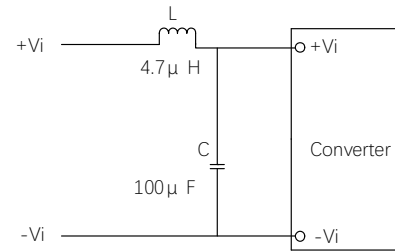


Figure 3: Reflected Ripple Current

Add LC filter at the front of the power module to reduce the interference of reflected ripple current on the DC bus, recommended value of L and C with appropriate current and voltage rating as below: $L=4.7\mu H$; $C=100\mu F$.

REMOTE CONTROL FUNCTION

Module Power Remote Control or called ON/OFF pin is for the user to enable or disable the output. Control use high and low level control, there are two general control logic, positive logic or negative logic control. Recommend to use optocoupler to control ON/OFF Pin as below.

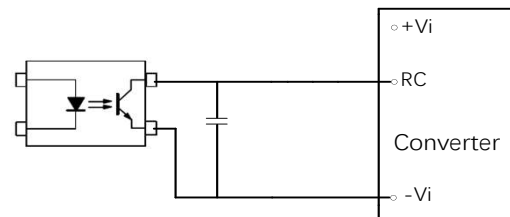


Figure 4: Remote Control

Remote Control Pin can be connected in parallel for multiple converters which with the same Remote Control characters. However, when several converters share the same remote control circuits, the total sink and source current must be taken into consideration, and make sure that the optocoupler has enough drive capability.

To reduce external PCB trace interference, it is recommended to add high frequency bypass capacitor between RC pin and $-Vi$, recommended capacitor value is 100-1000pF.

Technical Notes

THERMAL SHUTDOWN

These EKC10D12/24/48 converters are equipped with thermal-shutdown circuitry. If environmental conditions cause the internal temperature of the converter to rise above the designed operating temperature, a precision temperature sensor will power down the unit. When the internal temperature decreases below the threshold of the temperature sensor, the unit will auto restart.

OUTPUT RIPPLE & NOISE

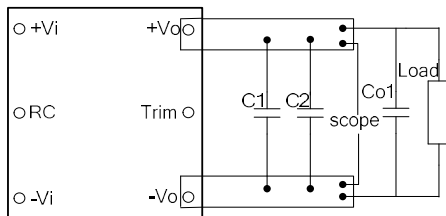


Figure 5- Output Ripple & Noise

These EKC10D12/24/48 modules' output ripple and noise is measured at the rated input voltage and output current, along with 10uF and 0.1uF MLCC used in parallel with appropriate voltage ratings and placed as C1&C2 shown in the figure above. The scope's bandwidth is set to 20MHz. External output capacitors are required to reduce the ripple & noise. The output capacitors should be low ESR and appropriate frequency response with appropriate voltage ratings, and must be located as close to the converters as possible, also PCB layout must be taken into consideration.

INPUT UNDERVOLTAGE SHUTDOWN AND START-UP THRESHOLD

Once operating, module will not turn off until the input voltage drops below the Undervoltage Shutdown threshold. Subsequent re-start will not occur until the input is brought back up to the Start-Up Threshold. This built in hysteresis prevents any unstable on/off situations from occurring at a single input voltage.

CURRENT LIMITING

The output voltage remains constant as the output current increases. However, once the output current is over the specified Output DC Current Limit, the converter turns off.

The converter then enters into "hiccup mode" where it repeatedly turns on and off until the short circuit condition is removed. This prevents excessive heating of the converter or the load board.

SHORT CIRCUIT CONDITION

When the converter is in current-limit mode, the output voltage will drop as the output current demand increases and then the converter will be shut down. If the short-circuit condition persists, another shutdown cycle will be initiated. This on/off cycling is referred to as "hiccup" mode. The hiccup cycling reduces the average output current, thereby preventing internal temperatures from rising to excessive levels. The module is capable of enduring an indefinite short circuit output condition.

OUTPUT OVERVOLTAGE PROTECTION

EKC10D12/24/48 output voltages are monitored for an overvoltage condition via magnetic feedback. The signal is coupled to the primary side and if the output voltage rises to a level which could be damaging to the load, the sensing circuitry will power down the PWM controller causing the output voltages to decrease. Following a time-out period the PWM will restart, causing the output voltages to ramp to their appropriate values. If the fault condition persists, and the output voltages again climb to excessive levels, the overvoltage circuitry will initiate another shutdown cycle.



This product is subject to the following operating requirements and the Life and Safety Critical Application Sales Policy:

Refer to: <http://www.densitypower.com>

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Specifications are subject to change without prior notice.

版本	修改说明	修改人	修改日期
A01	初始版本	Nicole	2020.10.30
A02	笔误更正，选型表格里 EKC10D24B12、EKC10D24B15 分别更正为 EKC10D12B12、EKC10D12B15	Nicole	2021.1.28