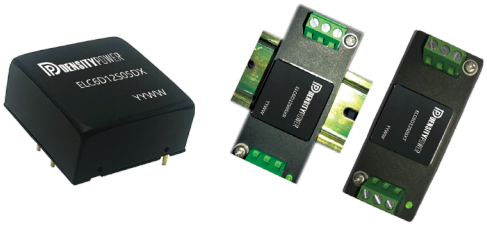
Technical Specification

ELC6D12/24/48 Series

Wide Input, Isolated 6Watts DC/DC Converters



FEATURES

- Cost-effective
- 2:1 input range: 9-18/18-36/36-75VDC
- Single & bipolar outputs: 3.3, 5, 9, 12, 15, 24, ±5, ±12, ±15Volts DC
- 6W isolated output
- Efficiency up to 88%
- 1.5KVDC I/O isolation
- Operation temperature: -40°C to +85°C
- Standard 1.0"×1.0"×0.47" DIP footprint, Din-rail & wall mount type options
- Extensive self-protection, UVLO, OTP, OVP, OCP and short-circuit protection
- Outstanding thermal dissipation
- Fully encapsulated, high reliability
- MTBF ⩾ 1 MHrs
- Compliance with RoHS

PRODUCT OVERVIEW

The ELC6D12/24/48 series are highly reliable, and efficient isolated DC/DC converter. Wide input range of 9-18 (12V nominal)/18-36 (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 ELC6D12/24/48 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]
ELC6D12S05	12	9-18	5	1.2	81	1000	1"×1"×0.47" DIP
ELC6D12S12	12	9-18	12	0.5	85	470	
ELC6D12B05	12	9-18	±5	±0.6	81	±470	
ELC6D12B12	12	9-18	±12	±0.25	85	±100	
ELC6D12B15	12	9-18	±15	±0.2	83	±100	
ELC6D24S03	24	18-36	3.3	1.5	77	1800	
ELC6D24S05	24	18-36	5	1.2	82	1000	
ELC6D24S09	24	18-36	9	0.667	85	470	

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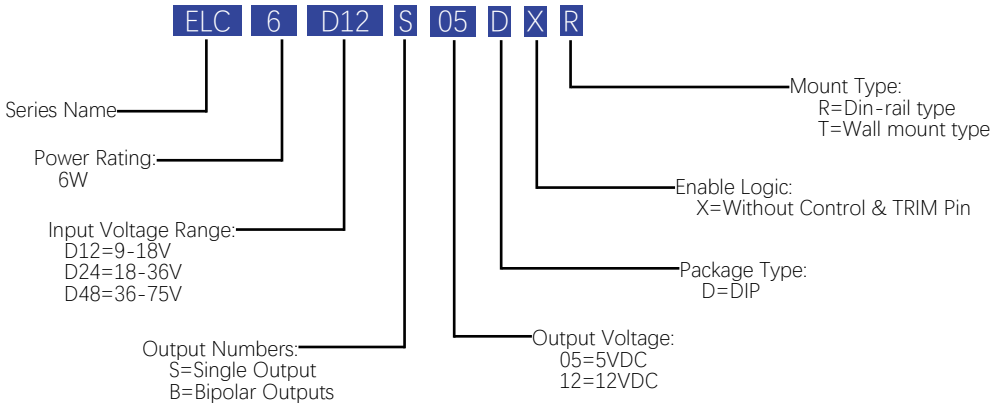
ELC6D24S12	24	18-36	12	0.5	85	470	1"×1"×0.47" DIP
ELC6D24S15	24	18-36	15	0.4	86	220	
ELC6D24S24	24	18-36	24	0.25	85	100	
ELC6D24B05	24	18-36	±5	±0.6	83	±470	
ELC6D24B12	24	18-36	±12	±0.25	87	±100	
ELC6D24B15	24	18-36	±15	±0.2	87	±100	
ELC6D48S03	48	36-75	3.3	1.5	79	1800	
ELC6D48S05	48	36-75	5	1.2	83	1000	
ELC6D48S12	48	36-75	12	0.5	87	470	
ELC6D48S15	48	36-75	15	0.4	88	220	
ELC6D48S24	48	36-75	24	0.25	88	100	

Model Numbering



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	3Vrms 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	

Absolute Maximum Ratings					
Parameters	Conditions	Min.	Typ.	Max.	Units
Input Voltage Continuous	12V type	-0.7		20	VDC
	24V type	-0.7		40	VDC
	48V type	-0.7		80	VDC
Input Voltage Transient	<100ms, 12V type			25	VDC
	<100ms, 24V type			50	VDC
	<100ms, 48V type			100	VDC
Operating Environment Temperature	>71℃ 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	12V type	9	12	18	VDC
	24V type	18	24	36	VDC
	48V type	36	48	75	VDC
Start-up Threshold	12V type			9	VDC
	24V type			18	VDC
	48V type			36	VDC
Under Voltage Shutdown	12V type	5.5	6.5		VDC
	24V type	12	15.5		VDC
	48V type	26	30		VDC
Input Current @ No Load	12V type		10	22	mA
	24V type		5	15	mA
	48V type		4	8	mA
Input Current @ Min. Line	12V type		0.85		A
	24V type		0.43		A
	48V type		0.25		A
Reflected Ripple Current			20		mA
Recommended Input Fuse	12V type		2		A
	24V type		1.5		A
	48V 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
Isolation Voltage (1 minute, 1mA)	Input to output	1500			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		1000		pF
Switching Frequency	ELC5D24S05		210		KHz
	Others		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				

Output Specifications					
Parameters	Conditions	Min.	Typ.	Max.	Units
Vout Accuracy		-1		+1	%
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	%
Cross Regulation	Only for bipolar ouputs. Vo1 is 50% load, Vo2 is 10%-100% load	-5		+5	%
Temperature Coefficient	From -40℃ to 85℃	-0.03		+0.03	% of Vout /℃
Over Current Protection	Hiccup, auto-recover	110		190	%
Over Voltage Protection		110		160	%
Output Short Protection	Hiccup, auto-recover				
Ripple & Noise Max. ①	100% load		60	85	mV Pk-Pk
Dynamic Load Peak Deviation ②		-5		+5	% of Vout
Dynamic Load Response	Within 1% band of Vout deviation		300	500	μS
Minimum Load	No minimum load required				

Notes

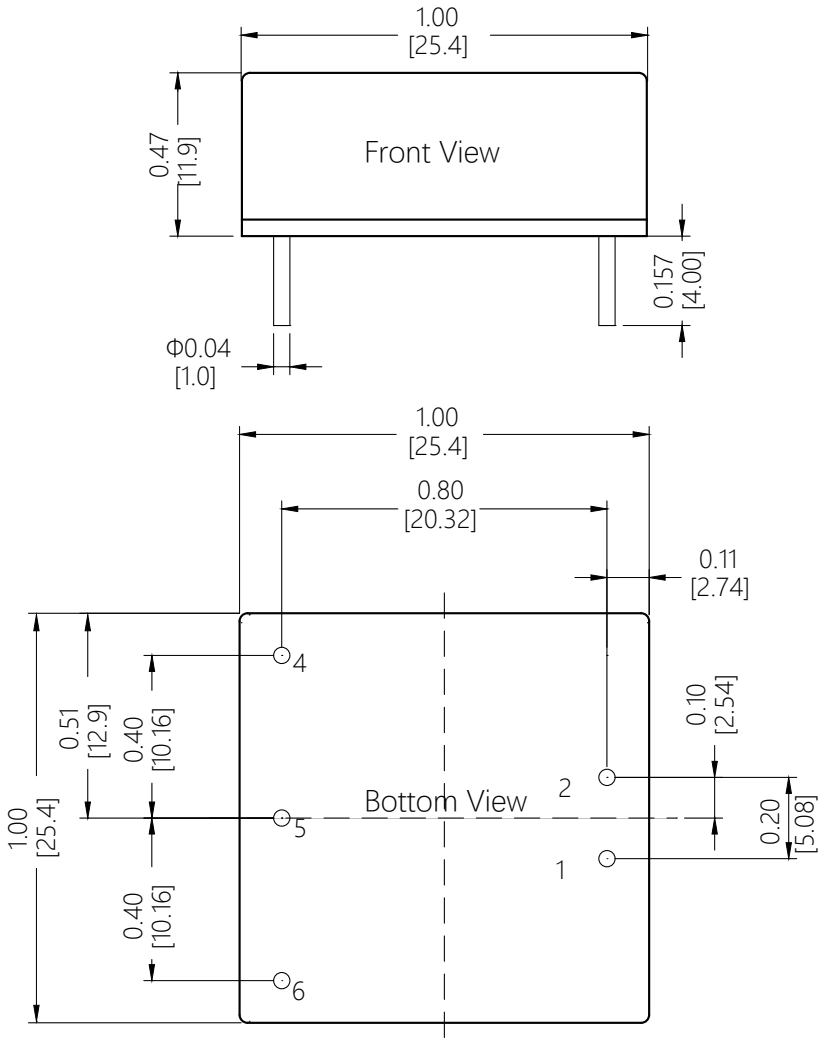
① Ripple & noise is tested with certain filter parameters, please see output ripple & noise intechnical notes on page 8 for more details.

② Load is set from 50%-75%-50% of full load, di/dt=0.1A/μS.

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

Mechanical Specifications

ELC6D12/24/48 SERIES: DIP TYPE

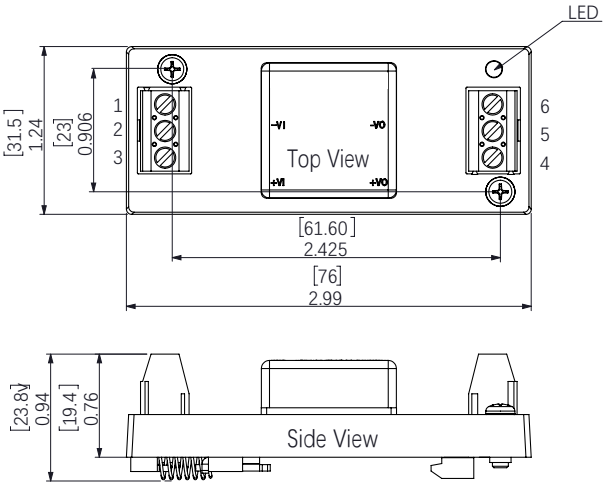


PIN:
Pin1, PIN2, PIN4, PIN5, PIN6: Φ0.040
Force: Applied force not exceed 4.9N
Material: Copper alloy
Finish: Gold 3 ~ 5μm(min.) over nickel 50μm(Min.)
TOLERANCE:
X.XX=±0.02 (0.5)
X.XXX= ±0.010 (0.25)
Dimensions are in inches [mm]
Weight: ~15g.

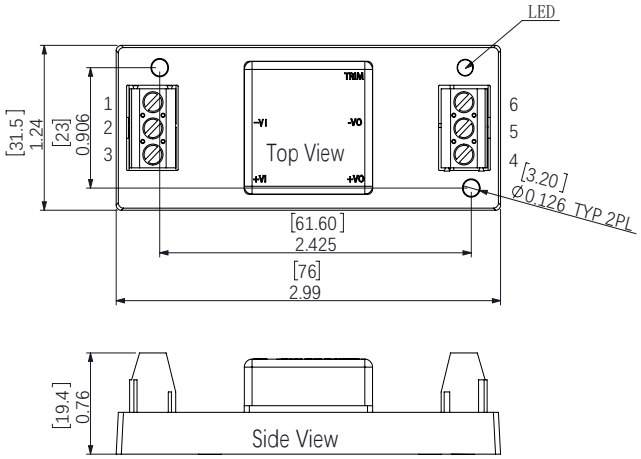
PIN CONNECTIONS			
Single Output		Bipolar Output	
Pin	Function	Pin	Function
1	+Vin	1	+Vin
2	-Vin	2	-Vin
4	-Vout	4	-Vout
5	No Pin	5	COM
6	+Vout	6	+Vout

Mechanical Specifications

ELC6D12/24/48 SERIES: DIN-RAIL TYPE



ELC6D12/24/48 SERIES: WALL MOUNT TYPE



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

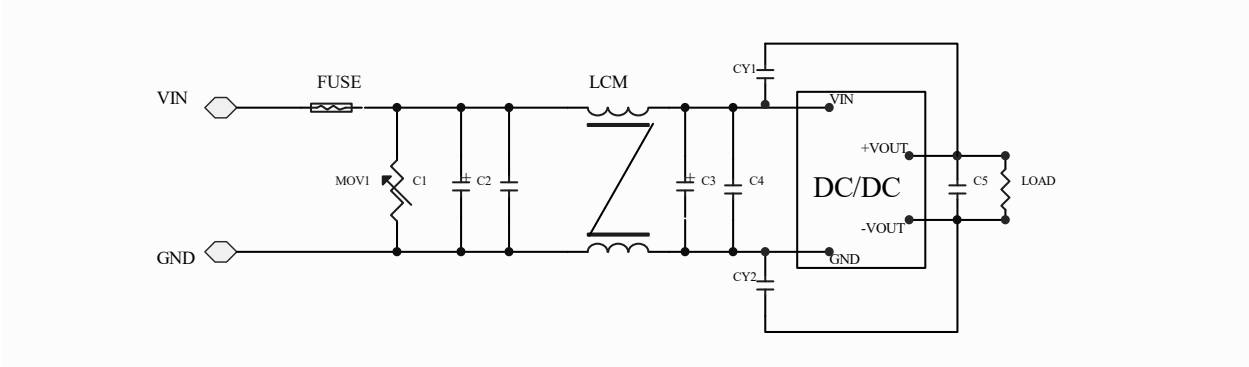
Tolerance:
X.XX=±0.02 (0.5)
X.XXX= ±0.010 (0.25)

Dimensions are in inches [mm]
Weight:
Din-rail Type: ~60g
Wall Mount Type: ~40g.

PIN CONNECTIONS			
Single Output		Bipolar Output	
Pin	Function	Pin	Function
1	NC	1	NC
2	-Vin	2	-Vin
3	+Vin	3	+Vin
4	+Vout	4	+Vout
5	-Vout	5	-Vout
6	No Pin	6	GND

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 6W. 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	14D330K	20D470K	14D101K
C0	1000μF/35V	1000μF/50V	680μF/100V
C1	1μF/50V	1μF/50V	4.7μF/100V
C2	330μF/35V	330μF/50V	330μF/100V
C3	4.7μF/50V	4.7μF/50V	4.7μF/100V
C4	10μF	10μF	10μF
LCM	4.7μH		
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 ELC6D12/24/48 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

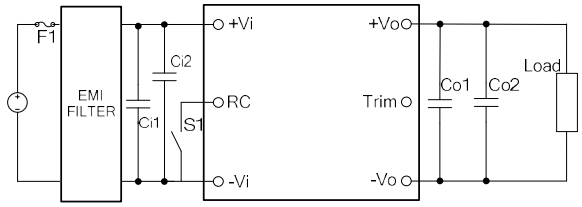


Figure 1· Typical Application Connection Single Output

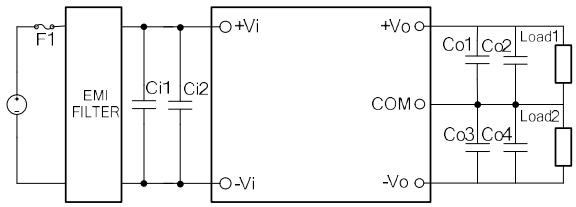


Figure 2· Typical Application Connection Bipolar Outputs

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=100μF electrolytic capacitor, Ci2 = 1uF CBB capacitor. Output Capacitance Co1=10uF tantalum capacitor, Co2 ESR <0.1Ω. For bipolar outputs, Co3 & Co4 are the same as Co1 & Co2. Please refer to capacitive load for details.

REFLECTED RIPPLE CURRENT

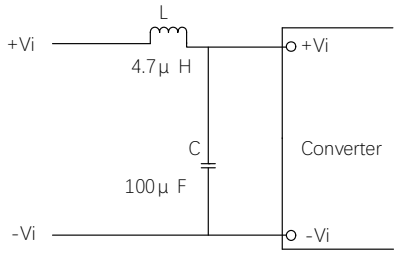


Figure 3· Reflected Ripple Current

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=4.7μH; C=100μF.

OUTPUT RIPPLE & NOISE

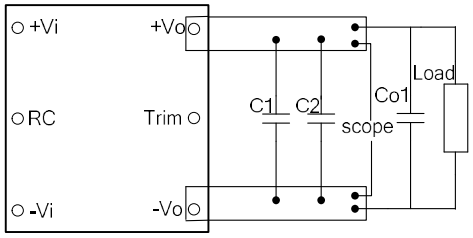


Figure 4· Output Ripple & Noise For Single Output

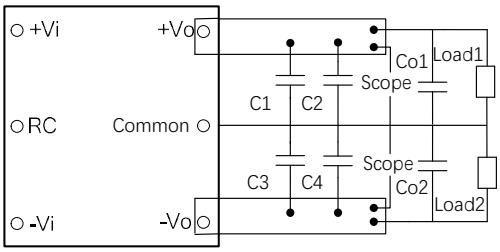


Figure 5· Output Ripple & Noise For Bipolar Outputs

These ELC6D12/24/48 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, C3, C4 shown in the figure

Technical Notes

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 maximum current limit remains constant as the output voltage drops. However, once the impedance of the short across the output is small enough to make the output voltage drop below the specified Output Current Limit Shutdown Voltage, 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

When the output voltage exceeds the overvoltage protection set point, the module enters the overvoltage protection mode. The output voltage is keeped at the overvoltage protection point and is limited to the continuous increase of the output voltage. When the external overvoltage condition disappears, the module automatically returns to normal operation.

THERMAL SHUTDOWN

These ELC6D12/24/48 converters are equipped with thermal-shutdown circuitry. If environmental conditions cause the internal temperature of the DC-DC 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.