ABB

DATASHEET

CLP0412DC Open Frame Power Supply

48Vdc Input; 12Vdc Output; 450W Output Power

Applications

- Industrial equipment
- Telecommunications equipment

Features

- Reverse input voltage protection
- Compact size 76.2 mm x 127 mm x 36.8 mm (3 in x 5 in x 1.45 in) with density of 20.7 W/in^3
- Universal DC Input Range (36 – 75VDC)
- Output voltage of 12V (adjustable ±5%)
- Standby output of 5V @ 1A (standard versions)
- Maximum output current of 37.5A @ 12Vout (450W)
- High efficiency (93% at Full Load)
- 450W capability at 42ºC and 1m/s airflow with derating at higher temperatures or lower airflows
- Capable of 320W out in sealed enclosure applications with enclosure ambient at 55ºC
- Output overcurrent protection (non-latching)
- Overtemperature protection
- Output overvoltage protection
- Up to 2ms of holdup time
- Parallelable with output current sharing (option)
- Conformal coated
- Conducted EMI - meets CISPR32 (EN55032) and FCC Class B requirements
- Compliant to RoHS Directive 2011/65/EU and amended Directive (EU) 2015/863
- Compliant to REACH Directive (EC) No 1907/2006
- UL and cUL approved to UL/CSA62368-1, TUV (EN62368-1), CE Mark (for LVD) and CB Report available
- ISO** 9001 and ISO 14001 certified manufacturing facilities

Description

In a small 3 x 5 inch footprint, the 12Vdc single-output CLP0412DC open frame power supply delivers 93 percent power efficiency and 450W output at 42˚C and 1m/s airflow. With its small size, the CLP series is specifically designed to handle power challenges associated with tight space and low airflow. Offering a high 20.7W/in^3 power density in a 1U high, fan-less form factor, the CLP series addresses a broad range of applications in new products from industrial equipment and communications original equipment manufacturers (OEMs). Higher temperature operation is possible at derated output. The CLP series utilizes a unique design approach at this power level, leveraging zero voltage switching techniques. Protection features include overcurrent (OCP), overvoltage (OVP), and overtemperature (OTP).

* *UL* is a registered trademark of Underwriters Laboratories, Inc.
† *CSA* is a registered trademark of Canadian Standards Association.
‡ *VDE* is a trademark of Verband Deutscher Elektrotechniker e.V.
** ISO is a registered trademark of the International Organization of Standards

©2020 ABB Inc, All rights reserved.

CLP0412DC Open Frame Power Supply

48Vdc Input; 12Vdc Output; 450W Output Power

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only, functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect the device reliability.

Parameter	Device	Min	Max	Unit
Input Voltage - Continuous	All	36	75	Vdc
Operating Ambient Temperature	All	-40	85	°C
(in sealed enclosure applications with thermally conductive pad to enclosure, $P_{O,max}$ = 320W)	All	-40	85	°C
Storage Temperature	All	-40	85	°C
Humidity (non-condensing)	All	5	95	%
Altitude	All		5000	m
Isolation Voltage – Input to output	All		1000	Vdc

Electrical Specifications

Parameter	Device	Min	Typ	Max	Unit
Operating Input Voltage	All	36	48	75	Vdc
Input Current	All			15	A
Inrush Transient Current (V_{IN} = 48Vdc, T_{amb} = 25ºC)	All			100	A Peak
Leakage Current to earth ground (V_{IN} = 48Vdc)	All			3.5	mA
Output Voltage Setpoint	All		12		Vdc
Output Voltage Tolerance (due to set point, temperature variations, load and line regulation)	All	-2		2	%
Output Voltage Adjustment Range	All	11.4		12.6	Vdc
Output Remote Sense Range	All			250	mVdc
Output Load Regulation	All			1	%Vout
Output Line Regulation	All			0.5	%Vout
Output Ripple and Noise – measured with 0.1µF ceramic capacitor in parallel with 470µF polymer capacitor[1] Peak-to-peak (20MHz Bandwidth)	All			240	mV p-p
Dynamic Load Response – 50% to 100% load transient, 1A/µs slew rate Output voltage deviation Settling Time	 All All			 5% 500	 % µs
Output Current	All	0		37.5	Adc
Output Current Limit Inception	All	105		140	% $I_{O,max}$
Maximum Output Capacitance	All			10000	µF
Standby Output Voltage	All		5		Vdc
Standby Output Current	All			1	Adc
Efficiency: V_{IN} = 48Vdc, 20% load 50% load 100% load	All	---	92.0 94.0 93.0	---	% % %
Holdup Time – 100% load[2] (Vout≥ 10.8V_{DC}, Tamb = 25°C, 450W, VIN = full range)	All	2			ms

[1] Output ripple specification is met over -40 to 85ºC

[2] Holdup time is reduced at cold temperatures

©2020 ABB Inc, All rights reserved.

CLP0412DC Open Frame Power Supply

48Vdc input; 12Vdc output; 450W Output Power

Isolation Specifications

Parameter	Device	Min	Max	Unit
Isolation Voltage – Input to output	All		1000	Vdc
– Input to ground			1000	Vdc
–output to ground			100	Vdc

General Specifications

Parameter	Device	Symbol	Typ.	Unit
Calculated Reliability based on Telcordia SR-332 Issue 3: Method 1 Case 3 (V_{IN}=48Vdc, I_o = 30A, T_A = 40ºC, airflow 200LFM, 90% confidence)	All	MTBF	1,591,287	Hours
Weight	All		355 12.52	g oz.

Feature Specifications

Parameter	Device	Min	Typ	Max	Unit
On/Off Signal Interface – signal referenced to GND					
Logic Low (Power Supply ON)					
Input Low Current	All			7	mA
Input Low Voltage	All			1	V
Logic High (Power Supply OFF)					
Input High Current	All			600	µA
Input Voltage	All			5.5	V
Delay from ON/OFF being enabled to start of output voltage rise	All			50	ms
Output Voltage Rise Time (from 10 to 90% of final value)	All		5		ms
Delay from Input being applied to standby output being in regulation	All		0.3		s
Delay from Input being applied to all outputs being in regulation	All		2		s
Output Overvoltage Protection	All	13.8		16	Vdc
Input Undervoltage lockout[3]					
Turn-on Threshold (100% load)	All	33	35	36	Vdc
Turn-off Threshold (100% load)	All	32	33	35	Vdc
DC OK – open collector, High when output available					
Sink Current	All			4	mA
Maximum Collector Voltage	All			12	V

[3] Undervoltage lockout threshold may vary with output load current level – decreasing as load goes lower

©2020 ABB Inc, All rights reserved.

CLP0412DC Open Frame Power Supply

48Vdc Input; 12Vdc Output; 450W Output Power

Environmental Specifications

Parameter	Device	Specification/Test
Conducted Emissions	All	CISPR32 (EN55032) Class B with 3dB margin
Radiated Emissions	All	CISPR32 (EN55032) to comply with system enclosure
ESD	All	IEC61000-4-2, Level 4 Performance Criteria A
Radiated Susceptibility	All	IEC61000-4-3, Level 3
Electrical Fast Transient Common Mode	All	IEC61000-4-4, Level 3
Surge Immunity	All	IEC 61000-4-5; ±1kV common mode and differential mode, unit passes criteria A (normal performance; impedance is 2 Ohms for differential and common mode.)
Conducted RF Immunity	All	IEC61000-4-6, Level 3
Voltage Dips, Interruptions	All	-53Vin, 80% load, Dip 100% duration 4ms, Criteria (A)
Shock and Vibration	All	IPC-9592B

©2020 ABB Inc, All rights reserved.

CLP0412**DC** Open Frame Power Supply

48Vdc input; 12Vdc output; 450W Output Power

Characteristic Curves

The following figures provide typical characteristics for the CLP0412DC power supply

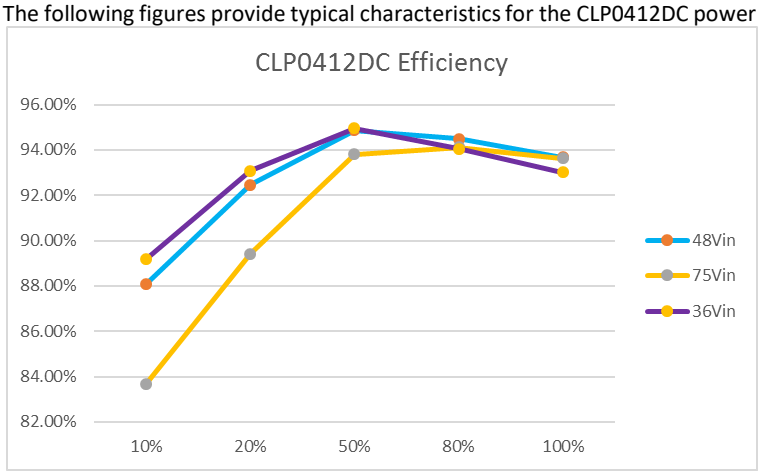


Figure 1. Power Supply Efficiency versus Output Current

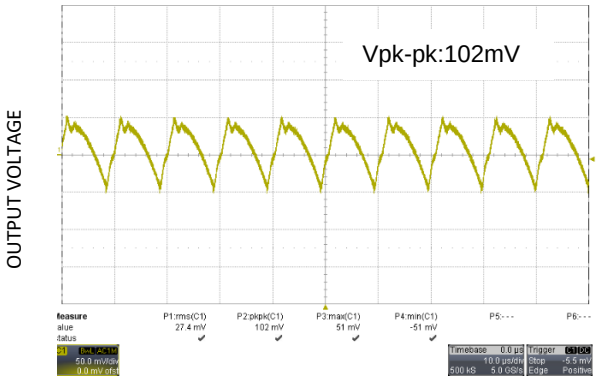


Figure 2. Typical output ripple and noise (V_{IN} = 48Vdc, 100% load).

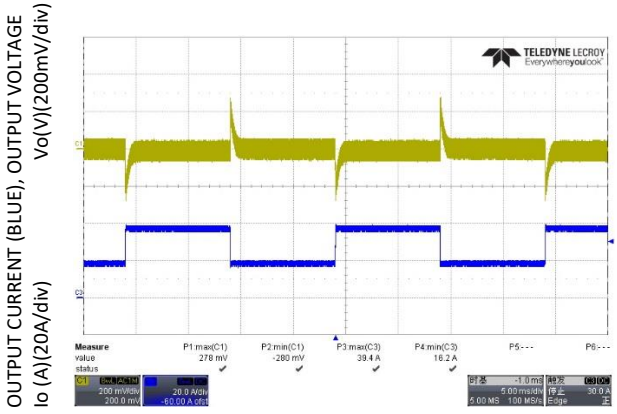


Figure 3. Transient Response to Dynamic Load change from 50% to 100% at Vin = 48Vdc.

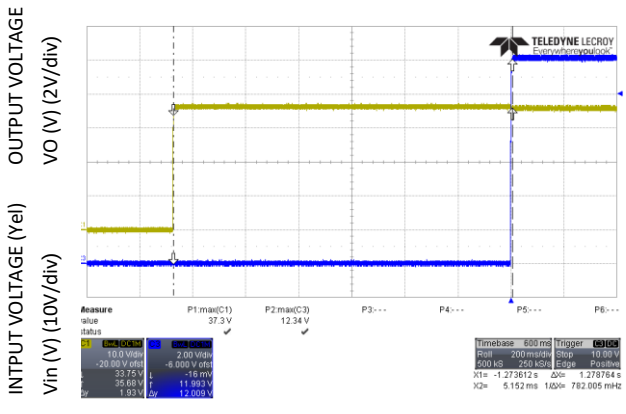


Figure 4. Minimum Input Start-up (V_{IN} = 36Vdc, Full Load).

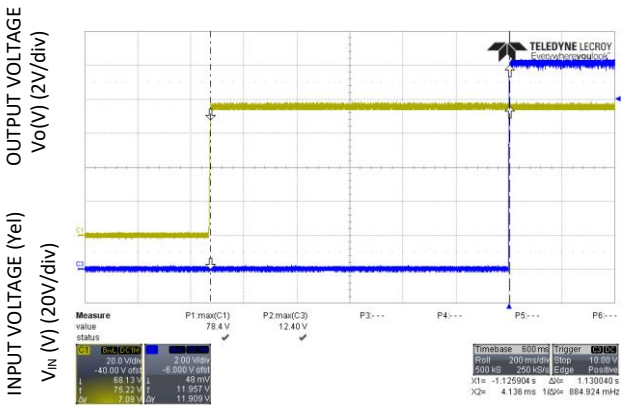


Figure 5. Maximum Input Start-up (VIN = 75Vdc, Full load).

©2020 ABB Inc, All rights reserved.

CLP0412DC Open Frame Power Supply

48Vdc Input; 12Vdc Output; 450W Output Power

Characteristic Curves (cont.)

The following figures provide typical characteristics for the CLP0412DC power supply

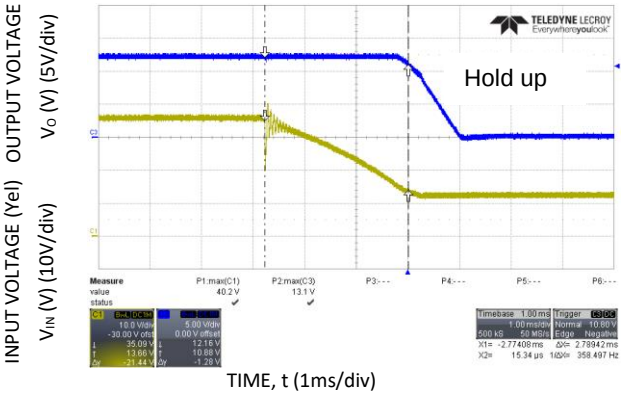


Figure 6. Minimum input Hold-up waveforms (V_{IN} = 36V, 100% Load).

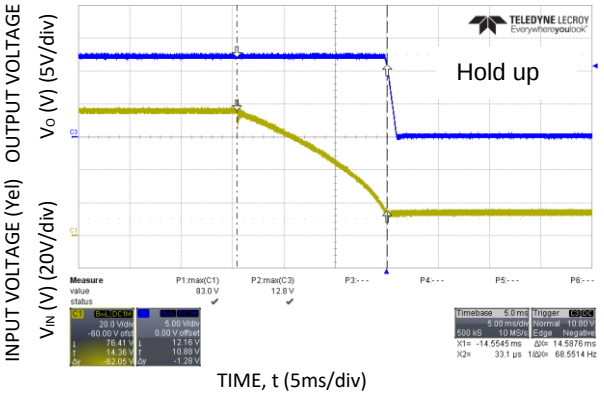


Figure 7. Maximum input Hold-up waveforms (V_{IN} = 75V, 100% load).

©2020 ABB Inc, All rights reserved.

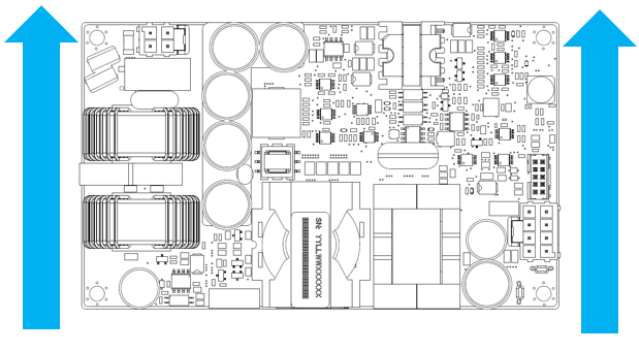
CLP0412DC Open Frame Power Supply

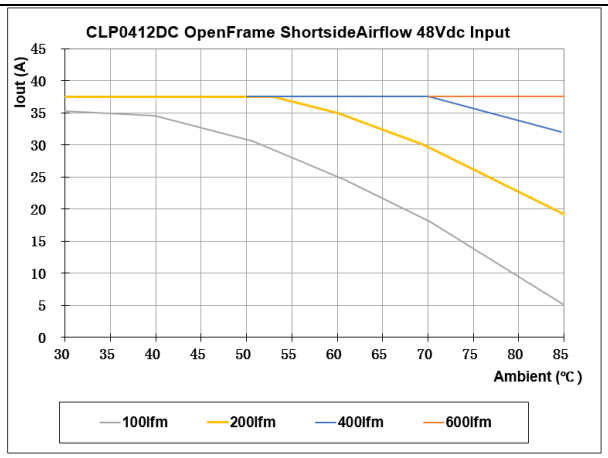
48Vdc input; 12Vdc output; 450W Output Power

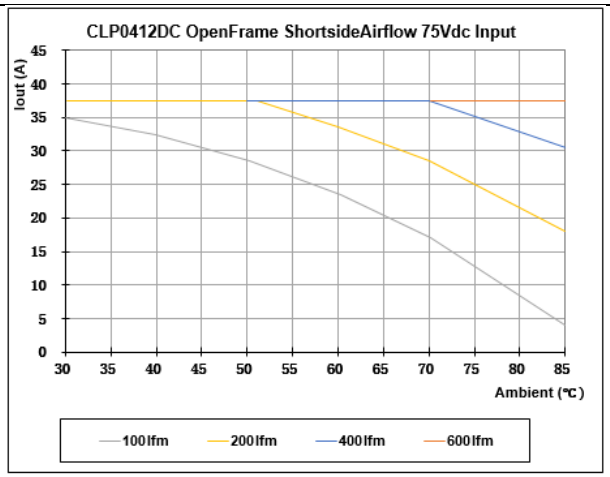
Power Derating for Forced Air Flow Application

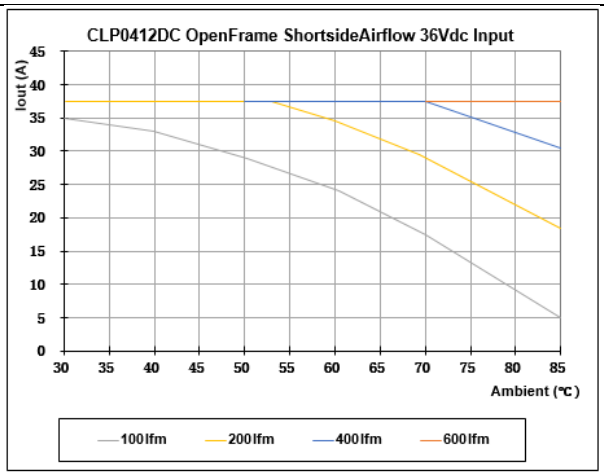
The following charts show derating under transverse and longitudinal airflow for various input voltages.

Transverse Airflow

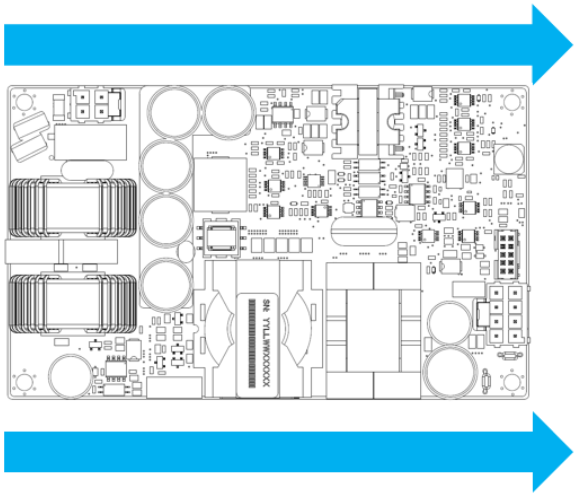


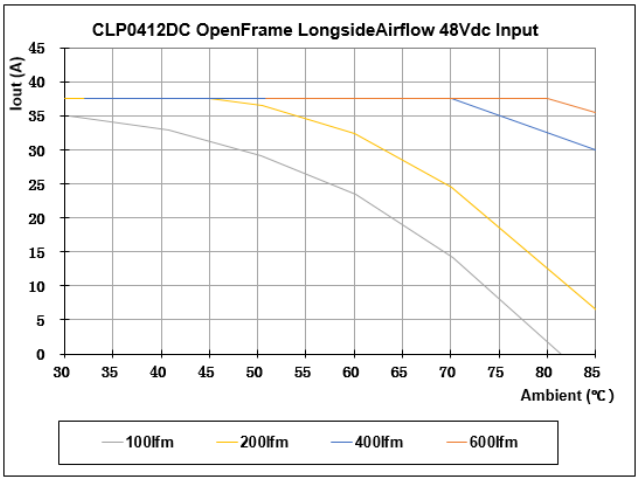






Longitudinal Airflow

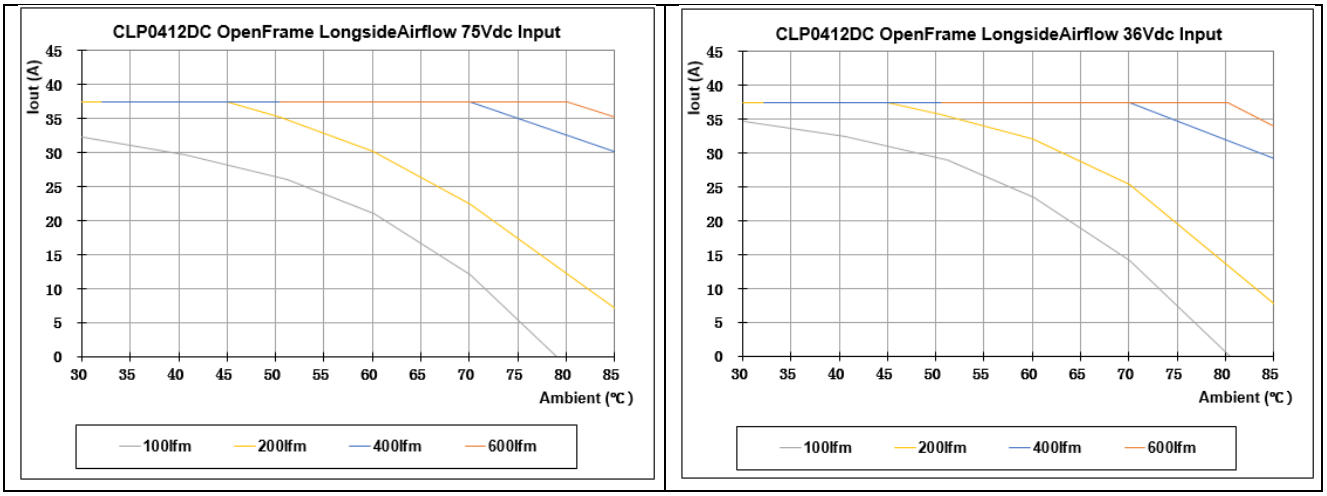




©2020 ABB Inc, All rights reserved.

CLP0412DC Open Frame Power Supply

48Vdc Input; 12Vdc Output; 450W Output Power



Power Derating for Conduction Cooling (when used inside sealed enclosures)

(Refer **Fig.11**)

Enclosure Outside Surface Temperature (°C)	Enclosure Inside Ambient Temperature (°C)	Max Output Power (W)
25	75	450
55	70	420

Table 1. Output Power Capability for Sealed Enclosure Applications

©2020 ABB Inc, All rights reserved.

CLP0412**DC** Open Frame Power Supply

48Vdc input; 12Vdc output; 450W Output Power

Safety Considerations

The CLP0412DC embedded power supply is intended for inclusion in an end product equipment and shall be installed in compliance with the enclosure, mounting, spacing, casualty and segregation requirements of the end-use application. A suitable Electrical and Fire enclosure shall be provided and is not intended to be operated as a stand-alone product. The power supply meets Class 1, IEC62368-1, EN62368-1, with the appliable national deviations which approved by TUV and UL(Recognized Component) C-UL (Canadian Approval by UL).

Feature Descriptions

Standby Power Supply

A standby output of 5V in the CLP0412DC power supply comes up when DC input in the operating range is applied.

Remote On/Off

The CLP0412DC power supply features a TTL-compatible On/Off control input. The power supply turns ON when the On/Off input goes low, and turns OFF when the input goes high. Note that if the On/Off pin is left unconnected, the power supply main output will turn ON when DC input is present.

Output Voltage Adjustment

For all units, the output voltage can be adjusted between 11.4V and 12.6V using a potentiometer on the power supply.

Remote Sense

For all versions, the power supply has both positive and negative remote sense connections that can be connected to the positive and negative rails of the main output near the load. The power supply operates even without the remote sense connections being made.

Overcurrent Protection

To provide protection in a fault condition (output overload), the power supply is equipped with internal current-limiting circuitry and can endure current limiting continuously. At the point of current-limit inception, the unit enters hiccup mode. The power supply operates normally once the output current is brought back into its specified range.

Overvoltage Protection

Overvoltage protection is a feature of the CLP0412DC power supply that protects both the load and the power supply from an output overvoltage condition. When an overvoltage occurs, the power supply shuts down and latches off. It is necessary to recycle the input to restart the power supply when this protection is activated.

Reverse Input Voltage Protection

Reverse Input Voltage Protection is a feature of the CLP0412DC power supply that protects the power supply from damage if a reverse voltage is applied to the input.

Overtemperature Protection (OTP)

For additional protection in a fault condition the CLP0412DC is equipped with a thermal shutdown circuit which detects excessive internal temperatures and shuts the unit down. Once the power supply goes into overtemperature shutdown, it will cool before attempting to restart. The overtemperature protection circuit will typically kick in when the unit is operated at 450W output with an ambient temperature of 53ºC and 1m/s (200LFM) airflow. In a sealed enclosure OTP will depend on enclosure design and cooling.

Input Undervoltage Lockout

At input voltages below this limit, power supply operation is disabled. The power supply will begin to operate at an input voltage above the undervoltage lockout turn-on threshold

DC OK

The CLP0412DC provides a DC OK signal that indicates when the output has come up and is in regulation. This is an open-collector type signal that goes high when the output is available and within regulation.

Power Good LED

A green LED on board the power supply illuminates when the main output voltage is above 10V.

Paralleling/Load Sharing

The CLP0412DC is capable of being employed in a paralleling scheme, following are some design attributes that need to be carefully considered prior to attempting a parallel operation with multiple CLP0412DC's. With the following design criteria, the CLP0412DC will load share at an accuracy of +/-5%, when the total current draw is at levels above 20% of max overall loading.

- Current share signals of each power supply to be connected.
- An external Oring function needs to be employed at the Vout(+) signal. An ORing diode or a Mosfet & controller scheme can be used.
- The 5V Standby Return SHOULD NEVER be connected to the VOUT- (RETURN). 5V stby returns will need to be connected, the 5V stby Vout(+) leg remain separate. The 5V stby output is not designed to be paralleled, if there is a desire for these to be paralleled for load sharing, then other considerations need to be included as well. Contact your local ABB sales representative for more details.
- Remote sense signals should be left unconnected to enable better current sharing performance.
- During parallel operation, it is essential that the Vout+ and Vout- of the paralleled power supplies always stay connected . If Vout+ or Vout- of any of the power supply gets disconnected, then it is important to reconnect it back or completely remove that power supply. This is to avoid damage to the power supply with only one connection.

Thermal Considerations

The power supply can be operated in a variety of thermal environments; however enough cooling should be provided to ensure reliable operation.

©2020 ABB Inc, All rights reserved.

Considerations include ambient temperature, airflow, power supply dissipation and the need for increased reliability. A reduction in the operating temperature of the power supply will result in increased reliability. The thermal data presented here is based on measurements taken during testing in a wind tunnel or temperature chamber.

Heat Transfer via Convection

Increased airflow through the power supply enhances the heat transfer via convection. Figure 10 shows the preferred airflow direction. Contact your ABB technical representative for derating information in other airflow directions.

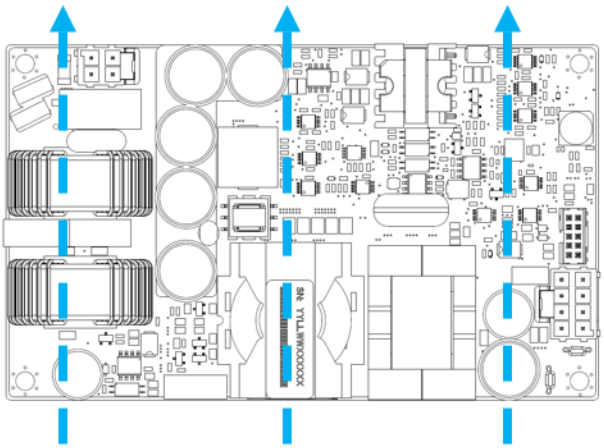


Fig. 10. Preferred airflow direction for cooling.

Operation in a Sealed Enclosure

The CLP0412DC power supply can also be operated in a sealed enclosure or in an environment where cooling is primarily via conduction. Figure 11 shows an arrangement where thermally conductive pads are used to transfer heat from the top and bottom of the power supply into the enclosure. Under such conditions, the power supply is capable of reduced power operation as shown in Table 1.

Thermal conductivity should be 3.0 W/m-K for thermal pad application, 3.0mm thickness and 1kV+ isolation, example:

Thermal gap pad:
http://www.bergquistcompany.com/pdfs/dataSheets/PDS_GP_HC3_0714%20v7.pdf

Thermal gap pad: *https://www.lairdtech.com/products/tputty-502*

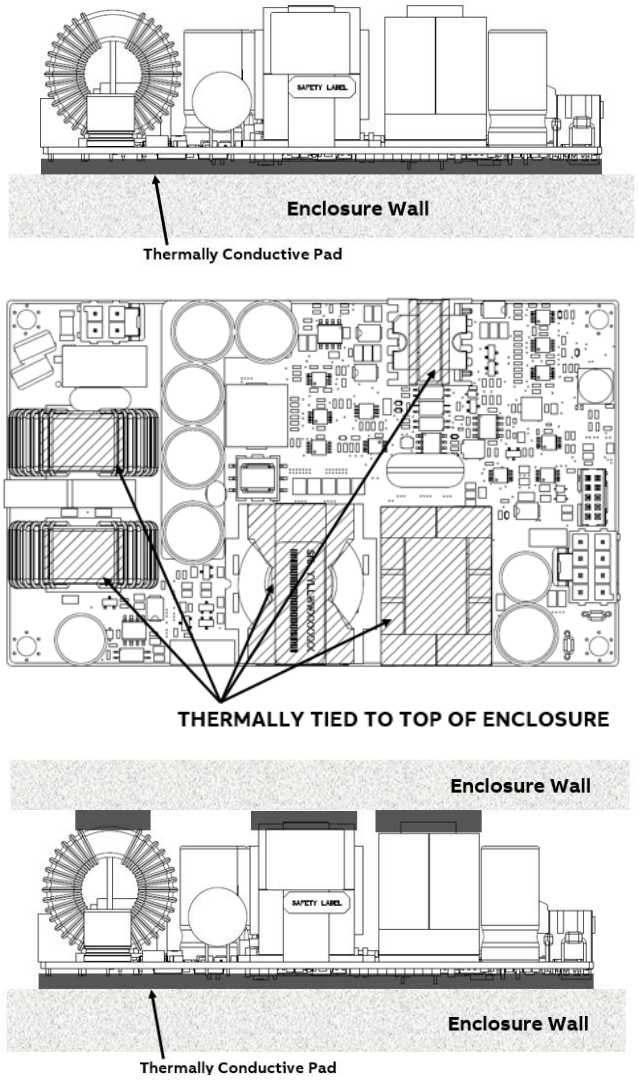


Fig. 11. Example arrangement of the CLP0412DC for sealed enclosure applications.

Assembling

• Please use metal screw to mount the unit and make sure 4 mounting holes connected to Earth well.

• In Applications where the power supply is enclosed, special attention to clearances between the supply and the enclosure should be paid. A min. 3.5mm on all sides is necessary for improved safety. For additional protection, a layer of Kapton tape, 3 mil in thickness, covering the whole surface under the supply is recommended. If a cover is used, a 3 mil Kapton Tape covering the whole cover is also recommended. Please contact your local ABB FAE if further information is need.

©2020 ABB Inc, All rights reserved.

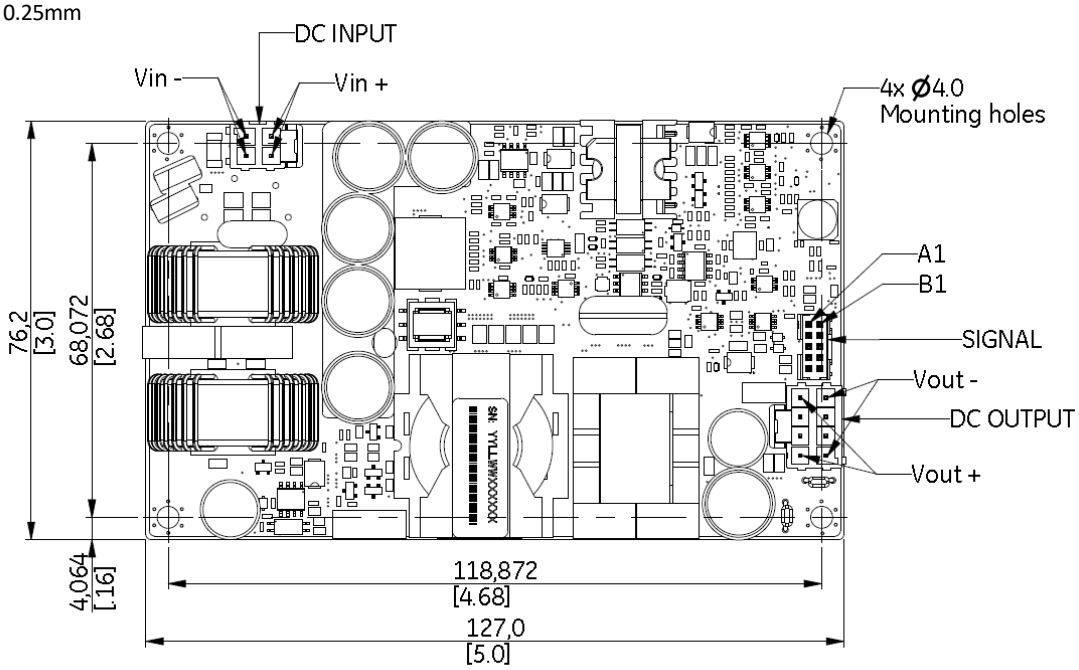
CLP0412**DC** Open Frame Power Supply

48Vdc input; 12Vdc output; 450W Output Power

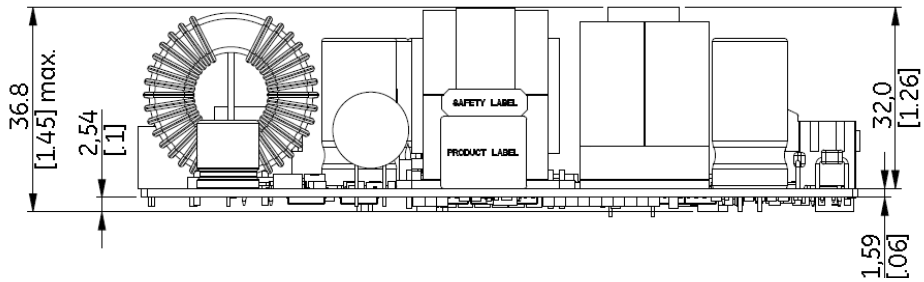
Mechanical Outline - CLP0412DC

Dimensions are in millimeters.
Tolerances: x.x mm ± 0.5mm [unless otherwise indicated]
x.xx mm ± 0.25mm

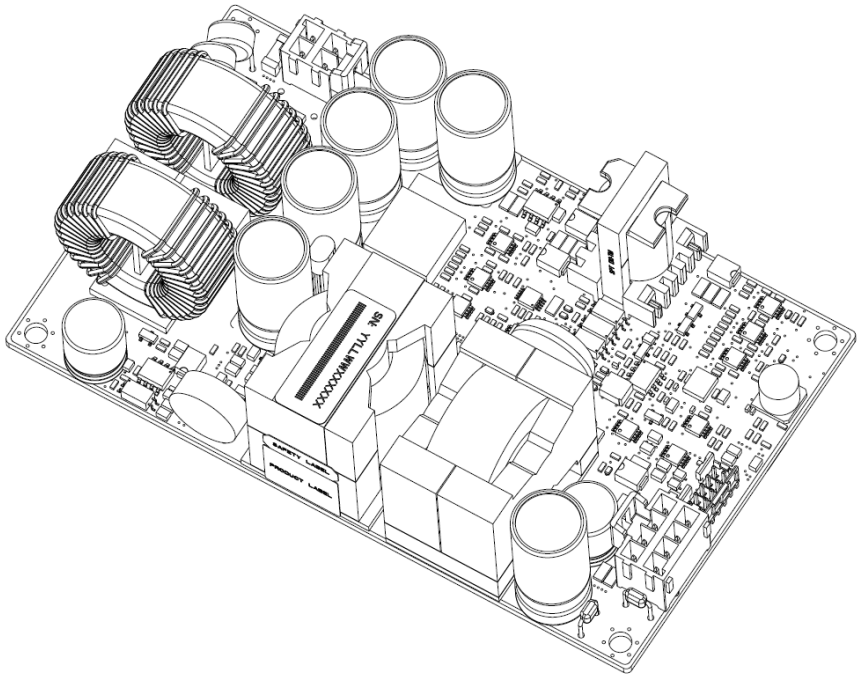
TOP VIEW



SIDE VIEW



3D VIEW



©2020 ABB Inc, All rights reserved.

Table 2. Connector Information

Connector	Connector on Power Supply	Mating Connector
DC Input Connector (HDR200)	Molex 172298-1204 or equivalent	Molex 172258-3104 or equivalent
DC Output Connector (HDR800)	Molex 172298-1208 or equivalent	Molex 172258-3108 or equivalent
Auxiliary Connector (HDR801)	FCI 98414-G04-10ULF or equivalent	FCI 90311-010LF or equivalent

Table 3. Pinout Information

DC Input Connector (HDR200)		DC Output Connector (HDR800)		Auxiliary Connector (HDR801)			
PIN 1, 2	DC INPUT+	PIN 1, 2, 3, 4	VOUT +	PIN A1	5V Standby	PIN B1	PARALLEL
PIN 3, 4	DC INPUT-	PIN 5, 6, 7, 8	VOUT – (Return)	PIN A2	5V Standby	PIN B2	5V Standby Return
				PIN A3	NC	PIN B3	5V Standby Return
				PIN A4	REMOTE SENSE +	PIN B4	DC_OK
				PIN A5	REMOTE SENSE –	PIN B5	ON/OFF

©2020 ABB Inc, All rights reserved.

CLP0412DC Open Frame Power Supply

48Vdc input; 12Vdc output; 450W Output Power

Ordering Information

Please contact your ABB Sales Representative for pricing, availability and any optional features.

Table 5. Device Codes

Device Code/ Comcode	Input Voltage Range	Output Voltage	Output Current	On/Off Control	Standby Supply	Temperature Range	Remark
CLP0412DCXXXZ01A	36 – 75Vdc	12.0Vdc	37.5A	Negative Logic Floating is ON	5V @ 1A	-40 to 85ºC	Conformal coated

Contact Us

For more information, call us at

USA/Canada:

+1 877 546 3243, or +1 972 244 9288

Asia-Pacific:

+86-21-53899666

Europe, Middle- East and Africa:

+49.89.878067-280

Go.ABB/Industrial

©2020 ABB Inc, All rights reserved.