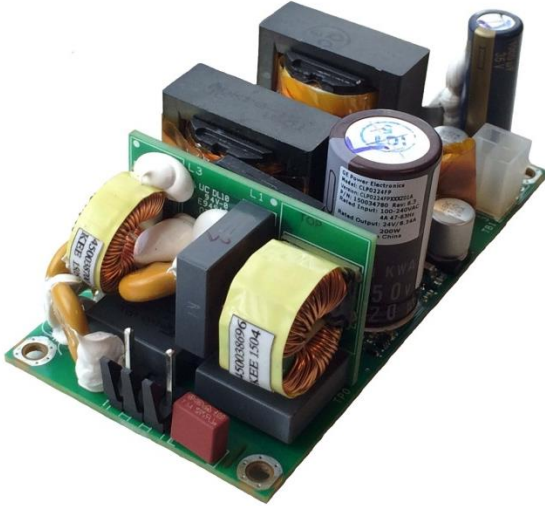


CLP0228 Open Frame Power Supply

90 - 264Vac input; 28Vdc output; 200W Output Power



Applications

- Industrial equipment
- Telecommunications equipment

Features

- Compact size 50.8 mm x 101.6 mm x 37.2 mm (2 in x 4 in x 1.46 in) with density of 18 W/in³
- Universal AC Input Range (90 – 264VAC)
- Output voltage of 28V (adjustable $\pm 5\%$)
- Maximum output current of 7.1A@ 28Vout (200W)
- High efficiency (93.6 % at Full Load, 230VAC in)
- Full load capability at 50°C and 1m/s airflow with derating at higher temperatures or lower airflows
- Output overcurrent protection (non-latching)
- Overtemperature protection
- Output overvoltage protection
- Up to 11ms of holdup time at 200W out
- Active power factor corrected input
- Conducted EMI - meets CISPR22 (EN55022) and FCC Class B requirements
- Compliant to RoHS II EU "Directive 2011/65/EU"
- UL and cUL approved to UL/CSA60950-1, TUV (EN60950-1), CE Mark (for LVD) and CB Report available
- ISO** 9001 and ISO 14001 certified manufacturing facilities

Description

In a small 2 x 4 inch footprint, the 28Vdc single-output CLP0228 open frame power supply delivers greater than 90 percent typical power efficiency and full load output at +50°C. With its small size, the CLP series is specifically designed to handle power challenges associated with tight space and low airflow. Offering a leading 18W/in³ 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 in conjunction with quasi-resonant power factor correction (PFC) circuits. 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

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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	90	264	Vac
Operating Ambient Temperature (see Thermal Considerations section)	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		3000	Vac
Input to safety ground	All		1500	Vac
Outputs to safety ground	All		50	Vac

Electrical Specifications

Parameter	Device	Min	Typ	Max	Unit
Operating Input Voltage	All	90	115/230	264	Vac
Input Source Frequency	All	47	50/60	63	Hz
Input Current ($V_{IN} = 90\text{Vac}$)	All			4	A_{RMS}
Input Power Factor (115VAC or 230VAC in at full load)	All	0.95			
Inrush Transient Current ($V_{IN} = 264\text{Vac}$, $T_{amb} = 25^{\circ}\text{C}$)	All			100	A Peak
Leakage Current to earth ground ($V_{IN} = 264\text{Vac}$)	All			2	mA
Output Voltage Setpoint	All		28		Vdc
Output Voltage Tolerance (due to set point, temperature variations, load and line regulation)	All	-3		3	%
Output Voltage Adjustment Range	All	26.6		29.4	Vdc
Output Load Regulation	All			1	%Vout
Output Line Regulation	All			0.5	%Vout
Output Ripple and Noise - measured with 0.1 μF ceramic capacitor in parallel with 10 μF electrolytic capacitor, at 25°C ¹ Peak-to-peak (20MHz Bandwidth)	All			360	mV p-p
Dynamic Load Response - 50% to 100% load transient, 1A/ μs slew rate	All				
Output voltage deviation	All			5%	%
Settling Time	All			500	μs
Output Current	All	0		7.1	Adc
Output Current Limit Inception	All	110		160	% $I_{O,max}$
Maximum Output Capacitance	All			3000	μF
Efficiency at 25°C:					
$V_{IN} = 230\text{Vac}$, 20% load	All		88.9		%
50% load	All		93.3		%
100% load	All		93.6		%
$V_{IN} = 115\text{Vac}$, 20% load	All		88.7		%
50% load	All		91.8		%
100% load	All		91.5		%
Holdup Time - $V_{IN} = 115\text{Vac}$, 100% load	All	11			ms
$V_{IN} = 230\text{Vac}$, 100% load	All	11			ms

¹ Below -25°C, output ripple may exceed the specified level. Specification will be met after warm up period of 15s.

CLP0228 Open Frame Power Supply
 90 - 264Vac input; 28Vdc output; 200W Output Power

General Specifications

Parameter	Device	Symbol	Typ.	Unit
Calculated Reliability based on Telcordia SR-332 Issue 2: Method 1 Case 3 ($V_{IN}=230V_{ac}$, $I_o = 7.1A$, $T_A = 40^{\circ}C$, airflow 200LFM, 90% confidence)	All	FIT	287.3	10 ⁹ /Hours
		MTBF	3,480,997	Hours
Weight	All		198 7.0	g oz.

Feature Specifications

Parameter	Device	Min	Typ	Max	Unit
Output Voltage Rise Time (from 10 to 90% of final value)	All		20		ms
Delay from Input being applied to all outputs being in regulation	All		2000		ms
Output Overvoltage Protection	All	31.4		35	Vdc
Input Undervoltage lockout ²					
Turn-on Threshold	All	75	80	90	Vac
Turn-off Threshold	All	65	75	88	Vac

² The undervoltage lockout thresholds vary with output load current level – decreasing as the load goes down

CLP0228 Open Frame Power Supply
 90 - 264Vac input; 28Vdc output; 200W Output Power

Environmental Specifications

Parameter	Device	Specification/Test
Radiated Emissions	All	CISPR22 Class A with 3dB margin
Conducted Emissions	All	CISPR22 Class B with 3dB margin
ESD	All	IEC61000-4-2, Level 3
Radiated Susceptibility	All	IEC61000-4-3, Level 2
Electrical Fast Transient Common Mode	All	IEC61000-4-4, Level 3
Surge Immunity	All	IEC61000-4-5, Level 3
Conducted RF Immunity	All	IEC61000-4-6, Level 3
Input Voltage Dips	All	Output stays within regulation for either ½ cycle interruption or 25% dip from nominal line for 1 second
Input Harmonics	All	IEC61000-3-2
Shock and Vibration	All	IPC-9592B

Safety Specifications

Parameter	Device	Specification
Dielectric Withstand Voltage (between input and output)	All	Minimum of 4,250Vdc for 1 minute
Insulation Resistance (between input and output)	All	Minimum of 5 MΩ
Safety Standards	All	Class 1, IEC60950, EN60950, with the following deviations: Nemko, UL 60950 (Recognized Component), cUL (Canadian Approval by UL)

CLP0228 Open Frame Power Supply

90 - 264Vac input; 28Vdc output; 200W Output Power

Characteristic Curves

The following figures provide typical characteristics for the CLP0228 power supply

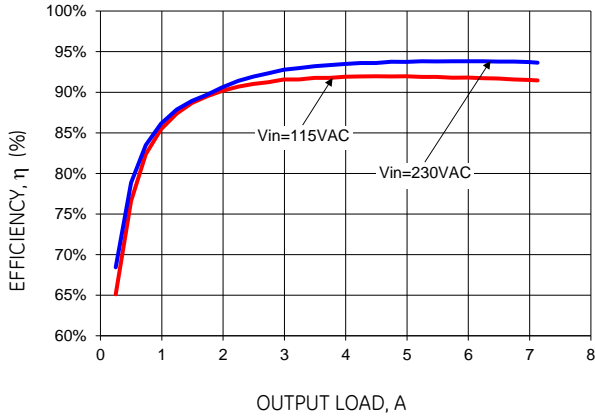


Figure 1. Power Supply Efficiency versus Output Current.

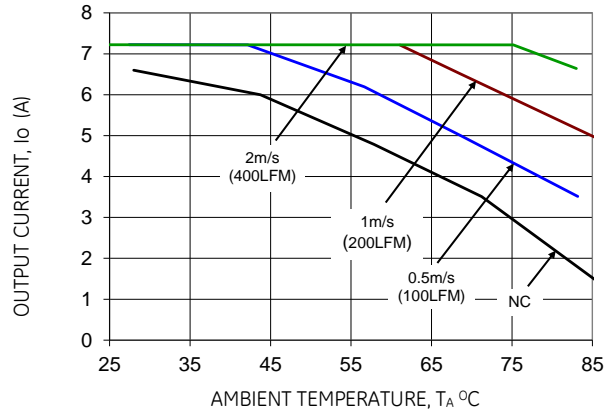


Figure 2. Derating Output Current versus Ambient Temperature and Airflow. Data shown for 115VAC in, at 230VAC in derating is the same or better. For derating at other input voltages, consult the GE Technical representative.

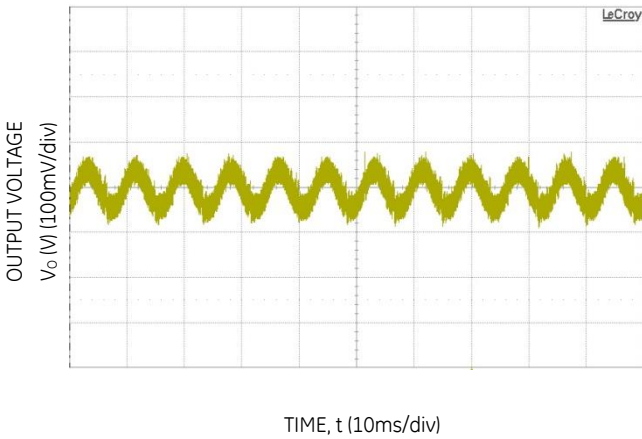


Figure 3. Typical output ripple and noise ($V_{IN} = 230\text{Vac}$, 100% load).

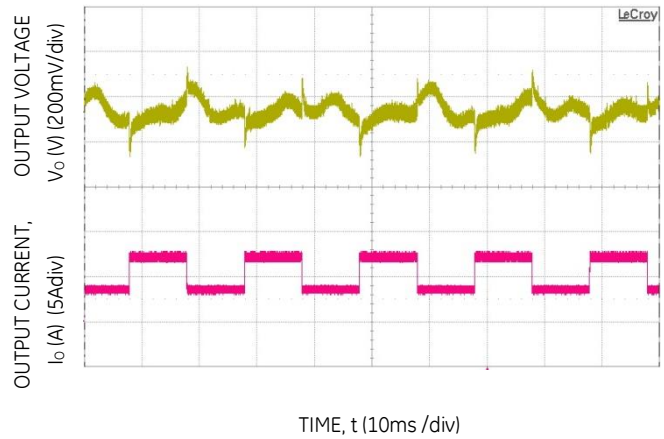


Figure 4. Transient Response to Dynamic Load Change from 50% to 100% at $V_{IN} = 230\text{Vac}$.

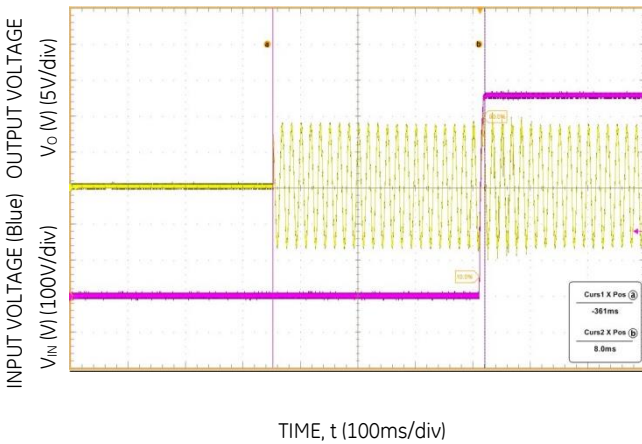


Figure 5. Typical Start-up ($V_{IN} = 115\text{Vac}$, Full Load).

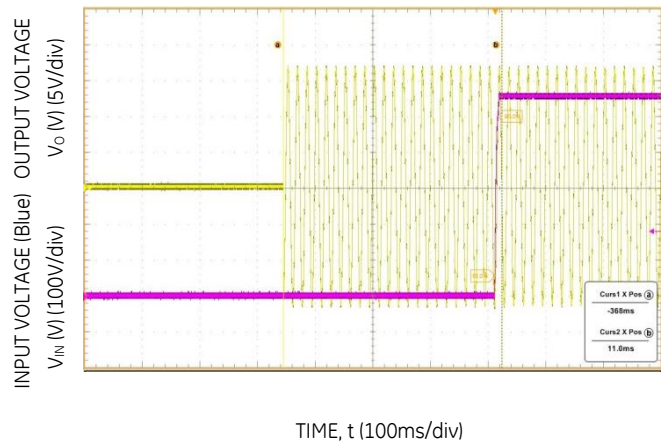


Figure 6. Typical Start-up ($V_{IN} = 230\text{Vac}$, Full load)

CLP0228 Open Frame Power Supply

90 - 264Vac input; 28Vdc output; 200W Output Power

Characteristic Curves (cont.)

The following figures provide typical characteristics for the CLP0228 power supply

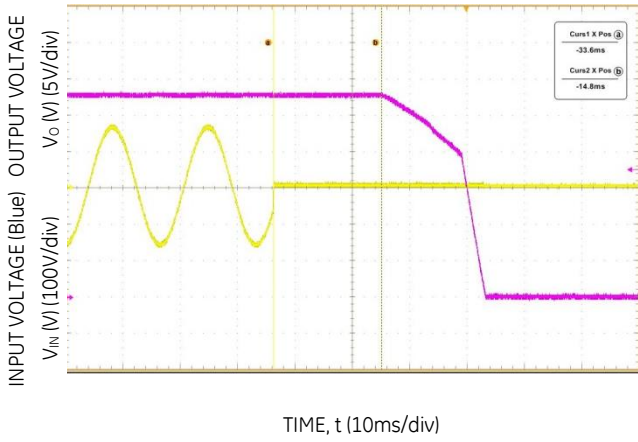


Figure 7. Typical Hold-up waveforms ($V_{IN} = 115V$, 100% load).

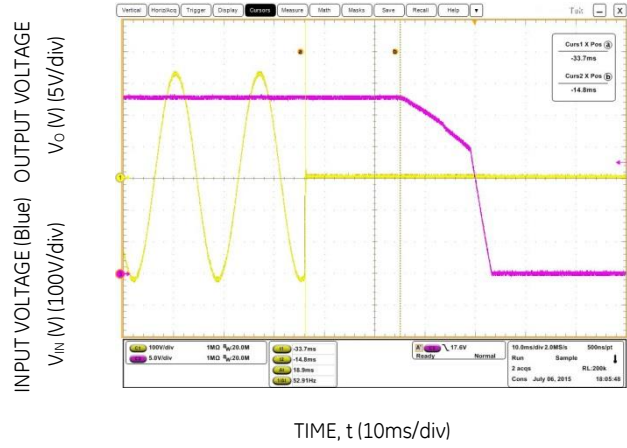


Figure 8. Typical Hold-up waveforms ($V_{IN} = 230V$, 100% load).

CLP0228 Open Frame Power Supply

90 - 264Vac input; 28Vdc output; 200W Output Power

Safety Considerations

The CLP0228 power supply is intended for inclusion in other equipment and the installer must ensure that it is in compliance with all the requirements of the end application. This product is only for inclusion by professional installers within other equipment and must not be operated as a stand-alone product. The power supply meets Class 1, IEC60950, EN60950, with the following deviations: Nemko. UL 60950 (Recognized Component) C-UL (Canadian Approval by UL).

Feature Descriptions

On/Off Considerations

The power supply output is available when the AC input is within operating range. No On/Off control is provided.

Output Voltage Adjustment

The output voltage can be adjusted between 26.6V and 29.4V using a potentiometer on the power supply.

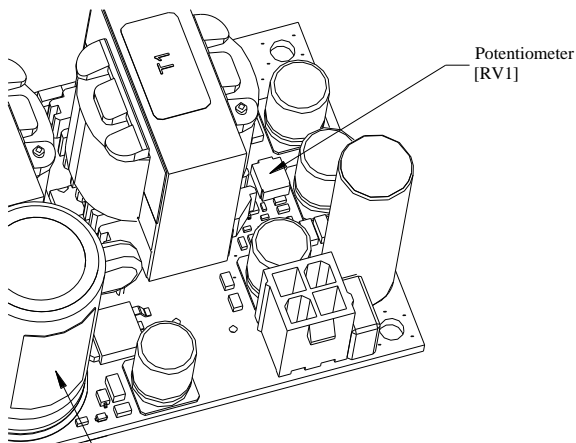


Fig. 9. Diagram showing location of the potentiometer used to adjust the power supply output voltage.

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 CLP0228 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 until the overvoltage condition is removed. It is necessary to recycle the input to restart the power supply when this protection is activated.

Overtemperature Protection

The CLP0228 also features overtemperature protection in order to provide additional protection in a fault condition. The

power supply 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 200W output with an ambient temperature of 75°C and 1m/s (200LFM) airflow, when input voltage is 115Vac. At 230Vac, the OTP kicks in at 80°C.

Input Undervoltage Lockout

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

CLP0228 Open Frame Power Supply

90 - 264Vac input; 28Vdc output; 200W Output Power

Thermal Considerations

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

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 in a wind tunnel.

Heat Transfer via Convection

Increased airflow through the power supply enhances the heat transfer via convection. Figure 11 shows the preferred airflow direction. Contact your GE technical representative for derating information in other airflow directions.

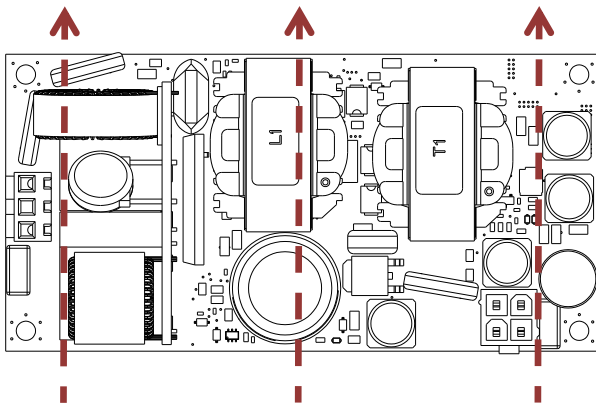


Fig. 10. Preferred airflow direction for cooling.

Operation In a Sealed Enclosure

The CLP0228 power supply can also be operated in a sealed enclosure provided proper means for removing heat from the power supply are used. Figure 11 shows an arrangement where a thermally conductive pad is used to transfer heat from the 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. Note that the Ambient Temperature shown in Table 1 is that outside the sealed enclosure, the CLP0228 may see higher ambient temperatures.

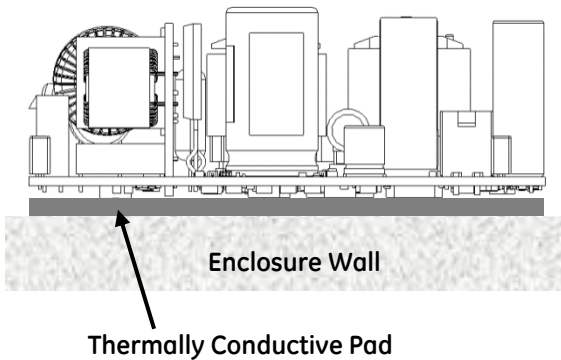


Fig. 11. Example arrangement of the CLP0228 for sealed enclosure applications.

Table 1. Output Power Capability when the CLP0228 is operated in a sealed enclosure with thermal pad for conduction cooling.

Ambient Temperature (°C)	Max. Output Power (W)
25	190
40	175
55	140

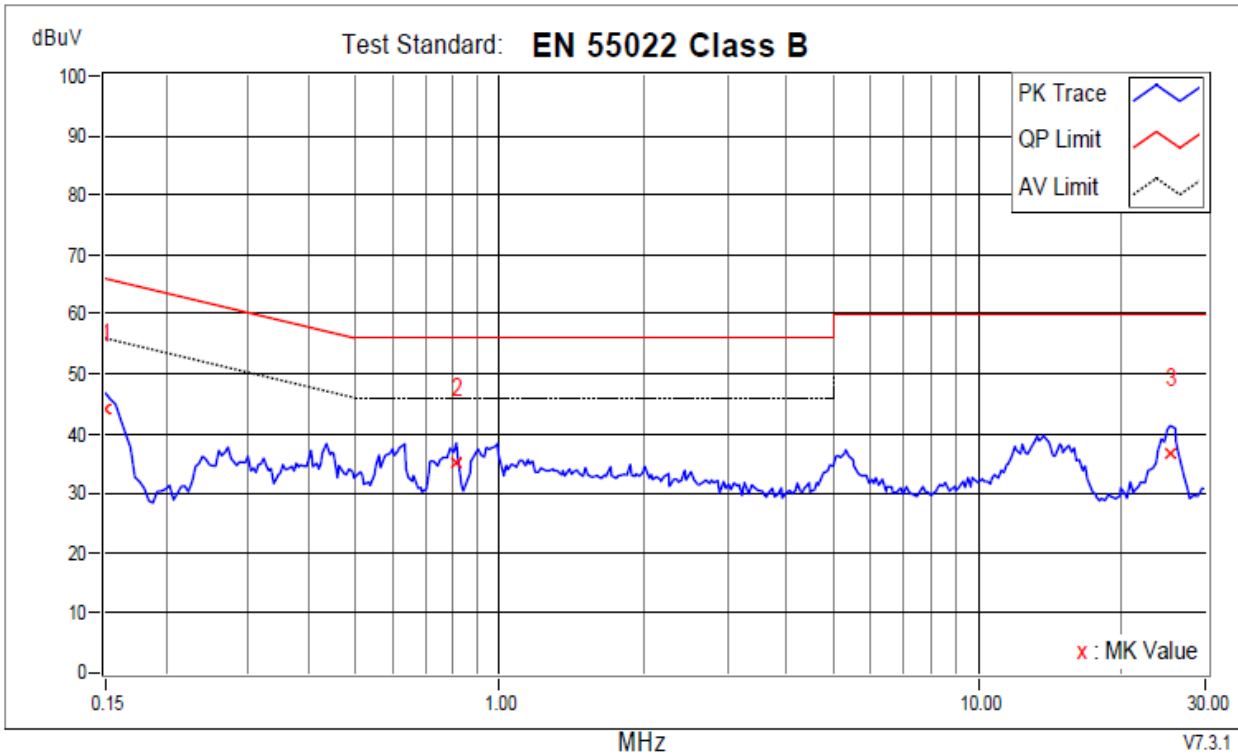
CLP0228 Open Frame Power Supply

90 - 264Vac input; 28Vdc output; 200W Output Power

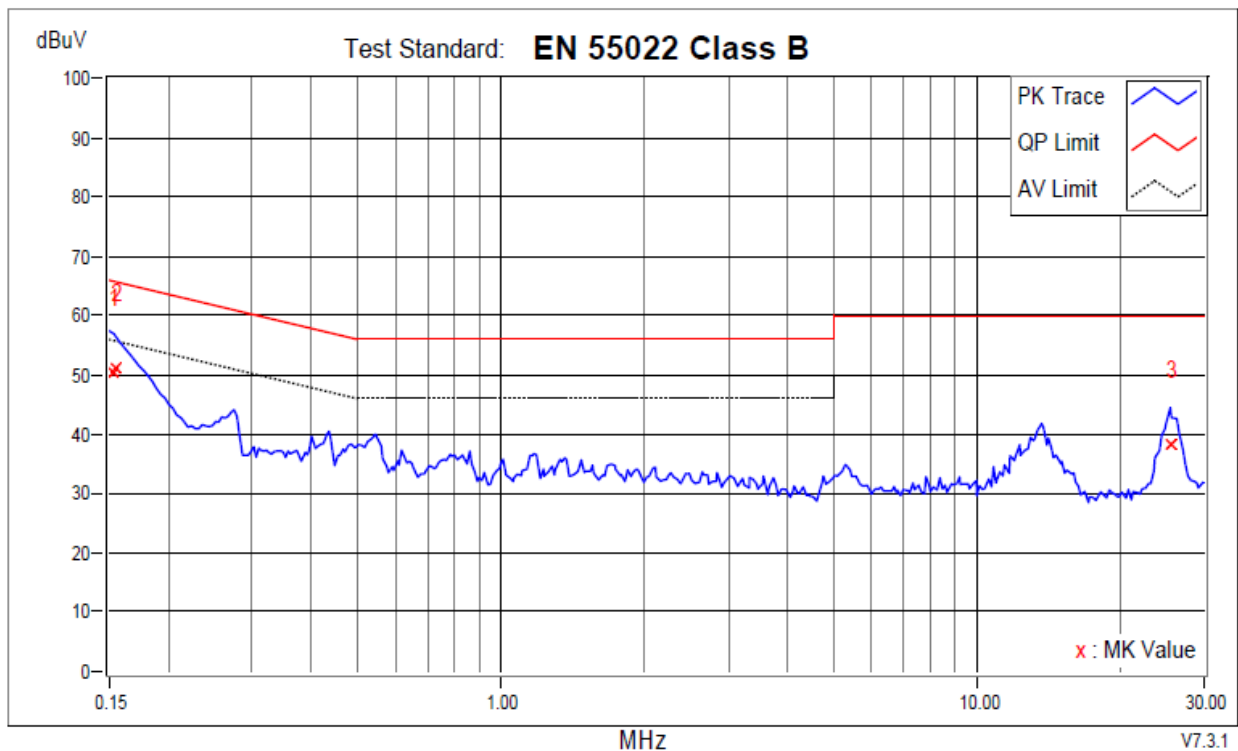
EMI performance

All CLP0228 power supplies are specified to meet conducted Class B EMI requirements per CISPR 22 (EN55022) with at least 3dB of margin. Results of tests conducted without any external filtering are shown below.

CLP0228FPXXZ01A (115VAC in, 28V @ 200W out, Negative of Output Grounded)



CLP0228FPXXZ01A (230VAC in, 28V @ 200W out, Negative of Output Grounded)

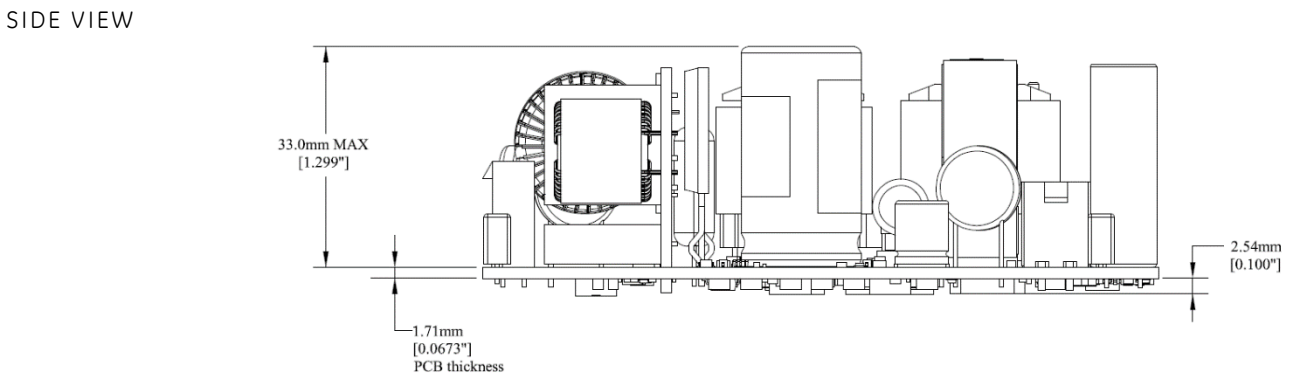
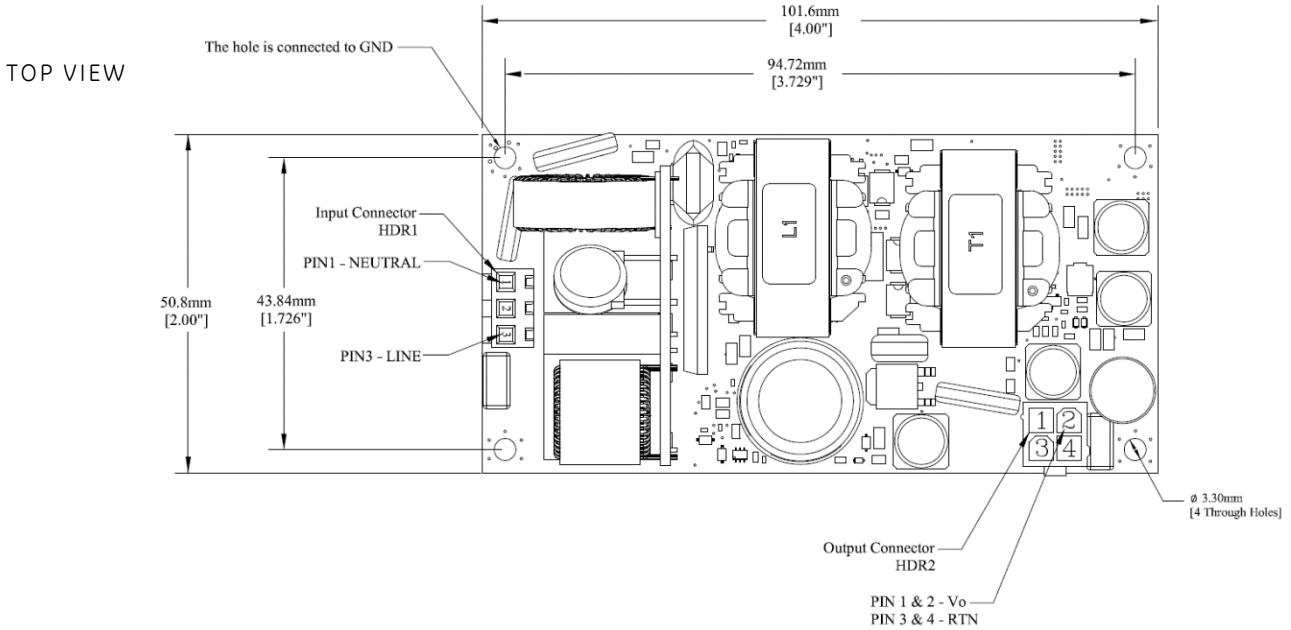


CLP0228 Open Frame Power Supply

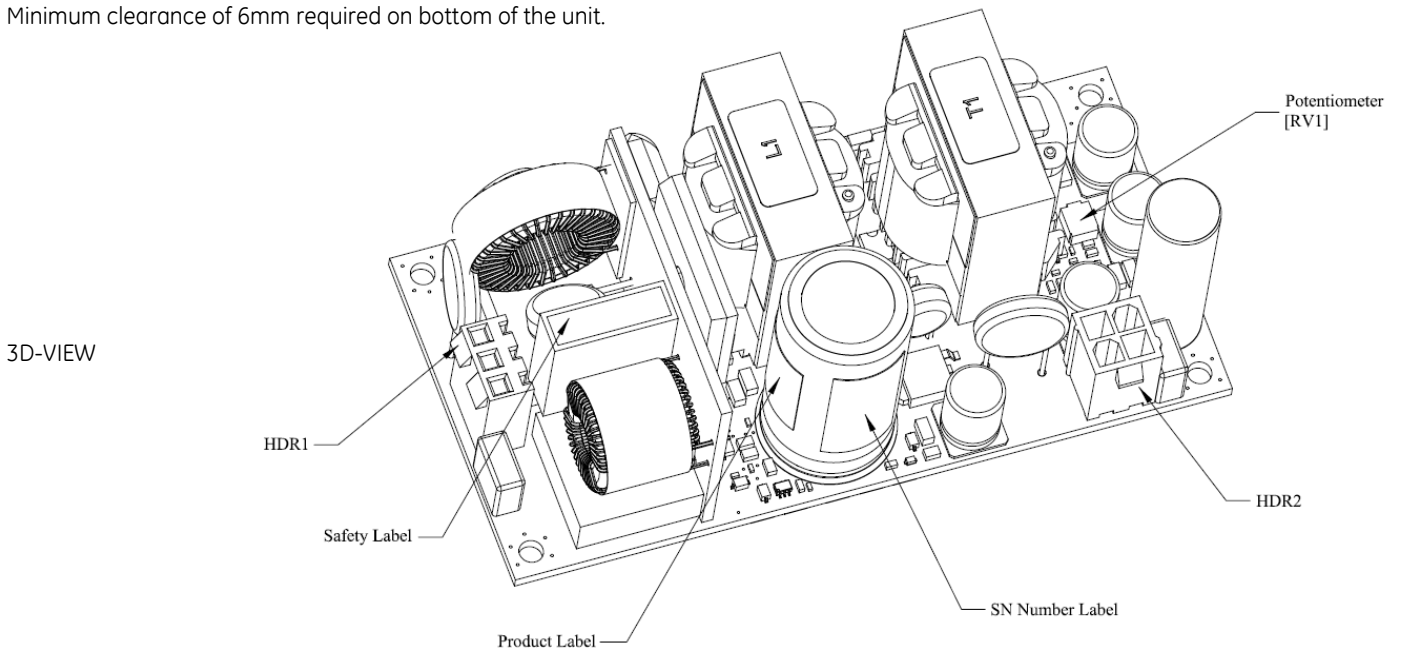
90 - 264Vac input; 28Vdc output; 200W Output Power

Mechanical Outline

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



Minimum clearance of 6mm required on bottom of the unit.



CLP0228 Open Frame Power Supply
 90 - 264Vac input; 28Vdc output; 200W Output Power

Connector Information

Connector	Connector on Power Supply	Mating Connector
AC Input Connector (HDR1)	Molex 26-50-3030	Molex 09-50-3031
DC Output Connector (HDR2)	Molex 39-28-8040	Molex 39-01-3048
DC Output Connector (HDR2) for Screw output terminal option	TE 282856-2	None needed

Pinout Information

AC Input Connector (HDR1)		DC Output Connector (HDR2) TE 282856-2 option		DC Output Connector (HDR2) Molex 39-28-8040 option	
Pin 1	Neutral	Pin 1	VO	Pin 1	VO
Pin 2	NC (removed)	Pin 2	RTN	Pin 2	VO
Pin 3	Line			Pin 3	RTN
				Pin 4	RTN

CLP0228 Open Frame Power Supply

90 - 264Vac input; 28Vdc output; 200W Output Power

Ordering Information

Please contact your GE Critical Power Sales Representative for pricing, availability and optional features.

Table 2. Device Codes

Device Code	Input Voltage Range	Output Voltage	Output Current	Output Connection	Temperature Range
CLP0228FPXXXZ01A	90 - 264Vac	28.0Vdc	7.14A	Connector	-40 to 85°C
CLP0228FPMXXZ01A	90 - 264Vac	28.0Vdc	7.14A	Screw Terminals	-40 to 85°C



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