CP2725AC48TEZ-FB Compact Power Line High Efficiency Rectifier

Input: 100-120/220-240 Vac; Output: 2725W[1] @ 52Vdc; 5 Vdc @ 4W

Applications

- Wide band power amplifiers

Features

- Efficiency 95%
- Compact 1RU form factor providing 30 W/in3
- 2725W @ 52V from nominal 220 – 240Vac
- 1200W from nominal 100 – 120Vac (for V_o > 42Vdc)
- Output voltage programmable from 18V – 53Vdc
- PMBus compliant dual I²C and RS485 serial busses
- Power factor correction (meets EN/IEC 61000-3-2 and EN 60555-2 requirements)
- Output overvoltage and overload protection
- AC Input overvoltage and undervoltage protection
- Over-temperature warning and protection
- Redundant, parallel operation with active load sharing
- Redundant +5V Aux power
- Remote ON/OFF
- Hot insertion/removal (hot plug)
- Four front panel LED indicators
- UL* Recognized to UL60950-1, CAN/ CSA† C22.2 No. 60950-1, and VDE‡ 0805-1 Licensed to IEC60950-1
- CE mark meets 2006/95/EC directive§
- Internally controlled Variable-speed fan
- RoHS 6 compliant
- Special Foldback Curve

Description

The CP2725AC48TEZ-FB Rectifier has an extremely wide programmable output voltage capability and fold-back current limiting features. High-density front-to-back airflow is designed for minimal space utilization and is highly expandable for future growth. This custom rectifier incorporates both RS485 and dual-redundant I²C communications busses that allow it to be used in a broad range of applications. Feature set flexibility makes this rectifier an excellent choice for a set of applications requiring operation over a wide output voltage range.

* 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.
§ This product is intended for integration into end-user equipment. All the required procedures for CE marking of end-user equipment should be followed. (The CE mark is placed on selected products.)
** ISO is a registered trademark of the International Organization of Standards.

[1] High line operation. The unit current limits below 52V and therefore the available output power below 52V operation is reduced.

imagination at work

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CP2725AC48TEZ-FB Rectifier

Input: 100-120/220-240 Vac; Output: 2725W[1] @ 52Vdc; 5 Vdc @ 4W

Electrical Specifications

Input					
Parameter	**Min**	**Typ**	**Max**	**Units**	**Notes**
Startup Input Voltage Low-line Operation High-line Operation Operating Voltage Range Low-line Configuration High-line Configuration Surges (no damage)	 90 200 305	 100, 110, 120 220 - 240	 90 200 140 265	Vac	
Input Frequency	47		66	Hz	
Input Current			12 13.5	A	At 110 Vac At 240 Vac
Inrush Transient		25	30	Apk	Measured at 25°C for all line conditions; does not include X-Capacitors charging.
Input Leakage Current		2.5	3.5	mA	Measured at 265Vac, 60Hz
Power Factor	0.96	0.98			From 50% to 100% (2725W @ HL, 1200W @ LL). load
Efficiency[2] 20 – 90% of FL	93	95		%	With or'ing function, aux 5V output, dual/redundant I²C and RS485 communications and POE isolation
Efficiency[2] >38V	85			%	>20% load Test condition: input; 240Vac, 60hz, output; 52Vdc
Holdup		20 30		ms	48Vdc, Measurement starts at zero crossing of the ac voltage, and voltage decayed to 40V. ← For loads below 1200W.
Ride thru	1/2	1		cycle	Tested at nominal 115V and 230V . Complies to CISPR24 standards
Power Fail Warning[3]	3	5		ms	Alarm issued via PFW signal going LO 5 ms prior to the main output decaying below 40Vdc.

Main Output					
Parameter	**Min**	**Typ**	**Max**	**Units**	**Notes**
Output Power	1200 2725			W	Above 52Vdc from nominal 90-120Vac upto 55°C. Above 52Vdc from nominal 200-265Vac upto 55°C
Default Set point		48		Vdc	Output floats with respect to frame ground.
Overall Regulation[4]	-1 -2		+1 +2	%	0 – 45C, minimum load 2.5A > 45C
Output Voltage Set Range	18		53	Vdc	Analog margining and RS485
	18		53	Vdc	Set by I²C
Output current	1 1		23 52.4	A	1200W @ 52V @ 90-120Vac. 2725W @ 52V @ 200-240Vac.

[2] At 52Vdc, 240Vrms and 25°C.
[3] Internal protection circuits may override the PFW signal and may trigger an immediate shutdown.
[4] Includes all variations due to specified load range, drift, and environmental conditions.

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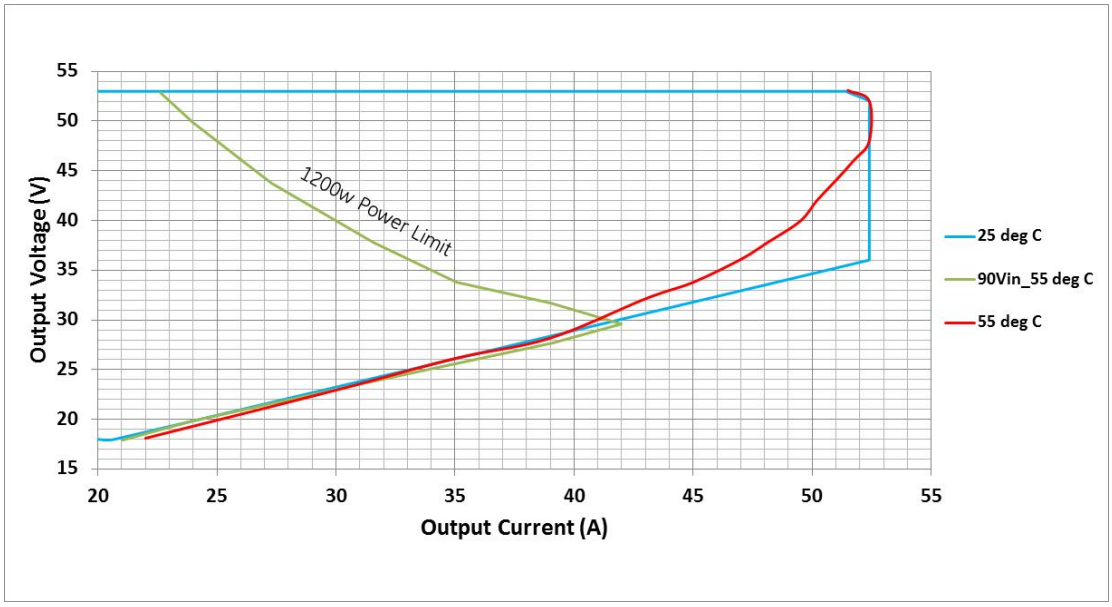
CP2725AC48TEZ-FB Rectifier

Input: 100-120/220-240 Vac; Output: 2725W[1] @ 52Vdc; 5 Vdc @ 4W

Electrical Specifications (continued)

Main Output (continued)						
Parameter		**Min**	**Typ**	**Max**	**Units**	**Notes**
Current Share	V_O > 42V V_O < 42V	-5 -10		5 10	%FL	Compared to the average output current delivered by a set of Rectifiers. Loads > 50% FL
Output Ripple RMS (5Hz to 20MHz) Peak-to-Peak (5Hz to 20MHz)			60	100 500	mVrms mVp-p	Measured with 20MHz bandwidth under any condition of loading. Minimum load is 1A.
External Bulk Load Capacitance		0		5,000	µF	External capacitance can be increased but the rectifier will not meet its turn-ON rise time requirement.
Turn-On Delay Rise Time - Standard (PMBus) -Telecom (RS-485)[5] Overshoot			 5 100 5	 2	 s ms s %	Monotonic Turn_On from 30% to 100% of Vnom above -5°C operation. Monotonic Turn_On from 60% to 100% of Vnom below -5°C operation.
Load Step Response ΔI ΔV Response Time			 2.0 2	50	 %FL Vdc ms	ΔI/Δt slew rate 1A/µs. Settling time to within regulation requirements. Minimum load of 2.5 amperes required.
Permissible Load Boundary	Power Limit – high line	2725			W	Down to 51Vdc
	Power limit – low line	1200			W	
	The overload current limit threshold should be set ≅ 5% above the load envelope shown here					
						
		Contract terms are for supporting all loads inside the load map. The customer will develop a control interface which maintains the operating voltage and current so as to not exceed the load map.				
	System Power Up	Units should be able to be plugged in one at a time and guarantee system start up. Units should stay in current limit for approximately 20 seconds to guarantee restart.				

[5] Below -5°C, the rise time is approximately 5 minutes to protect the bulk capacitors.

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CP2725AC48TEZ-FB Rectifier

Input: 100-120/220-240 Vac; Output: 2725W[1] @ 52Vdc; 5 Vdc @ 4W

Electrical Specifications (continued)

Main Output (continued)					
Over-voltage Delayed Immediate Latchoff			60 65	Vdc Vdc	200msec delayed shutdown to be implemented. Instantaneous shutdown above this point.
	Three restart attempts may be implemented within a one minute window prior to a latched shutdown				
Over-temperature Warning Shutdown Auto-recoverable		5 20		°C °C	Implemented prior to commencement of an OT shutdown Below the maximum rating of the device being protected
	Temperature hysteresis of approximately 10°C provided between shutdown and restart.				
Overcurrent events that exceed the envelope by 5% will hiccup continuously at a frequency of approximately once every 20 seconds. For voltage set-points below 42V, a tracking Under Voltage shutdown occurs at 2 volts below set-point. UV must exhibit for more than 1 second before shutdown. UV shutdown will exhibit the same 20 second hiccup behavior.					

Electrical Specifications (continued)

Auxiliary Output

Parameter	Min	Typ	Max	Units	Notes
Output Voltage Setpoint		5		Vdc	
Output Current	0.005		0.75	A	
Overall Regulation	-10		+5	%	Within ±5% when load is < 0.5A.
Ripple and Noise		50	100	mVpk-pk	20MHz bandwidth
Over-voltage Clamp			7	Vdc	
Over-current Limit	110		175	%FL	

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Environmental, EMC, Reliability Specifications

Environmental

Parameter	Min	Typ	Max	Units	Notes
Ambient Temperature Operating Derating	-40[6]	 1	 55 2	 °C °C	 Air inlet from sea level to 5,000 feet. Per 1,000 feet above 5,000 feet.
Storage Temperature	-40		85	°C	
Humidity	5		95	%	Relative humidity, non-condensing
Altitude	-60 -200		4000 13000	m ft	For operation above 2500m (5000 ft.), maximum operating temperature is derated by 2°C per 305m (1000 ft.).
Shock and Vibration					IPC9592 sections 5.2.8 – 5.2.13
Earthquake Rating	4			Zone	Per Telcordia GR-63-CORE, all floors, when installed in CP Shelf.
Acoustic Noise		55		dBA	Noise is proportional to fan speed, load and ambient temperature.
Harmonic Emissions	Per EN/IEC61000-3-2				
Radiated Emissions[7]	Exceeds FCC and CISPR22 (EN55022) - Class A by a 6dB margin				
Conducted Emissions - ac	Exceeds FCC and CISPR22 (EN55022) Class A Telcordia GR-1089-CORE - Class A by a 6dB margin				
ESD	Error free per EN/IEC 61000-4-2 Level 3 (6 kV contact discharge, 8 kV air discharge).				
Radiated Immunity	Error free per EN/IEC 61000-4-3 Level 3 (10 V/m).				
Electrical Fast Transient Burst	Error free per EN/IEC 61000-4-4 Level 3 (2 kV, 5 kHz repetition rate)				
Lightning Surge, Error Free Damage Free	EN/IEC61000-4-5 Level 4 (4 kV common mode, 2 kV differential mode). ANSI C62.41 Level A3 (6 kV common and differential mode)				
Line sags and interruptions	IPC9592A issued May 2010 ; 1 cycle interruption or 25% sag (115V, 230V – nominal for UUT) for 2 seconds the output shall stay above 40Vdc at full load. [Note: An input sag below 80V may cause an immediate shutdown.]				
Conducted Immunity	Error free per EN/IEC 61000-4-6 Level 3 (10Vrms).				
Reliability (calculated)		450,000		Hours	At ambient of 25°C at full load per Telcordia SR-332, issue 2, Reliability Prediction for Electronic Equipment, Method I Case III.
Isolation Input-Chassis/Signals Input - Output Output-Chassis Output-Chassis/Signals	 1500 3000 500 2250			 Vrms Vrms Vdc Vdc	 Per EN60950. Consult factory for testing to this requirement Internal Lineage standard, GR_947 POE compliant Rectifier, Per IEEE802.3.
Service Life		10		Years	25°C ambient, full load excluding fans.

[6] Designed to start and work at an ambient as low as -40°C, but may not meet operational limits until above -5°C

[7] Radiated emissions compliance was met using a Lineage Power shelf. This shelf includes output common and differential mode capacitors that assist in meeting compliance.

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Status and Control

The Rectifier provides three means for monitor/control: analog RS485or I²C.

Details of analog controls are provided in this Technical Requirements under Signal Definitions. GE Energy will provide separate application notes on the RS485 and I²C protocol for users to interface to the CPL RECTIFIERs. Contact your local GE Energy representative for details.

Hot Plug

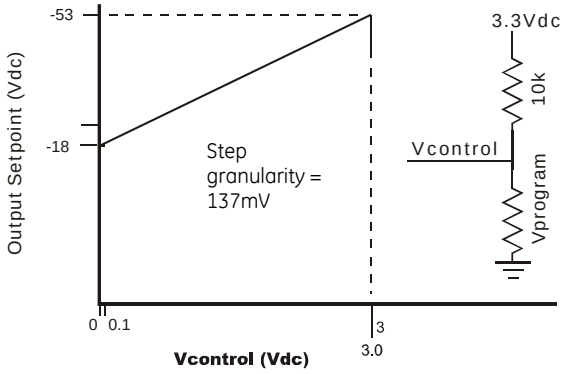
The Rectifier is designed to accommodate rapid extraction and reinsertion into either RS485 or I²C based protocol configurations as set by the *protocol* pin. The protocol state of the Rectifier shall reset immediately after disengagement from the mating connector and the Rectifier will configure itself to the state set by the *protocol* pin upon reinsertion.

Control Definitions

All signals are referenced to Logic_GRD unless otherwise noted. See the Signal Definitions Table at the end of this document for further description of all the signals.

Input Signals

Margining: Set point of the Rectifier can be changed via this input pin. Programming can be either a voltage source or a resistance divider. The margining pin is connected to 3.3Vdc via a 10kΩ resistor inside the Rectifier. See graphs below.



An open circuit on this pin reverts the voltage level back to the original setting of 48V

Software commanded margining overrides the hardware set point indefinitely or until the default setting is reinstated for example if input power and bias power have been removed from the module.

Module Present Signal: This signal has dual functionality. It can be used to alert the system when a module is inserted. A 500Ω resistor is present in series between this signal and Logic_GRD. An external pull-up should not raise the voltage on the pin above 0.25Vdc. Above 1Vdc, the write_protect feature of the EEPROM is enabled.

Protocol Select: Establishes the communications mode of the rectifier, between analog/I²C and RS485 modes. For RS485, connect 10kΩ pull-down resistor to 54_OUT(-DC).

Enable: On/Off control when I²C communications are utilized as configured by the Protocol pin. This pin must be pulled low to turn **ON** the rectifier. The rectifier will turn **OFF** if either the **Enable** or the **ON/OFF** pin is released. This signal is referenced to Logic_GRD. This function is not supported in RS485 mode.

ON/OFF: This is a short pin utilized for hot-plug applications to ensure that the rectifier turns **OFF** before the power pins are disengaged. It also ensures that the rectifier turns **ON** only after the power pins have been engaged. Must be connected to V_OUT (-DC).

Output Signals

Power Capacity: A HI on this pin indicates that the rectifier delivers high line rated output power; a LO indicates that the rectifier is connected to low line configured for 1200W operation.

Power Fail Warning: This signal is HI when the main output is being delivered and goes LO for the duration listed in this data sheet prior to the output decaying below the voltage level listed in this data sheet.

Alert #: I²C interrupt signal.

Fault: This signal goes LO for any failure that requires Rectifier replacement. Some of these faults may be due to:

- Fan failure, OT shutdown, OV shutdown, Internal fault

RS485 mode default: When the unit is powered ON in RS-485 mode the default operational state is powered ON. An RS-485 mode unit shall go to remote standby for any of the following conditions: Interlock Open, or loss of AC.

RS485 mode rise time: When the unit is powered ON in RS485 mode the rise time defaults to load current walk-in. The rise time can be configured to be rapid turn-ON independent of the load profile.

Fan Speed Control: The fan speed can be instructed to turn faster than what is required by the power supply using either the RS485 or I²C protocols. The RS485 command for this feature is:

Name	Cmd	Data Bytes	Type	Notes
Min_speed	3Bh	01h	Uchar	00h: 0% default 64h: 100%

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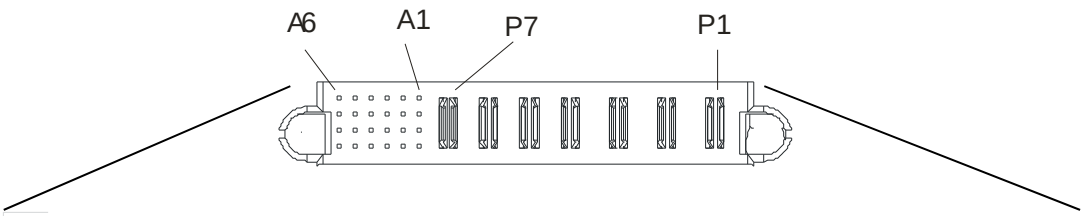
Alarm Table

	Power Supply LED State					Monitoring Signals (Referenced to Logic_GRD)			
Condition	**AC OK** Green	**DC OK** Green	**Service** Amber	**Fault** Red		**Fault**	**OTW**	**PFW**	**Module Present**
OK	1	1	0	0		HI	HI	HI	LO
Thermal Alarm (5C before shutdown)	1	1	1	0		HI	LO	HI	LO
Thermal Shutdown	1	0	1	1		LO	LO	LO	LO
Defective Fan	1	0	0	1		LO	HI	LO	LO
Blown AC Fuse in Unit	1	0	0	1		LO	HI	LO	LO
No AC <15mS (single unit)	0	1	0	0		HI	HI	LO[3]	LO
AC Present but not within limits	Blinks	0	0	0		HI	HI	LO	LO
AC not present[1]	0	0	0	0		HI	HI	LO	LO
Boost Stage Failure	1	0	0	1		LO	HI	LO	LO
Over Voltage Latched Shutdown	1	0	0	1		LO	HI	LO	LO
Over Current	1	Blinks	0	0		HI	HI	LO	LO
Non-catastrophic Internal Failure[2]	1	1	0	1		LO	HI	HI	LO
1 Missing Module									HI[4]
Standby (remote)	1	0	0	0		HI	HI	LO	LO
Service Request (PMBus mode)	1	1	Blinks	0		HI	HI	HI	LO
Communications Fault (RS485 mode)	1	1	0	Blinks		HI	HI	HI	LO

[1] This signal is correct if the Rectifier is back biased from other Rectifiers in the shelf .
[2] Any detectable fault condition that does not result in the power supply shutting down. For example, ORing FET failure, boost section out of regulation, etc.
[3] Signal transition from HI to LO is output load dependent
[4] Signal must be pulled HI external to the module

Output Connector

Mating Connector: right angle PWB mate – all pins: AMP 1450572-1, right angle PWB mate except pass-thru input power: AMP 6450378-1



Manufacturer part numbers: FCI 51939-568

	SIGNAL						OUTPUT POWER				INPUT POWER		
	6	5	4	3	2	1	P7	P6	P5	P4	P3	P2	P1
A	SCL_0	MOD_PRES	PFW	LOGIC_GRD	RS_485+	UNIT_ADDR							
B	SCL_1	OTW	Alert#_0	Alert#_1	RS_485-	8V_INT	V_OUT	V_OUT	V_OUT	V_OUT	EARTH	LINE-2	LINE-1
C	SDA_0	Margin	Enable	Reset	Ishare	Protocol	(-)	(+)	(+)	(-)	(GND)	(Neutral)	(HOT)
D	SDA_1	Fault	5VA	Power_Cap	ON/OFF	SHELF_ADDR							

Note: Connector is viewed from the rear positioned inside the rectifier
Signal pins columns 1 and 2 are referenced to V_OUT (–)
Signal pins columns 3 through 6 are referenced to Logic GRD
Last to make-first to break shortest pin
Earth — First make-last to break longest pin implemented in the mating connector

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CP2725AC48TEZ-FB Rectifier

Input: 100-120/220-240 Vac; Output: 2725W[1] @ 52Vdc; 5 Vdc @ 4W

Signal Definitions

All hardware alarm signals (Fault, PFW, OTW, Power Capacity) are open drain FETs. These signals should be pulled HI to either 3.3V or 5V. Maximum sink current 5mA. An active LO signal (< 0.4Vdc) state. All signals are referenced to Logic GRD unless otherwise stated. Contact your Lineage Power representative for more details.

Function	Label	Type	Description
Output Enable	Enable	Input	If shorted to LOGIC_GRD, the Rectifier output is enabled when using I²C mode of operation. May also be toggled to reset a latched OFF Rectifier. Function not available in RS485 mode.
Power Fail Warning	PFW	Output	An open drain FET; normally HI, indicating output power is present. Changes to LO at least 5msec before the output voltage decays below 40Vdc.
I²C Interrupt	Alert#_0 Alert#_1	Output	Interrupt signal via I²C lines indicating that service is requested from the host controller. This signal pin is pulled up to 3.3V via a 10kΩ resistor and switches to active LO when an interrupt occurs.
Rectifier Fault	Fault	Output	Indicates that an internal fault exists. An open drain FET; normally HI, changes to LO.
Module Present	MOD_PRES	Output	Short pin, see Status and Control description for further information on this signal.
ON/OFF	ON/OFF	Input	Short pin, connects last and breaks first; used to activate and deactivate output during hot-insertion and extraction, respectively. Ref: Vout (-)
Protocol select	Protocol	Input	See Status and Control description for further information on this signal. Ref: Vout (-).
Margining	Margin	Input	Allows changing of output voltage through an analog voltage input or via resistor divider.
Over-Temperature Warning	OTW	Output	An open drain FET; normally HI, changes to LO approximately 5°C prior to thermal shutdown.
Power Capacity	POWER_CAP	Output	Open drain FET; Used to indicate Rectifier operation mode; HI indicates 2725W operation and LO indicates 1200W operation.
Rectifier address	Unit_addr	Input	Voltage level addressing of Rectifiers within a single shelf. Ref: Vout (-).
Shelf Address	Shelf_addr	Input	Voltage level addressing of Rectifiers within multiple shelves. Ref: Vout (-).
Back bias	8V_INT	Bi-direct	Diode OR'ed 8Vdc drain; used to back bias microprocessors and DSP of failed Rectifier from operating Rectifiers. Ref: Vout (-).
Mux Reset	Reset	Input	Resets the I²C lines to I²C line 0.
Standby power	5VA	Output	5V at 0.75A provided for external use by either adjacent power supplies or the using system.
Current Share	Ishare	Bi-direct	A single wire interface between each of the power unit forces them to share the load current. Ref: Vout (-).
I²C Line 0	SCL_0, SDA_0	Input	I²C line 0.
I²C Line 1	SCL_1, SDA_1	Input	I²C line 1.
I²C Interrupt	Alert#_0, Alert#_1	Output	Goes active LO
RS485 Line	RS_485+ RS_485-	Bi-direct	RS485 line.

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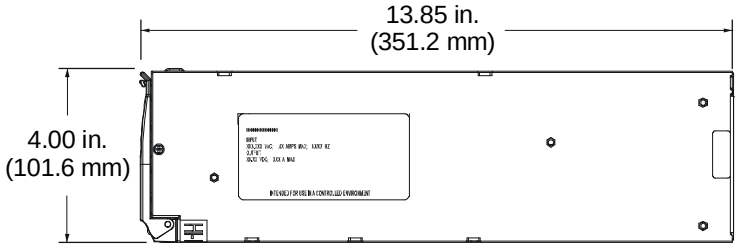
CP2725AC48TEZ-FB Rectifier

Input: 100-120/220-240 Vac; Output: 2725W[1] @ 52Vdc; 5 Vdc @ 4W

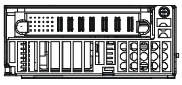
Front Panel LEDs

	Analog Mode	I²C Mode	RS485 Mode
☐~	←	**ON:** Input ok **Blinking:** Input out of limits	→
☐⎓	←	**ON:** Output ok **Blinking:** Overload	→
☐🛠	**ON:** Over-temperature Warning	**ON:** Over-temperature Warning **Blinking:** Service	**ON:** Over-temperature Warning
☐ !	← **ON:** Fault →		**ON:** Fault **Blinking:** Not communicating

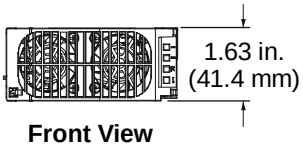
Dimensions



Top View



Rear View



Front View

Faceplate color shall be dark grey with a green hinge.

Physical

Packaged weight	5.4/2.45 lbs/kgs
Unpacked weight	4.8/2.18 lbs/kgs
Heat release	100 Watts or 341 BTUs @ 80% load, 153 Watts or 522 BTUs @ 100% load

Ordering Information

Item	Description	Comcode
CP2725AC48TEZ-FB	48Vdc @ 52.4A, 5Vdc @ 0.75A, RoHS 6/6	150030225

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Contact Us

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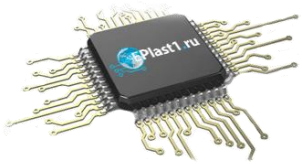
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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