CP2500AC54TE Compact Power Line High Efficiency Rectifier

Input: 100-120/200-277 Vac: Default Output: ±54 Vdc @ 2500W: 5 Vdc @ 4W



Applications

- 48Vdc distributed power architectures
- Routers/Switches
- VoIP/Soft Switches
- LAN/WAN/MAN applications
- File servers
- Indoor wireless
- Telecommunications equipment
- Enterprise Networks
- SAN/NAS/iSCSI applications

Features

- Efficiency 96.2%
- Compact 1RU form factor with 30 W/in³ density
- Constant power from 52 58Vdc
- 2500W from nominal 200 277Vac
- 1200W from nominal 100 120Vac
- Output voltage programmable from 42V 58Vdc
- PMBus compliant dual I²C and RS485 serial busses
- Isolated +5V Aux, signals and I²C communications
- 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
- 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

Description

The CP2500AC54TE Rectifier provides significant efficiency improvements in the Compact Power Line platform of Rectifiers. High-density front-to-back airflow is designed for minimal space utilization and is highly expandable for future growth. The standard product is provided with both RS485 and dual-redundant I²C communications busses that allow it to be used in a broad range of applications. These signals and the 5V auxiliary supply are isolated from the main output and frame ground. Feature set flexibility makes this rectifier an excellent choice for applications requiring modular ac-todc 48Vdc intermediate voltages, such as in distributed power.

- 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



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Electrical Specifications

Input Parameter	Min	Тур	Max	Units	Notes		
	MIII	тур	Mux	Ullits	Notes		
Startup Input Voltage Low-line Operation High-line Operation			90 185		CP2000AC54 Line Deraing		
Operating Voltage Range Low-line Configuration High-line Configuration	90 185	100, 110, 120 200 – 277	140 305	Vac	2400 y = 43.3Vin - 5078 2200 Equation for derating zone tolerance: ±5% 1800 1600 1400 1200 120 140 160 180 200		
Input Voltage Swell (no damage)	305				Vin (V)		
Input Frequency	47		66	Hz			
Input Current		10.9 12		А	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% load.		
Efficiency ¹ 30 – 90% of FL	94.5	96.2		%	With OR'ing function, aux 5V output, dual/redundant I ² C and RS485 communications and POE isolation		
		20			Measurement starts at zero crossing of the ac voltage		
Holdup Time		30		ms	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 ²	3	5		ms	Alarm issued via PFW signal going LO 5 ms prior to the main output decaying below 40Vdc.		

Main Output								
Parameter	Min	Тур	Max	Units	Notes			
Output Power	1200 2500 2000			W	At low-line input from nominal 100-120Vac. At high-line input from nominal 200-277Vac At nominal 277Vac and T _{amb} > 45°C			
Default Set point		54		Vdc	Output floats with respect to frame ground.			
Overall Regulation ³	-1 -2		+1 +2	%	0 – 45C, minimum load 2.5A > 45C			
Output Voltage Set Range	44		58	Vdc	Analog margining.			
	42		58	Vdc	Set either by I ² C, RS485			
Output current	1 1 1		25 46.3/48 37/38.4	А	At 1200W, 54V @ 100-120Vac. At 2500W, 54V/52V @ 200-240Vac. At 2000W, 54V/52V @ 277Vac and T _{amb} > 45°C.			

 $^{^{\, 1}}$ At 240Vrms and 25°C. See efficiency curves at the end of this document.

² Internal protection circuits may override the PFW signal and may trigger an immediate shutdown.

³ Includes all variations due to specified load range, drift, and environmental conditions.

CP2500AC54TE CPL High Efficiency Rectifier Input: 100-120/200-277 Vac; Default Output: ±54 Vdc @ 2500W; 5 Vdc @ 4W

Electrical Specifications (continued)

Main Output (co	ntinued)						
	Parameter	Min	Тур	Max	Units	Notes	
Current Share		-5		5	%FL	Compared to the average output current delivered by a set of rectifiers. Valid for loads > 50% of FL	
Proportional Currer	nt Share		<7		%FL	Among CP Rectifiers of different output capacities. Loads > 50% of FL	
Output Ripple RMS (5Hz to 20MHz) Peak-to-Peak (5Hz to 20MHz) Psophometric Noise				100 250 ⁴ 9 ⁵	mVrms mVp-p mVrms	Measured with 20MHz scope 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 may not meet its turn-ON rise time requirement.	
Turn-On Delay Rise Time¹ - Standard (PMBus) -Telecom (RS-485)6 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 Respons ΔI ΔV , $V_{AC} < 285_{AC}$ ΔV , $V_{AC} \ge 285_{AC}$ Response Time			2.0 3.2 2	50	%FL V _{DC} V _{DC} ms	dl/dt (output current slew rate) 1A/µs. Settling time to within regulation requirements. Minimum load of 2.5 amperes required.	
Overload	Power Limit – high line	2500			W	Down to 52Vdc	
_	Power limit – low line	1200			W		
_	Current limit > 41.5V _o ⁷ - HL	51		55.7	Adc	Hiccup mode with a 10% duty cycle enabled below 39Vdc.	
_	Current limit < 41.5V ₀ ⁵ - HL	36			Adc	Latched mode current limit optional. (FL = 48A @ 52V)	
	Current limit - LL	26			Adc		
_	System Power Up	Units she stay in c	ould be a urrent lim	ble to be nit for ap	plugged in or proximately 2	ne at a time and guarantee system start up. Units should 0 seconds to guarantee restart.	
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			5		°C	Implemented prior to commencement of an OT shutdown	
Shutdown			20		°C	Below the maximum rating of the device being protected	
Auto-recoverable	e	Temperature hysteresis of approximately 10°C provided between shutdown and restart.					

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^{4 500}mVp-p above 280Vrms

 $^{^{\}rm 1}$ Complies with GR947 which calls for a minimum rise time proportional to output load.

² Complies with ANSI TI.523-2001 section 4.9.2 emissions max limit of 20mV flat unweighted wideband noise limits

 $^{^{\}rm 6}$ Below -5°C, the rise time is approximately 5 minutes to protect the bulk capacitors.

⁷ Above 275V input, the current limit point changes at 45V. There is a 30 second delay prior to shifting to the lower limit.

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Electrical Specifications (cor	ntinued)							
Auxiliary Output								
Parameter	Min	Тур	Max	Units	Notes			
Output Voltage Setpoint		5		Vdc				
Output Current	0.005		0.75	Α				
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				

Environmental, EMC, Reliability Specifications **Environmental** Units **Parameter** Min Typ Max **Notes Ambient Temperature** Operating -408 55⁹ °C Air inlet from sea level to 5.000 feet. Derating °C Per 1,000 feet above 5,000 feet. 1 2 °C 75 **Extended Operating Temperature** 55 With 2%/°C power derating above 55°C. Storage Temperature -40 85 °C Humidity 5 95 % Relative humidity, non-condensing For operation above 2500m (5000 ft.), maximum operating -60 4000 m Altitude 13000 -200 ft temperature is derated by 2°C per 305m (1000 ft.). Shock and Vibration IPC9592 sections 5.2.8 - 5.2.13 Earthquake Rating 4 Per Telcordia GR-63-CORE, all floors, when installed in CP Shelf. Zone Acoustic Noise dBA Noise is proportional to fan speed, load and ambient temperature. Harmonic Emissions Per EN/IEC61000-3-2 Radiated Emissions¹⁰ Exceeds FCC and CISPR22 (EN55022) - Class A Exceeds FCC and CISPR22 (EN55022) Class A Conducted Emissions - ac Telcordia GR-1089-CORE - Class A by a 3dB margin 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). Error free per EN/IEC 61000-4-4 Level 3 (2 kV, 5 kHz repetition rate) **Electrical Fast Transient Burst** EN/IEC61000-4-5 Level 4 (4 kV common mode, 2 kV differential mode). Lightning Surge, Error Free ANSI C62.41 Level A3 (6 kV common and differential mode) Damage Free IPC9592A issued May 2010; 1 cycle interruption or 25% sag (115V, 230V – nominal for UUT) for 2 seconds the Line sags and interruptions 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). At ambient of 25°C at full load per Telcordia SR-332, issue 2, Reliability (calculated) 450,000 Hours Reliability Prediction for Electronic Equipment, Method I Case III. Isolation Input-Chassis/Signals 1500 Vrms Per EN60950. Input - Output 3000 Consult factory for testing to this requirement Vrms 500 Internal Lineage standard, GR 947 **Output-Chassis** Vdc POE compliant Rectifier, Per IEEE802.3. Output-Chassis/Signals 2250 Vdc

⁸ Designed to start and work at an ambient as low as -40°C, but may not meet operational limits until above -5°C

⁹ Output power is derated to 2kW for temperatures higher than 45°C and input voltages higher than 285Vrms.

¹⁰ 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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Service Life 10	Years 25°C ambient, full load excluding fans.	
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Status and Control

The Rectifier provides two means for monitor/control: analog or I^2C .

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

Hot Plug

When rapidly extracting and reinserting modules care should be taken to allow for discharging the internal bias supply so that a predictable restart could be achieved. The way to ensure that the circuit sufficiently discharges is to observe the spinning of the fans after an extraction. The unit should not be reinserted until the fans stop spinning.

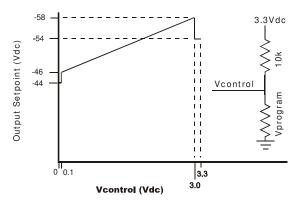
Without bleeding down internal bias the module may remember its last assigned address and may not configure itself properly if reinserted into another slot.

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 $10k\Omega$ resistor inside the Rectifier. See graphs below.



An open circuit on this pin reverts the voltage level back to the original setting.

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 $10k\Omega$ 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.

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_OK: This signal is HI when the main output is present and goes LO when the main output is not present.

Limit: This signal is HI when the main output is not in current limit and goes LO when current limit has activated.

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
- Over-temperature condition
- Over-temperature shutdown
- Over-voltage shutdown
- Internal Rectifier Fault

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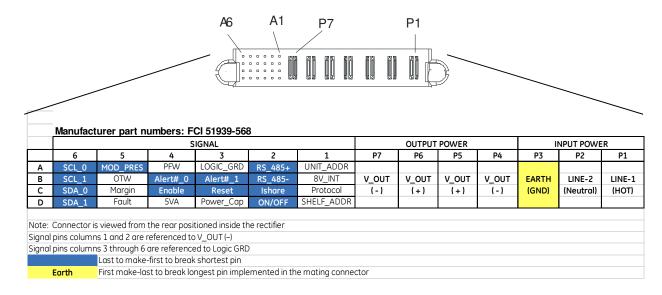
Alarm Table

	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
ОК	1	1	0	0	HI	HI	HI	LO
Thermal Alarm (5C before shutdown)	1	1	1	0	НІ	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	H	HI	HI	LO

 $^{^{}m 1}$ This signal is correct if the Rectifier is back biased from other Rectifiers in the shelf .

Output Connector

Mating Connector: right angle PWB mate - all pins: AMP 6450572-1, right angle PWB mate except pass-thru input power: AMP 6450378-1



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,

³ Signal transition from HI to LO is output load dependent

⁴ Signal must be pulled HI external to the module

GE

CP2500AC54TE CPL High Efficiency Rectifier Input: 100-120/200-277 Vac; Default Output: ±54 Vdc @ 2500W; 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	Туре	Description
Output Enable	Enable	Input	If shorted to LOGIC_GRD, the Rectifier output is enabled when using I ² C 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.
I ² C Interrupt	Alert#_0 Alert#_1	Output	Interrupt signal via I ² C lines indicating that service is requested from the host controller. This signal pin is pulled up to 3.3V via a $10k\Omega$ 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 2500W 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 I ² C lines to I ² C 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 (-).
I ² C Line 0	SCL_0, SDA_0	Input	I ² C line 0.
I ² C Line 1	SCL_1, SDA_1	Input	I ² C line 1.
I ² C Interrupt	Alert#	Output	Goes active LO
RS485 Line	RS_485+ RS_485-	Bi-direct	RS485 line.

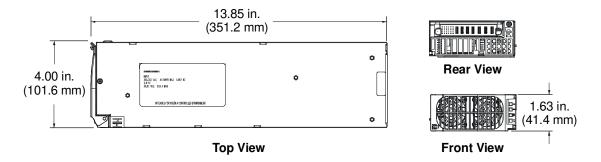
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CP2500AC54TE CPL High Efficiency Rectifier Input: 100-120/200-277 Vac; Default Output: ±54 Vdc @ 2500W; 5 Vdc @ 4W

Front Panel LEDs

	Analog Mode	I ² C 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
☐ !	← OI	N: Fault	ON: Fault Blinking: Not communicating

Dimensions



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

Data Sheet GE

CP2500AC54TE CPL High Efficiency Rectifier Input: 100-120/200-277 Vac; Default Output: ±54 Vdc @ 2500W; 5 Vdc @ 4W

Ordering Information

Item	Description	Comcode
CP2500AC54TEZ	54Vdc @ 50A, 5Vdc @ 0.75A, RoHS 6/6	
CP2500AC54TEZ-B	Same as above with a black faceplate	150037800

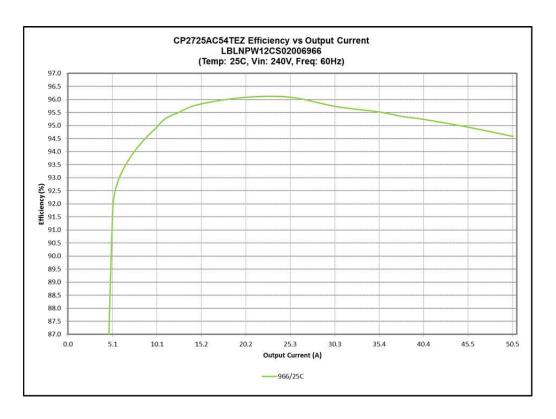
Accessories

Item	Description	Comcode
	Power supply interface board	150037482
	Isolated Interface Adapter Kit – interface between a USB port and the I ² C connector on the power supply interface board	150036482
To the financial control to the financial cont	Graphical User Interface download demonstrating the redundant I ² C capabilities of the power supply. The site below downloads the GE Digital Power Insight™ software tools, including the cpgui_I. When the download is complete, icons for the various utilities will appear on the desktop. Click on cpgui_I.exe program after the download is complete. http://apps.geindustrial.com/publibrary/checkout/Software% 7CCPSW-DPI%7Cgeneric	
	Graphical User Interface Manual; The GUI download created a directory Computer ➤ Windows7 (C:) ➤ DPI Suite ➤ In that	
	directory start the DPI_manual.pdf file.	

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Typical Efficiency





Contact Us

For more information, call us at

USA/Canada:

+1 888 546 3243, or +1 972 244 9288

Asia-Pacific:

+86.021.54279977*808

Europe, Middle-East and Africa:

+49.89.878067-280

India:

+91.80.28411633

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