CP2725AC54TE Compact Power Line High Efficiency Rectifier

100-120/200-277V_{AC} input; Default Outputs: ±54V_{DC} @ 2725W, 5V_{DC} @ 4W

Features

- Efficiency 96.2%
- Compact 1RU form factor with 30 W/in^3 density
- Constant power from 52 – 58V_{DC}
- 2725W from nominal 200 – 277V_{AC}
- 1200W from nominal 100 – 120V_{AC}
- Output voltage programmable from 42V – 58V_{DC}
- PMBus compliant dual I^2C and RS485 serial busses
- Isolated +5V Aux, signals and I^2C commu93 c3Oons
- Power factor correc3Oon (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
- Internally controlled Variable-speed fan
- 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§
- RoHS 6 compliant

Applications

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

Description

The CP2725AC54TE Rectifier provides significant efficiency improvements in the Compact Power Line platform of Rectifiers. High-g73.38 6210.0039.1 0

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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	Symbol	Min	Max	Unit
Input Voltage: Continuous	VIN	0	300	V_{AC}
Operating Ambient Temperature	TA	-10	75[1]	°C
Storage Temperature	Tstg	-40	85	°C
I/O Isolation voltage to Frame (100% factory Hi-Pot tested)			1500	V_{AC}

Electrical Specifications

Unless otherwise indicated, specifications apply over all operating input voltage, Vo=54V_{DC}, resistive load, and temperature conditions.

INPUT

Parameter	Symbol	Min	Typ	Max	Unit
Startup Input Voltage Low-line Operation High-line Operation	V_{IN}			90 185	V_{AC}
Operating Voltage Range Low-line Configuration High-line Configuration	V_{IN}	90 185	100 – 120 200 - 277	140 300	V_{AC}
Input Voltage Swell (no damage)		305			
Input Frequency	F_{IN}	47		66	Hz
Input Current; at 110V_{AC} at 240V_{AC}	I_{IN}		11.9 13.1		A_{AC}
Inrush Transient (at 25°C, excluding X-Capacitor charging)	I_{IN}		25	30	A_{PK}
Idle Power (at 220V_{AC}) 54V OFF 54V ON @ Io=0	P_{IN}		8.2 16		W
Input Leakage Current (265V_{AC}, 60Hz)	I_{IN}		2.5	3.5	mA
Power Factor (50 – 100% load)	PF	0.96	0.995		
Efficiency[2] (30 – 80% of FL, 240V_{AC} @ 25 C)		94.5	96.2		%
Holdup time (output allowed to decay down to 40V_{DC}) For loads below 1200W	T		20 30		ms
Ride thru (tested at 115V @ 230V. (Complies to CISPR24)	T	1/2	1		cycle
Power Fail Warning[3] (main output allowed to decay to 40V_{DC})	PFW	3	5		ms
Isolation (per EN60950) (consult factory for testing to this requirement) Input-Chassis/Signals Input - Output	V	 1500 3000			 V_{AC} V_{AC}

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Electrical Specifications (continued)

54V_{DC} MAIN OUTPUT

Parameter	Symbol	Min	Typ	Max	Unit
Output Power @ low line input 100 – 120V_{AC} @ high line input 200 – 277V_{AC} @ nominal 277Vac and T_{amb} > 45 C	W	1200 2725 2000			W_{DC}
Default Set point	V_{OUT}		54		V_{DC}
Overall regulation (load, temperature, aging) 0 - 45 C LOAD > 2.5A > 45 C		-1 -2		+1 +2	%
Output Voltage Set Range - analog margining - Set either by I^2C or RS485		44 42		58 58	V_{DC}
Output Current - @ 1200W (100 – 120Vac), 54V/52V @ 2725W (200 – 240V_{AC}), 54V/52V @ 2000W (> 277V_{AC} @ Tamb > 45 C), 54V/52V	I_{Out}	1 1 1		25/23 50.5/52.4 37/38.4	A_{DC}
Current Share (> 50% FL)		-5		5	%FL
Proportional Current Share between different rectifiers (> 50% FL)			<7		%FL
Output Ripple (20MHz bandwidth, load > 1A)					

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5V_{DC} Auxiliary output

Parameter	Symbol	Min	Typ	Max	Unit
Output Voltage Setpoint	V_{OUT}		5		V_{DC}
Overall Regulation		-10^{7}		+5	%
Output Current		0.005		0.75	A
Ripple and Noise (20mHz bandwidth)			50	100	mV_{p-p}

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100-1200-2 $_{AC}$ inpt; Defat Outputs: ±54V $_{DC}$ @ 2725W, 5V_{DC} @ 4W

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100-120/200-277V_{AC} input; Default Outputs: ±54V_{DC} @ 2725W, 5V_{DC} @ 4W

Environmental Specifications

Parameter	Min	Typ	Max	Units	Notes
Ambient Temperature	-40[12]		55[13]	°C	Air inlet from sea level to 5,000 feet.
Storage Temperature	-40		85	°C	
Operating Altitude			1524/5000	m / ft	

sunrise 11 (de) 4241.5( )459.5 3(5 8(505( )487.5( )5 13875dq651 (hp)88(A( ) 7265 (Fp38 u) 6 2lp)79(lp)8 1(lp)79(e0)1 6(a78 2dp)88(( )TJET71.94549 .42 .42

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100-120/200-277V_{AC}

Control and Status

The Rectifier provides three means for monitor/control: analog, PMBus™, or the GE Galaxy-based RS485 protocol.

Details of analog control and the PMBus™ based protocol are provided in this data sheet. GE will provide separate application notes on the Galaxy RS485 based protocol for users to interface to the rectifier. Contact your local GE representative for details.

Signal Reference

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

Logic_GRD is isolated from the main output of the power supply for PMBus communications. Communications and the 5V standby output are not connected to main power return (Vout(-)) and can be tied to the system digital ground point selected by the user. (Note that RS485 communications is referenced to Vout(-), main power return of the power supply).

Logic_GRD is capacitively coupled to Frame_GRD inside the power supply. The maximum voltage differential between Logic_GRD and Frame_GRD should be less than 100V_{DC}.

Control Signals

Enable: Controls the main 54V_{DC} output when either analog control or PMBus protocols are selected, 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. In RS485 mode this pin is ignored.

ON/OFF: This is a shorter 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 (-) for the rectifier to be ON.

Margining: The 54V_{DC} output can be adjusted between 44 – 58V_{DC} by a control voltage on the Margin pin. This control voltage can be generated either from an external voltage source, or by forming a voltage divider between 3.3V and Logic_GRD, as shown in Fig. 13. The power supply includes the high side pull-up 10kΩ resistor to 3.3V_{DC}. Connecting a resistor between the margin pin and Logic_GRD will complete the divider.

An open circuit, or a voltage level > 3.0V_{DC}, on this pin sets the main output to the factory default setting of 54V_{DC}.

Hardware margining is only effective until software commanded output voltage changes are not executed. Software commanded output voltage settings permanently override the hardware margin setting until power to the internal controller is interrupted, for example if input power or bias power is recycled.

The controller always restarts into its default configuration, programmed to set the output as instructed by the margin pin.
Su.1(inp1(.4()-1(Q).8(se Tw[(Sntg)7.6(s8 Tw[6( )-7.9Rec)4.(bet)6.3.4(m)9de)-7.p1(.4()-1e)--6.7( )-7.6(g).)9.2(f))7(e e)-4.7(de Tw[(Sdsid)8(e)-6.9.1(inp1(.4()-1tg)7.6(ec)4.(

Status 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 listed voltage level.

Fault: This signal goes LO for any failure that requires rectifier replacement. These faults may be due to:

- Fan failure
- Over-temperature warning
- Over-temperature shutdown
- Over-voltage shutdown
- Internal Rectifier Fault

Digital Feature Descriptions

PMBus™ compliance: The power supply is fully compliant to the Power Management Bus (PMBus™) rev1.2 requirements with the following exceptions:

The power supply continuously updates its STATUS and ALARM registers to the latest state in order to capture the 'present' state of the power supply. There are a number of indicators, such as those indicating a communications fault (PEC error, data error) that do not get cleared until specifically instructed by the host controller sending a clear_faults command. A 'bit' indicator notifies the user if the STATUS and ALARM registers changed since the last 'read' by the host controller.

For example, if a voltage surge causes a momentary shutdown for over voltage the power supply will automatically restart if the 'auto_restart' feature is invoked. During the momentary shutdown the power supply issues an Alert# indicating to the system controller that a status change has occurred. If the system controller reads back the STATUS and ALARM registers while the power supply is shut down it will get the correct fault condition. However, inquiry of the state of the power supply after the restart event would indicate that the power supply is functioning correctly. The STATUS and ALARM indicators did not freeze at the original shutdown state and so the reason for the original Alert# is erased. The restart 'bit' would be set to indicate that an event has occurred.

The power supply also clears the STATUS and ALARM registers after a successful read back of the information in these registers, with the exception of communications error alarms. This automated process improves communications efficiency since the host controller does not have to issue another clear_faults command to clear these registers.

Dual, redundant buses: Two independent I^2C lines provide true communications bus redundancy and allow two

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bit. To be certain that each power supply responded to the global instruction, a *READ* instruction should be executed to each power supply to verify that the command properly executed. The GLOBAL BROADCAST command should only be executed for write instructions to slave devices.

Note: The PCA9541 i2c master selector does not respond to the GLOBAL BROADCAST command.

Read back delay: The power supply issues the SMBAlert # notification as soon as the first state change occurred. During an event a number of different states can be transitioned to before the final event occurs. If a read back is implemented rapidly by the host a successive SMBAlert# could be triggered by the transitioning state of the power supply. In order to avoid successive SMBAlert# s and read back and also to avoid reading a transitioning state, it is prudent to wait more than 2 seconds after the receipt of an SMBAlert# before executing a read back. This delay will ensure that only the final state of the power supply is captured.

Successive read backs: Successive read backs to the power supply should not be attempted at intervals faster than every one second. This time interval is sufficient for the internal processors to update their data base so that successive reads provide fresh data.

Device ID: Address bits A2, A1, A0 set the specific address of the power supply. The least significant bit x (LSB) of the address byte configures write [0] or read [1] events. In a *write* command the system instructs the power supply. In a *read* command information is being accessed from the power supply.

Address Bit		
7	6	(u)-.3()-73835(El)-it

Invalid data
PEC error

Vout_Command (21h) : This command is used to change the output voltage of the power supply. Changing the output voltage should be performed simultaneously to all power supplies operating in parallel using the Global Address (Broadcast) feature. If only a single power supply is instructed to change its output, it may attempt to source all the required power which can cause either a power limit or shutdown condition.

Software programming of output voltage overrides the set point voltage configured during power_up. The program no longer looks at the 'margin pin' and will not respond to any hardware voltage setting. The default state cannot be accessed any longer unless power is removed from the DSP.

To properly hot-plug a power supply into a live backplane, the system generated voltage should get re-configured into either the factory adjusted firmware level or the voltage level reconfigured by the margin pin. Otherwise, the voltage state

Alarm-1

Bit	Title	Description
7	Unit in power limit	An overload condition that results in constant power
6	Primary fault	Indicates either primary failure or INPUT not present. Used in conjunction with bit-0 and Status_1 bits 2 and 5 to assess the fault.
5	Over temp. shutdown	One of the over_temperature sensors tripped the supply
4	Over temp warning	Temperature is too high, close to shutdown
3	In over current	Shutdown is triggered by low output voltage < 39V_{DC}.
2	Over voltage shutdown	
1	Vout out_of_limits	Indication the output is not within design limits. This condition may or may not cause an output shutdown.
0	Vin out_of_limits	The input voltage is outside design limits

LEDS test ON (D2h) : Will turn-ON simultaneously the four front panel LEDs of the Power supply sequentially 7 seconds ON and 2 seconds OFF until instructed to turn OFF. The intent of this function is to provide visual identification of the power supply being talked to and also to visually verify that the LEDs operate and driven properly by the micro controller.

LEDS test OFF (D3h) : Will turn-OFF simultaneously the four front panel LEDs of the Power supply.

Service LED ON (D4h) : Requests the power supply to *flash*-ON the Service (ok-to-remove) LED. The *flash* sequence is approximately 0.5 seconds ON and 0.5 seconds OFF.

Service LED OFF (D5h) : Requests the power supply to turn OFF the Service (ok-to-remove) LED.

Enable write (D6h) : This command enables write permissions into the upper ¼ of memory locations for the external EEPROM. A write into these locations is normally disabled until commanded through I^2C to permit writing into the protected area. A delay of about 10ms is required from the time the instruction is requested to the time that the power supply actually completes the instruction.

See the FRU-ID section for further information of content written into the EEPROM at the factory.

Disable write (D7h) : This command disables write permissions into the upper ¼ of memory locations for the external EEPROM.

Unit in Power Limit or in Current Limit: When output voltage is > 36V_{DC} the Output LED will continue blinking.
When output voltage is < 36V_{DC}, if the unit is in the RESTART mode, it goes into a hiccup. When the unit is ON the output LED is ON, when the unit is OFF the output LED is OFF.

When the unit is in latched shutdown the output LED is OFF.

Inhibit_restart (D8h) : The Inhibit-restart command directs the power supply to remain latched off for over_voltage, over_temperature and over_current. The command needs to be sent to the power supply only once. The power supply will remember the INHIBIT instruction as long as internal bias is active.

Restart after a lachoff: To restart after a latch_off either of four restart mechanisms are available. The hardware pin Enable may be turned OFF and then ON. The unit may be commanded to restart via i2c through the *Operation* command by first turning OFF then turning ON . The third way to restart is to remove and reinsert the unit. The fourth way is to turn OFF and then turn ON ac power to the unit. The fifth way is by changing firmware from latch off to restart. Each of these commands must keep the power supply in the OFF state for at least 2 seconds, with the exception of changing to restart.

A successful restart shall clear all alarm registers, set the restarted successful bit of the *Status_2* register.

A power system that is comprised of a number of power supplies could have difficulty restarting after a shutdown event because of the non-synchronized behavior of the individual power supplies. Implementing the latch-off mechanism permits a synchronized restart that guarantees the simultaneous resta3(h)]Th t
thes2..3rT*-E.5qiired.3( )7.41(i)-ea clh uttu8p. Wmd38.8(t)-1( )778(ng)-502h+ 1.9(ul)-std t -1.1692 TD-.

Read input string (DCh) : Reads back the input voltage and input power consumed by the power supply. In order to improve the resolution of the input voltage reading the data is shifted by 75V.

1	7	1	1	8
S	Slave address	Wr	A	Command Code 0xDC

1	1	7	1	1
A	Sr	Slave Address	Rd	A

8	1	8	1
Byte Count = 4	A	Voltage	A

8	1	8	1	8	1	1
Power - LSB	A	Power - MSB	A	PEC	No-ack	P

Read

revision of all three µC in the power supply.

1	7	1	1	8	1
S	Slave address	Wr	A	Command Code 0xDD	A

1	1	7	1	1	8	1
A	Sr	Slave Address	Rd	A	Byte Count = 4	A

8	1	8	1

State Change Definition

A state_change is an indication that an event has occurred that the MASTER should be aware of. The following events shall trigger a state_change;

Initial power-up of the system when AC gets turned ON . This is the indication from the rectifier that it has been turned ON. Note that the master needs to read the status of each power supply to reset the system_interrupt. If the power supply is back-biased through the 8V_INT or the 5VSTB it will not issue an SMBALERT# when AC power is turned back ON.

Whenever the power supply gets hot-plugged into a workingdlinition

Table 1: FRU_ID

The upper quarter of memory starting from address 6144 shall be reserved for factory ID and factory data.

Memory Location Decimal	Memory Location (HEX)	Length (bytes)	Format	Static Value Type	Description	Notes/Example
6144d	0x1800	12	ASCII	Fixed	GE-energy - Product ID	CP2725AC54TE
6156d	0x180C	10	ASCII	Fixed	GE-energy – Part Number	123456789x or C123456789
6166d	0x1816	6	ASCII	Variable	GE-energy - Hardware revision	x:xxxx controlled by PDI series #
6172d	0x181C	6	ASCII	Variable	spare	
6178d	0x1822	14	ASCII	Variable	GE-energy - Serial_No	01KZ51018193xx 01 .... Year of manufacture - 2001 KZ ... factory, in this case Matamoros 51 .. week of manufacture _____018193xx serial # mfg choice
6192d	0x1830	40	ASCII	Variable	GE- Manufacturing location	"Matamoros, Tamps, Mexico"
6232d	0x1858	8	ASCII	Fixed	spare	
6240d	0x1860	2	HEX	Fixed	spare	
6242d	0x1862	158	ASCII	Fixed	Customer Information	These fields are reserved for use by the customer.
6400d	0x1900	5	HEX	Fixed	M, B, & R for voltage read	M & B are 2 bytes each sent as MSB and then

Table 3: Signal Definitions

All hardware alarm signals (Fault, PFW, OTW, Power Capacity) are open drain FETs. These signals need to be pulled HI to either 3.3V or 5V. Maximum sink current 5mA. An active LO signal (< 0.4V_{DC}) state. All signals are referenced to Logic_GRD unless otherwise stated.

Function	Label	Type	Description
Output Enable	Enable	Input	If shorted to Logic_GRD main output is ON in Analog or PMBus mode.

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Ordering Information

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

Table 4: Device Codes

Item	Description	Comcode
CP2725AC54TEZ	54V_{DC} @ 50A, 5V_{DC} @ 0.75A, RoHS 6/6	CC109149423
CP2725AC54TEP	54V_{DC} @ 50A, 5V_{DC} @ 0.75A, RoHS 6/6, POE compliant	CC109167532

Contact Us

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