

CP3500AC52TE-FB2 Global Platform High Efficiency Rectifier

Input: 100-120/200-240 Vac; 3500W capable; Default set: ± 52 Vdc @; 5 Vdc @ 10W



RoHS Compliant



Features

- Efficiency exceeding 96%¹ (meets 80+ Titanium)
- Compact 1RU form factor with 40 W/in³ density
- 3500W from nominal 200-240V_{AC}
- 1500W from nominal 100 – 120V_{AC} for V_O > 52V_{DC}
- Output voltage programmable from 18V – 58V_{DC}
- ON/OFF control of the main output
- Comprehensive input, output and overtemp. protection
- PMBus compliant dual I²C serial bus and RS485
- Precision measurement reporting such as input power consumption, input/output voltage & current
- Remote firmware upgrade capable
- Power factor correction (meets EN/IEC 61000-3-2 and EN 60555-2 requirements)
- Redundant, parallel operation with active load sharing
- Redundant +5V @ 2A Aux power
- Internally controlled Variable-speed fan
- Hot insertion/removal (hot plug)
- Four front panel LED indicators
- RUL* Recognized to UL60950-1, CAN/ CSA[†] C22.2 No. 60950-1
- CE mark meets 2006/95/EC directive[§]
- Special Foldback Curve
- Black faceplate
- Conformal coating
- RoHS Directive 2011/65/EU and amended Directive (EU) 2015/863

Applications

- Wide band power amplifiers

Description

The CP3500AC52TE-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 CE marking procedures of end-user equipment should be followed.

** ISO is a registered trademark of the International Organization of Standards

* The PMBus name and logo are registered trademarks of the System Management Interface Forum (SMIF)

¹ At output voltages exceeding 52V_{DC}

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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	V_{IN}	0	264	V_{AC}
Operating Ambient Temperature ²	T_A	-10	75	°C
Storage Temperature	T_{stg}	-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, $V_o=52V_{DC}$, resistive load, and temperature conditions.

INPUT					
Parameter	Symbol	Min	Typ	Max	Unit
Startup Voltage	V_{IN}	80	85	90	V_{AC}
Low-line Operation					
High-line Operation		185	200 - 240	265	
Operating Voltage Range					
Low-line Configuration					
High-line Configuration					
Voltage Swell (no damage)		275			
Turn OFF Voltage		75	80	85	
Hysteresis		5			
Frequency	F_{IN}	47		66	Hz
Source Impedance (NEC allows 2.5% of source voltage drop inside a building)			0.2		Ω
Operating Current; at 110 V_{AC} at 240 V_{AC}	I_{IN}		15.5 16		A_{AC}
Inrush Transient (220 V_{RMS} , 25°C, excluding X-Capacitor charging)	I_{IN}		25	40	A_{PK}
Idle Power (at 240 V_{AC} , 25°C) 52V OFF 52V ON @ $I_o=0$	P_{IN}		9 18		W
Leakage Current (300 V_{AC} , 60Hz)	I_{IN}		2.5	3.5	mA
Power Factor (50 – 100% load)	PF	0.97	0.995		
Efficiency ³ , 240 V_{AC} , 52 V_{DC} , @ 25°C 10% of FL 20% of FL 50% of FL FL	η	90 94 96 91			%
Holdup time (output allowed to decay down to 40 V_{DC}) For loads below 1500W	T		10 15		ms
Ride through (at 240 V_{AC} , 25°C)	T	1/2	1		cycle
Power Good Warning ⁴ (main output allowed to decay to 40 V_{DC})	PG	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}

Electrical Specifications (continued)

52 V_{DC} MAIN OUTPUT					
Parameter	Symbol	Min	Typ	Max	Unit

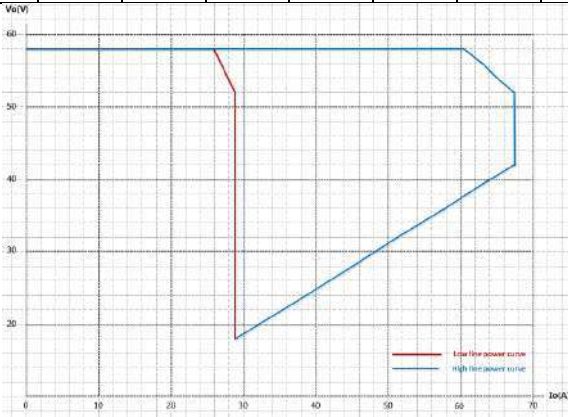
² See the derating guidelines under the Environmental Specifications section

³ Fan disabled, 5V output at 0 load.

⁴ Internal protection circuits may override the PG signal and may trigger an immediate shutdown. PG should not indicate normal (HI) until the main output is within regulation. PG should be asserted if the main output is about to shut down for any detectable reason.

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Output Power ⁵ @ low line input 100 – 120V _{AC} , V _O > 52V _{DC} @ high line input 200 – 240V _{AC} ⁶ , V _O > 52V _{DC}	W	1500 3500			W _{DC}																													
Factory set default set point	V _{OUT}		52		V _{DC}																													
Overall regulation (load, temperature, aging) 0 - 45°C LOAD > 2.5A > 45°C		-1 -2		+1 +2	%																													
Output Voltage Set Range Response to a ΔV ≤ 10V Vprog change command Response to a ΔV ≤ 10V i2c instruction		18		58	V _{DC}																													
Output Current - @ 1500W (100 – 120Vac), 52-58V @ 3500W (200 – 240V _{AC}), 52-58V	I _{OUT}	1 1		28.3/28.9 66/67.3	A _{DC}																													
Current Share (> 50% FL) V _O > 42V _{DC} V _O < 42V _{DC}		-5 -10		5 10	%FL																													
Output Ripple (20MHz bandwidth, load > 1A) RMS (5Hz to 20MHz) Peak-to-Peak (5Hz to 20MHz)	V _{OUT}			100 500	mV _{rms} mV _{P-P}																													
External Bulk Load Capacitance	C _{OUT}	0uF to at least 36000uF			μF																													
Turn-On (monotonic turn-ON from 30 – 100% of V _{nom} above 5°C) Delay Rise Time – PMBus mode Rise Time - RS-485 mode ⁷ Output Overshoot	T V _{OUT}		5 100 5		s ms s %																													
Load Step Response (I _{O,START} > 2.5A) ΔI ⁸ ΔV, Response Time	I _{OUT} V _{OUT} T			50 2.0 2	%FL V _{DC} ms																													
Permissible Load Boundary	Power limit , high line (down to 51V _{DC})	P _{OUT}	3500		W																													
	Low line	P _{OUT}	1500		W																													
	The overload current limit threshold should be set ≅ 0.6% above the load envelope shown here ⁹																																	
	Hine Line																																	
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>V_O(V)</td> <td>18</td> <td>23</td> <td>28</td> <td>32</td> <td>36</td> <td>40</td> <td>42</td> <td>48</td> <td>52</td> <td>54</td> <td>56</td> <td>58</td> <td></td> </tr> <tr> <td>I_O(A)</td> <td>29</td> <td>37</td> <td>45</td> <td>51.3</td> <td>57.7</td> <td>64</td> <td>67.3</td> <td>67.3</td> <td>67.3</td> <td>65</td> <td>62.7</td> <td>60.3</td> <td></td> </tr> </table>						V _O (V)	18	23	28	32	36	40	42	48	52	54	56	58		I _O (A)	29	37	45	51.3	57.7	64	67.3	67.3	67.3	65	62.7	60.3	
	V _O (V)	18	23	28	32	36	40	42	48	52	54	56	58																					
	I _O (A)	29	37	45	51.3	57.7	64	67.3	67.3	67.3	65	62.7	60.3																					
																																		
	$(I_o = 1.596 * V_o + 0.275 \text{ while } V_o < 42V \text{ @high line})$																																	
	Low Line																																	
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I _O (A)	28.85	28.85	28.85	28.85	28.85	28.85	28.85	28.85	28.85	27.8	26.8	25.9																						
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	Upon insertion the rectifier will delay an overload shutdown for 20 seconds.																																	

⁵ Output power capability is proportional to output voltage setting, see the permissible load boundary

⁶ Input line range: 90 – 264 V_{RMS} (±10%)

⁷ Below -5°C, the rise time is approximately 5 minutes to protect the bulk capacitors. RS485 mode walk-in can be disabled.

⁸ di/dt (output current slew rate) 1A/μs.

⁹ Overload shutdown is delayed for 3 seconds to allow the equipment to reduce utilized power. Increase in fan speed is also delayed 500ms.

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Electrical Specifications (continued)

52V _{DC} MAIN OUTPUT					
Parameter	Symbol	Min	Typ	Max	Unit
Overvoltage - 200ms delayed shutdown Immediate shutdown Latched shutdown	V _{OUT}	> 65		< 60	V _{DC}
Three restart attempts are implemented within a 1 minute window prior to a latched shutdown.					
Over-temperature warning (prior to commencement of shutdown) Shutdown (below the max device rating being protected) Restart attempt Hysteresis (below shutdown level)	T		5 20 10		°C
Isolation Output-Chassis (Standard, non-POE compliant) Output-Chassis/Signals (POE compliant per IEEE802.3)	V	500 2250			V _{DC} V _{DC}

5V _{DC} Auxiliary output					
Parameter	Symbol	Min	Typ	Max	Unit
Output Voltage Setpoint	V _{OUT}		5		V _{DC}
Overall Regulation		-3		+3	%
Output Current		0.005		2	A
Ripple and Noise (20mHz bandwidth)			50	100	mV _{P-P}
Over-voltage Clamp				7	V _{DC}
Over-current Limit		110		175	%FL

The 5V_{DC} should be ON before availability of the 52V_{DC} main output and should turn OFF only if insufficient input voltage exists to provide reliable 5V_{DC} power. The PG# signal should have indicated a warning that power would get turned OFF and the 52V_{DC} main output should be OFF way before interruption of the 5V_{DC} output.

General Specifications

Parameter	Min	Typ	Max	Units	Notes
Reliability		450,000		Hours	Full load, 25°C ; MTBF per SR232 Reliability protection for electronic equipment, issue 2, method I, case III,
Service Life		10		Years	Full load, excluding fans
Unpacked Weight		2.18/4.8		Kgs/Lbs	
Packed Weight		2.45/5.4		Kgs/Lbs	
Heat Dissipation	190 Watts or 648 BTUs @ 80% load, 250 Watts or 853 BTUs @ 100% load				

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Signal Specifications

Unless otherwise indicated, specifications apply over all operating input voltage, resistive load, and temperature conditions. Signals are referenced to Logic_GRD unless noted otherwise. Fault, PG#, OTW, and Alert need to be pulled HI through external pull-up resistors.

Parameter	Symbol	Min	Typ	Max	Unit
ON/OFF Main output OFF	V_{out}	$0.7V_{DD}$	—	5	V _{DC}
52V output ON (should be connected to Logic_GRD)	V_{OUT}	0	—	0.5	V _{DC}
Margining (through adjusting Vprog)		18		58	V _{DC}
Voltage control range	$V_{control}$	0		3.3	V _{DC}
Programmed output voltage range	V_{OUT}	18		58	V _{DC}
Voltage adjustment resolution (8-bit A/D)	$V_{control}$		3.3		mV _{DC}
Output configured to 52V _{DC}	$V_{control}$	3.0		3.3	V _{DC}
Output configured to 18V _{DC}	$V_{control}$	0		0.1	V _{DC}
Interlock	[short pin shorted to VOUT(-) on system side]				
Module Present	[short pin to Logic_GRD internally]				
Over Temperature Warning (OTW#) Logic HI (temperature normal)	V	$0.7V_{DD}$	—	12	V _{DC}
Sink current [note: open collector output FET]	I	—	—	5	mA
Logic LO (temperature is too high)	V	0	—	0.4	V _{DC}
Power Good (PG) Logic HI (temperature normal)	V	$0.7V_{DD}$	—	12	V _{DC}
Sink current [note: open collector output FET]	I	—	—	5	mA
Logic LO (temperature is too high)	V	0	—	0.4	V _{DC}
Protocol select Logic HI - Analog/PMBus™ mode	V_{IH}	2.7	—	3.5	V _{DC}
Logic – intermediate – RS485 mode	V_{II}	1.0	—	2.65	V _{DC}
Logic LO – DSP reprogram mode	V_{IL}	0	—	0.4	V _{DC}
Fault# Logic HI (No fault is present)	V	$0.7V_{DD}$	—	12	V _{DC}
Sink current	I	—	—	5	mA
Logic LO (Fault is present)	V	0	—	0.4	V _{DC}
Alert# (Alert#_0, Alert#_1) Logic HI (No Alert - normal)	V	$0.7V_{DD}$	—	12	V _{DC}
Sink current [note: open collector output FET]	I	—	—	5	mA
Logic LO (Alert# is set)	V	0	—	0.4	V _{DC}
SCL, SDA (SCL_0/1, SDA_0/1) Logic HI	V	2.1	—	12	V _{DC}
Sink current [note: open collector output FET]	I	—	—	5	mA
Logic LO (Alert# is set)	V	0	—	0.4	V _{DC}

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