

CC2725AC34TZL Conduction Cooled Wide-Output-Range Rectifier

Input: 200-240 Vac; 2725W capable; Default output: 34Vdc

RoHS Compliant



Features

- Peak Efficiency 94%
- Completely enclosed, conduction cooled
- Output constant power 2725W from 36~32VDC
- Output voltage programmable from 28V – 36Vdc
- Remote ON/OFF control of the main output
- Comprehensive input, output and overtemp protection
- Power factor correction (meets EN/IEC 61000-3-2 and EN 60555-2 requirements)
- Redundant, parallel operation with active load sharing
- Redundant 5V Aux power
- Four front panel LED indicators
- Analog status signals
- Trim port to adjust Vo
- PMBus compliant I²C serial bus and RS485
- RoHS 6 compliant
- CB report
- CE mark meets 2014/30/EU directive
- NRTL Recognized

Applications

- Wide band power amplifier
- Broadcast systems
- Lasers
- Acoustic noise sensitive systems
- LED signage

Description

The CC2725 Rectifier has an extremely wide programmable output voltage capability. Featuring high-density, fully enclosed, conduction-cooled packaging, it is designed for minimal space utilization and is highly expandable for future growth. This standard rectifier incorporates both RS485 and 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 applications requiring operation over a wide output-voltage range and conduction cooling.

** 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	Symbol	Min	Max	Unit
Input Voltage: Continuous	V_{IN}	0	264	V_{AC}
Operating Case Temperature (sink side)	T_C	-40 ¹	40 ²	°C
Storage Temperature	T_{stg}	-40	85	°C

Electrical Specifications

Unless otherwise indicated, specifications apply overall operating input voltage, $V_o=48V_{DC}$, resistive load, and temperature conditions.

INPUT					
Parameter	Symbol	Min	Typ	Max	Unit
Startup Voltage High-line Operation	V_{IN}			185	V_{AC}
Operating Voltage Range High-line Configuration		185	200 - 240	264	
Voltage Swell (no damage)		305			
Low voltage Turn off Turn on Hysteresis		175	10	185	
High voltage Turn off Turn on Hysteresis		265	10	275	
Frequency	F_{IN}	47		63	Hz
Operating input Current (185Vac, 100% load)	I_{IN}			16	A_{AC}
Inrush Transient (220V _{RMS} , $T_C=25^{\circ}C$, excluding X-Capacitor charging)	I_{IN}		25	30	A_{PK}
Leakage Current (265V _{AC} , 60Hz)	I_{IN}			3.5	mA
Power Factor (50 – 100% load)	PF	0.96	0.98		
Efficiency, 240V _{AC} , 34V _{DC} , $T_C=25^{\circ}C$ 20%~90 % of FL	η	93	94%		%
Holdup time (output allowed to decay down to 26V _{DC}) w/ full load	T		12		ms
Ride through (at 240V _{AC} , 25°C, $V_o>28V_{DC}$ with full load)	T	1/2			cycle
Isolation (per EN60950) (consult factory for testing to this requirement) Input to Chassis & Signals Input to Output	V	1500 3000			V_{AC} V_{AC}

¹ Designed to start and work at an ambient as low as -40°C, but meet operational limits until above -5°C

² refer to power curve (V_o vs I_o)

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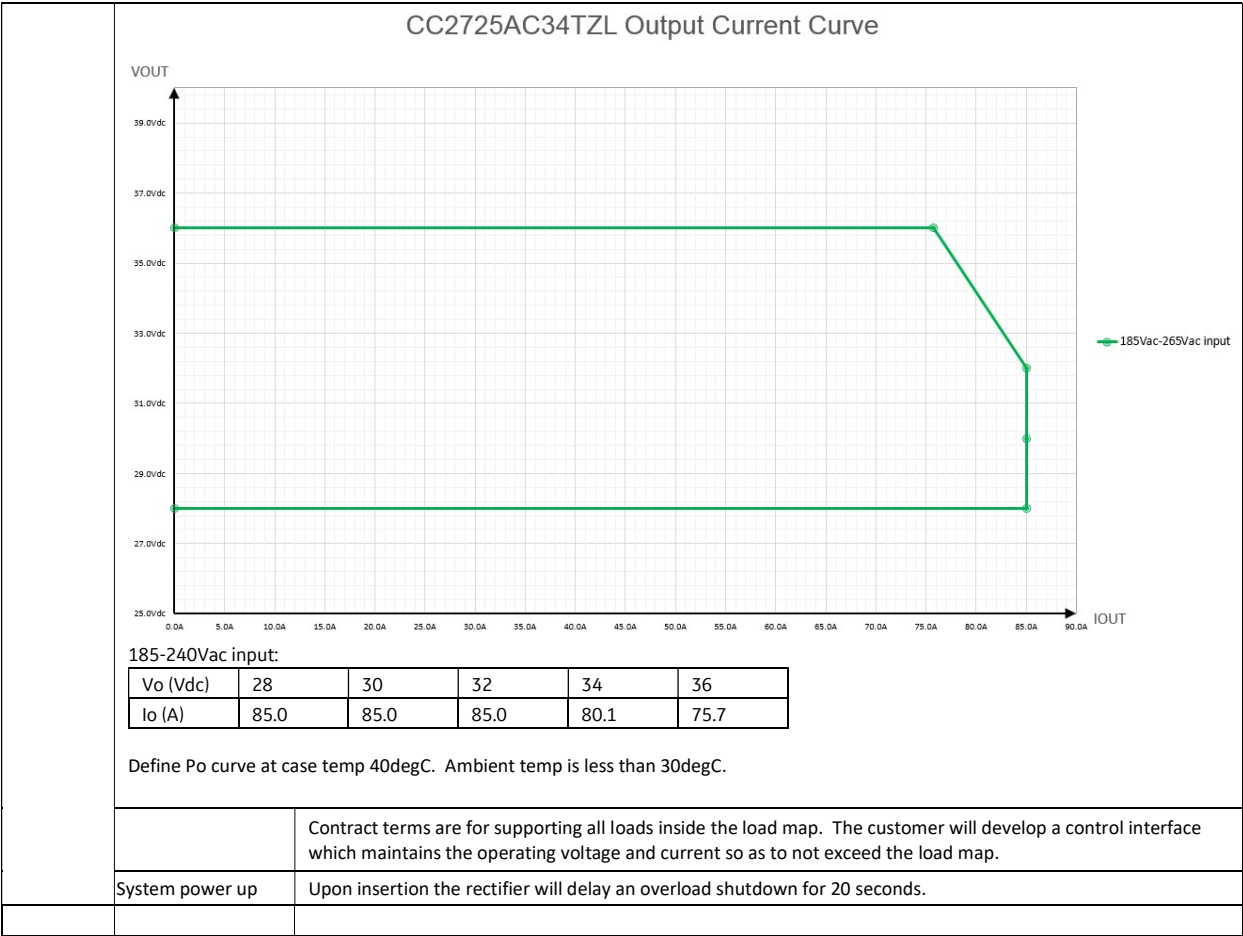
Electrical Specifications (continued)

MAIN OUTPUT					
Parameter	Symbol	Min	Typ	Max	Unit
Output Power @ high line input 200 – 240V _{AC} , V _O ≥ 32V _{DC} , T _C ≤ 40°C	W	2725			W _{DC}
Factory set default set point	V _{OUT}		34		V _{DC}
Overall regulation (load, temperature, aging) 0 – T _C ≤ 40°C LOAD > 2.5A		-1		+1	%
Output Voltage Set Range		28		36	V _{DC}
Output Current ³ - T _C ≤ 40°C	I _{OUT}				A _{DC}
36V		1		75.7	
32V		1		85	
30V		1		85	
28V		1		85	
Current Share (> 50% FL) V _O > 30V _{DC} V _O < 30 V _{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}	0		5,000	μF
Turn-On (monotonic turn-ON from 30 – 100% of V _{nom} above 5°C) Delay	T		5		s
Rise Time – PMBus mode			100		ms
Rise Time - RS-485 mode			100		ms
Output Overshoot	V _{OUT}			2	%
Load Step Response ⁴ (I start from 0A), V _O =34V ΔI ΔV Response Time ⁵	I _{OUT} V _{OUT} T		2.0 2	90	%FL V _{DC} ms
Permissible Load Boundary	Power limit (down to 32V _{DC})	P _{OUT}	2725		W
	1, dynamic Current limit threshold varies corresponding V _O set point and V _{in} 2, The overload current limit threshold is set at least > 1% above the load envelope shown here 3, Overcurrent events that exceed the envelope by 2% will hiccup continuously at a frequency of approximately once every 24seconds. 4, dynamic output UV protection V _{O,set} -2V is introduced when V _{O,set} is <TBD. 5, fixed output UV protection TBD when V _{O,set} >TBD				

³ refer to power curve on page⁴ Tested w/o Co bank⁵ V_O undershoot around 2V, may take longer time to recover

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MAIN OUTPUT					
Parameter	Symbol	Min	Typ	Max	Unit
Overvoltage - 200ms delayed shutdown	V _{OUT}	> 38		< 40	V _{DC}
Immediate shutdown					
Latched shutdown					
Three restart attempts are implemented within a 1-minute window prior to a latched shutdown.					
Over-temperature warning (prior to commencement of shutdown)	T		5		°C
Shutdown (below the max device rating being protected)			20		
Restart attempt Hysteresis (below shutdown level)			10		
Isolation Output to Chassis	V	100			V _{DC}

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5V _{DC} Auxiliary output (return is LGND)					
Parameter	Symbol	Min	Typ	Max	Unit
Output Voltage Setpoint	V _{OUT}		5		V _{DC}
Overall Regulation		-10		+5	%
Output Current		0		0.2	A
Ripple and Noise (20mHz bandwidth)			55	200	mV _{p-p}
Over-voltage Clamp				7	V _{DC}
Over-current Limit		400		670	%FL
Isolation LGND to Chassis		100			V _{DC}

The 5VDC should be ON before availability of the main output and should turn OFF only if insufficient input voltage exists to provide reliable 5VDC power. The PG signal should have indicated a warning that main output has turned OFF and the 48VDC main output should be OFF way before interruption of the 5VDC output.

General Specifications

Parameter	Min	Typ	Max	Units	Notes
Reliability		TBD		Hours	Full load, 25°C ; MTBF per SR232 Reliability protection for electronic equipment, issue 2, method I, case III,
Service Life		10		Years	At 80% load & 25°C cold plate
Unpacked Weight		TBD		Kg	
Packed Weight		TBD		Kg	

Signal Specifications

Unless otherwise indicated, specifications apply overall operating input voltage, resistive load, and temperature conditions. Signals are referenced to LGND unless noted otherwise.

Parameter	Symbol	Min	Typ	Max	Unit
ON/OFF Main output OFF	V _{OUT}	0.7V _{DD}	—	5	V _{DC}
main output ON (should be connected to LGND)	V _{OUT}	0	—	0.5	V _{DC}
Margining (by adjusting Margining; see “Voltage programming” section)					
Programmed output voltage range	V _{OUT}	28		36	V _{DC}
Linear voltage control range	V _{control}	> 0.1		≤ 3.0	V _{DC}
Voltage adjustment resolution (8-bit A/D)	V _{control}		TBD		mV _{DC}
Output set to 34V _{DC}	V _{control}	3.1		3.3	V _{DC}
Output set to 28V _{DC}	V _{control}	0		0.1	V _{DC}
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}
FAULT					
Logic HI (temperature normal)	V			12	VDC
Sink current [note: open collector output FET]	I			5	mA
Logic LO (internal fault occurred)	V			0.4	VDC
Power Good Warning (PG)					
Logic HI (output temperature normal)	V	0.7V _{DD}	—	12	V _{DC}
Sink current [note: open collector output FET]	I	—	—	5	mA
Logic LO (unit shutdown, temperature is too high)	V	0	—	0.4	mA

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Environmental Specifications

Parameter	Min	Typ	Max	Units	Notes
Operating Case Temperature	-40 ⁶		40	°C	Measured at the center of the cooling surface. Refer detailed power boundary curves
Storage Temperature	-40		85	°C	
Operating Altitude			5000/16463	m / ft	
Non-operating Altitude			8200/27,000	m / ft	
Over Temperature Protection		115		°C	Shutdown / restart [internally measured points]
Humidity					
Operating	5		95	%	Relative humidity, non-condensing
Storage	5		95	%	
Shock and Vibration acceleration			2.4	Grms	

EMC

Parameter	Measurement	Standard	Level	Test
AC input	Conducted emissions ⁷	EN55032	A +3dB margin	0.15 – 30MHz
	Radiated emissions ⁸	EN55032	A +3dB margin	30 – 1000MHz
	Line harmonics	EN61000-3-2 THD	Table 1 5%	0 – 2 kHz 230 Vac, full load, 25°C
Parameter	Measurement	Standard	Criteria ⁹	Test
AC Input Immunity	Line sags and interruptions	EN61000-4-11	B	-30%, 10ms
			B	-60%, 100ms
			B	-100%, 5sec
		Output will stay above 26V _{DC} @ 75% load Sag must be higher than 80Vrms.		A
	Lightning surge	EN61000-4-5, Level 4, 1.2/50μs – error free	A	4kV, common mode
			A	2kV, differential mode
	Fast transients	EN61000-4-4, Level 3	B	5/50ns, 2kV (common mode)
Enclosure immunity				
	ESD	EN61000-4-2, Level 4	B	8kV contact, 15kV air

⁶ Designed to start and work at an ambient as low as -40°C, but meet operational limits until above -5°C

⁷ test with external filter

⁸ Test with external filter

⁹ Criteria A: The product must maintain performance within specification limits. Criteria B: Temporary degradation which is self recoverable. Criteria C: Temporary degradation which requires operator intervention.

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Control and Status

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

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

factory default setting is Analog & PMBUS mode.

Analog controls: Details of analog controls are provided in this data sheet under Feature Specifications. Note that some signals are ignored in RS485 mode.

Signal Reference: Unless otherwise noted, all signals are referenced to LGND ("Logic Ground"). See the Signal Definitions Table at the end of this document for further description of all the signals.

LGND is isolated from the main output of the rectifier 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 rectifier).

LGND is capacitively coupled to Earth Ground inside the rectifier where Earth Ground is also wired to the metal case). The maximum voltage differential between LGND and Earth Ground should be less than 100V_{DC}.

Delayed overcurrent shutdown during startup: Rectifiers are programmed to stay in a constant current state for up to 20 seconds during power up. This delay has been introduced to permit the orderly application of input power to a subset of paralleled front-ends during power up. If the overload persists beyond the 20 second delay, rectifier will shut down and re-start.

Auto restart: Auto-restart is the default configuration for over-current and over-temperature shutdowns

An overvoltage shutdown is followed by three attempted restarts, each restart delayed 1 second, within a 1 minute window. If within the 1 minute window three attempted restarts failed, the unit will latch OFF. If within the 1 minute less than 3 shutdowns occurred then the count for latch OFF resets and the 1 minute window starts all over again.

To restart after a latch off either of five restart mechanisms are available.

1. The hardware pin **ON/OFF or DIP switch on rear side** may be cycled OFF and then ON.
2. Turn OFF and then turn ON AC power to the unit.
3. The unit may be commanded to restart via i2c through the *Operation* command by cycling the output OFF followed by ON.

Control Signals

There are two DIP switches and a port on rear side of rectifier, to provide way to adjust output voltage set-point and remote on/off main power output.

A separated signal connector includes all the control and status signals.

Protocol: Establishes the communications mode of the rectifier, between analog/I2C and RS485 modes. For RS485, connect 10kΩ pull-down resistor to Vout (-). Default setting of signal interface is open.

Margining:

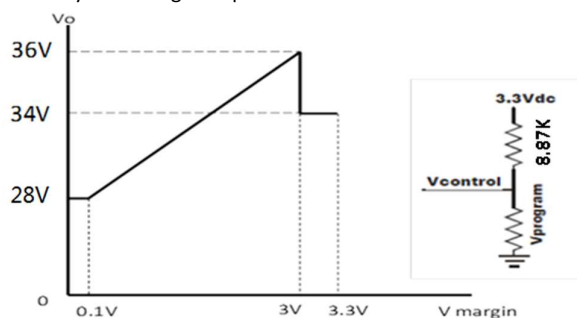
There is a trim port on rear panel of rectifier to provide an easy to adjust output voltage set-point. A DIP switch in off disable this trim pot when need to use external analog signal to adjust Vo through margin pin.

Output voltage set-point will return to factory default set-point once DIP switch for trim pot is off.

Factory default setting is switch on.

The margining pin from signal interface can also be used to adjust the output voltage set-point once DIP is off.

The margining pin is connected to 3.3Vdc via a 8.87 Ω resistor inside the Rectifier. Connecting a resistor or voltage source externally can change set-point.



Note that in RS485 mode the margining function include trim port and DIP switch is ignored.

Pls contact your local representative for details about how to change output voltage set-point through RS485 communication.

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ON/OFF: there is an on/off DIP switch on rear panel of rectifier to provide on/off main power output manually.

Factory default setting is switch on.

Enable pin from signal interface can be used to control main power on/off in case on/off DIP switch is off. This pin must be pulled low to turn **ON** the rectifier.

Note that in RS485 mode the ON/OFF pin is ignored.

ENABLE_RS485: this pin is used as main power on/off in RS485 mode.

In I2C/analog mode, this pin is ignored.

Status Signals

Power Good Warning (PG): A TTL compatible status signal representing whether main output is delivered. This signal needs to be pulled HI externally through a resistor.

This signal is HI when the main output is being delivered and goes LO when main power is shutdown. This signal deliver duty in case output current limit condition.

Fault: A TTL compatible status signal representing whether a internal Fault occurred. This signal needs to be pulled HI externally through a resistor.

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

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

In RS485 mode, this pin is ignored.

Over temp warning (OTW): A TTL compatible status signal representing whether an over temperature exists. This signal needs to be pulled HI externally through a resistor.

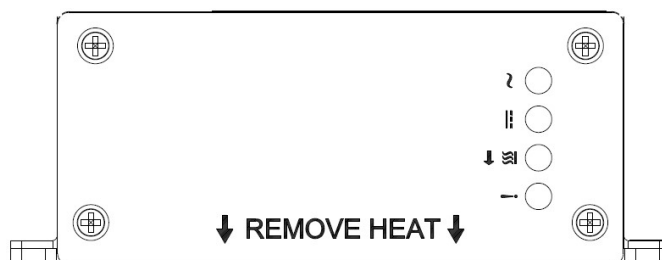
If an over temperature should occur, this signal would pull LO for approximately 10 seconds prior to shutting down the rectifier. In its default configuration, the unit would restart if internal temperatures recover within normal operational levels. At that time the signal reverts back to its open collector (HI) state.

In RS485 mode, this pin ignored

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Front Panel LEDs



	Analog Mode	I ² C Mode	RS485 Mode
<input type="checkbox"/> ~	←	ON: Input ok Blinking: Input out of limits	→
<input type="checkbox"/> ==	←	ON: Output ok Blinking: Overload	→
<input type="checkbox"/> ~~~ *	ON: Over-temperature Warning	ON: Over-temperature Warning Blinking: Service	ON: Over-temperature Warning
<input type="checkbox"/> !	←	ON: Fault	ON: Fault Blinking: Not communicating

*Arrow next to “hot” symbol points to the cooling side, where heat should be removed.

Table 1: Alarm and LED state summary

Condition	Rectifier LED State				Monitoring Signals			
	AC OK Green	DC OK Green	Service Amber	Fault Red		Fault	OTW	PG
OK	1	1	0	0		HI	HI	HI
Thermal Alarm (5C before shutdown)	1	1	1	0		HI	LO	HI
Thermal Shutdown	1	0	1	1		LO	LO	LO
AC Present but not within limits	Blinks	0	0	0		HI	HI	LO
AC not present ¹	0	0	0	0		HI	HI	LO
Boost Stage Failure	1	0	0	1		LO	HI	LO
Over Voltage Latched Shutdown	1	0	0	1		LO	HI	LO
Over Current	1	Blinks	0	0		HI	HI	Pulsing ⁴
Non-catastrophic Internal Failure ²	1	1	0	1		LO	HI	HI
Standby (remote) ⁵	1	0	0	0		HI	HI	LO
Service Request (PMBus mode)	1	1	Blinks	0		HI	HI	HI
Communications Fault (RS485 mode)	1	1	0	Blinks		N/A	N/A	High

¹ This signal is correct if another powered units provides 5VA and 8VINT as back-bias.

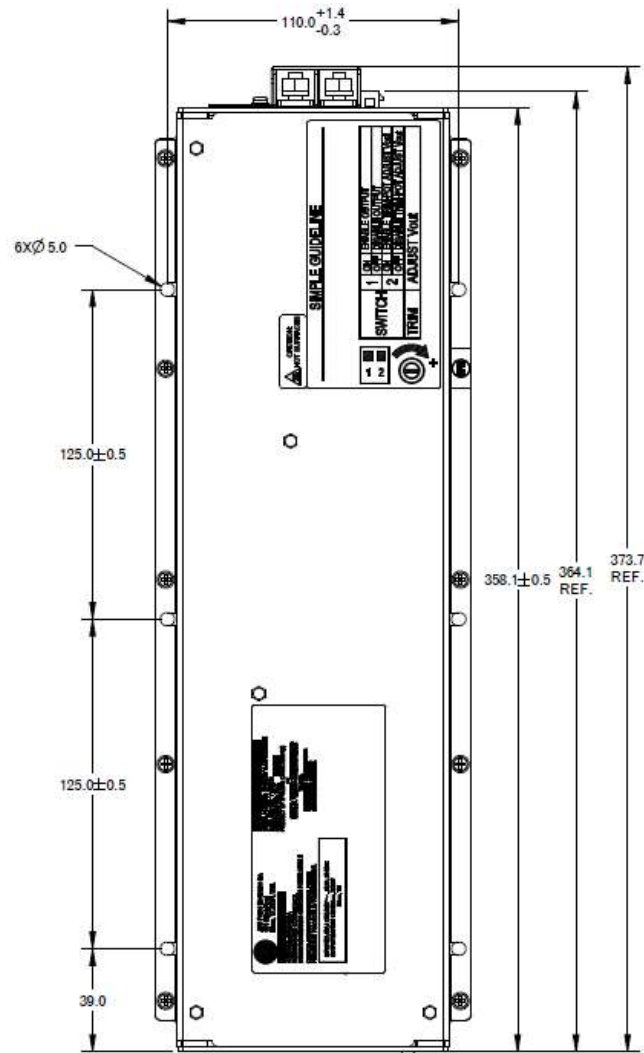
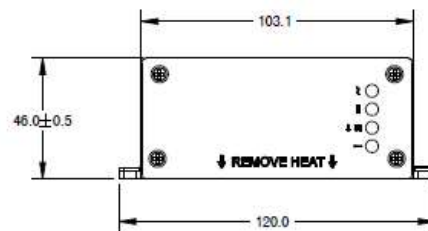
² Any detectable fault condition that does not cause a shutting down. For example, ORing FET failure, boost section out of regulation, etc.

⁴ Pulsing at a duty cycle of 1ms as long as the unit is in overload.

⁵ Remote on/off, or I2C command in i2c mode. or through interlock or GP command in RS485 mode.

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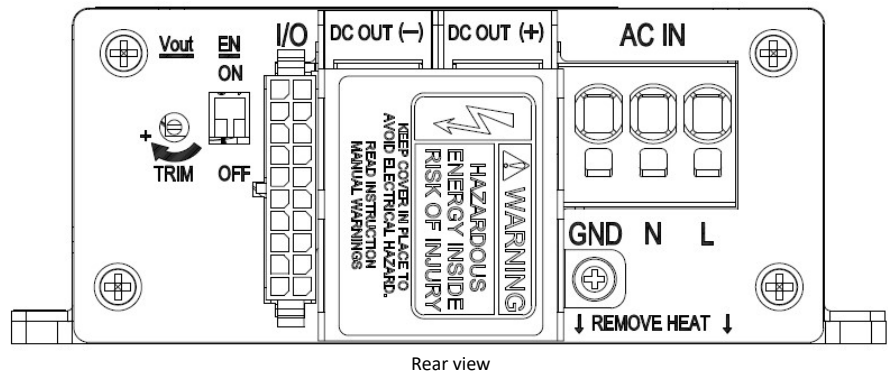
Mechanical Outline**TOP VIEW****FRONT VIEW**

All dimension in mm

CC2725AC34TZL Conduction Cooled Wide-Output-Range Rectifier

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Wiring interface



AC Input Wiring diagram



Whether it's a push-in spring or a leg spring, the spring principle makes for quick, tool-free conductor connection. Simply insert the solid conductors and conductors with ferrules into the push-in terminal point and release using a screwdriver. When connecting and releasing finely stranded conductors without ferrules, the terminal point can also be opened using a screwdriver

TB/Connector	Vendor P/N	Rated current	Rated insulation voltage	Pitch	Pos.
AC input	1719202 (Phoenix)	41A	1000V	7.5mm	3

Wire information for AC input TB

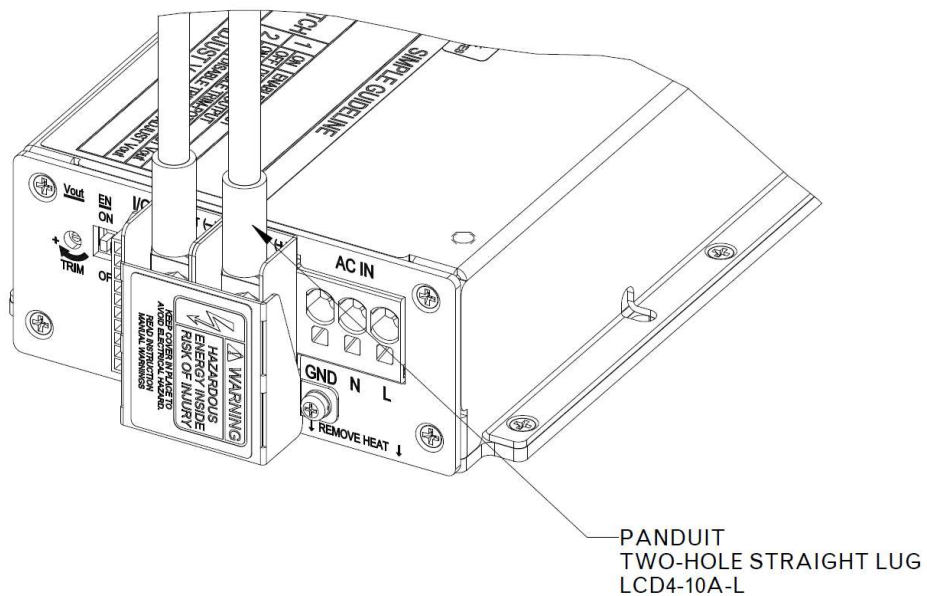
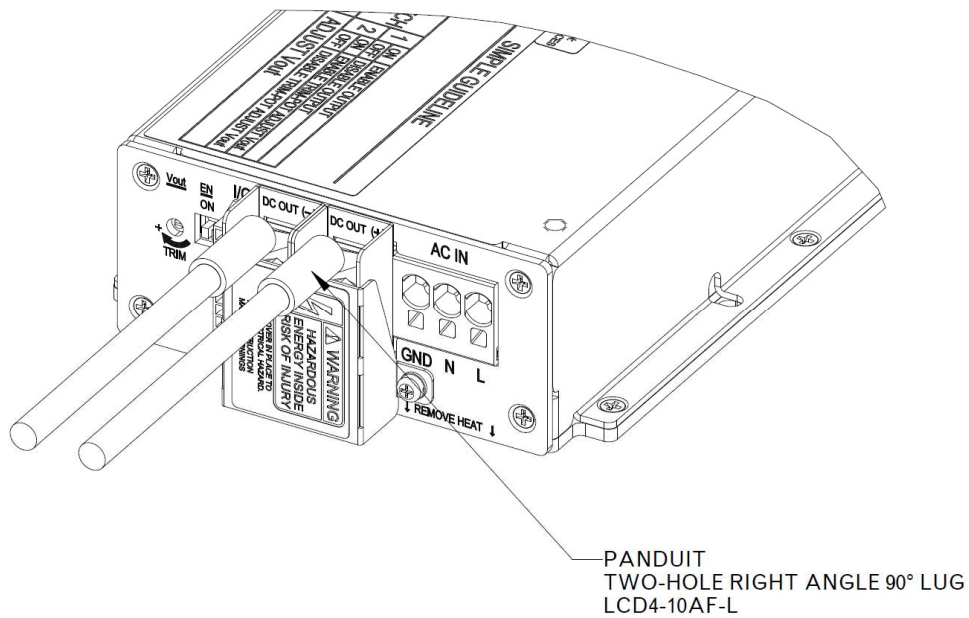
TB connection data	AC input TB
Conductor cross section solid	0.2~10mm ²
Conductor cross section flexible	0.2~6mm ²
Conductor cross section with ferrule without plastic sleeve	0.25~6mm ²
Conductor cross section with ferrule with plastic sleeve	0.25~4mm ²
Conductor cross section AWG	24~8 AWG
Nominal current I _N	41A
Stripping length	15mm

Notes:
Recommended to use ferrule with correct stripping length for input

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DC output Wiring diagram

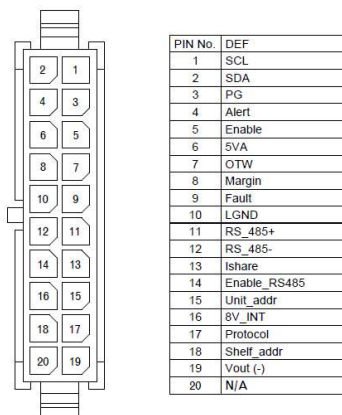


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Signal I/O pin definition

Pins table



TB/Connector	Vendor P/N	Rated current	Rated insulation voltage	Pitch	Pos.
Signal I/O	430202000 (Molex)	5A (UL)	350V (UL)	3.0mm	20

Signal Definitions

I/O	Function	Type	Description
SCL	I2C Line	Input	I2C 0 channel
SDA	I2C Line	Input	I2C 0 channel
PG	Power Good Warning	Output	Open drain FET; normal is High, Changes to Low if an imminent loss of the main output may occur. Ref: LGND
Alert	I2C Interrupt	Output	I2C 0 channel
Enable	Output control	Input	If shorted to LGND, main output is ON in Analog or PMBus mode. Active in case ON/OFF DIP switch is off status. Ref: LGND
5VA	Standby power	Output	5V provided for external use. Ref: LGND
OTW	Over-Temperature Warning	Output	Open drain FET; normally Hi, changes to low approximately 5°C prior to thermal shutdown. Ref: LGND
Margin	Margining	Input	Allows changing of output voltage through an analog voltage input or via resistor divider. Active when ON/OFF DIP switch is off status. Ref: LGND
Fault	Rectifier Fault	Output	An open drain FET; normally Hi, changes to Low if internal fault. Ref: LGND
LGND	Logic Ground	Bi-direct	Return for all signals unless Vout (-) is indicated in description
RS_485+	RS485 Line	Bi-direct	RS485 line +. Ref: Vout (-)
RS_485-	RS485 Line	Bi-direct	RS485 line -. Ref: Vout (-)
Ishare	Current Share	Bi-direct	A single wire active-current-share interconnect between rectifiers. Ref: Vout (-)
Enable_RS485	Output control	Input	ON/OFF in RS485 mode. Ref: Vout (-)
Unit_addr	Rectifier address	Input	I2C/RS485 address setting. Ref: Vout (-)
8V_INT	Back bias	Bi-direct	Diode OR'ed 8Vdc drain; used to back bias microprocessors and DSP of failed Rectifier from operating Rectifiers. Ref: Vout (-).
Protocol	Protocol select	Input	Selects communications mode. No-connect for Analog/PMBus; 10kΩ for RS485. Ref: Vout (-)
Shelf_addr	Shelf Address	Input	I2C/RS485 address setting. Ref: Vout (-)
Vout (-)	Reference	Bi-direct	Ref for RS485+/-, Ishare, Enable_RS485, Unit/Shelf addr, Protocol, 8V_INT, Protocol

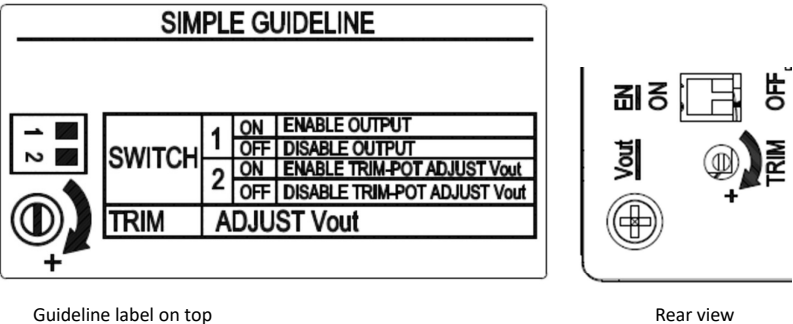
- All hardware alarm signals (Fault, PG, OTW) are open drain FETs. These signals need to be pulled HI to either 3.3V or 5V. Maximum sink current 5mA. An active LO signal (< 0.4V_{DC}) state. All signals are referenced to LGND unless otherwise stated.

In main output in series to extend Vo application, all signals refer to LGND from different units could be tied together. Other signals refer to Vout (-) from different units can NOT be tied together, otherwise may cause internal circuits damage due to different Vout (-) level.

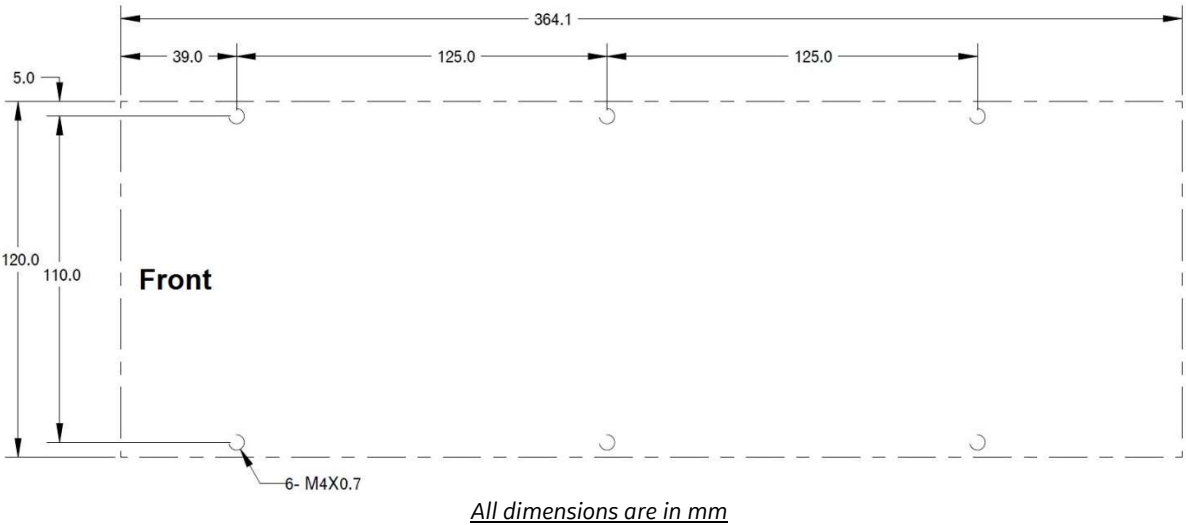
CC2725AC34TZL Conduction Cooled Wide-Output-Range Rectifier

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DIP Switch and Vo adjustment



Mounting dimensions



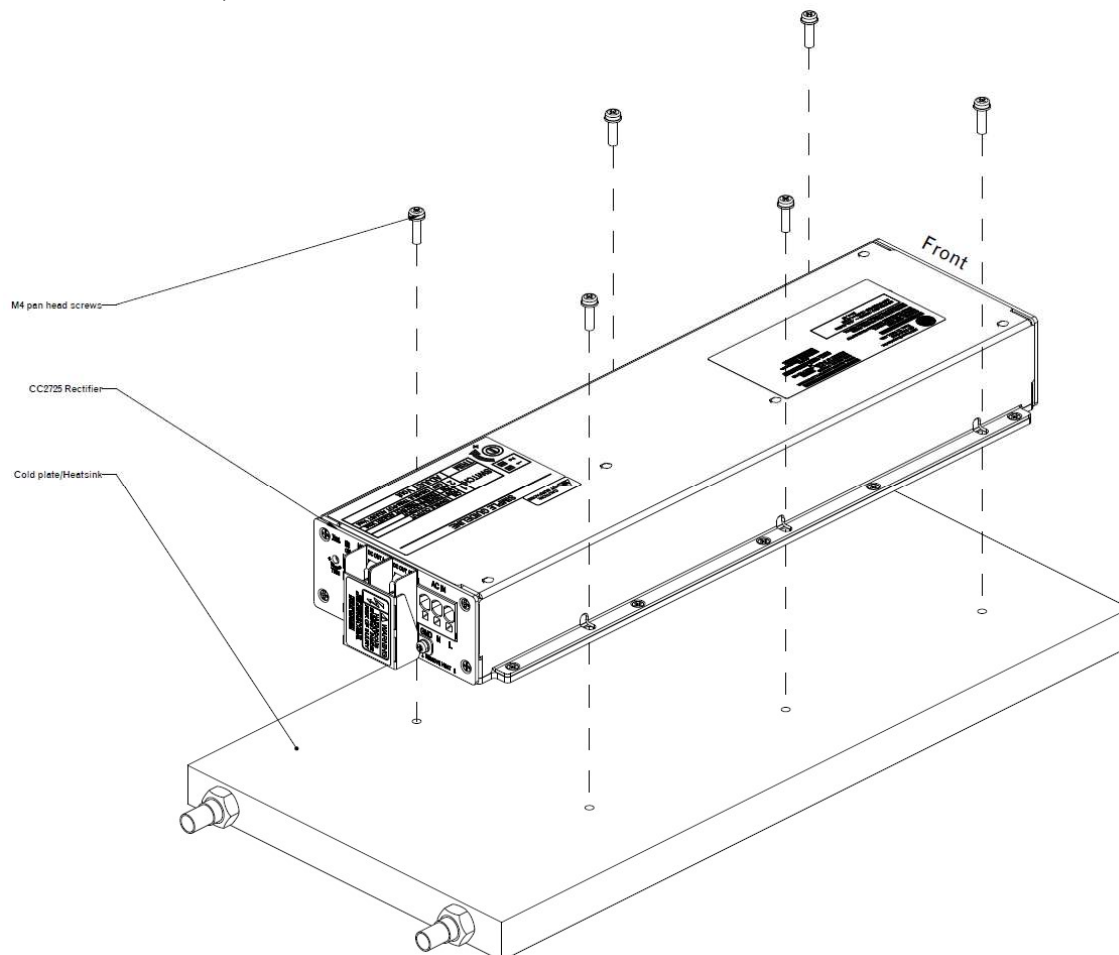
CC2725AC34TZL Conduction Cooled Wide-Output-Range Rectifier

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Mounting diagram

Install the module to cold plate/heatsink with 6 M4 pan head screw as shown, the torque to be 1.5Nm.

Apply gap filler, Laird T-putty 504, or equivalent material (thermal conductivity better than 1.8 W/mK), between module and cold plate/heatsink. Amount of Gap filler is around 20.9 cubic cm, thickness is around 0.5mm.

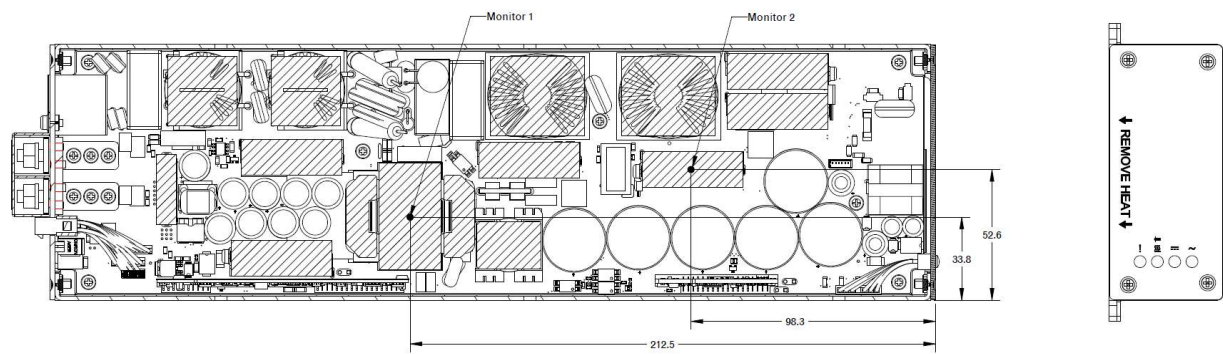


Case temperature monitoring location

Below diagram indicated the hot spots of CC2725AC48TZL rectifier, they are assumed as case temperature of coldplate/heatsink as well. In application, over temperature protection will be enabled if one of the hot spots the temperature is exceeded the operating temperature.

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Ordering Information

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

Table 4: Device Codes

Item	Description	Comcode
CC2725AC34TZL	Conduction cooled, 28~36Vdc output, shorter length rectifier, 2725W	1600281281A
Cable assembly	Wire set for signal I/O, 0.5m length	8600238857P