DATASHEET

CC1600 Conduction-Cooled IP65 Rated Rectifier

Input: 100-120/200-240 V_{ac}; 1200/1600W capable; Output: 52V

RoHS 6/6 Compliant

Description

The CC1600 is a conduction-cooled, industrial-grade rectifier designed for reliable operation in both outdoor and indoor applications. With high-range ac input (200-240 V_{ac}), it can deliver the maximum 1600W at case temperatures less than 50°C. With low-range ac input (100-120 V_{ac}), it delivers up to 1200W at case temperatures less than 50°C.

The CC1600 has an extremely wide programmable output voltage capability. Featuring high-density, fully enclosed, conduction - cooled packaging, it is designed for minimal space utilization

Applications

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

Features

- Efficiency exceeding 94%1
- IP65 rated for outdoor operation
- Compact form factor 11.52”L x 5.29”W x 1.83”H with max 14.3 W/in^3 density
- 1600W from nominal 200-240V_{AC} <50ºC baseplate
- 1200W from nominal 100–120V_{AC} for V_O < 52V_{DC}, < 50ºC baseplate
- Output voltage programmable from 42V – 58V_{DC}
- “Floating” output for positive or negative polarity
- Remote ON/OFF control of the main output by RS485
- Comprehensive input, output and overtemperature protection
- Precision measurement reporting of input/output voltage & current
- Power factor correction (meets EN/IEC 61000-3-2 and EN 60555-2 requirements)
- Redundant, parallel operation with active load sharing
- Completely enclosed, conduction cooled
- Adapter card available with I/O screw terminals
- UL* Recognized, CAN/ CSA† C22.2 specified compliance with IEC62368-1
- CE mark meets 2006/95/EC directive§
- Compliant to RoHS Directive 2011/65/EU and amended Directive (EU) 2015/863.
- Compliant to REACH Directive (EC) No 1907/2006

See footnotes on page 6

Technical Specifications

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)[2]	T_C	-10	75	°C
Storage Temperature	T_{stg}	-40	85	°C
Input Isolation voltage to Frame (100% factory Hi-Pot tested)			1500	V_{AC}
Output Isolation voltage to Frame (100% factory Hi-Pot tested)			500	V_{AC}

Electrical Specifications

Unless otherwise indicated, specifications apply over all operating input voltage, V_o=52V_{DC}, resistive load, and case temperature T_C ≤ 50°C (where derating starts). TC is measured in the middle of the heat-sink side.

INPUT					
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Low voltage Turn ON	V_{IN}		85	90	V_{AC}
Operating Input Voltage Low-line range High-line range		 90 176	 100 – 120 200 - 240	 175 264	
Voltage Swell (no damage)				275	
Low voltage Turn OFF Hysteresis			80 5	85	
High voltage Turn ON High voltage Turn OFF Hysteresis			267 272 5		
Frequency	F_{IN}	45		65	Hz
Full-Load Input Current at V_{IN} = 90-100V_{AC}, P_{OUT}=1200W 110-145V_{AC}, P_{OUT}=1200W 230V_{AC}, P_{OUT}=1600W	I_{IN}		 15.1 12.1 7.6		A_{RMS}
Inrush Current (90-264VAC , 25°C, excluding X-Capacitor charging)	I_{IN}			25	A_{PK}
Idle Power (230V_{AC}, P_{OUT}=0) Output OFF Output ON	P_{IN}		 7 15	 10 20	W
Leakage Current to Earth (250V_{AC}, 60Hz)	I_{IN}			3.5	mA_{RMS}
Harmonic Distortion (85% to 100% of rated load): Class A				5	%
Power Factor (230V_{AC}, 60–100% of full load)	PF	0.96	0.98		
Efficiency (V_{OUT} = 52V, 50%-100% of full load) 115V_{AC} 230V_{AC}	η	 90 93	 92 95		%
Holdup time (230V_{AC}, V_{OUT}= 52V, P_{OUT}=1200W, T_A ≥ -10°C , output allowed to decay down to 42V_{DC})	T	10			ms
Ride-through time	T	10			ms
Isolation[3] Input (each line) - Chassis		 1500			

See footnotes on page 6

Technical Specifications (continued)

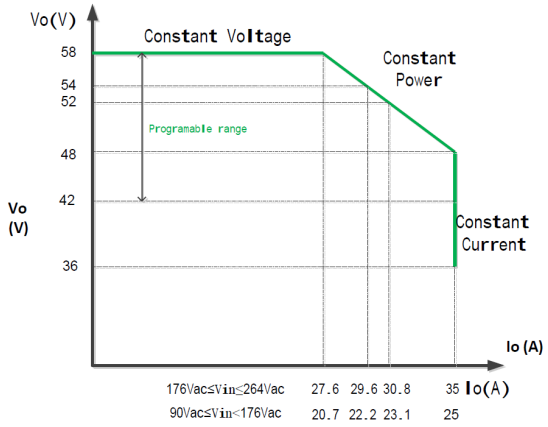
Electrical Specifications (continued)

52V$_{DC}$ MAIN OUTPUT						
Parameter		**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Maximum Output Power, 48-58 V_{dc} out Low-line input, 90–145V_{AC}, T_C < 50°C High-line input, 176–264V_{AC}, T_C < 50°C		P_{OUT}	1200 1600			W_{DC}
Derated Output Power at T_C > 50°C Low-line input, 90–145AC 2%/°C High-line input, 176–264V_{AC}2%/°C		P_{OUT}				W_{DC}
Factory set point (T_C=25°C, I_{OUT}=50% full load)[4]		$V_{O,NOM}$	51.5	52	52.5	V_{DC}
Overall regulation (load, line, temperature, life) Without controller		V_{OUT}			±2	% FL
Output Voltage Set Range (software control)			42		58	V_{DC}
Maximum Output Current Low-line input, V_{OUT}=42.0V (P_{OUT}=1200W) Low-line input, V_{OUT}=48.0V (P_{OUT}=1200W) Low-line input, V_{OUT}=52.0V (P_{OUT}=1200W) Low-line input, V_{OUT}=58.0V (P_{OUT}=1200W) High-line input, V_{OUT}=42.0V (P_{OUT}=1600W) High-line input, V_{OUT}=48.0V (P_{OUT}=1600W) High-line input, V_{OUT}=52.0V (P_{OUT}=1600W) High-line input, V_{OUT}=58.0V (P_{OUT}=1600W)		$I_{O,FL}$			25.0 25.0 23.1 20.7 33.3 33.3 30.8 27.6	A_{DC}
Current Share (single-wire, up to 12 rectifiers, each >50% full load)				±3	±5	% FL
Output Ripple (V_{IN}=120/230VAC, load > 0.5A, 5Hz to 20MHz bandwidth) Peak-to-Peak (0 to 50°C) RMS		V_{OUT}			 200 50	 mV_{p-p} mV_{rms}
External Bulk Load Capacitance		C_{OUT}	0		10,000	µF
Turn-On[5] Delay Rise Time (hardware signal /RS485) No load to full load Overshoot/Undershoot		 T		 115	 5 2	 S ms %
Load Step Response ($\Delta I_O/\Delta t$=1A/µS, $I_{O,START}$ ≥ 10% full load) ΔI ΔV Settling time (to within 10% peak deviation)		 I_{OUT} V_{OUT} T			 25 ±5 5	 % $I_{O,FL}$ % ms
Permissible Load Boundary	Power limit , high line	P_{OUT}	1600			W
	Low line	P_{OUT}	1200			W
	Current limit , high line	I_{OUT}	33.3			A
	Low line	I_{OUT}	25.0			A
	The overload current limit threshold is set □ 5% above the load envelope shown here.					

See footnotes on page 6

Technical Specifications (continued)

Electrical Specifications (continued)

52V_{DC} MAIN OUTPUT						
Parameter		**Symbol**	**Min**	**Typ**	**Max**	**Unit**
						
	System power up	Upon insertion the rectifier will delay an overload shutdown for 20 seconds.				
Short-circuit current (hiccup mode)				10		% of full load
Under-voltage shutdown[6]					36	V_{DC}
Over-Voltage (latched shutdown)		V_{OUT}		59.5		V_{DC}
Over-temperature Shutdown (below the max device rating being protected) Restart hysteresis (below shutdown level)		T	 20 10			°C
Isolation Output-Chassis (Standard, non-POE compliant)		V	500			V_{DC}

8VDC Auxiliary output[7]					
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Output Voltage Set-point	V_{OUT}		8		V_{DC}
Output Current		0		150	mA

General Specifications

Parameter	**Min**	**Typ**	**Max**	**Units**	**Notes**
Reliability		450,000		Hours	Full load, 25°C ; MTBF per SR232 Reliability protection forelectronic equipment, issue 2, method I, case III,
Service Life		10		Years	Full load 25C
Unpacked Weight		3.4		Kgs/Lbs	
Packed Weight		4.0		Kgs/Lbs	
Heat Dissipation	75 Watts or 246 BTUs @ 80% load, 100 Watts or 341 BTUs @ 100% load				

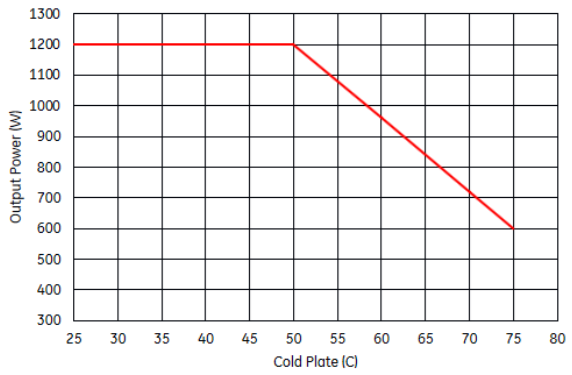
See footnotes on page 6

Technical Specifications (continued)

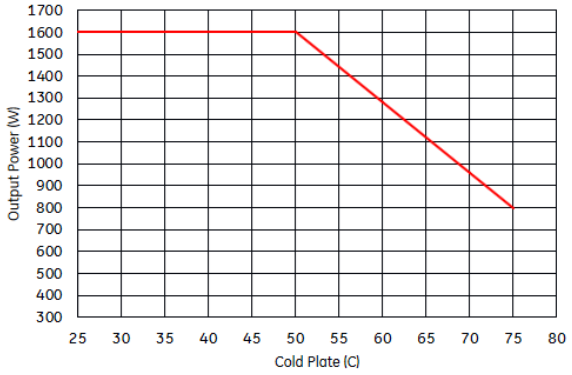
Environmental Specifications

Parameter	Min	Typ	Max	Units	Notes
Operating Case Temperature[8]	-40[9]		75	°C	Measured in the center of the heatsink
Storage Temperature	-40		85	°C	
Operating Altitude			4000/13,10	m / ft	
Non-operating Altitude			8200/27,0	m / ft	
Power Derating with Temperature			2	%/°C	50°C - 75°C
Acoustic noise		0		dbA	Full load
Humidity Operating Storage	5 5		95 95	% %	Relative humidity, non-condensing
Shock and Vibration acceleration			2.4	Grms	IPC-9592B, Class II

Output power derating curve with temperature



Low line at T_C > 50°C, 2%/°C



High line at T_C > 50°C, 2%/°C

EMC

Parameter	Measurement	Standard	Level	Test
AC input	Conducted emissions	EN55022, FCC Docket 20780 part 15, subpart J Meets Telcordia GR1089-CORE by a TBD dB margin	Class A 6dB margin	0.15 – 30MHz
	Radiated emissions	EN55032	Class A 6dB margin	30 – 10000MHz
	Line harmonics	EN61000-3-2 THD	Table 1 5%	0 – 2 kHz 230VAC, full load, 25°C
AC Input Immunity	Line sags and interruptions	EN61000-4-11	B	-30%, 10ms
			B	-60%, 100ms
			B	-100%, 5sec

See footnotes on page 6

Technical Specifications (continued)

EMC (continued)

Parameter	Measurement	Standard	Level	Test
AC Input Immunity	Line sags and interruptions	Output will stay above 40V_{DC} @ 75% load Sag must be higher than 80Vrms.	A	25% line sag for 2 seconds 1 cycle interruption
	Lightning surge	EN61000-4-5, Level 4, 1.2/50µs – error free	A	4kV, common mode
			A	2kV, differential mode
	Lightning surge	ANSI C62.41 - level A3	B	6kV, common & differential
	Fast transients	EN61000-4-4, Level 3	A	5/50ns, 2kV (common mode)
Enclosure immunity	Conducted RF fields	EN61000-4-6, Level 3	A	130dBµV, 0.15-80MHz, 80% AM
	Radiated RF fields	EN61000-4-3, Level 3	A	10V/m, 80-1000MHz, 80% AM
		ENV 50140	A	
	ESD	EN61000-4-2, Level 4	B	8kV contact, 15kV air

FOOTNOTES

* 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. (The CE mark is placed on selected products.)

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

[1] At output voltages exceeding 52V_{DC}

[2] See the derating guidelines under the Environmental Specifications section

[3] According to EN62368; test with equivalent dc voltage is acceptable. “Output” includes control signals. Consult factory before testing to avoid damage

[4] Output is floating; either side can be connected to frame ground.

[5] Monotonic turn-on from 30% to 100% of $V_{O,NOM}$ above -5°C operation, and from 60% to 100% of $V_{O,NOM}$ below -5°C operation.

[6] Attempts auto-restart (hiccup) a minimum of three times, then latches off. A restart command from the controller resets this protection.

[7] Designed for internal use only, to bias up to 4 other identical rectifiers. Therefore regulation, ripple & noise are not specified, and no over- **current protection is provided.**

[8] With power derating for T_C > 50°C regardless of low-line and high-line.

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

[10] 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.

Technical Specifications (continued)

Characteristic Curves

The following figures provide typical characteristics for the CC1600AC52SXZ01A rectifier and 25°C.

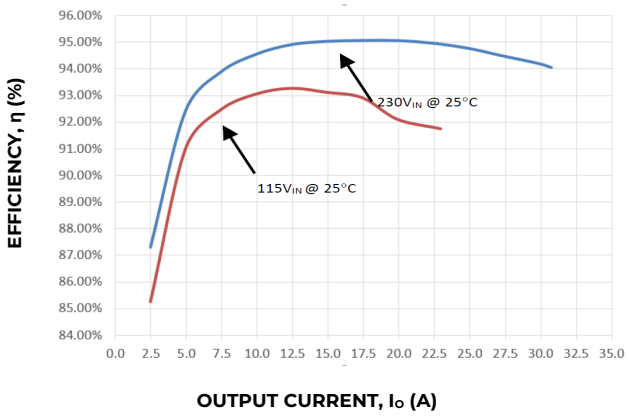


Figure 1. Rectifier Efficiency versus Output Current.

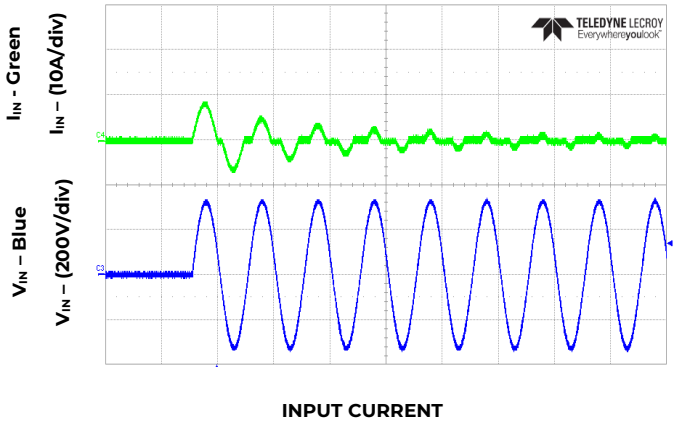


Figure 2. Inrush current V_{IN} = 230V_{AC}, 0ºC phase angle

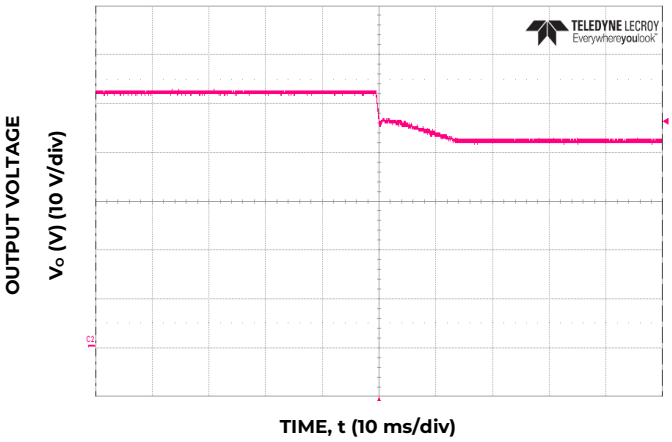


Figure 3. Main output: Output changed from 52V to 42V, full load; commanded via RS485.

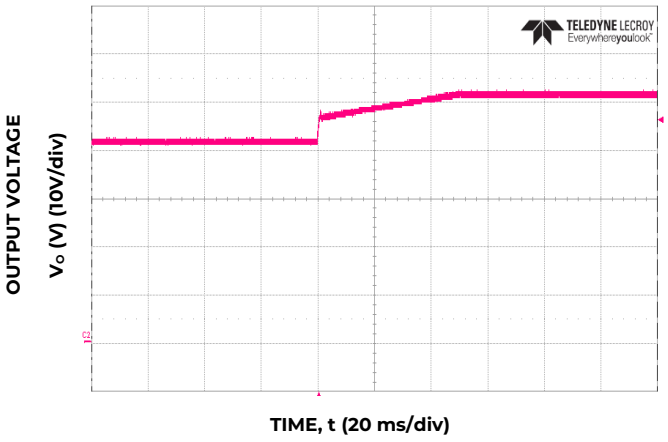


Figure 4. Main output: Output changed from 42V to 52V, full load; commanded via RS485.

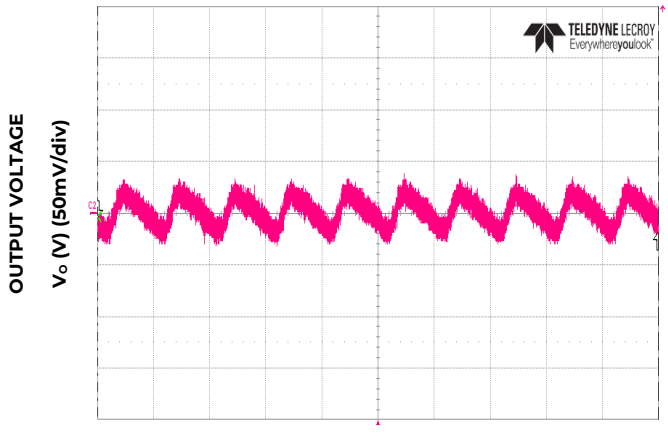


Figure 5. 52 V_{DC} output ripple and noise, full load, V_{IN} = 230V_{AC}, 20MHz bandwidth

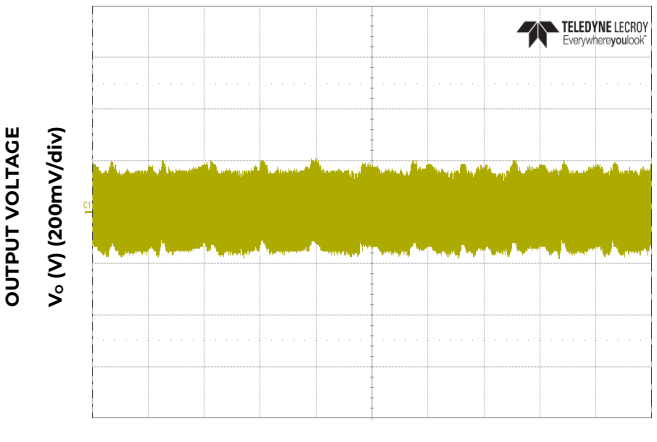


Figure 6. 8 V_{DC} output ripple and noise, all full load, V_{IN} = 230V_{AC}, 20 MHz bandwidth

Technical Specifications (continued)

Characteristic Curves (continued)

The following figures provide typical characteristics for the CC1600AC52SX rectifier and 25°C.

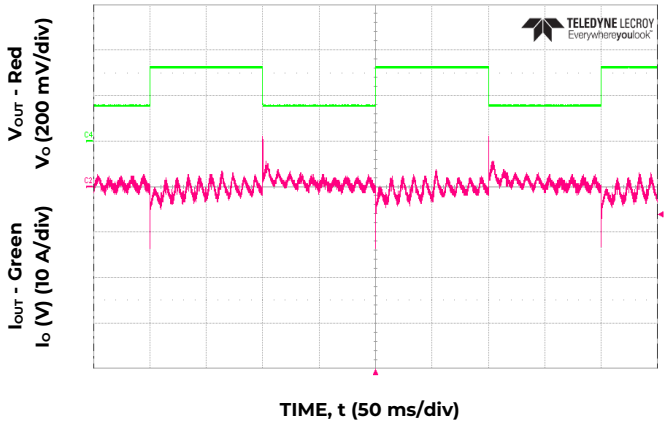


Figure 7. Transient response 52 V_{DC} load step 25 – 50%, Slew rate: 1A/µs, V_{IN} = 230V_{AC}

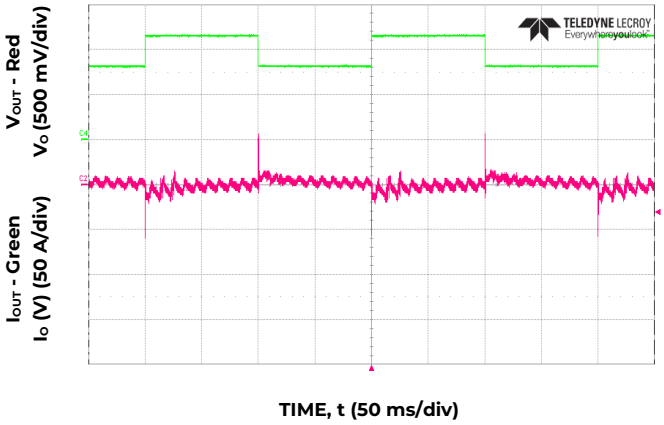


Figure 8. Transient response 52 V_{DC} load step 50 – 75%, Slew rate: 1A/µs, V_{IN} = 230V_{AC} .

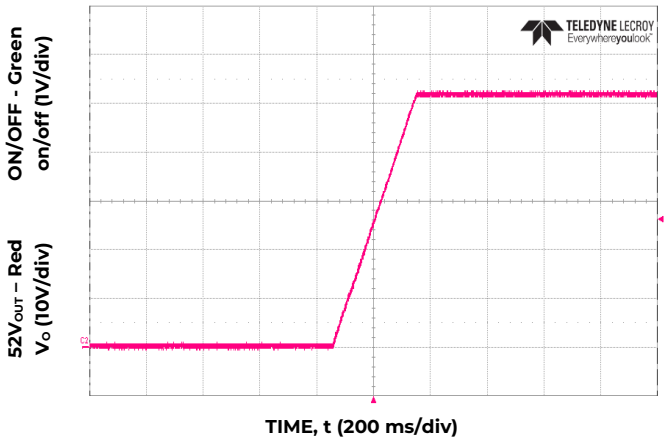


Figure 9. 52 V_{DC} soft start, 80% full load V_{IN} = 230V_{AC} .

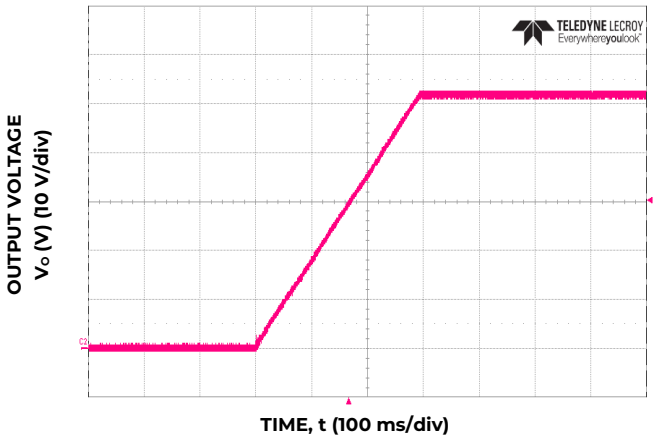


Figure 10. 52 V_{DC} soft start, 80% full load V_{IN} = 230V_{AC} with 10000µF external capacitance.

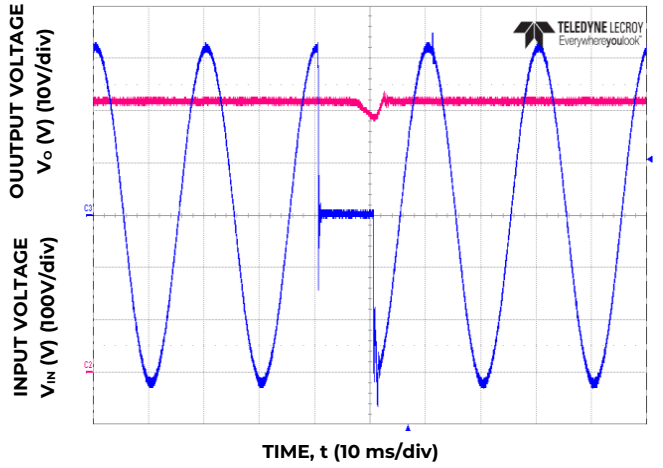


Figure 11. Ride through missing ½ cycle, full load, V_{IN} = 230V_{AC}.

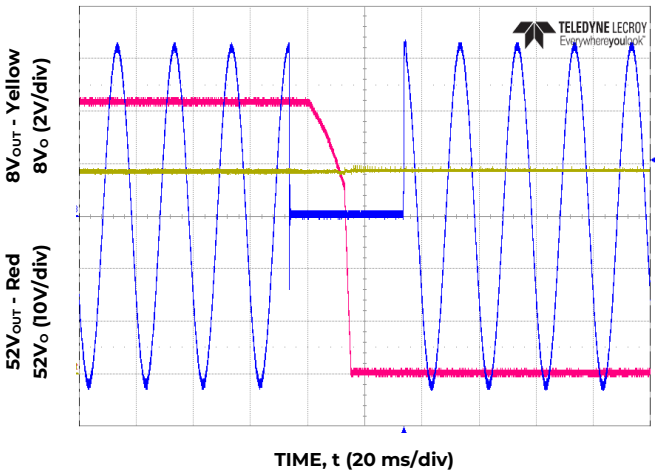
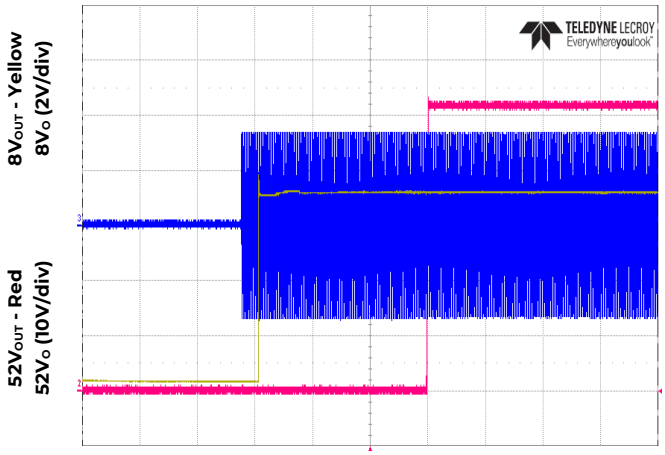


Figure 12. 40ms AC dropout @ full load, V_{IN} = 230V_{AC}.

Technical Specifications (continued)

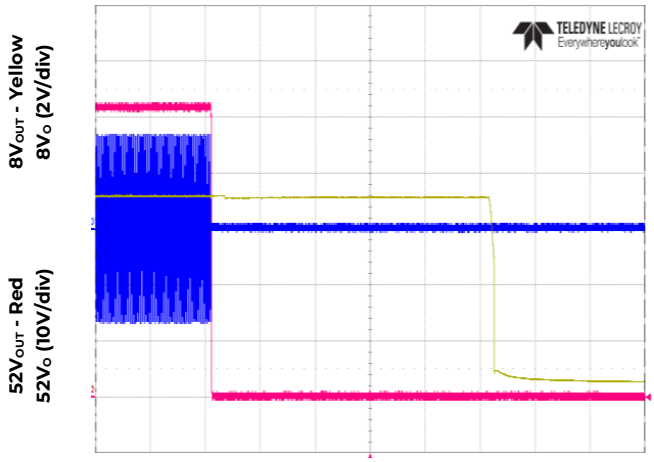
Characteristic Curves (continued)

The following figures provide typical characteristics for the CC1600AC52SX rectifier and 25°C.



TIME, t (1 s/div)

Figure 13. Turn-ON at full load V_{IN} = 230 V_{AC}



TIME, t (1 s/div)

Figure 14. Turn-OFF at full load V_{IN} = 230 V_{AC}.

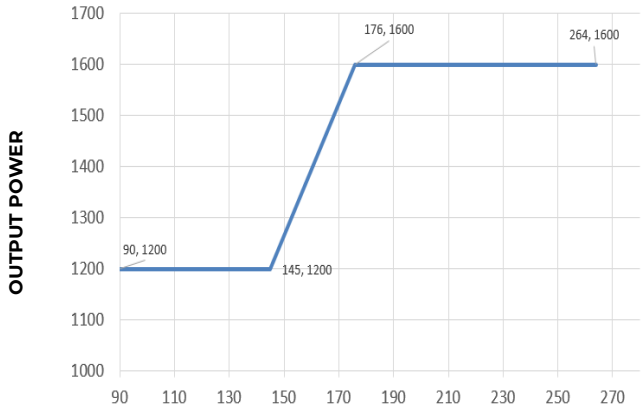
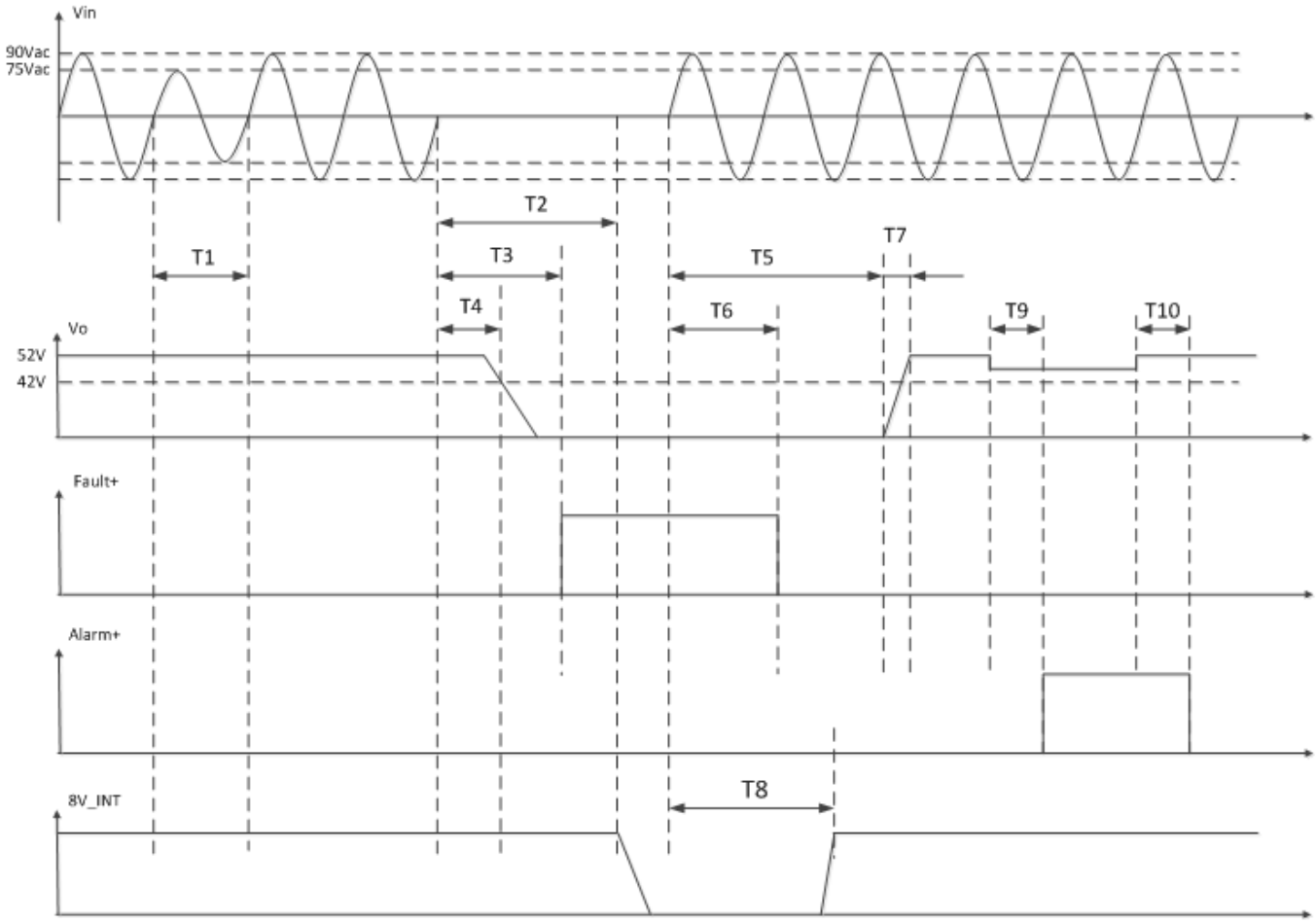


Figure 15. Output power derating below V_{IN} of 185 V_{AC}

Technical Specifications (continued)

Timing diagrams

Response to input fluctuations



T1 – ride through time – 0.5 to 1 cycles [10 – 20ms] V_{OUT} remains within regulation – load dependent
T2 – hold up time of the 8V_INT output @ full load – 5s – from the time when AC input is failed
T3 – AC failed delay time <320ms – from when the AC input failed to Fault signal be high
T4 – hold up time >10ms – V_{OUT} stays above $42V_{DC}$ for high line and >18ms for low line
T5 – delay time – 3.3s – from AC returns to regulation to restart of output
T6 – AC failed recovery time -400ms – from when the AC returns within regulation to Fault signal be low
T7 – rise time - 120ms – the time it takes for V_{OUT} to rise from 10% to 90% of regulation
T8 – turn on delay time of the 8V_INT output – 4.7s – 8V_INT is available at least 3s before the main output is within regulation
T9 – Alarm settle time for current limit– 140ms –from current limit to alarm signal be high.
T10 – Alarm recovery time for current limit – 1s –from releasing of current limitation to alarm signal be low

Technical Specifications (continued)

Output Behavior

The rectifier produces power at the output-voltage set-point (either at the factory default when the input AC voltage is within the defined operating input voltage range.

Current limit. As shown by the V_o versus Io curve in the Electrical Specifications table, the maximum rectifier current follows a constant-power curve from 48V to 58V (unless the current limit is reset to less than 100%). Overcurrent protection is initiated at 5% above this maximum current. Between 48V and the under-voltage shutdown limit ($36V_{dc}$ max), the maximum current is fixed. If the output voltage falls below the under-voltage shutdown limit, the rectifier shuts down and automatically attempt to restart. If the input voltage crosses 176 V_{ac}, the current limits jump to new values as shown below the Vo versus Io curve.

Output Over-Current. Depending on the input voltage the output behavior shall follow the power curve as described in the Rectifier.

Once the output current limit has reached and the output voltage is <36V, the rectifier shall enter a hiccup. During restart if the output voltage is still <36V and over-current is re-triggered, the unit will attempt to restart for 14 seconds, then remain off for 14 seconds, then retry.

Output Over-Voltage. If the rectifier's output voltage exceeds the HVSD threshold, the rectifier shall shut down its output. It shall then attempt to restart 3 times. Once 3 successive restarts have been attempted, the rectifier shall be latched off. The rectifier shall remain latched off until either the AC input is cycled.

Input Over-Voltage. If the rectifier AC input voltage exceeds the internal over-voltage threshold then the rectifier shall latch shut-down. The rectifier shall remain off until the AC input voltage returns to the allowable input range.

Over-Temperature. The unit is protected from over- temperature at multiple internal sense points by shutting down, then restarting after all points have cooled to acceptable levels.

Restart after a latch off: To restart after a latch off, any of three restart mechanisms are available:

1. Remove and reinsert the unit.
2. Turn OFF and then turn ON AC power to the unit.
3. The unit may be commanded to restart via RS485 through the Operation command by first turning OFF then turning ON.

Each of these commands must keep the rectifier in the OFF state for at least 2 seconds, except for changing to restart.

A successful restart shall clear all alarm registers.

Control and Status

Analog control inputs are provided only to share load current evenly between rectifiers connected in parallel. These signals are named SHARE+ and SHARE- , described in the "Pin Assignments" table near the end of this datasheet.

Signal Reference: There are three different signal "grounds" in the rectifier, Alarm-GND, Sig-GND, and Com-GND. Com- GND is connected to Sig-GND by a 10 ohm resistor inside the rectifier. Alarm-GND has 100V of functional isolation from the other two. Individual signals are referenced to one of these grounds as described in the "Pin Assignments" table near the end of this datasheet.

Com-GND and Sig-GND are connected internally by a 10- ohm resistor so they should never be driven to different potentials. Sig-GND is capacitively coupled to PE inside the rectifier; the voltage difference between them should be kept less than $100V_{DC}$. Likewise Alarm-GND should not be driven more than $100V_{DC}$ from Sig-Gnd or PE.

Analog Control Signals

Load share (Ishare+ and -): This is a two wire analog signal that is generated and acted upon automatically by rectifiers connected in parallel. Ishare pins should be connected to each other for rectifiers, if active current share among the rectifiers is desired. No resistors or capacitors should get connected to this pin.

8V_INT: Single wire connection between rectifiers, Provides bias to the DSP of an unpowered rectifier.

Digital Communications

CC1600 supports RS485 communication (with GP protocol). The details are not provided in this datasheet. OmniOn will provide separate application notes on the Galaxy RS485 based protocol for users to interface to rectifier. Contact your local OmniOn representative for details.

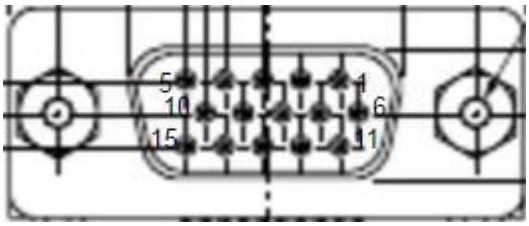
Technical Specifications (continued)

Pin Assignments

Signal Connector for Screw-Terminal Version (-ES)

Pin 5	Pin 4	Pin 3	Pin 2	Pin 1
Fault+	Alarm+	8V_INT	GND	RS485_A
Pin 10	Pin 9	Pin 8	Pin 7	Pin 6
ALARM-GND	Reserved	PS-Present	ComGND	RS485_B
Pin 15	Pin 14	Pin 13	Pin 12	Pin 11
ADDR0	ADDR1	ADDR2	Share+	Share-

- Sub D-15 connector (from which direction):



Pin Number	Function	Description
Signal Pins		
Pin5	Fault＋	Isolated open collector output with internal 100 ohms seriesresistor. Closed to ALARM-GND in normal non-FAULT condition. Opens (high resistance) with respect to ALARM-GND during a FAULT condition.
Pin4	Alarm＋	Isolated open collector output with internal 100 ohms series resistor. Closed to ALARM-GND in normal non-ALARM condition. Opens (high resistance) with respect to ALARM-GND during an ALARM condition.
Pin10	ALARM-GND	Isolated ground for Fault+ and Alarm+ signals.
Pin12	Share+	Current sharing bus
Pin11	Share-	
Pin9	Reserved	No connect
Pin8	PS-present	Module present signal connected to ALARM-GND inside the rectifier
Pin2	GND	Signal GND for 8V_INT and ADDR0, ADDR1, ADDR2.
Pin15	ADDR0	Address signals.
Pin14	ADDR1	
Pin13	ADDR2	
Pin3	8V_INT	8 V DC internal back-bias (~150mA)
Pin7	ComGND	RS485 circuit reference ground, connected to GND via a lowvalue resistor
Pin1	RS485_A	RS485 communication signals; RS485_A is the Signal + or non- inverting (+) pin aka '+' aka TxD+/RxD+. RS485_B is the Signal- or inverting (-) pin aka '-' aka TxD-/RxD.
Pin6	RS485_B	

Technical Specifications (continued)

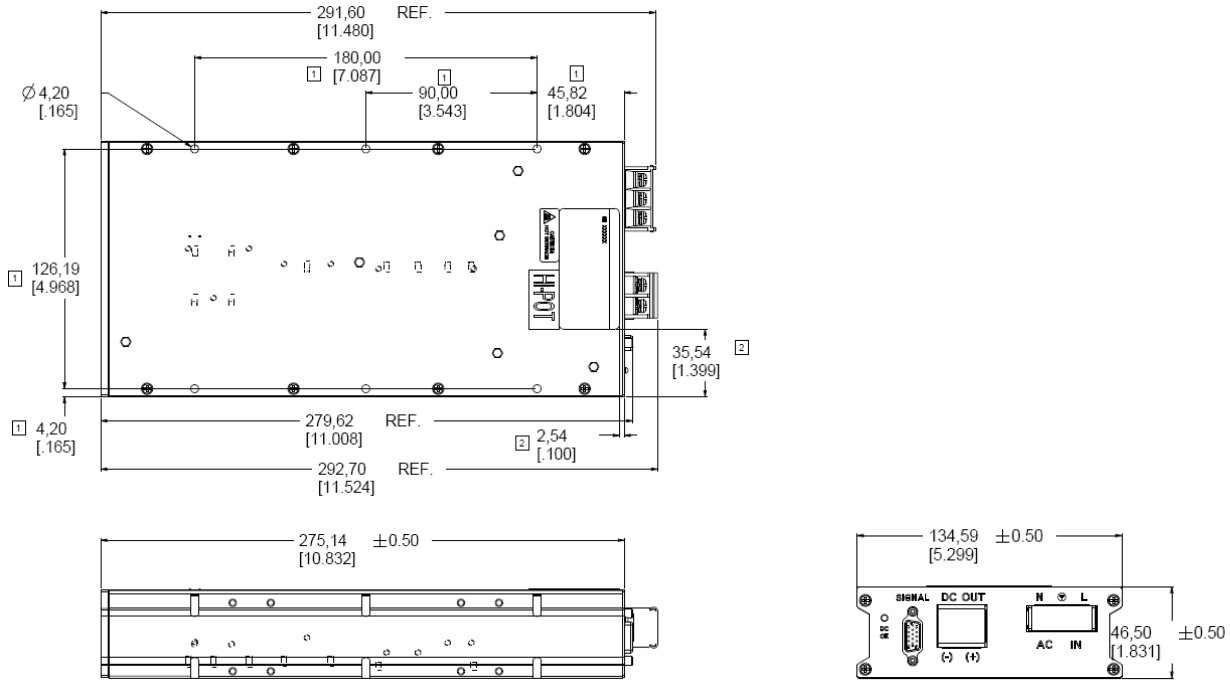
Mechanical Outline

Flatness of sink side ±0.15 mm

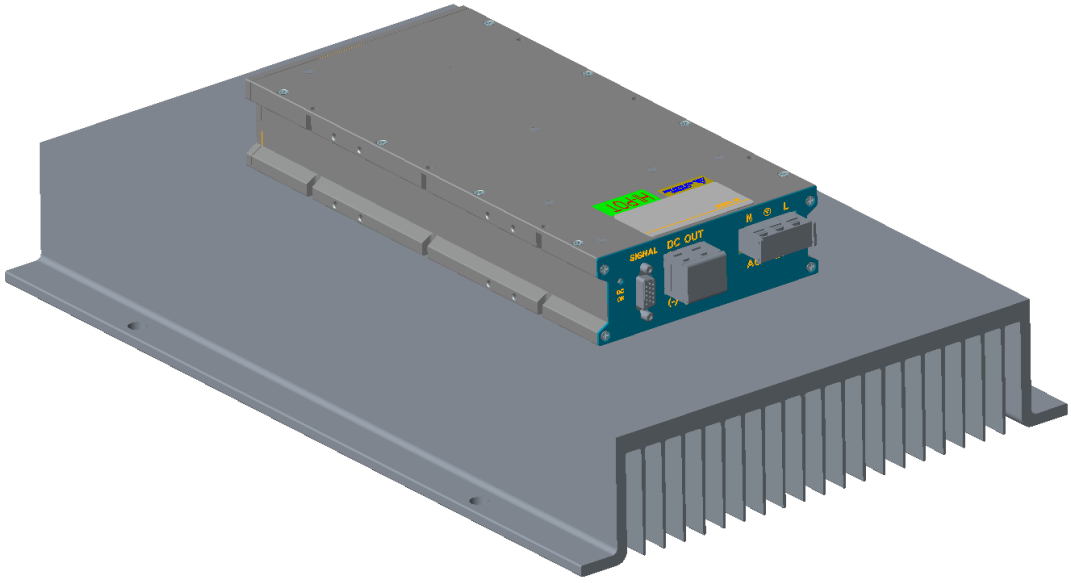
Outline Dimensions (including protruding connector): 292.70 x 134.59 x 46.50mm (11.524 x 5.299 x 1.831 inch) “Cooling side” (for heat transfer) is the large surface as below shown, opposite the label.

The cooling device (cold plate, warm wall or heat sink) should be placed in good thermal contact with the entire cooling surface by using thermal grease or thermal interface pad between rectifier and cold plate.

(Drill 6pcs M4 thread holes on cold plate to matting below 6 pcs φ4.2 of rectifier as marked [1.])



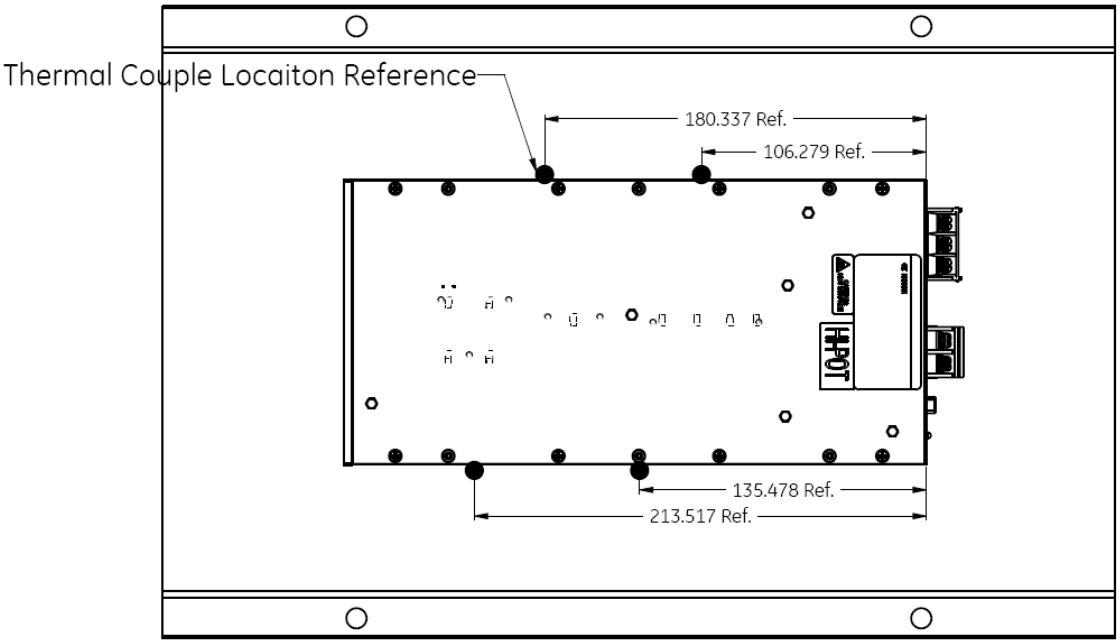
CC1600 rectifier mated on the surface of cold plate as below shown.

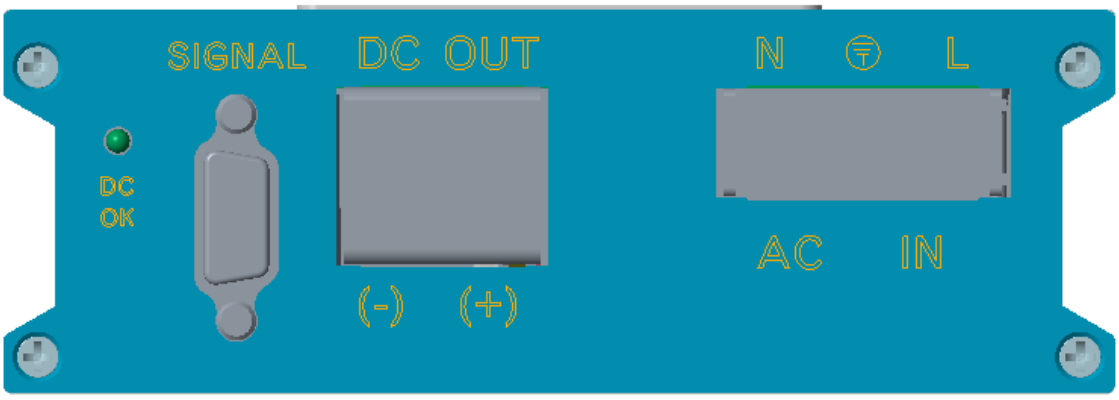


Technical Specifications (continued)

Mechanical Outline (continued)

The locations of 4 thermal couples reference as below shown.





Screw-Terminal Connector Option

Input Terminal Block	4600096785P	DINKLE: DT-51-B12W-03
Output Terminal Block	4600095190P	DINKLE: DT-66-C11W-02
Signal D SUB	450051939	TE: CONN 1734530-3 RIGHT-ANGLE RECEPTACLE ASSY 15P 3R

Visual Indicators (LED)

“DC OK” LED: The green LED shall illuminate when DC output voltages are within specification and able to provide power. LED will extinguish immediately when power is removed.

Technical Specifications (continued)

Accessories

Item	Description	Part number
	Signal D SUB Matting Connector,15Pin,	TE Connector: 748364-1 Terminal: 1658670-2 Cable wire: 10368 or EQ, AWG 24
	AC Input Harness	Ring Terminal TE PN: 4-51864-1 or EQ Min ID: Φ4.3mm Max OD: Φ8.4mm AWG: 14GA
	DC Output Harness	Ring Terminal TE PN: 8-35787-2 or EQ Min ID: Φ4.3mm Max OD: Φ9.0mm AWG: 10GA

Ordering Information

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

Part #	Des	Ordering Code
CC1600AC52SXZ01A	1600W ACDC fan less IP65 rated 52Vout rectifier with	CC1600AC52SXZ01A

Table: Device Codes

Contact Us

For more information, call us at

1-877-546-3243 (US)

1-972-244-9288 (Int'l)

Change History (excludes grammar & clarifications)

Revision	Date	Description of the change
2.3	01/07/2022	Updated as per template and upgraded RoHS
2.4	11/24/2023	Updated as per OmniOn template

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