

## DATASHEET

# CC1600 Conduction-Cooled IP65 Rated Rectifier

**Input: 100-120/200-240 V<sub>ac</sub>; 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<sub>ac</sub>), it can deliver the maximum 1600W at case temperatures less than 50°C. With low-range ac input (100-120 V<sub>ac</sub>), 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%<sup>1</sup>
- 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<sup>3</sup> density
- 1600W from nominal 200-240V<sub>AC</sub> <50°C baseplate
- 1200W from nominal 100-120V<sub>AC</sub> for V<sub>O</sub> < 52V<sub>DC</sub>, < 50°C baseplate
- Output voltage programmable from 42V – 58V<sub>DC</sub>
- "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<sup>†</sup> C22.2 specified compliance with IEC62368-1
- CE mark meets 2006/95/EC directive<sup>5</sup>
- 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

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## 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) <sup>2</sup>            | $T_C$     | -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  $T_C \leq 50^\circ\text{C}$  (where derating starts).  $T_C$  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                                                                                                                               |          | 90   | 100 – 120 | 175 |            |
| High-line range                                                                                                                              |          | 176  | 200 - 240 | 264 |            |
| Voltage Swell (no damage)                                                                                                                    |          |      |           | 275 |            |
| Low voltage Turn OFF                                                                                                                         |          |      | 80        | 85  |            |
| Hysteresis                                                                                                                                   |          |      | 5         |     |            |
| High voltage Turn ON                                                                                                                         |          |      | 267       |     |            |
| High voltage Turn OFF                                                                                                                        |          |      | 272       |     |            |
| Hysteresis                                                                                                                                   |          |      | 5         |     |            |
| Frequency                                                                                                                                    | $F_{IN}$ | 45   |           | 65  | Hz         |
| Full-Load Input Current at $V_{IN} =$                                                                                                        | $I_{IN}$ |      |           |     | $A_{RMS}$  |
| 90-100 $V_{AC}$ , $P_{OUT}=1200W$                                                                                                            |          |      | 15.1      |     |            |
| 110-145 $V_{AC}$ , $P_{OUT}=1200W$                                                                                                           |          |      | 12.1      |     |            |
| 230 $V_{AC}$ , $P_{OUT}=1600W$                                                                                                               |          |      | 7.6       |     |            |
| Inrush Current (90-264 $V_{AC}$ , 25°C, excluding X-Capacitor charging)                                                                      | $I_{IN}$ |      |           | 25  | $A_{PK}$   |
| Idle Power (230 $V_{AC}$ , $P_{OUT}=0$ )                                                                                                     | $P_{IN}$ |      | 7         | 10  | W          |
| Output OFF                                                                                                                                   |          |      | 15        | 20  |            |
| Output ON                                                                                                                                    |          |      |           |     |            |
| Leakage Current to Earth (250 $V_{AC}$ , 60Hz)                                                                                               | $I_{IN}$ |      |           | 3.5 | $mA_{RMS}$ |
| Harmonic Distortion (85% to 100% of rated load): Class A                                                                                     |          |      |           | 5   | %          |
| Power Factor (230 $V_{AC}$ , 60–100% of full load)                                                                                           | PF       | 0.96 | 0.98      |     |            |
| Efficiency ( $V_{OUT} = 52V$ , 50%-100% of full load)                                                                                        | $\eta$   |      |           |     | %          |
| 115 $V_{AC}$                                                                                                                                 |          | 90   | 92        |     |            |
| 230 $V_{AC}$                                                                                                                                 |          | 93   | 95        |     |            |
| Holdup time (230 $V_{AC}$ , $V_{OUT} = 52V$ , $P_{OUT}=1200W$ , $T_A \geq -10^\circ\text{C}$ , output allowed to decay down to 42 $V_{DC}$ ) | $T$      | 10   |           |     | ms         |
| Ride-through time                                                                                                                            | $T$      | 10   |           |     | ms         |
| Isolation <sup>3</sup>                                                                                                                       |          |      |           |     |            |
| Input (each line) - Chassis                                                                                                                  |          | 1500 |           |     |            |

See footnotes on page 6

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## Technical Specifications (continued)

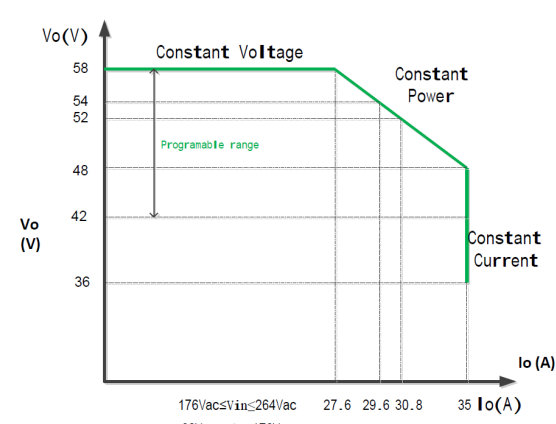
### Electrical Specifications (continued)

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

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## Technical Specifications (continued)

### Electrical Specifications (continued)

| 52V <sub>DC</sub> MAIN OUTPUT                                           |                                                                                                                                                                                                                                                                                                                        |                                                                              |      |     |                 |                       |      |      |      |    |        |                      |      |      |      |    |  |
|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|------|-----|-----------------|-----------------------|------|------|------|----|--------|----------------------|------|------|------|----|--|
| Parameter                                                               | Symbol                                                                                                                                                                                                                                                                                                                 | Min                                                                          | Typ  | Max | Unit            |                       |      |      |      |    |        |                      |      |      |      |    |  |
|                                                                         | <div></div> <table><tr><td>176Vac ≤ Vin ≤ 264Vac</td><td>27.6</td><td>29.6</td><td>30.8</td><td>35</td><td>Io (A)</td></tr><tr><td>90Vac ≤ Vin ≤ 176Vac</td><td>20.7</td><td>22.2</td><td>23.1</td><td>25</td><td></td></tr></table> |                                                                              |      |     |                 | 176Vac ≤ Vin ≤ 264Vac | 27.6 | 29.6 | 30.8 | 35 | Io (A) | 90Vac ≤ Vin ≤ 176Vac | 20.7 | 22.2 | 23.1 | 25 |  |
| 176Vac ≤ Vin ≤ 264Vac                                                   | 27.6                                                                                                                                                                                                                                                                                                                   | 29.6                                                                         | 30.8 | 35  | Io (A)          |                       |      |      |      |    |        |                      |      |      |      |    |  |
| 90Vac ≤ Vin ≤ 176Vac                                                    | 20.7                                                                                                                                                                                                                                                                                                                   | 22.2                                                                         | 23.1 | 25  |                 |                       |      |      |      |    |        |                      |      |      |      |    |  |
|                                                                         | 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 <sup>6</sup>                                     |                                                                                                                                                                                                                                                                                                                        |                                                                              |      | 36  | V <sub>DC</sub> |                       |      |      |      |    |        |                      |      |      |      |    |  |
| Over-Voltage (latched shutdown)                                         | V <sub>OUT</sub>                                                                                                                                                                                                                                                                                                       |                                                                              | 59.5 |     | V <sub>DC</sub> |                       |      |      |      |    |        |                      |      |      |      |    |  |
| Over-temperature Shutdown (below the max device rating being protected) | T                                                                                                                                                                                                                                                                                                                      | 20                                                                           |      |     | °C              |                       |      |      |      |    |        |                      |      |      |      |    |  |
| Restart hysteresis (below shutdown level)                               |                                                                                                                                                                                                                                                                                                                        | 10                                                                           |      |     |                 |                       |      |      |      |    |        |                      |      |      |      |    |  |
| Isolation Output-Chassis (Standard, non-POE compliant)                  | V                                                                                                                                                                                                                                                                                                                      | 500                                                                          |      |     | V <sub>DC</sub> |                       |      |      |      |    |        |                      |      |      |      |    |  |

| 8VDC Auxiliary output <sup>7</sup> |                  |     |     |     |                 |
|------------------------------------|------------------|-----|-----|-----|-----------------|
| Parameter                          | Symbol           | Min | Typ | Max | Unit            |
| Output Voltage Set-point           | V <sub>OUT</sub> |     | 8   |     | V <sub>DC</sub> |
| 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 |         |     |         |                                                                                                               |

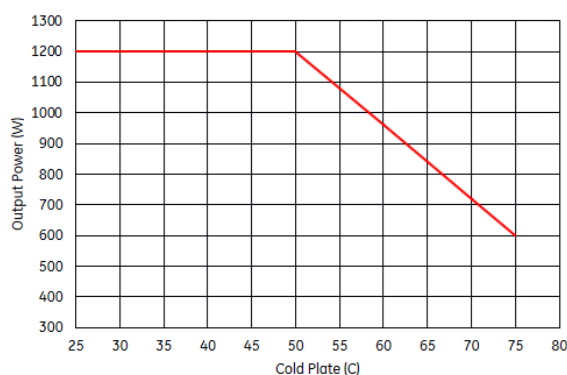
See footnotes on page 6

## Technical Specifications (continued)

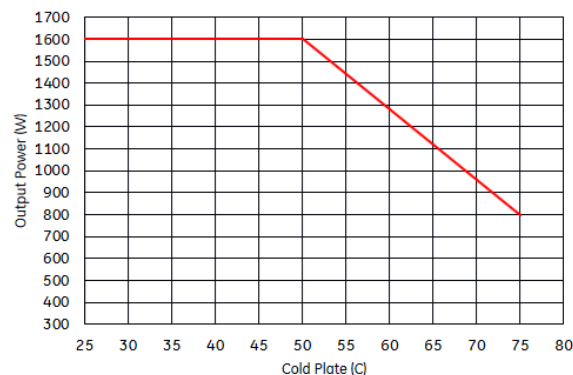
### Environmental Specifications

| Parameter                               | Min              | Typ | Max        | Units  | Notes                                  |
|-----------------------------------------|------------------|-----|------------|--------|----------------------------------------|
| Operating Case Temperature <sup>8</sup> | -40 <sup>9</sup> |     | 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<br>5           |     | 95<br>95   | %<br>% | 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<sub>c</sub> > 50°C, 2%/°C



High line at T<sub>c</sub> > 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 A6dB margin | 0.15 – 30MHz                         |
|                   | Radiated emissions          | EN55032                                                                                     | Class A6dB margin | 30 – 10000MHz                        |
|                   | Line harmonics              | EN61000-3-2THD                                                                              | Table 1<br>5%     | 0 – 2 kHz<br>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 <sub>DC</sub> @ 75% load<br>Sag must be higher than 80V <sub>rms</sub> . | A     | 25% line sag for 2 seconds<br>1 cycle interruption |
|                    | Lightning surge             | EN61000-4-5, Level 4, 1.2/50μs – error free                                                         | A     | 4kV, common mode                                   |
|                    | Lightning surge             | ANSI C62.41 - level A3                                                                              | A     | 2kV, differential mode                             |
|                    | Fast transients             | EN61000-4-4, Level 3                                                                                | B     | 6kV, common & differential                         |
| Enclosure Immunity | Conducted RF fields         | EN61000-4-6, Level 3                                                                                | A     | 5/50ns, 2kV (common mode)                          |
|                    | Radiated RF fields          | EN61000-4-3, Level 3                                                                                | A     | 130dBμV, 0.15-80MHz, 80% AM                        |
|                    |                             | ENV 50140                                                                                           | A     | 10V/m, 80-1000MHz, 80% AM                          |
|                    | 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

<sup>1</sup> At output voltages exceeding 52V<sub>DC</sub>

<sup>2</sup> See the derating guidelines under the Environmental Specifications section

<sup>3</sup> According to EN62368; test with equivalent dc voltage is acceptable. "Output" includes control signals. Consult factory before testing to avoid damage

<sup>4</sup> Output is floating; either side can be connected to frame ground.

<sup>5</sup> Monotonic turn-on from 30% to 100% of V<sub>O,NOM</sub> above -5°C operation, and from 60% to 100% of V<sub>O,NOM</sub> below -5°C operation.

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

<sup>7</sup> 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.**

<sup>8</sup> With power derating for T<sub>C</sub> > 50°C regardless of low-line and high-line.

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

<sup>10</sup> 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.

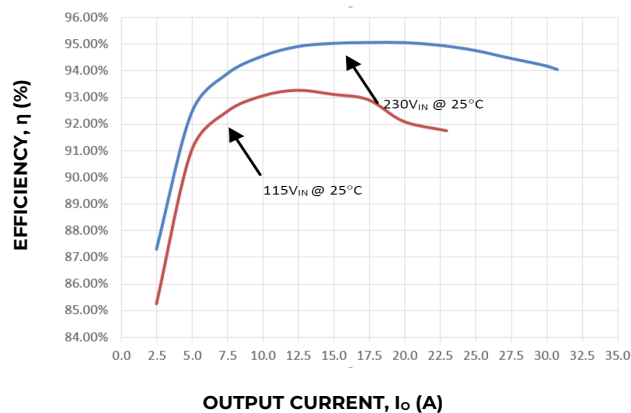


Figure 1. Rectifier Efficiency versus Output Current.

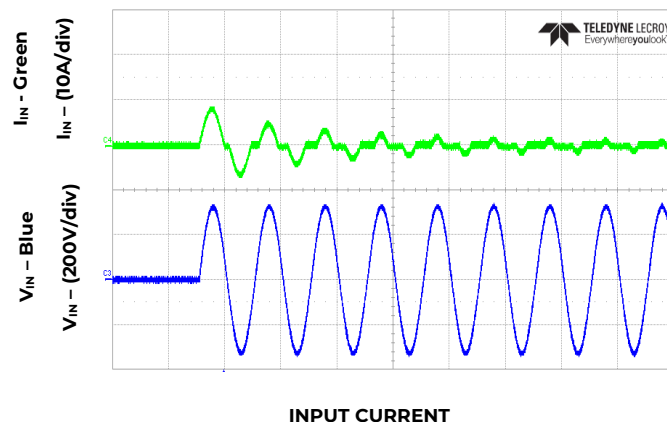


Figure 2. Inrush current  $V_{IN} = 230V_{AC}$ , 0°C phase angle

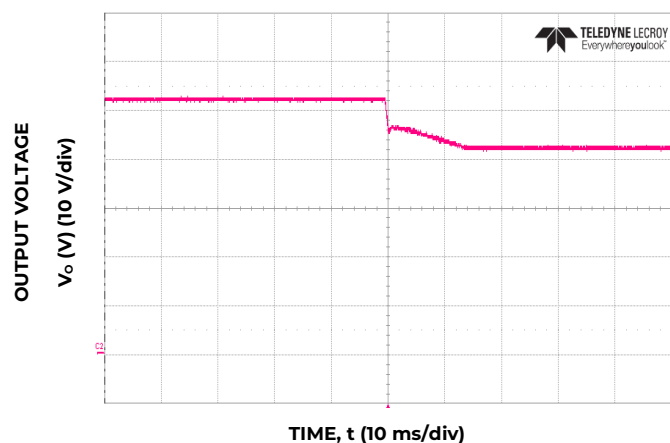


Figure 3. Main output: Output changed from 52V to 42V, full load; commanded via RS485.

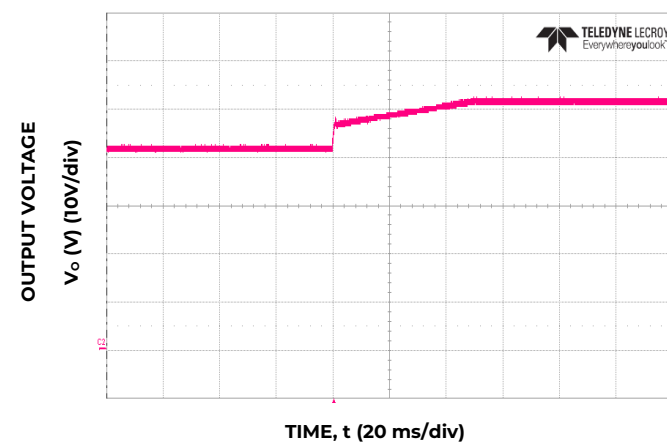


Figure 4. Main output: Output changed from 42V to 52V, full load; commanded via RS485.

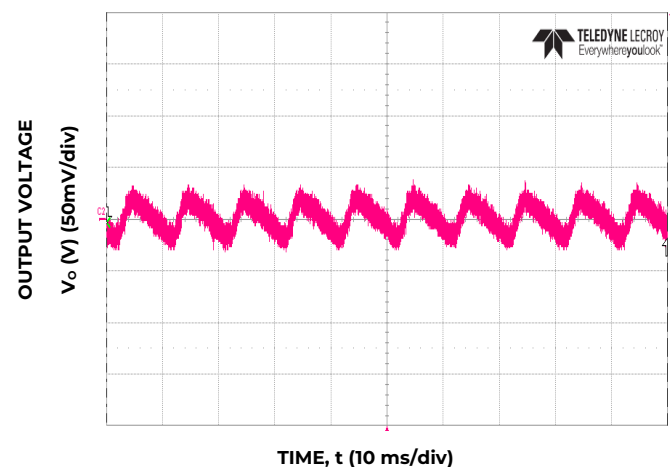


Figure 5. 52  $V_{DC}$  output ripple and noise, full load,  $V_{IN} = 230V_{AC}$ , 20MHz bandwidth

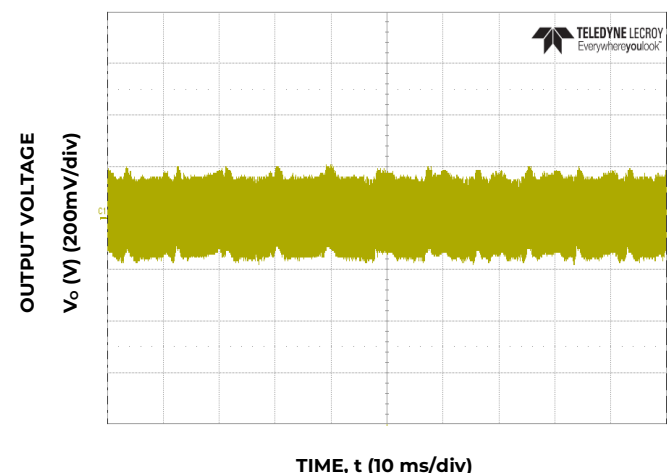


Figure 6. 8  $V_{DC}$  output ripple and noise, all full load,  $V_{IN} = 230V_{AC}$ , 20 MHz bandwidth

## Technical Specifications (continued)

### Characteristic Curves (continued)

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

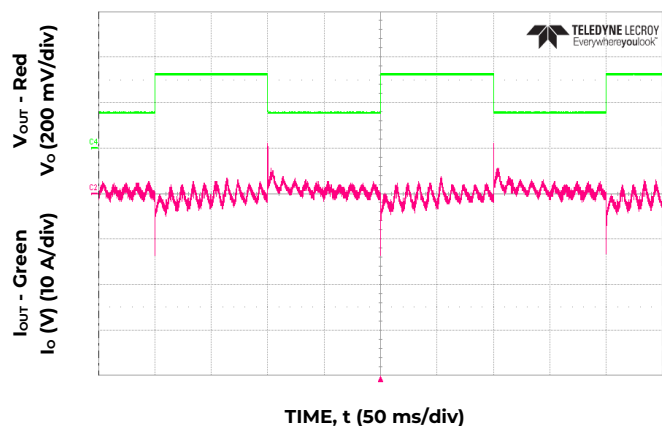


Figure 7. Transient response 52 V<sub>DC</sub> load step 25 – 50%, Slew rate: 1A/μs, V<sub>IN</sub> = 230V<sub>AC</sub>

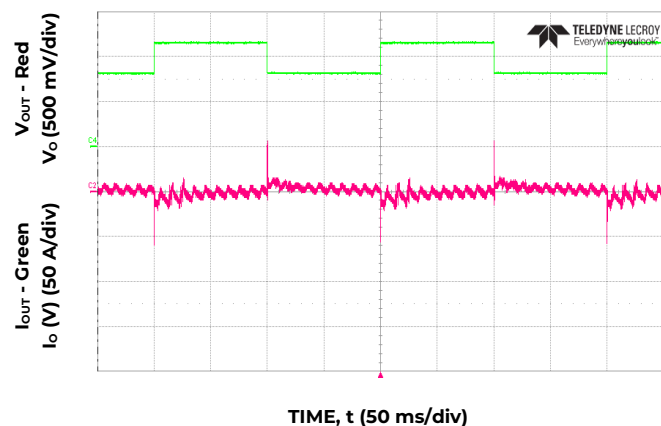


Figure 8. Transient response 52 V<sub>DC</sub> load step 50 – 75%, Slew rate: 1A/μs, V<sub>IN</sub> = 230V<sub>AC</sub> .

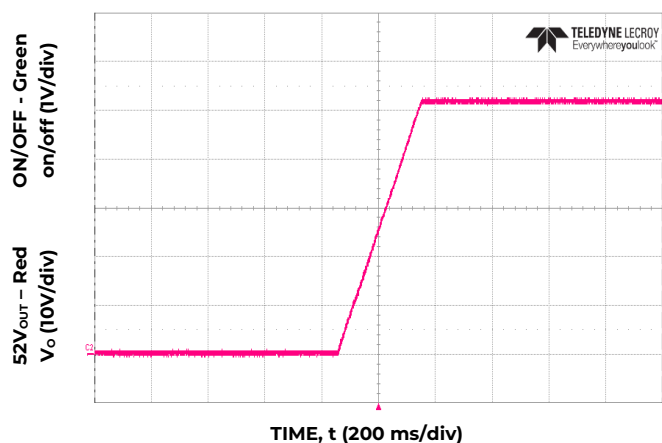


Figure 9. 52 V<sub>DC</sub> soft start, 80% full load V<sub>IN</sub> = 230V<sub>AC</sub> .

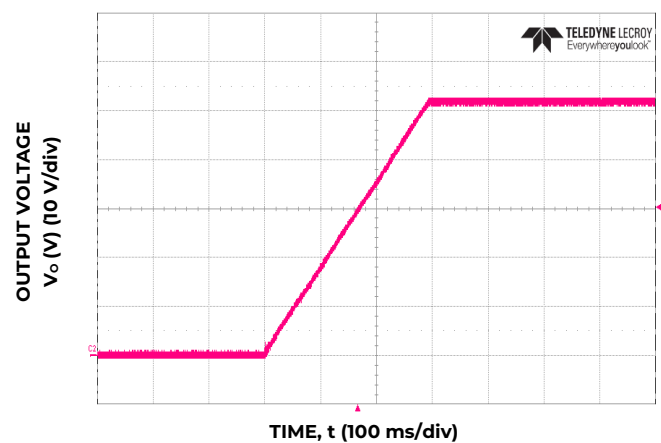


Figure 10. 52 V<sub>DC</sub> soft start, 80% full load V<sub>IN</sub> = 230V<sub>AC</sub> with 10000μF external capacitance.

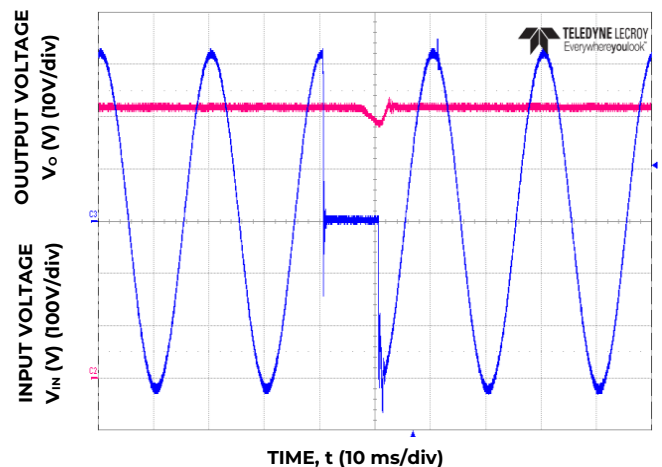


Figure 11. Ride through missing 1/2 cycle, full load, V<sub>IN</sub> = 230V<sub>AC</sub>.

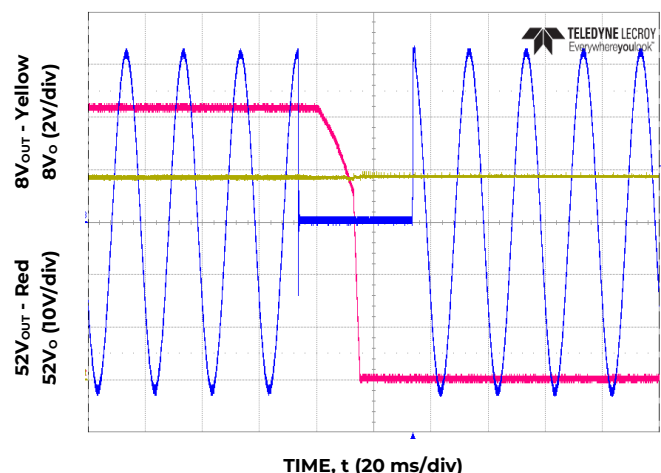


Figure 12. 40ms AC dropout @ full load, V<sub>IN</sub> = 230V<sub>AC</sub>.



## Technical Specifications (continued)

### Characteristic Curves (continued)

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

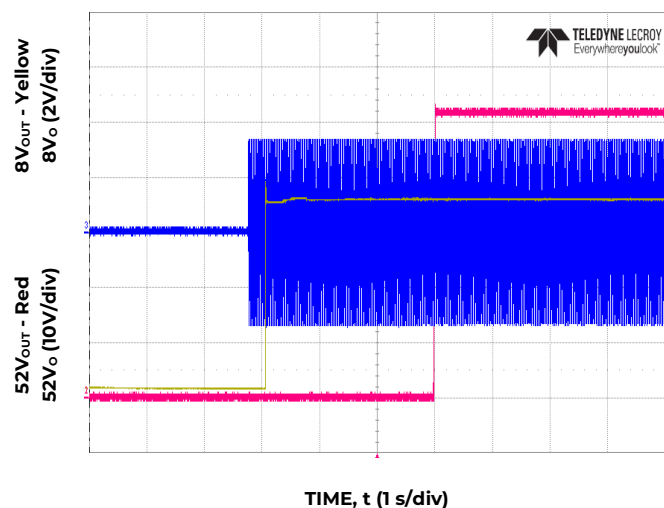


Figure 13. Turn-ON at full load  $V_{IN} = 230 V_{AC}$

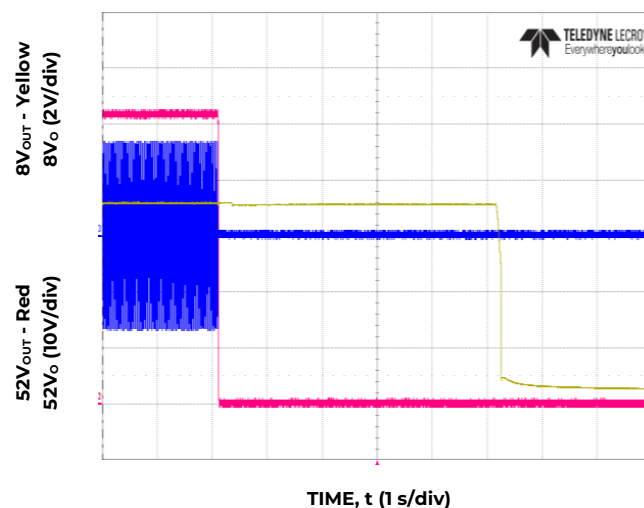


Figure 14. Turn-OFF at full load  $V_{IN} = 230 V_{AC}$ .

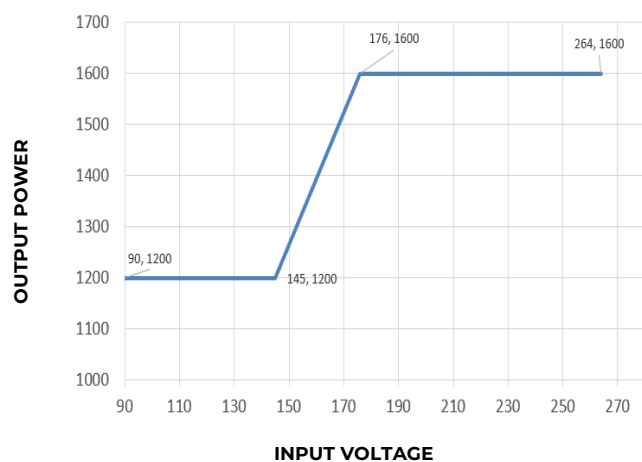
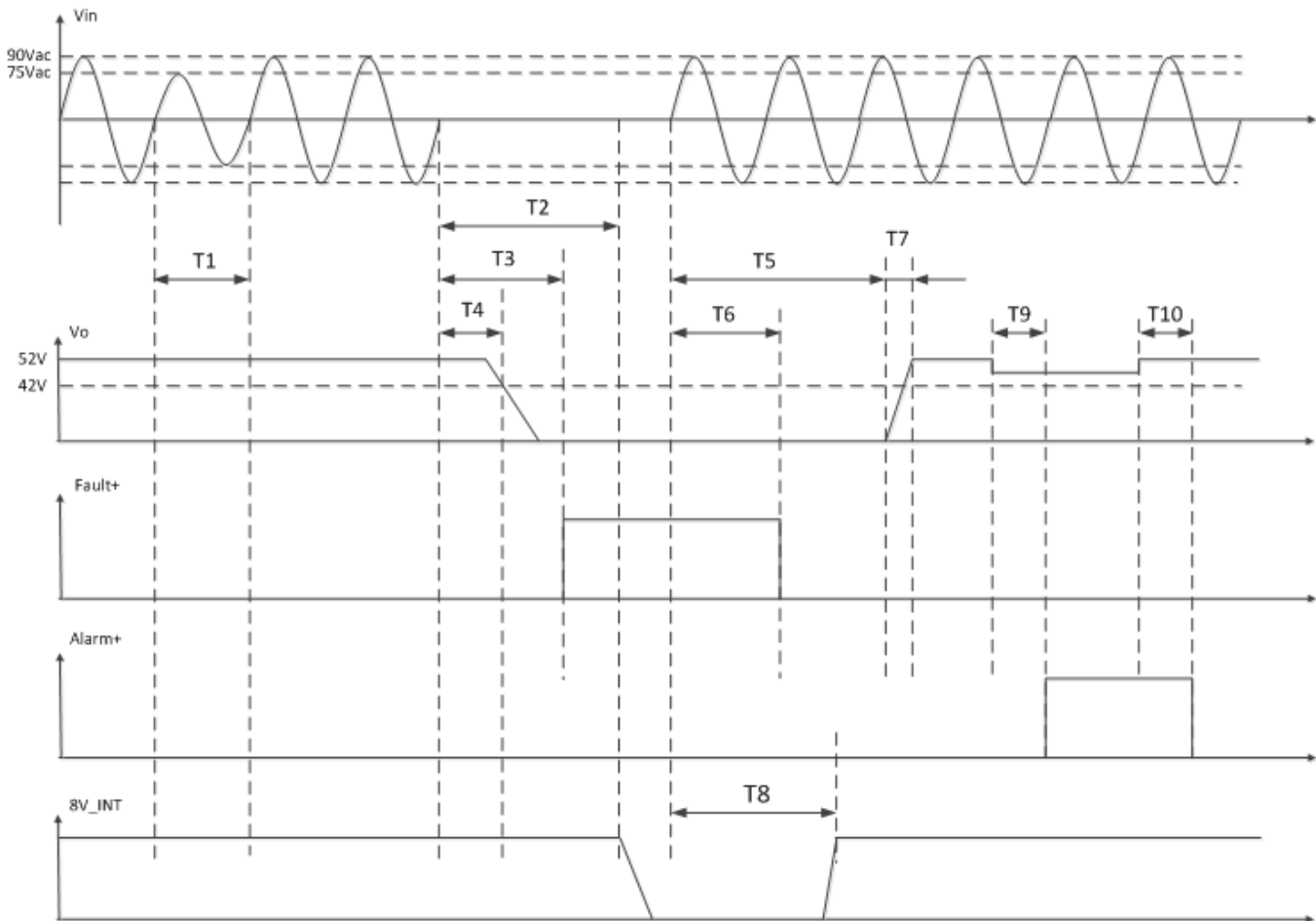


Figure 15. Output power derating below  $V_{IN}$  of 185  $V_{AC}$

## 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<sub>DC</sub> 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  $I_o$  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  $V_o$  versus  $I_o$  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

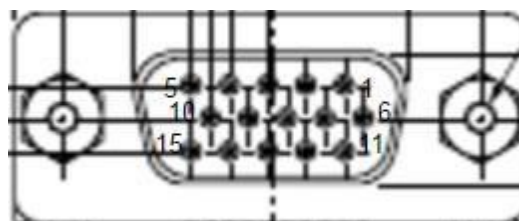
CC1600 supports RS485 communication (with GP protocol). The details are not provided in this datasheet. OmniOn will provide separate application notes on the Galaxy RS485 based protocol for users to interface to rectifier. Contact your local OmniOn representative for details.

## 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                                                                                                                                                                                            |
|--------------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Signal Pins</b> |            |                                                                                                                                                                                                        |
| Pin5               | Fault +    | Isolated open collector output with internal 100 ohms series resistor. 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)

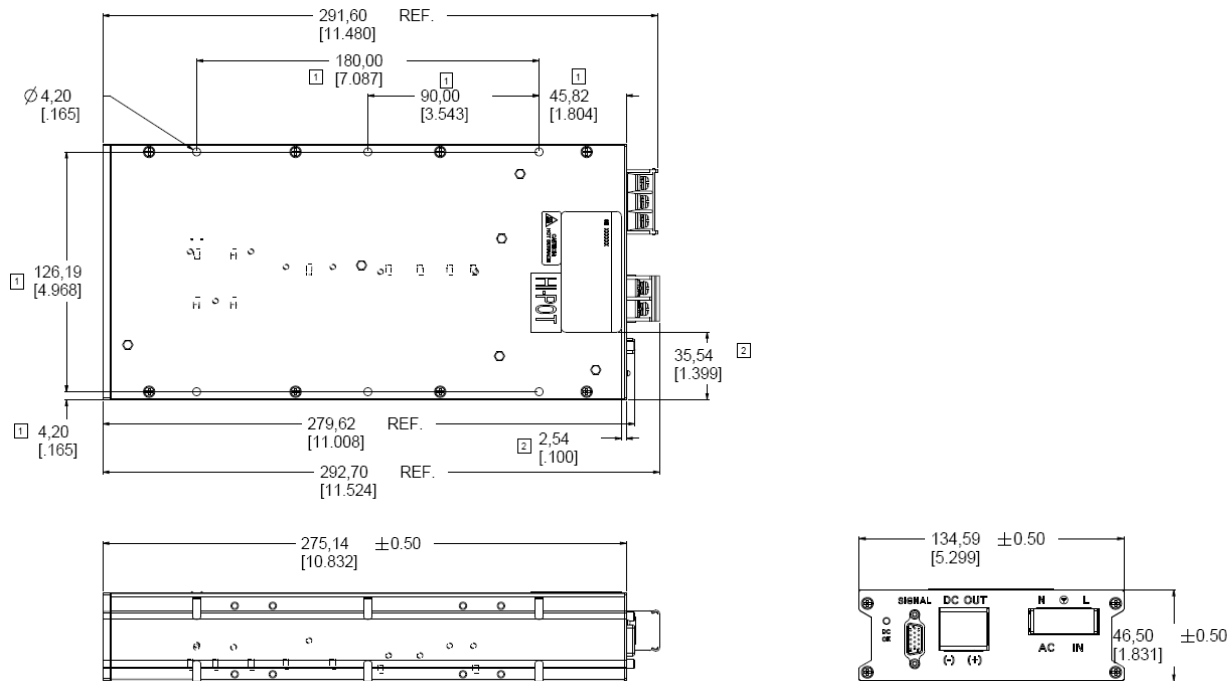
### Mechanical Outline

Flatness of sink side  $\pm 0.15$  mm

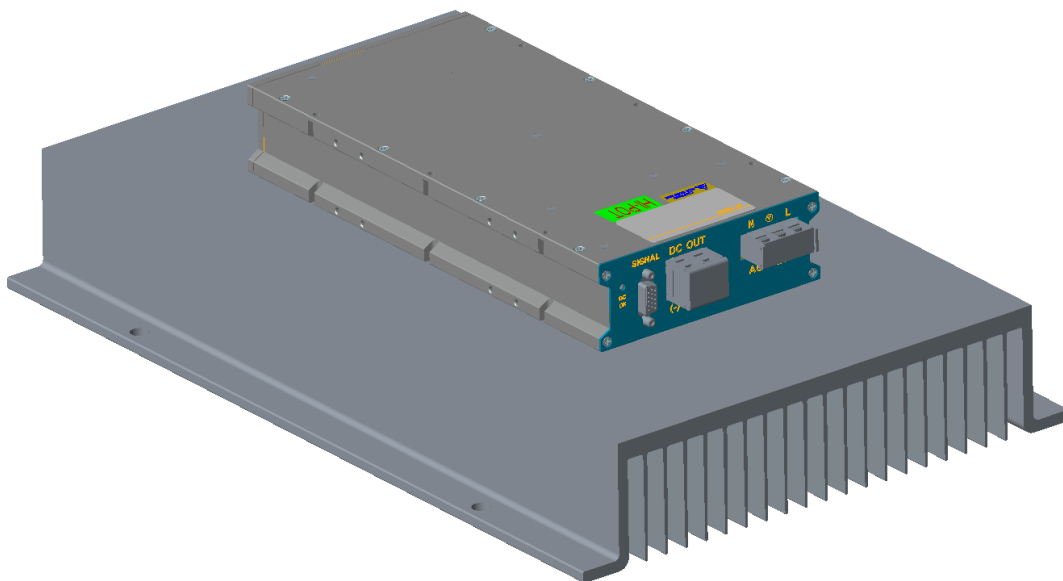
Outline Dimensions (including protruding connector): 292.70 x 134.59 x 46.50mm (11.524 x 5.299 x 1.831 inch) “Cooling side” (for heat transfer) is the large surface as below shown, opposite the label.

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 mating below 6 pcs  $\phi 4.2$  of rectifier as marked [1.])



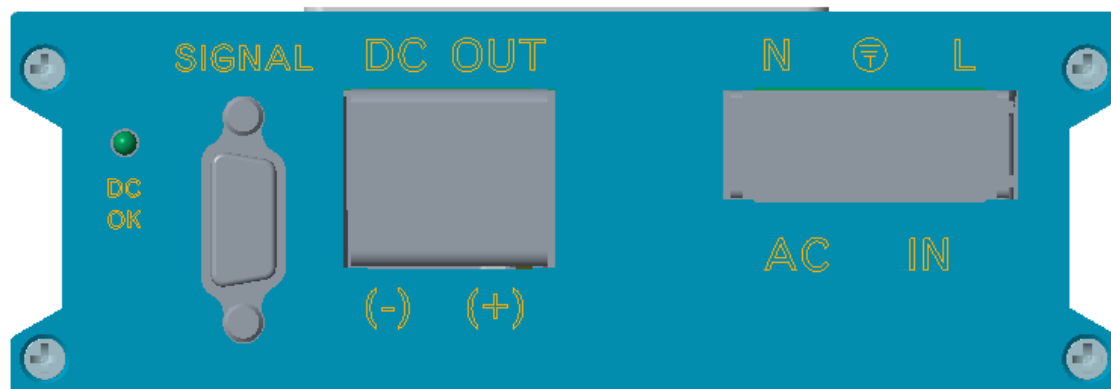
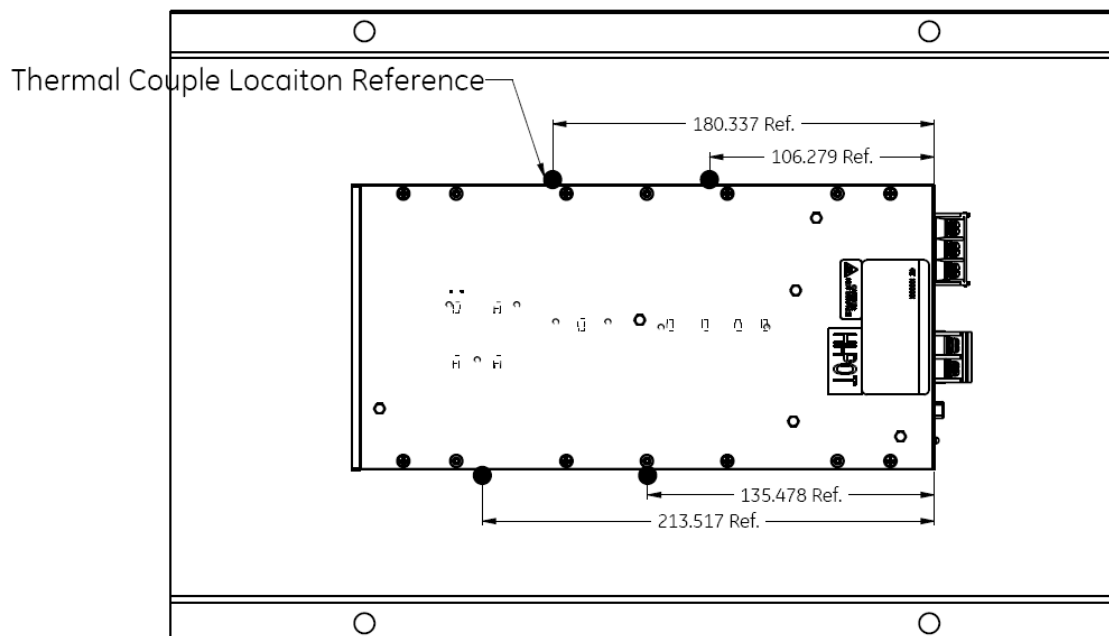
CC1600 rectifier mated on the surface of cold plate as below shown.



## 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<br>Terminal: 1658670-2<br>Cable wire: 10368 or EQ, AWG 24                                |
|  | AC Input Harness                       | Ring Terminal<br>TE PN: 4-51864-1 or EQ<br>Min ID: $\Phi 4.3\text{mm}$ Max OD: $\Phi 8.4\text{mm}$<br>AWG: 14GA |
|  | DC Output Harness                      | Ring Terminal<br>TE PN: 8-35787-2 or EQ<br>Min ID: $\Phi 4.3\text{mm}$ Max OD: $\Phi 9.0\text{mm}$<br>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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