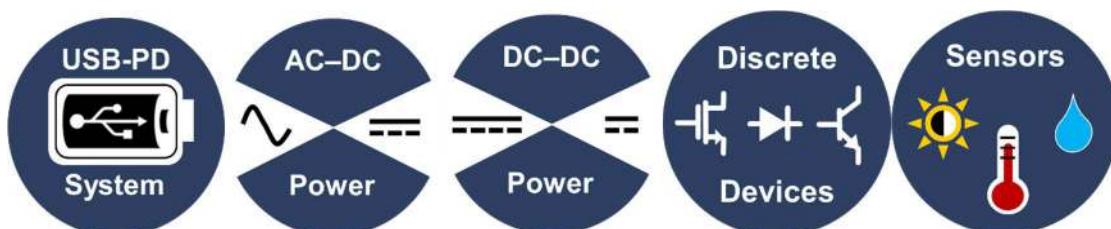




**ON Semiconductor®**

# **Universal Offline 200W 4-Port Type-C USB-PD Source User Guide**

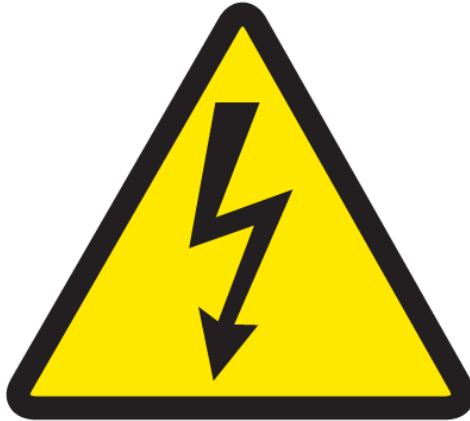


## Table of Contents

WARNINGS.....	3
INSTALLATION .....	3
STARTUP PROCEDURE.....	3
BASIC VIEW .....	4
ADVANCED VIEW .....	5
Default View .....	5
System Settings.....	6
Port Settings.....	6
SYSTEM SETTINGS.....	7
Power Management .....	7
Max System Power .....	7
First Come First Served Algorithm.....	7
Sleep State .....	7
Assured Power.....	7
Faults .....	8
Fault Protection.....	8
Thermal Fault Protection .....	8
Thermal Foldback Protection.....	8
Input Voltage Fault .....	8
INDIVIDUAL PORT CONTROLS .....	9
Assured Port Power (Port 1 only) .....	9
Max Port Power .....	9
Current limit.....	9
Cable compensation .....	9
Advertised Profiles.....	9

## Warnings

- High voltage exists on the AC/DC supply. Exercise extreme caution when evaluating this system.
- The connectors between these two boards is not compatible with any other system. Connecting these boards to any other system risks damage to both device.



## Installation

Go to [www.onsemi.com/strata](http://www.onsemi.com/strata) to download the most recent version of Strata and follow the installation prompts.

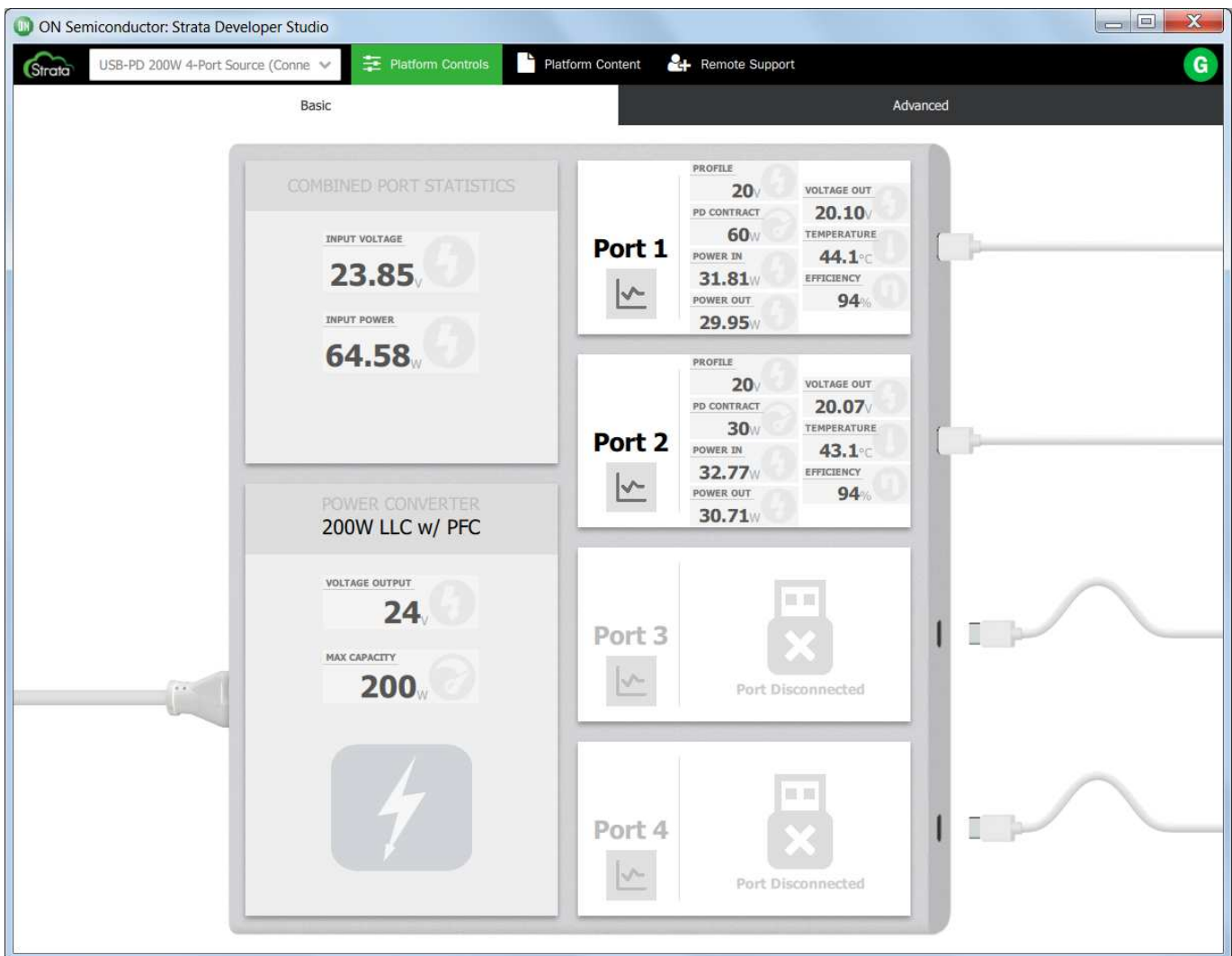
## Startup Procedure

1. Apply AC voltage to the input of the board
2. Connect your computer to the board using a USB Mini-B cable.
3. Login with your credentials or click “Login” with empty fields to login as guest
4. Your board will be detected and relevant content will be downloaded to your computer.

## Basic View

The basic view is comprised of two main sections...

1. Input
  - a. Bottom left is the voltage output and max power capability from the AC supply
  - b. Top left is the input voltage and instantaneous power to the USB type-C ports
2. Output
  - a. Telemetry from ports 1 through 4
    - i. **Profile** – PD Contract voltage
    - ii. **Voltage Out** - Measured voltage at type-C connector
    - iii. **PD Contract** – Negotiated power contract
    - iv. **Temperature** – Measured temperature next to high side MOSFET
    - v. **Power In** – Measured port input voltage multiplied by measured port input current
    - vi. **Power Out** – Measured output voltage multiplied by measured output current
    - vii. **Efficiency** – Power out / Power in \* 100
  - b. Graphs are available by clicking the button beneath the **Port #** title



## Advanced View

The advanced view is broken up into 3 main sections:

1. Telemetry
  - a. Port Telemetry – Described in “Basic View”
    - i. Additional power bar at top showing PD Contract of each port and instantaneous power consumed
      1. E.g. 100W PD Contract with approximately 30W consumed as seen below
    - b. Fault Display – prints out fault information
  - b. Fault Display – prints out fault information
2. System Settings – Controls regarding system behavior
  - a. Power Management
  - b. Fault
3. Port Settings – Controls relevant to an individual port

## Default View

The screenshot displays the ON Semiconductor Strata Developer Studio interface. The top navigation bar includes 'Platform Selection', 'Platform Controls', 'Platform Content', and 'Remote Support'. The main content area is split into 'Basic' and 'Advanced' views.

**Basic View:** A power bar at the top shows the PD Contract of each port and instantaneous power consumed. Below it, four port status cards are shown: PORT 1 (Active), PORT 2 (Port Disconnected), PORT 3 (Port Disconnected), and PORT 4 (Port Disconnected). The PORT 1 card displays the following data:

PROFILE	VOLTAGE OUT
20 V	20.10 V
PD CONTRACT	TEMPERATURE
100 W	40.3 °C
POWER IN	POWER OUT
31.59 W	30.15 W
EFFICIENCY	
96 %	

**System Settings:** This section contains controls for Power Management and Temperature Foldback.

**Power Management:** Includes sliders for Maximum System Power (set to 200 W), Power Negotiation (First come, first served), Assure Port 1 power (disabled), and Maximum Assured Power (set to 100 W).

**Temperature Foldback:** Includes a toggle for Active (ON), a slider for Limit above (set to 0 °C), and a dropdown for Reduce output power to (set to 45 %).

**Faults:** Includes Fault Protection (Retry/None) and a slider for Fault when temperature above (set to 135 °C).

**Port 1:** A detailed view of the first port, showing the same telemetry data as the Basic View, along with controls for Assure Port power (disabled), Maximum Power Output (set to 100 W), Current limit (set to 1 A), and Cable Compensation (set to Off).

## System Settings

**System Settings**

**Power Management**

Maximum System Power:  200W

Power Negotiation: First come, first served

Assure Port 1 power:

Maximum Assured Power:  W

**Temperature Foldback**

Active:

Limit above:  150°C

Reduce output power to:  %

**Faults**

Fault Protection:  Retry  None

Fault when temperature above:  135°C

## Port Settings

**Port 1** Open in new window

**Port 1**

PROFILE	20V	VOLTAGE OUT	20.10V
PD CONTRACT	100W	TEMPERATURE	40.8°C
POWER IN	31.35W	EFFICIENCY	95%
POWER OUT	30.15W		

Show Graphs:

Vout Iout Iin Pout Pin η

Assure Port power:

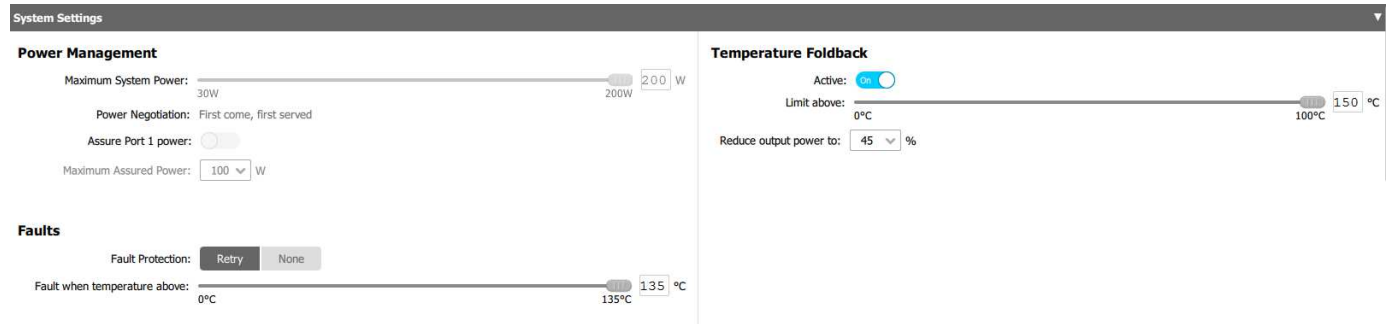
Maximum Power Output:  W

Current limit:  6A

Cable Compensation:  Off  100 mv/A  200 mv/A

Advertised Profiles: 5V, 5A 7V, 5A 8V, 5A 9V, 5A 12V, 5A 15V, 5A 20V, 5A

## System Settings



## Power Management

### Max System Power

This slider allows for artificially limiting the total power of the device anywhere from 30W to 200W.

### First Come First Served Algorithm

The First Come First Served power management algorithm is an intelligent power management scheme ensuring that the total PD contracts requested from the type-C ports do not exceed the total power that the AC supply is able to source. Using this algorithm, 7.5W is reserved for each remaining open type-C port with the rest available for power contracts up to 100W.

### Sleep State

This front end 200W AC/DC supply has a sleep state feature that must be tested outside the strata software.

1. Disconnect the AC board physically from the downstream DC/DC board
2. Populate the 100 mil header next to SW1 with an option plug
3. Make sure the switch is set to “Normal”
4. Apply AC power to the input of the board through a power monitor
5. Monitor the output voltage using the 24V pad or a test point (do not pull load)
6. Move the switch to “Sleep” and you will see the output waveform as indicated in the test report
  - a. Vout will rise to 24V then slowly drop to 5V, then repeat
7. Integrating power use over a minute or two will show the ultra-low power consumption.

### Assured Power

Multi-port type-C sources can have both assured and shared ports where assured ports will always have an allocated amount of power and shared ports will share a total maximum power between all of them. This system provides the option to include port 1 as a shared port (default operation) or assure port 1 to retain a certain amount of the total power reserve at all times.

These controls are both in the power management portion of system settings as well as the port 1 settings.

Please see “Individual Port Controls” for more info.

## Faults

### Fault Protection

**Retry** will cause the board to start back up once the fault is removed.

**None** will disable the fault and no action will occur when the temperature threshold is met.

This button affects **Thermal Fault** and individual port **Current Limit**.

### Thermal Fault Protection

Choose the temperature at which the over-temperature fault is initiated. The **Retry** or **None** buttons will determine how the board will respond to an over-temperature condition.

Note: The UI fault protection is a software control that is based on the readings from each port's temperature sensors. Individual parts may have their own over temperature protection. Hysteresis exists on this setting of 2°C.

### Thermal Foldback Protection

Thermal Foldback Protection is used to force a port to renegotiate the PD contract the % power of that port's total available power when the temperature threshold is met. Hysteresis exists on this setting of 2°C.

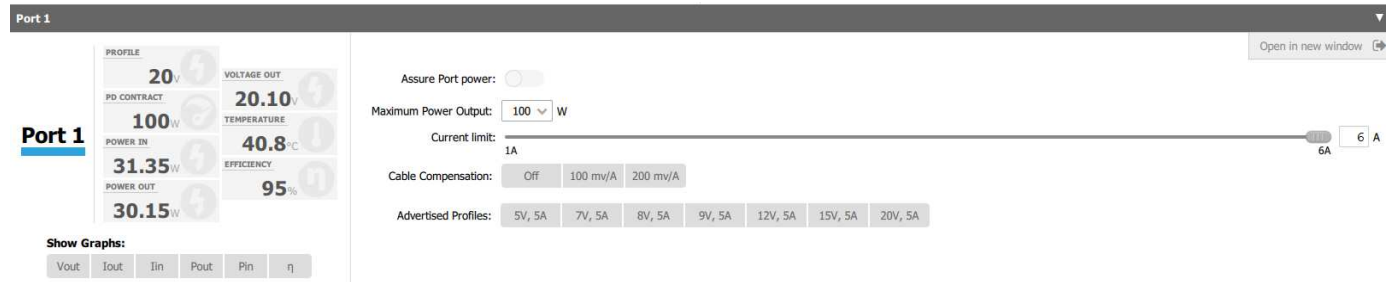
Temperature foldback reduces power by observing the max current for a port (3A or 5A) and selecting voltages starting from the lowest available (5V) and working up through the available voltages until a the chosen % power of that port's contract is exceeded. Once that happens, the last value that did not exceed the % power is chosen. Since the lowest value is 5V @ 3A (15W) or 5V @ 5A (25W), it is possible the new contract will exceed the % power.

### Input Voltage Fault

No controls are available to the user for this fault. If AC power is removed from the board (or 24V is no longer present on the main DC rail) the board will shut down until at least 22V is seen at the input of the DC board. Hysteresis exists on this setting of 0.5V that is unobservable to the user.



## Individual Port Controls



### Assured Port Power (Port 1 only)

This control allows you to switch port one between “Assured” and “Shared” power operation. Note that when the Assure Port 1 Power toggle is enabled and a device is plugged in, you will not be able to change the “Max Port Power” drop down.

### Max Port Power

The port power of each port can be artificially limited by selecting an option in the drop down box. Once this is set, no contract will be offered on that port that exceeds the chosen max port power limit.

### Current limit

The port current limit can be set in Strata to trigger from 0A to 6A. When triggered, the buck controller will be disabled and will hiccup in an attempt to restart until the current limit is increased or the requested current by the sink device decreases to an acceptable value. In addition to the software current limit, there is a fast hardware 6A current limit that exists due to the FPF2895 load switch.

### Cable compensation

The cable compensation feature is intended to reduce voltage droop at the sink device when sourcing higher currents. Cable compensation is set on default to increase the output voltage by 100mV per increment of 1A.

**Warning:** It is possible to exceed the voltage of downstream devices by reducing the current slider and increasing the voltage slider. Care must be taken by the user to ensure the voltage does not violate the specifications of the downstream device.

### Advertised Profiles

At the bottom of each port’s controls there are a number of boxes showing voltage and current. These default to 7.5W until a device is plugged in. Once a device is plugged in, a list of profiles that were offered to the sink device will be displayed. The maximum of these profiles will be the power contract the sink device accepted from our source. Non-PD devices will accept 7.5W contracts after waiting for the PD negotiations to time out.

## Visual Controls

### Show Graphs

Click on relevant button (e.g. **Vout**, **Pin**, etc) and graph will appear below port settings.

### Open in new window

Control in top right to pop out control for customizable view.

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at <https://www.onsemi.com/site/pdf/Patent-Marking.pdf>. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

---

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor 19521 E.  
32nd Pkwy, Aurora, Colorado 80011 USA

**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada

**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada

**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

### N. American Technical Support:

800-282-9855 Toll Free USA/Canada

### Europe, Middle East and Africa Technical Support:

Phone: 421 33 790 2910

### ON Semiconductor Website:

<https://www.onsemi.com/>

### Order Literature:

<https://www.onsemi.com/orderlit>

For additional information, please contact your local  
Sales Representative

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

The evaluation board/kit (research and development board/kit) (hereinafter the "board") is not a finished product and is as such not available for sale to consumers. The board is only intended for research, development, demonstration and evaluation purposes and should as such only be used in laboratory/development areas by persons with an engineering/technical training and familiar with the risks associated with handling electrical/mechanical components, systems and subsystems. This person assumes full responsibility/liability for proper and safe handling. Any other use, resale or redistribution for any other purpose is strictly prohibited.

The board is delivered "AS IS" and without warranty of any kind including, but not limited to, that the board is production-worthy, that the functions contained in the board will meet your requirements, or that the operation of the board will be uninterrupted or error free. ON Semiconductor expressly disclaims all warranties, express, implied or otherwise, including without limitation, warranties of fitness for a particular purpose and non-infringement of intellectual property rights.

ON Semiconductor reserves the right to make changes without further notice to any board.

You are responsible for determining whether the board will be suitable for your intended use or application or will achieve your intended results. Prior to using or distributing any systems that have been evaluated, designed or tested using the board, you agree to test and validate your design to confirm the functionality for your application. Any technical, applications or design information or advice, quality characterization, reliability data or other services provided by ON Semiconductor shall not constitute any representation or warranty by ON Semiconductor, and no additional obligations or liabilities shall arise from ON Semiconductor having provided such information or services.

The boards are not designed, intended, or authorized for use in life support systems, or any FDA Class 3 medical devices or medical devices with a similar or equivalent classification in a foreign jurisdiction, or any devices intended for implantation in the human body. Should you purchase or use the board for any such unintended or unauthorized application, you shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the board.

This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and may not meet the technical requirements of these or other related directives.

FCC WARNING – This evaluation board/kit is intended for use for engineering development, demonstration, or evaluation purposes only and is not considered by ON Semiconductor to be a finished end product fit for general consumer use. It may generate, use, or radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment may cause interference with radio communications, in which case the user shall be responsible, at its expense, to take whatever measures may be required to correct this interference.

ON Semiconductor does not convey any license under its patent rights nor the rights of others.

LIMITATIONS OF LIABILITY: ON Semiconductor shall not be liable for any special, consequential, incidental, indirect or punitive damages, including, but not limited to the costs of requalification, delay, loss of profits or goodwill, arising out of or in connection with the board, even if ON Semiconductor is advised of the possibility of such damages. In no event shall ON Semiconductor's aggregate liability from any obligation arising out of or in connection with the board, under any theory of liability, exceed the purchase price paid for the board, if any.

---

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULLFILLMENT:

Literature Distribution Center for ON Semiconductor 19521 E.  
32nd Pkwy, Aurora, Colorado 80011 USA

Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada

Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada

Email: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

### N. American Technical Support:

800-282-9855 Toll Free USA/Canada

### Europe, Middle East and Africa Technical Support:

Phone: 421 33 790 2910

### ON Semiconductor Website:

<https://www.onsemi.com/>

### Order Literature:

<https://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at <https://www.onsemi.com/site/pdf/Patent-Marking.pdf>. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. If the product is to be used as a critical component in life support systems, or any FDA Class 3 medical devices or medical devices with a similar or equivalent classification in a foreign jurisdiction, or any devices intended for implantation in the human body, sale is subject to ON Semiconductor's advance written authorization for product use and a separate indemnification agreement signed by Buyer. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

---

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor 19521 E.  
32nd Pkwy, Aurora, Colorado 80011 USA

**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

### N. American Technical Support:

800-282-9855 Toll Free USA/Canada

### Europe, Middle East and Africa Technical Support:

Phone: 421 33 790 2910

### ON Semiconductor Website:

<https://www.onsemi.com/>

### Order Literature:

<https://www.onsemi.com/orderlit>

For additional information, please contact your local  
Sales Representative