

Creating High-Voltage Outputs

For the Micro, Mini, Maxi; VI-200, MI-200; VI-J00, MI-J00 converter families only

Application Engineering
Vicor Corporation



Contents	Page
Introduction	1
Fixed Output Voltage	1
Adjustable Output Voltage	2
Important Notes	2

Introduction

For applications that require high-voltage outputs, multiple converters may be used in a series output configuration to produce a single output voltage that is the sum of all of the converter outputs in the array.

The following describes two approaches to produce a high-voltage output. The first solution provides a fixed output voltage, the second method, an adjustable output voltage. A variation of the second configuration also provides a solution for an adjustable split supply.

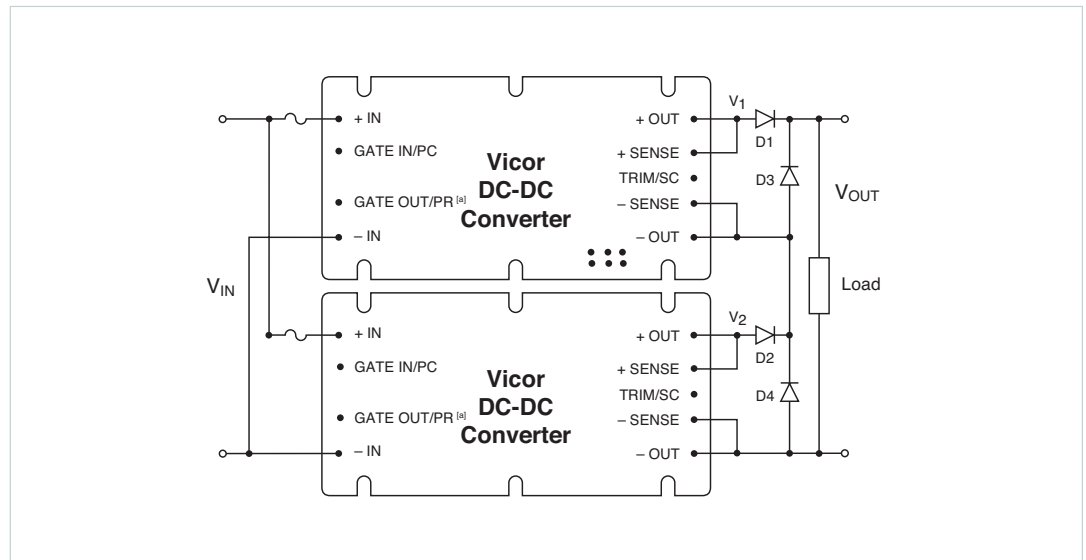
In a series array, the positive output of each module requires a series diode (D1 and D2) to prevent the array from being back-driven by load capacitance during turn off resulting in unequal voltage division and to assure proper operation during start up and dynamic loading. This diode must have a reverse voltage rating greater than the array's output voltage and a forward current rating greater than the array's maximum load current. In all configurations, diodes D3 and D4 prevent the output from going negative if only one converter is operational. Furthermore, D1 and D2 provide an additional voltage drop to compensate for the forward voltage drop of D3 and D4 under this condition.

Converters should be bypassed for common and differential mode noise per any Vicor recommendations in the Design Guide and Application Manual. Bypass capacitors should be appropriately rated and located as close to the individual converters as possible. In all applications utilizing an adjustable output voltage, all recommendations regarding trim ranges and preloads must be followed.

Fixed Output Voltage

For applications that require a fixed output voltage, two or more converters may be used in a series output configuration as shown in Figure 1.

Figure 1
Fixed High Output Voltage
 $V_{OUT} = V_1 + V_2$



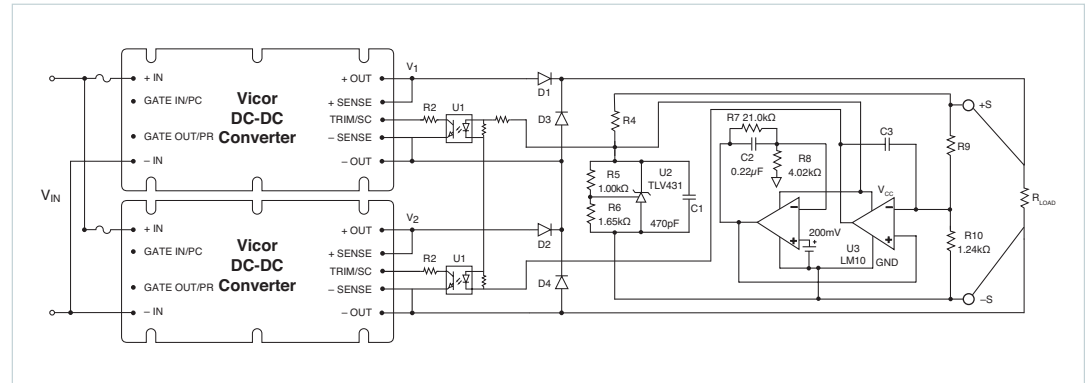
^[a] GATE OUT/PR must be left floating.

Adjustable Output Voltage

For applications that require an adjustable output voltage or remote sense, the configuration in Figure 2 provides a simple and inexpensive solution, requiring a minimum of external components.

[AN:205](#) can be used as a starting point for a design. However, given the wide range of the applications, please contact Vicor Applications Engineering for adjustable output supplies using Brick Maxi, Mini, Micro converters.

Figure 2
Adjustable High
Output Voltage



Important Notes

1. Do not series connect the output of Booster modules. Do not connect GATE OUT to GATE IN of series connected converters.
2. Do not make any connection to the GATE OUT/PR pins. The converters must run as independent voltage sources. Connecting this pin will result in unequal voltage division and module damage.
3. When series connecting the outputs of the converters, the total voltage of the series connection must not exceed 200V with respect to the baseplate. For higher voltages a $\pm 200V$ split supply can be made for a maximum differential output voltage of 400V. The midpoint of such an array must be referenced to both the baseplate and earth ground.
4. If additional output capacitance is added for the load, the majority of the capacitance must be added directly at the output of each converter rather than at the load. In all cases the added capacitance and effective load capacitance must not exceed the values as calculated in the [MAXI, MINI, MICRO Family Design Guide, page 17](#), "Maximum Output Capacitance."

For constructing high-power arrays or for further information on array output voltage limitations, email Vicor Applications Engineering at: apps@vicorpower.com.

Limitation of Warranties

Information in this document is believed to be accurate and reliable. HOWEVER, THIS INFORMATION IS PROVIDED "AS IS" AND WITHOUT ANY WARRANTIES, EXPRESSED OR IMPLIED, AS TO THE ACCURACY OR COMPLETENESS OF SUCH INFORMATION. VICOR SHALL HAVE NO LIABILITY FOR THE CONSEQUENCES OF USE OF SUCH INFORMATION. IN NO EVENT SHALL VICOR BE LIABLE FOR ANY INDIRECT, INCIDENTAL, PUNITIVE, SPECIAL OR CONSEQUENTIAL DAMAGES (INCLUDING, WITHOUT LIMITATION, LOST PROFITS OR SAVINGS, BUSINESS INTERRUPTION, COSTS RELATED TO THE REMOVAL OR REPLACEMENT OF ANY PRODUCTS OR REWORK CHARGES).

Vicor reserves the right to make changes to information published in this document, at any time and without notice. You should verify that this document and information is current. This document supersedes and replaces all prior versions of this publication.

All guidance and content herein are for illustrative purposes only. Vicor makes no representation or warranty that the products and/or services described herein will be suitable for the specified use without further testing or modification. You are responsible for the design and operation of your applications and products using Vicor products, and Vicor accepts no liability for any assistance with applications or customer product design. It is your sole responsibility to determine whether the Vicor product is suitable and fit for your applications and products, and to implement adequate design, testing and operating safeguards for your planned application(s) and use(s).

VICOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED OR WARRANTED FOR USE IN LIFE SUPPORT, LIFE-CRITICAL OR SAFETY-CRITICAL SYSTEMS OR EQUIPMENT. VICOR PRODUCTS ARE NOT CERTIFIED TO MEET ISO 13485 FOR USE IN MEDICAL EQUIPMENT NOR ISO/TS16949 FOR USE IN AUTOMOTIVE APPLICATIONS OR OTHER SIMILAR MEDICAL AND AUTOMOTIVE STANDARDS. VICOR DISCLAIMS ANY AND ALL LIABILITY FOR INCLUSION AND/OR USE OF VICOR PRODUCTS IN SUCH EQUIPMENT OR APPLICATIONS AND THEREFORE SUCH INCLUSION AND/OR USE IS AT YOUR OWN RISK.

Terms of Sale

The purchase and sale of Vicor products is subject to the Vicor Corporation Terms and Conditions of Sale which are available at: (<http://www.vicorpower.com/termsconditionswarranty>)

Export Control

This document as well as the item(s) described herein may be subject to export control regulations. Export may require a prior authorization from U.S. export authorities.

Contact Us: <http://www.vicorpower.com/contact-us>

Vicor Corporation
25 Frontage Road
Andover, MA, USA 01810
Tel: 800-735-6200
Fax: 978-475-6715
www.vicorpower.com

email

Customer Service: custserv@vicorpower.com
Technical Support: apps@vicorpower.com