

Power Module / On-Board Power Supply Application Construction Examples

Abstract

This document provides various power supply application configuration examples, by using Power Modules or On-Board power supply products of TDK-Lambda. Please refer and utilize these contents when using the following products below.

Object Product (Series Name)

CC-E, CCG, CC-P-E, CN-A, iEA, iQE, iQL, iQG, KWD, KWS-A, PAE, PAF, PAH, PF-A, PFE-F(A), PFE-SA, PH-A, PV, PVD, CE-10, i3A, i6A, iAF, iBF, iCF, iCG, PML

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< CAUTION >

Please refer the instruction manual with using direction, for individual products. Some part of this document overlap with the instruction manual of each products. The products names listed in this document are as of December 2021.

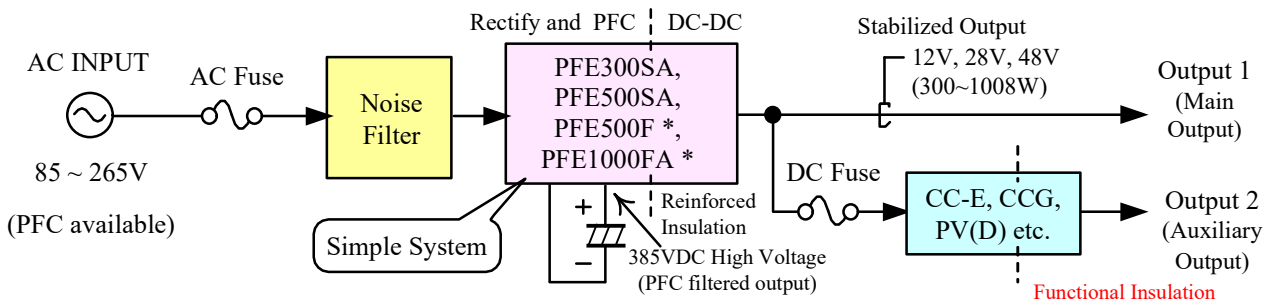
As of Dec. 2021

Products Application Construction Examples

Various system power supplies can be obtained by combining Power Modules and On-Board power supply products with a rich line-up. Here, typical combination examples are shown below by using conceptual diagrams. In addition, it may be necessary to connect in consideration of the start-up sequence. Please also refer to the instruction manual in detail for the each product.

Example 1 : 300W, 500W, 1000W~ AC/DC System

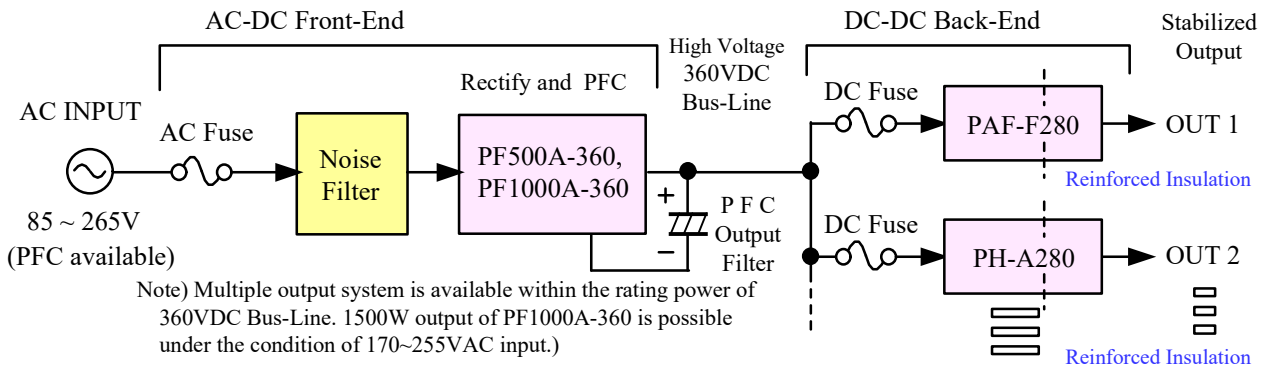
This is AC/DC power supply system example using PFE series, built-in PFC and DC-DC in one unit. As the block diagram below, auxiliary (sub) output power supply can be added, but please note start-up timing difference from main output.



* PFE-F, PFE-FA are available for more high power output by current-share parallel operation.

Example 2 : 500 ~ 1500W AC/DC System

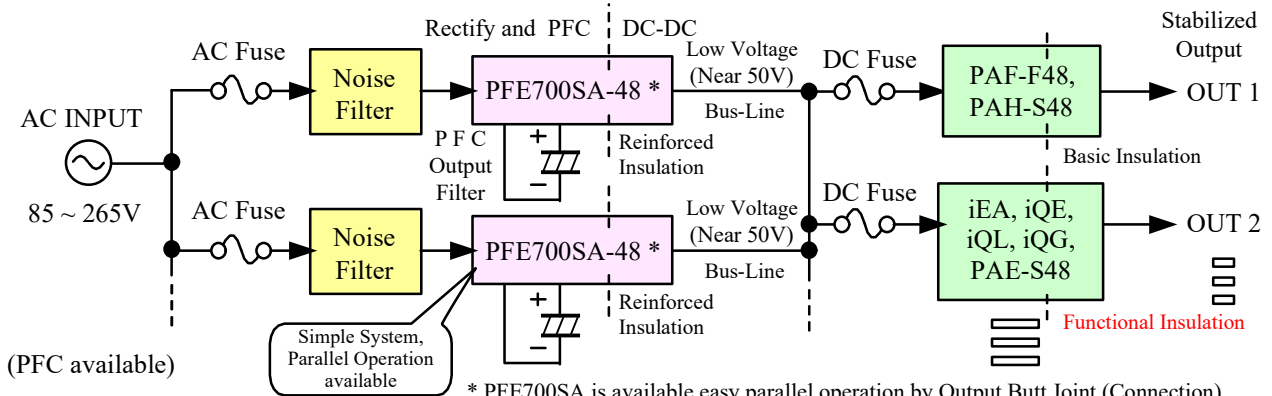
PFC designated Power Module, PF-A360 series is used for 360VDC High voltage Buss Line, and on latter stage, 280V input DC-DC modules can be placed for various multiple output system.



Note) Multiple output system is available within the rating power of 360VDC Bus-Line. 1500W output of PF1000A-360 is possible under the condition of 170~255VAC input.)

Example 3 : 700W ~ AC/DC System (Low Voltage Bus-Line)

This is low voltage Bus-Line system for multiple DC output system, using PFE700SA-48, laugh regulation output near 50V which is available for easy parallel operation without using PC terminal. At latter stage, 48V input DC-DC can be used.

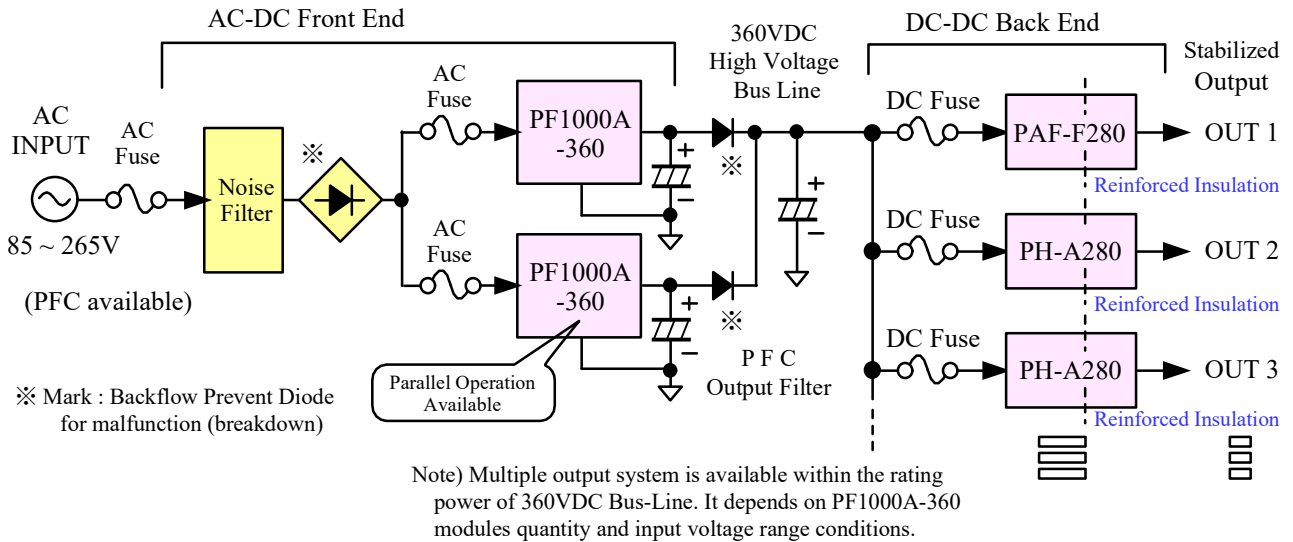


* PFE700SA is available easy parallel operation by Output Butt Joint (Connection).

Note) Multiple output system is available within the rating power of 50V Bus-Line.

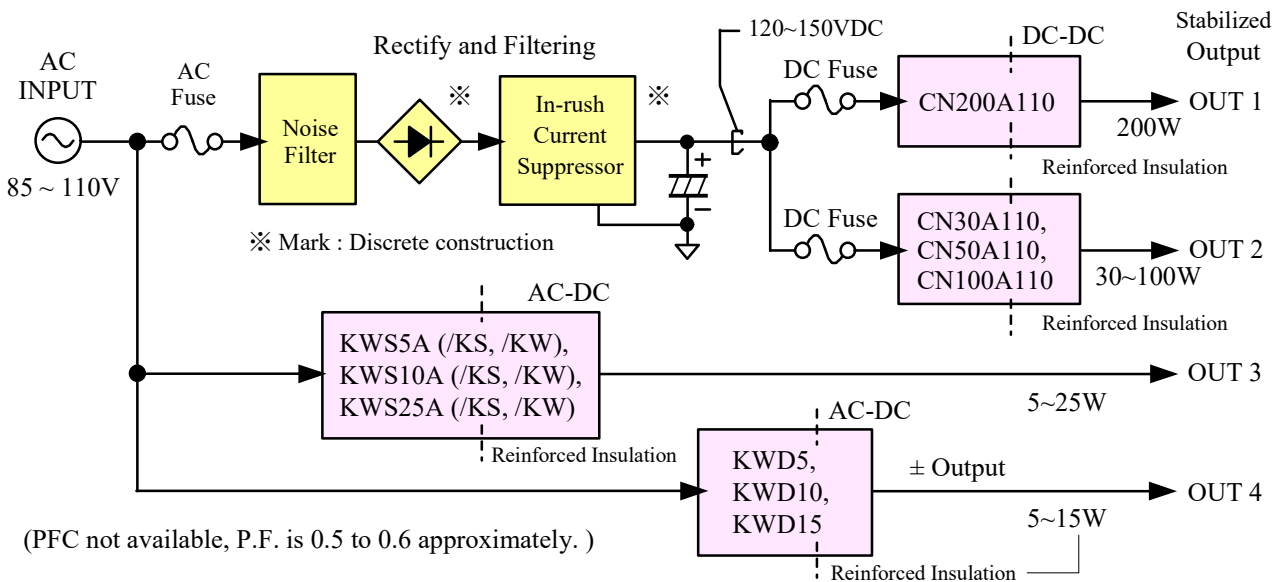
Example 4 : High Power “kW” class N+1 Redundant Parallel AC/DC Aystem

Redundant parallel operation of PF1000A-360 series can realize “High Power and High Reliability” multiple output power supply system with latter DC-DC power module of 280V input type.



Example 5 : 100VAC input (for Japan) AC/DC System

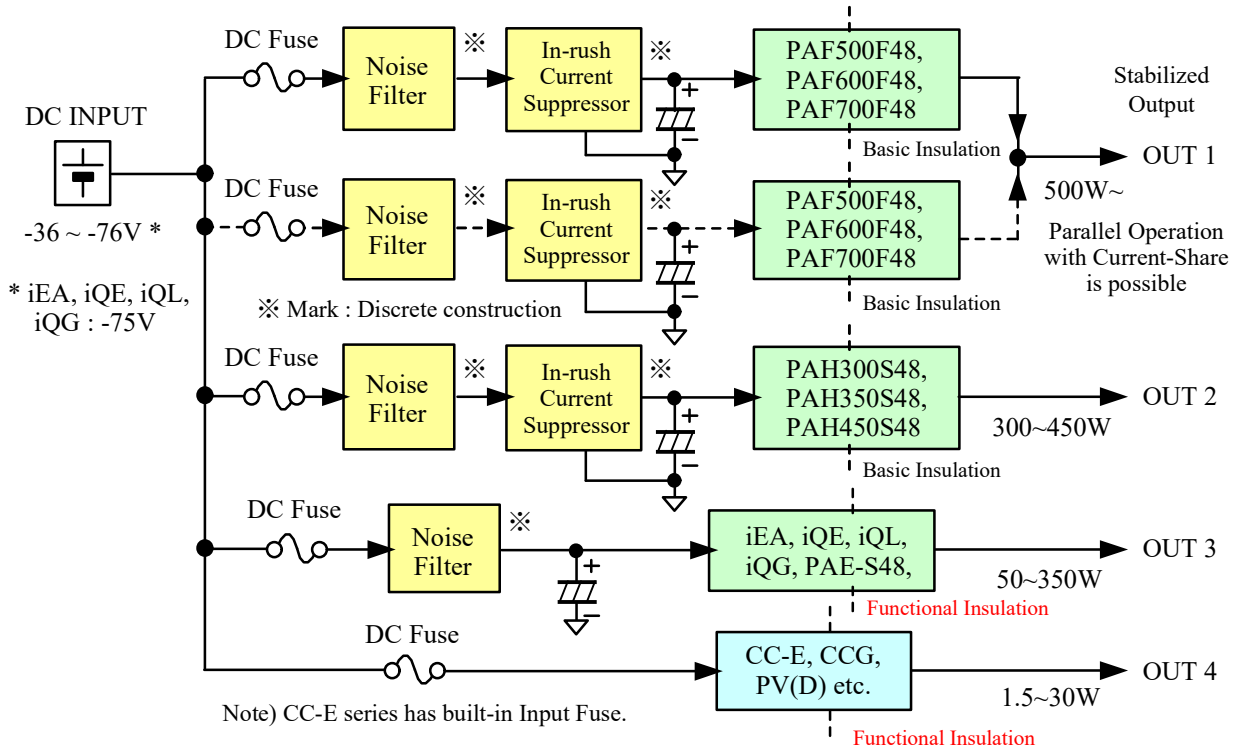
Japanese commercial line 100VAC is rectified and filtered, and apply on 110VDC input type power modules (CN-A110). KWS-A or KWD series can be used if output power is small, 25W or less.



Note) KWS-A, KWD series is “All-in-One” type On-Board AC-DC power supply, and also built-in EMC (input) filter, having wide input range spec: 85~265VAC.

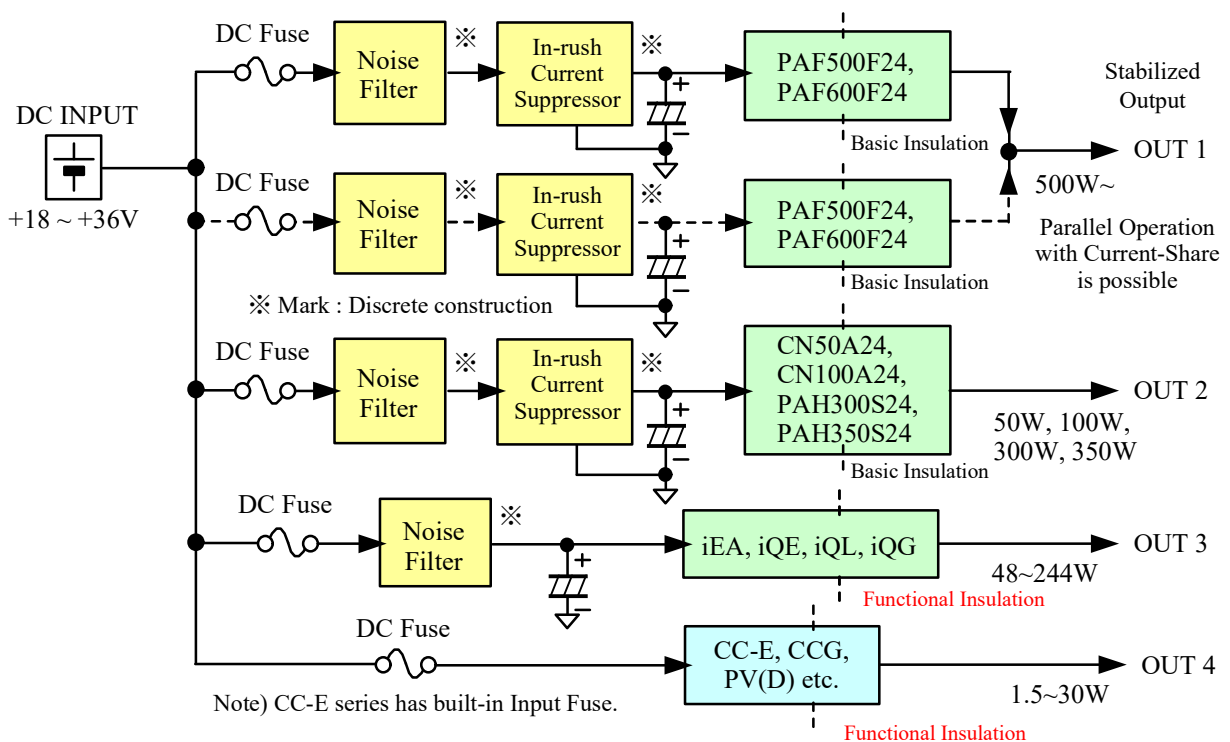
Example 6 : -48V Input DC-DC System for Telecommunication

This is -48V DC input for communication system. Please use input fuse for used equipment with optimization. Input filters or In-rush current suppressor will be no need if having countermeasure at former power supply.



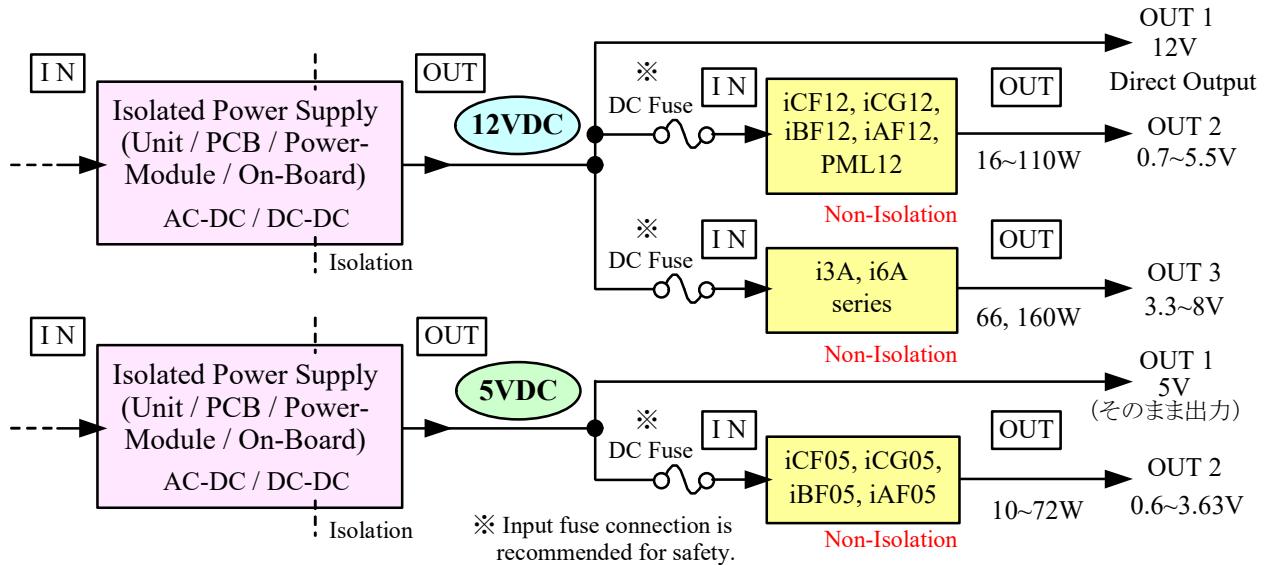
Example 7 : +24V Input DC-DC System for Industry Equipment

This is +24V input for General Industry. Please use input fuse for used equipment with optimization. Input filters or In-rush current suppressor will be no need if having countermeasure at former power supply.



Example 8 : Use of Isolated / Non-isolated DC-DC

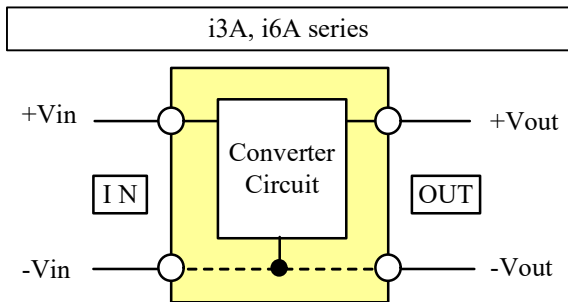
This is a system example, non-isolated DC-DC is connected after isolated power supplies for multiple output. Here, 12V or 5V output is converted to other lower voltage. Please note that TDK-Lambda's DC-DC type is Plus (+) output and stepdown only, no line-up of minus (-) output or step-up (boost) DC-DCs.



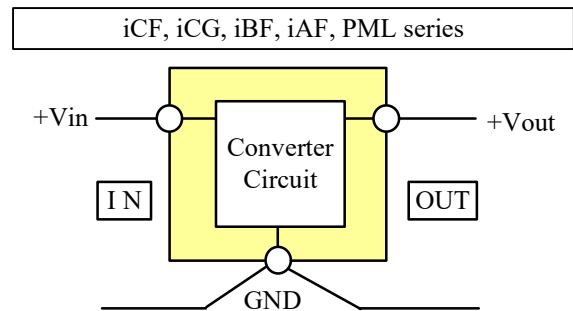
Note) Voltage difference is required between input and output to operate Non-isolated DC-DC power supplies. For example, 4V or more is needed for $V_{in}-V_o$ to use i3A, i6A series. Here example i3A, i6A has output power limitation (up to 8V) therefore output wattage is 66,160W each.

Reference Information : Internal wiring of Non-isolated DC-DCs

Minus side input/output is common for Non-isolated DC-DC, internally connected even if having multiple terminals.



Although “-Vin” and “-Vout” are same voltage potential, please separate “-Vin” and “-Vout” wiring due to current-flow consideration. Please use “-Vin” only for input wiring, and “-Vout” only for output wiring.



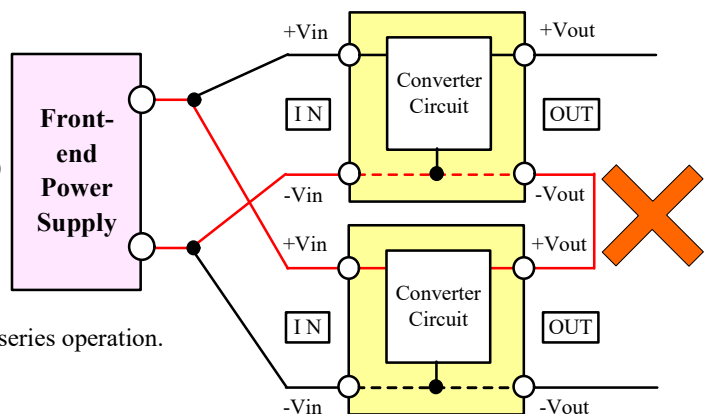
GND terminal is common with input and output. Good performance can be realized when wiring as “One Point Earth” by separating IN & OUT at GND terminal.

Other Notice for using

For Non-isolated DC-DCs, series operation shown at the right side circuit diagram cannot be done. (Please avoid this circuit to prevent product damage.)

※ Reason : For the low side DC-DC, +Vin and -Vout are connected between front-end power supply output.

Please use Isolated type DC-DC when using as output series operation.



Example 9 : Input and Output Connection for Isolated DC-DC Converter

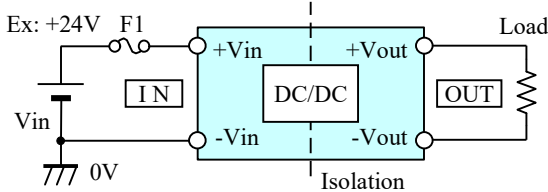
Conceptual figure of Isolated DC/DC usage is shown below. External parts will be required depending on the products type. And the terminal name may be different. (For details, refer to the instruction manual of each product.)

Note) The earth mark (\perp) is '0V' voltage reference of each circuit. RC, CNT, and TRM terminal is omitted.

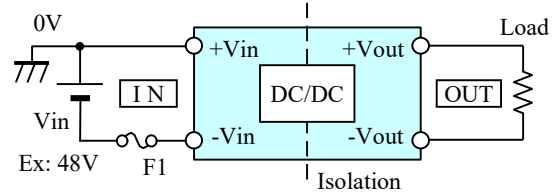
1. Insertion point of Input Fuse

There are two input fuse insertion positions: (1) positive power supply on the positive side, and (2) negative power supply on the negative side. Please determine the insertion position of the fuse by the safety of the connection state that remains after the fuse (F1) is blown when a failure occurs. give me. In addition, in the instruction manual for each product, it is described based on the positive power supply in (1).

(1) Positive supply (General Industry Use)



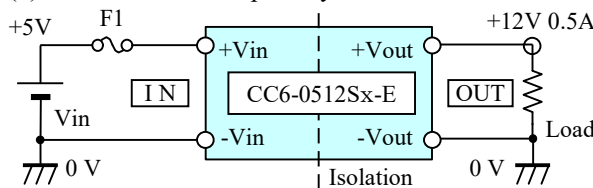
(2) Negative supply (Telecommunication Use)



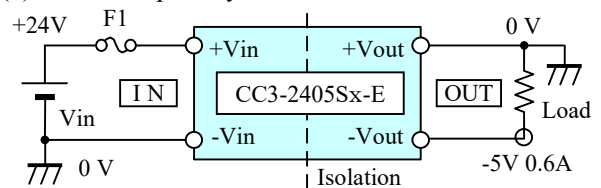
2. Use as Non-isolated DC-DC

If conventional Non-isolated DC-DC power is too large (i3A, i6A:100W~) for the customer, it can be used small isolated DC-DC (CC-E, CCG etc.) as Non-isolated DC-DC by connection between input and output. Then its handling is easy, and available for boost (step-up) DC-DC for partial products.

(1) DC-DC with same polarity

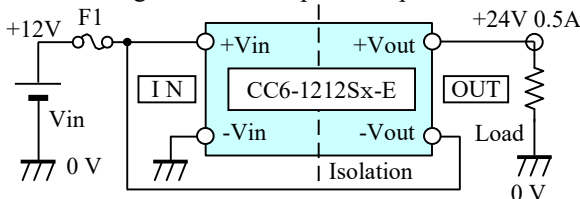


(2) DC-DC as polarity inversion

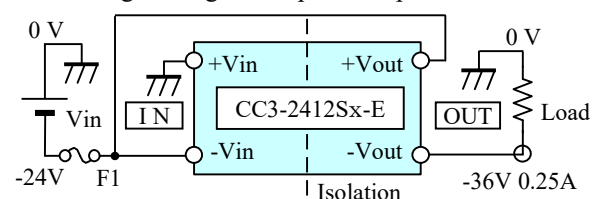


(3) Piling DC-DC output on its input

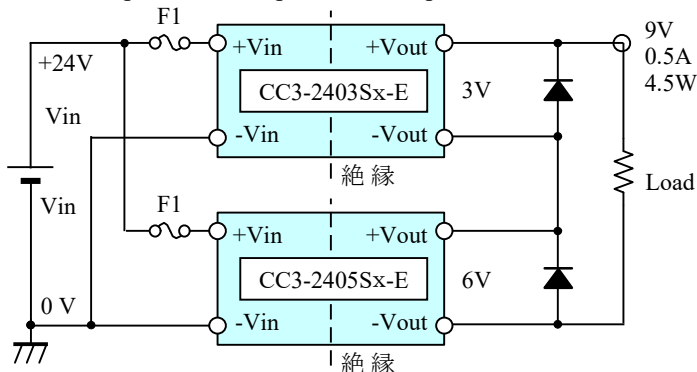
< A. Piling on Positive input example >



< B. Piling on Negative input example >



3. Series operation example with multiple DC-DC



By DC-DC series operation with different output voltages, various output can be realized that is not in the product line-up. In this example on the left, two CC3 series are used, and obtained 9V, 0.5A (4.5W). Output side to align the startup at SBD diode as shown in the figure connection. (Example: Rated 30V, 2A).

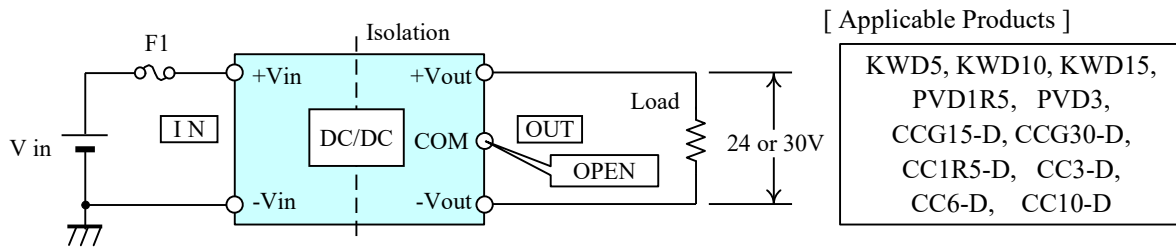
※ The circuit shown above is an example of the CC-E series. By applying the same idea, it is available CCG or other isolated DC-DC application circuit. In addition, various connection methods can be constructed.

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Example 9 : Input and Output Connection for Isolated DC-DC Converter

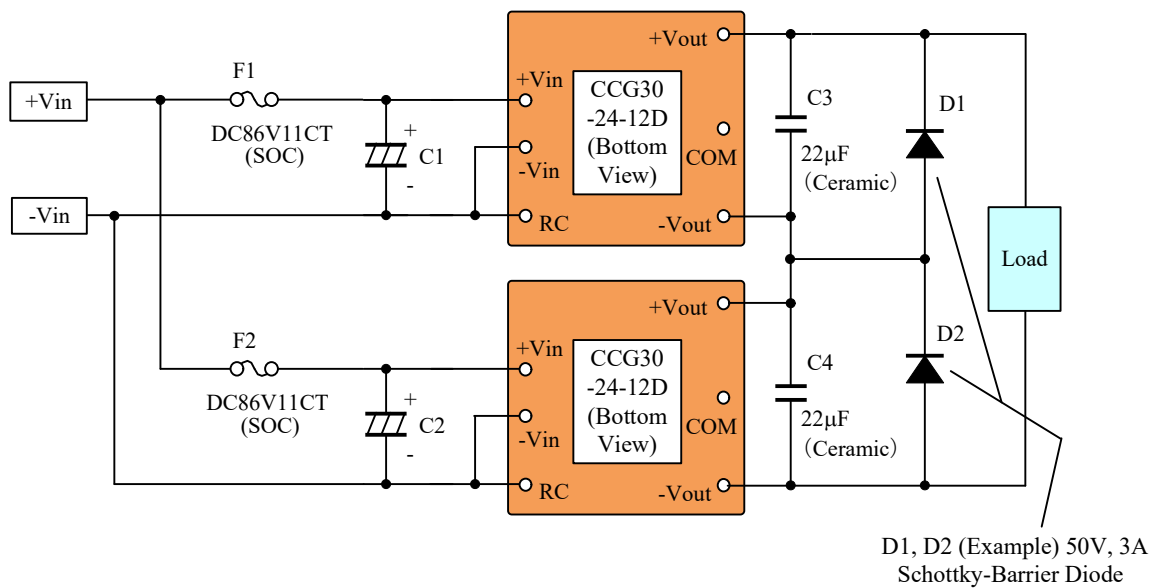
4. Utilization Outputs at Both Ends on Dual Type (+/-) DC-DC

The output at both ends (+Vout, -Vout) can be used without connecting COM terminal on Dual Type DC-DC. For this application, output voltage is 24V or 30V. And applicable products are as shown below. These products control is monitoring the both ends voltage, so they operate stable on this application.



[Application Case Study] 24V Input, 48V / 60W Output DC/DC Converter

24V Input, 48V/1.25A (60W) Output DC/DC converter can be constructed by using 2 pcs of CCG30-24-12D by connection as the figure below. Please insert the fuse F1, F2, and connect the input capacitor C1, C2 for each CCG30 product. And the diodes D1, D2 should be used to align the rise up timing. The output capacitor C3, C4 should be connected to reduce output switching noise. Isolation voltage is 1,500VDC between input and output.



◆ Precautions for Handling the Product

1. Storage Condition and Period (Before Mounting with Soldering on PCB)

(1) Storage Condition

* Temperature Range : 5°C ~ 30°C, * Humidity Range : 40% ~ 60%RH (No Dew Condensation)

Please keep the product in the packaged state at purchasing, and also avoid direct sunlight.
And please handle the product without excessive vibration, shock or weight load.

Note) Please keep away from the places where temperature and humidity change drastically, because there is the risk for occurrence of dew condensation and deterioration.

(2) Storage Period

It is recommended for use within 2 years after delivery. However, if 1 year passed after delivery, to make sure, please check the lead pins of the product whether oxidation or rust occurs or not, and use after checking their solderability.

Note) In the case for long-term Storage

The oxidation factor (oxygen or moisture) countermeasure is recommended by applying degassed packing with using desiccant (for example, silica-gel) to store with an emphasis on not oxidizing the terminal pins.

2. Saving Conditions and Period (After Mounting with Soldering on PCB)

(1) Saving Conditions

* Temperature Range : -40°C ~ 85°C, * Humidity Range : 5% ~ 95%RH (No Dew Condensation)

(2) Saving Period

There is no particular regulation, but it is recommended to use the products in about 2 years as a guide. In addition, if a limited life-time component (such as electrolytic capacitor) is mounted externally, please also check that it is not deteriorated.