

Isolated Converters Provide Positive or Negative Outputs from Plus or Minus Rails

MS Kennedy Corp.; Revised 9/19/2013

Isolated DC-DC voltage converters can provide positive or negative voltages from a single device. Most isolated converters have “floating” outputs that can withstand over 500V between the case, the input and the output circuitry. (See Fig. 1A,B & C) Connecting the output circuit reference node (ground) to the positive output will cause the output common of the device to be at a relative negative voltage. For example, by connecting the MSK DHC2805S +5V output to ground, the output common may be used to supply a negative voltage (-5V) to the load. (See Fig. 2)

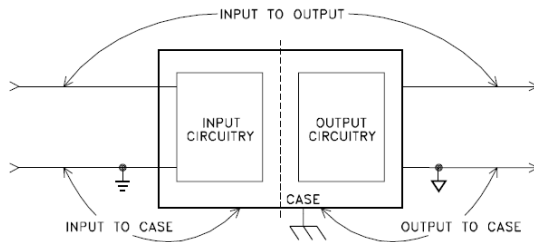


FIGURE 1A
500V ISOLATION BETWEEN CASE, INPUT AND OUTPUT CIRCUITRY

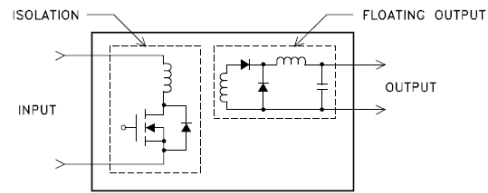


FIGURE 1B
SIMPLIFIED INPUT/OUTPUT CIRCUITRY FOR SINGLE OUTPUT DEVICE

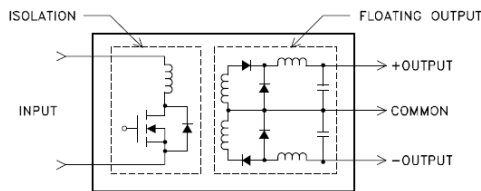


FIGURE 1C
SIMPLIFIED INPUT/OUTPUT CIRCUITRY FOR DUAL OUTPUT DEVICE

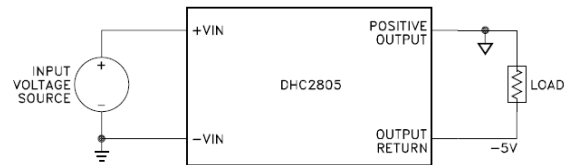


FIGURE 2
ISOLATED OUTPUT CONFIGURED TO PROVIDE NEGATIVE VOLTAGE

A dual output device may sometimes be used as a positive or negative single output device. The output voltage is the sum of the magnitudes of both outputs. For example, the MSK DAC2812D +/-12V dual output unit may be used as a single output 24V device. (See Fig. 3) A positive 24V is configured by grounding the negative output, leaving the output common floating and connecting the load between the positive output and ground. A negative 24V can be created by grounding the positive output, while again leaving the output common floating. The load is placed across the span of the two series connected outputs to form a single-sided arrangement. Sometimes it is helpful to create a “balancing network” when using a dual output device in this manner. (See Fig. 4) This is easily accomplished by using a symmetrical resistive divider and connecting the midpoint to the output common node to

help balance the internal bias currents within the converter. A few milliamps is all that is required.

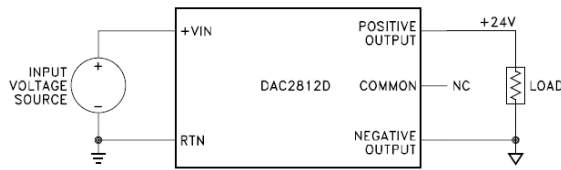


FIGURE 3
SINGLE-SIDED OUTPUT FROM DUAL OUTPUT DEVICE

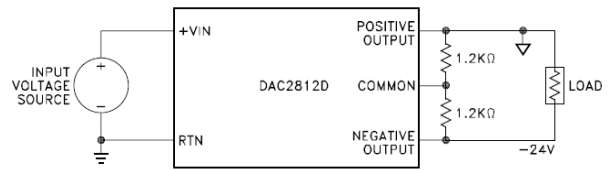


FIGURE 4
SINGLE-SIDED OPERATION WITH BALANCING NETWORK

A “virtual ground” configuration is achieved by connecting a dual output device in a single-sided fashion. Op-amp circuits that require positive and negative rails can be interfaced with devices that work single-sided, such as telemetry circuits, relays, or motors. The virtual ground is hard-wired as a floating reference node. Telecom and shipboard systems that operate from negative voltages are examples. (See Fig. 5)

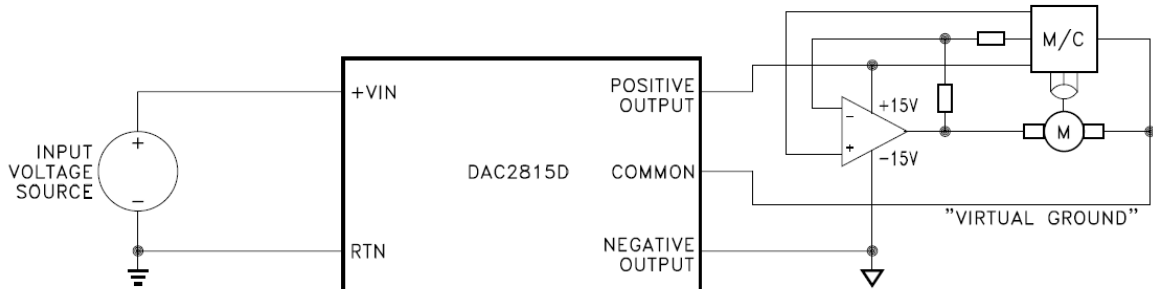


Figure 5
Single-sided Operation with “Virtual Ground” using Dual Rail Op-Amp and Motor Controller

Isolated DC-DC converters may be also be used with either a positive or a negative input voltage source, as long as the relative polarity of the input to the device is maintained. (See Fig. 6) The positive input (V_{in}) must be positive with respect to the input return. The input return must be kept negative with respect to the V_{in} pin. If this polarity is reversed, the converter input will approximate a forward biased diode and permanent damage to the unit will occur. An example of operating from a negative source is shown, connecting the input return to the $-24V$ and the input positive terminal to ground, maintaining the correct polarity. The outputs can still be made either positive or negative as described earlier.

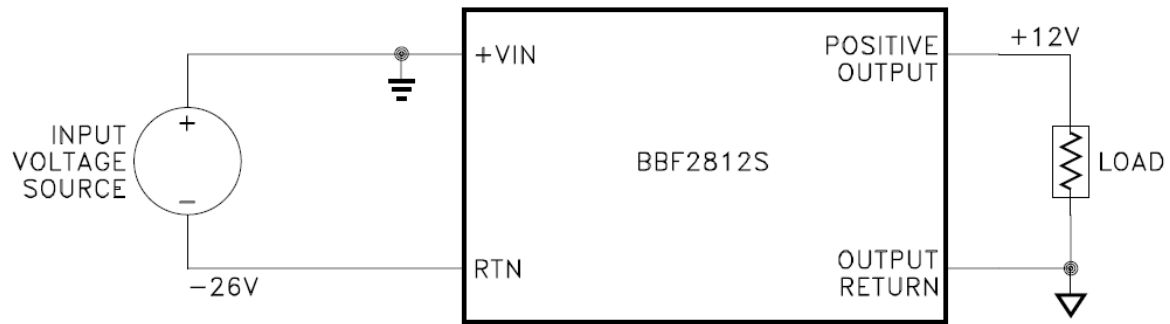


Figure 6
Negative Input Voltage Operation

M. S. Kennedy Corporation (MSK) has been a leader in the design and production of high performance/ reliability analog microelectronics since 1971. MSK manufactures hybrids to DSCC (Defense Supply Center, Columbus) Standard Military Drawings (SMD), we offer a line of standard products including both isolated and non-isolated DC-DC converters, and we design microelectronic hybrids to customers' specifications.