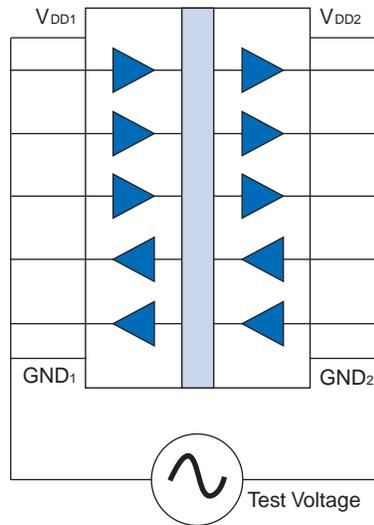


## **Application Bulletin AB-18** *IsoLoop Isolators Have Best-in-Class Endurance Voltage*

The core of isolator functionality is their ability to withstand high voltage between their input and output sides. This bulletin explains three high-voltage isolation specifications: isolation voltage, working voltage, and endurance voltage. We will illustrate the importance of endurance, which may be the least well-known high-voltage specification.

Isolator high-voltage test configurations are considered two-port networks with all pins on one side of the device connected to a common point, all pins on the other side connected to a second common point. Figure 1 shows these connections and the voltage source for test:



**Fig. 1. Isolator high-voltage test configuration.**

### **Isolation Voltage**

“Isolation voltage” is usually specified at one minute, so isolators cannot be operated at the isolation voltage, nor is it a measure of transient voltage tolerance. Furthermore, it allows “partial discharge” failures that can compromise safety and damage circuitry. Thus it is one of the least useful high-voltage specifications. Most IsoLoop PDIP and SOIC isolators have an isolation voltage specification of  $2500 V_{RMS}$  for one minute; MSOPs are rated at  $2300 V_{RMS}$ .

### **Working Voltage**

Working voltage relates to the maximum line voltage where the part can be operated indefinitely. It is meant to cover line voltage, line voltage variations, and one-time high-voltage transients. Parts must generally pass a destructive lot sample test and a 100% nondestructive part test. There are several standards that specify working voltage and related test methods; VDE 0884-10 is emerging as the *de facto* standard for isolators. VDE 0884-10 mandates a lot test that incorporates a transient overvoltage test and a one-second test on each part. Both tests have partial discharge limits.

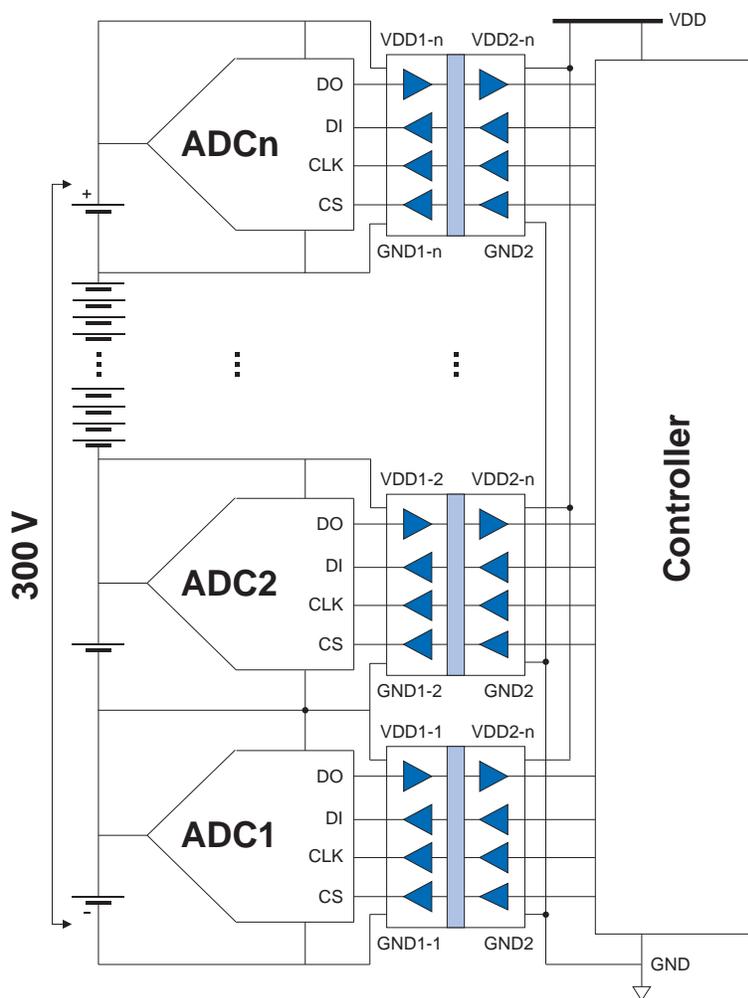
Most NVE isolators are rated at a best-in-class Working Voltage of  $600 V_{RMS}$  per VDE 0884-10.

The IsoLoop working voltage specification includes a 4000 V<sub>PK</sub> transient overvoltage specification (1500 V<sub>PK</sub> for MSOPs).

### Endurance Voltage

Endurance voltage is the maximum voltage that can be applied between the input and output pins of an isolator indefinitely without damage. Endurance voltage is typically not specified in data sheets but is useful in applications where the isolators are not subject to line voltage transients. The endurance voltage for IsoLoop Isolators has been determined to be 1000 V<sub>RMS</sub> and 1500 V<sub>DC</sub> based on qualification testing. Isolator barrier life is calculated to be remarkable 44000 years at the endurance voltage.

The following circuit, used for measuring the voltage of each battery cell of a DC to AC inverter, illustrates the importance of endurance voltage:



**Fig. 2. Endurance voltage illustrative application.**

As shown in Figure 2, the last stage of isolation is a full 300 V above the controller ground, so the isolator is subject to 300 V between inputs and outputs.

Because the isolators have an endurance voltage of 1500 V<sub>DC</sub>, the isolators can be expected to withstand the voltage virtually indefinitely with considerable safety margin.

The following table summarizes the isolation parameters discussed in this bulletin for IsoLoop Isolators:

	<b>IsoLoop Package</b>		
	<b>MSOP</b>	<b>0.15" SOIC (8 or 16 pin)</b>	<b>0.3" SOIC (True 8™)</b>
Isolation voltage (1 minute per UL 1577)	1200 V <sub>RMS</sub>	2500 V <sub>RMS</sub>	2500 V <sub>RMS</sub>
Working voltage (per VDE 0884-10)	600 V <sub>RMS</sub>	600 V <sub>RMS</sub>	600 V <sub>RMS</sub>
Transient overvoltage (per VDE 0884-10)	1500 V <sub>PK</sub>	4000 V <sub>PK</sub>	4000 V <sub>PK</sub>
AC endurance voltage	1000 V <sub>RMS</sub>	1000 V <sub>RMS</sub>	1000 V <sub>RMS</sub>
DC endurance voltage	1500 V <sub>RMS</sub>	1500 V <sub>RMS</sub>	1500 V <sub>RMS</sub>

**Summary of IsoLoop Isolator high-voltage parameters.**