AB-13—IsoLoop Isolators Have Low Emissions, Low EMI Susceptibility, and Excellent Magnetic Immunity

IsoLoop Isolators have the best EMC footprint of any isolation technology with low emissions, low EMI susceptibility, and excellent magnetic immunity.

Low Emissions

Unlike other isolation technologies, IsoLoop Isolators do not need RF carriers or high-frequency clocks for stability. Furthermore, they do not use power transfer coils or transformers, which are natural antennas. Extensive experience in a variety of applications has demonstrated trouble-free compliance with EN55022-B, FCC Class B, CISPR 22, and similar regulations. Figure 1 shows the virtually undetectable radiated emissions for an IsoLoop Isolator (below the testing laboratory's noise floor), compared to problematic emission levels for a transformer-based isolator, even with no other system components:

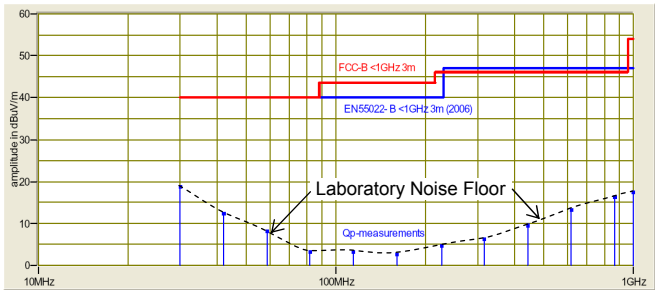

Fig. 1a. The IsoLoop IL715 four-channel isolator has virtually undetectable radiated emissions (blue dots are the testing laboratory's noise floor).

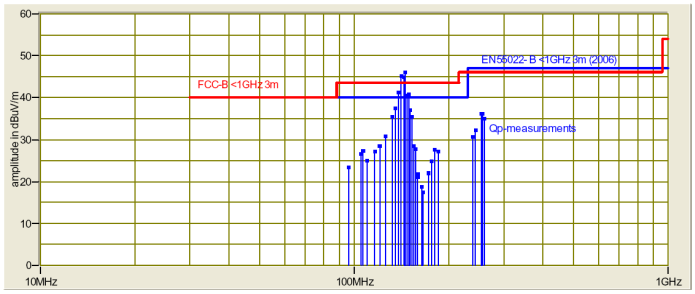

Fig. 1b. A transformer-based four-channel isolator fails EN55022-B and FCC B.

Low EMI Susceptibility

Because they have no pulse trains or carriers to interfere with, IsoLoop Isolators also have low EMI susceptibility. Susceptibility limits for most industrial, commercial, telecom, residential and medical applications are governed by the European Electromagnetic Compliance specifications EN50081, EN50082 and EN600001. NVE has completed compliance tests in the categories below:

EN50081-1

Residential, Commercial & Light Industrial Methods EN55022, EN55014

EN50082-2

EN61000-4-2 (Industrial Environment Methods—ESD)
EN61000-4-3 (Electromagnetic Field Immunity)
EN61000-4-4 (Electrical Transient Immunity)
EN61000-4-6 (RFI Immunity)
EN61000-4-8 (Power Frequency Magnetic Field Immunity)
EN61000-4-9 (Pulsed Magnetic Field)
EN61000-4-10 (Damped Oscillatory Magnetic Field)

ENV50204

Radiated Field from Digital Telephones (Immunity Test)

As shown in Table 1, even at low frequency and worst-case field orientation, IsoLoop Isolators meet the required immunity for each standard. Oriented optimally (cross-axis), immunity jumps to at least several times the standard limits:

Standard	Standard Limit (A/m)	Min. IsoLoop Specification (A/m)	
		Cross-Axis	On-Axis
EN50081-1, Methods EN55022, EN55014	100	2500	1000
EN50082-2, Method EN61000-4-8 (*Power Frequency Magnetic Field Immunity*)	1000	2500	1000
EN50082-2, Method EN61000-4-9 (*Pulsed Magnetic Field*)	1000	4500	1800
EN50082-2, Method EN61000-4-10 (*Damped Oscillatory Magnetic Field*)	100	4500	1800

Table 1. IsoLoop Isolator magnetic immunity specifications versus EN standards.

Fields in the ranges of the Table 1 standards would only occur with very high currents close to the isolator, and would be quite unusual. IsoLoop Isolators are proven in many years of operation in the most demanding applications, including medical devices, military, and aerospace electronics.

Immunity Improves With Frequency

Figure 2 shows the immunity of IsoLoop Isolator compared to the frequency-dependent EN standards referenced in Table 1 compared to transformer-coupled isolators:

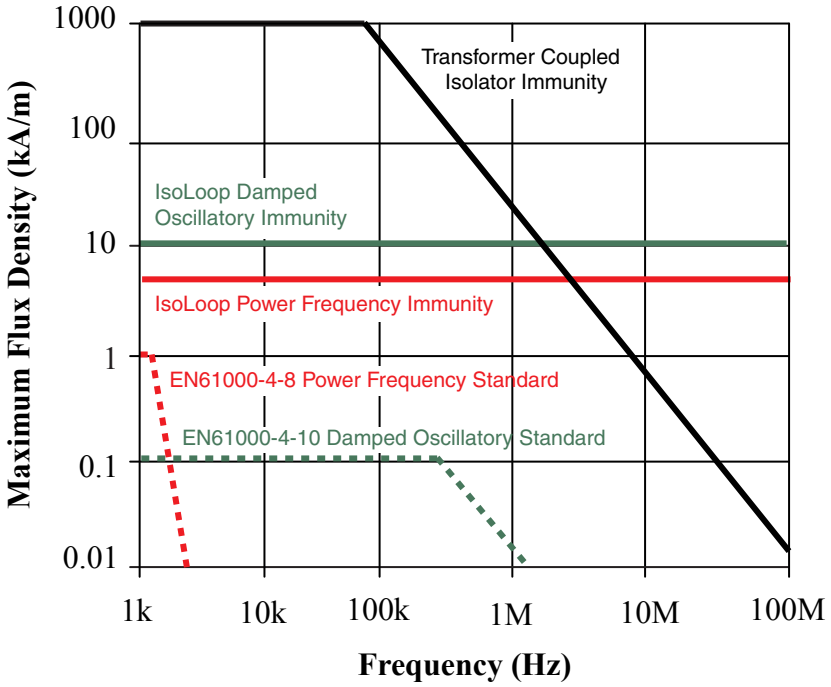

Fig. 2. Magnetic immunity frequency dependence.

IsoLoop shield effectiveness increases with frequency, and because there are no carriers or clocks to be disrupted by AC fields, IsoLoop electromagnetic immunity improves with frequency. Conversely, transformer-coupled isolators are inherently susceptible to high-frequency energy, and their immunity decreases with frequency.

Bridge Design Cancels External Fields

IsoLoop Isolators' EMC advantages can be traced to their revolutionary spintronic GMR technology. The input drives a low-field generator. The field changes the electron spin polarization, which changes the resistance of giant magnetoresistor (GMR) bridge elements. Unlike transformers or conventional coils, this does not rely on energy transfer, so EMI emissions are minimal. A Wheatstone bridge configuration maintains the required sensitivity to the internal fields but cancels ambient magnetic fields. This results in excellent immunity to external magnetic fields:

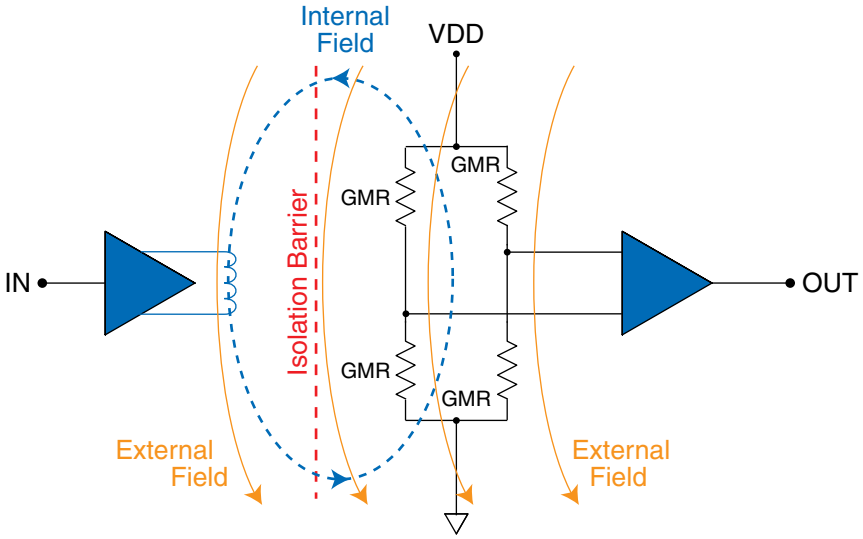

Fig. 3. A GMR bridge configuration cancels external fields.

Shielding Enhances Immunity

An integrated high-permeability alloy EMI shield over the GMR bridge elements, as shown below, further enhances magnetic immunity:

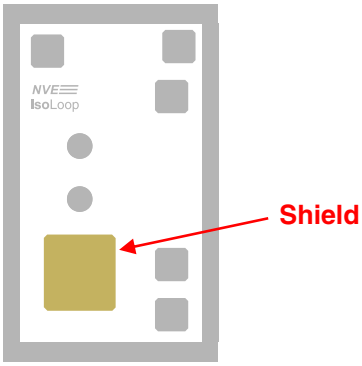

Fig. 4. Isolator die magnetic shield.

Orientation to Maximize Immunity

Magnetic immunity depends on the orientation of the package and die with respect to the field. As shown in Table 1, immunity to external magnetic fields is higher if the field direction is end-to-end (cross-axis) as shown below rather than to pin-to-pin:

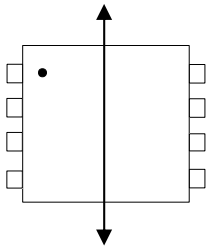

Fig. 5. Direction of highest immunity (cross-axis).

Conclusion—Low emissions, Low Susceptibility, and High Immunity

Because they do not use RF carriers or refresh pulse trains, IsoLoop isolators inherently have extremely low EMI emissions. Their shielded Wheatstone bridge design provides high magnetic immunity, and unlike transformers, IsoLoop Isolator magnetic immunity improves with frequency, making them ideal for digital circuit isolation. Finally, device orientation can increase immunity even more.