Notes on Selection of Digital Isolator

1 Introduction

Isolation is a method of preventing direct current or alternating current interference between two parts of the system, while allowing signals to be transmitted between two parts of the system. This isolation, cutting off ground loops in the communication network to communicate with high-end equipment, is needed to protect operators and avoid expensive processors damage in high-voltage systems. Digital isolators, such as SPI, UART, I^2C, RS-485 and CAN, are the best choise for many different system applications, including industrial automation system, motor drive, medical device, solar inverter, power supply and hybrid electic vehicle.

2 Chipanalog Isolation Technology

Chipanalog isolators use silicon dioxide (SiO_2) as the dielectric media used in signal insulation and digital isolators. Two silicon dioxide capacitors in series, one on each side of the gate, are usually used to achieve high voltage isolation, and the equivalent isolation diagram is shown in Fig. 1. Compared to the inductor-based (magnetic barrier) isolator and the traditional optocoupler, SiO_2 provides the highest dielectric strength, is not degraded by exposure to ambient humidity, and can have an isolation life of more than 100 years. For further description of Chipanalog isolation techniques, please see Making High Voltage Signal Isolation Quality and Reliability.

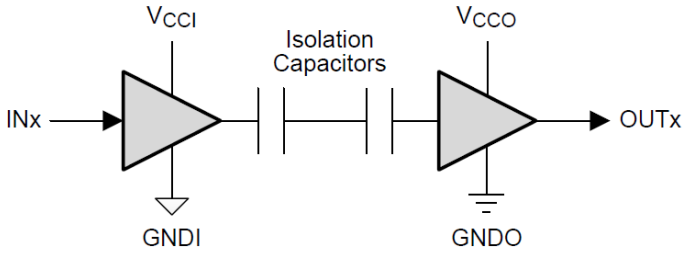

Fig. 1 Series Capacitor Isolation

3 Key Isolation Specifications

Before selecting the right digital isolator, the designer should know the key isolation specification parameters, and the isolation specification requirements of system applications, which is very important. Only by knowing the required isolation requirements can the designer know how much protection the isolator can provide to the system, for example, what is the maximum voltage the isolator can withstand? Or high voltage isolation performance of the digital isolator, such as maximum transient isolation voltage (V_{IOTM}), maximum isolation voltage (V_{ISO}), maximum surge isolation voltage (V_{IOSM}), maximum repetitive peak isolation voltage (V_{IORM}), maximum working isolation voltage (V_{IOWM}) and common mode transient immunity (CMTI). These parameters represent the ability of the digital isolator to handle high voltage. Different voltage resistance and transient response are the criteria for selecting isolators.

Maximum Transient Isolation Voltage (V_{IOTM}): IEC 60747-5-5 and VDE 0884-11 standards specify that the isolator can handle peak transient voltage of up to 60 seconds without failure. A voltaic arc or load change on the power supply of the system can cause interference, and the voltage can temporarily become several times the circuit voltage. The isolator must be able to handle the overvoltage without damage.

Maximum Isolation Voltage (V_{ISO}): Similar to V_{IOTM}, according to UL 1577, isolation tolerance voltage is defined as the root mean square (RMS) value of the voltage at which the isolator can not break down for 60 seconds, with the voltage difference being the peak value.

Maximum Surge Isolation Voltage (V_{IOSM}): It means the ability of the isolator to withstand extremely high voltage pulse at specific transient voltage. The waveform is shown in Fig. 2. This parameter represents direct and indirect surge impact. According to IEC 60747-5-5 and VDE 0884-11, the isolator with the maximum surge isolation voltage V_{IOSM} must pass the surge test at the peak voltage of 1.3 times V_{IOSM} to achieve basic isolation, and 1.6 times V_{IOSM} to achieve enhanced isolation. When passing the surge test above 10kV, the digital isolator can be called component-level enhancement.

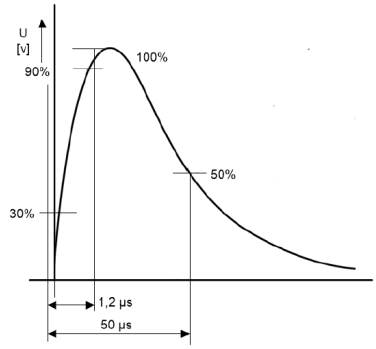

Fig. 2

Maximum Repetitive Peak Isolation Voltage (V_{IORM}): It is defined as the maximum repetitive peak voltage that the isolator can withstand in IEC 60747-5-5 and VDE 0884-11. The purpose of this specification is to identify the isolation voltage of the isolator on a continuous daily basis.

Maximum Working Isolation Voltage (V_{IOWM}): Similar to the maximum repetitive peak voltage, the working voltage is the maximum effective value or equivalent DC voltage, and the isolator can withstand for a specified long life. Again, the difference is in terms of RMS, not the peak voltage.

Common Mode Transient Immunity (CMTI): It means the ability of the isolator to withstand high-conversion voltage transients between its two grounds without damaging the signals passing through, which could result in signal transmission errors. In some applications, these signal errors caused by transients can lead to short circuit events. Higher CMTI indicates more reliable isolation channels.

Additional explanations of these isolation parameters can be found in definitions and test methods for high-voltage reinforced isolation. The isolation certification mentioned above ensures that the application complies with global industry standards.

4 Package Selection

Creepage and clearance are the distance along the surface of the package and the distance of air between the pins on one side of the isolator and the pins on the other. This distance is specified by system-level standards based on parameters such as isolation voltage requirements. Tab. 1 below details the parameters of Chipanalog's corresponding packages.

Tab. 1 Package Parameters

Package	Identifier	Length (mm)	Width (mm)	Creepage (mm)
8-pin SOIC (narrow body)	S	4.90	3.91	4
8-pin SOIC (wide body)	G	4.90	7.5	8.5
16-pin SOIC (narrow body)	N	10.30	3.91	4
16-pin SOIC (wide body)	W	10.30	7.5	8.5

5 Conclusion

This article introduces some important reference factors that are important in selecting the Chipanalog's digital isolator combination for use in industrial and automotive design. These factors are also useful in evaluating the application of Chipanalog's isolation interface device. For more in-depth explanation and analysis of the content involved, please refer to the corresponding specification of Chipanalog.

6 Version Information

Version	Date	State Description
Ver1.0	Apr. 2022	Initial version

7 Important Statement

The above information is for reference only and used for helping Chipanalog customers with design, research and development. Chipanalog reserves the rights to change the above information due to technological innovation without advance notice.

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