

USB 2.0 COMPLIANT, HIGH-SPEED, ISOLATED USB REPEATERS

New Product
Update

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Agenda

- Isolated USB repeater applications
- Our SiO₂ capacitive isolation technology
- Product highlight: ISOUSB211 (HS) and ISOUSB111 (FS/LS)
- TI.com resources

Isolation portfolio

Digital isolators

Products

- Low cost digital isolators
- Reinforced isolators
- Basic isolators
- Ultra-low low power isolators

Applications

- Factory automation
- Motor control and grid infrastructure
- Power delivery
- Automotive – HEV/EV



Isolated interfaces

Products

- ISO RS-485
- ISO CAN
- ISO I2C
- ISO IO
- ISO LVDS
- ISO USB

Applications

- Factory automation
- Motor drives and grid infrastructure
- Servers/Enterprise
- Automotive – HEV/EV



Isolated DC/DC (ISOW)

Products

- ISOW – Channel ISO
- ISOW – RS485
- ISOW – CAN
- Transformer drivers

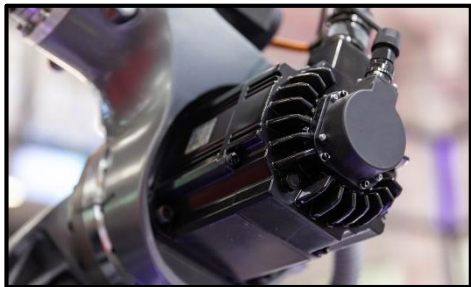
Applications

- Industrial networks
- Grid infrastructure
- Industrial transport
- Automotive – HEV/EV



Isolated USB repeater applications

Factory automation & control / Motor drive



- PLC - Comms module
- Industrial / Rugged PC
- Servo motor drive / AC inverter

Medical



- CPAP machine
- Patient monitor
- Hospital bed

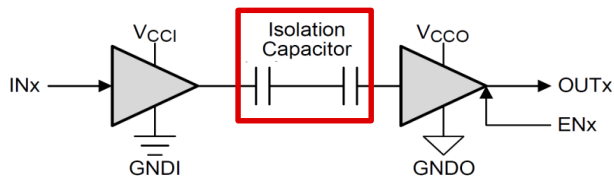
Grid infrastructure / Test measurement



- Data concentrator
- UPS
- Semiconductor tester

TI's capacitive isolation technology

Our reinforced isolators use a logic input and output buffer separated by a **double capacitive SiO₂ insulation barrier**



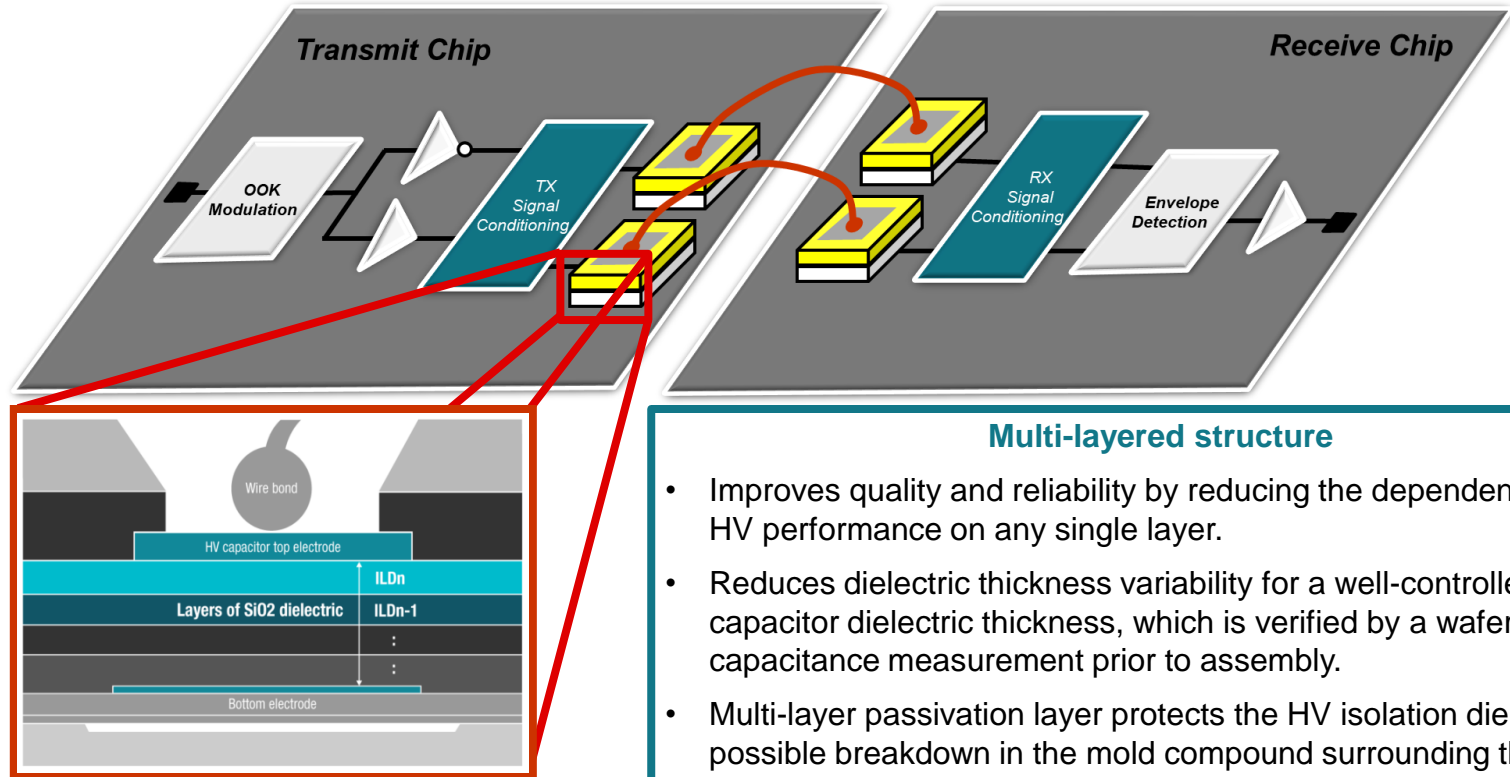
Manufactured and thoroughly tested in a controlled environment to ensure the highest quality isolation products.

Silicon dioxide (SiO₂) offers the **highest** dielectric strength in the industry

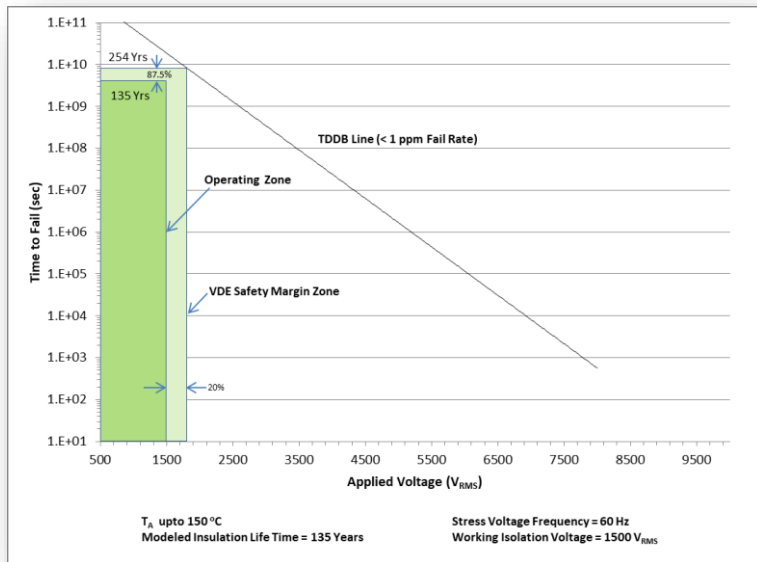
Insulator Materials	Dielectric Strength
Air	~1 Vrms/μm
Epoxies	~20 Vrms/μm
Silica filled Mold Compounds	~100 Vrms/μm
Polyimide	~300 Vrms/μm
SiO ₂	~500 Vrms/μm

Unlike polyimide and other polymer based insulators, the reliability of an SiO₂-insulated capacitor does not degrade with exposure to ambient moisture.

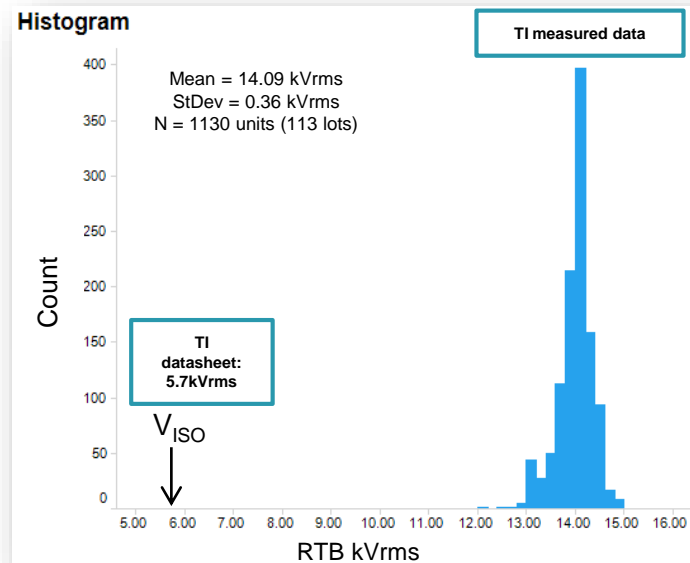
TI's capacitive isolation technology



TI's capacitive isolation technology



Insulation lifetime projection



Ramp to breakdown qualification test

Our capacitive isolation portfolio combines **highest working voltage** and **highest reliability** to enable extended system lifetime and protection.

ISOUSB211:

Robust 5.7kVrms USB 2.0 LS/FS/HS isolator

Features

- **Isolation, immunity and certifications**
 - Integrated SiO₂ dielectric capacitors
 - Reinforced and basic isolation (DIN V VDE V 0884-11)
 - V_{ISO} rating: up to 5,700 V_{RMS}
 - V_{IOSM} surge: >10,000 V_{PK}
 - V_{IOWM} working voltage: up to 1,000 V_{RMS}
 - CMTI: 100 kV/μs (typ) 85 kV/μs (min)
- **Electrical characteristics**
 - Data rate: 480 Mbps (max)
 - In-built connect and speed detection
 - Host, hub, cable or device Isolation
 - Supports L0/L1/L2 power states
 - US VBUS OK signal on DS side
 - Adjustable Equalization/Pre-emphasis to compensate channel Inter-symbol Interference (ISI)
 - Takes up the timing budget of two hubs
 - BC1.2 CDP support
 - Operating temperature range: -40°C to 120°C
- **Package**
 - SOIC-28DP: 8 mm creepage / clearance

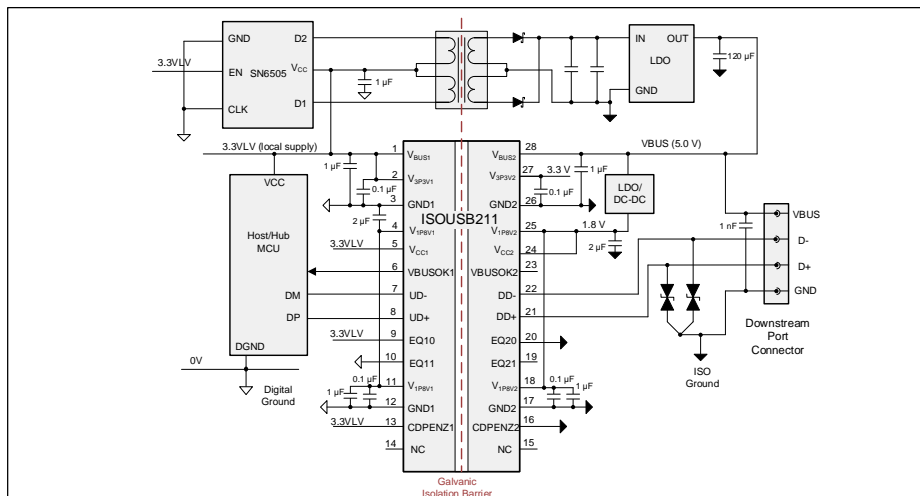
Applications

- Motor control
- Factory automation
- Grid infrastructure
- Medical
- Power delivery
- Wired networking

Sampling - Now

Benefits

- Plug-and-play USB isolation: LS/FS/HS
 - Fits seamlessly with existing hubs/hosts/devices
- High immunity and robustness
 - System level EMC for IEC61000-4-x ESD, EFT events, radiated and conducted RF immunity.
- Low EM emissions



Robust 5.7kVrms USB 2.0 LS/FS isolator

- **Isolation, immunity and certifications**

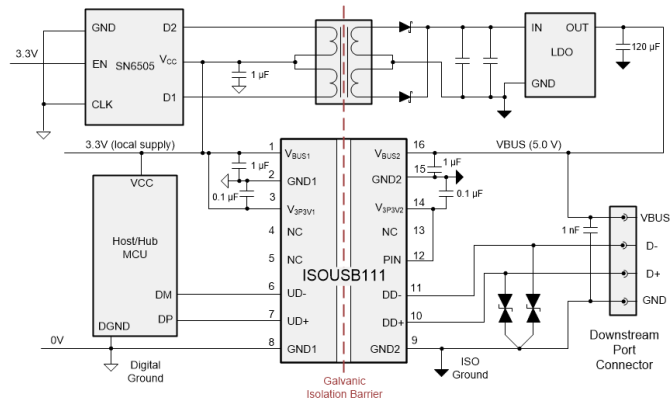
- **Package**

- SOIC-16DW: 8 mm creepage / clearance

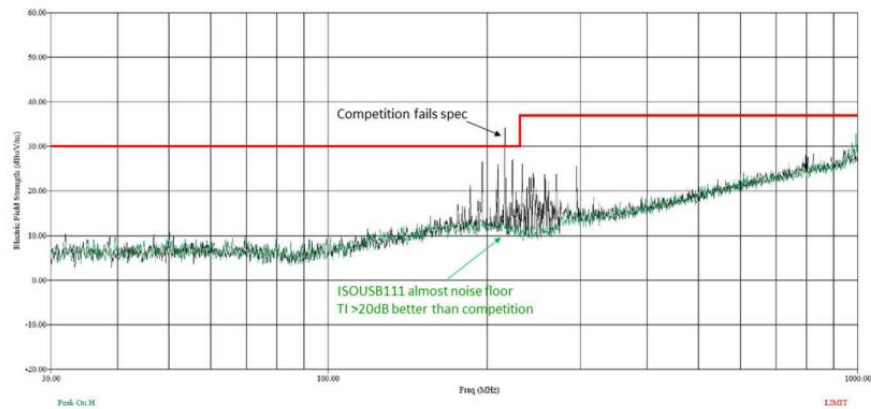
- Motor control
- Factory automation
- Grid infrastructure
- Medical
- Power delivery
- Wired networking

- Plug-and-play USB isolation: LS/FS

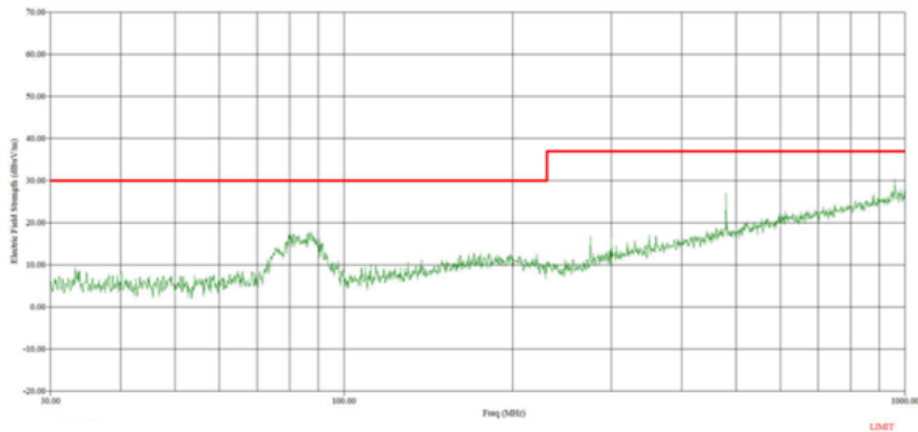
- Fits seamlessly with existing hubs/hosts/devices
- High immunity and robustness
 - System level EMC for IEC61000-4-x ESD, EFT events, radiated and conducted RF immunity.
 - Low EM emissions
- Pin compatible with ADUM3160 & ADUM4160



CISPR32 Class B emissions

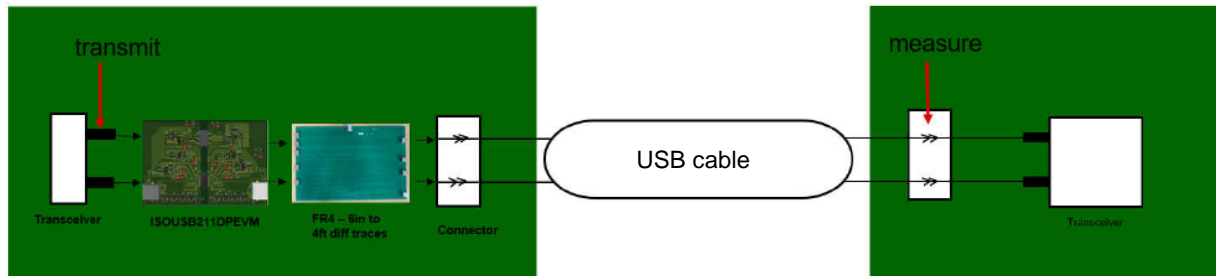


ISOUSB111 CISPR32 Class B emissions compared to competition



ISOUSB211 CISPR32 Class B emissions

Signal integrity improvement with ISOUSB211 equalizer and pre-emphasis



Far-end eye measurement set-up

	00	0f	01	f0	ff	f1	10	1f	11
6inch	0.7361	0.7917	0.83006	0.8686	0.91386	0.91386	1.0478	1.0478	1.1166
1ft	0.70288	0.74485	0.7827	0.82115	0.8689	0.914	0.9859	1.0707	1.0832
2ft	0.6097	0.6498	0.6913	0.7306	0.7719	0.8074	0.8843	0.9821	0.9885
3ft	0.577	0.618	0.6334	0.6802	0.7102	0.738	0.8188	0.929	0.9411
4ft	0.4787	0.5246	0.5595	0.59259	0.6325	0.63256	0.73192	0.8352	0.8372

fail marginal pass optimal

fail = EH and/or EW violate eye-mask

marginal = EH < 5mV or EW < 0.05UI from eye-mask

pass = meet eye-mask

optimal = best performance setting

Application note: [Compensate for Channel Loss with Equalizer Settings on High-Speed USB Isolators](#)

EQUALIZATION AND PRE-EMPHASIS				
EQ _{HS}	High-speed RX Equalization	EQ1=low, EQ0=low, 240MHz	-0.24	0.46 0.75 dB
EQ _{HS}	High-speed RX Equalization	EQ1=low, EQ0=float, 240MHz	0.27	0.98 1.5 dB
EQ _{HS}	High-speed RX Equalization	EQ1=low, EQ0=high, 240MHz	0.70	1.50 2.2 dB
EQ _{HS}	High-speed RX Equalization	EQ1=float, EQ0=low, 240MHz	1.04	2.00 2.81 dB
EQ _{HS}	High-speed RX Equalization	EQ1=float, EQ0=float, 240MHz	1.45	2.68 3.8 dB
EQ _{HS}	High-speed RX Equalization	EQ1=float, EQ0=high, 240MHz	1.73	3.09 4.4 dB
EQ _{HS}	High-speed RX Equalization	EQ1=high, EQ0=low, 240MHz	2.00	3.46 4.7 dB
EQ _{HS}	High-speed RX Equalization	EQ1=high, EQ0=float, 240MHz	2.25	3.80 5.1 dB
EQ _{HS}	High-speed RX Equalization	EQ1=high, EQ0=high, 240MHz	2.25	3.80 5.1 dB
PE _{HS}	High-speed TX Pre-emphasis	EQ1=low, EQ0=low, 240MHz	0.25	0.48 0.75 dB
PE _{HS}	High-speed TX Pre-emphasis	EQ1=low, EQ0=float, 240MHz	0.62	0.9 1.2 dB
PE _{HS}	High-speed TX Pre-emphasis	EQ1=low, EQ0=high, 240MHz	0.89	1.36 1.5 dB
PE _{HS}	High-speed TX Pre-emphasis	EQ1=float, EQ0=low, 240MHz	1.4	1.7 2.0 dB
PE _{HS}	High-speed TX Pre-emphasis	EQ1=float, EQ0=float, 240MHz	1.7	2.1 2.5 dB
PE _{HS}	High-speed TX Pre-emphasis	EQ1=float, EQ0=high, 240MHz	2.1	2.5 2.9 dB
PE _{HS}	High-speed TX Pre-emphasis	EQ1=high, EQ0=low, 240MHz	2.7	3.2 3.7 dB
PE _{HS}	High-speed TX Pre-emphasis	EQ1=high, EQ0=float, 240MHz	3.4	4.0 4.6 dB
PE _{HS}	High-speed TX Pre-emphasis	EQ1=high, EQ0=high, 240MHz	3.4	4.0 4.6 dB

Ti.com resources

Technical documents:

- Protect your Designs with Low-Emissions USB 2.0 Compliant 480 Mbps Isolators
- Compensate for Channel Loss with Equalizer Settings on High-Speed USB Isolators

Evaluation modules:

- ISOUSB211 high/full/low speed isolated USB repeater evaluation module
- ISOUSB111 evaluation module for full/low speed isolated USB repeater

E2E™ design support forums

- Isolation forum

www.ti.com/isolation

Visit www.ti.com/npu

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