

High-Speed Triple-Channel Digital Isolators

UMISO7331U WSSOP10

1 Description

The UMISO7331U is high-performance triple-channel, unidirectional digital isolators with 5.7kV_{RMS} wide-body package isolation rating and up to 10Mbps data rate. The device offers high electromagnetic immunity and low emissions at low power consumption while isolating different ground domains and block high-voltage/high-current transients from sensitive or human interface circuitry. Each isolation channel has a logic input and output buffer separated by capacitive silicon dioxide(SiO₂) insulation barrier, the integrated Schmitt trigger on each input provide excellent noise immunity in automotive applications.

The UMISO7331U features two-forward and one-reverse direction channels, making it ideal for applications such as isolated SPI, RS-485 communication.

The UMISO7331U features default outputs. When the input is either not powered or is open-circuit, the default output is low for devices with suffix L and high for devices with suffix H, see the **Selection Guide** table for suffixes associated with each option.

The UMISO7331U is available in WSSOP10 wide body package. The device is characterized over ambient free-air temperatures from -40 °C to 125 °C.

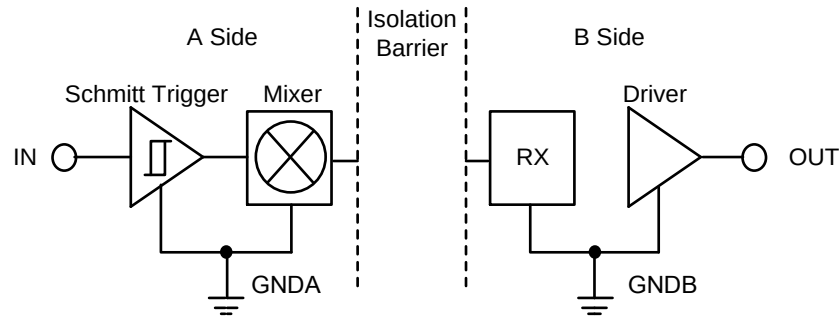
2 Features

- Maximum Data rate: 10Mbps
- Robust galvanic isolation of digital signals
 - High lifetime: >40 years
 - Up to 5700 V_{RMS} isolation rating
 - ±200 kV/μs typical CMTI
- Wide supply range: 3.0V to 5.5V
- Extended ambient temperature range: -40 °C to 125 °C
- Available in WSSOP10 package
- Default output high (UMISO7331UH) and low (UMISO7331UL) options
- High ElectroMagnetic Immunity
- No start-up initialization required
- Excellent propagation delay and skew
 - Propagation delay: ≤ 54 ns
 - Pulse width distortion: ≤ 10 ns
- Compliant with safety regulatory
 - DIN EN IEC 60747-17 (VDE 0884-17)
 - UL according to UL1577
 - IEC 61010-1 and GB 4943.1-2022 certifications

3 Applications

- Industrial Automation
- Medical Systems
- Solar Inverter
- Motor Control
- Isolated Power Supplies
- Isolated ADC,DAC

4 Simplified Channel Structure

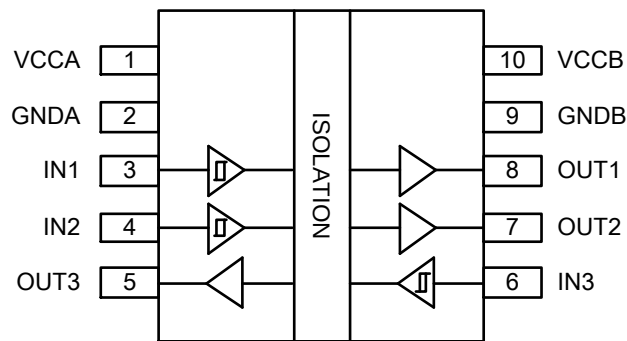


GNDA and GNDB are the isolated grounds for A side and B side respectively.

5 Selection Guide

Part Number	A Side Inputs	B Side Inputs	Default Output	Isolation Rating (V _{RMS})	Package
UMISO7331UHWAB	2	1	High	5700	WSSOP10
UMISO7331ULWAB	2	1	Low	5700	WSSOP10

6 Functional Block Diagrams



7 Ordering Information

Part Number	Mark Code	Package Type	Shipping Qty
UMISO7331UHWAB	UMISO7331UH	WSSOP10	4000pcs/13Inch Tape & Reel
UMISO7331ULWAB	UMISO7331UL	WSSOP10	4000pcs/13Inch Tape & Reel

8 Pin Configuration and Function

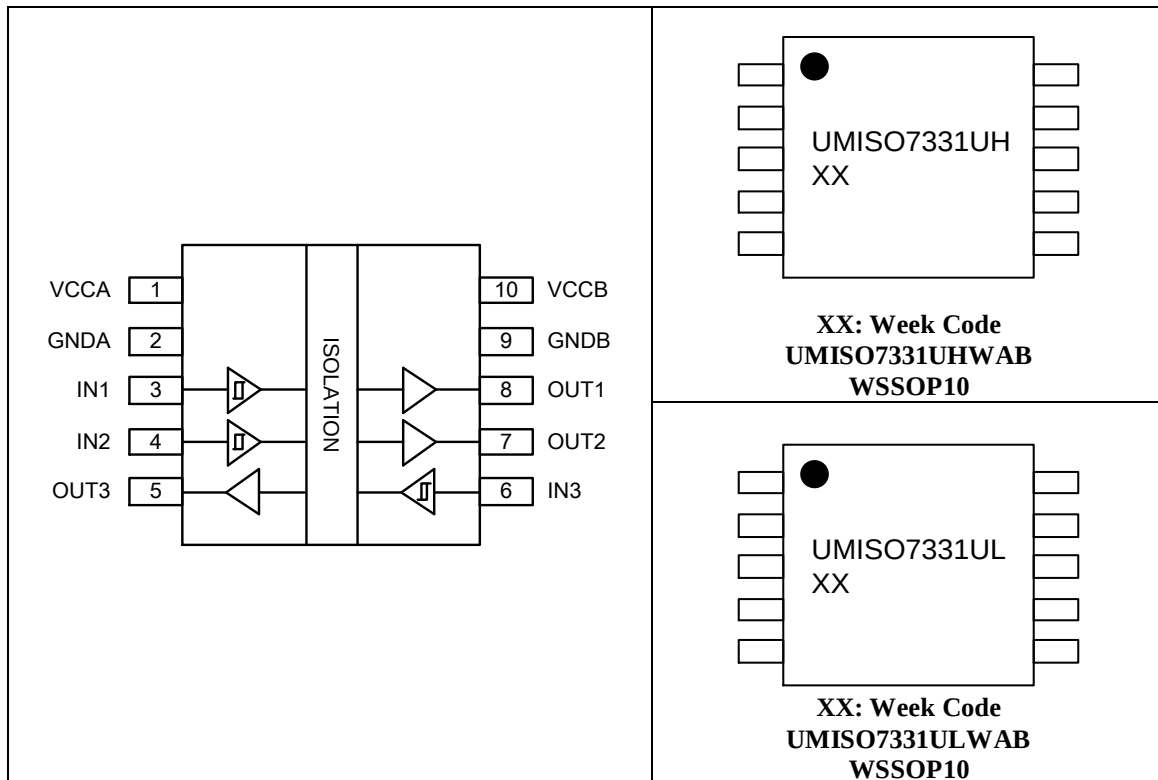


Table 8-1. Pin functions

Pin No.	Pin Name	Function
1	VCCA	Power supply for isolator side A.
2	GNDA	Ground reference for isolator side A.
3	IN1	Logic input 1, corresponds to logic output 1.
4	IN2	Logic input 2, corresponds to logic output2.
5	OUT3	Logic output 3,OUT3 is the logic output for the IN3 input.
6	IN3	Logic input 2, corresponds to logic output2.
7	OUT2	Logic output 2,OUT2 is the logic output for the IN2 input.
8	OUT1	Logic output 1,OUT1 is the logic output for the IN1 input.
9	GNDB	Ground reference for isolator side B.
10	VCCB	Power supply for isolator side B.

9 Specifications

9.1 Absolute Maximum Ratings (Note 1)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{CCA}	Supply voltage for isolator side A	Note 2	-0.5		7	V
V _{CCB}	Supply voltage for isolator side B	Note 2	-0.5		7	V
V _I	Voltage on INx	Note 3	-0.5		V _{CCI} +0.5	V
V _O	Voltage on OUTx	Note 3	-0.5		V _{CCO} +0.5	V
V _{ESD}	Human body model (HBM)	All pins		±8		kV
I _O	Average Output Current per Pin Output Current		-10		10	mA
T _A	Ambient Operating temperature		-40		125	°C
T _{STG}	Storage temperature		-65		150	°C

Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Note 2: All voltage values are with respect to the local ground terminal (GNDA or GNDB) and are peak voltage values.

Note 3: V_{CCI} = Input-side supply V_{CC}, V_{CCO} = Output-side supply V_{CC}. Maximum voltage must not exceed 7 V.

9.2 Recommended Operating Conditions (Note 1)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{CCA}	Supply voltage for isolator side A		3.0		5.5	V
V _{CCB}	Supply voltage for isolator side B		3.0		5.5	V
V _{IH}	High Level Input Signal Voltage		0.7V _{CCI}		V _{CCI}	V
V _{IL}	Low Level Input Signal Voltage		0		0.3V _{CCI}	V
I _{OH}	High-level output current	V _{CCO} = 5V	-4			mA
		V _{CCO} = 3.3V	-2			
I _{OL}	Low-level output current	V _{CCO} = 5V			4	mA
		V _{CCO} = 3.3V			2	
DR	Data Rate		0		10	Mbps
T _J	Junction Temperature		-40		150	°C
T _A	Ambient Operating temperature		-40		125	°C

Note 1: V_{CCI} = Input-side supply V_{CC}, V_{CCO} = Output-side supply V_{CC}.

9.3 Thermal Information

Symbol	Parameter	Value	Unit
R _{θJA}	Junction to ambient thermal	WSSOP10	45

9.4 Insulation Specifications

Symbol	Parameter	Conditions	Value	Unit
			WSSOP10	
CLR	External clearance	Shortest terminal-to-terminal distance through air	8	mm
CPG	External creepage	Shortest terminal-to-terminal distance across the package surface	8	mm
DTI	Distance through the insulation	Minimum internal gap (internal clearance)	>20	μm
CTI	Comparative tracking index	DIN EN 60112 (VDE 0303-11); IEC 60112	>600	V
	Material group	Per IEC 60664-1	I	
	Overvoltage category per IEC 60664-1	Rated mains voltage ≤ 150 V _{RMS}	I-IV	
		Rated mains voltage ≤ 300 V _{RMS}	I-IV	
		Rated mains voltage ≤ 600 V _{RMS}	I-IV	
		Rated mains voltage ≤ 1000 V _{RMS}	I-II	
DIN EN IEC 60747-17 (VDE 0884-17) (Note 1)				
V _{IORM}	Maximum repetitive peak isolation voltage	AC voltage (bipolar)	1414	V _{PK}
V _{IOWM}	Maximum operating isolation voltage	AC voltage; time-dependent dielectric breakdown (TDDB) test	1000	V _{RMS}
		DC voltage	1414	V _{DC}
V _{IOTM}	Maximum transient isolation voltage	V _{TEST} = V _{IOTM} , t=60 s (certified); V _{TEST} = 1.2 × V _{IOTM} , t = 1 s (100% product test)	8060	V _{PK}
V _{IMP}	Maximum impulse voltage	Tested in air, 1.2/50 μs waveform per IEC 62368-1,	9000	V _{PK}
V _{IOSM}	Maximum surge isolation voltage	V _{IOSM} ≥ 1.3 × V _{IMP} ; Tested in oil (qualification test), 1.2/50 μs waveform per IEC 62368-1	12000	V _{PK}

9.4 Insulation Specifications (continued)

Symbol	Parameter	Conditions	Value	Unit
			WSSOP10	
q _{pd}	Apparent charge (Note 2)	Method a, after input/output safety test of the subgroup 2/3, V _{ini} = V _{IOTM} , t _{ini} = 60 s; V _{pd(m)} = 1.2 × V _{IORM} , t _m = 10 s	≤5	pC
		Method a, after environmental test of the subgroup 1, V _{ini} = V _{IOTM} , t _{ini} = 60 s; V _{pd(m)} = 1.3 × V _{IORM} , t _m = 10 s	≤5	pC
		Method b, at routine test (100% production test) and preconditioning (type test) V _{ini} = 1.2 × V _{IOTM} , t _{ini} = 1 s; V _{pd(m)} = 1.5 × V _{IORM} , t _m = 1 s (methodb1) or V _{pd(m)} = V _{ini} , t _m = t _{ini} (methodb2)	≤5	pC
C _{IO}	Barrier capacitance, input to output (Note 3)	V _{IO} = 0.4 × sin (2πft), f = 1 MHz	1.5	pF
R _{IO}	Isolation resistance (Note 3)	V _{IO} = 500 V, T _A = 25 °C	>10 ¹²	Ω
		V _{IO} = 500 V, 100 °C ≤ T _A ≤ 125 °C	>10 ¹¹	
		V _{IO} = 500 V at T _S = 150 °C	>10 ⁹	
UL 1577				
V _{ISO}	Maximum withstanding isolation voltage	V _{TEST} = V _{ISO} , t = 60 s(qualification) V _{TEST} = 1.2 × V _{ISO} , t = 1 s (100% production test)	5700	V _{RMS}

Note 1: This coupler is suitable for “safe electrical insulation” only within the safety ratings.

Compliance with the safety ratings shall be ensured by means of suitable protective circuits.

Note 2: The characterization charge is discharging charge (pd) caused by partial discharge.

Note 3: Capacitance and resistance are measured with all pins on field-side and logic-side tied together.

9.5 Electrical Characteristics (Note 1)

$V_{CCA} = V_{CCB} = 3.3V \pm 10\%$ or $5V \pm 10\%$, $T_A = -40$ to 125°C (over recommended operating conditions, unless otherwise specified). All typical values are at 25°C .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IT+}	Rising Input Signal Voltage Threshold			$0.5 \times V_{CCI}$	$0.7 \times V_{CCI}$	V
V_{IT-}	Falling Input Signal Voltage Threshold		$0.3 \times V_{CCI}$	$0.35 \times V_{CCI}$		V
V_{OH}	High Level Output Voltage	$V_{CCO}=5V$, $I_{OH} = -4 \text{ mA}$	V_{CCO} -0.4	V_{CCO} -0.2		V
		$V_{CCO}=3.3V$, $I_{OH} = -2 \text{ mA}$	V_{CCO} -0.4	V_{CCO} -0.1		
V_{OL}	Low Level Output Voltage	$V_{CCO}=5V$, $I_{OL} = 4 \text{ mA}$		0.2	0.4	V
		$V_{CCO}=3.3V$, $I_{OL} = 2 \text{ mA}$		0.1	0.4	
I_{IN}	Input Current per Signal Channel	$0 \text{ V} \leq V_{IN} \leq V_{CCI}$	-10	0.1	10	μA
$V_{CC(UVLO+)}$	V_{CC} undervoltage-lockout threshold when supply voltage is rising		2.6	2.7	2.9	V
$V_{CC(UVLO-)}$	V_{CC} undervoltage-lockout threshold when supply voltage is falling		2.5	2.6	2.7	V
$V_{HYS(UVLO)}$	V_{CC} undervoltage-lockout threshold hysteresis			100		mV
CMTI Immunity	Common-mode transient	$V_I = V_{CCI}$ or 0 V , $V_{CM} = 1200 \text{ V}$, see Figure 10-2 (Note 1)	± 150	± 200		kV/ μs

Note 1: V_{CCI} = Input-side supply V_{CC} , V_{CCO} = Output-side supply V_{CC} .

9.6 Quiescent Supply Current Characteristics

$V_{CCA} = V_{CCB} = 3.3V \pm 10\%$ or $5V \pm 10\%$, $T_A = -40$ to 125°C (over recommended operating conditions, unless otherwise specified). All typical values are at 25°C .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
UMISO7331UH						
I_{CCA}	Supply Current - DC signal (Note 1)	$V_{CCA} = V_{CCB} = 5V$, $C_L = 0\text{ pF}$	$V_{IN} = V_{CCI}$ (UMISO7331UH), $V_{IN} = 0V$ (UMISO7331UL)	1.3	2.3	mA
I_{CCB}				1.9	3.1	
I_{CCA}			$V_{IN} = 0V$ (UMISO7331UH), $V_{IN} = V_{CCI}$ (UMISO7331UL)	3.2	5.3	
I_{CCB}				2.9	4.6	
I_{CCA}		$V_{CCA} = V_{CCB} = 3.3V$, $C_L = 0\text{ pF}$	$V_{IN} = V_{CCI}$ (UMISO7331UH), $V_{IN} = 0V$ (UMISO7331UL)	1.25	2.3	mA
I_{CCB}				1.85	3.1	
I_{CCA}			$V_{IN} = 0V$ (UMISO7331UH), $V_{IN} = V_{CCI}$ (UMISO7331UL)	3.15	5.3	
I_{CCB}				2.85	4.6	
I_{CCA}	Supply Current - AC signal	$V_{CCA} = V_{CCB} = 5V$, $C_L = 15\text{ pF}$	Data rate = 150kbps	2.26	3.1	mA
I_{CCB}				2.49	3.5	
I_{CCA}			Data rate = 1Mbps	2.31	3.3	
I_{CCB}				2.6	3.8	
I_{CCA}			Data rate = 10Mbps	2.83	3.7	
I_{CCB}				3.63	4.8	
I_{CCA}		$V_{CCA} = V_{CCB} = 3.3V$, $C_L = 15\text{ pF}$	Data rate = 150kbps	2.22	3.1	mA
I_{CCB}				2.44	3.5	
I_{CCA}			Data rate = 1Mbps	2.25	3.3	
I_{CCB}				2.51	3.8	
I_{CCA}			Data rate = 10Mbps	2.62	3.7	
I_{CCB}				3.24	4.8	

Note 1: V_{CCI} = Input-side supply V_{CC} , V_{CCO} = Output-side supply V_{CC} .

9.7 Electrical Characteristics (Dynamic)

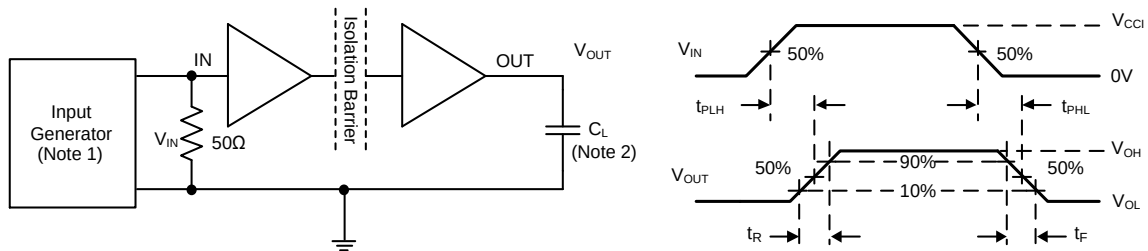
$V_{CCA} = V_{CCB} = 3.3V \pm 10\%$ or $5V \pm 10\%$, $T_A = -40$ to 125°C (over recommended operating conditions, unless otherwise specified). All typical values are at 25°C .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
DR	Data rate	Within PWD limit			10	Mbps
PWM _{MIN}	Minimum pulse width	Within pulse width distortion (PWD) limit			25	ns
t _{PLH} , t _{PHL}	Propagation delay time	see Figure 10-1	$V_{CCA} = V_{CCB} = 5V$	34	53	ns
			$V_{CCA} = V_{CCB} = 3.3V$	35	54	
PWD	Pulse width distortion, t _{PLH} - t _{PHL}	see Figure 10-1	$V_{CCA} = V_{CCB} = 5V$	1	10	ns
			$V_{CCA} = V_{CCB} = 3.3V$	1	10	
t _{SK(O)}	Channel-to-Channel output skew time (Note 1)	Same-direction channels	$V_{CCA} = V_{CCB} = 5V$	0.5	2	ns
			$V_{CCA} = V_{CCB} = 3.3V$	0.3	2	
t _{SK(PP)}	Part-to-Part output skew time (Note 2)	$V_{CCA} = V_{CCB} = 5V$			4	ns
		$V_{CCA} = V_{CCB} = 3.3V$			4.5	
t _R , t _F	Output signal rise/fall time	see Figure 10-1		2.5		ns
I _{CCI(D)}	Dynamic Input Supply Current per Channel	Inputs switching, 50% duty cycle square wave, C _L = 15pF	$V_{CCA} = V_{CCB} = 5V$	490		μA/ Mbps
			$V_{CCA} = V_{CCB} = 3.3V$	490		
I _{CCO(D)}	Dynamic Output Supply Current per Channel	Inputs switching, 50% duty cycle square wave, C _L = 15pF	$V_{CCA} = V_{CCB} = 5V$	110		μA/ Mbps
			$V_{CCA} = V_{CCB} = 3.3V$	70		

Note 1: t_{SK(O)} is the skew between outputs of a single device with all driving inputs connected together and the outputs switching in the same direction while driving identical loads.

Note 2: t_{SK(PP)} is the magnitude of the difference in propagation delay times between any terminals of different devices switching in the same direction while operating at identical supply voltages, temperature, input signals and loads.

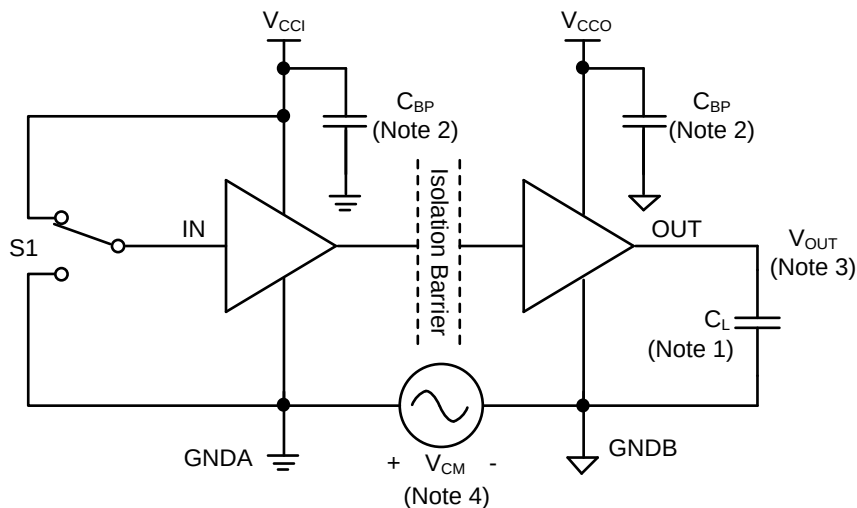
10 Parameter Measurement Information



Note 1: A square wave generator provides V_{IN} input signal with characteristics: frequency $\leq 100\text{kHz}$, 50% duty cycle, $t_R \leq 3\text{ns}$, $t_F \leq 3\text{ns}$, $Z_{OUT} = 50\Omega$. At the input, 50Ω resistor is required to terminate input generator signal. It is not needed in actual application.

Note 2: $C_L = 15\text{pF}$ and includes external circuit (instrumentation and fixture etc.) capacitance. Since the load capacitance influence the output rising time, it's a key factor in the timing characteristic measurement.

Figure 10-1. Switching Characteristics Test Circuit and Voltage Waveforms



Note 1: $C_L = 15\text{pF}$ and includes external circuit (instrumentation and fixture etc.) capacitance.

Note 2: C_{BP} ($0.1 \sim 1\mu\text{F}$) is bypass capacitance.

Note 3: Pass-fail criteria: the output must remain stable.

Note 4: The High Voltage Surge Generator generates repetitive high voltage surges with $>1\text{kV}$ amplitude, rise time $<10\text{ns}$ and fall time $<10\text{ns}$, to reach common-mode transient noise with $>150\text{kV}/\mu\text{s}$ slew rate.

Figure 10-2. Common-Mode Transient Immunity Test Circuit

11 Detailed Description

11.1 Overview

The UMISO7331U is automotive, triple-channel digital galvanic isolator using Union's full differential capacitive isolation technology. The device has an ON-OFF keying (OOK) modulation scheme to transfer digital signals across the SiO₂ based isolation barrier between circuits with different power domains. The transmitter sends a high frequency carrier across the barrier to represent one digital state and sends no signal to represent the other digital state. The receiver demodulates the signal and recovers input signal at output through a buffer stage. With this OOK architecture, the UMISO7331U builds a robust data transmission path between different power domains, without any special start-up initialization requirement.

The device also incorporates advanced full differential techniques to maximize the CMTI performance and minimize the radiated emissions due the high frequency carrier and I/O buffer switching.

11.2 Functional Block Diagram

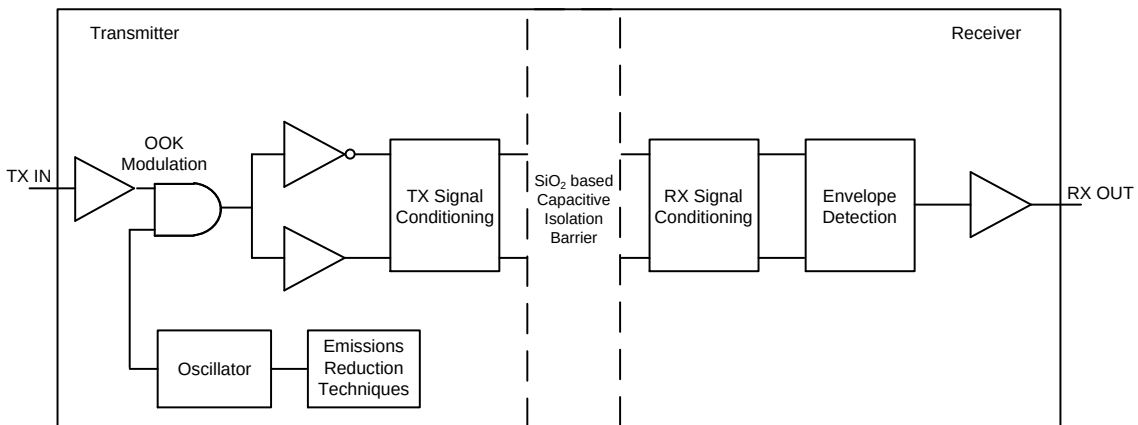


Figure 11-1. Functional Block Diagram of a Single Channel

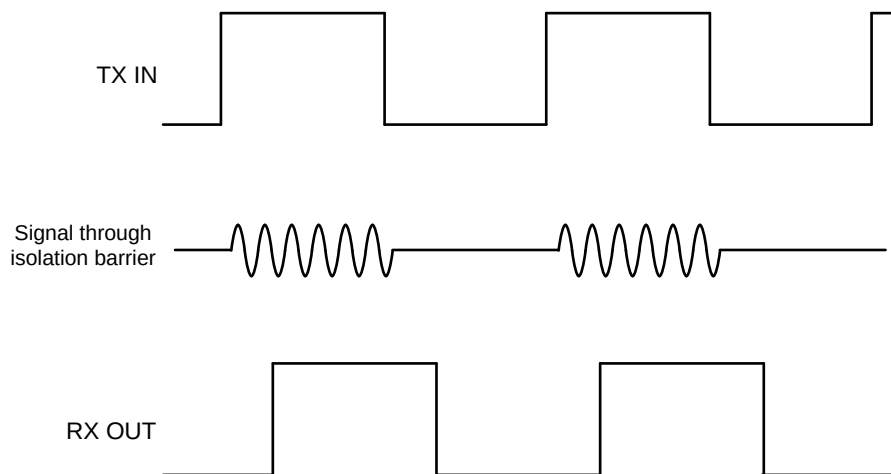


Figure 11-2. Conceptual Operation Waveforms of a Single Channel

11.3 Device Operation Modes (Note 1, 2, 3)

Table 11-1 lists the operation modes for the UMISO7331U.

Table 11-1. Operation Mode Table (Note 1,2)

IN _x	V _{CCI} State	V _{CCO} State	Default Low OUT _x Output	Default High OUT _x Output	Test Conditions /Comments
Low	PU	PU	Low	Low	Normal operation
High	PU	PU	High	High	Normal operation
Open	PU	PU	Low	High	Default output
X	PD	PU	Low	High	Default output
X	X	PD	Undetermined	Undetermined	If the output side V _{CCO} is unpowered, a channel output is undetermined. (Note 3)

Note 1: V_{CCI} = Input-side V_{CC}; V_{CCO} = Output-side V_{CC}; PU = Powered up (V_{CC} > V_{CC(UVLO+)}); PD = Powered down (V_{CC} < V_{CC(UVLO-)}); X = Irrelevant; H = High level; L = Low level; Z = High Impedance.

Note 2: A strongly driven input signal can weakly power the floating V_{CC} through an internal protection diode and cause undetermined output.

Note 3: The outputs are in undetermined state when V_{CCI} > V_{CC(UVLO+)}, V_{CCO} < V_{CC(UVLO-)}.

12 Application and Implementation

12.1 Application Information

The UMISO7331U provides complete galvanic isolation between two power domains, protecting circuits from high common-mode transients and faults, and eliminating ground loops. In many applications, digital isolators are replacing optocouplers because they can reduce the power requirements and take up less board space while offering the same isolation capability. The UMISO7331U is a high-performance, triple-channel digital isolator. Unlike optocouplers, which require external components to improve performance, provide bias, or limit current, the UMISO7331U only requires two external bypass capacitors to operate. To reduce ripple and the chance of introducing data errors, bypass V_{CCA} and V_{CCB} pins with $0.1\mu\text{F}$ to $1\mu\text{F}$ low-ESR ceramic capacitors to GNDA and GNDB respectively. Place the bypass capacitors as close to the power supply input pins as possible.

12.2 Typical Application

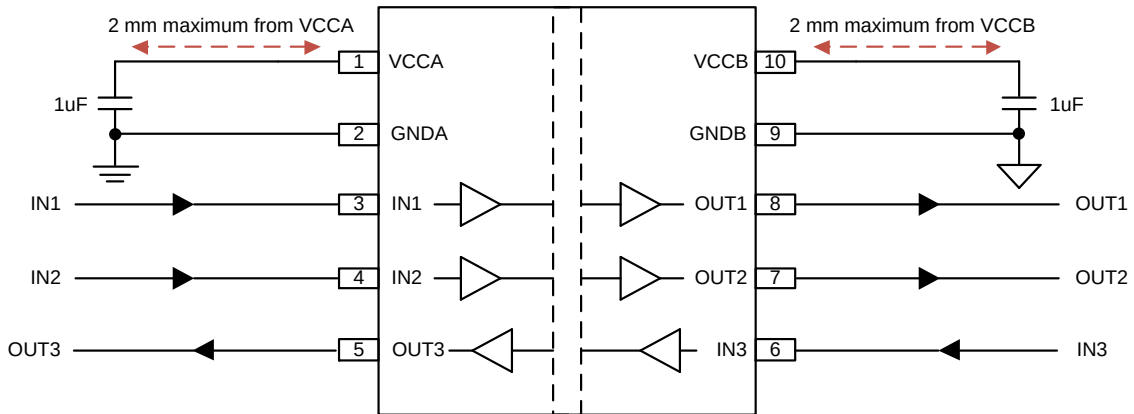
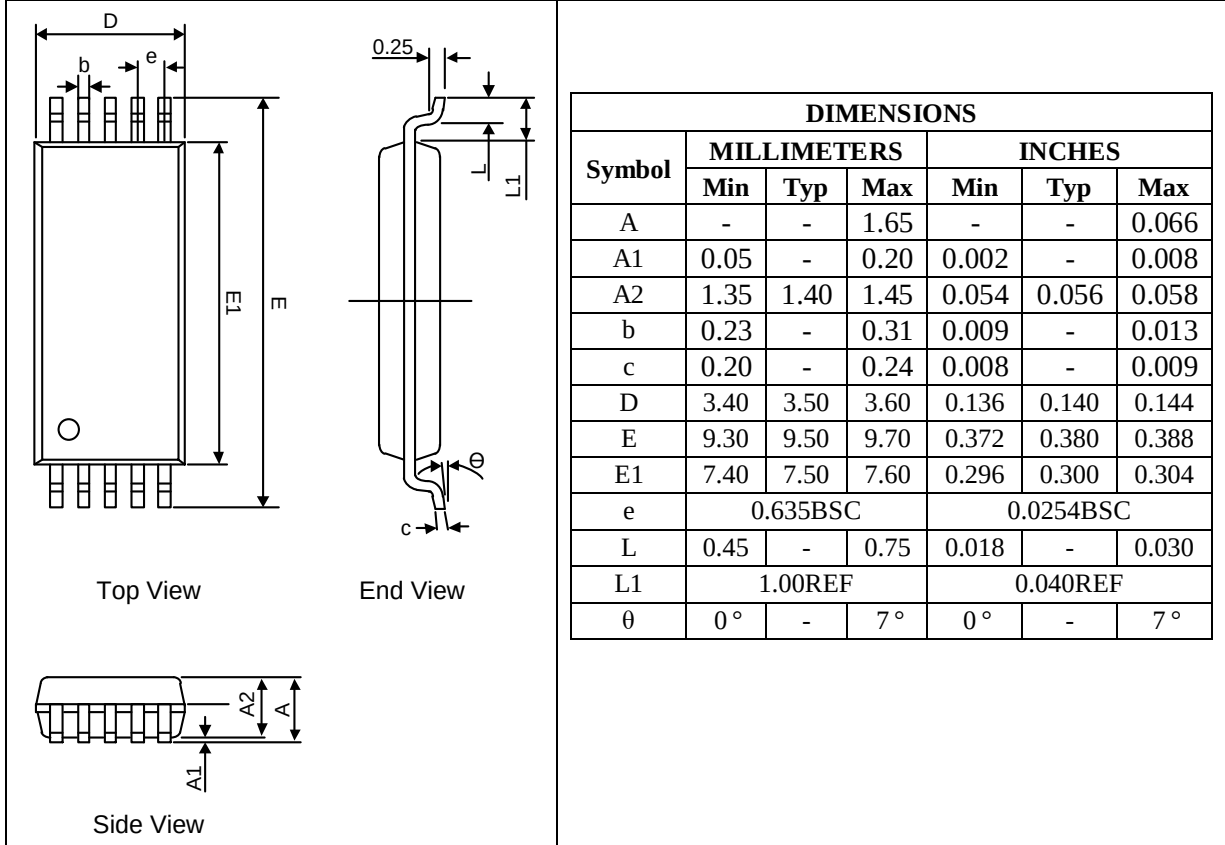


Figure 12-1. UMISO7331U Typical Application

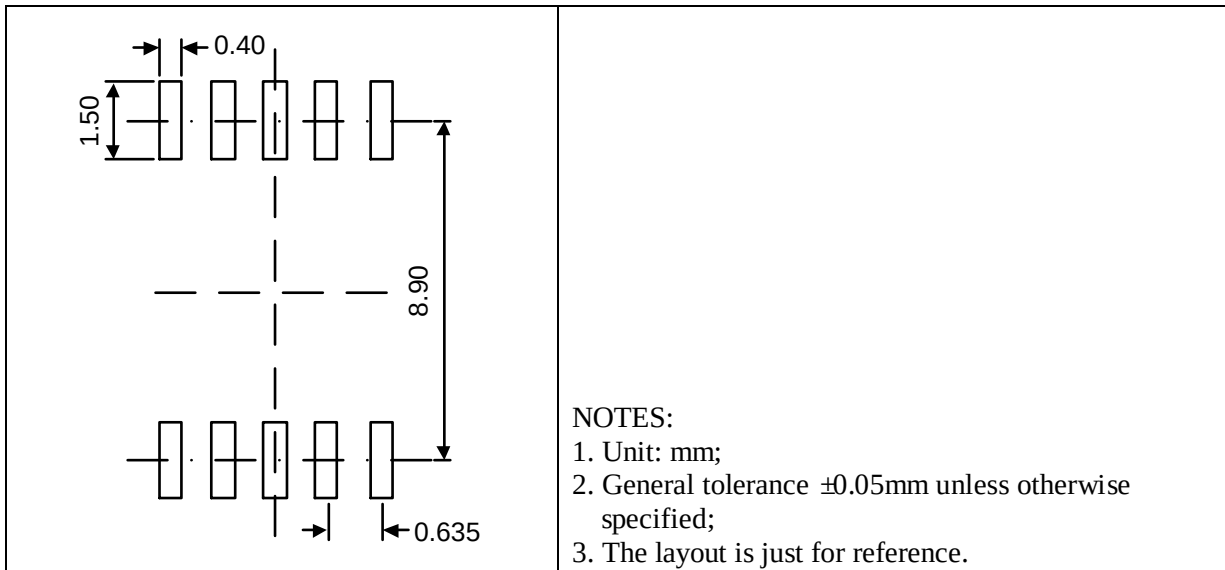
Package Information

WSSOP10

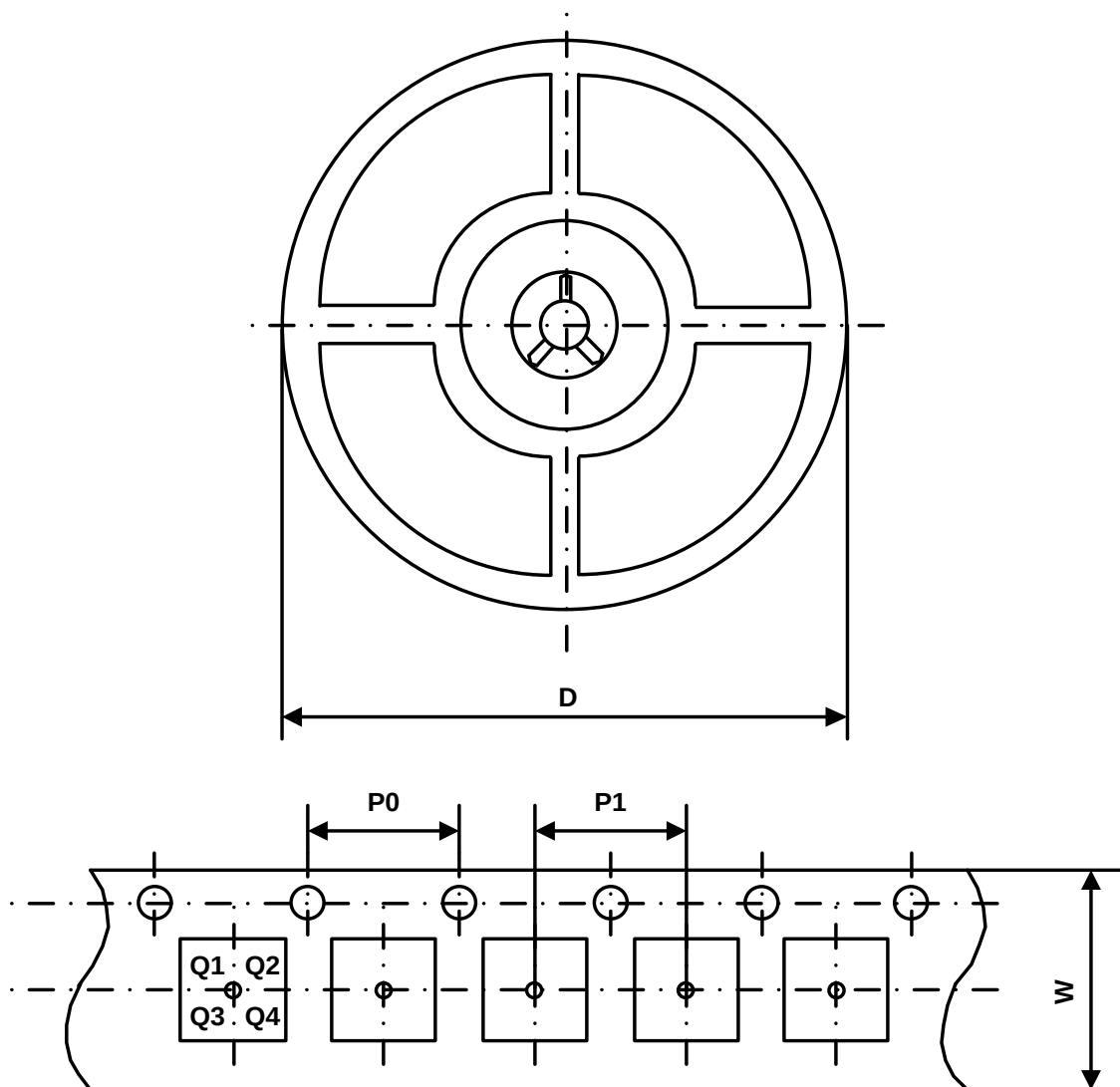
Outline Drawing



Land Pattern



Packing Information



Part Number	Package Type	Carrier Width (W)	Pitch (P0)	Pitch (P1)	Reel Size (D)	PIN 1 Quadrant
UMISO7331UHWAB	WSSOP10	16 mm	4 mm	8 mm	330 mm	Q2
UMISO7331ULWAB	WSSOP10	16 mm	4 mm	8 mm	330 mm	Q2

GREEN COMPLIANCE

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