Triple-Channel Digital Isolators

UMISO7331 *WSSOP10*

1 Description

The UMISO7331 is high-performance triple-channel, unidirectional digital isolators with 5kV$_{RMS}$ wide-body package isolation rating and up to 20Mbps 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(SiO_2) insulation barrier, the integrated Schmitt trigger on each input provide excellent noise immunity in automotive applications.

The UMISO7331 features two-forward and one-reverse direction channels, making it ideal for applications such as isolated CAN, RS-485 communication.

The UMISO7331 features default outputs. When the input is either not powered or is open-circuit, the default output is low for devices with suffix L, high for devices with suffix H, OUT1 is low and OUT2/OUT3 is high with suffix M, see the **Selection Guide** table for suffixes associated with each option.

The UMISO7331 is available in WSSOP10 wide body package. The device is characterized over ambient free-air temperatures from -40 ℃ to 125 ℃.

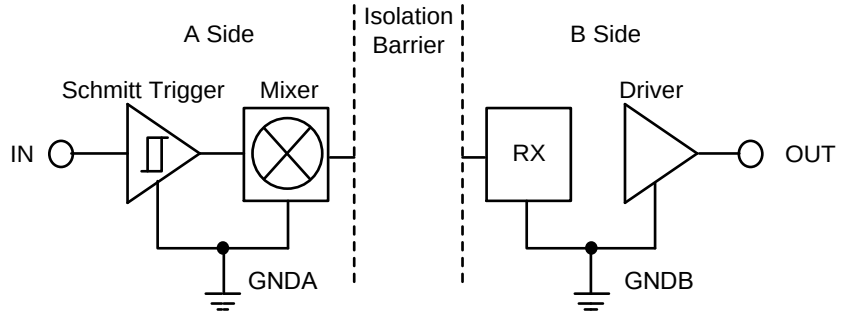
2 Features

- Maximum Data rate: 20Mbps
- Robust galvanic isolation of digital signals
  - High lifetime: >40 years
  - Up to 5000 V_{RMS} isolation rating
  - ±200 kV/μs typical CMTI
- Wide supply range: 3.0V to 5.5V
- Extended ambient temperature range: −40 ℃ to 125 ℃
- Available in WSSOP10 package
- Default output high (UMISO7331H), low (UMISO7331L), OUT1 low and OUT2/OUT3 high (UMISO7331M) options
- High ElectroMagnetic Immunity
- No start-up initialization required
- Excellent propagation delay and skew
  - Propagation delay: ≤ 100ns
  - Pulse width distortion: ≤ 10ns
- 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

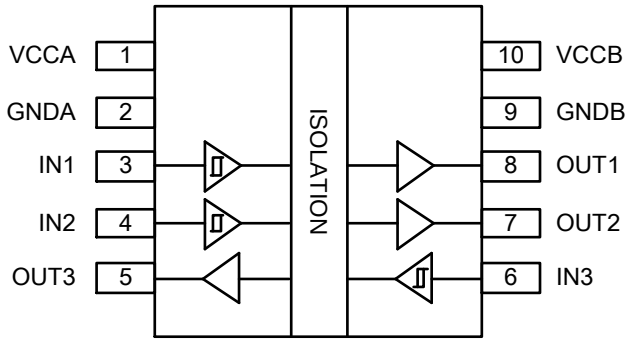


GNDA and GNDB are the isolated grounds for A side and B side respectively.

5 Selection Guide

Part Number	A Side Inputs	B Side Inputs	Default Output	Isolation Rating (V_{RMS})	Package
UMISO7331HWAB	2	1	High (All OUT High)	5000	WSSOP10
UMISO7331LWAB	2	1	Low (All OUT Low)	5000	WSSOP10
UMISO7331MWAB	2	1	Low (OUT1), High (OUT2, OUT3)	5000	WSSOP10

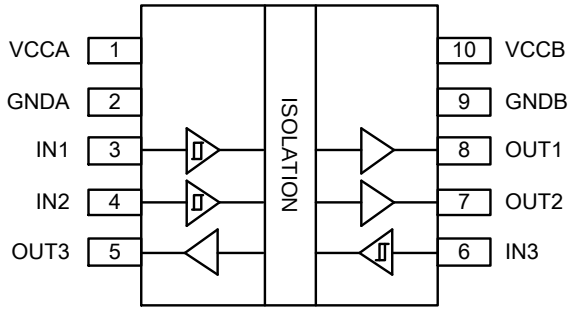
6 Functional Block Diagrams

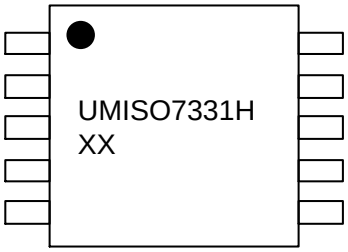


7 Ordering Information

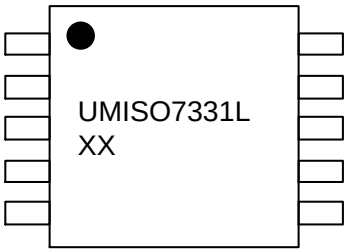
Part Number	Mark Code	Package Type	Shipping Qty
UMISO7331HWAB	UMISO7331H	WSSOP10	4000pcs/13Inch Tape & Reel
UMISO7331LWAB	UMISO7331L	WSSOP10	4000pcs/13Inch Tape & Reel
UMISO7331MWAB	UMISO7331M	WSSOP10	4000pcs/13Inch Tape & Reel

8 Pin Configuration and Function

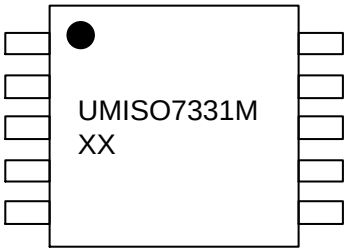




XX: Week Code
UMISO7331HWAB
WSSOP10



XX: Week Code
UMISO7331LWAB
WSSOP10



XX: Week Code
UMISO7331MWAB
WSSOP10

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	℃
T_{STG}	Storage temperature		-65		150	℃

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		20	Mbps
T_J	Junction Temperature		-40		150	℃
T_A	Ambient Operating temperature		-40		125	℃

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

9.3 Thermal Information

Symbol	Parameter		Value	Unit
$R_{\theta JA}$	Junction to ambient thermal	WSSOP10	45	℃/W

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); $V_{TEST} = 1.2 \times V_{IOTM}$, 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	$V_{IOSM} \geq 1.3 \times V_{IMP}$; 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; $V_{pd(m)} = 1.2 \times V_{IORM}$, $t_m = 10$ s	≤5	pC
		Method a, after environmental test of the subgroup 1, $V_{ini} = V_{IOTM}$, $t_{ini} = 60$ s; $V_{pd(m)} = 1.3 \times V_{IORM}$, $t_m = 10$ s	≤5	pC
		Method b, at routine test (100% production test) and preconditioning (type test) $V_{ini} = 1.2 \times V_{IOTM}$, $t_{ini} = 1$ s; $V_{pd(m)} = 1.875 \times V_{IORM}$ (for reinforced devices) or $V_{pd(m)} = 1.5 \times V_{IORM}$ (for basic devices), $t_m = 1$ s (method b1) or $V_{pd(m)} = V_{ini}$, $t_m = t_{ini}$ (method b2)	≤5	pC
C_{IO}	Barrier capacitance, input to output (Note 3)	$V_{IO} = 0.4 \times \sin(2\pi ft)$, f = 1 MHz	1.5	pF
R_{IO}	Isolation resistance (Note 3)	V_{IO} = 500 V, T_A = 25 ℃	$>10^{12}$	Ω
		V_{IO} = 500 V, 100 ℃ ≤ T_A ≤ 125 ℃	$>10^{11}$	
		V_{IO} = 500 V at T_S = 150 ℃	$>10^{9}$	
UL 1577				
V_{ISO}	Maximum withstanding isolation voltage	$V_{TEST} = V_{ISO}$, t = 60 s(qualification) $V_{TEST} = 1.2 \times V_{ISO}$, t = 1 s (100% production test)	5000	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±10% or 5V±10%, T_A = -40 to 125℃ (over recommended operating conditions, unless otherwise specified). All typical values are at 25℃.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IT+}	Rising Input Signal Voltage Threshold			0.5× V_{CCI}	0.7× V_{CCI}	V
V_{IT-}	Falling Input Signal Voltage Threshold		0.3× V_{CCI}	0.35× V_{CCI}		V
V_{OH}	High Level Output Voltage	V_{CCO}=5V, I_{OH} = -4 mA	V_{CCO} -0.4	V_{CCO} -0.2		V
		V_{CCO}=3.3V, I_{OH} = -2 mA	V_{CCO} -0.4	V_{CCO} -0.1		
V_{OL}	Low Level Output Voltage	V_{CCO}=5V, I_{OL} = 4 mA		0.2	0.4	V
		V_{CCO}=3.3V, I_{OL} = 2 mA		0.1	0.4	
I_{IN}	Input Current per Signal Channel	0 V ≤V_{IN}≤ 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		2.4	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 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 Supply Current Characteristics

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

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CCA}	Supply Current - DC signal (Note 1)	V_{CCA} = V_{CCB} = 5V, C_L = 0 pF	V_{IN} = V_{CCI} (UMISO7331H), V_{IN} = 0V (UMISO7331L) V_{IN1} = 0V, V_{IN2} = V_{IN3} = V_{CCI}, (UMISO7331M)		1.3	2.3	mA
I_{CCB}					1.9	3.1	
I_{CCA}			V_{IN} = 0V (UMISO7331H), V_{IN} = V_{CCI} (UMISO7331L) V_{IN1} = V_{CCI}, V_{IN2} = V_{IN3} = 0V, (UMISO7331M)		3.2	5.3	
I_{CCB}					2.9	4.6	
I_{CCA}		V_{CCA} = V_{CCB} = 3.3V, C_L = 0 pF	V_{IN} = V_{CCI} (UMISO7331H), V_{IN} = 0V (UMISO7331L) V_{IN1} = 0V, V_{IN2} = V_{IN3} = V_{CCI}, (UMISO7331M)		1.2	2.3	mA
I_{CCB}					1.85	3.1	
I_{CCA}			V_{IN} = 0V (UMISO7331H), V_{IN} = V_{CCI} (UMISO7331L) V_{IN1} = V_{CCI}, V_{IN2} = V_{IN3} = 0V, (UMISO7331M)		3.1	5.3	
I_{CCB}					2.8	4.6	
I_{CCA}	Supply Current - AC signal	V_{CCA} = V_{CCB} = 5V, C_L = 15 pF	Data rate = 1Mbps			3.3	mA
I_{CCB}						3.8	
I_{CCA}			Data rate = 10Mbps			3.7	
I_{CCB}						4.8	
I_{CCA}			Data rate = 20Mbps			4.7	
I_{CCB}						5.8	
I_{CCA}		V_{CCA} = V_{CCB} = 3.3V, C_L = 15 pF	Data rate = 1Mbps			3.3	mA
I_{CCB}						3.8	
I_{CCA}			Data rate = 10Mbps			3.7	
I_{CCB}						4.8	
I_{CCA}			Data rate = 20Mbps			4.7	
I_{CCB}						5.8	

Note 1: V_{IN1} is the input voltage of IN1, V_{IN2} is the input voltage of IN2, V_{IN3} is the input voltage of IN3.

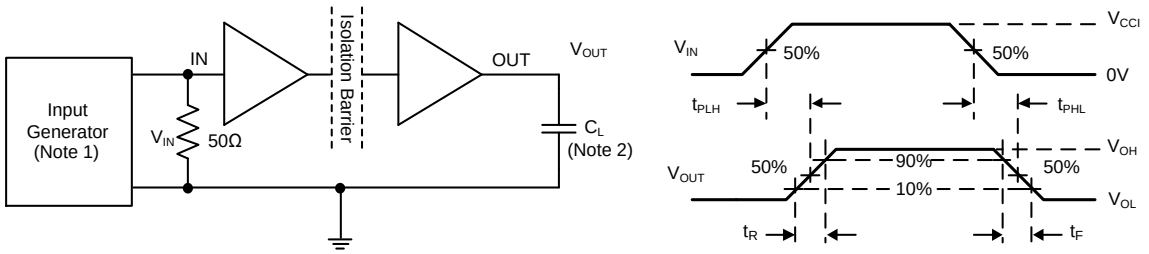
9.7 Switching Characteristics

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

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
DR	Data rate	Within PWD limit				20	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	100	ns
			V_{CCA} = V_{CCB} = 3.3V		35	100	
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

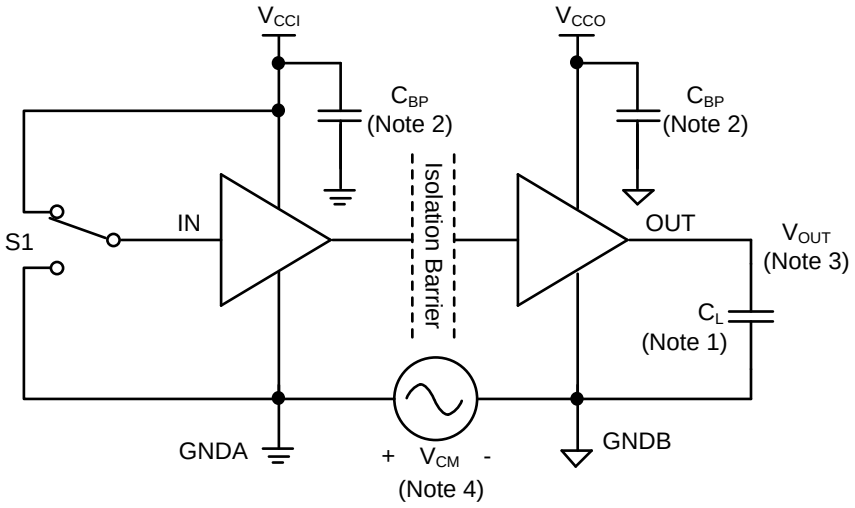
Note 1: $t_{SK(O)}$ is the skew between outputs of a single device with all driving inputs connected together and the outputs switching in the same direction while driving identical loads.
Note 2: $t_{SK(PP)}$ is the magnitude of the difference in propagation delay times between any terminals of different 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≤ 100kHz, 50% duty cycle, $t_R \leq 3ns$, $t_F \leq 3ns$, $Z_{OUT} = 50\Omega$. At the input, 50 Ω resistor is required to terminate input generator signal. It is not needed in actual application.
Note 2: C_L = 15pF 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 = 15pF and includes external circuit (instrumentation and fixture etc.) capacitance.
Note 2: C_{BP} (0.1 ~ 1uF) 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 >1kV amplitude, rise time <10ns and fall time <10ns, to reach common−mode transient noise with >150kV/μs slew rate.

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

11 Detailed Description

11.1 Overview

The UMISO7331 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 SiO_2 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 UMISO7331 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

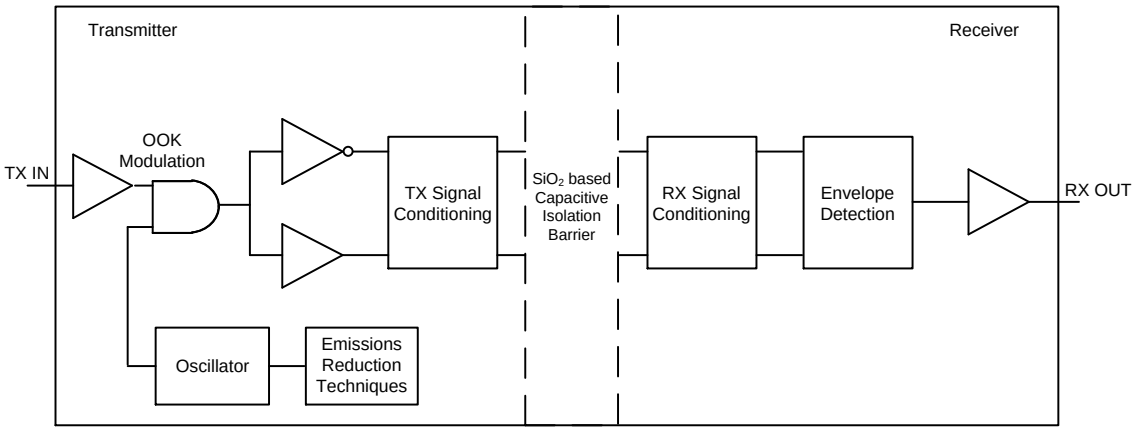


Figure 11-1. Functional Block Diagram of a Single Channel

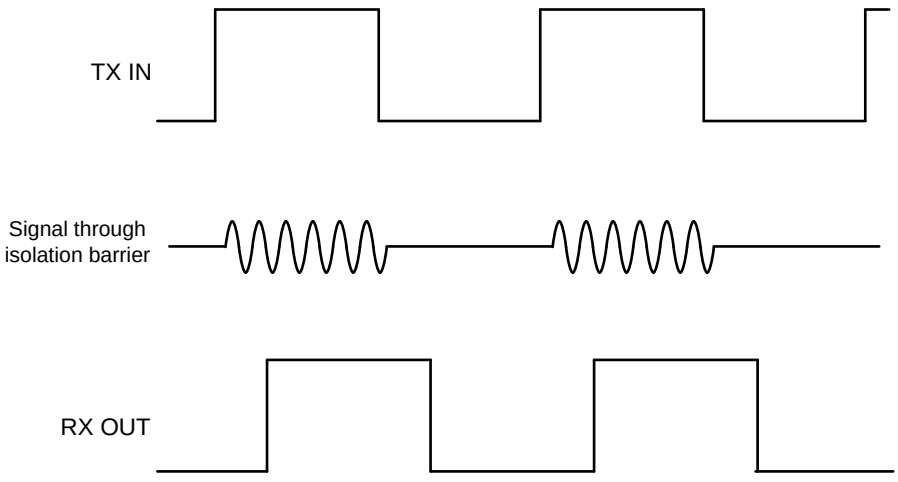


Figure 11-2. Conceptual Operation Waveforms of a Single Channel

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

Table 11-1 lists the operation modes for the UMISO7331.

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

INx	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 UMISO7331 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 UMISO7331 is a high-performance, triple-channel digital isolator. Unlike optocouplers, which require external components to improve performance, provide bias, or limit current, the UMISO7331 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 0.1μF to 1μF 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

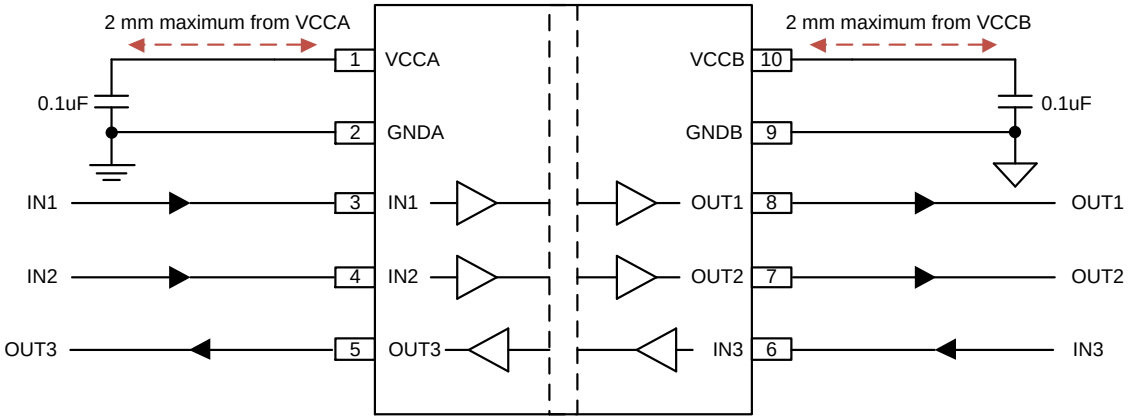
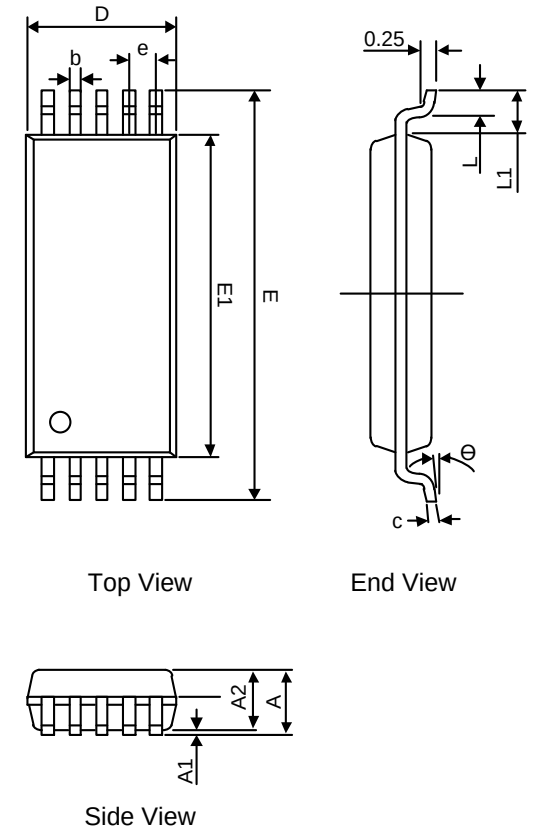


Figure 12-1. UMISO7331 Typical Application

13 Package Information

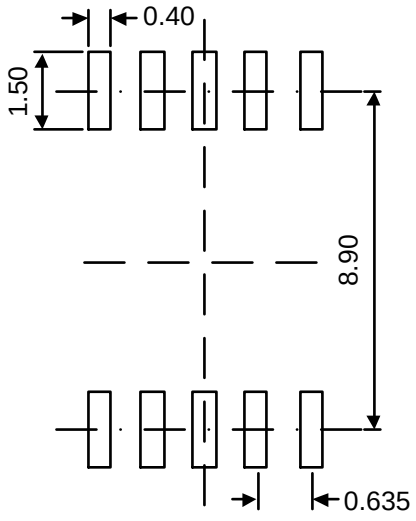
WSSOP10

Outline Drawing



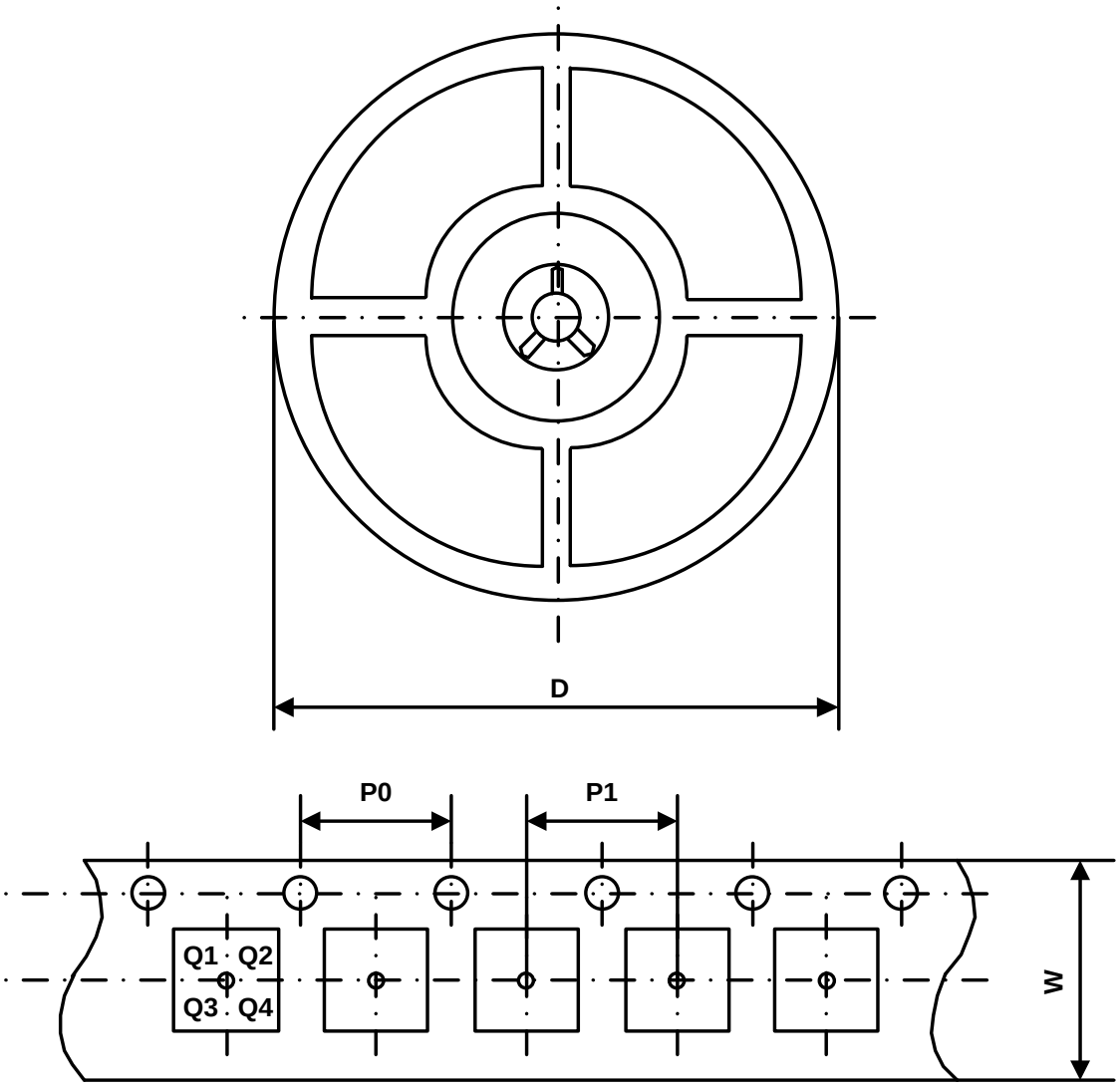
Symbol	DIMENSIONS					
	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	-	-	1.65	-	-	0.066
A1	0.05	-	0.20	0.002	-	0.008
A2	1.35	1.40	1.45	0.054	0.056	0.058
b	0.23	-	0.31	0.009	-	0.013
c	0.20	-	0.24	0.008	-	0.009
D	3.40	3.50	3.60	0.136	0.140	0.144
E	9.30	9.50	9.70	0.372	0.380	0.388
E1	7.40	7.50	7.60	0.296	0.300	0.304
e	0.635BSC			0.0254BSC		
L	0.45	-	0.75	0.018	-	0.030
L1	1.00REF			0.040REF		
θ	0°	-	7°	0°	-	7°

Land Pattern



NOTES:
1. Unit: mm;
2. General tolerance ±0.05mm unless otherwise specified;
3. The layout is just for reference.

14 Packing Information



Part Number	Package Type	Carrier Width (W)	Pitch (P0)	Pitch (P1)	Reel Size (D)	PIN 1 Quadrant
UMISO7331HWAB	WSSOP10	16 mm	4 mm	8 mm	330 mm	Q2
UMISO7331LWAB	WSSOP10	16 mm	4 mm	8 mm	330 mm	Q2
UMISO7331MWAB	WSSOP10	16 mm	4 mm	8 mm	330 mm	Q2

GREEN COMPLIANCE

Union Semiconductor is committed to environmental excellence in all aspects of its operations including meeting or exceeding regulatory requirements with respect to the use of hazardous substances. Numerous successful programs have been implemented to reduce the use of hazardous substances and/or emissions.
All Union components are compliant with the RoHS directive, which helps to support customers in their compliance with environmental directives. For more green compliance information, please visit:
https://www.union-ic.com/Quality.html

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