THE DATASHEET OF

ADUM231D1BRIZ-RL

Data Sheet

ADuM230D/ADuM230E/ADuM231D/ADuM231E

5.0 kV RMS Triple Channel Digital Isolators

FEATURES

- High common-mode transient immunity: 100 kV/µs
- High robustness to radiated and conducted noise
- Low propagation delay: 13 ns maximum for 5 V operation,
  - 15 ns maximum for 1.8 V operation
- 150 Mbps maximum data rate
- Safety and regulatory approvals (pending)
  - UL 1577
    - V_{ISO} = 5000 V rms for 1 minute
  - IEC/EN/CSA 62368-1
  - IEC/CSA 60601-1
  - IEC/CSA 61010-1
  - CQC GB 4943.1
  - DIN EN IEC 60747-17 (VDE 0884-17)
    - V_{IORM} = 849 V peak
- Low dynamic power consumption
- 1.8 V to 5 V level translation
- High temperature operation: 125°C
- Fail-safe high or low options
- 16-lead, RoHS compliant, SOIC package

APPLICATIONS

- General-purpose multichannel isolation
- Serial peripheral interface (SPI)/data converter isolation
- Industrial field bus isolation

GENERAL DESCRIPTION

The ADuM230D/ADuM230E/ADuM231D/ADuM231E[1] are triple-channel digital isolators based on Analog Devices, Inc., *i*Coupler® technology. Combining high speed, complementary metal-oxide semiconductor (CMOS) and monolithic air core transformer technology, these isolation components provide outstanding performance characteristics superior to alternatives such as optocoupler devices and other integrated couplers. The maximum propagation delay is 13 ns with a pulse width distortion of less than 3 ns at 5 V operation. Channel matching is tight at 3.0 ns maximum.

The ADuM230D/ADuM230E/ADuM231D/ADuM231E data channels are independent and are available in a variety of configurations with a withstand voltage rating of 5.0 kV rms (see the Ordering Guide). The devices operate with the supply voltage on either side ranging from 1.8 V to 5 V, providing compatibility with lower voltage systems as well as enabling voltage translation functionality across the isolation barrier.

Unlike other optocoupler alternatives, dc correctness is ensured in the absence of input logic transitions. Two different fail-safe options are available, by which the outputs transition to a predetermined state when the input power supply is not applied or the inputs are disabled.

[1] Protected by U.S. Patents 5,952,849; 6,873,065; 6,903,578; and 7,075,329. Other patents are pending.

Rev. C

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1/2025—Rev. B to Rev. C

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FUNCTIONAL BLOCK DIAGRAMS

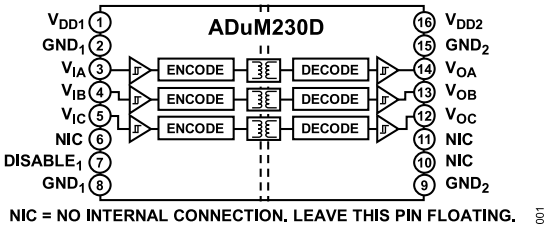

Figure 1. ADuM230D Functional Block Diagram

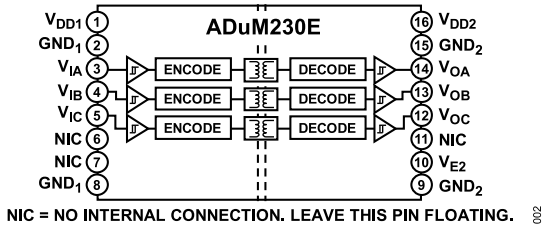

Figure 2. ADuM230E Functional Block Diagram

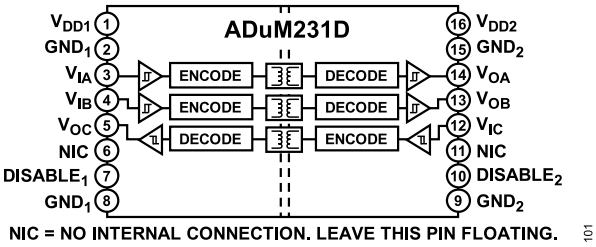

Figure 3. ADuM231D Functional Block Diagram

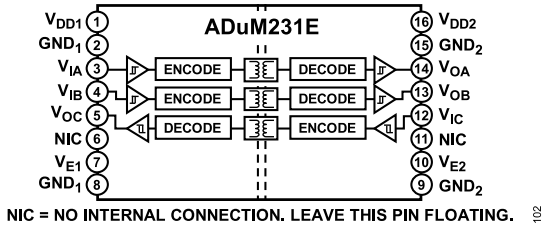

Figure 4. ADuM231E Functional Block Diagram

SPECIFICATIONS

ELECTRICAL CHARACTERISTICS—5 V OPERATION

All typical specifications are at T_A = 25°C, V_{DD1} = V_{DD2} = 5 V. Minimum/maximum specifications apply over the entire recommended operation range of 4.5 V ≤ V_{DD1} ≤ 5.5 V, 4.5 V ≤ V_{DD2} ≤ 5.5 V, and −40°C ≤ T_A ≤ +125°C, unless otherwise noted. Switching specifications are tested with C_L = 15 pF and CMOS signal levels, unless otherwise noted. Supply currents are specified with 50% duty cycle signals.

Table 1.

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
SWITCHING SPECIFICATIONS						
Pulse Width	PW	6.6			ns	Within pulse width distortion (PWD) limit
Data Rate[1]		150			Mbps	Within PWD limit
Propagation Delay	t_{PHL}, t_{PLH}	4.8	7.2	13	ns	50% input to 50% output
Pulse Width Distortion	PWD		0.5	3	ns	$\lvert t_{PLH} - t_{PHL} \rvert$
Change vs. Temperature			1.5		ps/°C	
Propagation Delay Skew	t_{PSK}			6.1	ns	Between any two devices at the same temperature, voltage, and load
Channel Matching						
Codirectional	t_{PSKCD}		0.5	3.0	ns	
Opposing Direction	t_{PSKOD}		0.5	3.0	ns	
Jitter			630		ps p-p	See the Jitter Measurement section
			80		ps rms	See the Jitter Measurement section
DC SPECIFICATIONS						
Input Threshold Voltage						
Logic High	V_{IH}	0.7 × V_{DDx}			V	
Logic Low	V_{IL}			0.3 × V_{DDx}	V	
Output Voltage						
Logic High	V_{OH}	V_{DDx} − 0.1	V_{DDx}		V	I_{Ox}[2] = −20 μA, V_{Ix} = V_{IxH}[3]
		V_{DDx} − 0.4	V_{DDx} − 0.2		V	I_{Ox}[2] = −4 mA, V_{Ix} = V_{IxH}[3]
Logic Low	V_{OL}		0.0	0.1	V	I_{Ox}[2] = 20 μA, V_{Ix} = V_{IxL}[4]
			0.2	0.4	V	I_{Ox}[2] = 4 mA, V_{Ix} = V_{IxL}[4]
Input Current per Channel	I_I	−10	+0.01	+10	μA	0 V ≤ V_{Ix} ≤ V_{DDx}
V_{E2} Enable Input Pull-Up Current	I_{PU}	−10	−3		μA	V_{E2} = 0 V
$DISABLE_1$ Input Pull-Down Current	I_{PD}		9	15	μA	$DISABLE_1$ = V_{DDx}
Tristate Output Current per Channel	I_{OZ}	−10	+0.01	+10	μA	0 V ≤ V_{Ox} ≤ V_{DDx}
Quiescent Supply Current						
ADuM230D/ADuM230E						
	$I_{DD1 (Q)}$		1.35	2.6	mA	V_I[5] = 0 (E0, D0), 1 (E1, D1)[6]
	$I_{DD2 (Q)}$		1.73	2.9	mA	V_I[5] = 0 (E0, D0), 1 (E1, D1)[6]
	$I_{DD1 (Q)}$		9.7	15.2	mA	V_I[5] = 1 (E0, D0), 0 (E1, D1)[6]
	$I_{DD2 (Q)}$		1.87	3.0	mA	V_I[5] = 1 (E0, D0), 0 (E1, D1)[6]
ADuM231D/ADuM231E						
	$I_{DD1 (Q)}$		1.62	2.7	mA	V_I[5] = 0 (E0, D0), 1 (E1, D1)[6]
	$I_{DD2 (Q)}$		1.61	2.8	mA	V_I[5] = 0 (E0, D0), 1 (E1, D1)[6]
	$I_{DD1 (Q)}$		7.4	11.4	mA	V_I[5] = 1 (E0, D0), 0 (E1, D1)[6]
	$I_{DD2 (Q)}$		5.34	7.2	mA	V_I[5] = 1 (E0, D0), 0 (E1, D1)[6]
Dynamic Supply Current						
Dynamic Input	$I_{DDI (D)}$		0.01		mA/Mbps	Inputs switching, 50% duty cycle
Dynamic Output	$I_{DDO (D)}$		0.02		mA/Mbps	Inputs switching, 50% duty cycle
Undervoltage Lockout	UVLO					
Positive V_{DDx} Threshold	V_{DDxUV+}		1.6		V	
Negative V_{DDx} Threshold	V_{DDxUV-}		1.5		V	

SPECIFICATIONS

Table 1. (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
V_{DDx} Hysteresis	V_{DDxUVH}		0.1		V	
AC SPECIFICATIONS						
Output Rise/Fall Time	t_R/t_F		2.5		ns	10% to 90%
Common-Mode Transient Immunity[7]	$\|CM_H\|$	75	100		kV/µs	$V_{Ix} = V_{DDx}$, V_{CM} = 1000 V, transient magnitude = 800 V
	$\|CM_L\|$	75	100		kV/µs	V_{Ix} = 0 V, V_{CM} = 1000 V, transient magnitude = 800 V

[1] 150 Mbps is the highest data rate that can be guaranteed, although higher data rates are possible.

[2] I_{Ox} is the Channel x output current, where x = A, B, or C.

[3] V_{IxH} is the input side logic high.

[4] V_{IxL} is the input side logic low.

[5] V_I is the voltage input.

[6] E0 refers to the ADuM230E0/ADuM231E0 models, D0 refers to the ADuM230D0/ADuM231D0 models, E1 refers to the ADuM230E1/ADuM231E1 models, and D1 refers to the ADuM230D1/ADuM231D1 models. See the Ordering Guide section.

[7] $|CM_H|$ is the maximum common-mode voltage slew rate that can be sustained while maintaining the voltage output (V_{Ox}) > 0.8 V_{DDx}. $|CM_L|$ is the maximum common-mode voltage slew rate that can be sustained while maintaining V_{Ox} > 0.8 V. The common-mode voltage slew rates apply to both rising and falling common-mode voltage edges.

Table 2. Total Supply Current vs. Data Throughput

		1 Mbps			25 Mbps			100 Mbps			
Parameter	Symbol	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Unit
SUPPLY CURRENT											
ADuM230D/ADuM230E											
Supply Current Side 1	I_{DD1}		5.6	9.0		6.3	9.8		9.4	14.3	mA
Supply Current Side 2	I_{DD2}		1.9	3.7		3.1	4.9		6.8	10	mA
ADuM231D/ADuM231E											
Supply Current Side 1	I_{DD1}		4.6	7.2		5.5	8.3		8.8	11.9	mA
Supply Current Side 2	I_{DD2}		3.6	5.8		4.6	6.8		8.0	11.3	mA

ELECTRICAL CHARACTERISTICS—3.3 V OPERATION

All typical specifications are at T_A = 25°C, V_{DD1} = V_{DD2} = 3.3 V. Minimum/maximum specifications apply over the entire recommended operation range: 3.0 V ≤ V_{DD1} ≤ 3.6 V, 3.0 V ≤ V_{DD2} ≤ 3.6 V, and −40°C ≤ T_A ≤ +125°C, unless otherwise noted. Switching specifications are tested with C_L = 15 pF and CMOS signal levels, unless otherwise noted. Supply currents are specified with 50% duty cycle signals.

Table 3.

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
SWITCHING SPECIFICATIONS						
Pulse Width	PW	6.6			ns	Within PWD limit
Data Rate[1]		150			Mbps	Within PWD limit
Propagation Delay	t_{PHL}, t_{PLH}	4.8	6.8	14	ns	50% input to 50% output
Pulse Width Distortion	PWD		0.7	3	ns	$\|t_{PLH} - t_{PHL}\|$
Change vs. Temperature			1.5		ps/°C	
Propagation Delay Skew	t_{PSK}			7.5	ns	Between any two devices at the same temperature, voltage, and load
Channel Matching						
Codirectional	t_{PSKCD}		0.7	3.0	ns	
Opposing Direction	t_{PSKOD}		0.7	3.0	ns	

SPECIFICATIONS

Table 3. (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
Jitter			640		ps p-p	See the Jitter Measurement section
			75		ps rms	See the Jitter Measurement section
DC SPECIFICATIONS						
Input Threshold Voltage						
Logic High	V_{IH}	0.7 × V_{DDx}			V	
Logic Low	V_{IL}			0.3 × V_{DDx}	V	
Output Voltage						
Logic High	V_{OH}	V_{DDx} − 0.1	V_{DDx}		V	I_{Ox}[2] = −20 μA, V_{Ix} = V_{IxH}[3]
		V_{DDx} − 0.4	V_{DDx} − 0.2		V	I_{Ox}[2] = −2 mA, V_{Ix} = V_{IxH}[3]
Logic Low	V_{OL}		0.0	0.1	V	I_{Ox}[2] = 20 μA, V_{Ix} = V_{IxL}[4]
			0.2	0.4	V	I_{Ox}[2] = 2 mA, V_{Ix} = V_{IxL}[4]
Input Current per Channel	I_I	−10	+0.01	+10	μA	0 V ≤ V_{Ix} ≤ V_{DDx}
V_{E2} Enable Input Pull-Up Current	I_{PU}	−10	−3		μA	V_{E2} = 0 V
$DISABLE_1$ Input Pull-Down Current	I_{PD}		9	15	μA	$DISABLE_1$ = V_{DDx}
Tristate Output Current per Channel	I_{OZ}	−10	+0.01	+10	μA	0 V ≤ V_{Ox} ≤ V_{DDx}
Quiescent Supply Current						
ADuM230D/ADuM230E						
	$I_{DD1 (Q)}$		1.25	2.5	mA	V_I[5] = 0 (E0, D0), 1 (E1, D1)[6]
	$I_{DD2 (Q)}$		1.65	2.8	mA	V_I[5] = 0 (E0, D0), 1 (E1, D1)[6]
	$I_{DD1 (Q)}$		9.57	15.0	mA	V_I[5] = 1 (E0, D0), 0 (E1, D1)[6]
	$I_{DD2 (Q)}$		1.79	2.9	mA	V_I[5] = 1 (E0, D0), 0 (E1, D1)[6]
ADuM231D/ADuM231E						
	$I_{DD1 (Q)}$		1.52	2.6	mA	V_I[5] = 0 (E0, D0), 1 (E1, D1)[6]
	$I_{DD2 (Q)}$		1.52	2.6	mA	V_I[5] = 0 (E0, D0), 1 (E1, D1)[6]
	$I_{DD1 (Q)}$		7.28	11.3	mA	V_I[5] = 1 (E0, D0), 0 (E1, D1)[6]
	$I_{DD2 (Q)}$		5.24	7.1	mA	V_I[5] = 1 (E0, D0), 0 (E1, D1)[6]
Dynamic Supply Current						
Dynamic Input	$I_{DDI (D)}$		0.01		mA/Mbps	Inputs switching, 50% duty cycle
Dynamic Output	$I_{DDO (D)}$		0.01		mA/Mbps	Inputs switching, 50% duty cycle
Undervoltage Lockout	UVLO					
Positive V_{DDx} Threshold	V_{DDxUV+}		1.6		V	
Negative V_{DDx} Threshold	V_{DDxUV-}		1.5		V	
V_{DDx} Hysteresis	V_{DDxUVH}		0.1		V	
AC SPECIFICATIONS						
Output Rise/Fall Time	t_R/t_F		2.5		ns	10% to 90%
Common-Mode Transient Immunity[7]	$\|CM_H\|$	75	100		kV/μs	V_{Ix} = V_{DDx}, V_{CM} = 1000 V, transient magnitude = 800 V
	$\|CM_L\|$	75	100		kV/μs	V_{Ix} = 0 V, V_{CM} = 1000 V, transient magnitude = 800 V

1 150 Mbps is the highest data rate that can be guaranteed, although higher data rates are possible.

2 I_{Ox} is the Channel x output current, where x = A, B, or C.

3 V_{IxH} is the input side logic high.

4 V_{IxL} is the input side logic low.

5 V_I is the voltage input.

6 E0 refers to the ADuM230E0/ADuM231E0 models, D0 refers to the ADuM230D0/ADuM231D0 models, E1 refers to the ADuM230E1/ADuM231E1 models, and D1 refers to the ADuM230D1/ADuM231D1 models. See the Ordering Guide section.

SPECIFICATIONS

[7] $|CM_H|$ is the maximum common-mode voltage slew rate that can be sustained while maintaining the voltage output (V_{Ox}) > 0.8 V_{DDx}. $|CM_L|$ is the maximum common-mode voltage slew rate that can be sustained while maintaining V_{Ox} > 0.8 V. The common-mode voltage slew rates apply to both rising and falling common-mode voltage edges.

Table 4. Total Supply Current vs. Data Throughput

		1 Mbps			25 Mbps			100 Mbps			
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
SUPPLY CURRENT											
ADuM230D/ADuM230E											
Supply Current Side 1	I_{DD1}		5.4	8.8		6.0	9.4		8.5	12.7	mA
Supply Current Side 2	I_{DD2}		1.8	3.6		2.9	4.7		6.2	8.4	mA
ADuM231D/ADuM231E											
Supply Current Side 1	I_{DD1}		4.4	7.1		5.2	8.0		8.1	10.7	mA
Supply Current Side 2	I_{DD2}		3.4	5.6		4.3	6.5		7.4	9.5	mA

ELECTRICAL CHARACTERISTICS—2.5 V OPERATION

All typical specifications are at T_A = 25°C, V_{DD1} = V_{DD2} = 2.5 V. Minimum/maximum specifications apply over the entire recommended operation range: 2.25 V ≤ V_{DD1} ≤ 2.75 V, 2.25 V ≤ V_{DD2} ≤ 2.75 V, −40°C ≤ T_A ≤ +125°C, unless otherwise noted. Switching specifications are tested with C_L = 15 pF and CMOS signal levels, unless otherwise noted. Supply currents are specified with 50% duty cycle signals.

Table 5.

Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**	**Test Conditions/Comments**
SWITCHING SPECIFICATIONS						
Pulse Width	PW	6.6			ns	Within PWD limit
Data Rate[1]		150			Mbps	Within PWD limit
Propagation Delay	t_{PHL}, t_{PLH}	5.0	7.0	14	ns	50% input to 50% output
Pulse Width Distortion	PWD		0.7	3	ns	$\lvert t_{PLH} - t_{PHL} \rvert$
Change vs. Temperature			1.5		ps/°C	
Propagation Delay Skew	t_{PSK}			6.8	ns	Between any two devices at the same temperature, voltage, and load
Channel Matching						
Codirectional	t_{PSKCD}		0.7	3.0	ns	
Opposing Direction	t_{PSKOD}		0.7	3.0	ns	
Jitter			770		ps p-p	See the Jitter Measurement section
			160		ps rms	See the Jitter Measurement section
DC SPECIFICATIONS						
Input Threshold Voltage						
Logic High	V_{IH}	0.7 × V_{DDx}			V	
Logic Low	V_{IL}			0.3 × V_{DDx}	V	
Output Voltage						
Logic High	V_{OH}	V_{DDx} − 0.1	V_{DDx}		V	I_{Ox}[2] = −20 μA, V_{Ix} = V_{IxH}[3]
		V_{DDx} − 0.4	V_{DDx} − 0.2		V	I_{Ox}[2] = −2 mA, V_{Ix} = V_{IxH}[3]
Logic Low	V_{OL}		0.0	0.1	V	I_{Ox}[2] = 20 μA, V_{Ix} = V_{IxL}[4]
			0.2	0.4	V	I_{Ox}[2] = 2 mA, V_{Ix} = V_{IxL}[4]
Input Current per Channel	I_I	−10	+0.01	+10	μA	0 V ≤ V_{Ix} ≤ V_{DDx}
V_{E2} Enable Input Pull-Up Current	I_{PU}	−10	−3		μA	V_{E2} = 0 V
$DISABLE_1$ Input Pull-Down Current	I_{PD}		9	15	μA	$DISABLE_1$ = V_{DDx}
Tristate Output Current per Channel	I_{OZ}	−10	+0.01	+10	μA	0 V ≤ V_{Ox} ≤ V_{DDx}
Quiescent Supply Current						
ADuM230D/ADuM230E						
	$I_{DD1 (Q)}$		1.2	2.4	mA	V_I[5] = 0 (E0, D0), 1 (E1, D1)[6]

SPECIFICATIONS

Table 5. (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
	$I_{DD2 (Q)}$		1.61	2.7	mA	V_I[5] = 0 (E0, D0), 1 (E1, D1)[6]
	$I_{DD1 (Q)}$		9.52	14.9	mA	V_I[5] = 1 (E0, D0), 0 (E1, D1)[6]
	$I_{DD2 (Q)}$		1.76	2.8	mA	V_I[5] = 1 (E0, D0), 0 (E1, D1)[6]
ADuM231D/ADuM231E						
	$I_{DD1 (Q)}$		1.47	2.5	mA	V_I[5] = 0 (E0, D0), 1 (E1, D1)[6]
	$I_{DD2 (Q)}$		1.48	2.5	mA	V_I[5] = 0 (E0, D0), 1 (E1, D1)[6]
	$I_{DD1 (Q)}$		7.23	11.2	mA	V_I[5] = 1 (E0, D0), 0 (E1, D1)[6]
	$I_{DD2 (Q)}$		5.19	7.0	mA	V_I[5] = 1 (E0, D0), 0 (E1, D1)[6]
Dynamic Supply Current						
Dynamic Input	$I_{DDI (D)}$		0.01		mA/Mbps	Inputs switching, 50% duty cycle
Dynamic Output	$I_{DDO (D)}$		0.01		mA/Mbps	Inputs switching, 50% duty cycle
Undervoltage Lockout						
Positive V_{DDx} Threshold	V_{DDxUV+}		1.6		V	
Negative V_{DDx} Threshold	V_{DDxUV-}		1.5		V	
V_{DDx} Hysteresis	V_{DDxUVH}		0.1		V	
AC SPECIFICATIONS						
Output Rise/Fall Time	t_R/t_F		2.5		ns	10% to 90%
Common-Mode Transient Immunity[7]	$\|CM_H\|$	75	100		kV/µs	$V_{Ix} = V_{DDx}$, V_{CM} = 1000 V, transient magnitude = 800 V
	$\|CM_L\|$	75	100		kV/µs	V_{Ix} = 0 V, V_{CM} = 1000 V, transient magnitude = 800 V

1 150 Mbps is the highest data rate that can be guaranteed, although higher data rates are possible.

2 I_{Ox} is the Channel x output current, where x = A, B, or C.

3 V_{IxH} is the input side logic high.

4 V_{IxL} is the input side logic low.

5 V_I is the voltage input.

6 E0 refers to the ADuM230E0/ADuM231E0 models, D0 refers to the ADuM230D0/ADuM231D0 models, E1 refers to the ADuM230E1/ADuM231E1 models, and D1 refers to the ADuM230D1/ADuM231D1 models. See the Ordering Guide section.

7 $|CM_H|$ is the maximum common-mode voltage slew rate that can be sustained while maintaining the voltage output (V_{Ox}) > 0.8 V_{DDx}. $|CM_L|$ is the maximum common-mode voltage slew rate that can be sustained while maintaining V_{Ox} > 0.8 V. The common-mode voltage slew rates apply to both rising and falling common-mode voltage edges.

Table 6. Total Supply Current vs. Data Throughput

		1 Mbps			25 Mbps			100 Mbps			
Parameter	Symbol	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Unit
SUPPLY CURRENT											
ADuM230D/ADuM230E											
Supply Current Side 1	I_{DD1}		5.3	8.7		5.9	9.3		8.2	12.3	mA
Supply Current Side 2	I_{DD2}		1.8	3.6		2.6	4.4		5.2	7.4	mA
ADuM231D/ADuM231E											
Supply Current Side 1	I_{DD1}		4.4	7.1		5.0	7.8		7.5	10.1	mA
Supply Current Side 2	I_{DD2}		3.4	5.6		4.1	6.3		6.6	8.7	mA

SPECIFICATIONS

ELECTRICAL CHARACTERISTICS—1.8 V OPERATION

All typical specifications are at T_A = 25°C, V_{DD1} = V_{DD2} = 1.8 V. Minimum/maximum specifications apply over the entire recommended operation range: 1.7 V ≤ V_{DD1} ≤ 1.9 V, 1.7 V ≤ V_{DD2} ≤ 1.9 V, and −40°C ≤ T_A ≤ +125°C, unless otherwise noted. Switching specifications are tested with C_L = 15 pF and CMOS signal levels, unless otherwise noted. Supply currents are specified with 50% duty cycle signals.

Table 7.

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
SWITCHING SPECIFICATIONS						
Pulse Width	PW	6.6			ns	Within PWD limit
Data Rate[1]		150			Mbps	Within PWD limit
Propagation Delay	t_{PHL}, t_{PLH}	5.8	8.7	15	ns	50% input to 50% output
Pulse Width Distortion	PWD		0.7	3	ns	$\lvert t_{PLH} - t_{PHL} \rvert$
Change vs. Temperature			1.5		ps/°C	
Propagation Delay Skew	t_{PSK}			7.0	ns	Between any two devices at the same temperature, voltage, and load
Channel Matching						
Codirectional	t_{PSKCD}		0.7	3.0	ns	
Opposing Direction	t_{PSKOD}		0.7	3.0	ns	
Jitter			600		ps p-p	See the Jitter Measurement section
			90		ps rms	See the Jitter Measurement section
DC SPECIFICATIONS						
Input Threshold Voltage						
Logic High	V_{IH}	0.7 × V_{DDx}			V	
Logic Low	V_{IL}			0.3 × V_{DDx}	V	
Output Voltage						
Logic High	V_{OH}	V_{DDx} − 0.1	V_{DDx}		V	I_{Ox}[2] = −20 μA, V_{Ix} = V_{IxH}[3]
		V_{DDx} − 0.4	V_{DDx} − 0.2		V	I_{Ox}[2] = −2 mA, V_{Ix} = V_{IxH}[3]
Logic Low	V_{OL}		0.0	0.1	V	I_{Ox}[2] = 20 μA, V_{Ix} = V_{IxL}[4]
			0.2	0.4	V	I_{Ox}[2] = 2 mA, V_{Ix} = V_{IxL}[4]
Input Current per Channel	I_I	−10	+0.01	+10	μA	0 V ≤ V_{Ix} ≤ V_{DDx}
V_{E2} Enable Input Pull-Up Current	I_{PU}	−10	−3		μA	V_{E2} = 0 V
$DISABLE_1$ Input Pull-Down Current	I_{PD}		9	15	μA	$DISABLE_1$ = V_{DDx}
Tristate Output Current per Channel	I_{OZ}	−10	+0.01	+10	μA	0 V ≤ V_{Ox} ≤ V_{DDx}
Quiescent Supply Current						
ADuM230D/ADuM230E						
	$I_{DD1 (Q)}$		1.15	2.3	mA	V_I[5] = 0 (E0, D0), 1 (E1, D1)[6]
	$I_{DD2 (Q)}$		1.58	2.6	mA	V_I[5] = 0 (E0, D0), 1 (E1, D1)[6]
	$I_{DD1 (Q)}$		9.41	14.8	mA	V_I[5] = 1 (E0, D0), 0 (E1, D1)[6]
	$I_{DD2 (Q)}$		1.72	2.7	mA	V_I[5] = 1 (E0, D0), 0 (E1, D1)[6]
ADuM231D/ADuM231E						
	$I_{DD1 (Q)}$		1.42	2.4	mA	V_I[5] = 0 (E0, D0), 1 (E1, D1)[6]
	$I_{DD2 (Q)}$		1.44	2.4	mA	V_I[5] = 0 (E0, D0), 1 (E1, D1)[6]
	$I_{DD1 (Q)}$		7.15	11.1	mA	V_I[5] = 1 (E0, D0), 0 (E1, D1)[6]
	$I_{DD2 (Q)}$		5.13	6.9	mA	V_I[5] = 1 (E0, D0), 0 (E1, D1)[6]
Dynamic Supply Current						
Dynamic Input	$I_{DDI (D)}$		0.01		mA/Mbps	Inputs switching, 50% duty cycle
Dynamic Output	$I_{DDO (D)}$		0.01		mA/Mbps	Inputs switching, 50% duty cycle
Undervoltage Lockout	UVLO					
Positive V_{DDx} Threshold	V_{DDxUV+}		1.6		V	
Negative V_{DDx} Threshold	V_{DDxUV-}		1.5		V	

SPECIFICATIONS

Table 7. (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
V_{DDx} Hysteresis	V_{DDxUVH}		0.1		V	
AC SPECIFICATIONS						
Output Rise/Fall Time	t_R/t_F		2.5		ns	10% to 90%
Common-Mode Transient Immunity[7]	$\|CM_H\|$	75	100		kV/µs	$V_{Ix} = V_{DDx}$, V_{CM} = 1000 V, transient magnitude = 800 V
	$\|CM_L\|$	75	100		kV/µs	V_{Ix} = 0 V, V_{CM} = 1000 V, transient magnitude = 800 V

1 150 Mbps is the highest data rate that can be guaranteed, although higher data rates are possible.

2 I_{Ox} is the Channel x output current, where x = A, B, or C.

3 V_{IxH} is the input side logic high.

4 V_{IxL} is the input side logic low.

5 V_I is the voltage input.

6 E0 refers to the ADuM230E0/ADuM231E0 models, D0 refers to the ADuM230D0/ADuM231D0 models, E1 refers to the ADuM230E1/ADuM231E1 models, and D1 refers to the ADuM230D1/ADuM231D1 models. See the Ordering Guide section.

7 $|CM_H|$ is the maximum common-mode voltage slew rate that can be sustained while maintaining the voltage output (V_{Ox}) > 0.8 V_{DDx}. $|CM_L|$ is the maximum common-mode voltage slew rate that can be sustained while maintaining V_{Ox} > 0.8 V. The common-mode voltage slew rates apply to both rising and falling common-mode voltage edges.

Table 8. Total Supply Current vs. Data Throughput

		1 Mbps			25 Mbps			100 Mbps			
Parameter	Symbol	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Unit
SUPPLY CURRENT											
ADuM230D/ADuM230E											
Supply Current Side 1	I_{DD1}		5.2	8.6		5.8	9.3		8.1	12.2	mA
Supply Current Side 2	I_{DD2}		1.7	3.5		2.5	4.3		5.2	7.3	mA
ADuM231D/ADuM231E											
Supply Current Side 1	I_{DD1}		4.3	7.0		4.9	7.7		7.26	10.0	mA
Supply Current Side 2	I_{DD2}		3.3	5.5		4.0	6.2		6.5	8.6	mA

INSULATION AND SAFETY RELATED SPECIFICATIONS

For additional information, see www.analog.com/icouplersafety.

Table 9. Insulation and Safety Related Specifications Table

Parameter	Symbol	Value	Unit	Test Conditions/Comments
Rated Dielectric Insulation Voltage		5000	V rms	1-minute duration
Minimum External Air Gap (Clearance)[1, 2]	L (I01)			Measured from input terminals to output terminals, shortest distance through air
RI-16-2		8.3	mm	
RW-16		7.8	mm	
Minimum External Tracking (Creepage)	L (I02)			Measured from input terminals to output terminals, shortest distance path along body
RI-16-2		8.3	mm	
RW-16		7.8	mm	
Minimum Clearance in the Plane of the Printed Circuit Board (PCB Clearance)	L (PCB)		mm	Measured from input terminals to output terminals, shortest distance through air, line of sight, in the PCB mounting plane
RI-16-2		8.3	mm	
RW-16		8.1	mm	
Minimum Internal Gap (Internal Clearance)		29	µm	Insulation distance through insulation
Tracking Resistance (Comparative Tracking Index)	CTI	>400	V	DIN IEC 112/VDE 0303 Part 1

SPECIFICATIONS

Table 9. Insulation and Safety Related Specifications Table (Continued)

Parameter	Symbol	Value	Unit	Test Conditions/Comments
Material Group		II		Material Group per IEC 60664-1

1 In accordance with IEC 62368-1/IEC 60601-1 guidelines for the measurement of creepage and clearance distances for a pollution degree of 2 and altitudes ≤2000 meters.

2 Consideration must be given to pad layout to ensure the minimum required distance for clearance is maintained.

PACKAGE CHARACTERISTICS

Table 10.

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
Resistance (Input to Output)[1]	R_{I-O}		10^{13}		Ω	
Capacitance (Input to Output)[1]	C_{I-O}		2.2		pF	f = 1 MHz
Input Capacitance[2]	C_I		4.0		pF	
IC Junction to Ambient Thermal Resistance	θ_{JA}		45		°C/W	Thermocouple located at center of package underside

1 The device is considered a 2-terminal device: Pin 1 through Pin 8 are shorted together, and Pin 9 through Pin 16 are shorted together.

2 Input capacitance is from any input data pin to ground.

REGULATORY INFORMATION

The ADuM230D/ADuM230E/ADuM231D/ADuM231E certification approvals are listed in Table 11 and Table 12.

Table 11. RW-16 Wide Body [SOIC_W] Package

UL	CSA	VDE	CQC
UL 1577[1] Single Protection, 5000 V rms	IEC/EN/CSA 62368-1 Basic insulation, 780 V rms Reinforced insulation, 390 V rms IEC/CSA 60601-1 Reinforced insulation (2 MOPP), 237.5 V rms IEC/CSA 61010-1 Basic insulation, 600 V rms, Overvoltage Category III Reinforced insulation, 300 V rms	DIN EN IEC 60747-17 (VDE 0884-17)[2] Reinforced insulation, 849 V peak	CQC GB 4943.1 Basic insulation, 760 V rms Reinforced insulation, 380 V rms
File E214100	File No. 205078	Certificate No. 40051926	Certificate No. CQC16001147385

1 In accordance with UL 1577, each ADuM230D/ADuM230E/ADuM231D/ADuM231E is proof tested by applying an insulation test voltage ≥ 6000 V rms for 1 sec.

2 In accordance with DIN EN IEC 60747-17 (VDE 0884-17), each ADuM230D/ADuM230E/ADuM231D/ADuM231E is proof tested by applying an insulation test voltage ≥ 1592 V peak for 1 sec (partial discharge detection limit = 5 pC).

Table 12. RI-16 -2 Wide Body Increased Creepage [SOIC_IC] Package

UL	CSA	VDE	CQC
UL 1577[1] Single Protection, 5000 V rms	IEC/EN/CSA 60950-1 Basic insulation, 830 V rms Reinforced insulation, 415 V rms IEC/CSA 60601-1 Reinforced insulation (2 MOPP), 250 V rms IEC/CSA 61010-1 Basic insulation, 600 V rms, Overvoltage Category IV Reinforced insulation, 300 V rms	DIN EN IEC 60747-17 (VDE 0884-17)[2] Reinforced insulation, 849 V peak	CQC GB 4943.1 Basic insulation, 820 V rms Reinforced insulation, 410 V rms
File E214100	File 205078	Certificate No. 40051926	Certificate No. CQC17001171586

1 In accordance with UL 1577, each ADuM230D/ADuM230E/ADuM231D/ADuM231E is proof tested by applying an insulation test voltage ≥ 6000 V rms for 1 sec.

SPECIFICATIONS

[2] In accordance with DIN EN IEC 60747-17 (VDE 0884-17), each ADuM230D/ADuM230E/ADuM231D/ADuM231E is proof tested by applying an insulation test voltage ≥ 1592 V peak for 1 sec (partial discharge detection limit = 5 pC).

DIN EN IEC 60747-17 (VDE 0884-17) INSULATION CHARACTERISTICS

These isolators are suitable for reinforced electrical isolation only within the safety limit data. Protective circuits ensure the maintenance of the safety data. The * marking on packages denotes DIN EN IEC 60747-17 (VDE 0884-17) approval.

Table 13.

Description	Test Conditions/Comments	Symbol	Characteristic	Unit
Overvoltage Category per IEC 60664-1				
≤ 150 V rms			I to IV	
≤ 300 V rms			I to III	
≤ 400 V rms			I to III	
Climatic Classification			40/125/21	
Pollution Degree per DIN VDE 0110, Table 1			2	
Maximum Repetitive Isolation Voltage		V_{IORM}	849	V peak
Maximum Working Insulation Voltage		V_{IOWM}	600	V rms
Input to Output Test Voltage, Method B1	V_{IORM} × 1.875 = $V_{pd\ (m)}$, 100% production test, t_{ini} = t_m = 1 sec, partial discharge < 5 pC	$V_{pd\ (m)}$	1592	V peak
Input to Output Test Voltage, Method A		$V_{pd\ (m)}$		
After Environmental Tests Subgroup 1	V_{IORM} × 1.6 = $V_{pd\ (m)}$, t_{ini} = 60 sec, t_m = 10 sec, partial discharge < 5 pC		1358	V peak
After Input and/or Safety Test Subgroup 2 and Subgroup 3	V_{IORM} × 1.2 = $V_{pd\ (m)}$, t_{ini} = 60 sec, t_m = 10 sec, partial discharge < 5 pC		1019	V peak
Maximum Transient Isolation Voltage	V_{TEST} = 1.2 × V_{IOTM}, t =1s (100% production)	V_{IOTM}	8000	V peak
Maximum Impulse Voltage	Surge voltage in air, waveform per IEC 61000-4-5	V_{IMP}	8000	V peak
Maximum Surge Isolation Voltage	V_{TEST} ≥ 1.3 × V_{IMP} (sample test), tested in oil, waveform per IEC 61000-4-5	V_{IOSM}	12,800	V peak
Safety Limiting Values	Maximum value allowed in the event of a failure (see Figure 5)			
Maximum Junction Temperature		T_S	150	°C
Total Power Dissipation at 25°C		P_S	2.78	W
Insulation Resistance at T_S	V_{IO} = 500 V	R_S	>10^9	Ω

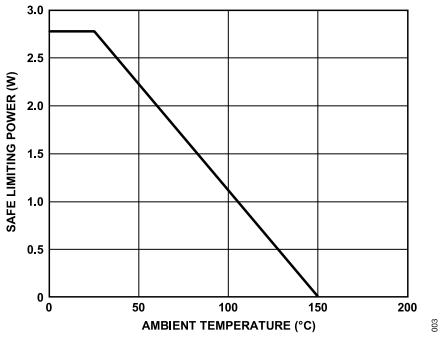

Figure 5. Thermal Derating Curve, Dependence of Safety Limiting Values with Ambient Temperature per DIN EN IEC 60747-17 (VDE 0884-17)

SPECIFICATIONS

RECOMMENDED OPERATING CONDITIONS

Table 14.

Parameter	Symbol	Rating
Operating Temperature	T_A	−40°C to +125°C
Supply Voltages	V_{DD1}, V_{DD2}	1.7 V to 5.5 V
Input Signal Rise and Fall Times		1.0 ms

ABSOLUTE MAXIMUM RATINGS

T_A = 25°C, unless otherwise noted.

Table 15.

Parameter	Rating
Storage Temperature (T_{ST}) Range	−65°C to +150°C
Ambient Operating Temperature (T_A) Range	−40°C to +125°C
Supply Voltages (V_{DD1}, V_{DD2})	−0.5 V to +7.0 V
Input Voltages (V_{IA}, V_{IB}, V_{IC}, V_{E1}, V_{E2}, $DISABLE_1$, $DISABLE_2$)[1]	−0.5 V to V_{DDI} + 0.5 V
Output Voltages (V_{OA}, V_{OB}, V_{OC})[2]	−0.5 V to V_{DDO} + 0.5 V
Average Output Current per Pin[3]	
Side 1 Output Current (I_{O1})	−10 mA to +10 mA
Side 2 Output Current (I_{O2})	−10 mA to +10 mA
Common-Mode Transients[4]	−150 kV/µs to +150 kV/µs

[1] V_{DDI} is the input side supply voltage.

[2] V_{DDO} is the output side supply voltage.

[3] See Figure 5 for the maximum rated current values for various ambient temperatures.

[4] Refers to the common-mode transients across the insulation barrier. Common-mode transients exceeding the absolute maximum ratings may cause latch-up or permanent damage.

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

MAXIMUM CONTINUOUS WORKING VOLTAGE

Table 16. Maximum Continuous Working Voltage[1]

Parameter	Max	Unit	Applicable Certification
AC Voltage			
Bipolar Waveform	849	V peak	Reinforced insulation rating as per IEC 60747-17 (VDE 0884-17)

[1] Refers to the continuous voltage magnitude imposed across the isolation barrier. See the Insulation Lifetime section for more details.

ABSOLUTE MAXIMUM RATINGS

TRUTH TABLES

Table 17. ADuM230D/ADuM231D Truth Table (Positive Logic)

V_{Ix} Input[1, 2]	$V_{DISABLEx}$ Input[1, 2]	V_{DDI} State[2]	V_{DDO} State[2]	Default Low (D0), V_{Ox} Output[1, 2, 3]	Default High (D1), V_{Ox} Output[1, 2, 3]	Test Conditions/ Comments
L	L or NC	Powered	Powered	L	L	Normal operation
H	L or NC	Powered	Powered	H	H	Normal operation
X	H	Powered	Powered	L	H	Inputs disabled, fail-safe output
X[4]	X[4]	Unpowered	Powered	L	H	Fail-safe output
X[4]	X[4]	Powered	Unpowered	Indeterminate	Indeterminate	

1 L means low, H means high, X means don't care, and NC means not connected.

2 V_{Ix} and V_{Ox} refer to the input and output signals of a given channel (A, B, or C). $V_{DISABLEx}$ refers to the input disable signal on the same side as the V_{Ix} inputs. V_{DDI} and V_{DDO} refer to the supply voltages on the input and output sides of the given channel, respectively.

3 D0 refers to the ADuM230D0/ADuM231D0 models, and D1 refers to the ADuM230D1/ADuM231D1 models. See the Ordering Guide section.

4 Input pins (V_{Ix}, $DISABLE_x$) on the same side as an unpowered supply must be in a low state to avoid powering the device through its ESD protection circuitry.

Table 18. ADuM230E/ADuM231E Truth Table (Positive Logic)

V_{Ix} Input[1, 2]	V_{Ex} Input[1, 2]	V_{DDI} State[2]	V_{DDO} State[2]	Default Low (E0), V_{Ox} Output[1, 2, 3]	Default High (E1), V_{Ox} Output[1, 2, 3]	Test Conditions/ Comments
L	H or NC	Powered	Powered	L	L	Normal operation
H	H or NC	Powered	Powered	H	H	Normal operation
X	L	Powered	Powered	Z	Z	Outputs disabled
L	H or NC	Unpowered	Powered	L	H	Fail-safe output
X[4]	L[4]	Unpowered	Powered	Z	Z	Outputs disabled
X[4]	X[4]	Powered	Unpowered	Indeterminate	Indeterminate	

1 L means low, H means high, X means don't care, and NC means not connected, and Z means high impedance.

2 V_{Ix} and V_{Ox} refer to the input and output signals of a given channel (A, B, or C). V_{Ex} refers to the output enable signal on the same side as the V_{Ox} inputs. V_{DDI} and V_{DDO} refer to the supply voltages on the input and output sides of the given channel, respectively.

3 E0 refers to the ADuM230E0/ADuM231E0 models, and E1 refers to the ADuM230E1/ADuM231E1 models. See the Ordering Guide section.

4 Input pins (V_{Ix}, V_{Ex}) on the same side as an unpowered supply must be in a low state to avoid powering the device through its ESD protection circuitry.

PIN CONFIGURATIONS AND FUNCTION DESCRIPTIONS

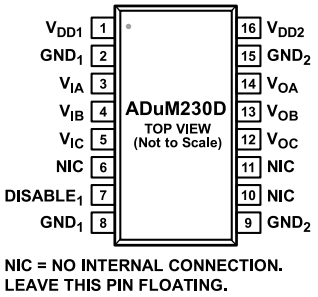

Figure 6. ADuM230D Pin Configuration

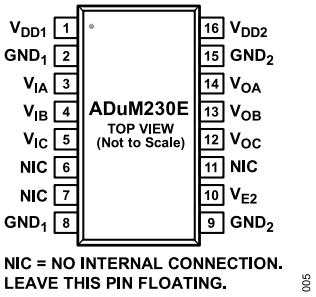

Figure 7. ADuM230E Pin Configuration

Table 19. Pin Function Descriptions

Pin No.[1]			
ADuM230D	**ADuM230E**	**Mnemonic**	**Description**
1	1	V_{DD1}	Supply Voltage for Isolator Side 1.
2, 8	2, 8	GND_1	Ground Reference for Isolator Side 1.
3	3	V_{IA}	Logic Input A.
4	4	V_{IB}	Logic Input B.
5	5	V_{IC}	Logic Input C.
6, 10, 11	6, 7, 11	NIC	No Internal Connection. Leave these pins floating.
7	Not applicable	$DISABLE_1$	Input Disable 1. This pin disables the isolator inputs. Outputs take on the logic state determined by the fail-safe option shown in the Ordering Guide.
9, 15	9, 15	GND_2	Ground Reference for Isolator Side 2.
Not applicable	10	V_{E2}	Output Enable 2. Active high logic input. When V_{E2} is high or disconnected, the V_{OA}, V_{OB}, and V_{OC} outputs are enabled. When V_{E2} is low, the V_{OA}, V_{OB}, and V_{OC} outputs are disabled to the high-Z state.
12	12	V_{OC}	Logic Output C.
13	13	V_{OB}	Logic Output B.
14	14	V_{OA}	Logic Output A.
16	16	V_{DD2}	Supply Voltage for Isolator Side 2.

[1] Reference the AN-1109 Application Note for specific layout guidelines.

PIN CONFIGURATIONS AND FUNCTION DESCRIPTIONS

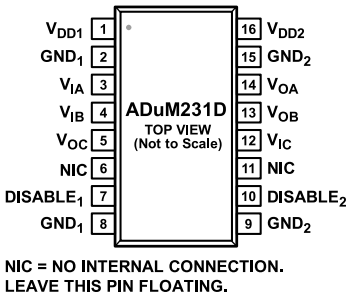

Figure 8. ADuM231D Pin Configuration

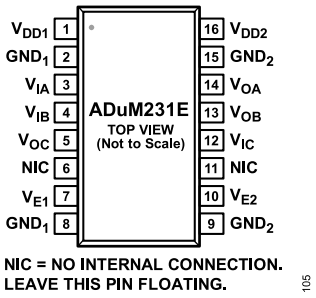

Figure 9. ADuM231E Pin Configuration

Table 20. Pin Function Descriptions

Pin No.[1]			
ADuM231D	**ADuM231E**	**Mnemonic**	**Description**
1	1	V_{DD1}	Supply Voltage for Isolator Side 1.
2, 8	2, 8	GND_1	Ground Reference for Isolator Side 1.
3	3	V_{IA}	Logic Input A.
4	4	V_{IB}	Logic Input B.
5	5	V_{OC}	Logic Output C.
6, 11	6, 11	NIC	No Internal Connection. Leave these pins floating.
7	Not applicable	$DISABLE_1$	Input Disable 1. This pin disables the isolator inputs. Outputs take on the logic state determined by the fail-safe option shown in the Ordering Guide.
Not applicable	7	V_{E1}	Output Enable 1. Active high logic input. When V_{E1} is high or disconnected, the V_{OC} output is enabled. When V_{E1} is low, the V_{OC} output is disabled to the high-Z state.
9, 15	9, 15	GND_2	Ground Reference for Isolator Side 2.
10	Not applicable	$DISABLE_2$	Input Disable 2. This pin disables the isolator inputs. Outputs take on the logic state determined by the fail-safe option shown in the Ordering Guide.
Not applicable	10	V_{E2}	Output Enable 2. Active high logic input. When V_{E2} is high or disconnected, the V_{OA} and V_{OB} outputs are enabled. When V_{E2} is low, the V_{OA} and V_{OB} outputs are disabled to the high-Z state.
12	12	V_{IC}	Logic Input C.
13	13	V_{OB}	Logic Output B.
14	14	V_{OA}	Logic Output A.
16	16	V_{DD2}	Supply Voltage for Isolator Side 2.

[1] Reference the AN-1109 Application Note for specific layout guidelines.

TYPICAL PERFORMANCE CHARACTERISTICS

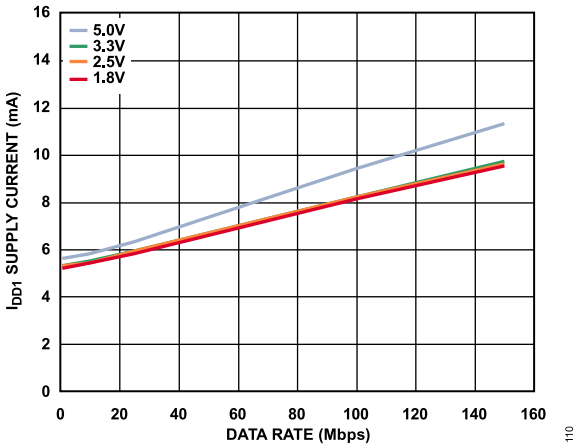

Figure 10. ADuM230D/ADuM230E I_{DD1} Supply Current vs. Data Rate at Various Voltages

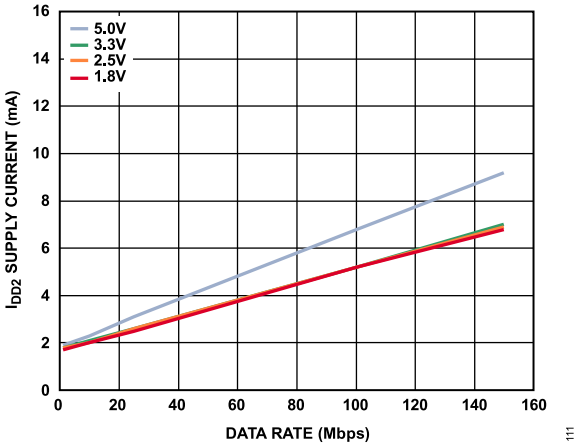

Figure 11. ADuM230D/ADuM230E I_{DD2} Supply Current vs. Data Rate at Various Voltages

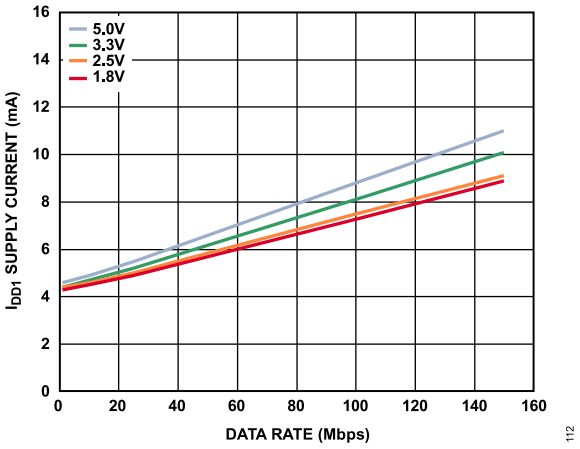

Figure 12. ADuM231D/ADuM231E I_{DD1} Supply Current vs. Data Rate at Various Voltages

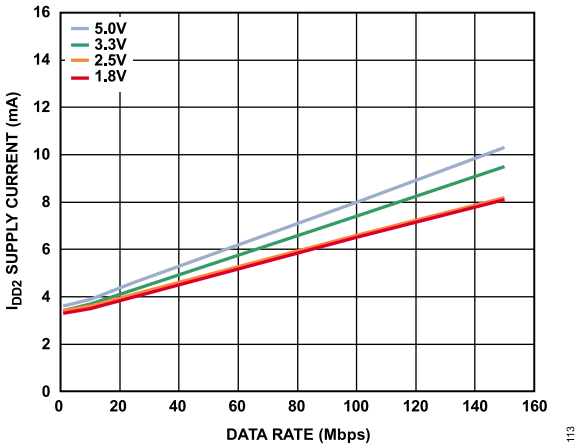

Figure 13. ADuM231D/ADuM231E I_{DD2} Supply Current vs. Data Rate at Various Voltages

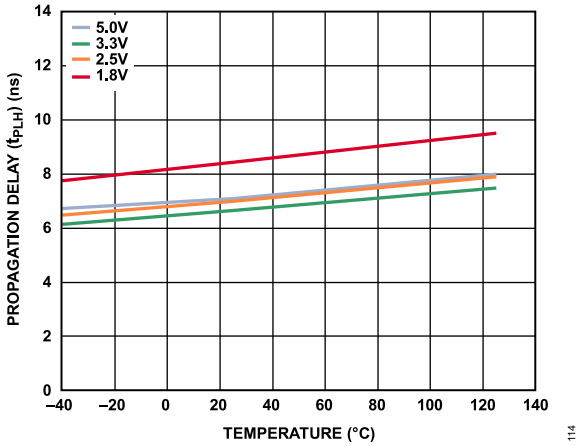

Figure 14. Propagation Delay (t_{PLH}) vs. Temperature at Various Voltages

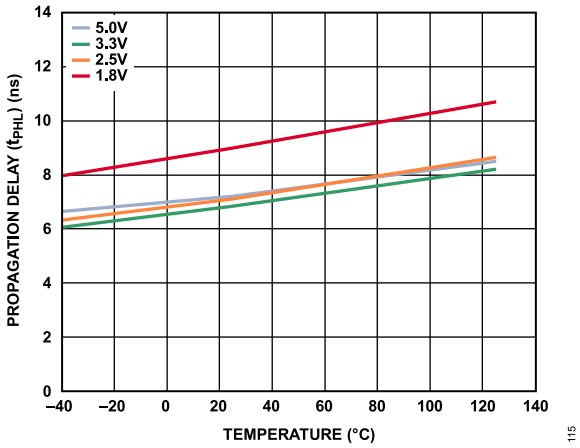

Figure 15. Propagation Delay (t_{PHL}) vs. Temperature at Various Voltages

THEORY OF OPERATION

The ADuM230D/ADuM230E/ADuM231D/ADuM231E use a high frequency carrier to transmit data across the isolation barrier using *i*Coupler chip scale transformer coils separated by layers of polyimide isolation. Using an on/off keying (OOK) technique and the differential architecture shown in Figure 16 and Figure 17, the ADuM230D/ADuM230E/ADuM231D/ADuM231E have very low propagation delay and high speed. Internal regulators and input/output design techniques allow logic and supply voltages over a wide range from 1.7 V to 5.5 V, offering voltage translation of 1.8 V, 2.5 V, 3.3 V, and 5 V logic. The architecture is designed for high common-mode transient immunity and high immunity to electrical noise and magnetic interference. Radiated emissions are minimized with a spread spectrum OOK carrier and other techniques.

Figure 16 illustrates the waveforms for the models of the ADuM230D/ADuM230E/ADuM231D/ADuM231E that have the condition of the fail-safe output state equal to low, where the carrier waveform is off when the input state is low. If the input side is off or not operating, the low fail-safe output state (the ADuM230D0, ADuM231D0, ADuM230E0, and ADuM231E0 models) sets the output to low. For the ADuM230D/ADuM230E/ADuM231D/ADuM231E models that have a fail-safe output state of high, Figure 17 illustrates the conditions where the carrier waveform is off when the input state is high. When the input side is off or not operating, the high fail-safe output state (the ADuM230D1, ADuM231D1, ADuM230E1, and ADuM231E1 models) sets the output to high. See the Ordering Guide for the model numbers that have the fail-safe output state of low or the fail-safe output state of high.

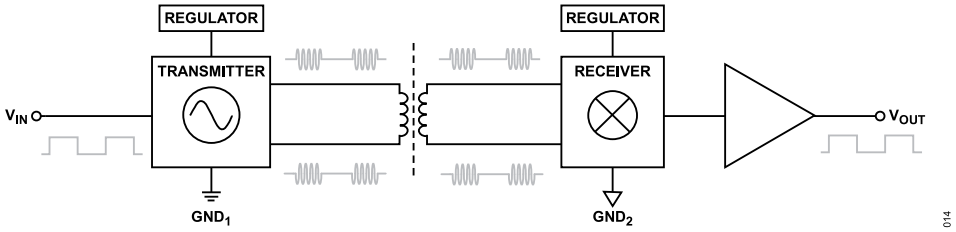

Figure 16. Operational Block Diagram of a Single Channel with a Low Fail-Safe Output State

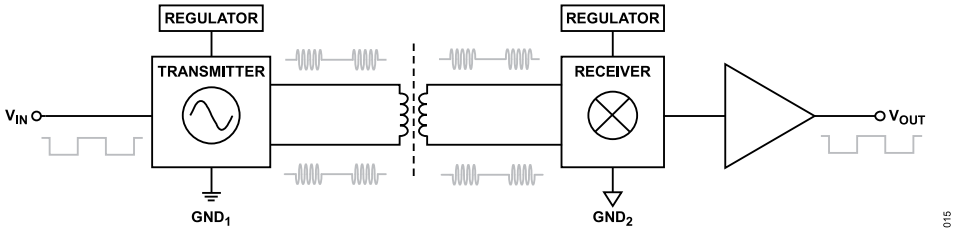

Figure 17. Operational Block Diagram of a Single Channel with a High Fail-Safe Output State

APPLICATIONS INFORMATION

PCB LAYOUT

The ADuM230D/ADuM230E/ADuM231D/ADuM231E digital isolators require no external interface circuitry for the logic interfaces. Power supply bypassing is strongly recommended at the input and output supply pins (see Figure 18). Bypass capacitors are most conveniently connected between Pin 1 and Pin 2 for V_{DD1} and between Pin 15 and Pin 16 for V_{DD2}. The recommended bypass capacitor value is between 0.01 µF and 0.1 µF. The total lead length between both ends of the capacitor and the input power supply pin must not exceed 10 mm. Bypassing between Pin 1 and Pin 8 and between Pin 9 and Pin 16 must also be considered, unless the ground pair on each package side is connected close to the package.

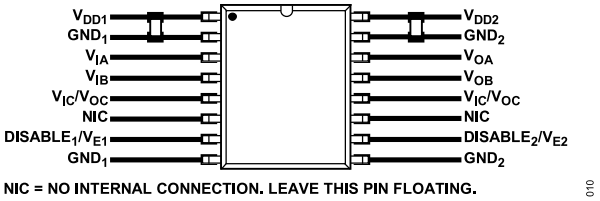

Figure 18. Recommended PCB Layout

In applications involving high common-mode transients, ensure that board coupling across the isolation barrier is minimized. Furthermore, design the board layout such that any coupling that does occur equally affects all pins on a given component side. Failure to ensure this can cause voltage differentials between pins exceeding the Absolute Maximum Ratings of the device, thereby leading to latch-up or permanent damage.

See the AN-1109 Application Note for board layout guidelines.

PROPAGATION DELAY RELATED PARAMETERS

Propagation delay is a parameter that describes the time required for a logic signal to propagate through a component. The propagation delay to a Logic 0 output may differ from the propagation delay to a Logic 1 output.

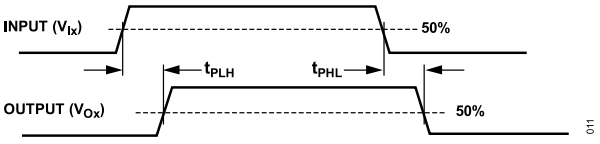

Figure 19. Propagation Delay Parameters

Pulse width distortion is the maximum difference between these two propagation delay values and is an indication of how accurately the timing of the input signal is preserved.

Channel matching is the maximum amount the propagation delay differs between channels within a single ADuM230D/ADuM230E/ADuM231D/ADuM231E component.

Propagation delay skew is the maximum amount the propagation delay differs between multiple ADuM230D/ADuM230E/ADuM231D/ADuM231E components operating under the same conditions.

JITTER MEASUREMENT

Figure 20 shows the eye diagram for the ADuM230D/ADuM230E/ADuM231D/ADuM231E. The measurement was taken using an Agilent 81110A pulse pattern generator at 150 Mbps with pseudorandom bit sequences (PRBS), 2(n − 1), n = 14, for 5 V supplies. Jitter was measured with the Tektronix Model 5104B oscilloscope, 1 GHz, 10 GSPS with the DPOJET jitter and eye diagram analysis tools. The result shows a typical measurement on the ADuM230D/ADuM230E/ADuM231D/ADuM231E with 630 ps p-p jitter.

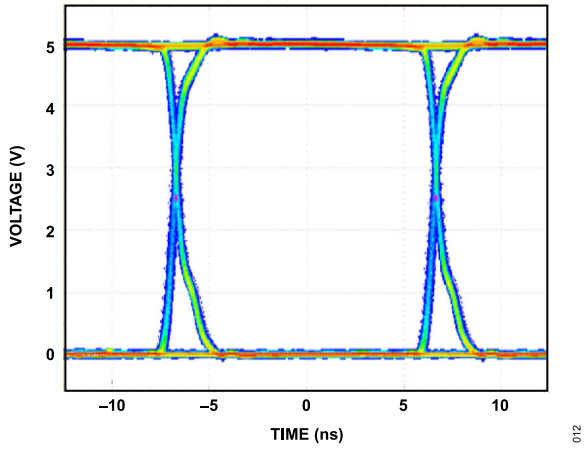

Figure 20. Eye Diagram

INSULATION LIFETIME

All insulation structures eventually break down when subjected to voltage stress over a sufficiently long period. The rate of insulation degradation is dependent on the characteristics of the voltage waveform applied across the insulation. In addition to the testing performed by the regulatory agencies, Analog Devices carries out an extensive set of evaluations to determine the lifetime of the insulation structure within the ADuM230D/ADuM230E/ADuM231D/ADuM231E.

Analog Devices performs accelerated life testing using voltage levels higher than the rated continuous working voltage. Acceleration factors for several operating conditions are determined. These factors allow calculation of the time to failure at the actual working voltage. The values shown in Table 16 summarize the maximum continuous working voltages as per IEC 60747-17. Operation at working voltages higher than the service life voltage listed leads to premature insulation failure.

OUTLINE DIMENSIONS

Package Drawing (Option)	Package Type	Package Description
RW-16	SOIC_W	16-Lead Standard Small Outline Package, Wide Body
RI-16-2	SOIC_IC	16-Lead Standard Small Outline Package, with Increased Creepage, Wide Body

For the latest package outline information and land patterns (footprints), go to Package Index.

ORDERING GUIDE

Model[1]	Temperature Range	Package Description	Package Option
ADuM230D1BRWZ	−40°C to +125°C	16-Lead SOIC_W	RW-16
ADuM230D1BRWZ-RL	−40°C to +125°C	16-Lead SOIC_W	RW-16
ADuM230D0BRWZ	−40°C to +125°C	16-Lead SOIC_W	RW-16
ADuM230D0BRWZ-RL	−40°C to +125°C	16-Lead SOIC_W	RW-16
ADuM230E1BRWZ	−40°C to +125°C	16-Lead SOIC_W	RW-16
ADuM230E1BRWZ-RL	−40°C to +125°C	16-Lead SOIC_W	RW-16
ADuM230E0BRWZ	−40°C to +125°C	16-Lead SOIC_W	RW-16
ADuM230E0BRWZ-RL	−40°C to +125°C	16-Lead SOIC_W	RW-16
ADuM230D1BRIZ	−40°C to +125°C	16-Lead SOIC_IC	RI-16-2
ADuM230D1BRIZ-RL	−40°C to +125°C	16-Lead SOIC_IC	RI-16-2
ADuM230D0BRIZ	−40°C to +125°C	16-Lead SOIC_IC	RI-16-2
ADuM230D0BRIZ-RL	−40°C to +125°C	16-Lead SOIC_IC	RI-16-2
ADuM230E1BRIZ	−40°C to +125°C	16-Lead SOIC_IC	RI-16-2
ADuM230E1BRIZ-RL	−40°C to +125°C	16-Lead SOIC_IC	RI-16-2
ADuM230E0BRIZ	−40°C to +125°C	16-Lead SOIC_IC	RI-16-2
ADuM230E0BRIZ-RL	−40°C to +125°C	16-Lead SOIC_IC	RI-16-2
ADuM231D1BRWZ	−40°C to +125°C	16-Lead SOIC_W	RW-16
ADuM231D1BRWZ-RL	−40°C to +125°C	16-Lead SOIC_W	RW-16
ADuM231D0BRWZ	−40°C to +125°C	16-Lead SOIC_W	RW-16
ADuM231D0BRWZ-RL	−40°C to +125°C	16-Lead SOIC_W	RW-16
ADuM231E1BRWZ	−40°C to +125°C	16-Lead SOIC_W	RW-16
ADuM231E1BRWZ-RL	−40°C to +125°C	16-Lead SOIC_W	RW-16
ADuM231E0BRWZ	−40°C to +125°C	16-Lead SOIC_W	RW-16
ADuM231E0BRWZ-RL	−40°C to +125°C	16-Lead SOIC_W	RW-16
ADuM231D1BRIZ	−40°C to +125°C	16-Lead SOIC_IC	RI-16-2
ADuM231D1BRIZ-RL	−40°C to +125°C	16-Lead SOIC_IC	RI-16-2
ADuM231D0BRIZ	−40°C to +125°C	16-Lead SOIC_IC	RI-16-2
ADuM231D0BRIZ-RL	−40°C to +125°C	16-Lead SOIC_IC	RI-16-2
ADuM231E1BRIZ	−40°C to +125°C	16-Lead SOIC_IC	RI-16-2
ADuM231E1BRIZ-RL	−40°C to +125°C	16-Lead SOIC_IC	RI-16-2
ADuM231E0BRIZ	−40°C to +125°C	16-Lead SOIC_IC	RI-16-2
ADuM231E0BRIZ-RL	−40°C to +125°C	16-Lead SOIC_IC	RI-16-2

[1] Z = RoHS Compliant Part.

OUTLINE DIMENSIONS

NO. OF INPUTS, WITHSTAND VOLTAGE RATING, FAIL-SAFE OUTPUT STATE, INPUT DISABLE, AND OUTPUT ENABLE OPTIONS

Model[1]	No. of Inputs, V_{DD1} Side	No. of Inputs, V_{DD2} Side	Withstand Voltage Rating (kV rms)	Fail-Safe Output State	Input Disable	Output Enable
ADuM230D1BRWZ	3	0	5.0	High	Yes	No
ADuM230D1BRWZ-RL	3	0	5.0	High	Yes	No
ADuM230D0BRWZ	3	0	5.0	Low	Yes	No
ADuM230D0BRWZ-RL	3	0	5.0	Low	Yes	No
ADuM230E1BRWZ	3	0	5.0	High	No	Yes
ADuM230E1BRWZ-RL	3	0	5.0	High	No	Yes
ADuM230E0BRWZ	3	0	5.0	Low	No	Yes
ADuM230E0BRWZ-RL	3	0	5.0	Low	No	Yes
ADuM230D1BRIZ	3	0	5.0	High	Yes	No
ADuM230D1BRIZ-RL	3	0	5.0	High	Yes	No
ADuM230D0BRIZ	3	0	5.0	Low	Yes	No
ADuM230D0BRIZ-RL	3	0	5.0	Low	Yes	No
ADuM230E1BRIZ	3	0	5.0	High	No	Yes
ADuM230E1BRIZ-RL	3	0	5.0	High	No	Yes
ADuM230E0BRIZ	3	0	5.0	Low	No	Yes
ADuM230E0BRIZ-RL	3	0	5.0	Low	No	Yes
ADuM231D1BRWZ	2	1	5.0	High	Yes	No
ADuM231D1BRWZ-RL	2	1	5.0	High	Yes	No
ADuM231D0BRWZ	2	1	5.0	Low	Yes	No
ADuM231D0BRWZ-RL	2	1	5.0	Low	Yes	No
ADuM231E1BRWZ	2	1	5.0	High	No	Yes
ADuM231E1BRWZ-RL	2	1	5.0	High	No	Yes
ADuM231E0BRWZ	2	1	5.0	Low	No	Yes
ADuM231E0BRWZ-RL	2	1	5.0	Low	No	Yes
ADuM231D1BRIZ	2	1	5.0	High	Yes	No
ADuM231D1BRIZ-RL	2	1	5.0	High	Yes	No
ADuM231D0BRIZ	2	1	5.0	Low	Yes	No
ADuM231D0BRIZ-RL	2	1	5.0	Low	Yes	No
ADuM231E1BRIZ	2	1	5.0	High	No	Yes
ADuM231E1BRIZ-RL	2	1	5.0	High	No	Yes
ADuM231E0BRIZ	2	1	5.0	Low	No	Yes
ADuM231E0BRIZ-RL	2	1	5.0	Low	No	Yes

[1] Z = RoHS Compliant Part.

Looking for pricing, stock, or lifecycle information?

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