



Low Voltage, 1.15 V to 5.5 V, 8-Channel Bidirectional Logic Level Translators

ADG3308/ADG3308-1

FEATURES

- Bidirectional logic level translation
- Operates from 1.15 V to 5.5 V
- Low quiescent current $< 1 \mu\text{A}$
- No direction pin

APPLICATIONS

- Low voltage ASIC level translation
- Smart card readers
- Cell phones and cell phone cradles
- Portable communication devices
- Telecommunications equipment
- Network switches and routers
- Storage systems (SAN/NAS)
- Computing/server applications
- GPS
- Portable POS systems
- Low cost serial interfaces

GENERAL DESCRIPTION

The ADG3308/ADG3308-1/ADG3308-2 are bidirectional level translators containing eight bidirectional channels. They can be used in multivoltage digital system applications, such as a data transfer between a low voltage DSP controller and a higher voltage device. The internal architecture allows the device to perform bidirectional level translation without an additional signal to set the direction in which the translation takes place.

The voltage applied to V_{CCA} sets the logic levels on the A side of the device, and V_{CCY} sets the levels on the Y side. For proper operation, V_{CCA} must always be less than V_{CCY} . The V_{CCA} compatible logic signals applied to the A side of the device appear as V_{CCY} compatible levels on the Y side. Similarly, V_{CCY} compatible logic levels applied to the Y side of the device appear as V_{CCA} compatible logic levels on the A side.

The enable pin (EN) provides three-state operation on both the A side and the Y side pins. When the EN pin is pulled low, the terminals on both sides of the device are in the high impedance state. For normal operation, EN should be driven high.

FUNCTIONAL BLOCK DIAGRAM

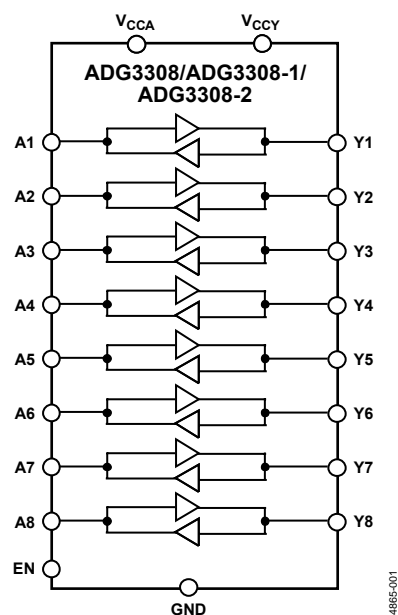


Figure 1.

The ADG3308 is available in a compact 20-lead TSSOP and a 20-lead LFCSP, the ADG3308-1 is available in a 20-ball WLCSP, and the ADG3308-2 is available in a backside-coated 20-ball WLCSP. The EN pin is referred to the V_{CCY} supply voltage for the ADG3308 and to the V_{CCA} supply voltage for the ADG3308-1 and ADG3308-2.

The ADG3308/ADG3308-1/ADG3308-2 are guaranteed to operate over the 1.15 V to 5.5 V supply voltage range and the extended -40°C to $+85^{\circ}\text{C}$ temperature range.

PRODUCT HIGHLIGHTS

1. Bidirectional logic level translation.
2. Fully guaranteed over the 1.15 V to 5.5 V supply range.
3. No direction pin.
4. Packages: 20-lead TSSOP and 20-lead LFCSP (ADG3308), 20-ball WLCSP (ADG3308-1), and backside-coated 20-ball WLCSP (ADG3308-2).

Rev. C

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One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781.329.4700 www.analog.com
Fax: 781.461.3113 ©2005–2007 Analog Devices, Inc. All rights reserved.

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REVISION HISTORY

9/07—Rev. B to Rev. C

Updated Outline Dimensions	19
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7/07—Rev. A to Rev. B

Added Backside-Coated WLCSP Package	Universal
Changes to Input Driving Requirements Section	16
Updated Outline Dimensions	19
Changes to Ordering Guide	20

7/06—Rev. 0 to Rev. A

Added WLCSP Package.....	Universal
Added Figure 4.....	7
Updated Outline Dimensions.....	19
Changes to Ordering Guide.....	19

1/05—Revision 0: Initial Version

SPECIFICATIONS

$V_{CCY} = 1.65\text{ V to }5.5\text{ V}$, $V_{CCA} = 1.15\text{ V to }V_{CCY}$, $GND = 0\text{ V}$. All specifications T_{MIN} to T_{MAX} , unless otherwise noted. ¹

Table 1.

Parameter	Symbol	Conditions	Min	Typ ²	Max	Unit
LOGIC INPUTS/OUTPUTS						
A Side						
Input High Voltage ³	V_{IHA}	$V_{CCA} = 1.15\text{ V}$	$V_{CCA} - 0.3$			V
	V_{IHA}	$V_{CCA} = 1.2\text{ V to }5.5\text{ V}$	$0.65 \times V_{CCA}$			V
Input Low Voltage ³	V_{ILA}				$0.35 \times V_{CCA}$	V
Output High Voltage	V_{OHA}	$V_Y = V_{CCY}$, $I_{OH} = 20\text{ }\mu\text{A}$, see Figure 29	$V_{CCA} - 0.4$			V
Output Low Voltage	V_{OLA}	$V_Y = 0\text{ V}$, $I_{OL} = 20\text{ }\mu\text{A}$, see Figure 29			0.4	V
Capacitance ³	C_A	$f = 1\text{ MHz}$, $EN = 0$, see Figure 34		10		pF
Leakage Current	$I_{LA, HIGH-Z}$	$V_A = 0\text{ V or }V_{CCA}$, $EN = 0$, see Figure 31			± 1	μA
Y Side						
Input High Voltage ³	V_{IHY}		$0.65 \times V_{CCY}$			V
Input Low Voltage ³	V_{ILY}				$0.35 \times V_{CCY}$	V
Output High Voltage	V_{OHY}	$V_A = V_{CCA}$, $I_{OH} = 20\text{ }\mu\text{A}$, see Figure 30	$V_{CCY} - 0.4$			V
Output Low Voltage	V_{OLY}	$V_A = 0\text{ V}$, $I_{OL} = 20\text{ }\mu\text{A}$, see Figure 30			0.4	V
Capacitance ³	C_Y	$f = 1\text{ MHz}$, $EN = 0$, see Figure 35		6.8		pF
Leakage Current	$I_{LY, HIGH-Z}$	$V_Y = 0\text{ V or }V_{CCY}$, $EN = 0$, see Figure 32			± 1	μA
Enable (EN)						
Input High Voltage ³	V_{IHEN}		$0.65 \times V_{CCY}$			V
ADG3308 (TSSOP, LFCSP)		$V_{CCA} = 1.15\text{ V}$	$V_{CCA} - 0.3$			V
ADG3308-1/ADG3308-2 (WLCSP)		$V_{CCA} = 1.2\text{ V to }5.5\text{ V}$	$0.65 \times V_{CCA}$			V
Input Low Voltage ³	V_{ILEN}				$0.35 \times V_{CCY}$	V
ADG3308 (TSSOP, LFCSP)					$0.35 \times V_{CCA}$	V
ADG3308-1/ADG3308-2 (WLCSP)					± 1	μA
Leakage Current	I_{LEN}	$V_{EN} = 0\text{ V or }V_{CCY}$, $V_A = 0\text{ V}$, see Figure 33			± 1	μA
Capacitance ³	C_{EN}			4.5		pF
Enable Time ³	t_{EN}	$R_S = R_T = 50\text{ }\Omega$, $V_A = 0\text{ V or }V_{CCA}$ (A \rightarrow Y), $V_Y = 0\text{ V or }V_{CCY}$ (Y \rightarrow A), see Figure 36		1	1.8	μs
SWITCHING CHARACTERISTICS ³						
$3.3\text{ V} \pm 0.3\text{ V} \leq V_{CCA} \leq V_{CCY}$, $V_{CCY} = 5\text{ V} \pm 0.5\text{ V}$						
A \rightarrow Y Level Translation						
Propagation Delay	$t_{P, A\rightarrow Y}$	$R_S = R_T = 50\text{ }\Omega$, $C_L = 50\text{ pF}$, see Figure 37		6	10	ns
Rise Time	$t_{R, A\rightarrow Y}$			2	3.5	ns
Fall Time	$t_{F, A\rightarrow Y}$			2	3.5	ns
Maximum Data Rate	$D_{MAX, A\rightarrow Y}$		50			Mbps
Channel-to-Channel Skew	$t_{SKEW, A\rightarrow Y}$			2	4	ns
Part-to-Part Skew	$t_{PPSKEW, A\rightarrow Y}$				3	ns
Y \rightarrow A Level Translation						
Propagation Delay	$t_{P, Y\rightarrow A}$	$R_S = R_T = 50\text{ }\Omega$, $C_L = 15\text{ pF}$, see Figure 38		4	7	ns
Rise Time	$t_{R, Y\rightarrow A}$			1	3	ns
Fall Time	$t_{F, Y\rightarrow A}$			3	7	ns
Maximum Data Rate	$D_{MAX, Y\rightarrow A}$		50			Mbps
Channel-to-Channel Skew	$t_{SKEW, Y\rightarrow A}$			2	3.5	ns
Part-to-Part Skew	$t_{PPSKEW, Y\rightarrow A}$				2	ns

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Parameter	Symbol	Conditions	Min	Typ ²	Max	Unit
1.8 V ± 0.15 V ≤ V _{CCA} ≤ V _{CCY} , V _{CCY} = 3.3 V ± 0.3 V						
A→Y Level Translation		R _S = R _T = 50 Ω, C _L = 50 pF, see Figure 37	50			
Propagation Delay	t _{P, A→Y}			8	11	ns
Rise Time	t _{R, A→Y}			2	5	ns
Fall Time	t _{F, A→Y}			2	5	ns
Maximum Data Rate	D _{MAX, A→Y}					Mbps
Channel-to-Channel Skew	t _{SKEW, A→Y}			2	4	ns
Part-to-Part Skew	t _{PPSKEW, A→Y}				4	ns
Y→A Level Translation						
Propagation Delay	t _{P, Y→A}	R _S = R _T = 50 Ω, C _L = 15 pF, see Figure 38	50	5	8	ns
Rise Time	t _{R, Y→A}			2	3.5	ns
Fall Time	t _{F, Y→A}			2	3.5	ns
Maximum Data Rate	D _{MAX, Y→A}					Mbps
Channel-to-Channel Skew	t _{SKEW, Y→A}			2	3	ns
Part-to-Part Skew	t _{PPSKEW, Y→A}				3	ns
1.15 V to 1.3 V ≤ V _{CCA} ≤ V _{CCY} , V _{CCY} = 3.3 V ± 0.3 V						
A→Y Level Translation		R _S = R _T = 50 Ω, C _L = 50 pF, see Figure 37	40			
Propagation Delay	t _{P, A→Y}			9	18	ns
Rise Time	t _{R, A→Y}			3	5	ns
Fall Time	t _{F, A→Y}			2	5	ns
Maximum Data Rate	D _{MAX, A→Y}					Mbps
Channel-to-Channel Skew	t _{SKEW, A→Y}			2	5	ns
Part-to-Part Skew	t _{PPSKEW, A→Y}				10	ns
Y→A Level Translation		R _S = R _T = 50 Ω, C _L = 15 pF, see Figure 38	40			
Propagation Delay	t _{P, Y→A}			5	9	ns
Rise Time	t _{R, Y→A}			2	4	ns
Fall Time	t _{F, Y→A}			2	4	ns
Maximum Data Rate	D _{MAX, Y→A}					Mbps
Channel-to-Channel Skew	t _{SKEW, Y→A}			2	4	ns
Part-to-Part Skew	t _{PPSKEW, Y→A}				4	ns
1.15 V to 1.3 V ≤ V _{CCA} ≤ V _{CCY} , V _{CCY} = 1.8 V ± 0.3 V						
A→Y Level Translation		R _S = R _T = 50 Ω, C _L = 50 pF, see Figure 37	25			
Propagation Delay	t _{P, A→Y}			12	25	ns
Rise Time	t _{R, A→Y}			7	12	ns
Fall Time	t _{F, A→Y}			3	5	ns
Maximum Data Rate	D _{MAX, A→Y}					Mbps
Channel-to-Channel Skew	t _{SKEW, A→Y}			2	5	ns
Part-to-Part Skew	t _{PPSKEW, A→Y}				15	ns
Y→A Level Translation		R _S = R _T = 50 Ω, C _L = 15 pF, see Figure 38	25			
Propagation Delay	t _{P, Y→A}			14	35	ns
Rise Time	t _{R, Y→A}			5	16	ns
Fall Time	t _{F, Y→A}			2.5	6.5	ns
Maximum Data Rate	D _{MAX, Y→A}					Mbps
Channel-to-Channel Skew	t _{SKEW, Y→A}			3	6.5	ns
Part-to-Part Skew	t _{PPSKEW, Y→A}				23.5	ns

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Parameter	Symbol	Conditions	Min	Typ ²	Max	Unit
$2.5\text{ V} \pm 0.2\text{ V} \leq V_{CCA} \leq V_{CCY}, V_{CCY} = 3.3\text{ V} \pm 0.3\text{ V}$						
A→Y Level Translation		$R_S = R_T = 50\ \Omega, C_L = 50\text{ pF}$, see Figure 37				
Propagation Delay	$t_{P, A \rightarrow Y}$			7	10	ns
Rise Time	$t_{R, A \rightarrow Y}$			2.5	4	ns
Fall Time	$t_{F, A \rightarrow Y}$			2	5	ns
Maximum Data Rate	$D_{MAX, A \rightarrow Y}$		60			Mbps
Channel-to-Channel Skew	$t_{SKEW, A \rightarrow Y}$			1.5	2	ns
Part-to-Part Skew	$t_{PPSKEW, A \rightarrow Y}$				4	ns
Y→A Level Translation		$R_S = R_T = 50\ \Omega, C_L = 15\text{ pF}$, see Figure 38				
Propagation Delay	$t_{P, Y \rightarrow A}$			5	8	ns
Rise Time	$t_{R, Y \rightarrow A}$			1	4	ns
Fall Time	$t_{F, Y \rightarrow A}$			3	5	ns
Maximum Data Rate	$D_{MAX, Y \rightarrow A}$		60			Mbps
Channel-to-Channel Skew	$t_{SKEW, Y \rightarrow A}$			2	3	ns
Part-to-Part Skew	$t_{PPSKEW, Y \rightarrow A}$				3	ns
POWER REQUIREMENTS						
Power Supply Voltages	V_{CCA}	$V_{CCA} \leq V_{CCY}$	1.15		5.5	V
	V_{CCY}		1.65		5.5	V
Quiescent Power Supply Current	I_{CCA}	$V_A = 0\text{ V}$ or $V_{CCA}, V_Y = 0\text{ V}$ or $V_{CCY}, V_{CCA} = V_{CCY} = 5.5\text{ V}, EN = V_{CCY}$		0.17	1	μA
	I_{CCY}	$V_A = 0\text{ V}$ or $V_{CCA}, V_Y = 0\text{ V}$ or $V_{CCY}, V_{CCA} = V_{CCY} = 5.5\text{ V}, EN = V_{CCY}$		0.27	1	μA
Three-State Mode Power Supply Current	$I_{HIGH-ZA}$	$V_{CCA} = V_{CCY} = 5.5\text{ V}, EN = 0$		0.1	1	μA
	$I_{HIGH-ZY}$	$V_{CCA} = V_{CCY} = 5.5\text{ V}, EN = 0$		0.1	1	μA

¹ Temperature range is -40°C to $+85^\circ\text{C}$ (B Version) for the TSSOP, the LFCSP, the WLCSP, and the backside-coated WLCSP.

² All typical values are at $T_A = 25^\circ\text{C}$, unless otherwise noted.

³ Guaranteed by design; not subject to production test.

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ABSOLUTE MAXIMUM RATINGS

$T_A = 25^\circ\text{C}$, unless otherwise noted.

Table 2.

Parameter	Rating
V_{CCA} to GND	$-0.3\text{ V to }+7\text{ V}$
V_{CCY} to GND	V_{CCA} to $+7\text{ V}$
Digital Inputs (A)	$-0.3\text{ V to } (V_{CCA} + 0.3\text{ V})$
Digital Inputs (Y)	$-0.3\text{ V to } (V_{CCY} + 0.3\text{ V})$
EN to GND	$-0.3\text{ V to }+7\text{ V}$
Operating Temperature Range	
Extended Industrial Range (B Version)	$-40^\circ\text{C to }+85^\circ\text{C}$
Storage Temperature Range	$-65^\circ\text{C to }+150^\circ\text{C}$
Junction Temperature	150°C
θ_{JA} Thermal Impedance	
20-Lead TSSOP	78°C/W
20-Lead LFCSP	30.4°C/W
20-Ball WLCSP	100°C/W
20-Ball Backside-Coated WLCSP	100°C/W
Lead Temperature, Soldering (10 sec)	300°C
IR Reflow, Peak Temperature (<20 sec)	$260^\circ\text{C } (+0^\circ\text{C}/-5^\circ\text{C})$

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

Only one absolute maximum rating may be applied at any one time.

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.

PIN CONFIGURATIONS AND FUNCTION DESCRIPTIONS

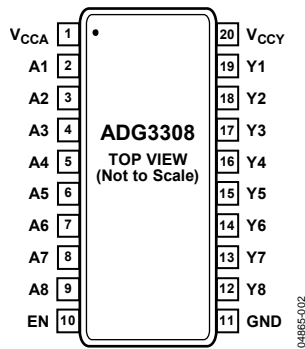


Figure 2. 20-Lead TSSOP

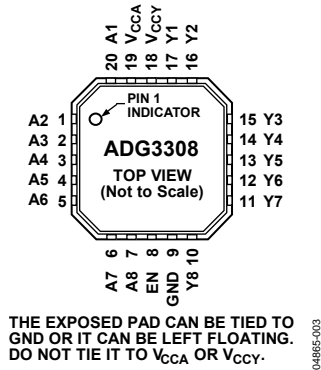


Figure 3. 20-Lead LFCSP

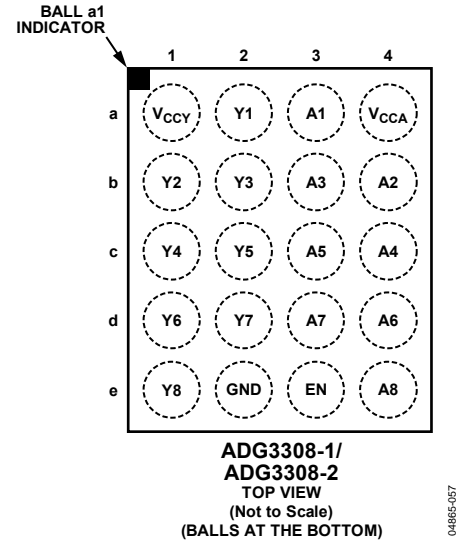


Figure 4. 20-Ball WLCSP

Table 3. Pin Function Descriptions

Pin/Ball No.			Mnemonic	Description
TSSOP	LFCSP	WLCSP		
1	19	a4	V _{CCA}	Power Supply. Power supply voltage input for the A1 I/O pin to the A8 I/O pin ($1.15\text{ V} \leq V_{CCA} < V_{CCY}$).
2	20	a3	A1	Input/Output A1. Referenced to V _{CCA} .
3	1	b4	A2	Input/Output A2. Referenced to V _{CCA} .
4	2	b3	A3	Input/Output A3. Referenced to V _{CCA} .
5	3	c4	A4	Input/Output A4. Referenced to V _{CCA} .
6	4	c3	A5	Input/Output A5. Referenced to V _{CCA} .
7	5	d4	A6	Input/Output A6. Referenced to V _{CCA} .
8	6	d3	A7	Input/Output A7. Referenced to V _{CCA} .
9	7	e4	A8	Input/Output A8. Referenced to V _{CCA} .
10	8	e3	EN	Active High Enable Input.
11	9	e2	GND	Ground.
12	10	e1	Y8	Input/Output Y8. Referenced to V _{CCY} .
13	11	d2	Y7	Input/Output Y7. Referenced to V _{CCY} .
14	12	d1	Y6	Input/Output Y6. Referenced to V _{CCY} .
15	13	c2	Y5	Input/Output Y5. Referenced to V _{CCY} .
16	14	c1	Y4	Input/Output Y4. Referenced to V _{CCY} .
17	15	b2	Y3	Input/Output Y3. Referenced to V _{CCY} .
18	16	b1	Y2	Input/Output Y2. Referenced to V _{CCY} .
19	17	a2	Y1	Input/Output Y1. Referenced to V _{CCY} .
20	18	a1	V _{CCY}	Power Supply. Power supply voltage input for the Y1 I/O pin to the Y8 I/O pin ($1.65\text{ V} \leq V_{CCY} \leq 5.5\text{ V}$).

TYPICAL PERFORMANCE CHARACTERISTICS

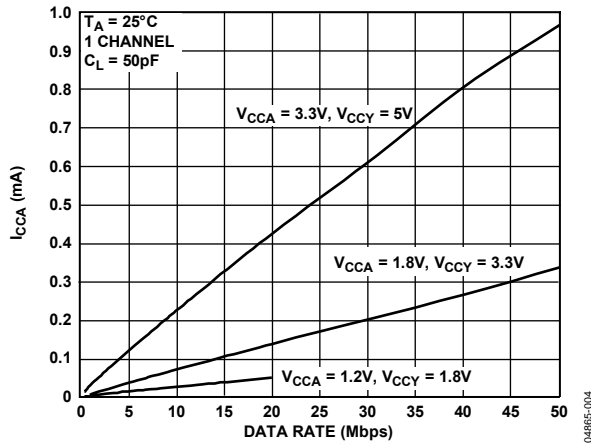


Figure 5. I_{CCA} vs. Data Rate (A→Y Level Translation)

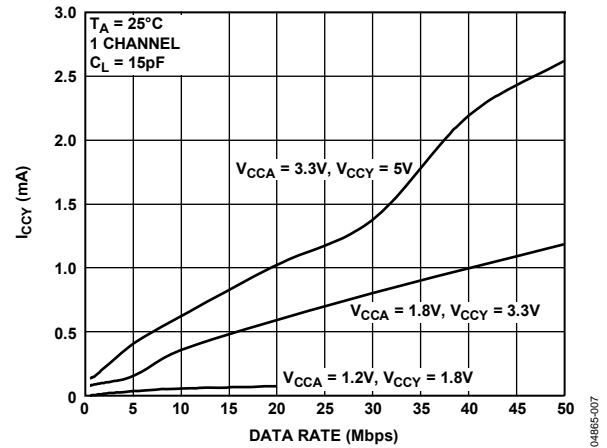


Figure 8. I_{CCY} vs. Data Rate (Y→A Level Translation)

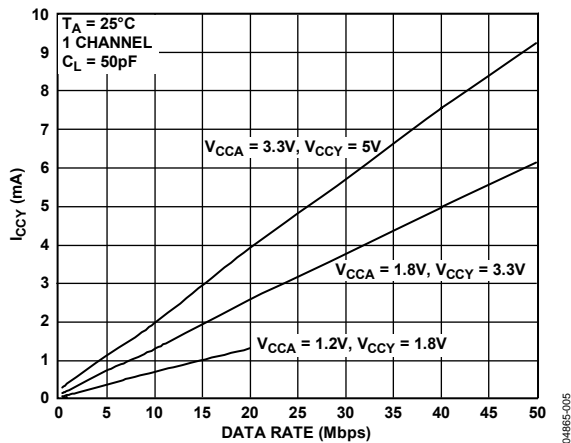


Figure 6. I_{CCY} vs. Data Rate (A→Y Level Translation)

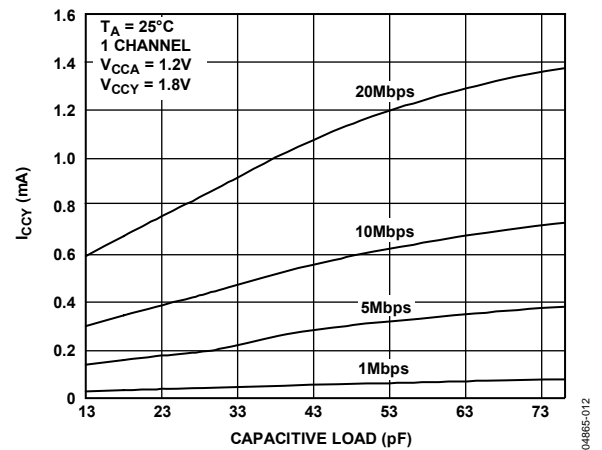


Figure 9. I_{CCY} vs. Capacitive Load at Pin Y for A→Y (1.2V→1.8V) Level Translation

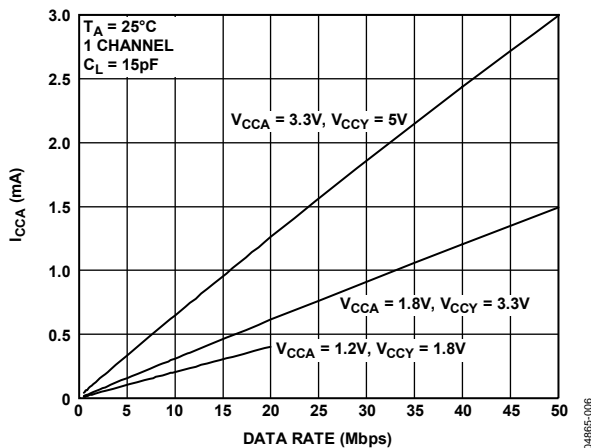


Figure 7. I_{CCA} vs. Data Rate (Y→A Level Translation)

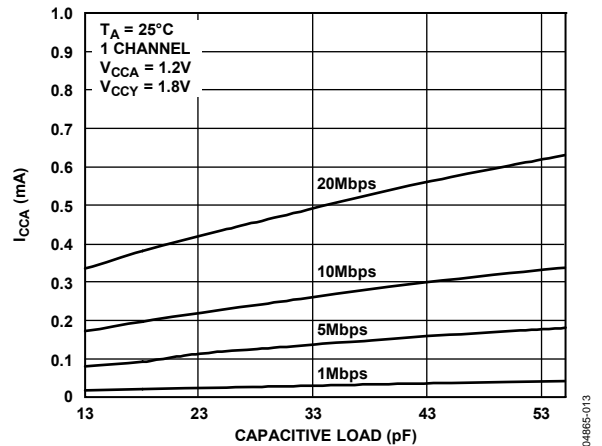


Figure 10. I_{CCA} vs. Capacitive Load at Pin A for Y→A (1.8V→1.2V) Level Translation

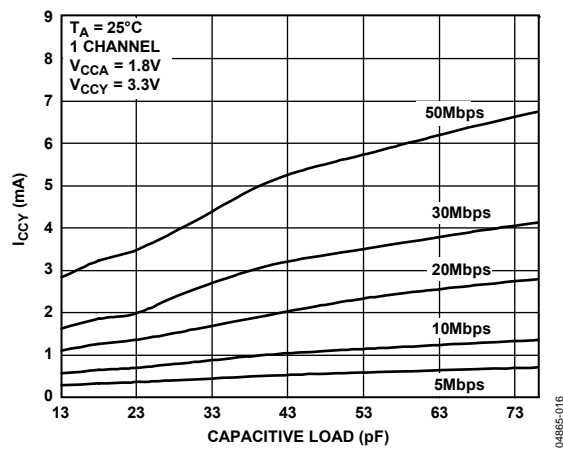


Figure 11. I_{CCY} vs. Capacitive Load at Pin Y for A→Y (1.8 V→3.3 V) Level Translation

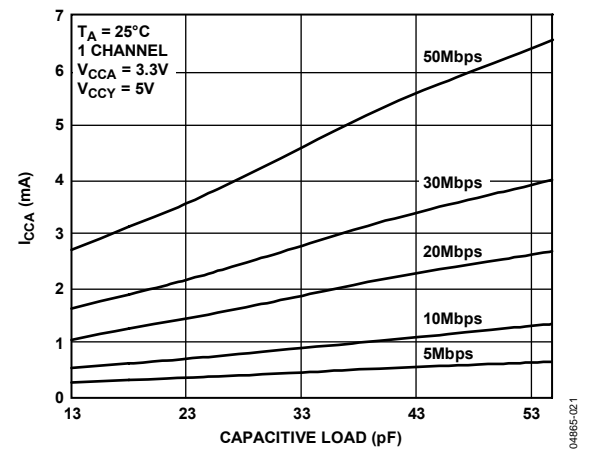


Figure 14. I_{CCA} vs. Capacitive Load at Pin A for Y→A (5 V→3.3 V) Level Translation

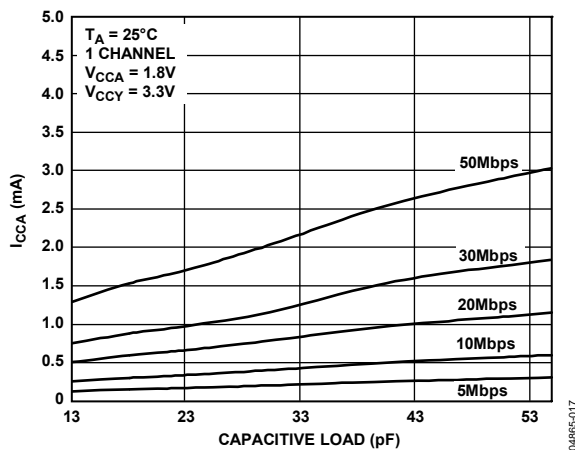


Figure 12. I_{CCA} vs. Capacitive Load at Pin A for Y→A (3.3 V→1.8 V) Level Translation

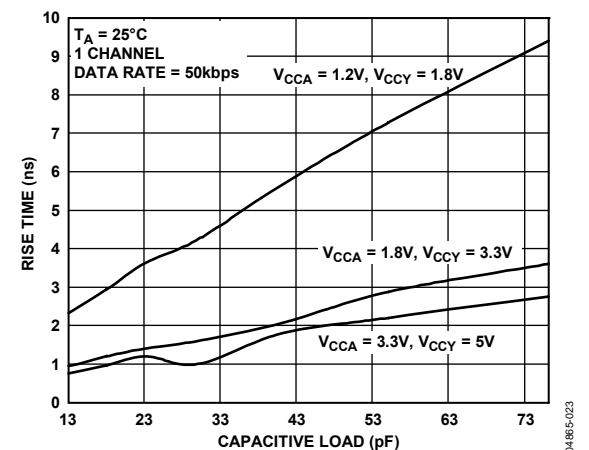


Figure 15. Rise Time vs. Capacitive Load at Pin Y (A→Y Level Translation)

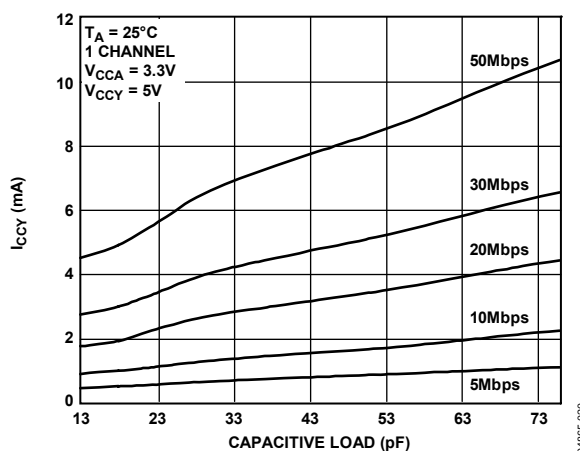


Figure 13. I_{CCY} vs. Capacitive Load at Pin Y for A→Y (3.3 V→5 V) Level Translation

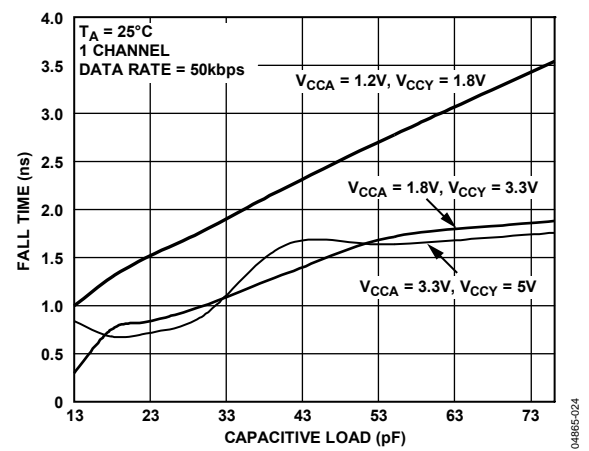


Figure 16. Fall Time vs. Capacitive Load at Pin Y (A→Y Level Translation)

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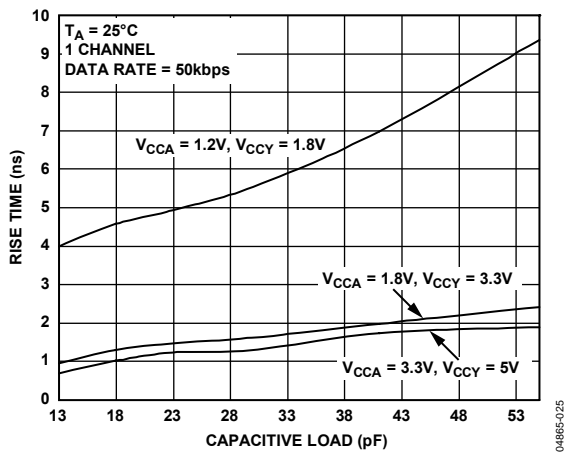


Figure 17. Rise Time vs. Capacitive Load at Pin A (Y→A Level Translation)

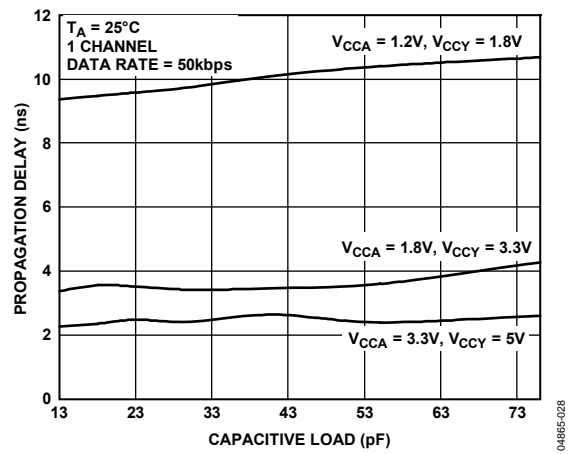


Figure 20. Propagation Delay (t_{PHL}) vs. Capacitive Load at Pin Y (A→Y Level Translation)

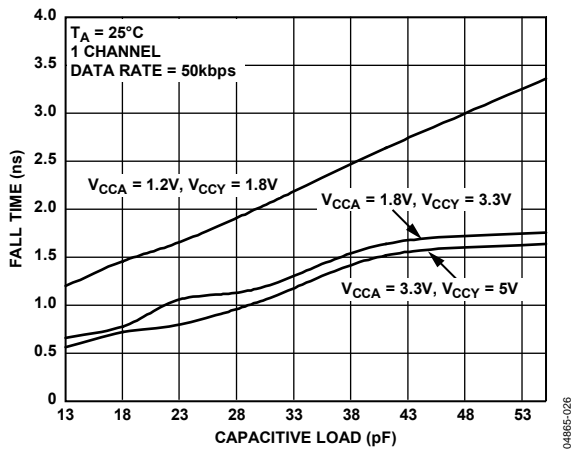


Figure 18. Fall Time vs. Capacitive Load at Pin A (Y→A Level Translation)

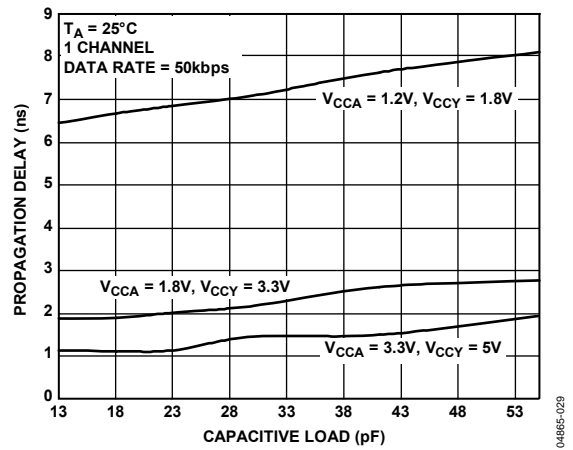


Figure 21. Propagation Delay (t_{PLH}) vs. Capacitive Load at Pin A (Y→A Level Translation)

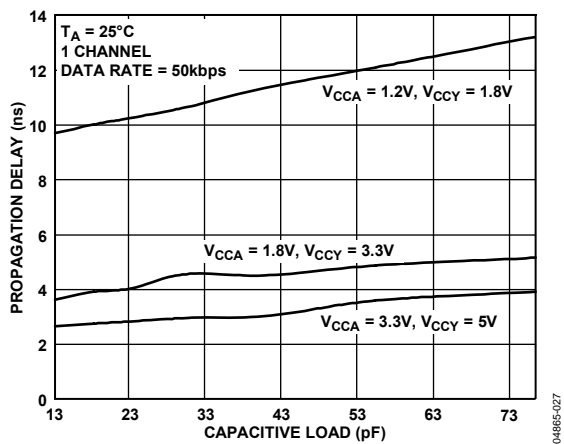


Figure 19. Propagation Delay (t_{PLH}) vs. Capacitive Load at Pin Y (A→Y Level Translation)

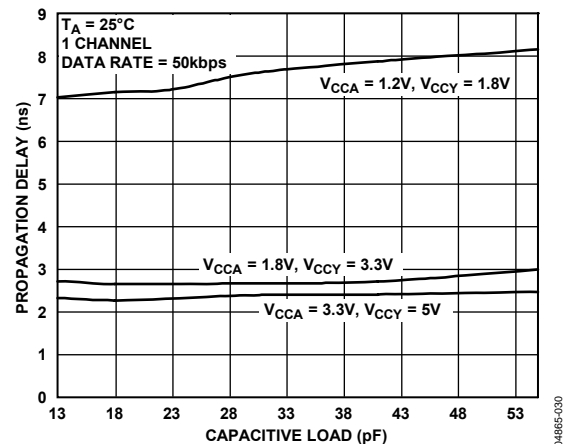


Figure 22. Propagation Delay (t_{PHL}) vs. Capacitive Load at Pin A (Y→A Level Translation)

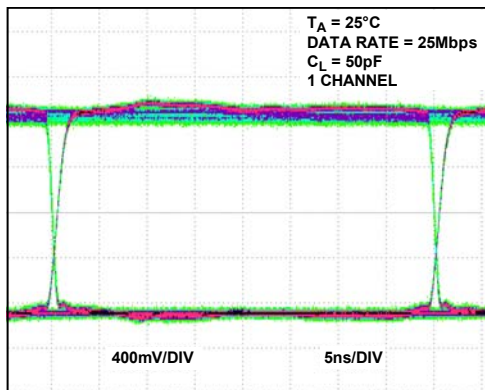


Figure 23. Eye Diagram at Y Output
(1.2 V \rightarrow 1.8 V Level Translation, 25 Mbps)

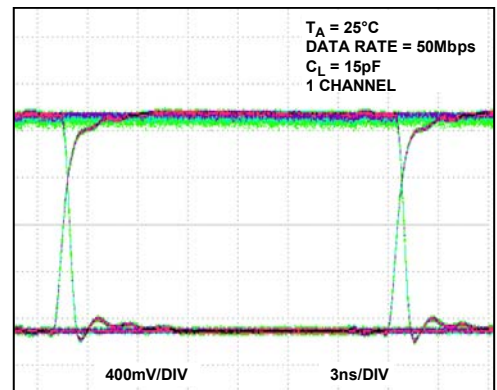


Figure 26. Eye Diagram at A Output
(3.3 V \rightarrow 1.8 V Level Translation, 50 Mbps)

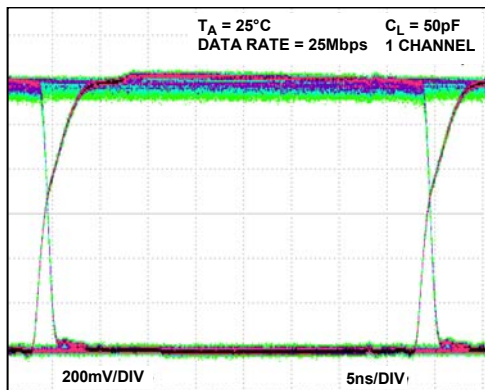


Figure 24. Eye Diagram at A Output
(1.8 V \rightarrow 1.2 V Level Translation, 25 Mbps)

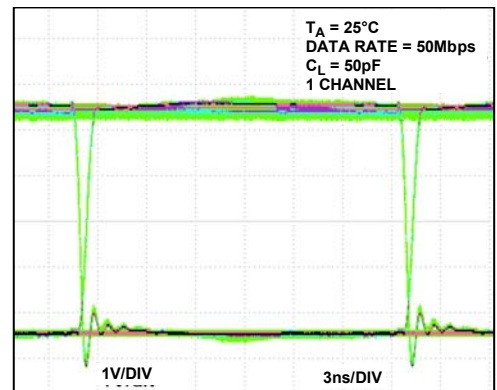


Figure 27. Eye Diagram at Y Output
(3.3 V \rightarrow 5 V Level Translation, 50 Mbps)

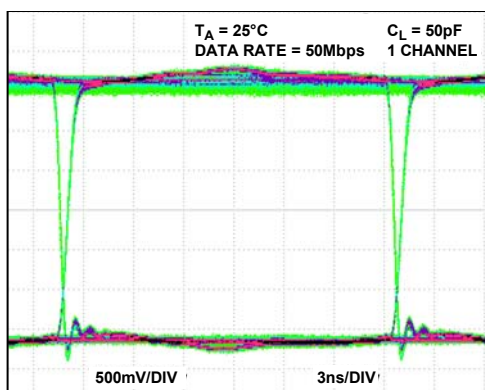


Figure 25. Eye Diagram at Y Output
(1.8 V \rightarrow 3.3 V Level Translation, 50 Mbps)

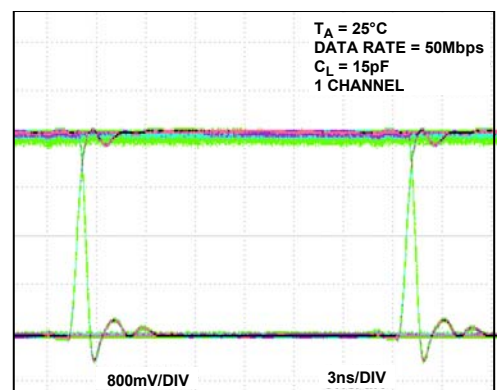


Figure 28. Eye Diagram at A Output
(5 V \rightarrow 3.3 V Level Translation, 50 Mbps)

ADG3308/ADG3308-1

TEST CIRCUITS

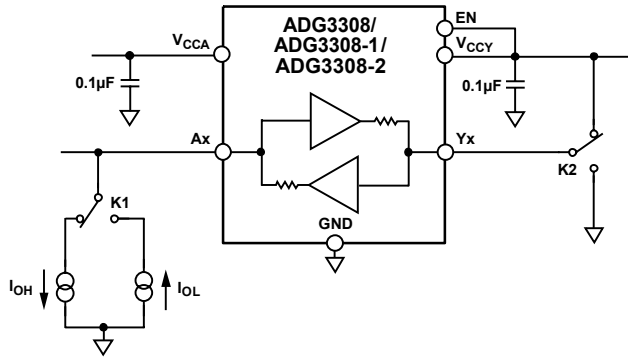


Figure 29. V_{OH}/V_{OL} Voltages at Pin A

04865-043

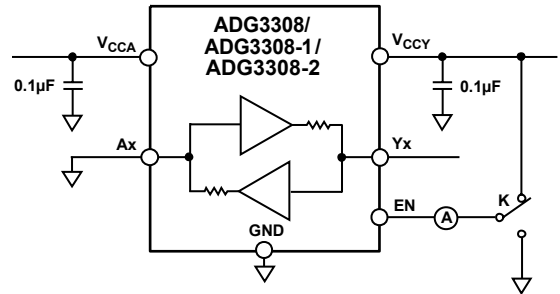


Figure 33. EN Pin Leakage Current

04865-047

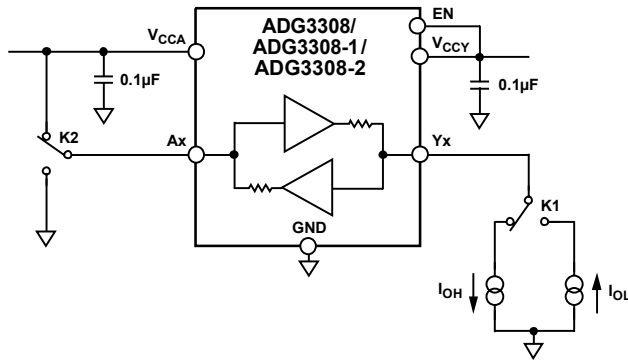


Figure 30. V_{OH}/V_{OL} Voltages at Pin Y

04865-044

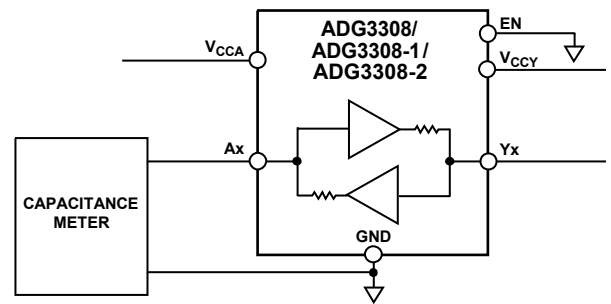


Figure 34. Capacitance at Pin A

04865-048

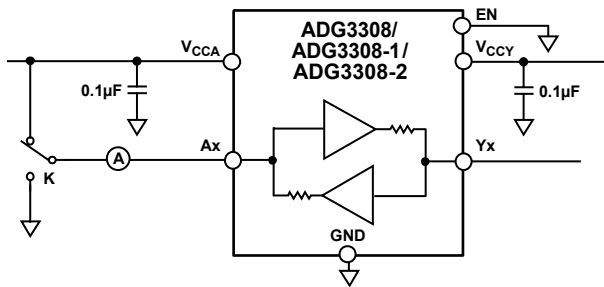


Figure 31. Three-State Leakage Current at Pin A

04865-045

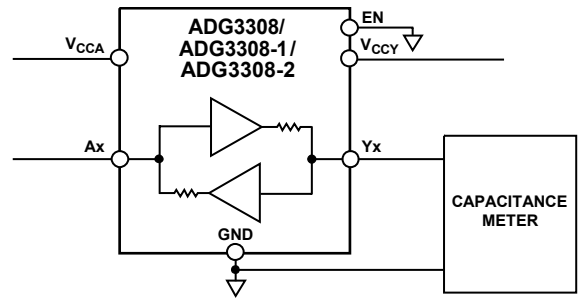


Figure 35. Capacitance at Pin Y

04865-049

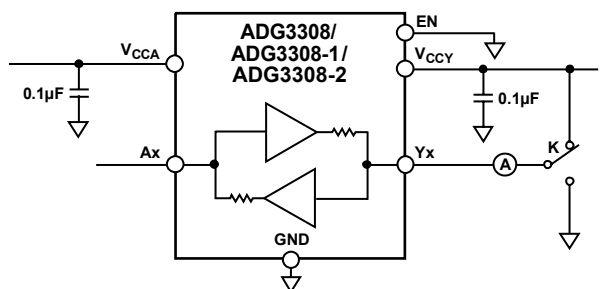


Figure 32. Three-State Leakage Current at Pin Y

04865-046

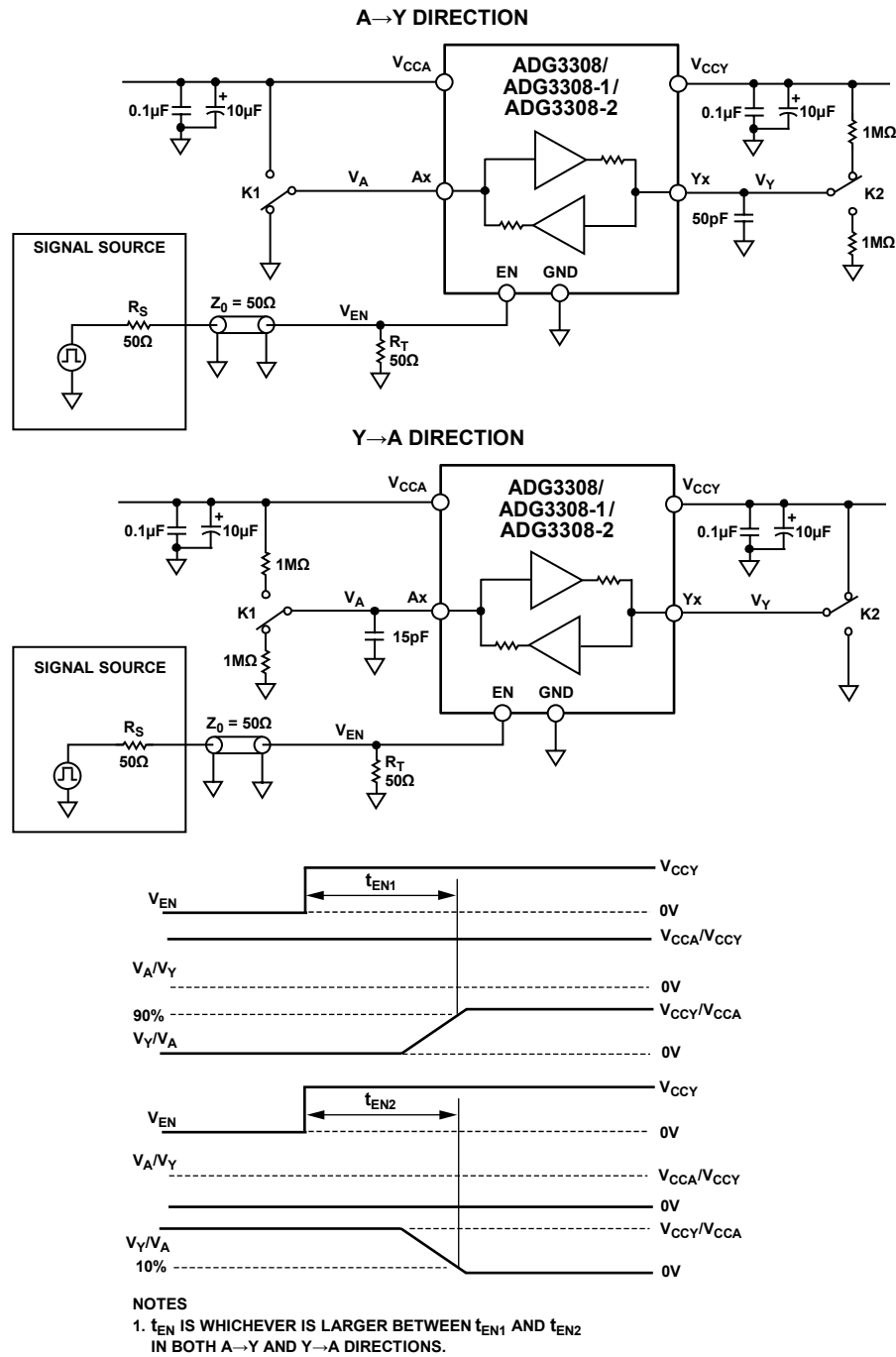


Figure 36. Enable Time

04865-050

ADG3308/ADG3308-1

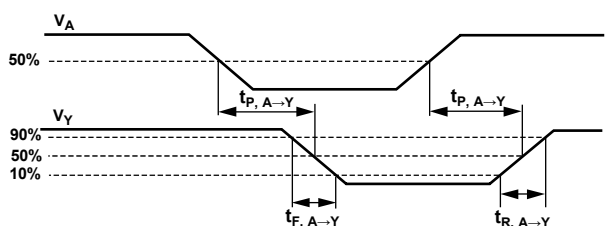
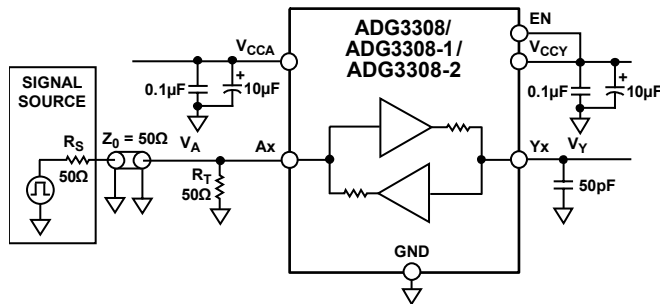


Figure 37. Switching Characteristics (A→Y Level Translation)

04865-051

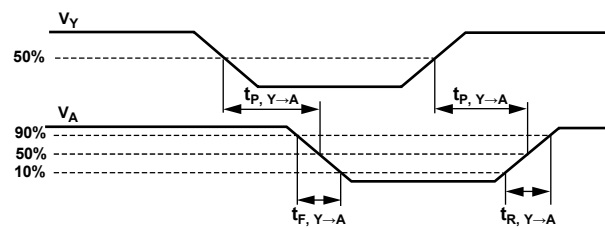
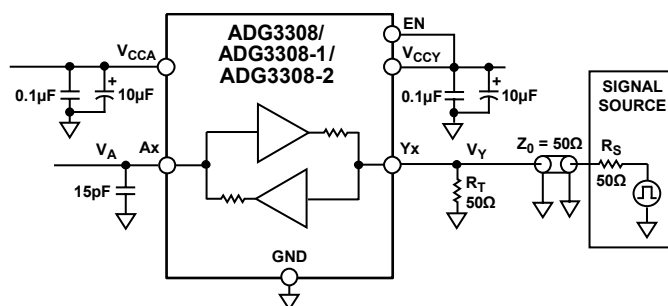


Figure 38. Switching Characteristics (Y→A Level Translation)

1007 OF 020

TERMINOLOGY

V_{IHA}

Logic input high voltage at Pin A1 to Pin A8.

V_{ILA}

Logic input low voltage at Pin A1 to Pin A8.

V_{OHA}

Logic output high voltage at Pin A1 to Pin A8.

V_{OLA}

Logic output low voltage at Pin A1 to Pin A8.

C_A

Capacitance measured at Pin A1 to Pin A8 (EN = 0).

$I_{LA, HIGH-Z}$

Leakage current at Pin A1 to Pin A8 when EN = 0 (high impedance state at Pin A1 to Pin A8).

V_{IHY}

Logic input high voltage at Pin Y1 to Pin Y8.

V_{ILY}

Logic input low voltage at Pin Y1 to Pin Y8.

V_{OHY}

Logic output high voltage at Pin Y1 to Pin Y8.

V_{OLY}

Logic output low voltage at Pin Y1 to Pin Y8.

C_Y

Capacitance measured at Pin Y1 to Pin Y8 (EN = 0).

$I_{LY, HIGH-Z}$

Leakage current at Pin Y1 to Pin Y8 when EN = 0 (high impedance state at Pin Y1 to Pin Y8).

V_{IHEN}

Logic input high voltage at the EN pin.

V_{ILEN}

Logic input low voltage at the EN pin.

C_{EN}

Capacitance measured at EN pin.

I_{LEN}

Enable (EN) pin leakage current.

t_{EN}

Three-state enable time for Pin A1 to Pin A8/Pin Y1 to Pin Y8.

$t_{R, A \rightarrow Y}$

Propagation delay when translating logic levels in the A→Y direction.

$t_{R, A \rightarrow Y}$

Rise time when translating logic levels in the A→Y direction.

$t_{F, A \rightarrow Y}$

Fall time when translating logic levels in the A→Y direction.

$D_{MAX, A \rightarrow Y}$

Guaranteed data rate when translating logic levels in the A→Y direction under the driving and loading conditions specified in Table 1.

$t_{SKEW, A \rightarrow Y}$

Difference between propagation delays on any two channels when translating logic levels in the A→Y direction.

$t_{PPSKEW, A \rightarrow Y}$

Difference in propagation delay between any one channel and the same channel on a different part (under same driving/loading conditions) when translating in the A→Y direction.

$t_{R, Y \rightarrow A}$

Propagation delay when translating logic levels in the Y→A direction.

$t_{R, Y \rightarrow A}$

Rise time when translating logic levels in the Y→A direction.

$t_{F, Y \rightarrow A}$

Fall time when translating logic levels in the Y→A direction.

$D_{MAX, Y \rightarrow A}$

Guaranteed data rate when translating logic levels in the Y→A direction under the driving and loading conditions specified in Table 1.

$t_{SKEW, Y \rightarrow A}$

Difference between propagation delays on any two channels when translating logic levels in the Y→A direction.

$t_{PPSKEW, Y \rightarrow A}$

Difference in propagation delay between any one channel and the same channel on a different part (under same driving/loading conditions) when translating in the Y→A direction.

V_{CCA}

V_{CCA} supply voltage.

V_{CCY}

V_{CCY} supply voltage.

I_{CCA}

V_{CCA} supply current.

I_{CCY}

V_{CCY} supply current.

$I_{HIGH-ZA}$

V_{CCA} supply current during three-state mode (EN = 0).

$I_{HIGH-ZY}$

V_{CCY} supply current during three-state mode (EN = 0).

DATA RATE

The maximum data rate at which the device is guaranteed to operate is a function of the V_{CCA} and V_{CCY} supply voltage combination and the load capacitance. It represents the maximum frequency of a square wave that can be applied to the I/O pins, ensuring that the device operates within the data sheet specifications in terms of output voltage (V_{OL} and V_{OH}) and power dissipation (the junction temperature does not exceed the value specified under the Absolute Maximum Ratings section). Table 5 shows the guaranteed data rates at which the ADG3308/ADG3308-1/ADG3308-2 can operate in both directions (A→Y level translation or Y→A level translation) for various V_{CCA} and V_{CCY} supply combinations.

Table 5. Guaranteed Data Rates¹

V_{CCA}	V_{CCY}			
	1.8 V (1.65 V to 1.95 V)	2.5 V (2.3 V to 2.7 V)	3.3 V (3.0 V to 3.6 V)	5 V (4.5 V to 5.5 V)
1.2 V (1.15 V to 1.3 V)	25 Mbps	30 Mbps	40 Mbps	40 Mbps
1.8 V (1.65 V to 1.95 V)		45 Mbps	50 Mbps	50 Mbps
2.5 V (2.3 V to 2.7 V)			60 Mbps	50 Mbps
3.3 V (3.0 V to 3.6 V)				50 Mbps
5 V (4.5 V to 5.5 V)				

¹ The load capacitance used is 50 pF when translating in the A→Y direction and 15 pF when translating in the Y→A direction.

ADG3308/ADG3308-1

APPLICATIONS

The ADG3308/ADG3308-1/ADG3308-2 are designed for digital circuits that operate at different supply voltages; therefore, logic level translation is required. The lower voltage logic signals are connected to the A pins, and the higher voltage logic signals to the Y pins. The ADG3308/ADG3308-1/ADG3308-2 can provide level translation in both directions (A→Y or Y→A) on all eight channels, eliminating the need for a level translator IC for each direction. The internal architecture allows the ADG3308/ADG3308-1/ADG3308-2 to perform bidirectional level translation without an additional signal to set the direction in which the translation is made. It also allows simultaneous data flow in both directions on the same part, for example, when two channels translate in the A→Y direction while the other two translate in the Y→A direction. This simplifies the design by eliminating the timing requirements for the direction signal and reduces the number of ICs used for level translation.

Figure 40 shows an application where a 3.3 V microprocessor can read or write data to and from a 1.8 V peripheral device using an 8-bit bus.

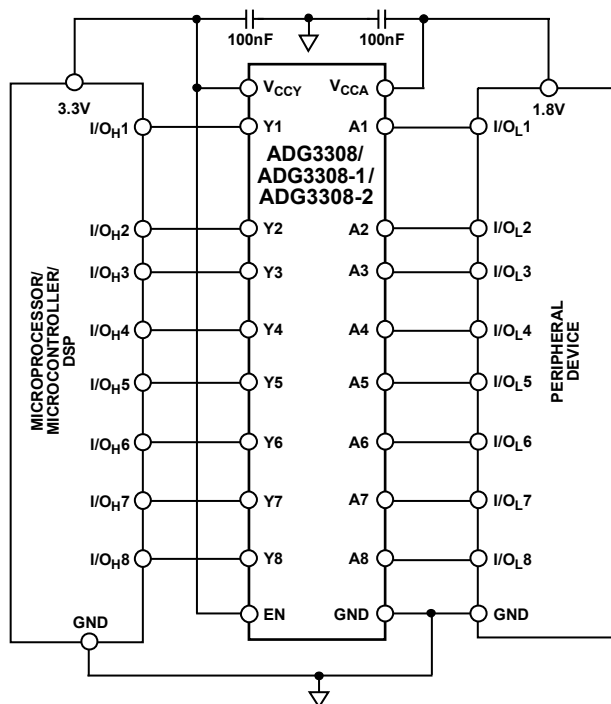


Figure 40. 1.8 V to 3.3 V 8-Bit Level Translation Circuit

When the application requires level translation between a microprocessor and multiple peripheral devices, the ADG3308/ADG3308-1/ADG3308-2 I/O pins can be three-stated by setting EN = 0. This feature allows the ADG3308/ADG3308-1/ADG3308-2 to share the data buses with other devices without causing contention issues. Figure 41 shows an application where a 3.3 V microprocessor is connected to 1.8 V peripheral devices using the three-state feature.

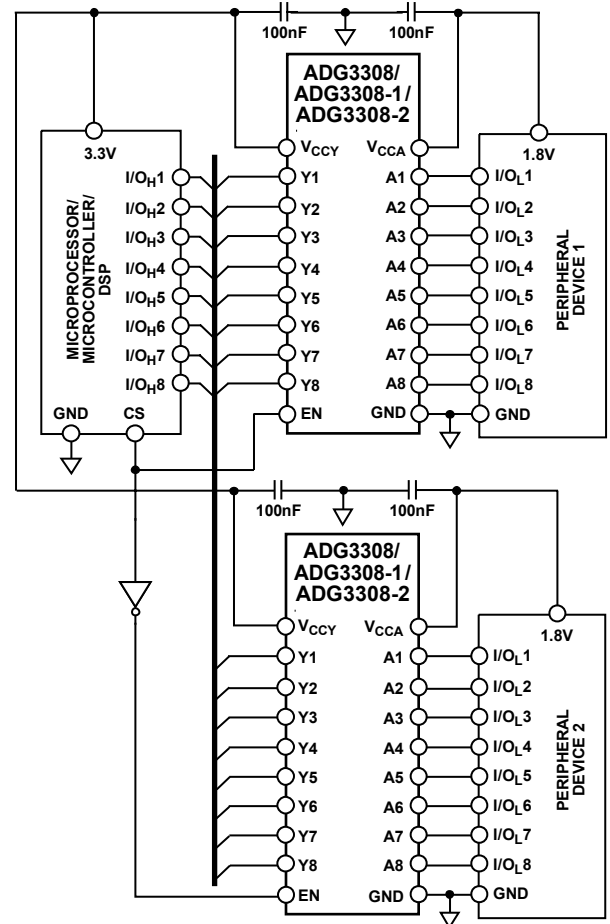
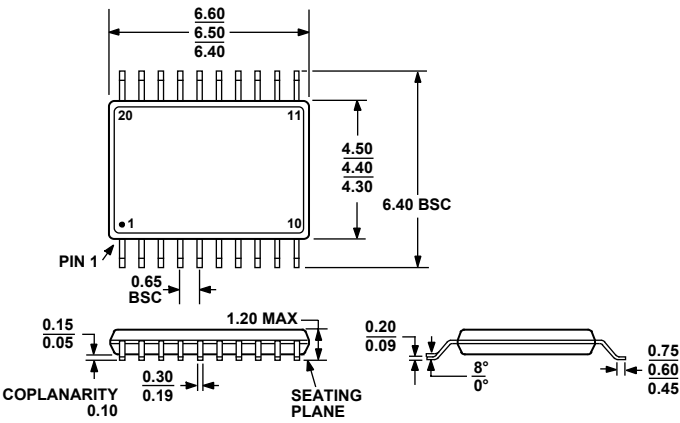


Figure 41. 1.8 V to 3.3 V Level Translation Circuit Using the Three-State Feature

LAYOUT GUIDELINES

As with any high speed digital IC, the printed circuit board layout is important in the overall performance of the circuit. Care should be taken to ensure proper power supply bypass and return paths for the high speed signals. Each V_{CC} pin (V_{CCA} and V_{CCY}) should be bypassed using low effective series resistance (ESR) and effective series inductance (ESI) capacitors placed as close as possible to the V_{CCA} and V_{CCY} pins. The parasitic inductance of the high speed signal track can cause significant overshoot. This effect can be reduced by keeping the length of the tracks as short as possible. A solid copper plane for the return path (GND) is also recommended.

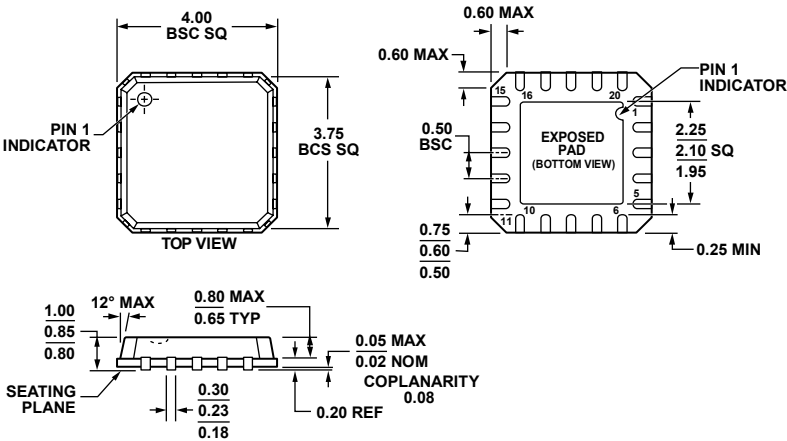
OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS MO-153-AC

Figure 42. 20-Lead Thin Shrink Small Outline Package [TSSOP]
(RU-20)

Dimensions shown in millimeters



COMPLIANT TO JEDEC STANDARDS MO-220-VGGD-1

Figure 43. 20-Lead Lead Frame Chip Scale Package [LFCSP_VQ]
4 mm x 4 mm Body, Very Thin Quad
(CP-20-1)

Dimensions shown in millimeters

082207/B

ADG3308/ADG3308-1

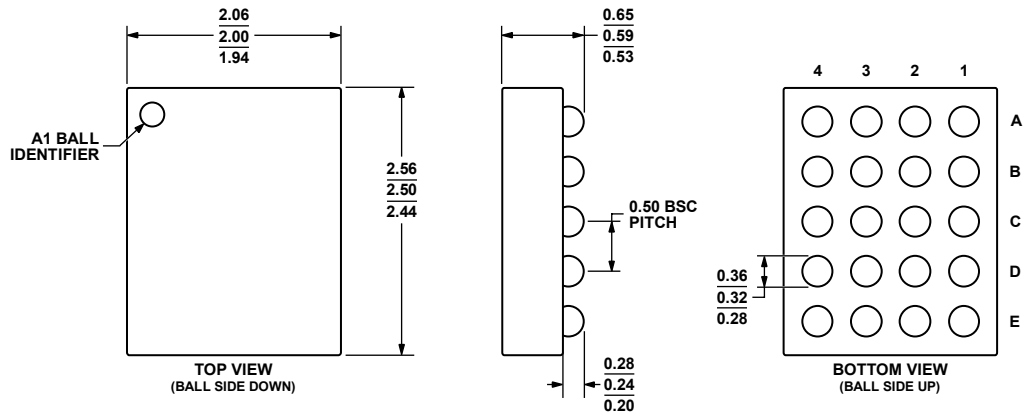


Figure 44. 20-Ball Wafer Level Chip Scale Package [WLCSP]
(CB-20-2)

Dimensions shown in millimeters

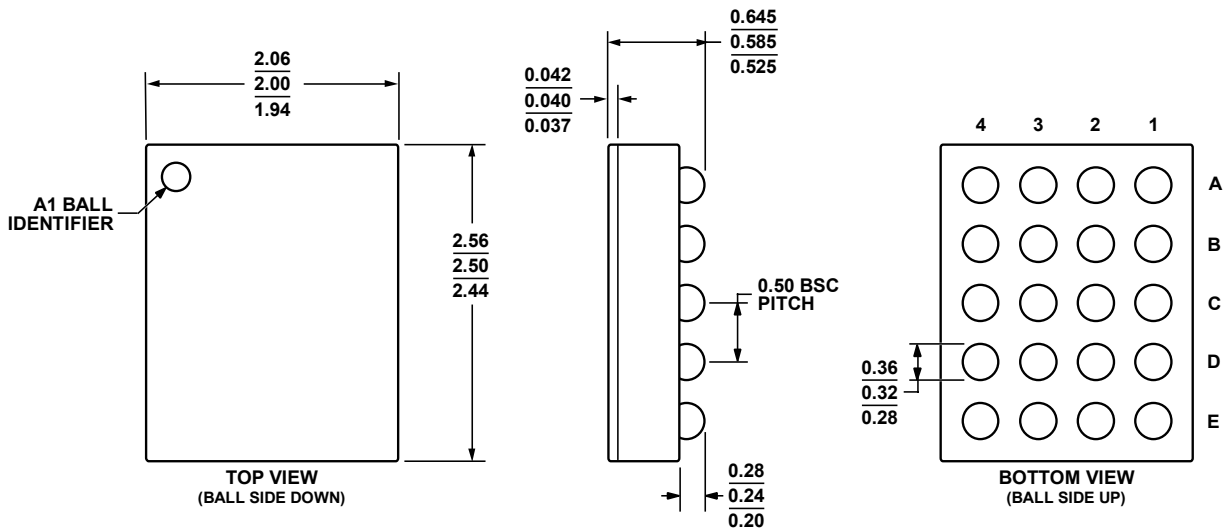


Figure 45. Backside-Coated 20-Ball Wafer Level Chip Scale Package [WLCSP]
(CB-20-3)

Dimensions shown in millimeters

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
ADG3308BRUZ ¹	–40°C to +85°C	20-Lead Thin Shrink Small Outline Package [TSSOP]	RU-20
ADG3308BRUZ-REEL ¹	–40°C to +85°C	20-Lead Thin Shrink Small Outline Package [TSSOP]	RU-20
ADG3308BRUZ-REEL7 ¹	–40°C to +85°C	20-Lead Thin Shrink Small Outline Package [TSSOP]	RU-20
ADG3308BCPZ-REEL ¹	–40°C to +85°C	20-Lead Lead Frame Chip Scale Package [LFCSP_VQ]	CP-20-1
ADG3308BCPZ-REEL7 ¹	–40°C to +85°C	20-Lead Lead Frame Chip Scale Package [LFCSP_VQ]	CP-20-1
ADG3308BCBZ-1-RL7 ¹	–40°C to +85°C	20-Ball Wafer Level Chip Scale Package [WLCSP]	CB-20-2
ADG3308BCBZ-1-REEL ¹	–40°C to +85°C	20-Ball Wafer Level Chip Scale Package [WLCSP]	CB-20-2
ADG3308BCBZ-2-RL7 ¹	–40°C to +85°C	Backside-Coated 20-Ball Wafer Level Chip Scale Package [WLCSP]	CB-20-3
ADG3308BCBZ-2-REEL ¹	–40°C to +85°C	Backside-Coated 20-Ball Wafer Level Chip Scale Package [WLCSP]	CB-20-3

¹ Z = RoHS Compliant Part.