Low Voltage 1.15 V to 5.5 V, Single-Channel Bidirectional Logic Level Translator

ADG3301

FEATURES

Bidirectional level translation
Operates from 1.15 V to 5.5 V
Low quiescent current < 5 µA
No direction pin

APPLICATIONS

SPI®, MICROWIRE® level translation
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

FUNCTIONAL BLOCK DIAGRAM

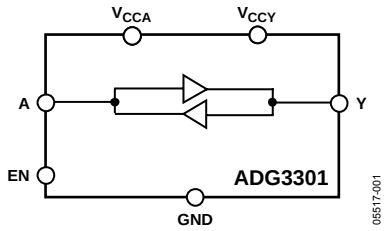

Figure 1.

GENERAL DESCRIPTION

The ADG3301 is a single-channel, bidirectional logic level translator. It can be used in multivoltage digital system applications such as data transfer between a low voltage DSP/controller and a higher voltage device. The internal architecture allows the device to perform bidirectional logic 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, while 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 pin appear as V_{CCY}-compatible levels on the Y pin. Similarly, V_{CCY}-compatible logic levels applied to the Y pin appear as V_{CCA}-compatible logic levels on the A pin. The enable pin (EN) provides three-state operation on both the A pin and the Y pin. When the device enable pin is pulled low, the terminals on both sides of the device are in the high impedance state. The EN pin is referred to the V_{CCA} supply voltage and driven high for normal operation.

The ADG3301 is available in a compact 6-lead SC70 package and is guaranteed to operate over the 1.15 V to 5.5 V supply voltage range and extended −40°C to +85°C temperature range.

PRODUCT HIGHLIGHTS

1. Bidirectional level translation.
2. Fully guaranteed over the 1.15 V to 5.5 V supply range.
3. No direction pin.
4. Compact 6-lead SC70 package.

Rev. 0

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

TABLE OF CONTENTS

REVISION HISTORY

12/05—Revision 0: Initial Version

SPECIFICATIONS

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

Table 1.

Parameter[1]	Symbol	Conditions	Min	Typ[2]	Max	Unit
LOGIC INPUTS/OUTPUTS						
A Side						
Input High Voltage[3]	V_{IHA}	V_{CCA} = 1.15 V	V_{CCA} − 0.3			V
	V_{IHA}	V_{CCA} = 1.2 V to 5.5 V	0.65 × V_{CCA}			
Input Low Voltage[3]	V_{ILA}				0.35 × V_{CCA}	V
Output High Voltage	V_{OHA}	V_Y = V_{CCY}, I_{OH} = 20 µA, see Figure 27	V_{CCA} − 0.4			V
Output Low Voltage	V_{OLA}	V_Y = 0 V, I_{OL} = 20 µA, see Figure 27			0.4	V
Capacitance[3]	C_A	f = 1 MHz, EN = 0, see Figure 32		9		pF
Leakage Current	$I_{LA, HiZ}$	V_A = 0 V/V_{CCA}, EN = 0, see Figure 29			±1	µA
Y Side						
Input High Voltage[3]	V_{IHY}		0.65 × V_{CCY}			V
Input Low Voltage[3]	V_{ILY}				0.35 × V_{CCY}	V
Output High Voltage	V_{OHY}	V_A = V_{CCA}, I_{OH} = 20 µA, see Figure 28	V_{CCY} − 0.4			V
Output Low Voltage	V_{OLY}	V_A = 0 V, I_{OL} = 20 µA, see Figure 28			0.4	V
Capacitance[3]	C_Y	f = 1 MHz, EN = 0, see Figure 33		6		pF
Leakage Current	$I_{LY, HiZ}$	V_Y = 0 V/V_{CCY}, EN = 0, see Figure 30			±1	µA
Enable (EN)						
Input High Voltage[3]	V_{IHEN}	V_{CCA} = 1.15 V	V_{CCA} − 0.3			V
	V_{IHEN}	V_{CCA} = 1.2 V to 5.5 V	0.65 × V_{CCA}			V
Input Low Voltage[3]	V_{ILEN}				0.35 × V_{CCA}	V
Leakage Current	I_{LEN}	V_{EN} = 0 V/V_{CCA}, V_A = 0 V, see Figure 31			±1	µA
Capacitance[3]	C_{EN}			3		pF
Enable Time[3]	t_{EN}	R_S = R_T = 50 Ω, V_A = 0 V/V_{CCA} (A→Y), V_Y = 0 V/V_{CCY} (Y→A), see Figure 34		1	1.8	µs
SWITCHING CHARACTERISTICS[3]						
3.3 V ± 0.3 V ≤ V_{CCA} ≤ V_{CCY}, V_{CCY} = 5 V ± 0.5 V						
A→Y Level Translation		R_S = R_T = 50 Ω, C_L = 50 pF, see Figure 35				
Propagation Delay	$t_{P, A→Y}$			6	10	ns
Rise Time	$t_{R, A→Y}$			2	3.5	ns
Fall Time	$t_{F, A→Y}$			2	3.5	ns
Maximum Data Rate	$D_{MAX, A→Y}$		50			Mbps
Part-to-Part Skew	$t_{PPSKEW, A→Y}$				3	ns
Y→A Level Translation		R_S = R_T = 50 Ω, C_L = 15 pF, see Figure 36				
Propagation Delay	$t_{P, Y→A}$			4	7	ns
Rise Time	$t_{R, Y→A}$			1	3	ns
Fall Time	$t_{F, Y→A}$			3	7	ns
Maximum Data Rate	$D_{MAX, Y→A}$		50			Mbps
Part-to-Part Skew	$t_{PPSKEW, Y→A}$				2	ns
1.8 V ± 0.15 V ≤ V_{CCA} ≤ V_{CCY}, V_{CCY} = 3.3 V ± 0.3 V						
A→Y Translation		R_S = R_T = 50 Ω, C_L = 50 pF, see Figure 35				
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	$D_{MAX, A→Y}$		50			Mbps
Part-to-Part Skew	$t_{PPSKEW, A→Y}$				4	ns

Parameter[1]	Symbol	Conditions	Min	Typ[2]	Max	Unit
Y→A Translation		$R_S = R_T = 50\ \Omega$, $C_L = 15$ pF, see Figure 36				
Propagation Delay	$t_{P,Y\rightarrow A}$			5	8	ns
Rise Time	$t_{R,Y\rightarrow A}$			2	3.5	ns
Fall Time	$t_{F,Y\rightarrow A}$			2	3.5	ns
Maximum Data Rate	$D_{MAX,Y\rightarrow A}$		50			Mbps
Part-to-Part Skew	$t_{PPSKEW,Y\rightarrow A}$				3	ns
1.15 V to 1.3 V ≤ V_{CCA} ≤ V_{CCY}, V_{CCY} = 3.3 V ± 0.3 V						
A→Y Translation		$R_S = R_T = 50\ \Omega$, $C_L = 50$ pF, see Figure 35				
Propagation Delay	$t_{P,A\rightarrow Y}$			9	18	ns
Rise Time	$t_{R,A\rightarrow Y}$			3	5	ns
Fall Time	$t_{F,A\rightarrow Y}$			2	5	ns
Maximum Data Rate	$D_{MAX,A\rightarrow Y}$		40			Mbps
Part-to-Part Skew	$t_{PPSKEW,A\rightarrow Y}$				10	ns
Y→A Translation		$R_S = R_T = 50\ \Omega$, $C_L = 15$ pF, see Figure 36				
Propagation Delay	$t_{P,Y\rightarrow A}$			5	9	ns
Rise Time	$t_{R,Y\rightarrow A}$			2	4	ns
Fall Time	$t_{F,Y\rightarrow A}$			2	4	ns
Maximum Data Rate	$D_{MAX,Y\rightarrow A}$		40			Mbps
Part-to-Part Skew	$t_{PPSKEW,Y\rightarrow A}$				4	ns
1.15 V to 1.3 V ≤ V_{CCA} ≤ V_{CCY}, V_{CCY} = 1.8 V ± 0.3 V						
A→Y Translation		$R_S = R_T = 50\ \Omega$, $C_L = 50$ pF, see Figure 35				
Propagation Delay	$t_{P,A\rightarrow Y}$			12	25	ns
Rise Time	$t_{R,A\rightarrow Y}$			7	12	ns
Fall Time	$t_{F,A\rightarrow Y}$			3	5	ns
Maximum Data Rate	$D_{MAX,A\rightarrow Y}$		25			Mbps
Part-to-Part Skew	$t_{PPSKEW,A\rightarrow Y}$				15	ns
Y→A Translation		$R_S = R_T = 50\ \Omega$, $C_L = 15$ pF, see Figure 36				
Propagation Delay	$t_{P,Y\rightarrow A}$			14	35	ns
Rise Time	$t_{R,Y\rightarrow A}$			5	16	ns
Fall Time	$t_{F,Y\rightarrow A}$			2.5	6.5	ns
Maximum Data Rate	$D_{MAX,Y\rightarrow A}$		25			Mbps
Part-to-Part Skew	$t_{PPSKEW,Y\rightarrow A}$				23.5	ns
2.5 V ± 0.2 V ≤ V_{CCA} ≤ V_{CCY}, V_{CCY} = 3.3 V ± 0.3 V						
A→Y Translation		$R_S = R_T = 50\ \Omega$, $C_L = 50$ pF, see Figure 35				
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
Part-to-Part Skew	$t_{PPSKEW,A\rightarrow Y}$				4	ns
Y→A Translation		$R_S = R_T = 50\ \Omega$, $C_L = 15$ pF, see Figure 36				
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
Part-to-Part Skew	$t_{PPSKEW,Y\rightarrow A}$				3	ns

Parameter[1]	Symbol	Conditions	Min	Typ[2]	Max	Unit
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}	$V_A = 0$ V/V_{CCA}, $V_Y = 0$ V/V_{CCY}, $V_{CCA} = V_{CCY} = 5.5$ V, EN = 1		0.17	5	µA
	I_{CCY}	$V_A = 0$ V/V_{CCA}, $V_Y = 0$ V/V_{CCY}, $V_{CCA} = V_{CCY} = 5.5$ V, EN = 1		0.27	5	µA
Three-State Mode Power Supply Current	I_{HiZA}	$V_{CCA} = V_{CCY} = 5.5$ V, EN = 0		0.1	5	µA
	I_{HiZY}	$V_{CCA} = V_{CCY} = 5.5$ V, EN = 0		0.1	5	µA

[1] Temperature range for the B version is −40°C to +85°C.
[2] All typical values are at T_A = 25°C, unless otherwise noted.
[3] Guaranteed by design, not subject to production test.

ABSOLUTE MAXIMUM RATINGS

T_A = 25°C, unless otherwise noted.

Table 2.

Parameter	Rating
V_{CCA} to GND	−0.3 V to +7 V
V_{CCY} to GND	V_{CCA} to +7 V
Digital Inputs (A)	−0.3 V to V_{CCA} + 0.3 V
Digital Inputs (Y)	−0.3 V to V_{CCY} + 0.3 V
EN to GND	−0.3 V to +7 V
Operating Temperature Range	
Industrial (B Version)	−40°C to +85°C
Storage Temperature Range	−65°C to +150°C
Junction Temperature	150°C
θ_{JA} Thermal Impedance (4-Layer Board)	
6-Lead SC70	494.1°C/W
Lead Temperature, Soldering (10 sec)	300°C
IR Reflow, Peak Temperature (< 20 sec)	260(+0/−5)°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 listed in the operational sections 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. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although this product features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

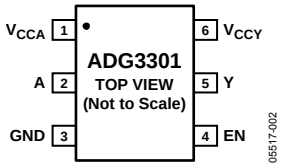

Figure 2. Pin Configuration

Table 3. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	V_{CCA}	Power Supply Voltage Input for the A I/O Pin (1.15 V ≤ V_{CCA} ≤ V_{CCY}).
2	A	Input/Output A. Referenced to V_{CCA}.
3	GND	Ground (0 V).
4	EN	Active High Enable Input.
5	Y	Input/Output Y. Referenced to V_{CCY}.
6	V_{CCY}	Power Supply Voltage Input for the Y I/O Pin (1.65 V ≤ V_{CCY} ≤ 5.5V).

TYPICAL PERFORMANCE CHARACTERISTICS

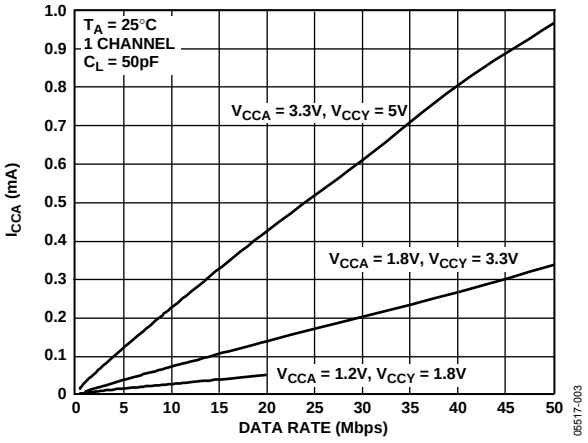

Figure 3. I_{CCA} vs. Data Rate (A→Y Level Translation)

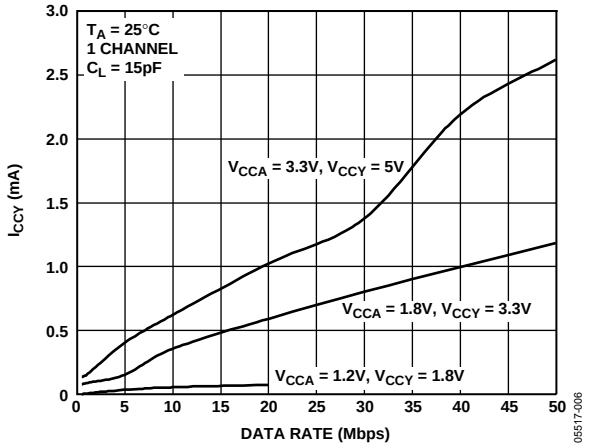

Figure 6. I_{CCY} vs. Data Rate (Y→A Level Translation)

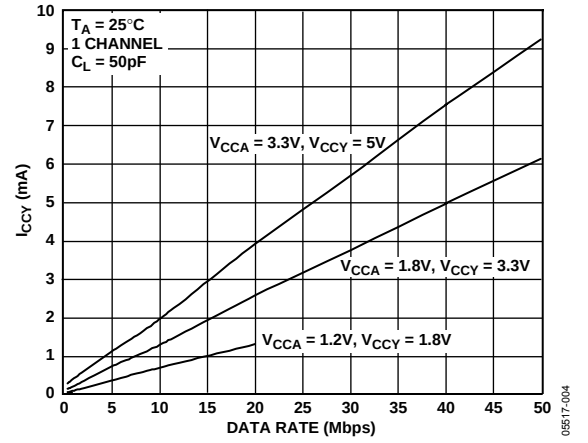

Figure 4. I_{CCY} vs. Data Rate (A→Y Level Translation)

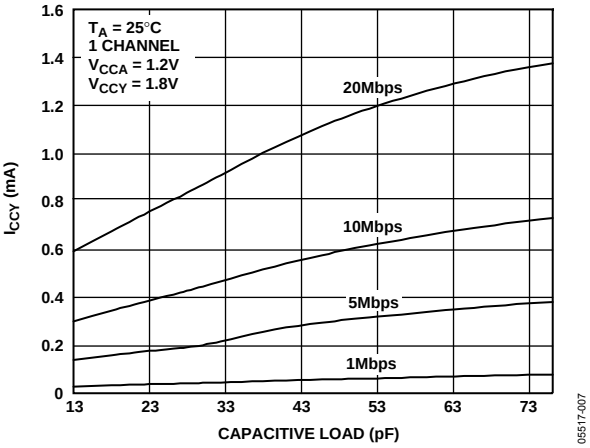

Figure 7. I_{CCY} vs. Capacitive Load at Pin Y for A→Y (1.2 V→1.8 V) Level Translation

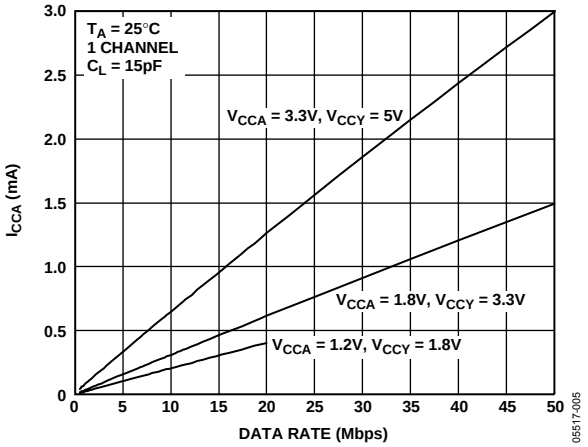

Figure 5. I_{CCA} vs. Data Rate (Y→A Level Translation)

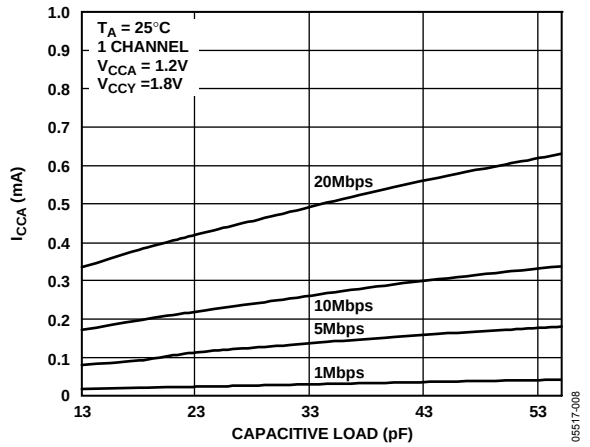

Figure 8. I_{CCA} vs. Capacitive Load at Pin A for Y→A (1.8 V→1.2 V) Level Translation

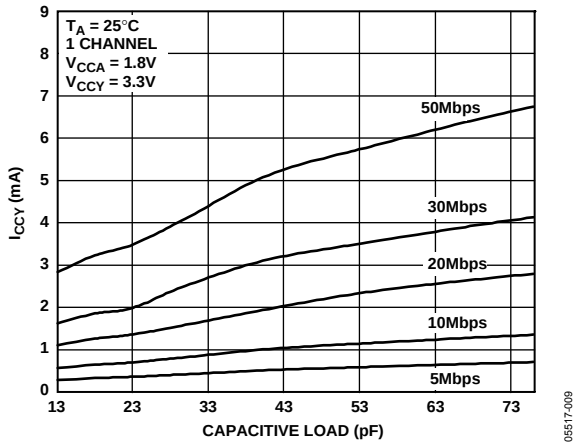

Figure 9. I_{CCY} vs. Capacitive Load at Pin Y for A→Y (1.8 V→3.3 V) Level Translation

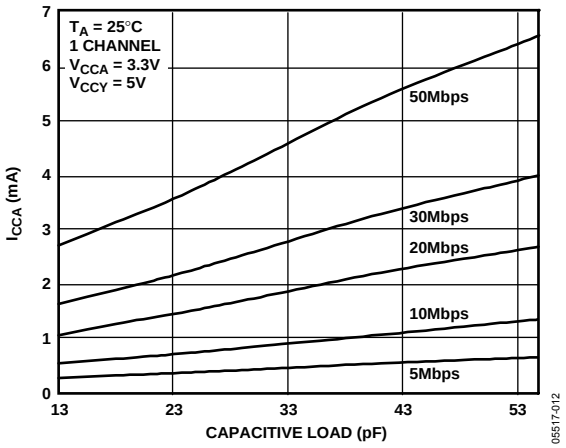

Figure 12. I_{CCA} vs. Capacitive Load at Pin A for Y→A (5 V→3.3 V) Level Translation

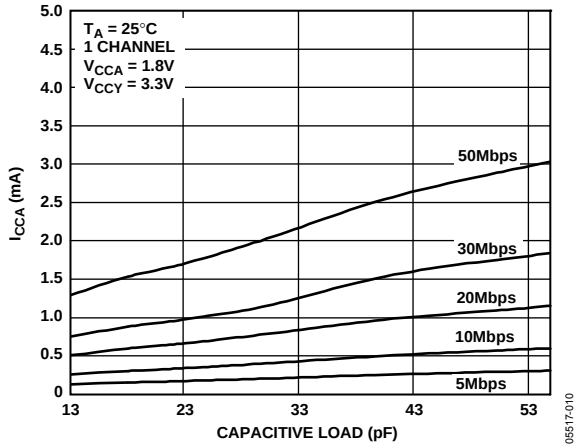

Figure 10. I_{CCA} vs. Capacitive Load at Pin A for Y→A (3.3 V→1.8 V) Level Translation

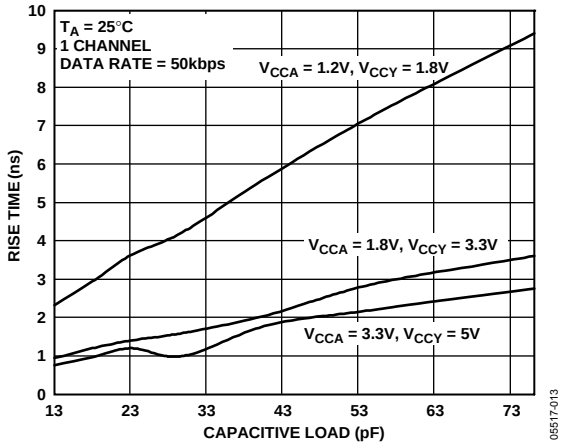

Figure 13. Rise Time vs. Capacitive Load at Pin Y (A→Y Level Translation)

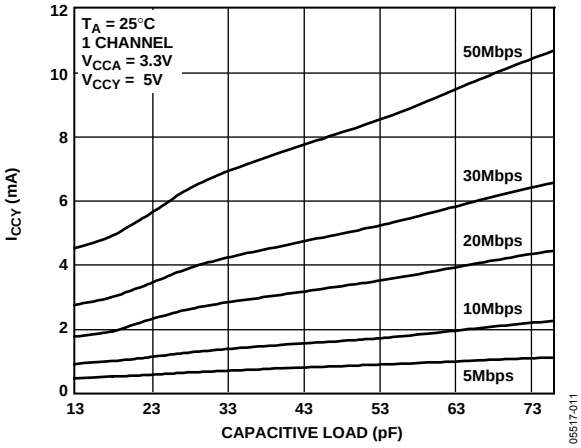

Figure 11. I_{CCY} vs. Capacitive Load at Pin Y for A→Y (3.3 V→5 V) Level Translation

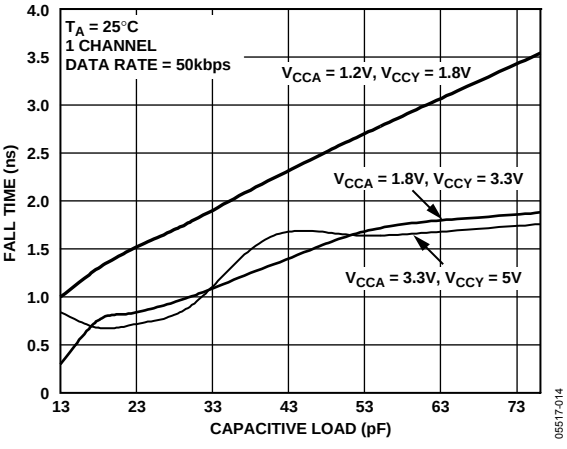

Figure 14. Fall Time vs. Capacitive Load at Pin Y (A→Y Level Translation)

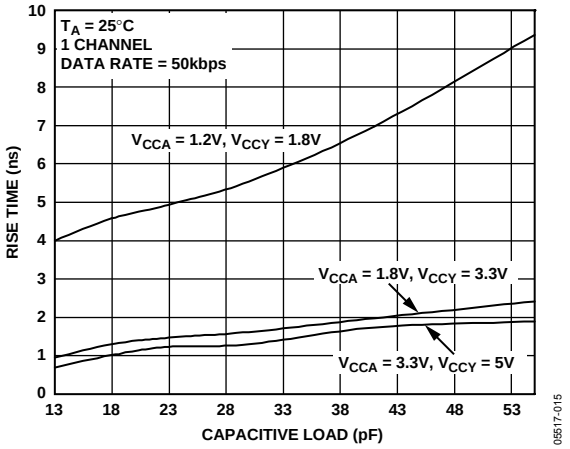

Figure 15. Rise Time vs. Capacitive Load at Pin A (Y→A Level Translation)

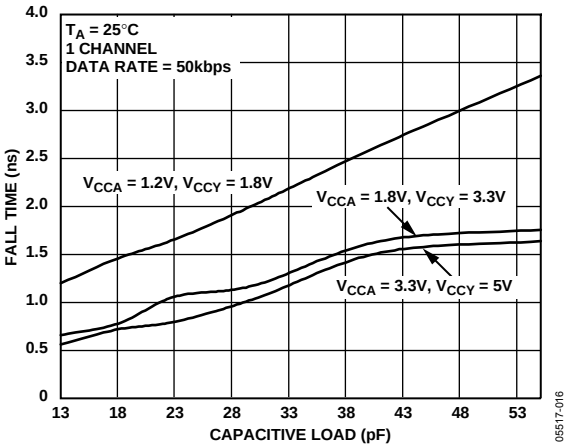

Figure 16. Fall Time vs. Capacitive Load at Pin A (Y→A Level Translation)

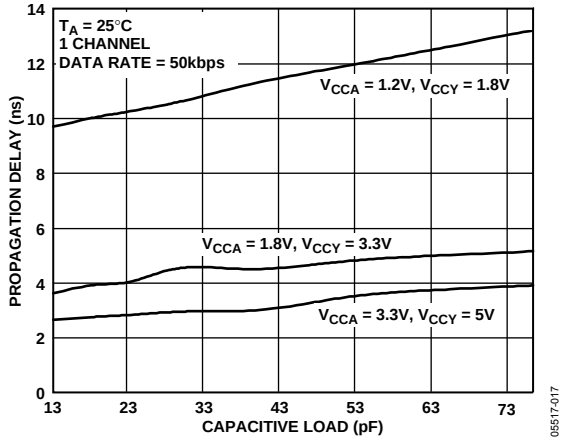

Figure 17. Propagation Delay (t_{PLH}) vs. Capacitive Load at Pin Y (A→Y Level Translation)

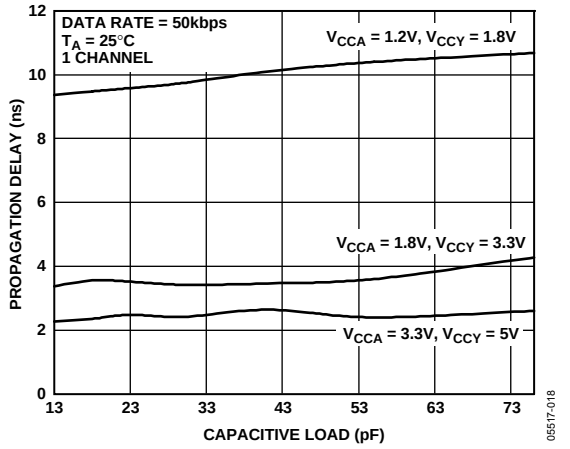

Figure 18. Propagation Delay (t_{PHL}) vs. Capacitive Load at Pin Y (A→Y Level Translation)

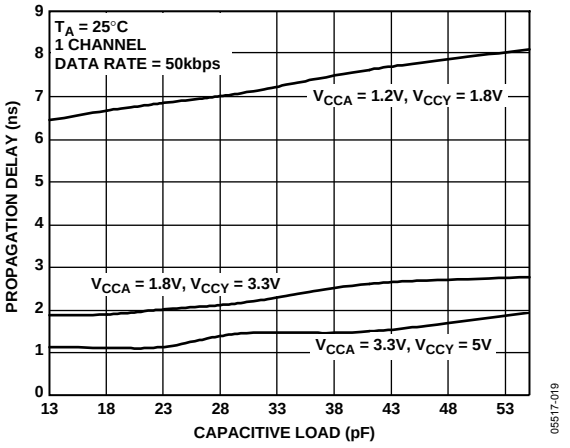

Figure 19. Propagation Delay (t_{PLH}) vs. Capacitive Load at Pin A (Y→A Level Translation)

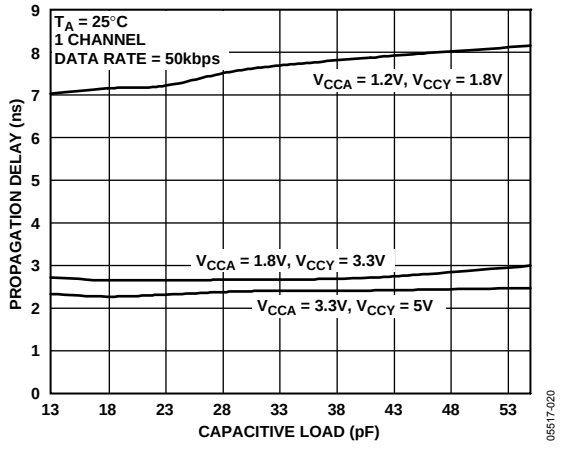

Figure 20. Propagation Delay (t_{PHL}) vs. Capacitive Load at Pin A (Y→A Level Translation)

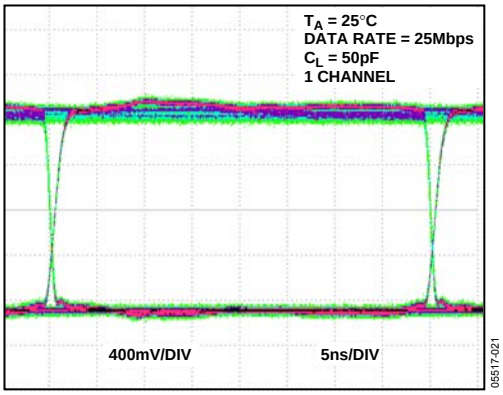

Figure 21. Eye Diagram at Y Output
(1.2 V to 1.8 V Level Translation, 25 Mbps)

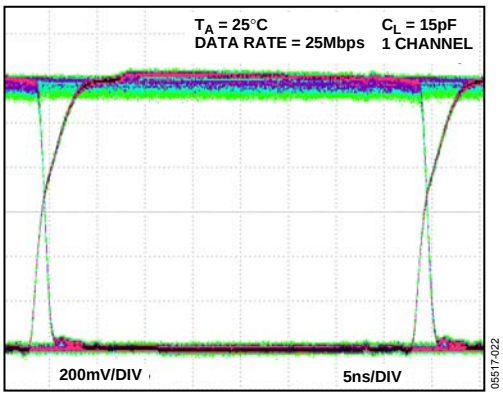

Figure 22. Eye Diagram at A Output
(1.8 V to 1.2 V Level Translation, 25 Mbps)

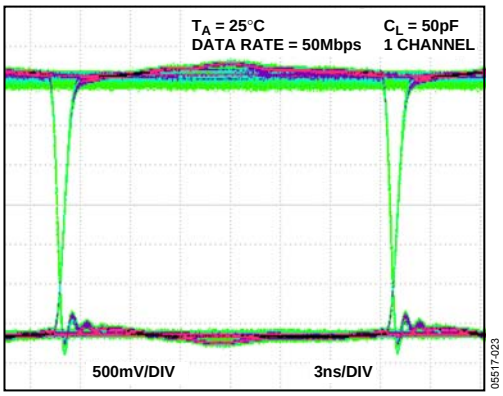

Figure 23. Eye Diagram at Y Output
(1.8 V to 3.3 V Level Translation, 50 Mbps)

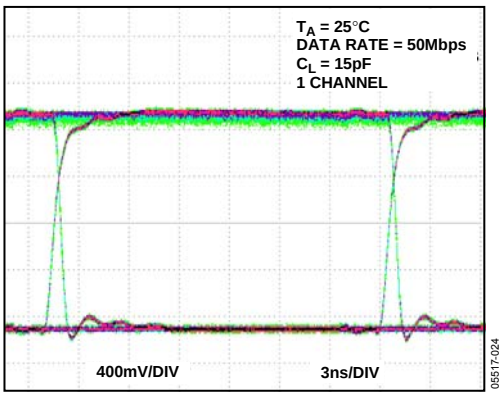

Figure 24. Eye Diagram at A Output
(3.3 V to 1.8 V Level Translation, 50 Mbps)

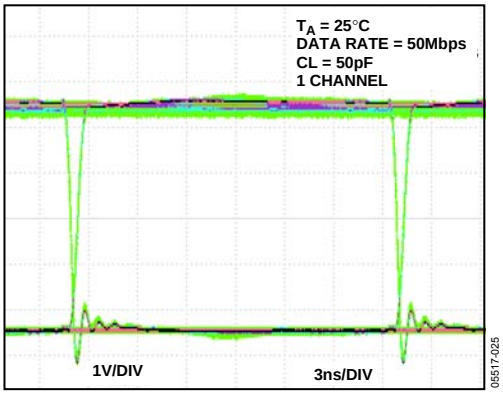

Figure 25. Eye Diagram at Y Output
(3.3 V to 5 V Level Translation, 50 Mbps)

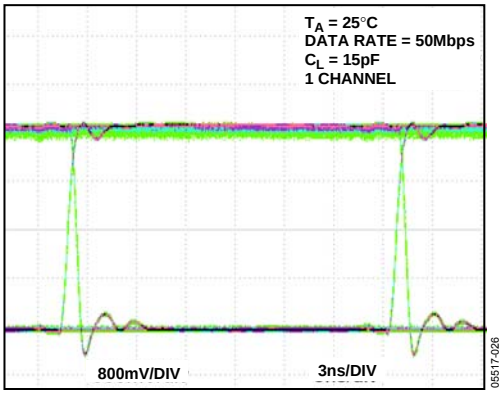

Figure 26. Eye Diagram at A Output
(5 V to 3.3 V Level Translation, 50 Mbps)

TEST CIRCUITS

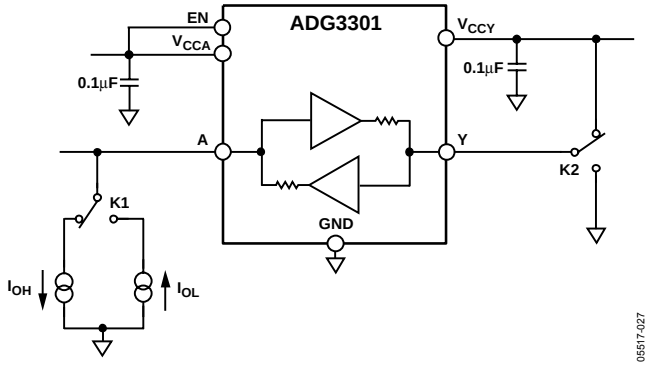

Figure 27. V_{OH}/V_{OL} Voltages at Pin A

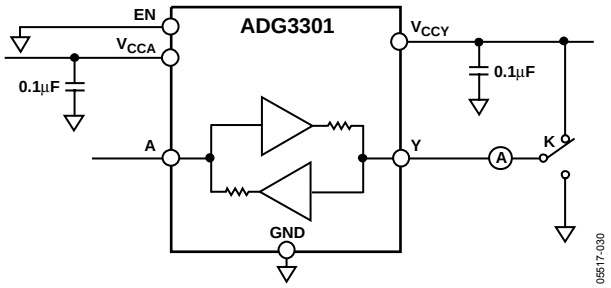

Figure 30. Three-State Leakage Current at Pin Y

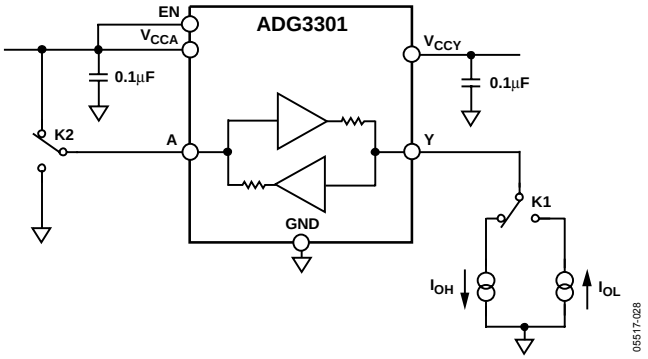

Figure 28. V_{OH}/V_{OL} Voltages at Pin Y

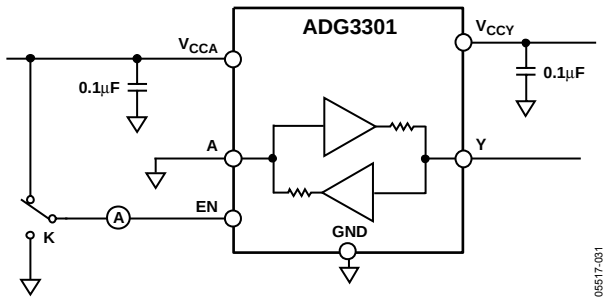

Figure 31. EN Pin Leakage Current

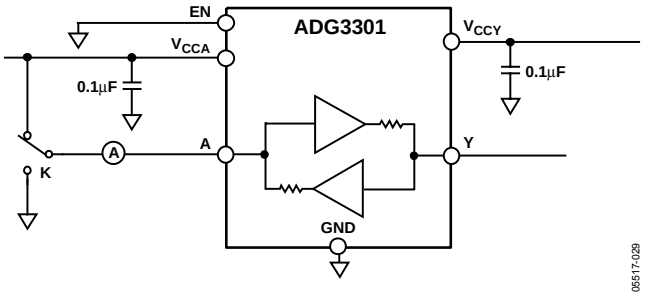

Figure 29. Three-State Leakage Current at Pin A

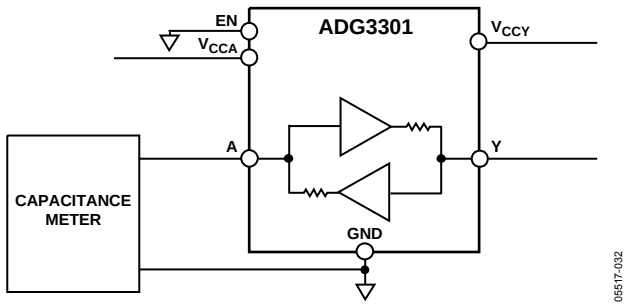

Figure 32. Capacitance at Pin A

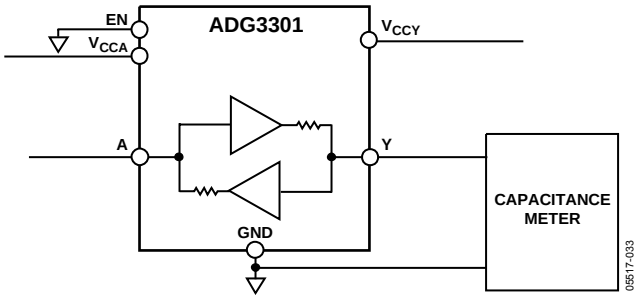

Figure 33. Capacitance at Pin Y

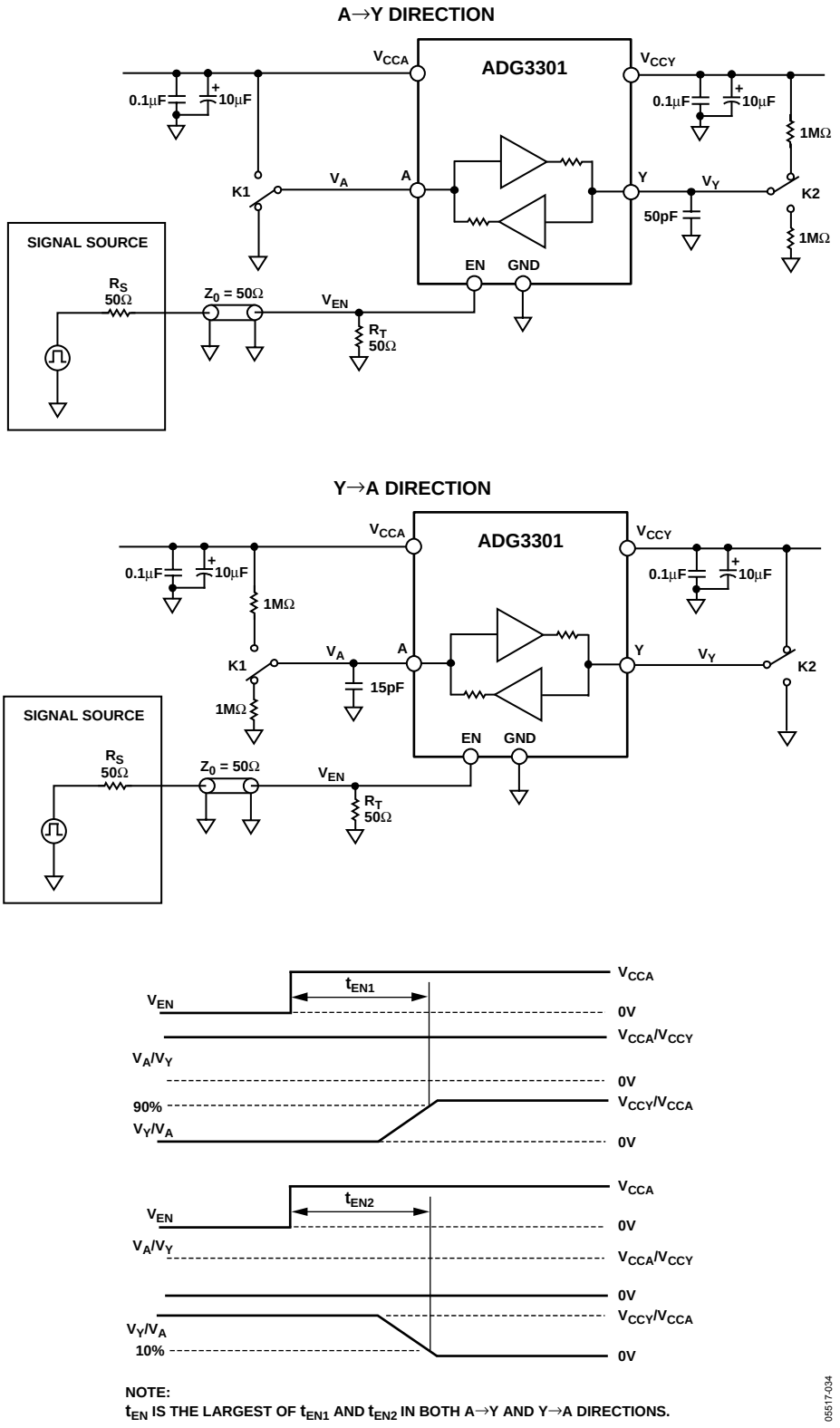

Figure 34. Enable Time

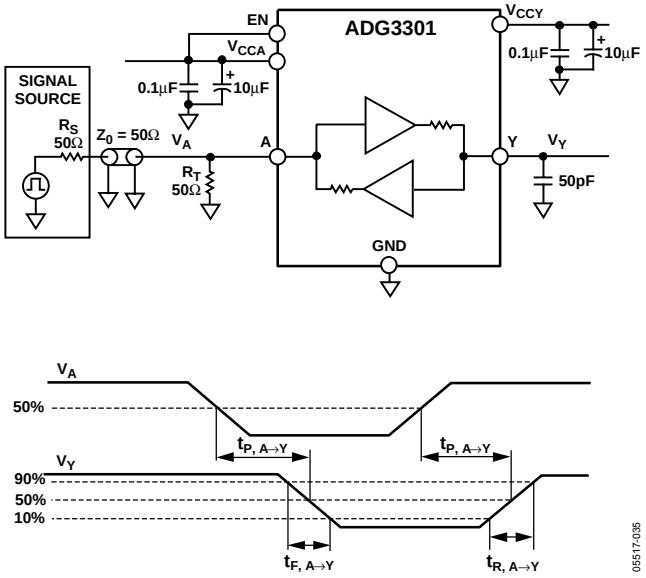

Figure 35. Switching Characteristics (A→Y Level Translation)

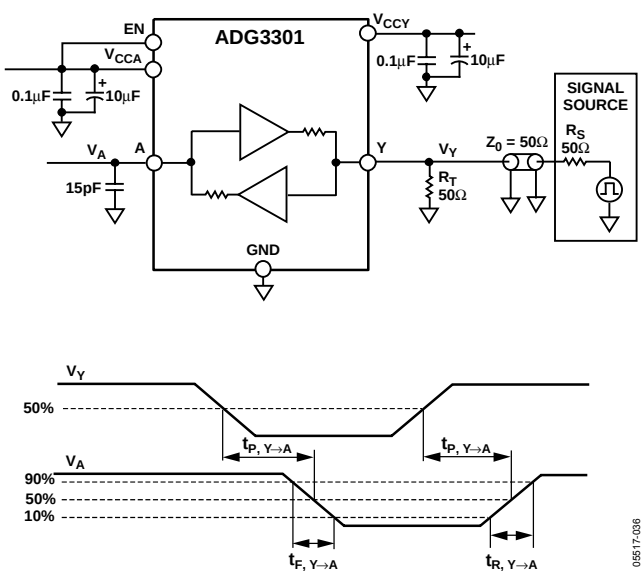

Figure 36. Switching Characteristics (Y→A Level Translation)

TERMINOLOGY

V_{IHA}
Logic input high voltage at Pin A.

V_{ILA}
Logic input low voltage at Pin A.

V_{OHA}
Logic output high voltage at Pin A.

V_{OLA}
Logic output low voltage at Pin A.

C_A
Capacitance measured at Pin A (EN = 0).

$I_{LA, HiZ}$
Leakage current at Pin A when EN = 0 (Pin A three-stated).

V_{IHY}
Logic input high voltage at Pin Y.

V_{ILY}
Logic input low voltage at Pin Y.

V_{OHY}
Logic output high voltage at Pin Y.

V_{OLY}
Logic output low voltage at Pin Y.

C_Y
Capacitance measured at Pin Y (EN = 0).

$I_{LY, HiZ}$
Leakage current at pin and when EN = 0 (Pin A three-stated).

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 A and Pin Y.

$t_{P, A\rightarrow Y}$
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.

$t_{PPSKEW, A\rightarrow Y}$
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.

$t_{P, Y\rightarrow A}$
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.

$t_{PPSKEW, Y\rightarrow A}$
Difference in propagation delay between any one channel and the same channel on a different part (under the same driving/loading conditions) when translating in the Y→A direction.

I_{CCA}
V_{CCA} supply current.

I_{CCY}
V_{CCY} supply current.

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

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

THEORY OF OPERATION

The ADG3301 level translator allows the level shifting necessary for data transfer in a system where multiple supply voltages are used. The device requires two supplies, V_{CCA} and V_{CCY} ($V_{CCA} \leq V_{CCY}$). These supplies set the logic levels on each side of the device. When driving the A pin, the device translates the V_{CCA}-compatible logic levels to V_{CCY}-compatible logic levels available at the Y pin. Similarly, because the device is capable of bidirectional translation, when driving the Y pin the V_{CCY}-compatible logic levels are translated to V_{CCA}-compatible logic levels available at the A pin. When EN = 0, the A pin and the Y pin are three-stated. When EN is driven high, the ADG3301 goes into normal operation mode and performs level translation.

LEVEL TRANSLATOR ARCHITECTURE

The ADG3301 consists of a single bidirectional channel that can translate logic levels in either the A→Y or the Y→A direction. It uses a one-shot accelerator architecture that ensures excellent switching characteristics. Figure 37 shows a simplified block diagram of the ADG3301 level translator.

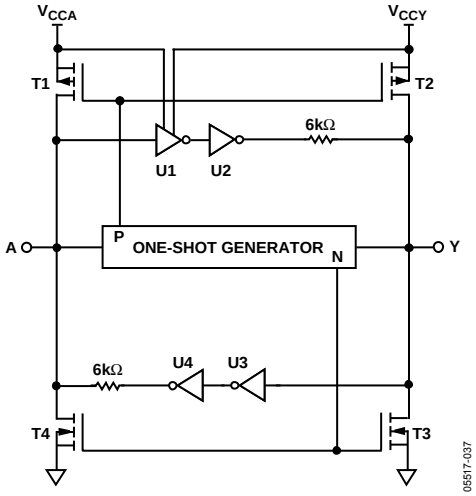

Figure 37. Simplified Block Diagram of an ADG3301 Channel

The logic level translation in the A→Y direction is performed using a level translator (U1) and an inverter (U2), while the translation in the Y→A direction is performed using the inverters U3 and U4. The one-shot generator detects a rising or falling edge present on either the A side or the Y side of the channel. It sends a short pulse that turns on the PMOS transistors (T1 and T2) for a rising edge, or the NMOS transistors (T3 and T4) for a falling edge. This charges/discharges the capacitive load faster, which results in fast rise and fall times.

INPUT DRIVING REQUIREMENTS

To ensure correct operation of the ADG3301, the circuit that drives the input of an ADG3301 channel must have an output impedance of less than or equal to 150 Ω and a minimum peak current driving capability of 36 mA.

OUTPUT LOAD REQUIREMENTS

The ADG3301 level translator is designed to drive CMOS-compatible loads. If current driving capability is required, it is recommended to use buffers between the ADG3301 outputs and the load.

ENABLE OPERATION

The ADG3301 provides three-state operation at the A I/O pin and Y I/O pin by using the enable (EN) pin as shown in Table 4.

Table 4. Truth Table

EN	Y I/O Pin	A I/O Pin
0	Hi-Z[1]	Hi-Z[1]
1	Normal operation[2]	Normal operation[2]

[1] High impedance state.
[2] In normal operation, the ADG3301 performs level translation.

While EN = 0, the ADG3301 enters into tri-state mode. In this mode, the current consumption from both the V_{CCA} and V_{CCY} supplies is reduced, allowing the user to save power, which is critical especially on battery-operated systems. The EN input pin can be driven with either V_{CCA}- or V_{CCY}-compatible logic levels.

POWER SUPPLIES

For proper operation of the ADG3301, the voltage applied to the V_{CCA} must be always less than or equal to the voltage applied to V_{CCY}. To meet this condition, the recommended power-up sequence is V_{CCY} first and then V_{CCA}. The ADG3301 operates properly only after both supply voltages reach their nominal values. It is not recommended to use the part in a system where, during power-up, V_{CCA} may be greater than V_{CCY} due to a significant increase in the current taken from the V_{CCA} supply For optimum performance, the V_{CCA} and V_{CCY} pins should be decoupled to GND, and placed as close as possible to the device.

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, which ensures that the device operates within the datasheet 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 ADG3301 can operate in both directions (A→Y or Y→A level translation) for various V_{CCA} and V_{CCY} supply combinations.

Table 5. Guaranteed Data Rate (Mbps)[1]

	V_{CCY}			
V_{CCA}	**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	30	40	40
1.8 V (1.65 V to 1.95 V)	–	45	50	50
2.5 V (2.3 V to 2.7 V)	–	–	60	50
3.3 V (3.0 V to 3.6 V)	–	–	–	50
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.

APPLICATIONS

The ADG3301 is 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 pin, and the higher voltage logic signals are connected to the Y pin. The ADG3301 can provide level translation in both directions from A→Y or Y→A, eliminating the need for a level translator IC for each direction. The internal architecture allows the ADG3301 to perform bidirectional level translation without an additional signal to set the direction in which the translation is made. This simplifies the design by eliminating the timing requirements for the direction signal and reduces the number of ICs used for level translation.

Figure 38 shows an application where a 1.8 V microprocessor transfers data to or from a 3.3 V peripheral device using the ADG3301 level translator.

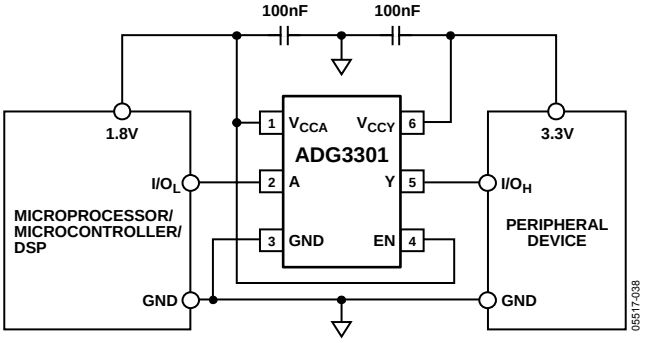

Figure 38 1.8 V to 3.3 V Level Translation Circuit

LAYOUT GUIDELINES

As with any high speed digital IC, the printed circuit board layout is important for 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 might 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

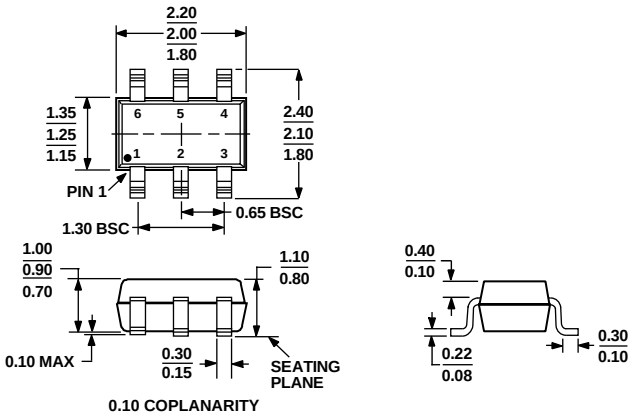

Figure 39. 6-Lead Thin Shrink Small Outline Transistor Package [SC70]
(KS-6)
Dimensions shown in millimeters

ORDERING GUIDE

Model	Temperature Range	Package Description	Branding[1]	Package Option
ADG3301BKSZ-REEL[2]	−40°C to +85°C	6-Lead Thin Shrink Small Outline Transistor Package	S0H	KS-6
ADG3301BKSZ-REEL7[2]	−40°C to +85°C	6-Lead Thin Shrink Small Outline Transistor Package	S0H	KS-6

[1] Branding on this package is limited to three characters due to space constraints.
[2] Z = Pb-free part.

NOTES

D05517-0-12/05(0)

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Analog Devices Inc.:
ADG3301BKSZ-REEL7