DESCRIPTION

The AL0108-Q is an 8-bit non-inverting level translator that uses two separate configurable power-supply rails. The A ports tracks the V_{CCA} pin supply voltage. The V_{CCA} pin accepts any supply voltage between 1.65V to 5.5V. The B port tracks the V_{CCB} pin supply voltage. The V_{CCB} pin accepts any supply voltage between 2.3V to 5.5V. Two input supply pins allows for low Voltage bidirectional translation between any of the 1.8V, 2.5V, 3.3V and 5V voltage nodes.

When the output-enable (OE) input is low, all are placed in the high-impedance (Hi-Z) state.

To ensure the Hi-Z state during power-up or power-down periods, tie OE to GND through a pull-down resistor. The minimum value of the resistor is determined by the current-sourcing capability of the driver.

AL0108-Q operates over an ambient temperature range of
-40°C to +125°C.

The AL0108-Q is available in TSSOP20 package.

FEATURES

- No Direction-Control Signal Needed
- Maximum Date Rates

  24Mbps (Push-Pull)

  2Mbps (Open-Drain)
- 1.65V to 5.5V on A ports and 2.3V to 5.5V on B Ports ($V_{CCA} \leq V_{CCB}$)
- No Power-Supply Sequencing Required: Either V_{CCA} or V_{CCB} can be Ramped First
- V_{CC} Isolation: If Either V_{CC} is at GND, Both Ports are in the High-Impedance State
- I_{OFF}: Supports Partial-Power-Down Mode Operation
- Extended Temperature: -40°C to +125°C
- AECQ Certificated

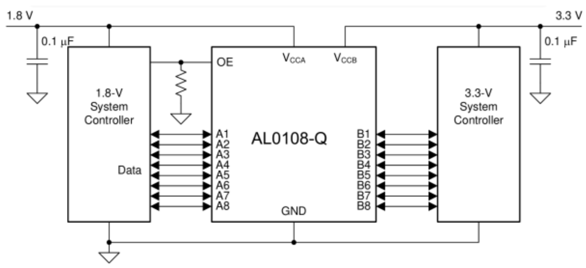
APPLICATION

- Automotive Infotainment
- Advance Driver Assistance Systems (ADAS)
- Telematics

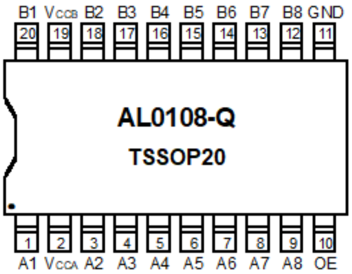
ORDERING INFORMATION

Package Type		Part Number
TSSOP20 SPQ: 4,000pcs/Reel	TMX20	AL0108TMX20VR-Q
Note	V: Halogen free Package R: Tape & Reel	
AiT provides all RoHS products		

TYPICAL APPLICATION CIRCUIT



PIN DESCRIPTION



TSSOP20, TMX20

Top View

PIN#	Symbol	Type (1)	Function
1	A1	I/O	Input/output A1. Reference to V_{CCA}.
2	V_{CCA}	P	A Port Supply Voltage.1.65V ≤ V_{CCA} ≤ 5.5V and V_{CCA} ≤ V_{CCB}.
3	A2	I/O	Input/output A2. Reference to V_{CCA}.
4	A3	I/O	Input/output A3. Reference to V_{CCA}.
5	A4	I/O	Input/output A4. Reference to V_{CCA}.
6	A5	I/O	Input/output A5. Reference to V_{CCA}.
7	A6	I/O	Input/output A6. Reference to V_{CCA}.
8	A7	I/O	Input/output A7. Reference to V_{CCA}.
9	A8	I/O	Input/output A8. Reference to V_{CCA}.
10	OE	I	Output Enable (Active High). Pull OE low to place all outputs in 3-state mode. Referenced to V_{CCA}.
11	GND	–	Ground.
12	B8	I/O	Input/output B8. Reference to V_{CCB}.
13	B7	I/O	Input/output B7. Reference to V_{CCB}.
14	B6	I/O	Input/output B6. Reference to V_{CCB}.
15	B5	I/O	Input/output B5. Reference to V_{CCB}.
16	B4	I/O	Input/output B4. Reference to V_{CCB}.
17	B3	I/O	Input/output B3. Reference to V_{CCB}.
18	B2	I/O	Input/output B2. Reference to V_{CCB}.
19	V_{CCB}	P	B Ports Supply Voltage.2.3V ≤ V_{CCB} ≤ 5.5V.
20	B1	I/O	Input/output B1. Reference to V_{CCB}.

(1) I=input, O=output, I/O=input and output, P=power

ABSOLUTE MAXIMUM RATINGS

Over operating free-air temperature range, unless otherwise noted

V_{CCA}, Supply Voltage Range		-0.3V ~ 6.0V
V_{CCB}, Supply Voltage Range		-0.3V ~ 6.0V
V_I, Input Voltage Range (1)	A port	-0.3V ~ 6.0V
	B port	-0.3V ~ 6.0V
	OE	-0.3V ~ 6.0V
V_O, Voltage range applied to any output in the high-impedance or power-off state (1)	A port	-0.3V ~ 6.0V
	B port	-0.3V ~ 6.0V
V_O, Voltage range applied to any output in the high or low state (1)(2)	A port	-0.3V ~ V_{CCA}+0.3V
	B port	-0.3V ~ V_{CCB}+0.3V
I_{IK}, Input Clamp Current	V_I<0	-50mA
I_{OK}, Output Clamp Current	V_O<0	-25mA
I_O, Continuous Output Current		±50mA
Continuous current through V_{CCA}, V_{CCB} or GND		±100mA
$θ_{JA}$, Package thermal impedance (3)		40℃/W
T_J, Junction Temperature (4)		-40℃ ~ 150℃
T_{STG}, Storage Temperature		-65℃ ~ 150℃

Stresses above may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

(1) The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed
(2) The value of V_{CCA} and V_{CCB} are provided in the recommended operating conditions table.
(3) The package thermal impedance is calculated in accordance with JESD-51.
(4) The maximum power dissipation is a function of $T_{J(MAX)}$, $θ_{JA}$, and T_A. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(MAX)} - T_A) / R_{θJA}$. All numbers apply for packages soldered directly onto a PCB.

ESD Ratings

The following ESD information is provided for handing of ESD-sensitive devices in an ESD protected area only.

$V_{(ESD)}$, Electrostatic Discharge	Human-body model (HBM), per AEC-Q100-002*	±2000V
	Charged-Device Model (CDM), per AEC-Q100-011	±1000V
	Latch-Up (LU), per AEC-Q100-004	±200mA

*AEC-Q100-002 indicates that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.

RECOMMENDED OPERATING CONDITIONS

V_{CCI} is the supply voltage associated with the input port. V_{CCO} is the supply voltage associated with the output port.

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Supply voltage (1)	V_{CCA}	-	1.65	-	5.5	V
	V_{CCB}	-	2.3	-	5.5	
High-level input voltage (V_{IH})	A-port I/Os	V_{CCA} =1.65V to 1.95V V_{CCB} =2.3V to 5.5V	V_{CCI} - 0.2	-	V_{CCI}	V
		V_{CCA} =2.3V to 5.5V V_{CCB} =2.3V to 5.5V	V_{CCI} - 0.4	-	V_{CCI}	V
	B-port I/Os	V_{CCA} =1.65V to 5.5V V_{CCB} =2.3V to 5.5V	V_{CCI} - 0.4	-	V_{CCI}	V
	OE input	V_{CCA} =1.65V to 5.5V V_{CCB} =2.3V to 5.5V	V_{CCA} x 0.8	-	5.5	V
Low-level input voltage (V_{IL})	A-port I/Os	V_{CCA} =1.65V to 5.5V V_{CCB} =2.3V to 5.5V	0	-	0.15	V
	B-port I/Os	V_{CCA} =1.65V to 5.5V V_{CCB} =2.3V to 5.5V	0	-	0.15	V
	OE input	V_{CCA} =1.65V to 5.5V V_{CCB} =2.3V to 5.5V	0	-	V_{CCA} x 0.25	V
Input transition rise or fall rate($\Delta t/\Delta v$)	-	A-port I/Os push-pull driving	-	-	10	ns/V
	-	B-port I/Os push-pull driving	-	-	10	ns/V
	-	Control input	-	-	10	ns/V
Operating Free-air Temperature	T_A	-	-40	-	125	℃

(1) V_{CCA} must be less than or equal to V_{CCB}.

(2) The maximum V_{IL} value is provided to ensure that a valid V_{OL} is maintained. The V_{OL} value is V_{IL} plus the voltage drop across the pass gate transistor.

ELECTRICAL CHARACTERISTICS

over recommended operating free-air temperature range (unless otherwise noted) (1) (2) (3)

Parameter		Conditions	V_{CCA}	V_{CCB}	Temp	Min(4)	Typ(5)	Max (4)	Unit
V_{OHA}	Port A Output High Voltage	I_{OH} = - 20μA $V_{IB} \geq V_{CCB}$ - 0.4V	1.65V to 5.5V	2.3V to 5.5V	Full	V_{CCA} × 0.7	-	5.5	V
V_{OLA}	Port A OutputLow Voltage	I_{OL} = 1mA $V_{IB} \leq$ 0.15V	1.65V to 5.5V	2.3V to 5.5V	Full	-	-	0.3	
V_{OHB}	Port B Output High Voltage	I_{OH} = - 20μA $V_{IA} \geq V_{CCA}$ - 0.4V	1.65V to 5.5V	2.3V to 5.5V	Full	V_{CCB} × 0.7	-	-	
V_{OLB}	Port B OutputLow Voltage	I_{OL} = 1mA $V_{IA} \leq$ 0.15V	1.65V to 5.5V	2.3V to 5.5V	Full	-	-	0.3	
I_I	Input Leakage Current	OE	1.65V to 5.5V	2.3V to 5.5V	+25℃	-	-	±2	μA
					Full	-	-	±3	
I_{off}	Partial Power Down Current	A Ports	0V	0V to 5.5V	+25℃	-	-	±0.5	μA
					Full	-	-	±1	
		B Ports	0V to 5.5V	0V	+25℃	-	-	±0.5	μA
					Full	-	-	±1	
I_{OZ} (6)	High-Impedance State Output Current	A or B Port OE=0V	1.65V to 5.5V	2.3V to 5.5V	+25℃	-	-	±0.5	μA
					Full	-	-	±1	
I_{CCA}	V_{CCA} Supply Current	V_I = V_O = open I_O = 0	1.65V to V_{CCB}	2.3V to 5.5V	Full	-	-	2.0	μA
			5.5V	0V	Full	-	-	2.0	
			0V	5.5V	Full	-	-	-1	
I_{CCB}	V_{CCB} Supply Current	V_I = V_O = open I_O = 0	1.65V to V_{CCB}	2.3V to 5.5V	Full	-	-	20	μA
			5.5V	0V	Full	-	-	-1	
			0V	5.5V	Full	-	-	1	
I_{CCA} + I_{CCB}	Combined Supply Current	V_I = V_O or open I_O = 0	1.65V to V_{CCB}	2.3V to 5.5V	Full	-	-	30	μA
I_{CCZA}	V_{CCA} Supply Current	V_I = V_{CCI} or 0V I_O = 0, OE=0V	1.65V to V_{CCB}	2.3V to 5.5V	Full	-	-	1	μA
I_{CCZB}	V_{CCB} Supply Current	V_I = V_{CCI} or 0V I_O = 0, OE=0V	2.3V to 5.5V	2.3V to 5.5V	Full	-	-	1	μA
C_I	Input Capacitance	OE	3.3V	3.3V	+25℃	-	2.5	-	pF
C_{IO}	Input-to-output Internal Capacitance	A port	3.3V	3.3V	+25℃	-	5	-	pF
		B port	3.3V	3.3V	+25℃	-	5	-	

(1)V_{CCI} is the V_{CC} associated with the input port (2)V_{CCO} is the V_{CC} associated with the output port (3)V_{CCA} must be less or equal to V_{CCB}.

(4)Limits are 100% production tested at 25℃. Limits over the operating temperature range are ensured through correlations using statistical equality control (SQC) method.

(5)Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.

(6)For I/O ports, the parameter IOZ includes the input leakage current.

TIMING REQUIREMENTS

V_{CCA}=1.8V±0.15V

		V_{CCB}=2.5V±0.2V	V_{CCB}=3.3V±0.2V	V_{CCB}=5V±0.2V	Unit
		TYP	TYP	TYP	
Data rate	Push-pull driving	21	22	24	Mbps
	Open-drain driving	2	2	2	
Pulse duration(t_w)	Push-pull driving (data inputs)	47	45	41	ns
	Open-drain driving (data inputs)	500	500	500	

V_{CCA}=2.5V±0.15V

		V_{CCB}=2.5V±0.2V	V_{CCB}=3.3V±0.2V	V_{CCB}=5V±0.2V	Unit
		TYP	TYP	TYP	
Data rate	Push-pull driving	20	22	24	Mbps
	Open-drain driving	2	2	2	
Pulse duration(t_w)	Push-pull driving (data inputs)	50	45	41	ns
	Open-drain driving (data inputs)	500	500	500	

V_{CCA}=3.3V±0.15V

		V_{CCB}=3.3V±0.2V	V_{CCB}=5V±0.2V	Unit
		TYP	TYP	
Data rate	Push-pull driving	23	24	Mbps
	Open-drain driving	2	2	
Pulse duration(t_w)	Push-pull driving (data inputs)	43	41	ns
	Open-drain driving (data inputs)	5000	200	

V_{CCA}=5V±0.15V

		V_{CCB}=5V±0.2V	Unit
		TYP	
Data rate	Push-pull driving	24	Mbps
	Open-drain driving	2	
Pulse duration(t_w)	Push-pull driving (data inputs)	41	ns
	Open-drain driving (data inputs)	500	

SWITCHING CHARACTERISTICS

V_{CCA}=1.8V±0.15V
Over recommended operating free-air temperature range, unless otherwise noted

Parameter		Conditions		V_{CCB}=2.5V ±0.2V		V_{CCB}=3.3V ±0.2V		V_{CCB}=5V ±0.2V		Unit
				MIN	MAX	MIN	MAX	MIN	MAX	
t_{PHL}	Propagation delay time high-to-low output	A-to-B	Push-pull driving	1.2	3.8	1.5	4.7	2.2	6.8	ns
			Open-drain driving	1.3	39.2	13.2	39.6	13.3	40	
t_{PLH}	Propagation delay time low-to-high output	A-to-B	Push-pull driving	2.1	6.3	1.8	5.6	1.8	5.4	ns
			Open-drain driving	110	332	91.5	275	71.5	215	
t_{PHL}	Propagation delay time high-to-low output	B-to-A	Push-pull driving	1.0	3.2	1.0	3.0	1.1	3.3	ns
			Open-drain driving	13	39.2	13	39.2	13.1	39.3	
t_{PLH}	Propagation delay time low-to-high output	B-to-A	Push-pull driving	0.9	2.7	0.8	2.4	0.7	2.3	ns
			Open-drain driving	86.5	260	44.5	134	33	99	
t_{en}	Enable time	OE-to-A or B		12.5	37.5	10.5	31.5	9.5	28.5	ns
t_{dis}	Disable time	OE-to-A or B		625	1875	625	1875	625	1875	ns
t_{rA}	Input rise time	A port rise time	Push-pull driving	3.4	10.4	3.0	9.2	2.8	8.4	ns
			Open-drain driving	59	177	19.5	58.5	6.5	19.5	
t_{rB}	Input rise time	B port rise time	Push-pull driving	2.9	8.7	2.4	7.2	2.0	6.2	ns
			Open-drain driving	8.3	249	63.5	191	37.5	113	
t_{fA}	Input fall time	A port fall time	Push-pull driving	1.5	4.5	1.4	4.2	1.3	4.1	ns
			Open-drain driving	0.9	2.9	0.8	2.6	0.8	2.4	
t_{fB}	Input fall time	B port fall time	Push-pull driving	2.4	7.2	3.1	9.3	4.2	12.6	ns
			Open-drain driving	1.1	3.5	1.2	3.6	1.4	4.2	
$t_{sk(O)}$	Skew(time), output	Channel-to-Channel Skew		-	0.8	-	0.8	-	0.8	ns

Parameter	Conditions	V_{CCB}=2.5V ±0.2V	V_{CCB}=3.3V ±0.2V	V_{CCB}=5V ±0.2V	Unit
		TYP	TYP	TYP	
Maximum data rata	Push-pull driving	21	22	24	Mbps
	Open-drain driving	2	2	2	

V_{CCA}=2.5V±0.15V
Over recommended operating free-air temperature range, unless otherwise noted

Parameter		Conditions		V_{CCB}=2.5V ±0.2V		V_{CCB}=3.3V ±0.2V		V_{CCB}=5V ±0.2V		Unit
				MIN	MAX	MIN	MAX	MIN	MAX	
t_{PHL}	Propagation delay time high-to-low output	A-to-B	Push-pull driving	1.4	4.2	1.7	5.1	2.5	7.5	ns
			Open-drain driving	13.1	39.5	13.2	39.8	13.3	40	
t_{PLH}	Propagation delay time low-to-high output	A-to-B	Push-pull driving	1.3	4.1	1.2	3.8	1.2	3.6	ns
			Open-drain driving	99	297	84.5	254	65.5	197	
t_{PHL}	Propagation delay time high-to-low output	B-to-A	Push-pull driving	1.2	3.8	1.2	3.6	1.2	3.8	ns
			Open-drain driving	13.2	39.6	13.2	39.8	13.3	40	
t_{PLH}	Propagation delay time low-to-high output	B-to-A	Push-pull driving	1.0	3.2	1.0	3.0	0.9	2.9	ns
			Open-drain driving	98	294	69	207	31.5	94.5	
t_{en}	Enable time	OE-to-A or B		12	36	10	30	8.5	25.5	ns
t_{dis}	Disable time	OE-to-A or B		625	1875	625	1875	625	1875	ns
t_{rA}	Input rise time	A port rise time	Push-pull driving	1.7	5.1	1.4	4.4	1.3	4.1	ns
			Open-drain driving	78	234	46	138	6.5	19.5	
t_{rB}	Input rise time	B port rise time	Push-pull driving	2.3	7.1	1.7	5.3	1.3	4.1	ns
			Open-drain driving	80	240	62	186	40.5	122	
t_{fA}	Input fall time	A port fall time	Push-pull driving	2.5	7.7	2.6	7.8	2.5	7.5	ns
			Open-drain driving	10	3.2	1.0	3.0	0.9	2.7	
t_{fB}	Input fall time	B port fall time	Push-pull driving	2.5	7.5	3.2	9.6	4.3	13.1	ns
			Open-drain driving	1.0	3.0	1.1	3.3	1.4	4.2	
$t_{sk(O)}$	Skew(time), output	Channel-to-Channel Skew		-	0.8	-	0.8	-	0.8	ns

Parameter	Conditions	V_{CCB}=2.5V ±0.2V	V_{CCB}=3.3V ±0.2V	V_{CCB}=5V ±0.2V	Unit
		TYP	TYP	TYP	
Maximum data rata	Push-pull driving	20	22	24	Mbps
	Open-drain driving	2	2	2	

V_{CCA}=3.3V±0.3V
Over recommended operating free-air temperature range, unless otherwise noted

Parameter		Conditions		V_{CCB}=3.3V ±0.2V		V_{CCB}=5V ±0.2V		Unit
				MIN	MAX	MIN	MAX	
t_{PHL}	Propagation delay time high-to-low output	A-to-B	Push-pull driving	1.8	5.4	2.5	7.7	ns
			Open-drain driving	13.2	39.6	13.3	40	
t_{PLH}	Propagation delay time low-to-high output	A-to-B	Push-pull driving	1.1	3.5	1.0	3.2	ns
			Open-drain driving	77.5	232.5	54.5	163.5	
t_{PHL}	Propagation delay time high-to-low output	B-to-A	Push-pull driving	1.5	4.7	1.6	5	ns
			Open-drain driving	13.2	39.8	13.3	40.1	
t_{PLH}	Propagation delay time low-to-high output	B-to-A	Push-pull driving	0.9	2.9	0.9	2.7	ns
			Open-drain driving	79	237	43.5	130.5	
t_{en}	Enable time	OE-to-A or B		9.5	28.5	7.5	22.5	ns
t_{dis}	Disable time	OE-to-A or B		625	1875	625	1875	ns
t_{rA}	Input rise time	A port rise time	Push-pull driving	1.1	3.5	1.0	3.2	ns
			Open-drain driving	58.5	175.5	24	72	
t_{rB}	Input rise time	B port rise time	Push-pull driving	1.5	4.5	1.2	3.6	ns
			Open-drain driving	58.5	175.5	37.5	112.5	
t_{fA}	Input fall time	A port fall time	Push-pull driving	4.0	12	3.8	11.4	ns
			Open-drain driving	1.1	3.3	1.0	3.2	
t_{fB}	Input fall time	B port fall time	Push-pull driving	4.1	12.3	5.4	16.2	ns
			Open-drain driving	1.0	3.2	1.2	3.6	
$t_{sk(O)}$	Skew(time), output	Channel-to-Channel Skew		-	0.8	-	0.8	ns

Parameter	Conditions	V_{CCB}=3.3V ±0.2V	V_{CCB}=5V ±0.2V	Unit
		TYP	TYP	
Maximum data rata	Push-pull driving	23	24	Mbps
	Open-drain driving	2	2	

V_{CCA}=5V±0.35V
Over recommended operating free-air temperature range, unless otherwise noted

Parameter		Conditions		V_{CCB}=5V±0.2V Typ	V_{CCB}=5V±0.2V MAX	Unit
t_{PHL}	Propagation delaytime high-to-low output	A-to-B	Push-pull driving	2.8	8.4	ns
			Open-drain driving	13.4	40.2	
t_{PLH}	Propagation delaytime low-to-high output	A-to-B	Push-pull driving	1.0	3.0	ns
			Open-drain driving	77.5	232.5	
t_{PHL}	Propagation delaytime high-to-low output	B-to-A	Push-pull driving	2.9	8.7	ns
			Open-drain driving	13.7	41.3	
t_{PLH}	Propagation delaytime low-to-high output	B-to-A	Push-pull driving	0.9	2.7	ns
			Open-drain driving	80	240	
t_{en}	Enable time	OE-to-A or B		8.5	25.5	ns
t_{dis}	Disable time	OE-to-A or B		625	1875	ns
t_{rA}	Input rise time	A port rise time	Push-pull driving	0.9	2.9	ns
			Open-drain driving	52.5	157.5	
t_{rB}	Input rise time	B port rise time	Push-pull driving	1.1	3.5	ns
			Open-drain driving	47.5	142.5	
t_{fA}	Input fall time	A port fall time	Push-pull driving	4.5	13.5	ns
			Open-drain driving	1.3	3.9	
t_{fB}	Input fall time	B port fall time	Push-pull driving	4.4	13.4	ns
			Open-drain driving	1.2	3.8	
$t_{sk(O)}$	Skew(time), output	Channel-to-Channel Skew		-	0.8	ns

Parameter	Conditions	V_{CCB}=5V±0.2V Typ	Unit
Maximum data rata	Push-pull driving	24	Mbps
	Open-drain driving	2	

TYPICAL PERFORMANCE CHARACTERISTICS

Fig 1. Low-Level Output Voltage vs Low-Level Current

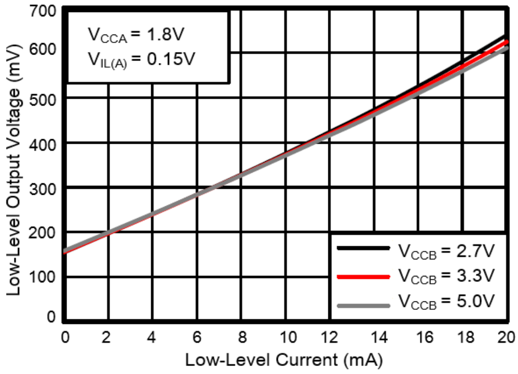


Fig 2. Low-Level Output Voltage vs Low-Level Current

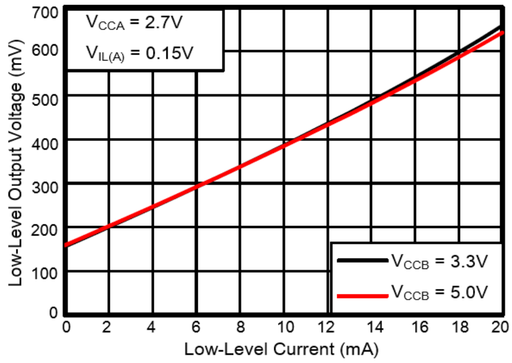


Fig 3. Low-Level Output Voltage vs Low-Level Current

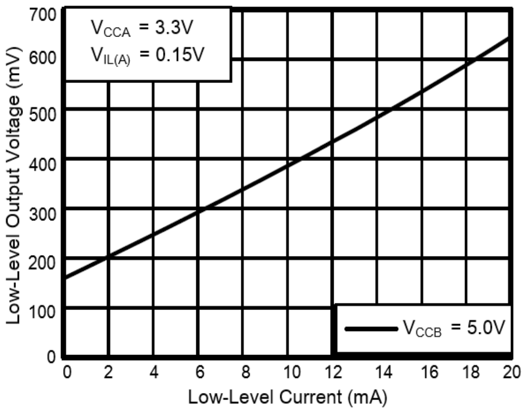


Fig 4. Low-Level Output Voltage vs Low-Level Current

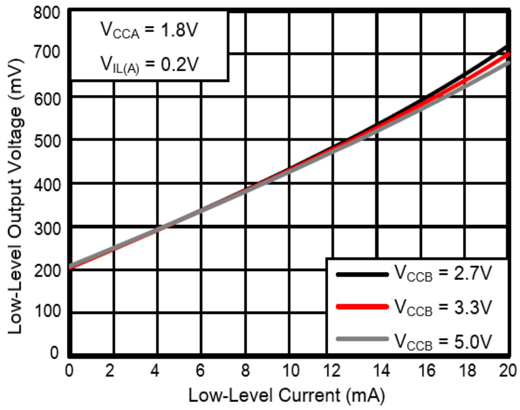


Fig 5. Low-Level Output Voltage vs Low-Level Current

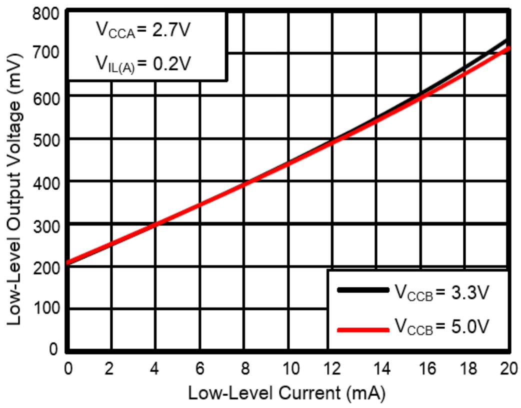


Fig 6. Low-Level Output Voltage vs Low-Level Current

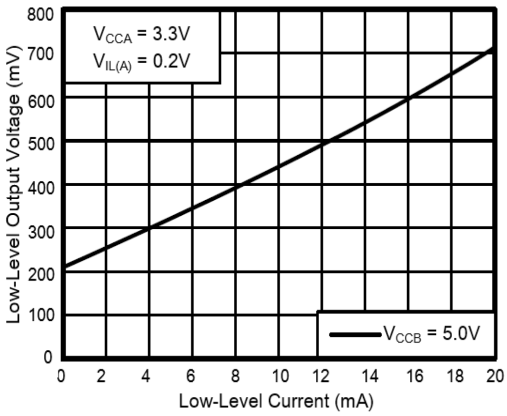


Fig 7. Low-Level Output Voltage vs
Low-Level Current

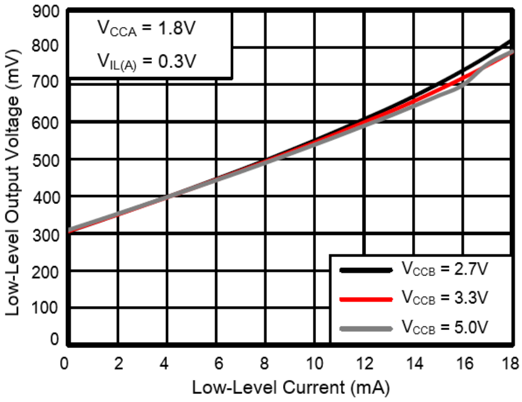


Fig 8. Low-Level Output Voltage vs
Low-Level Current

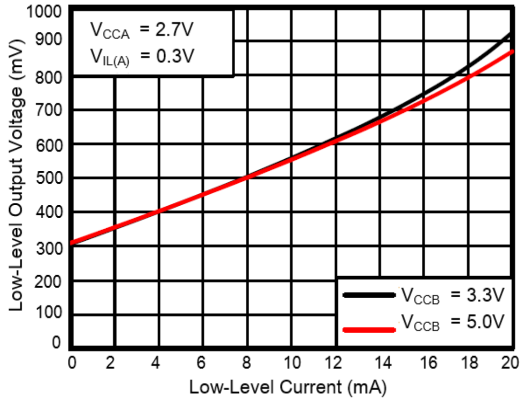


Fig 9. Low-Level Output Voltage vs
Low-Level Current

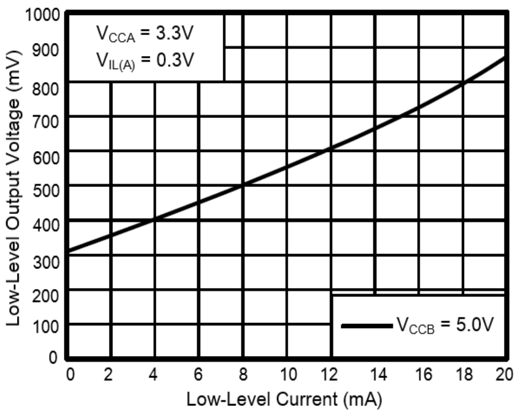


Fig 10. Low-Level Output Voltage vs
Low-Level Current

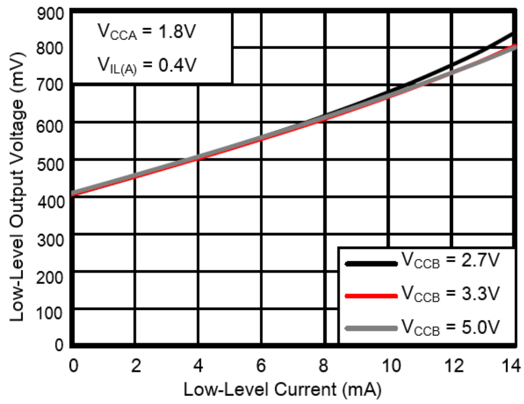


Fig 11. Low-Level Output Voltage vs
Low-Level Current

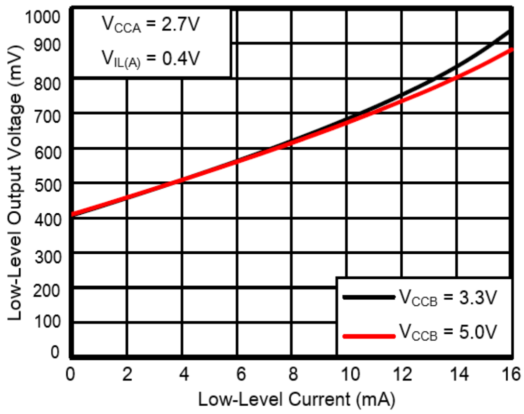


Fig 12. Low-Level Output Voltage vs
Low-Level Current

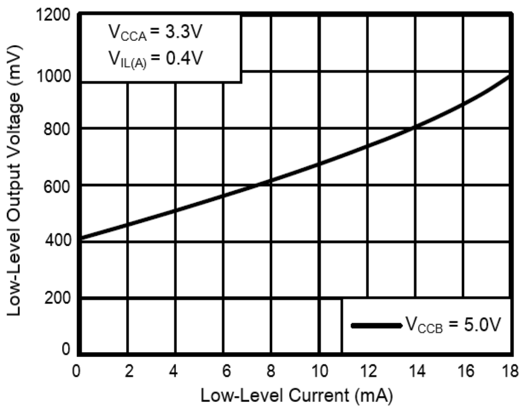


Fig 13. Low-Level Output Voltage vs
Low-Level Current

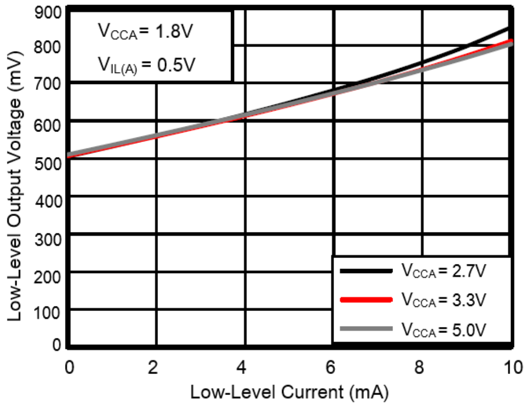


Fig 14. Low-Level Output Voltage vs
Low-Level Current

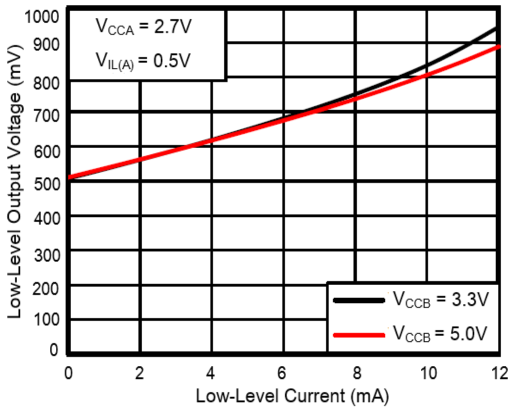
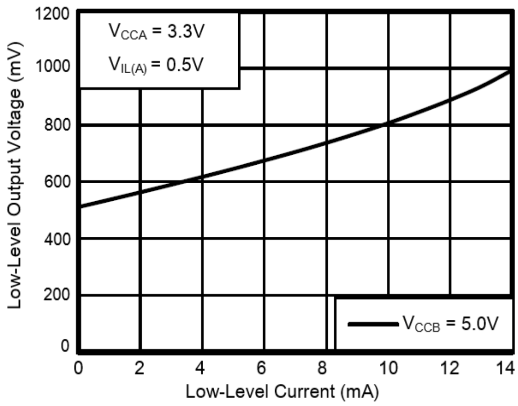


Fig 15. Low-Level Output Voltage vs
Low-Level Current



DETAILED INFORMATION

Parameter Measurement Information

Unless otherwise noted, all input pulses are supplied by generators having the following characteristics:

- PRR 10MHz
- Z_O = 50Ω
- dv/dt ≥ 1V/ns

NOTE: All input pulses are measured one at a time, with one transition per measurement.

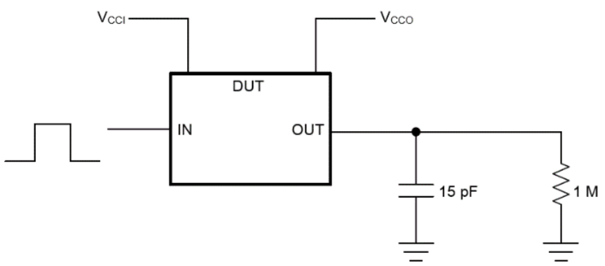


Fig 16. Data Rate, Pulse Duration, Propagation Delay, Output Rise and Fall Time Measurement Using A Push-Pull Driver

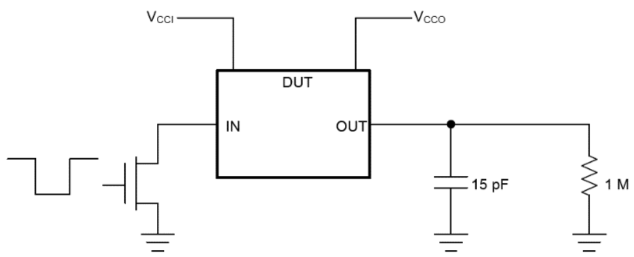


Fig 17. Data Rate, Pulse Duration, Propagation Delay, Output Rise and Fall Time Measurement Using An Open-Drain Driver

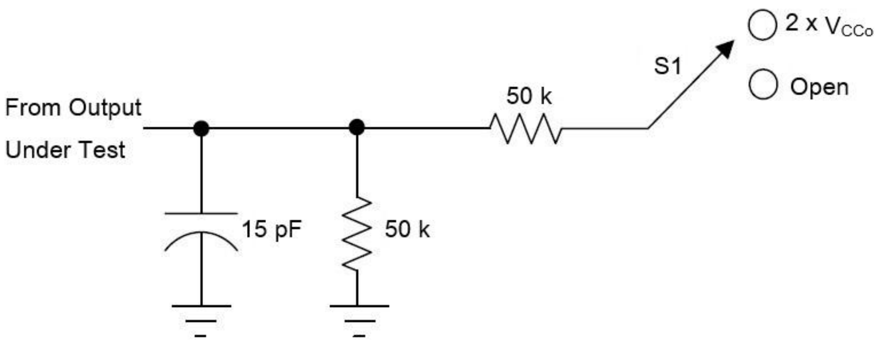


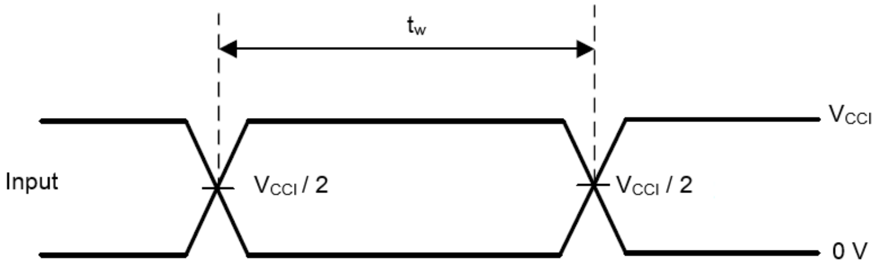
Figure 18. Load Circuit For Enable/Disable Time Measurement

Table 1. Switch Configuration For Enable/Disable Timing

TEST	S1
t_{PZL} (1), t_{PLZ} (2)	2 × V_{CCO}
t_{PHZL} (1), t_{PZH} (2)	Open

(1) t_{PZL} and t_{PZH} are the same as t_{en}.

(2) t_{PLZ} and t_{PHZ} are the same as t_{dis}.



(1) All input pulses are measured one at a time, with one transition per measurement.

Fig 19. Voltage Waveforms Pulse Duration

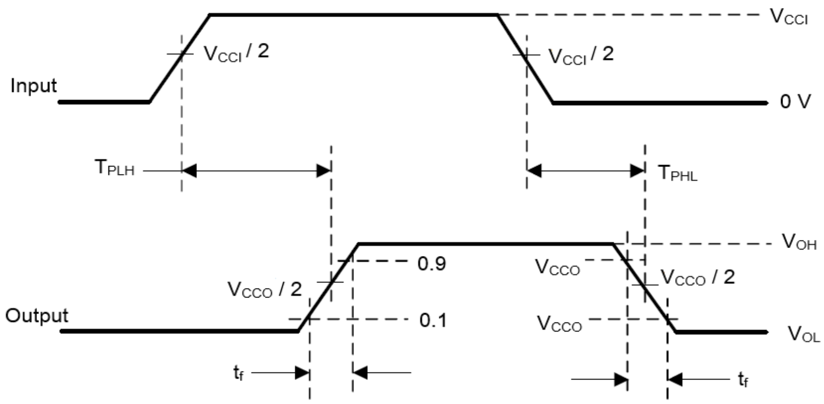
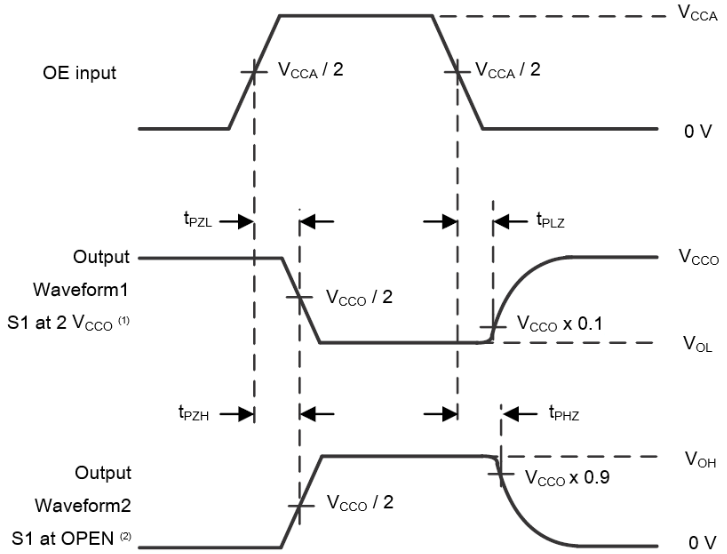


Fig 20. Voltage Waveforms Propagation Delay Times

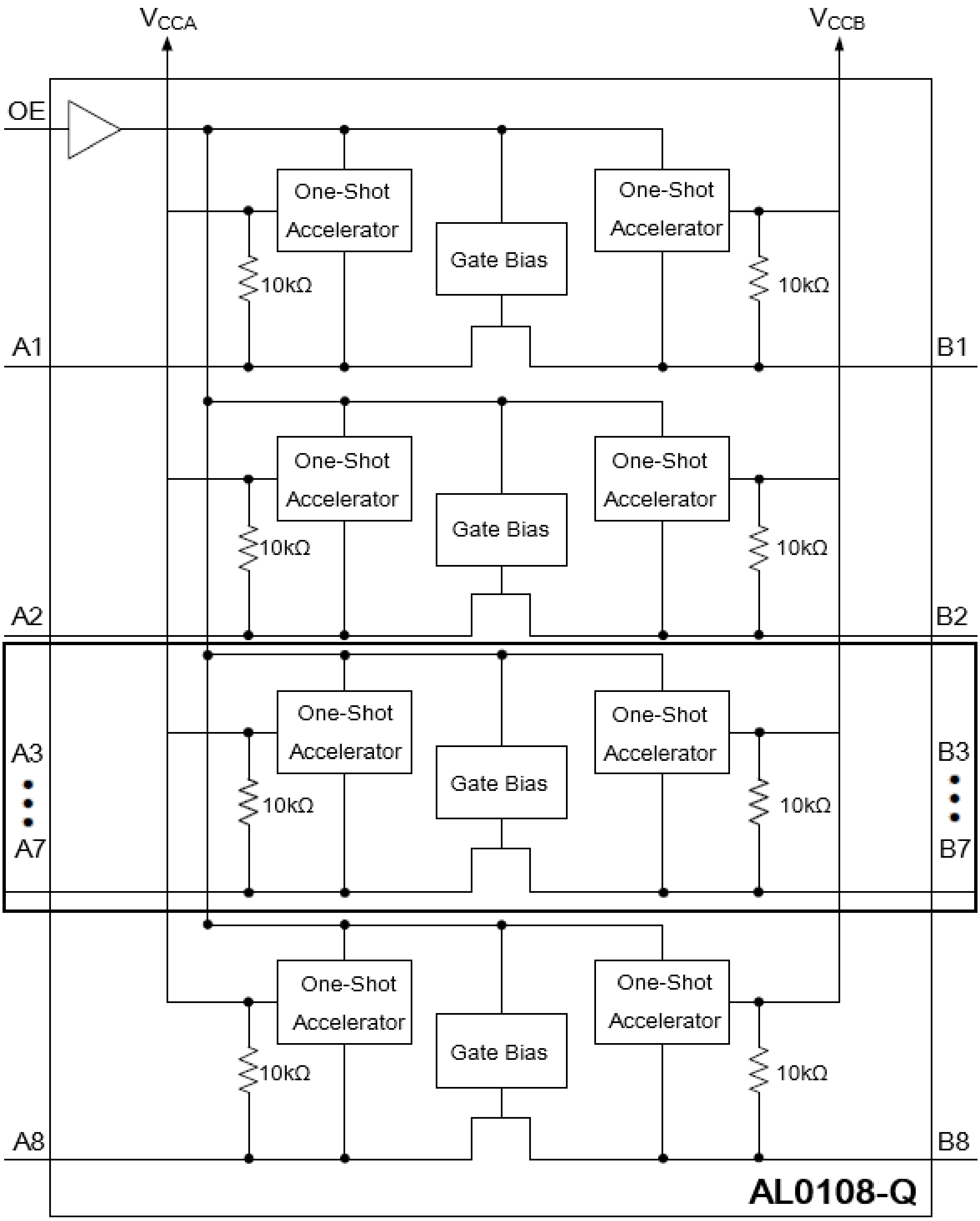


A. Waveform 1 is for an output with internal such that the output is high, except when OE is high.

B. Waveform 2 is for an output with conditions such that the output is low, except when OE is high.

Fig 21. Voltage Waveforms Enable And Disable

BLOCK DIAGRAM



Overview

The AL0108-Q device is a directionless voltage-level translator specifically designed for translating logic voltage levels. The A port is able to accept I/O voltages ranging from 1.65V to 5.5V, while the B port can accept I/O voltages from 2.3V to 5.5V. The device is a pass-gate architecture with edge-rate accelerators (one-shots) to improve the overall data rate. 10-kΩ pullup resistors, commonly used in open-drain applications, have been conveniently integrated so that an external resistor is not needed. While this device is designed for open-drain applications, the device can also translate push-pull CMOS logic outputs.

The AL0108-Q architecture (see Fig 22) is an auto-direction-sensing based translator that does not require a direction-control signal to control the direction of data flow from A to B or from B to A. These two bidirectional channels independently determine the direction of data flow without a direction-control signal. Each I/O pin can be automatically reconfigured as either an input or an output, which is how this auto-direction feature is realized.

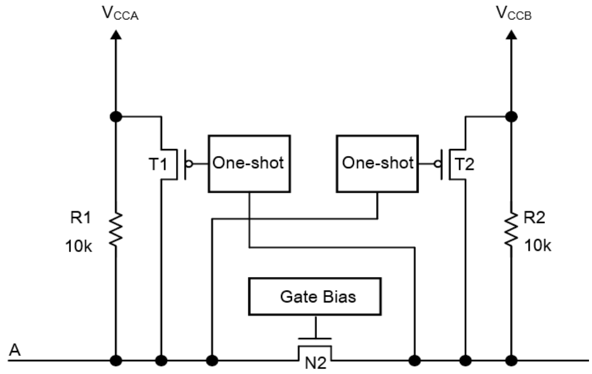


Fig 22. Architecture of a AL0108-Q Cell

The AL0108-Q employs two key circuits to enable this voltage translation:

(1) An N-channel pass-gate transistor topology that ties the A-port to the B-port

(2) Output one-shot (O.S.) edge-rate accelerator circuitry to detect and accelerate rising edges on the A or B Ports.

Input Driver Requirements

The continuous dc-current "sinking" capability is determined by the external system-level open-drain (or push -pull) drivers that are interfaced to the AL0108-Q I/O pins. Since the high bandwidth of these bidirectional I/O circuits is used to facilitate this fast change from an input to an output and an output to an input, they have a modest dc-current "sourcing" capability of hundreds of micro-Amps, as determined by the internal 10-kΩ pullup resistors.

The fall time (t_{fA}, t_{fB}) of a signal depends on the edge-rate and output impedance of the external device driving AL0108-Q data I/Os, as well as the capacitive loading on the data lines.

Similarly, the tPHL and max data rates also depend on the output impedance of the external driver. The values for t_{fA}, t_{fB}, tPHL, and maximum data rates in the data sheet assume that the output impedance of the external driver is less than 50Ω.

Output Load Considerations

We recommend careful PCB layout practices with short PCB trace lengths to avoid excessive capacitive loading and to ensure that proper O.S. triggering takes place. PCB signal trace-lengths should be kept short enough such that the round-trip delay of any reflection is less than the one-shot duration. This improves signal integrity by ensuring that any reflection sees a low impedance at the driver. The O.S. circuits have been designed to stay on for approximately 30ns. The maximum capacitance of the lumped load that can be driven also depends directly on the one-shot duration. With very heavy capacitive loads, the one-shot can time-out before the signal is driven fully to the positive rail. The O.S. duration has been set to best optimize trade-offs between dynamic ICC, load driving capability, and maximum bit-rate considerations. Both PCB trace length and connectors add to the capacitance that the AL0108-Q device output sees, so it is recommended that this lumped-load capacitance be considered to avoid O.S. retriggering, bus contention, output signal oscillations, or other adverse system-level affects.

Enable and Disable

The AL0108-Q device has an OE input that is used to disable the device by setting OE low, which places all I/Os in the Hi-Z state. The disable time (tdis) indicates the delay between the time when OE goes low and when theoutputs are disabled (Hi-Z). The enable time (t_{en}) indicates the amount of time the user must allow for the one-shot circuitry to become operational after OE is taken high.

Pullup or Pulldown Resistors on I/O Lines

Each A-port I/O has an internal 10-kΩ pullup resistor to V_{CCA}, and each B-port I/O has an internal 10-kΩ pullup resistor to V_{CCB}. If a smaller value of pullup resistor is required, an external resistor must be added from the I/O to V_{CCA} or V_{CCB} (in parallel with the internal 10-kΩ resistors). Adding lower value pull-up resistors will affect V_{OL} levels, however. The internal pull-ups of the AL0108-Q are disabled when the OE pin is low.

APPLICATION INFORMATION

The AL0108-Q device can be used to bridge the digital-switching compatibility gap between two voltage nodes to successfully interface logic threshold levels found in electronic systems. It should be used in a point-to-point topology for interfacing devices or systems operating at different interface voltages with one another. Its primary target application use is for interfacing with open-drain drivers on the data I/Os such as I_2C or 1-wire, where the data is bidirectional and no control signal is available. The device can also be used in applications where a push-pull driver is connected to the data I/Os, but the AL0108-Q might be a better option for such push-pull applications.

Typical Application

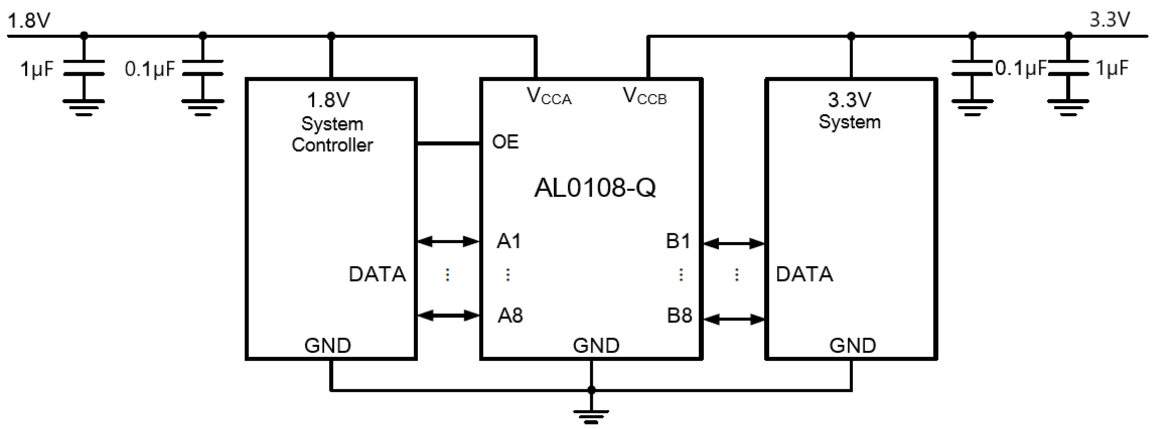
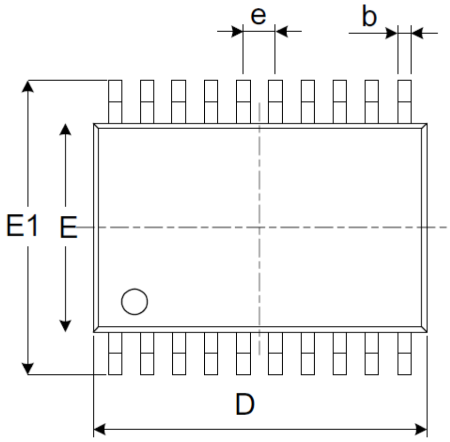
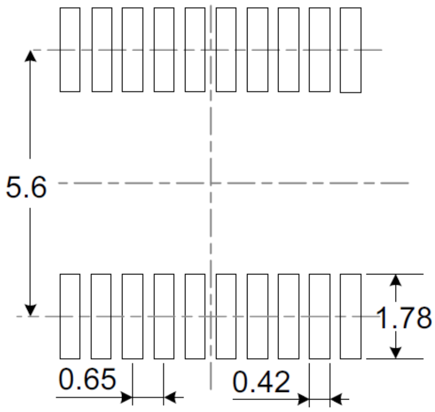


Fig 23. Typical Application Circuit

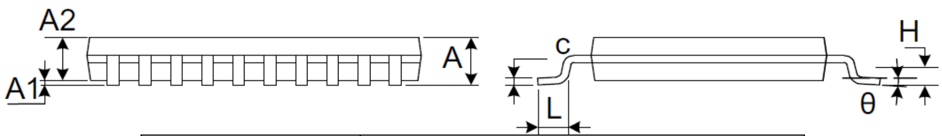
PACKAGE INFORMATION

Dimension in TSSOP20(Unit: mm)





RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Millimeters	
	Min	**Max**
A	-	1.200
A1	0.050	0.150
A2	0.800	1.050
b	0.200	0.280
c	0.130	0.170
D	6.400	6.600
E	4.300	4.500
E1	6.200	6.600
e	0.650 BSC	
L	0.450	0.750
H	0.250 Typ	
θ	0°	8°

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