8-Bit Bi-Directional Level Shifter with Automatic Direction Sensing for Push-Pull and Open-Drain Applications

Description

The LXS0108 is an 8-bit, dual-supply, automatic direction sensing level translator. The A and B ports are designed to track two different power supply rails, VCCA and VCCB respectively. This allows bi-directional translation between lower and higher logic signals. Each channel can be mixed and matched with different output types (open-drain or push-pull) and mixed data flows (transmit or receive) without intervention from the host.

When the OE pin is low, all I/Os are configurated to be in a high-impedance 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.

The LXS0108 is available in TSSOP-20 and W-QFN3545 package with temperature range specified from -40°C to +85°C.

Block Diagram

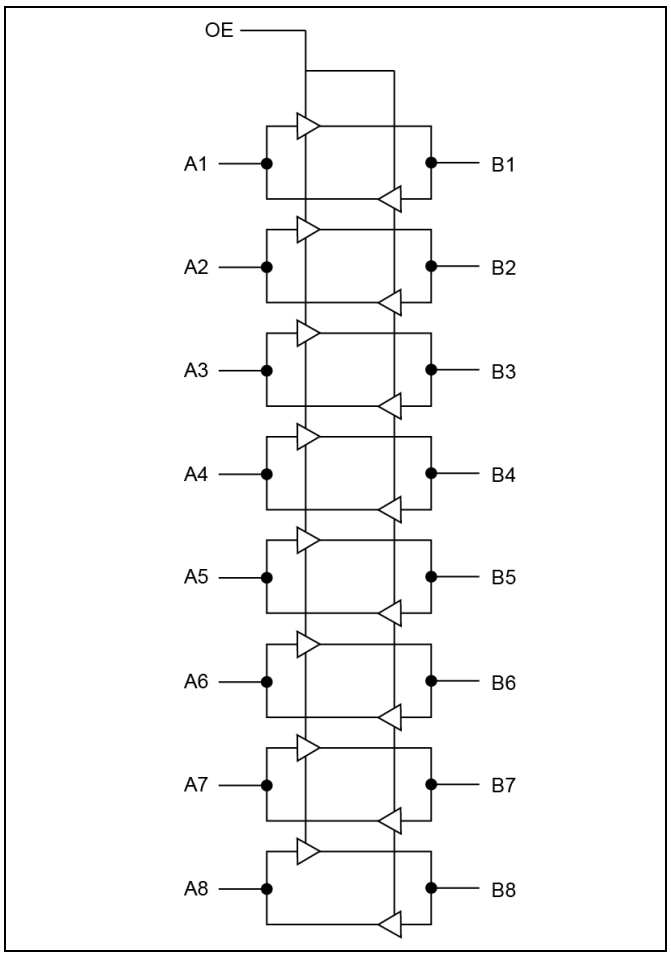


Figure 1. Block Diagram

Features

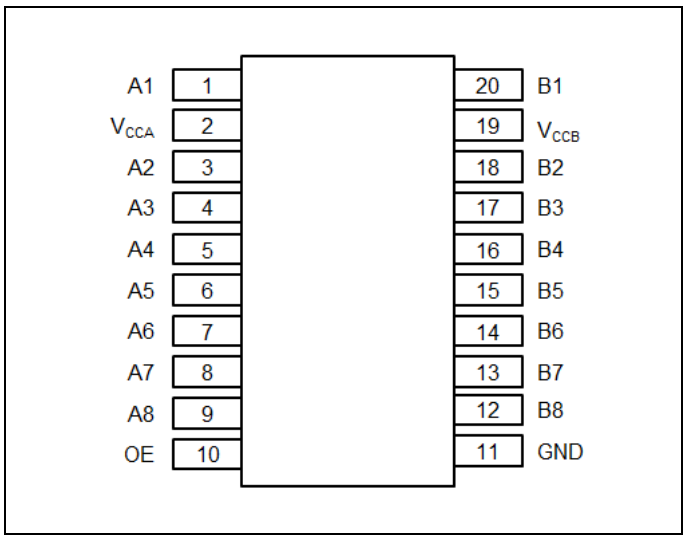
- Specified From -40°C to +85°C
- 3.3V and 5.0V Translations
  - 110Mbps (Push-Pull)
  - 0.8Mbps (Open-Drain)
- 1.8V and 2.5V, 3.3V, 5.0V Translations
  - 60Mbps (Push-Pull)
  - 0.8Mbps (Open-Drain)
- 1.2V and 1.8V, 2.5V, 3.3V, 5.0V Translations
  - 20Mbps (Push-Pull)
  - 0.6Mbps (Open-Drain)
- V_{CCA}: 1.2V to 3.6V
- V_{CCB}: 1.65V to 5.5V
- V_{CCA} Must Be Less Than or Equal to VCCB
- No Direction-Control Signal Required
- Bit-to-Bit Skew as Low as 1.0ns
- ESD Protection Per ANSI/ESDA/JEDEC JS-001
  - A Port: HBM ±5000V
  - B Port: HBM ±8000V
- IEC 61000-4-2 ESD (B Port)
  - ±8000V Contact Discharge
- Integrated Pull-Up ResistorsPackaging (Pb-free & Green):
  - 20-pin, TSSOP (L)
  - 20-pin, 4.5mm x 3.5mm, W-QFN3545 (ZH)
- Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)
- Halogen and Antimony Free. “Green” Device (Note 3)
- An automotive-compliant part is available under separate datasheet (LXS0108Q)

Application(s)

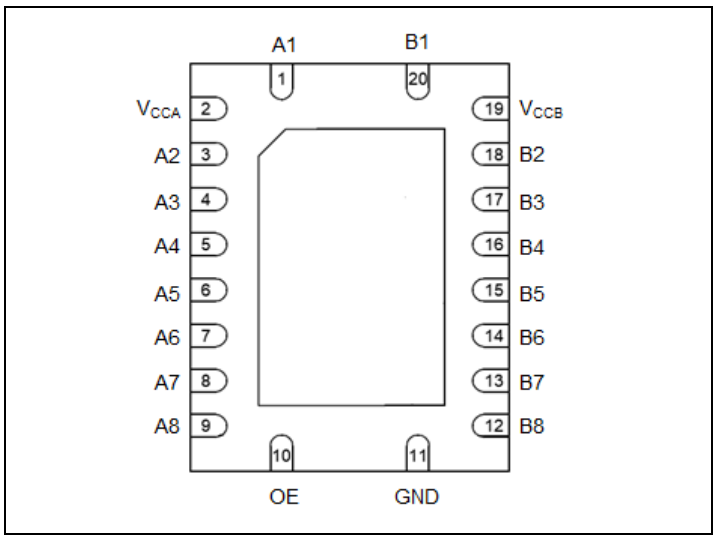
- IGPIO, SPI, SDIO, UART
- I2C or 1-Wire Voltage-Level Translation
- Low Voltage ASIC Level Translation
- Mobile Phone, Tablets,
- Desktop PCs

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated’s definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green” products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Pin Configuration



TSSOP-20 (TOP VIEW)



WQFN-20 (TOP VIEW)

Pin Description

Pin Number		Pin Name	Type	Description
TSSOP	WQFN			
2	2	V_{CCA}	Power	A-port supply voltage. $1.2V \le V_{CCA} \le 3.6V$
19	19	V_{CCB}	Power	B-port supply voltage. $1.65V \le V_{CCB} \le 5.5V$
1	1	A1	I/O	Input/output A. Referenced to V_{CCA}.
3	3	A2	I/O	Input/output A. Referenced to V_{CCA}
4	4	A3	I/O	Input/output A. Referenced to V_{CCA}
5	5	A4	I/O	Input/output A. Referenced to V_{CCA}
6	6	A5	I/O	Input/output A. Referenced to V_{CCA}
7	7	A6	I/O	Input/output A. Referenced to V_{CCA}
8	8	A7	I/O	Input/output A. Referenced to V_{CCA}
9	9	A8	I/O	Input/output A. Referenced to V_{CCA}
20	20	B1	I/O	Input/output B. Referenced to V_{CCB}
18	18	B2	I/O	Input/output B. Referenced to V_{CCB}
17	17	B3	I/O	Input/output B. Referenced to V_{CCB}
16	16	B4	I/O	Input/output B. Referenced to V_{CCB}
15	15	B5	I/O	Input/output B. Referenced to V_{CCB}
14	14	B6	I/O	Input/output B. Referenced to V_{CCB}
13	13	B7	I/O	Input/output B. Referenced to V_{CCB}
12	12	B8	I/O	Input/output B. Referenced to V_{CCB}
10	10	OE	Input	Outputs enable (active High). Pull OE low to place all outputs in 3-state mode. Referenced to V_{CCA}.
11	11	GND	GND	Ground. The exposed center thermal pad must be either be connected to Ground or left electrically opened.

Maximum Ratings

Storage Temperature	-65°C to +150°C
DC Supply Voltage Port B	V to +6.5V
DC Supply Voltage Port A	V to +4.6V
Vi(A) Referenced DC Input Voltage	V to +4.6V
Vi(B) Referenced DC Input Voltage	V to +6.5V
Enable Control Pin DC Input Voltage	V to +4.6V
Continuous Output Current, I/O	30mA
Total Power Dissipation	500mW(2)

Note:

1. Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
2. Total Power Dissipation derates linearly with 10.0mW/°C above 100°C.

Recommended Operation Conditions

Symbol	Parameter	Min	Typ	Max	Unit
V_{CCA}	V_{CCA} Positive DC Supply Voltage	1.2		3.6	V
V_{CCB}	V_{CCB} Positive DC Supply Voltage	1.65		5.5	V
V_{OE}	Enable Control Pin Voltage	GND		5.5	V
V_{IO}	A-Port I/O Pin Voltage (A_X)	GND		V_{CCA}	V
	B-Port I/O Pin Voltage (B_X)	GND		V_{CCB}	V
$\Delta t / \Delta v$	A or B port Push-Pull Driving, (V_{CCA} = 1.4V to 3.6V, V_{CCB} = 1.65V to 5.5V)			10	ns/V
	OE (V_{CCA} = 1.4V to 3.6V, V_{CCB} = 1.65V to 3.6V)			10	ns/V
T_A	Operating Temperature Range	−40		+85	°C

DC Electrical Characteristics

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

Symbol	Parameter	Test Conditions	V_{CCA}	V_{CCB}	T_A = –40°C to 85°C		Unit
					Min	Max	
V_{IHA}	A port Input HIGH Voltage		1.2V to 1.95V	1.65V to 5.5V	V_{CCI} – 0.2	V_{CCI}	V
			1.95V to 3.6V		V_{CCI} – 0.4		
V_{ILA}	A port Input LOW Voltage		1.2V to 1.95V	1.65V to 5.5V	0	0.15	V
			1.95V to 3.6V				
V_{IHB}	B port Input HIGH Voltage		1.2V to 3.6V	1.65V to 5.5V	V_{CCI} – 0.4	V_{CCI}	V
V_{ILB}	B port Input LOW Voltage		1.2V to 3.6V	1.65V to 5.5V	0	0.15	V
V_{OHA}	A port Output HIGH Voltage	I_{OHA} = -20uA, $V_{IB} \geq V_{CCB}$ – 0.4V	1.2V	1.65V to 5.5V	0.67* V_{CCA}		V
V_{OLA}	A port Output LOW Voltage	I_{OLA} = 180uA, $V_{IB} \leq$ 0.15V	1.4V	1.65V to 5.5V		0.4	V
		I_{OLA} = 220uA, $V_{IB} \leq$ 0.15V	1.65V			0.4	V
		I_{OLA} = 300uA, $V_{IB} \leq$ 0.15V	2.3V			0.4	V
		I_{OLA} = 400uA, $V_{IB} \leq$ 0.15V	3V			0.55	V
V_{OHB}	B port Output HIGH Voltage	I_{OHB} = -20uA, $V_{IA} \geqq V_{CCA}$ - 0.2V	1.2V	1.65V to 5.5V	0.67* V_{CCB}		V
V_{OLB}	B port Output LOW Voltage	I_{OLB} = 220uA, $V_{IA} \leq$ 0.15V	1.2V to 3.6V	1.65V		0.4	V
		I_{OLB} = 300uA, $V_{IA} \leq$ 0.15V		2.3V		0.4	V
		I_{OLB} = 400uA, $V_{IA} \leq$ 0.15V		3V		0.55	V
		I_{OLB} = 620uA, $V_{IA} \leq$ 0.15V		4.5V		0.55	V
V_{IH}	OE Input HIGH Voltage		1.2V to 3.6V	1.65V to 5.5V	0.65 * V_{CCA}		V
V_{IL}	OE Input LOW Voltage		1.2V to 3.6V	1.65V to 5.5V		0.35 * V_{CCA}	V
I_I	Input leakage current	OE, V_I = V_{CCI} or GND	1.2V	1.65V to 5.5V		1	µA

Symbol	Parameter	Test Conditions	V_{CCA}	V_{CCB}	T_A = –40°C to 85°C		Unit
					Min	Max	
I_{OZ}	Off-state Leakage current	A or B port, OE = V_{IL}	1.2V	1.65V to 5.5V	-1	1	µA
I_{CCA}	V_{CCA} Supply Current	V_I = V_O = open, I_O = 0	1.2V	1.65V to 5.5V	-1	5	µA
			1.5V to 3.6V	2.3V to 5.5V		7	
			3.6V	0		5	
			0	5.5V	-1	1	
I_{CCB}	V_{CCA} Supply Current	V_I = V_O = open, I_O = 0	1.2V	1.65V to 5.5V		18	µA
			1.5V to 3.6V	2.3V to 5.5V		18	
			3.6V	0	-1	1	
			0	5.5V		8	
I_{CCA} + I_{CCB}	Total Supply current	V_I = V_{CCI} or GND, I_O = 0	1.2V	2.3V to 5.5V		18	µA
			1.5V to 3.6V	2.3V to 5.5V		18	
I_{CCZA}	Off-state V_{CCA} Supply	V_I = V_O = Open, I_O = 0, OE = GND	1.2V	1.65V to 5.5V		3	µA
I_{CCZB}	Off-state V_{CCB} Supply	V_I = V_O = Open, I_O = 0, OE = GND	1.2V	1.65V to 5.5V		10	µA
C_I	Input Capacitance	OE	3.3V	3.3V		5.5	pF
C_{IO}	Input-to-output Capacitance	A Port	3.3V	3.3V		7.5	pF
		B Port	3.3V	3.3V		7.5	pF

Timing Requirements

Temperature Range: -40°C to 85°C

V_{CCA} = 1.2V			V_{CCB} = 1.8V ± 0.15V		V_{CCB} = 2.5V ± 0.2V		V_{CCB} = 3.3V ± 0.3V		V_{CCB} = 5V ± 0.5V		Unit
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
Data Rate	Push-Pull			20		20		20		20	Mbps
	Open-Drain			0.6		0.6		0.6		0.6	
t_W Pulse Duration	Data Input	Push-Pull	50		50		50		50		ns
		Open-Drain	1250		1250		1250		1250		

V_{CCA} = 1.5V ± 0.1V			V_{CCB} = 1.8V ± 0.15V		V_{CCB} = 2.5V ± 0.2V		V_{CCB} = 3.3V ± 0.3V		V_{CCB} = 5V ± 0.5V		Unit
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
Data Rate	Push-Pull			40		50		50		50	Mbps
	Open-Drain			0.8		0.8		0.8		0.8	
t_W Pulse Duration	Data Input	Push-Pull	25		16.7		20		20		ns
		Open-Drain	1250		1250		1250		1250		

V_{CCA} = 1.8V ± 0.15V			V_{CCB} = 1.8V ± 0.15V		V_{CCB} = 2.5V ± 0.2V		V_{CCB} = 3.3V ± 0.3V		V_{CCB} = 5V ± 0.5V		Unit
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
Data Rate	Push-Pull			40		60		60		60	Mbps
	Open-Drain			0.8		0.8		0.8		0.8	
t_W Pulse Duration	Data Input	Push-Pull	25		16.7		16.7		16.7		ns
		Open-Drain	1250		1250		1250		1250		

V_{CCA} = 2.5V ± 0.2V			V_{CCB} = 2.5V ± 0.2V		V_{CCB} = 3.3V ± 0.3V		V_{CCB} = 5V ± 0.5V		Unit
			MIN	MAX	MIN	MAX	MIN	MAX	
Data Rate	Push-Pull			70		90		90	Mbps
	Open-Drain			0.8		0.8		0.8	
t_W Pulse Duration	Data Input	Push-Pull	14		11		11		ns
		Open-Drain	1250		1250		1250		

V_{CCA} = 3.3V ± 0.3V			V_{CCB} = 3.3V ± 0.3V		V_{CCB} = 5V ± 0.5V		Unit
			MIN	MAX	MIN	MAX	
Data Rate	Push-Pull			90		110	Mbps
	Open-Drain			0.8		0.8	
t_W Pulse Duration	Data Input	Push-Pull	11		9		ns
		Open-Drain	1250		1250		

AC Electrical Characteristics

I/O test circuits of Figures 2, 3, 4 & 5, C_{LOAD} = 15pF, R_{LOAD} = 1MΩ, input pulse generator having the following characteristics: Z_O = 50Ω, PRR ≤ 10MHz, dv/dt ≥ 1V/ns

V_{CCA}= 1.2V ± 0.1V, Temperature Range: -40°C to 85°C

Symbol	Parameter	Test Conditions	V_{CCB}= 1.8V ± 0.15V		V_{CCB}= 2.5V ± 0.2V		V_{CCB}= 3.3V ± 0.3V		V_{CCB}= 5.0V ± 0.5V		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	
$t_{PHL-A-B}$	High to Low propagation delay	Push-Pull driving		15.8		14.5		13.8		12.8	ns
		Open-Drain driving		17.4		16.8		15.2		13.9	
$t_{PLH-A-B}$	Low to High propagation delay	Push-Pull driving		17.8		14.5		13.3		12.5	ns
		Open-Drain driving		745		581		495		414	
$t_{PHL-B-A}$	High to Low propagation delay	Push-Pull driving		18.9		17.9		16.8		15.8	ns
		Open-Drain driving		16.2		13.6		12.5		11.5	
$t_{PLH-B-A}$	Low to High propagation delay	Push-Pull driving		16.1		13.6		12.7		12.8	ns
		Open-Drain driving		775		635		540		438	
t_{en}	Enable Time	OE to A or B		200		200		200		300	ns
t_{dis}	Disable Time	OE to A or B		28.1		22		20.1		19.6	ns
t_{RA}	A port Rise Time	Push-Pull driving		18.4		15.3		14.3		13.4	ns
		Open-Drain driving		981		782		719		635	
t_{RB}	B port Rise Time	Push-Pull driving		18.1		15.1		12.6		10.8	ns
		Open-Drain driving		1080		825		793		790	
t_{FA}	A port Fall Time	Push-Pull driving		14.5		12.5		11.4		9.8	ns
		Open-Drain driving		15.4		13.6		12.5		9.5	
t_{FB}	B port Fall Time	Push-Pull driving		12.9		10.9		10.6		9.2	ns
		Open-Drain driving		13.5		11.6		11.5		10.7	
t_{PPSKEW}	Channel-to-Channel Skew			1.2		1.2		1.2		1.2	ns
f_{DATA}	Maximum Data Rate	Push-Pull driving		20		20		20		20	Mbps
		Open-Drain driving		0.6		0.6		0.6		0.6	

V_{CCA}= 1.5V ± 0.1V, Temperature Range: -40°C to 85°C

Symbol	Parameter	Test Conditions	V_{CCB}= 1.8V ± 0.15V		V_{CCB}= 2.5V ± 0.2V		V_{CCB}= 3.3V ± 0.3V		V_{CCB}= 5.0V ± 0.5V		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	
$t_{PHL-A-B}$	High to Low propagation delay	Push-Pull driving		11		9.2		8.6		8.6	ns
		Open-Drain driving		14.4		12.8		12.2		12	
$t_{PLH-A-B}$	Low to High propagation delay	Push-Pull driving		12		10		9.8		9.7	ns
		Open-Drain driving		720		554		473		384	
$t_{PHL-B-A}$	High to Low propagation delay	Push-Pull driving		12.7		11.1		11		12	ns
		Open-Drain driving		13.2		9.6		8.5		7.5	
$t_{PLH-B-A}$	Low to High propagation delay	Push-Pull driving		9.5		6.2		5.3		4.6	ns
		Open-Drain driving		745		603		519		407	
t_{en}	Enable Time	OE to A or B		200		200		200		200	ns
t_{dis}	Disable Time	OE to A or B		28.1		22		20.1		19.6	ns
t_{RA}	A port Rise Time	Push-Pull driving		13.1		9.8		9		8.3	ns
		Open-Drain driving		982		720		592		590	
t_{RB}	B port Rise Time	Push-Pull driving		11.4		7.6		6.9		6.3	ns

Symbol	Parameter	Test Conditions	V_{CCB} = 1.8V ± 0.15V		V_{CCB} = 2.5V ± 0.2V		V_{CCB} = 3.3V ± 0.3V		V_{CCB} = 5.0V ± 0.5V		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	
		Open-Drain driving		1020		756		753		670	
t_{FA}	A port Fall Time	Push-Pull driving		9.9		8.7		6.8		6	ns
		Open-Drain driving		10		7.9		7		6.2	
t_{FB}	B port Fall Time	Push-Pull driving		8.7		5.8		5.5		5.5	ns
		Open-Drain driving		11.5		8.6		9.6		7.7	
t_{PPSKEW}	Channel-to-Channel Skew			1		1		1		1	ns
f_{DATA}	Maximum Data Rate	Push-Pull driving	40		50		50		50		Mbps
		Open-Drain driving	0.8		0.8		0.8		0.8		

V_{CCA}= 1.8V ± 0.15V, Temperature Range: -40°C to 85°C

Symbol	Parameter	Test Conditions	V_{CCB} = 1.8V ± 0.15V		V_{CCB} = 2.5V ± 0.2V		V_{CCB} = 3.3V ± 0.3V		V_{CCB} = 5.0V ± 0.5V		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	
$t_{PHL-A-B}$	High to Low propagation delay	Push-Pull driving		9.7		6.4		8.7		6.6	ns
		Open-Drain driving		11.4		9.9		9.3		8.9	
$t_{PLH-A-B}$	Low to High propagation delay	Push-Pull driving		9		8.1		6.5		8.5	ns
		Open-Drain driving		729		584		466		346	
$t_{PHL-B-A}$	High to Low propagation delay	Push-Pull driving		9.8		8		7.4		7	ns
		Open-Drain driving		12.1		8.5		7.3		6.2	
$t_{PLH-B-A}$	Low to High propagation delay	Push-Pull driving		10.2		7		5.8		5	ns
		Open-Drain driving		733		578		459		323	
t_{en}	Enable Time	OE to A or B		200		200		200		200	ns
t_{dis}	Disable Time	OE to A or B		25.1		18.8		16.5		15.3	ns
t_{RA}	A port Rise Time	Push-Pull driving		11.9		8.6		7.8		7.2	ns
		Open-Drain driving		996		691		508		350	
t_{RB}	B port Rise Time	Push-Pull driving		10.5		10.2		8.2		8.7	ns
		Open-Drain driving		1001		677		546		323	
t_{FA}	A port Fall Time	Push-Pull driving		8.8		8.6		8.7		6.9	ns
		Open-Drain driving		9		6.7		5.8		5.2	
t_{FB}	B port Fall Time	Push-Pull driving		8.3		7.8		5.9		5.1	ns
		Open-Drain driving		10.5		10.7		9.6		7.8	
t_{PPSKEW}	Channel-to-Channel Skew			1		1		1		1	ns
f_{DATA}	Maximum Data Rate	Push-Pull driving	40		60		60		60		Mbps
		Open-Drain driving	0.8		0.8		0.8		0.8		

V_{CCA}= 2.5V ± 0.2V, Temperature Range: -40°C to 85°C

Symbol	Parameter	Test Conditions	V_{CCB} = 2.5V ± 0.2V		V_{CCB} = 3.3V ± 0.3V		V_{CCB} = 5.0V ± 0.5V		Unit
			Min	Max	Min	Max	Min	Max	
$t_{PHL-A-B}$	High to Low propagation delay	Push-Pull driving		5		4		3.7	ns
		Open-Drain driving		6.9		6.3		5.8	
$t_{PLH-A-B}$	Low to High propagation delay	Push-Pull driving		5.5		5.3		4.9	ns
		Open-Drain driving		592		488		368	
$t_{PHL-B-A}$	High to Low	Push-Pull driving		6.4		5.7		4.6	ns

Symbol	Parameter	Test Conditions	V_{CCB} = 2.5V ± 0.2V		V_{CCB} = 3.3V ± 0.3V		V_{CCB} = 5.0V ± 0.5V		Unit
			Min	Max	Min	Max	Min	Max	
	propagation delay	Open-Drain driving		7.3		6		4.9	
$t_{PLH-B-A}$	Low to High propagation delay	Push-Pull driving		5.9		4.6		4.5	ns
		Open-Drain driving		595		481		345	
t_{en}	Enable Time	OE to A or B		200		200		200	ns
t_{dis}	Disable Time	OE to A or B		15.7		12.9		11.2	ns
t_{RA}	A port Rise Time	Push-Pull driving		8.8		6.4		5.8	ns
		Open-Drain driving		692		529		469	
t_{RB}	B port Rise Time	Push-Pull driving		6.5		5.6		4.4	ns
		Open-Drain driving		693		483		304	
t_{FA}	A port Fall Time	Push-Pull driving		6.7		5.7		4.8	ns
		Open-Drain driving		5.6		4.7		4	
t_{FB}	B port Fall Time	Push-Pull driving		5.4		4.1		3.9	ns
		Open-Drain driving		14.2		19.4		12	
t_{PPSKEW}	Channel-to-Channel Skew			1		1		1	ns
f_{DATA}	Maximum Data Rate	Push-Pull driving	70		90		90		Mbps
		Open-Drain driving	0.8		0.8		0.8		

V_{CCA}= 3.3V ± 0.3V, Temperature Range: -40°C to 85°C

Symbol	Parameter	Test Conditions	V_{CCB} = 3.3V ± 0.3V		V_{CCB} = 5.0V ± 0.5V		Unit
			Min	Max	Min	Max	
$t_{PHL-A-B}$	High to Low propagation delay	Push-Pull driving		5.8		5.5	ns
		Open-Drain driving		5.3		4.8	
$t_{PLH-A-B}$	Low to High propagation delay	Push-Pull driving		7.9		7.5	ns
		Open-Drain driving		439		352	
$t_{PHL-B-A}$	High to Low propagation delay	Push-Pull driving		4.2		3.8	ns
		Open-Drain driving		5.5		4.5	
$t_{PLH-B-A}$	Low to High propagation delay	Push-Pull driving		3.8		4.3	ns
		Open-Drain driving		449		339	
t_{en}	Enable Time	OE to A or B		200		200	ns
t_{dis}	Disable Time	OE to A or B		11.9		9.8	ns
t_{RA}	A port Rise Time	Push-Pull driving		5.7		5	ns
		Open-Drain driving		446		337	
t_{RB}	B port Rise Time	Push-Pull driving		5		4.6	ns
		Open-Drain driving		427		290	
t_{FA}	A port Fall Time	Push-Pull driving		4.5		4.2	ns
		Open-Drain driving		4.4		3.7	
t_{FB}	B port Fall Time	Push-Pull driving		4.2		3.1	ns
		Open-Drain driving		4.2		3.1	
t_{PPSKEW}	Channel-to-Channel Skew			1		1	ns
f_{DATA}	Maximum Data Rate	Push-Pull driving	90		110		Mbps
		Open-Drain driving	0.8		0.8		

Test Circuits

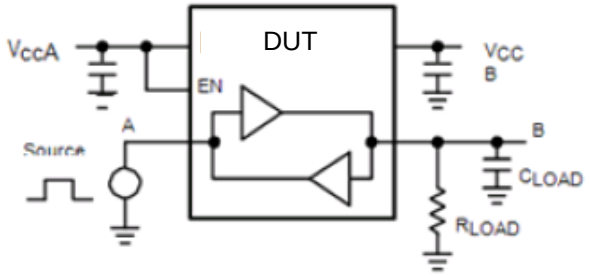


Figure 2: Rail-to-Rail Driving A

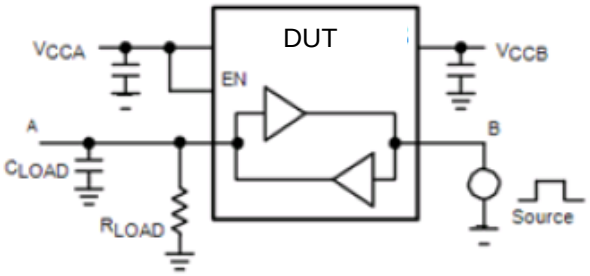


Figure 3: Rail-to-Rail Driving B

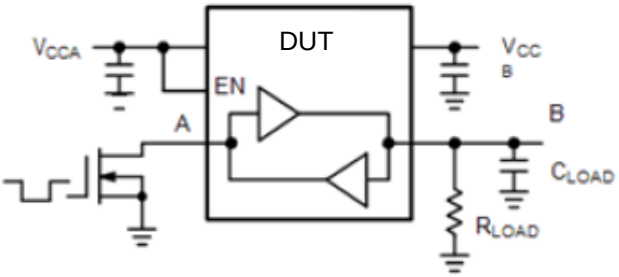


Figure 4: Open-Drain Driving A

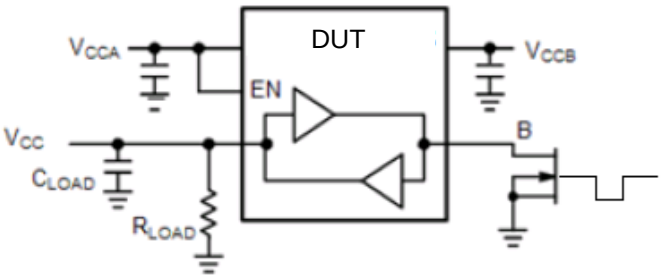
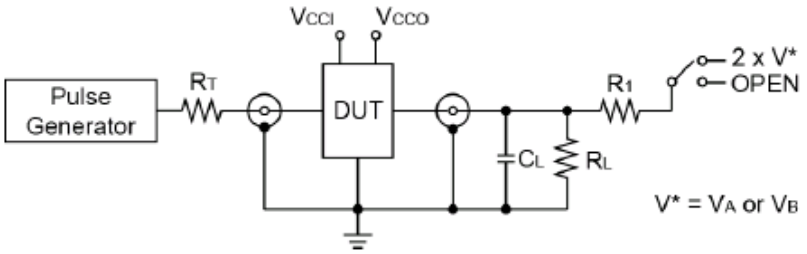


Figure 5: Open-Drain Driving B



Test	Switch
t_{PZH}, t_{PHZ}	Open
t_{PZL}, t_{PLZ}	2 x V*

C_L = 15pF
$R_L = R_1$ = 50kΩ
$R_T = Z_{OUT}$ of pulse generator (Typically 50Ω)
V* = V_A or V_B for A or B measurements, respectively.

Figure 6: Test Circuit for Enable/Disable Time Measurement

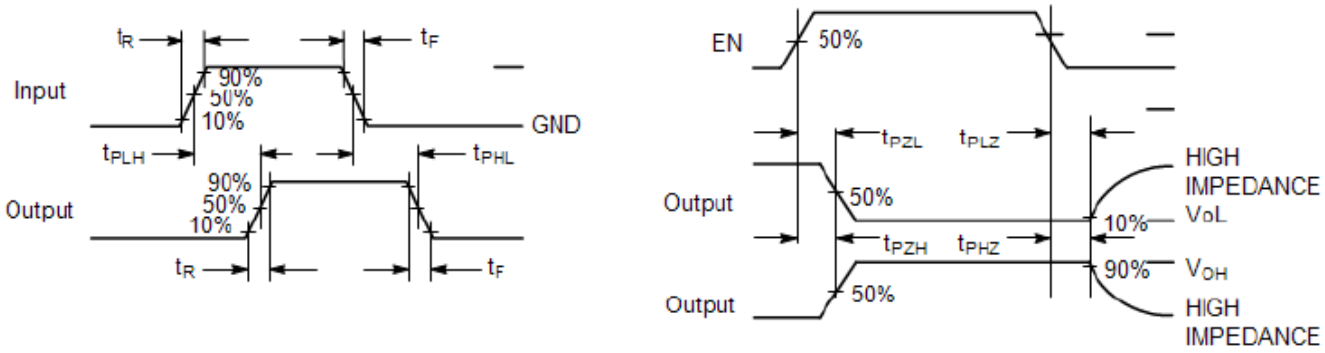


Figure 7: Timing Definitions for Propagation Delays and Enable/Disable Measurement

Functional Description

Level Translator Architecture

The LXS0108 is a 8-bit configurable dual supply level shifter with edge rate accelerators (one shots) to improve the overall data rate. The A port operating voltage range is from 1.2V to 3.6V, and the B port is from 1.65V to 5.5V. While this device is designed for open drain applications, the device can also translate push-pull CMOS logic outputs.

The device has integrated a pull-up resistor on each I/O pin. This pull-up resistor is used to pull the I/O line to either V_{CCA} (called R_{PUA}) or V_{CCB} (called R_{PUB}). When the output is driving high, R_{PUA} and R_{PUB} are set to 4kΩ resistors. In contrast, when the output is driving low, R_{PUA} and R_{PUB} are set to 40kΩ resistors because this feature provides a lower static power consumption, a lower VOL values, and a faster simultaneous switching performance. R_{PUA} and R_{PUB} are disabled when OE is Low to switch off the device.

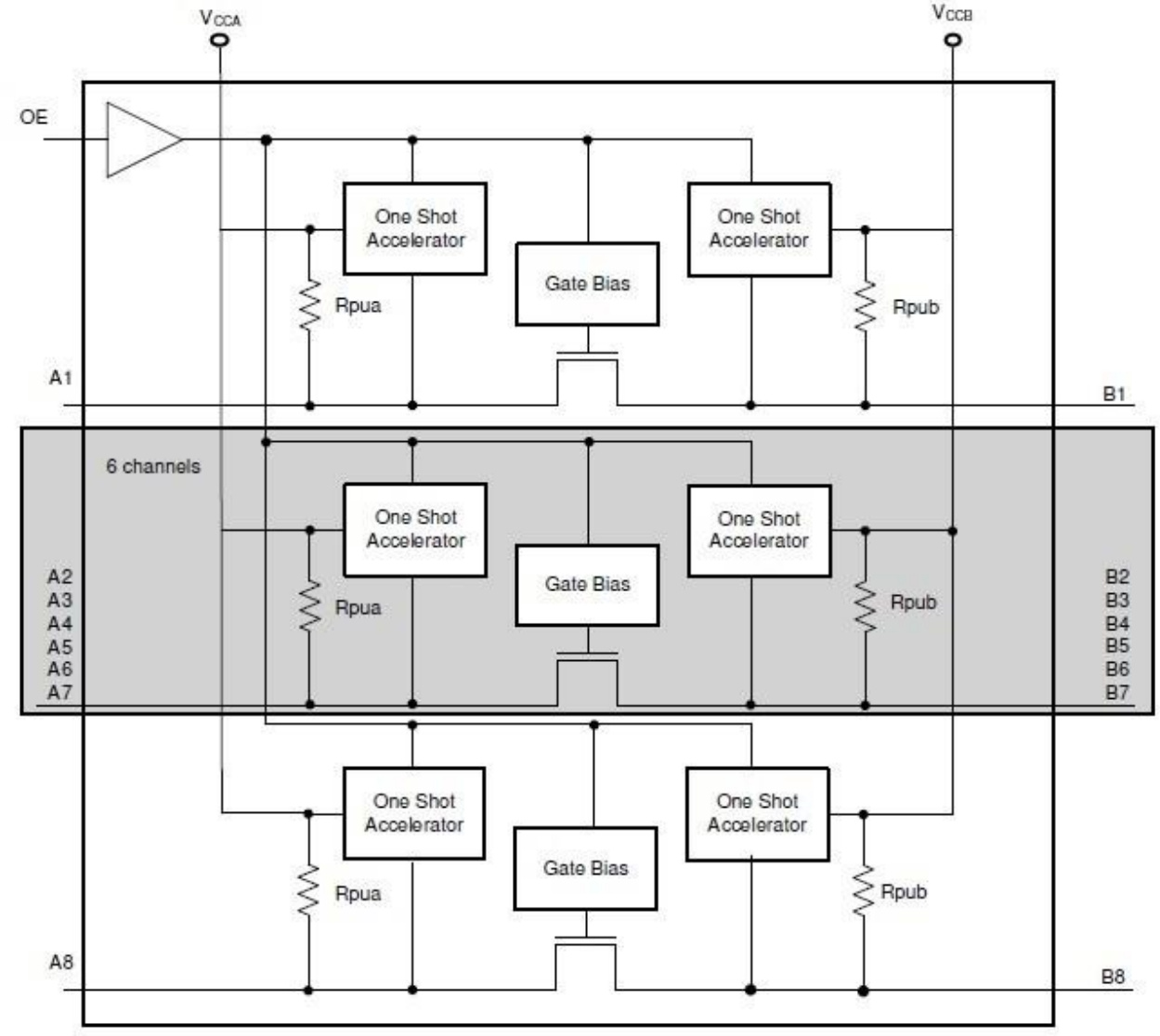


Figure 8. Functional Block Diagram

Input Driver Requirements

The rise and fall time of a signal depends on the edge-rate and output impedance of the external device driving LXS0108 data I/Os, as well as the capacitive load on the data lines. Similarly, the propagating delay and maximum data rates also depend on the output impedance of the external driver. The AC timing parameters listed in the datasheet assume that the output impedance of the external drivers is less than 50Ω.

Output Enable and Disable (OE)

The LXS0108 has an Output Enable pin (OE) that enables the device by active-high. In contrast, setting the OE pin to a logic low state can switch off the device to a minimize power consumption with all I/Os in high-impedance. Normal translation occurs when the OE pin is equal to a logic high state where the OE pin in referenced to the VCCA supply rail.

Output Load Considerations

Care shall be taken consideration careful for PCB trace lengths to avoid excessive capacitive loading and to ensure that proper one-shot 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, which is 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. Both PCB trace length and connectors add to the capacitance of the LXS0108 output. Therefore, the lumped-load capacitance shall be considered in order to avoid one-shot retriggering, or bus contention, or output signal oscillations.

Power Supply Guidelines

For normal operation, the V_{CCA} must be less than or equal to V_{CCB} where the LXS0108 does not require power sequencing between V_{CCA} and V_{CCB} during power-up. To minimize power noise from supply rails, decouple capacitors, 0.01μF to 0.1μF should be placed as closed as V_{CCA} and V_{CCB}. The PCB trace of signals must be kept short enough so that the round-trip delay of any reflection is less than the one-shot duration, approximately 30ns.

Part Marking

L Package

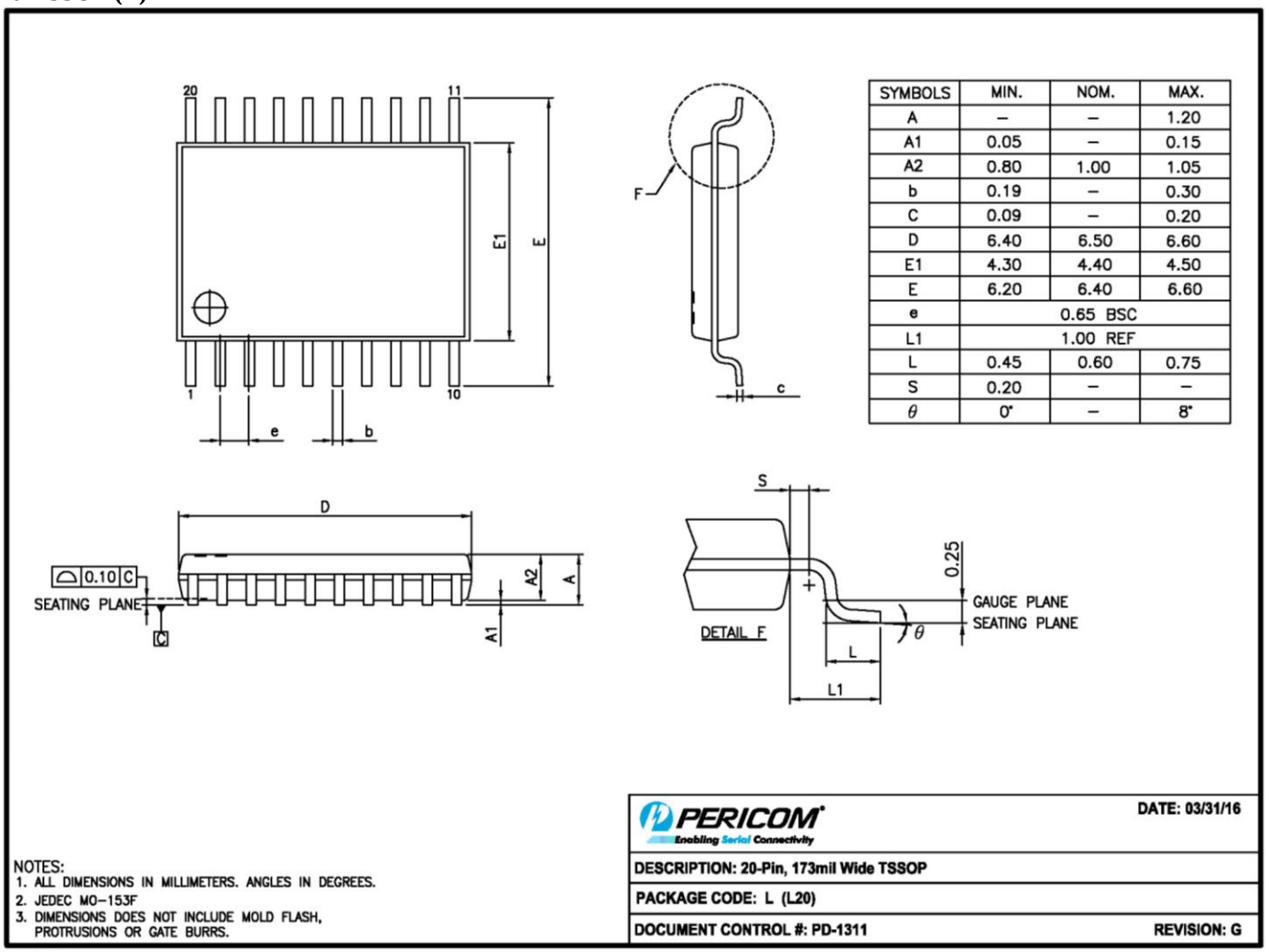
YY: Date Code (Year)
WW: Date Code (Workweek)
1st X: Assembly Code
2nd X: Fab Code
Bar above 2nd "X" means Cu wire

ZH Package

Y: Date Code (Year)
W: Date Code (Workweek)
1st X: Assembly Code
2nd X: Fab Code
Bar above 2nd "X" means Cu wire

Packaging Mechanical

20-TSSOP (L)



SYMBOLS	MIN.	NOM.	MAX.
A	–	–	1.20
A1	0.05	–	0.15
A2	0.80	1.00	1.05
b	0.19	–	0.30
C	0.09	–	0.20
D	6.40	6.50	6.60
E1	4.30	4.40	4.50
E	6.20	6.40	6.60
e	0.65 BSC		
L1	1.00 REF		
L	0.45	0.60	0.75
S	0.20	–	–
θ	0°	–	8°

NOTES:
1. ALL DIMENSIONS IN MILLIMETERS. ANGLES IN DEGREES.
2. JEDEC MO-153F
3. DIMENSIONS DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.

PERICOM Enabling Serial Connectivity

DATE: 03/31/16

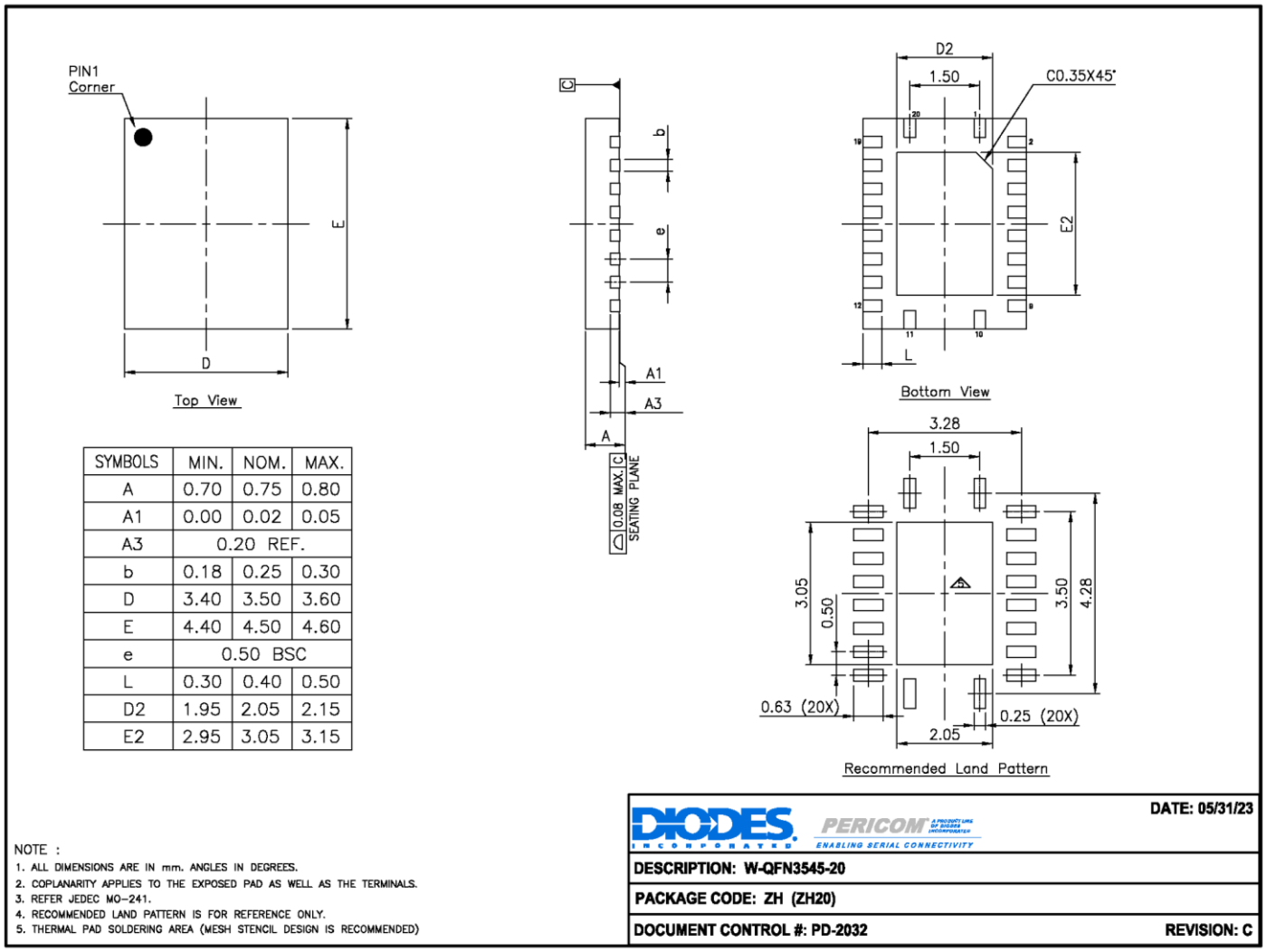
DESCRIPTION: 20-Pin, 173mil Wide TSSOP

PACKAGE CODE: L (L20)

DOCUMENT CONTROL #: PD-1311 REVISION: G

16-0074

20-WQFN (ZH)



SYMBOLS	MIN.	NOM.	MAX.
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3		0.20 REF.	
b	0.18	0.25	0.30
D	3.40	3.50	3.60
E	4.40	4.50	4.60
e		0.50 BSC	
L	0.30	0.40	0.50
D2	1.95	2.05	2.15
E2	2.95	3.05	3.15

NOTE :
1. ALL DIMENSIONS ARE IN mm. ANGLES IN DEGREES.
2. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
3. REFER JEDEC MO-241.
4. RECOMMENDED LAND PATTERN IS FOR REFERENCE ONLY.
5. THERMAL PAD SOLDERING AREA (MESH STENCIL DESIGN IS RECOMMENDED)

DATE: 05/31/23

DESCRIPTION: W-QFN3545-20

PACKAGE CODE: ZH (ZH20)

DOCUMENT CONTROL #: PD-2032 REVISION: C

For latest package info.

please check: http://www.diodes.com/design/support/packaging/pericom-packaging/packaging-mechanicals-and-thermal-characteristics/

Ordering Information

Orderable Part Number	Package Code	Package Description
LXS0108LEX	L	20-pin, 173mil Wide (TSSOP)
LXS0108ZHEX	ZH	20-pin, W-QFN3545-20

Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. E = Pb-free and Green
5. X suffix = Tape/Reel

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