SY898531L

Precision Differential 3.3V Low Skew LVPECL 1:9 Fanout Buffer

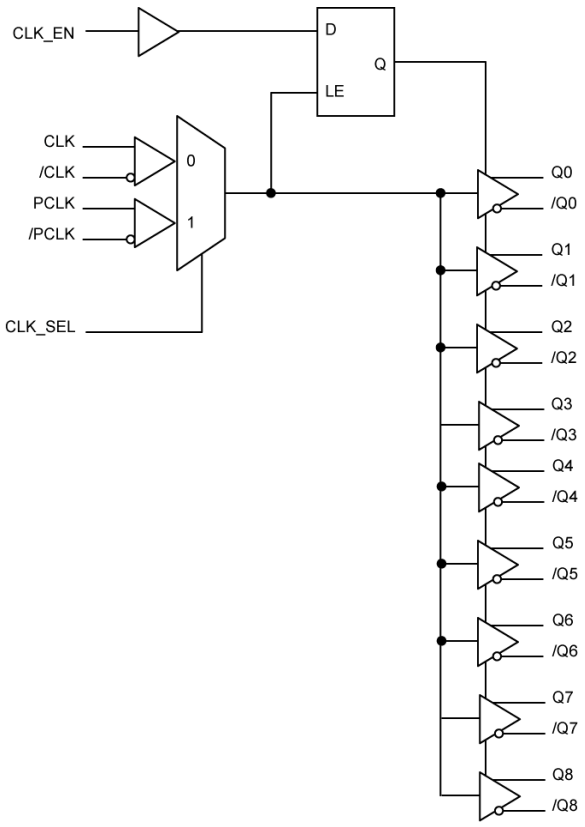
General Description

The SY898531L is a 3.3V, low skew, 1:9 LVPECL fanout buffer with two selectable clock input pairs. Most standard differential input levels can be applied to the CLK, /CLK pair while LVPECL, CML, or SSTL input levels can be applied to the PCLK, /PCLK pair. To eliminate runt pulses on the outputs during asynchronous assertion/de-assertion of the clock enable pin, the clock enable is synchronized with the input signal.

The SY898531L operates from a 3.3V ±5% supply and is guaranteed over the full industrial temperature range of 0°C to +70°C. The SY898531L is part of Micrel's high-speed, Precision Edge® product line.

Datasheets and support documentation can be found on Micrel's web site at: www.micrel.com.

Functional Block Diagram



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Precision Edge®

Features

- Provides nine differential 3.3V LVPECL copies
- Selects between differential CLK, /CLK or LVPECL clock inputs
- CLK, /CLK pair accepts LVDS, LVPECL, LVHSTL, SSTL, HCSL input levels
- PCLK, /PCLK pair accepts LVPECL, CML, SSTL input levels
- Guaranteed AC performance over temperature and supply voltage:
  - 500MHz Maximum output frequency
  - < 2ns Propagation delay (In-to-Q)
  - < 50ps Output skew
  - < 250ps Part-to-part skew
  - Additive phase jitter, RMS: 0.17ps (typical)
- 3.3V ±5% supply voltage
- 0°C to +70°C temperature operating range
- Available in a 32-pin TQFP package

Applications

- SONET clock distribution
- Backplane distribution

Markets

- LAN/WAN
- Enterprise servers
- ATE
- Test and measurement

Ordering Information

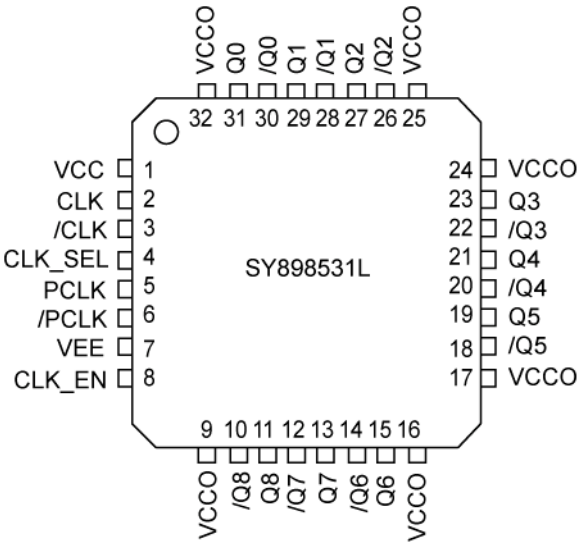
Part Number	Package Type	Operating Range	Package Marking	Lead Finish
SY898531LTZ	T32-1	Commercial	SY898531LTZ with Pb-Free bar-line Indicator	Matte-tin Pb-Free
SY898531LTZTR[2]	T32-1	Commercial	SY898531LTZ with Pb-Free bar-line Indicator	Matte-tin Pb-Free

Notes:

1. Contact factory for die availability. Dice are guaranteed at T_A = 25°C, DC Electricals Only.

2. Tape and Reel.

Pin Configuration



32-Pin TQFP (T32-1)

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Pin Description

Pin Number	Pin Name	Pin Function
7	V_{EE}	Ground.
8	CLK_EN	Single-Ended Input: This TTL/CMOS input disables and enables the Q0-Q8 outputs. It is internally connected to a 50kΩ pull-up resistor and will default to a logic HIGH state if left open. When disabled, Q goes LOW and /Q goes HIGH. Since CLK_EN is synchronous with the input clock, the outputs will be enabled/disabled following a rising and a falling edge of the input clock. V_{TH} = is approximately 1.5V.
4	CLK_SEL	Single-Ended Input: This single-ended TTL/CMOS-compatible input selects the input to the multiplexer. Note that this input is internally connected to a 50kΩ pull-down resistor and will default to logic LOW state if left open. V_{TH} = is approximately 1.5V.
2, 3	CLK, /CLK	Differential Input: This input pair is a differential signal input to the device. This input accepts AC- or DC-coupled signals. CLK is internally connected to a 28kΩ pull-down resistor and will default to a logic LOW state if left open while /CLK is connected to a 50kΩ pull-up resistor and will default to a logic HIGH state if left open. This input pair is selected when CLK_SEL is set to logic LOW.
5, 6	PCLK, /PCLK	Differential Input: This input pair is a differential signal input to the device. This input accepts AC- or DC-coupled signals. PCLK is internally connected to a 50kΩ pull-down resistor and will default to a logic LOW state if left open while /PCLK is connected to a 50kΩ pull-up resistor and will default to a logic HIGH state if left open. This input pair is selected when CLK_SEL is set to logic HIGH.
1	V_{CC}	Positive Power Supply Pin: Bypass with 0.1µF||0.01µF low ESR capacitor as close to the V_{CC} pin as possible.
9, 16, 17, 24, 25, 32	V_{CCO}	Output Positive Power Supply Pins: Bypass with 0.1µF||0.01µF low ESR capacitors as close to the V_{CCO} pins as possible.
30, 31 28, 29 26, 27 22, 23 20, 21 18, 19 14, 15 12, 13 10, 11	Q0, /Q0 Q1, /Q1 Q2, /Q2 Q3, /Q3 Q4, /Q4 Q5, /Q5 Q6, /Q6 Q7, /Q7 Q8, /Q8	LVPECL Differential Output Pairs: Differential buffered output copies of the selected input signal. The output swing is typically 800mV. Unused output pairs may be left floating with no impact on jitter. These differential LVPECL outputs are a logic function of the CLK, /CLK and PCLK, /PCLK, and CLK_SEL inputs. See “Truth Table” below.

Truth Table

Inputs			Outputs	
CLK_EN	**CLK_SEL**	**Selected Source**	**Q0 :Q8**	**/Q0:/Q8**
0	0	CLK, /CLK	Disabled : LOW	Disabled : HIGH
0	1	PCLK, /PCLK	Disabled : LOW	Disabled : HIGH
1	0	CLK, /CLK	CLK	/CLK
1	1	PCLK, /PCLK	PCLK	/PCLK

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Absolute Maximum Ratings[1]

Supply Voltage (V_{CC}) .....–0.5V to +4.6V
Input Voltage (V_{IN}) .....–0.5V to V_{CC} +0.5V
LVPECL Output Current (I_{OUT}) .....
Continuous 50mA
Surge 100mA
Lead Temperature (soldering, 20 sec.) .....+260°C
Storage Temperature (T_s) ..... –65°C to 150°C

Operating Ratings[2]

Supply Voltage (V_{CC}) .....+3.135V to +3.465V
Ambient Temperature (T_A) ..... 0°C to +70°C
Package Thermal Resistance[3]
TSSOP (θ_{JA})
Still-Air..... 50°C/W

Power Supply DC Electrical Characteristics[4]

V_{CC} = V_{CCO} = 3.3V ±5%; T_A = 0°C to +70°C, unless otherwise stated.

Symbol	Parameter	Condition	Min	Typ	Max	Units
V_{CC}	Power Supply		3.135	3.3	3.465	V
V_{CCO}	Output Power Supply		3.135	3.3	3.465	V
I_{EE}	Power Supply Current	No load, max V_{CC}			80	mA

LVCMOS/LVTTL DC Electrical Characteristics[4]

V_{CC} = V_{CCO} = 3.3V ±5%; T_A = 0°C to +70°C, unless otherwise stated.

Symbol	Parameter		Condition	Min	Typ	Max	Units
V_{IH}	Input High Voltage			2		V_{CC} + 0.3	V
V_{IL}	Input Low Voltage			-0.3		0.8	V
I_{IH}	Input High Current	CLK_EN	V_{IN} = V_{CC} = 3.465V			5	µA
		CLK_SEL	V_{IN} = V_{CC} = 3.465V			150	µA
I_{IL}	Input Low Current	CLK_EN	V_{IN} = 0V, V_{CC} = 3.465V	-150			µA
		CLK_SEL	V_{IN} = 0V, V_{CC} = 3.465V	-5			µA

Differential DC Electrical Characteristics[4]

V_{CC} = V_{CCO} = 3.3V ±5%; T_A = 0°C to +70°C, unless otherwise stated.

Symbol	Parameter		Condition	Min	Typ	Max	Units
I_{IH}	Input High Current	CLK	V_{IN} = V_{CC} = 3.465V			150	µA
		/CLK	V_{IN} = V_{CC} = 3.465V			5	µA
I_{IL}	Input Low Current	CLK	V_{IN} = 0.5V, V_{CC} = 3.465V	-5			µA
		/CLK	V_{IN} = 0.5V, V_{CC} = 3.465V	-150			µA
V_{PP}	Peak-to-Peak Input Voltage			0.15		1.3	V
V_{CMR}	Common Mode Input Voltage[5, 6]			V_{EE} + 0.5		V_{CC} - 0.85	V

Notes:

1. Permanent device damage may occur if absolute maximum ratings are exceeded. This is a stress rating only and functional operation is not implied at conditions other than those detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
2. The data sheet limits are not guaranteed if the device is operated beyond the operating ratings.
3. θ_{JA} value is determined for a 4-layer board in still air unless otherwise stated.
4. The circuit is designed to meet the DC specifications shown in the above table after thermal equilibrium has been established.
5. Maximum input voltage for CLK and /CLK is V_{CC} + 0.3V for single ended applications.
6. V_{IH} is defined as the common mode voltage.

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LVPECL DC Electrical Characteristics[7]

V_{CC} = V_{CCO} = 3.3V ±5%; T_A = 0°C to +70°C, unless otherwise stated.

Symbol	Parameter		Condition	Min	Typ	Max	Units
I_{IH}	Input High Current	PCLK	V_{IN} = V_{CC} = 3.465V			150	µA
		/PCLK	V_{IN} = V_{CC} = 3.465V			5	µA
I_{IL}	Input Low Current	PCLK	V_{IN} = 0V, V_{CC} = 3.465V	-5			µA
		/PCLK	V_{IN} = 0V, V_{CC} = 3.465V	-150			µA
V_{PP}	Peak-to-Peak Input Voltage			0.3		1	V
V_{CMR}	Common Mode Input Voltage[8, 9]			V_{EE} + 1.5		V_{CC}	V
V_{OH}	Output High Voltage[10]			V_{CC} - 1.4		V_{CC} – 1.0	V
V_{OL}	Output Low Voltage[10]			V_{CC} – 2.0		V_{CC} - 1.7	V
V_{SWING}	Peak-to-Peak Output Voltage Swing			0.6		1.0	V

Notes:

7. The circuit is designed to meet the DC specifications shown in the above table after thermal equilibrium has been established.
8. Maximum input voltage for PCLK and /PCLK is V_{CC} + 0.3V for single ended applications.
9. V_{IH} is defined as the common mode voltage.
10. 50Ω to V_{CCO}-2V terminated outputs.

AC Electrical Characteristics[11]

V_{CC} = V_{CCO} = 3.3V ±5%; R_L = 50Ω to V_{CCO}-2V; T_A = 0°C to +70°C, unless otherwise stated.

Symbol	Parameter	Condition	Min	Typ	Max	Units
f_{MAX}	Maximum Operating Frequency		500			MHz
t_{PD}	Differential Propagation Delay CLK-to-Q, PCLK-to-Q	f ≤ 250MHz	1		2	ns
t_{SKEW}	Output-to-Output Skew[12]				50	ps
	Part-to-Part Skew[13]				250	ps
t_{JITTER}	Additive Phase Jitter[14]	155.52MHz, (12KHz to 20MHz)		0.17		ps_{RMS}
t_r, t_f	Output Rise/Fall Time	20% to 80% @ 50MHz	300		700	ps
odc	Output Duty Cycle		48	50	52	%

Notes:

11. High-frequency AC-parameters are guaranteed by design and characterization.
12. Output-to-Output skew is measured between two different outputs under identical transitions.
13. Part-to-Part skew is defined for two parts with identical power supply voltages at the same temperature and with no skew of the edges at the respective inputs. This parameter is defined in accordance with JEDEC Standard 65.
14. Driving only one input clock.

Timing Diagrams

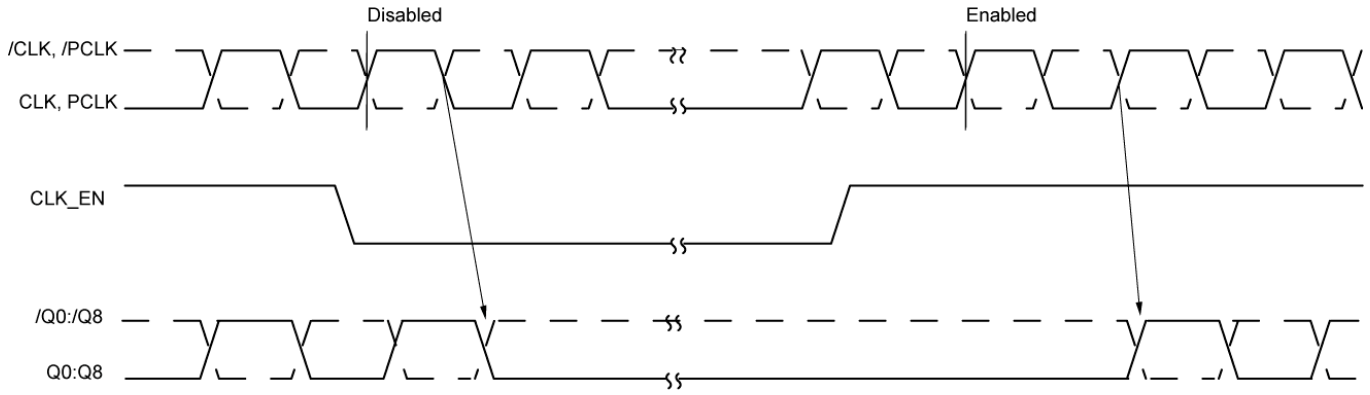


Figure 1a. CLK_EN Timing Diagram

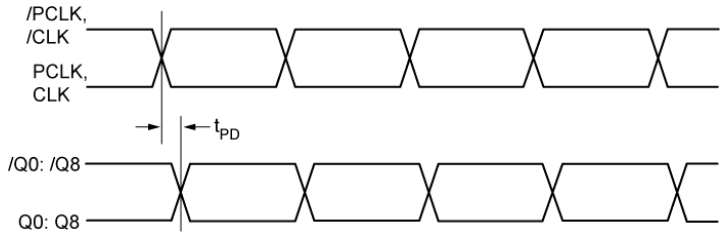


Figure 1b. Propagation Delay

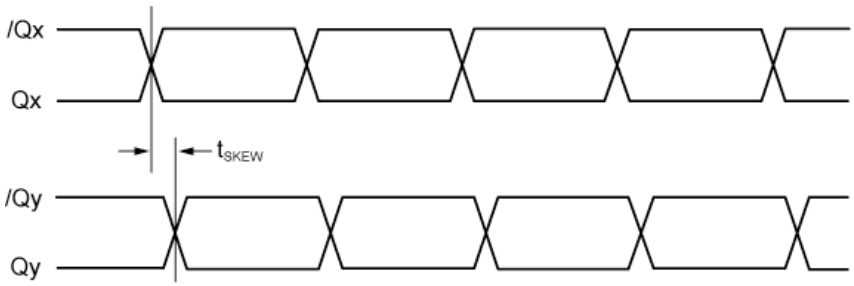
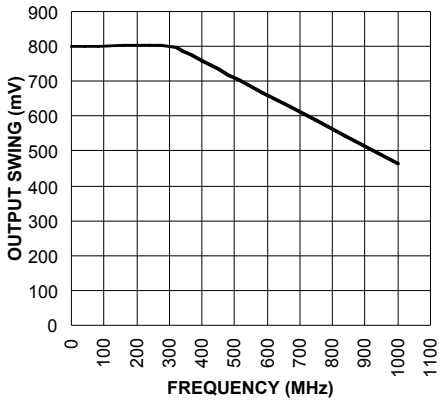


Figure 1c. Output-to-Output Skew

Typical Operating Characteristics

V_{CC} = 3.3V, V_{EE} = 0V, V_{IN} = 800mV, R_L = 50Ω to V_{CC}–2V; T_A = 25°C, unless otherwise stated.

Output Swing vs. Frequency

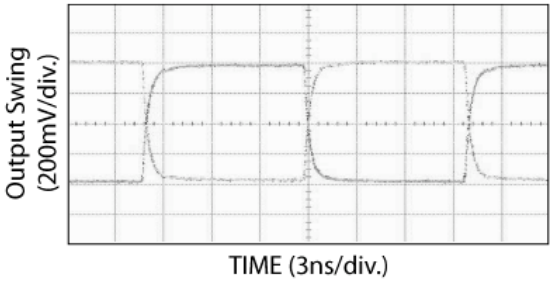


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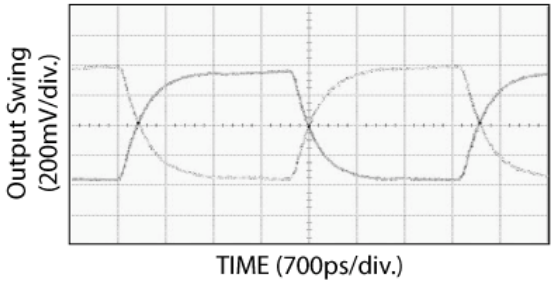
Functional Characteristics

V_{CC} = 3.3V, V_{EE} = 0V, V_{IN} = 800mV, R_L = 50Ω to V_{CC}-2V; T_A = 25°C, unless otherwise stated

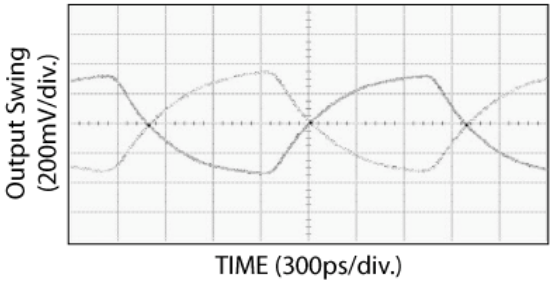
50MHz Clock



200MHz Clock



500MHz Clock



CLK, /CLK Input Interface Applications

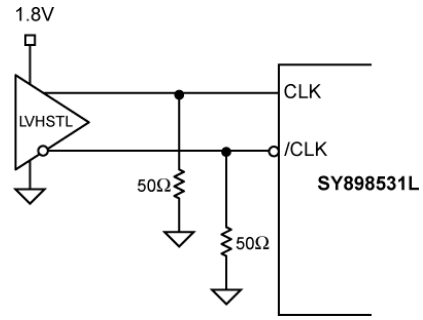


Figure 2a. LVHSTL Interface (DC-Coupled)

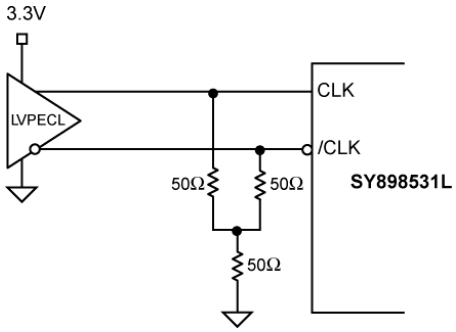


Figure 2b. LVPECL Interface (DC-Coupled)

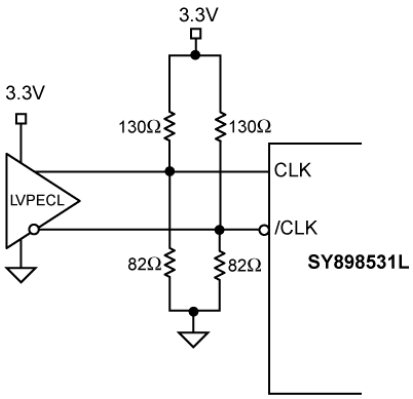


Figure 2c. LVPECL Interface (DC-Coupled)

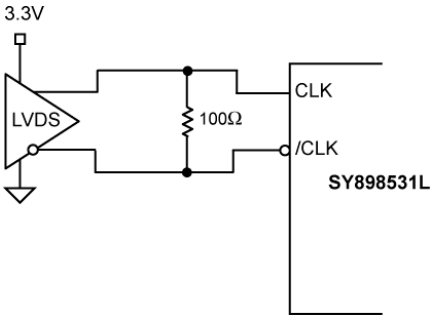


Figure 2d. LVDS Interface (DC-Coupled)

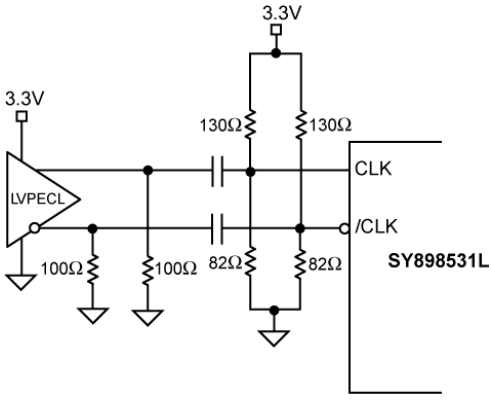


Figure 2e. LVPECL Interface (AC-Coupled)

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PCLK, /PCLK Input Interface Applications

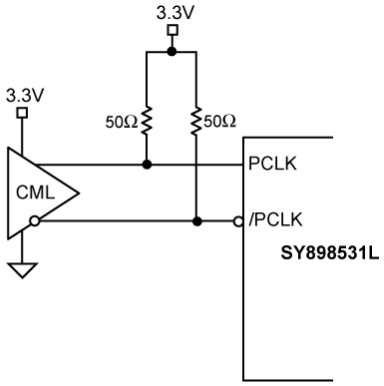


Figure 3a. CML Open Collector Interface (DC-Coupled)

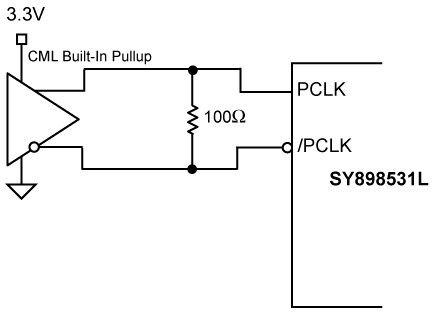


Figure 3b. CML Built-in Pull-up Interface (DC-Coupled)

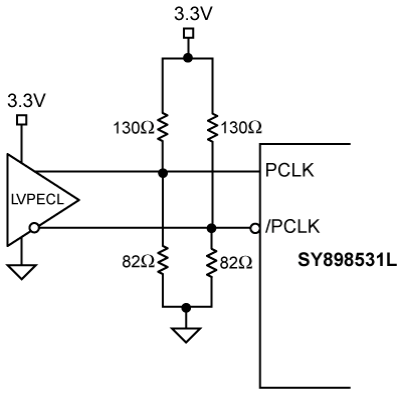


Figure 3c. LVPECL Interface (DC-Coupled)

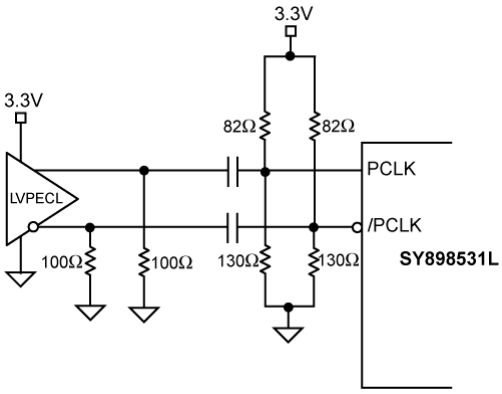


Figure 3d. LVPECL Interface (AC-Coupled)

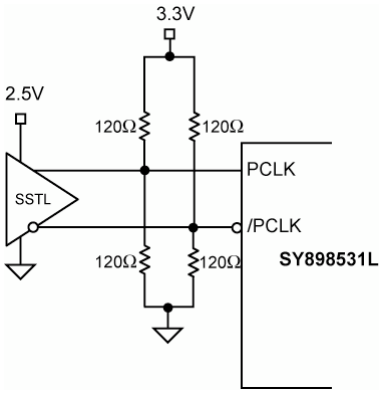


Figure 3e. SSTL Interface (DC-Coupled)

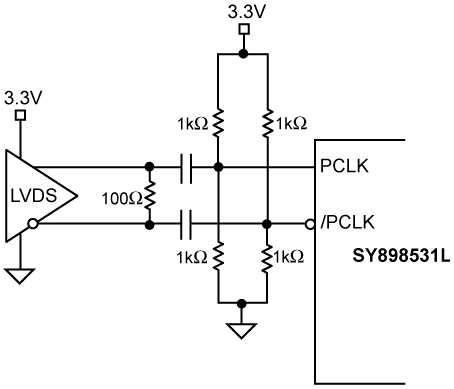
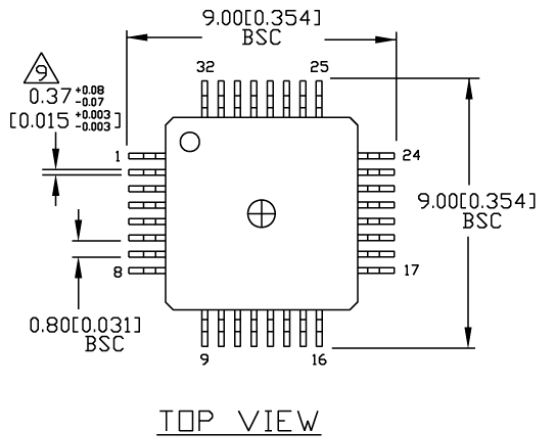
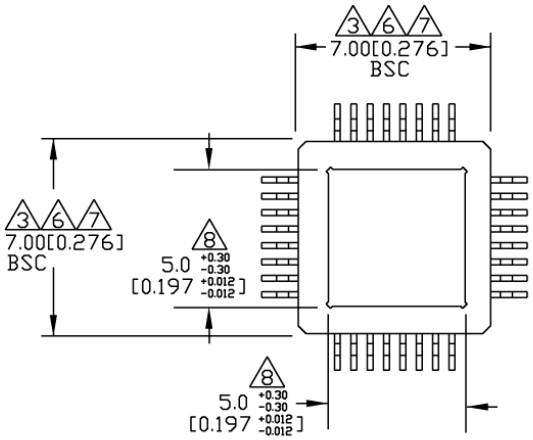


Figure 3f. LVDS Interface (AC-Coupled)

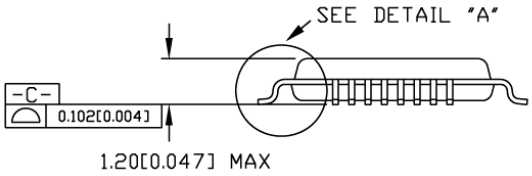
Package Information



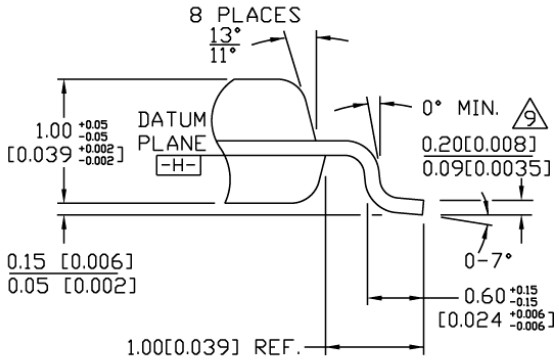
TOP VIEW



BOTTOM VIEW



SIDE VIEW



NOTES:
1. DIMENSIONS ARE IN MM[INCHES].
2. CONTROLLING DIMENSION: MM.
3. DIMENSION DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS, EITHER OF WHICH SHALL NOT EXCEED 0.254 [0.010].
4. LEAD DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION.
5. MAXIMUM AND MINIMUM SPECIFICATIONS ARE INDICATED AS FOLLOWS: MAX/MIN.
6. THESE DIMENSIONS TO BE DETERMINED AT DATUM PLANE -H-
7. PACKAGE TOP DIMENSIONS ARE SMALLER THAN BOTTOM DIMENSIONS AND TOP OF PACKAGE WILL NOT OVERHANG BOTTOM OF PACKAGE.
8. EXPOSED PAD SHALL BE COPLANAR WITH PACKAGE BOTTOM WITHIN 0.05mm
   EXPOSED PAD: Cu WITH Sn/Pb PLATING
9. DIMENSION INCLUDES LEAD FINISH.

32-Pin TQFP (T32-1)

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