



Dual 1:5 Differential Clock Drivers with LVPECL Inputs and LVDS Outputs

General Description

The MAX9317/MAX9317A/MAX9317B/MAX9317C low-skew, dual 1-to-5 differential drivers are designed for clock and data distribution. The differential input is reproduced at five LVDS outputs with a low output-to-output skew of 5ps.

The MAX9317/MAX9317A are designed for low-voltage operation from a 2.375V to 2.625V power supply for use in 2.5V systems. The MAX9317B/MAX9317C operate from a 3.0V to 3.6V power supply for use in 3.3V systems. The MAX9317A/MAX9317C feature 50Ω input termination resistors to reduce component count.

The MAX9317 family is available in 32-pin 7mm × 7mm TQFP and space-saving 5mm × 5mm QFN packages and operate across the extended temperature range of -40°C to +85°C. The MAX9317A is pin compatible with ON Semiconductor's MC100EP210S.

Applications

- Precision Clock Distribution
- Low-Jitter Data Repeaters
- Data and Clock Drivers and Buffers
- Central-Office Backplane Clock Distribution
- DSLAM Backplanes
- Base Stations
- ATE

Pin Configurations appear at end of data sheet.

Features

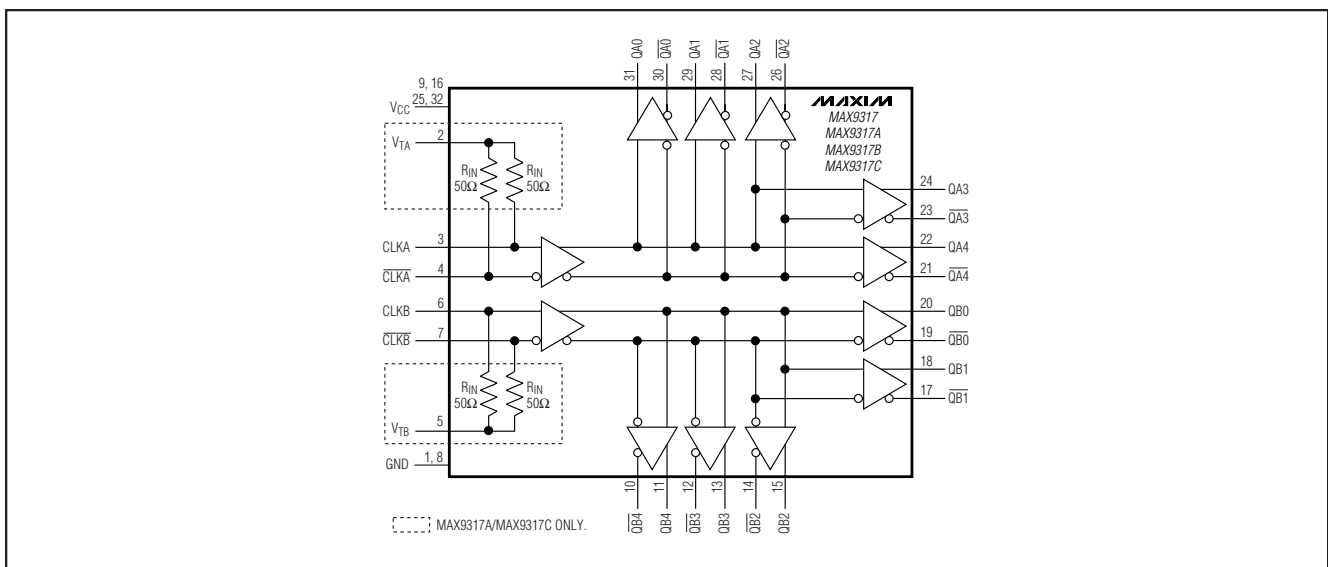
- ◆ Guaranteed 1.0GHz Operating Frequency
- ◆ 145ps (max) Part-to-Part Skew
- ◆ 5ps Output-to-Output Skew
- ◆ 330ps Propagation Delay from CLK_{_} to Q_{_}
- ◆ 2.375V to 2.625V Operation (MAX9317/MAX9317A)
- ◆ 3.0V to 3.6V Operation (MAX9317B/MAX9317C)
- ◆ ESD Protection: ±2kV (Human Body Model)
- ◆ Internal 50Ω Input Termination Resistors (MAX9317A/MAX9317C)

Ordering Information

PART	TEMP RANGE	PIN-PACKAGE	NOMINAL SUPPLY VOLTAGE (V)
MAX9317ETJ*	-40°C to +85°C	32 Thin QFN	2.5
MAX9317ECJ	-40°C to +85°C	32 TQFP	2.5
MAX9317AETJ*	-40°C to +85°C	32 Thin QFN	2.5
MAX9317AECJ	-40°C to +85°C	32 TQFP	2.5
MAX9317BETJ*	-40°C to +85°C	32 Thin QFN	3.3
MAX9317BECJ	-40°C to +85°C	32 TQFP	3.3
MAX9317CETJ*	-40°C to +85°C	32 Thin QFN	3.3
MAX9317CECJ	-40°C to +85°C	32 TQFP	3.3

*Future product—contact factory for availability.

Functional Diagram



MAX9317/MAX9317A/MAX9317B/MAX9317C



Dual 1:5 Differential Clock Drivers with LVPECL Inputs and LVDS Outputs

ABSOLUTE MAXIMUM RATINGS

V _{CC} to GND	-0.3V to +4.1V	Junction-to-Ambient Thermal Resistance in Still Air	
Input Pins to GND	-0.3V to (V _{CC} + 0.3V)	32-Pin, 7mm × 7mm TQFP	+48.4°C/W
Differential Input Voltage	V _{CC} or 3.0V, whichever is less	32-Pin, 5mm × 5mm QFN	+47°C/W
Continuous Output Current	28mA	Junction-to-Case Thermal Resistance	
Surge Output Current	50mA	32-Pin, 7mm × 7mm TQFP	+12°C/W
Continuous Power Dissipation (T _A = +70°C)		32-Pin, 5mm × 5mm QFN	+2°C/W
32-Pin, 7mm × 7mm TQFP		Operating Temperature Range	-40°C to +85°C
(derate 20.7mW/°C above +70°C)	1.65W	Junction Temperature	+150°C
32-Pin 5mm × 5mm QFN		Storage Temperature Range	-65°C to +150°C
(derate 21.3mW/°C above +70°C)	1.7W	ESD Protection	
		Human Body Model (CLK ₋ , $\overline{\text{CLK}}_{-}$, Q ₋ , $\overline{\text{Q}}_{-}$, V _{T-})	±2kV
		Soldering Temperature (10s)	+300°C

Stresses beyond those listed under "Absolute Maximum Ratings" 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 operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC ELECTRICAL CHARACTERISTICS

(V_{CC} = 2.375V to 2.625V (MAX9317/MAX9317A), V_{CC} = 3.0V to 3.6V (MAX9317B/MAX9317C), all outputs loaded 100Ω ±1% between Q₋ and $\overline{\text{Q}}_{-}$, unless otherwise noted. Typical values are at V_{CC} = 2.5V (MAX9317/MAX9317A), V_{CC} = 3.3V (MAX9317B/MAX9317C), V_{IHD} = V_{CC} - 1.0V, V_{ILD} = V_{CC} - 1.5V, unless otherwise noted.) (Notes 1, 2, and 3)

PARAMETER	SYMBOL	CONDITIONS	-40°C			+25°C			+85°C			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
INPUTS (CLK₋, $\overline{\text{CLK}}_{-}$)												
Differential Input High Voltage	V _{IHD}	Figure 1	1.2		V _{CC}	1.2		V _{CC}	1.2		V _{CC}	V
Differential Input Low Voltage	V _{ILD}	Figure 1	0		V _{CC} - 0.1	0		V _{CC} - 0.1	0		V _{CC} - 0.1	V
Differential Input Voltage	V _{ID}	V _{IHD} - V _{ILD}	MAX9317/MAX9317A		0.1	V _{CC}	0.1	V _{CC}	0.1	V _{CC}		V
			MAX9317B/MAX9317C		0.1	3.0	0.1	3.0	0.1	3.0		
Input Current	I _{IH} , I _{IL}	CLK ₋ or $\overline{\text{CLK}}_{-}$ = V _{IHD} or V _{ILD} , MAX9317/MAX9317B	-60		+60	-60		+60	-60		+60	μA
Input Termination Resistance	R _{IN}	MAX9317A/MAX9317C, Figure 2 (Note 4)	43	50	57	43	50	57	43	50	57	Ω
OUTPUTS (Q₋, $\overline{\text{Q}}_{-}$)												
Output High Voltage	V _{OH}	Figure 1			1.6			1.6			1.6	V
Output Low Voltage	V _{OL}	Figure 1	0.9			0.9			0.9			V

Dual 1:5 Differential Clock Drivers with LVPECL Inputs and LVDS Outputs

DC ELECTRICAL CHARACTERISTICS (continued)

($V_{CC} = 2.375V$ to $2.625V$ (MAX9317/MAX9317A), $V_{CC} = 3.0V$ to $3.6V$ (MAX9317B/MAX9317C), all outputs loaded $100\Omega \pm 1\%$ between Q_- and $\overline{Q_-}$, unless otherwise noted. Typical values are at $V_{CC} = 2.5V$ (MAX9317/MAX9317A), $V_{CC} = 3.3V$ (MAX9317B/MAX9317C), $V_{IHD} = V_{CC} - 1.0V$, $V_{ILD} = V_{CC} - 1.5V$, unless otherwise noted.) (Notes 1, 2, and 3)

PARAMETER	SYMBOL	CONDITIONS	-40°C			+25°C			+85°C			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
Differential Output Voltage	V_{OD}	Figure 1	250	350	450	250	350	450	250	350	450	mV
Change in V_{OD} Between Complementary Output States	ΔV_{OD}			7	50		6	50		6	50	mV
Output Offset Voltage	V_{OS}		1.125	1.25	1.375	1.125	1.25	1.375	1.125	1.25	1.375	V
Change in V_{OS} Between Complementary Output States	ΔV_{OS}				25			25			25	mV
Output Short-Circuit Current	I_{OSC}	Q_- shorted to $\overline{Q_-}$			12			12			12	mA
		Q_- or $\overline{Q_-}$ shorted to GND			28			28			28	
POWER SUPPLY												
Power-Supply Current (Note 5)	I_{CC}	MAX9317/9317A		69	107		75	107		80	107	mA
		MAX9317B/9317C		75	107		81	107		86	107	

AC ELECTRICAL CHARACTERISTICS

($V_{CC} = 2.375V$ to $2.625V$ (MAX9317/MAX9317A) or $V_{CC} = 3.0V$ to $3.6V$ (MAX9317B/MAX9317C), all outputs loaded with $100\Omega \pm 1\%$, between Q_- and $\overline{Q_-}$, $f_{IN} \leq 1.0GHz$, input transition time = 125ps (20% to 80%), $V_{IHD} - V_{ILD} = 0.15V$ to V_{CC} , unless otherwise noted. Typical values are at $V_{CC} = 2.5V$ (MAX9317/MAX9317A), $V_{CC} = 3.3V$ (MAX9317B/MAX9317C), $f_{IN} = 1.0GHz$, $V_{IHD} = V_{CC} - 1.0V$, $V_{ILD} = V_{CC} - 1.5V$, unless otherwise noted.) (Notes 1 and 4)

PARAMETER	SYMBOL	CONDITIONS	-40°C			+25°C			+85°C			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
Propagation Delay CLK_- , $\overline{CLK_-}$ to Q_- , $\overline{Q_-}$	t_{PHL} t_{PLH}	Figure 1	250	310	600	250	330	600	250	335	600	ps
Output-to-Output Skew	t_{SKEW1}	(Note 6)		9	55		5	45		4	25	ps
Part-to-Part Skew	t_{SKEW2}	(Note 7)			145			145			145	ps
Added Random Jitter	t_{RJ}	$f_{IN} = 1.0GHz$, clock pattern (Note 8)		0.8	2.0		0.8	2.0		0.8	2.0	ps(RMS)
Added Deterministic Jitter	t_{DJ}	$f_{IN} = 1.0GHz$, $2^{23} - 1$ PRBS pattern (Note 8)		80	105		80	105		80	105	ps(P-P)
Operating Frequency	f_{MAX}	$V_{OD} \geq 250mV$		1.0			1.0			1.0		GHz

Dual 1:5 Differential Clock Drivers with LVPECL Inputs and LVDS Outputs

AC ELECTRICAL CHARACTERISTICS (continued)

($V_{CC} = 2.375V$ to $2.625V$ (MAX9317/MAX9317A) or $V_{CC} = 3.0V$ to $3.6V$ (MAX9317B/MAX9317C), all outputs loaded with $100\Omega \pm 1\%$, between Q_- and \bar{Q}_- , $f_{IN} \leq 1.0GHz$, input transition time = $125ps$ (20% to 80%), $V_{IHD} - V_{ILD} = 0.15V$ to V_{CC} , unless otherwise noted. Typical values are at $V_{CC} = 2.5V$ (MAX9317/MAX9317A), $V_{CC} = 3.3V$ (MAX9317B/MAX9317C), $f_{IN} = 1.0GHz$, $V_{IHD} = V_{CC} - 1.0V$, $V_{ILD} = V_{CC} - 1.5V$, unless otherwise noted.) (Notes 1 and 4)

PARAMETER	SYMBOL	CONDITIONS	-40°C			+25°C			+85°C			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
Differential Output Rise/Fall Time	t_{r}/t_{f}	20% to 80%, Figure 1	140	200	300	140	205	300	140	205	300	ps

Note 1: Measurements are made with the device in thermal equilibrium.

Note 2: Current into a pin is defined as positive. Current out of a pin is defined as negative.

Note 3: DC parameters are production tested at +25°C. DC limits are guaranteed by design and characterization over the full operating temperature range.

Note 4: Guaranteed by design and characterization, and are not production tested. Limits are set to ± 6 sigma.

Note 5: All outputs loaded with 100Ω differential, all inputs biased differential high or low except V_{T-} .

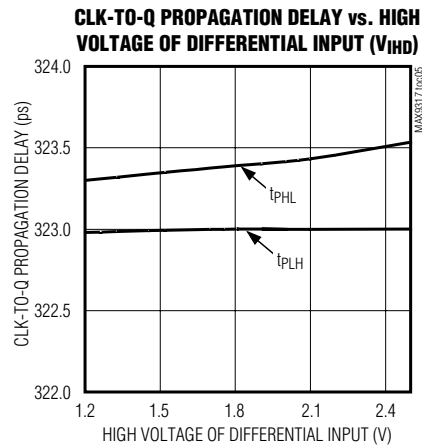
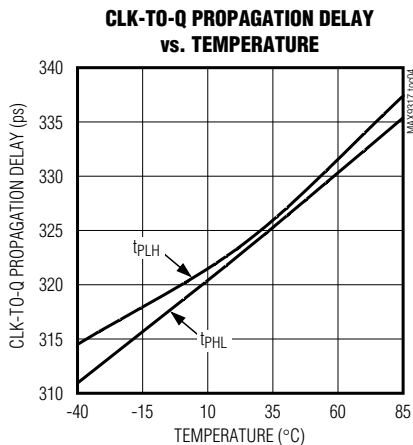
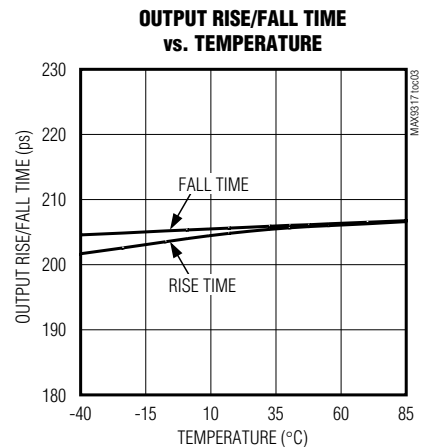
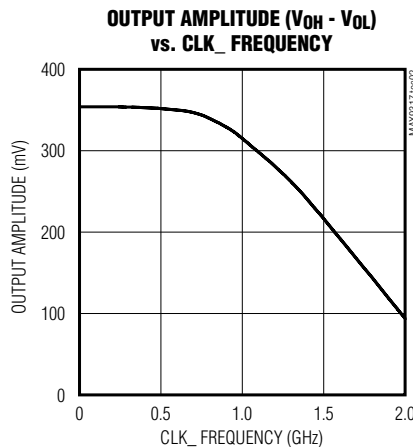
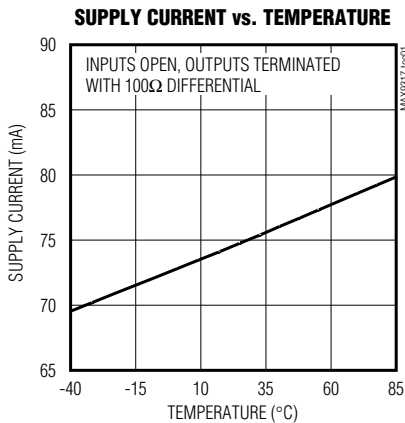
Note 6: Measured between outputs of the same device at the signal crossing points for a same-edge transition.

Note 7: Measured between outputs on different devices for identical transitions and V_{CC} levels.

Note 8: Device jitter added to the input signal.

Typical Operating Characteristics

(MAX9317, $V_{CC} = 2.5V$, all outputs loaded with $100\Omega \pm 1\%$, between Q_- and \bar{Q}_- , $f_{IN} = 1.0GHz$, input transition time = $125ps$ (20% to 80%), $V_{IHD} = V_{CC} - 1.0V$, $V_{ILD} = V_{CC} - 1.5V$, unless otherwise noted.)



Dual 1:5 Differential Clock Drivers with LVPECL Inputs and LVDS Outputs

Pin Description

PIN	NAME		FUNCTION
	MAX9317 MAX9317B	MAX9317A MAX9317C	
1, 8	GND	GND	Ground
2	N.C.	—	No Connection. Connect this pin to ground or leave floating.
	—	V _{TA}	CLKA Input Termination Voltage. This pin is connected to CLK _A and $\overline{\text{CLK}}_{\text{A}}$ through 50Ω termination resistors. Connect this pin to V _{CC} - 2V for an LVPECL input signal on CLK _A or leave floating for an LVDS input signal.
3	CLKA	CLKA	Noninverting Differential Clock Input A
4	$\overline{\text{CLK}}_{\text{A}}$	$\overline{\text{CLK}}_{\text{A}}$	Inverting Differential Clock Input A
5	N.C.	—	No Connection. Connect this pin to ground or leave floating.
	—	V _{TB}	CLKB Input Termination Voltage. This pin is connected to CLK _B and $\overline{\text{CLK}}_{\text{B}}$ through 50Ω termination resistors. Connect this pin to V _{CC} - 2V for an LVPECL input signal on CLK _B or leave floating for an LVDS input signal.
6	CLKB	CLKB	Noninverting Differential Clock Input B
7	$\overline{\text{CLK}}_{\text{B}}$	$\overline{\text{CLK}}_{\text{B}}$	Inverting Differential Clock Input B
9, 16, 25, 32	V _{CC}	V _{CC}	Positive Supply Voltage. Bypass each V _{CC} pin to ground with 0.1μF and 0.01μF ceramic capacitors. Place the capacitors as close to the device as possible with the 0.01μF capacitor closest to the device.
10	$\overline{\text{QB}}_{\text{4}}$	$\overline{\text{QB}}_{\text{4}}$	CLKB Inverting Differential Output 4. Terminate with 100Ω to QB ₄ .
11	QB ₄	QB ₄	CLKB Noninverting Differential Output 4. Terminate with 100Ω to $\overline{\text{QB}}_{\text{4}}$.
12	$\overline{\text{QB}}_{\text{3}}$	$\overline{\text{QB}}_{\text{3}}$	CLKB Inverting Differential Output 3. Terminate with 100Ω to QB ₃ .
13	QB ₃	QB ₃	CLKB Noninverting Differential Output 3. Terminate with 100Ω to $\overline{\text{QB}}_{\text{3}}$.
14	$\overline{\text{QB}}_{\text{2}}$	$\overline{\text{QB}}_{\text{2}}$	CLKB Inverting Differential Output 2. Terminate with 100Ω to QB ₂ .
15	QB ₂	QB ₂	CLKB Noninverting Differential Output 2. Terminate with 100Ω to $\overline{\text{QB}}_{\text{2}}$.
17	$\overline{\text{QB}}_{\text{1}}$	$\overline{\text{QB}}_{\text{1}}$	CLKB Inverting Differential Output 1. Terminate with 100Ω to QB ₁ .
18	QB ₁	QB ₁	CLKB Noninverting Differential Output 1. Terminate with 100Ω to $\overline{\text{QB}}_{\text{1}}$.
19	$\overline{\text{QB}}_{\text{0}}$	$\overline{\text{QB}}_{\text{0}}$	CLKB Inverting Differential Output 0. Terminate with 100Ω to QB ₀ .
20	QB ₀	QB ₀	CLKB Noninverting Differential Output 0. Terminate with 100Ω to $\overline{\text{QB}}_{\text{0}}$.
21	$\overline{\text{QA}}_{\text{4}}$	$\overline{\text{QA}}_{\text{4}}$	CLKA Inverting Differential Output 4. Terminate with 100Ω to QA ₄ .
22	QA ₄	QA ₄	CLKA Noninverting Differential Output 4. Terminate with 100Ω to $\overline{\text{QA}}_{\text{4}}$.
23	$\overline{\text{QA}}_{\text{3}}$	$\overline{\text{QA}}_{\text{3}}$	CLKA Inverting Differential Output 3. Terminate with 100Ω to QA ₃ .
24	QA ₃	QA ₃	CLKA Noninverting Differential Output 3. Terminate with 100Ω to $\overline{\text{QA}}_{\text{3}}$.
26	$\overline{\text{QA}}_{\text{2}}$	$\overline{\text{QA}}_{\text{2}}$	CLKA Inverting Differential Output 2. Terminate with 100Ω to QA ₂ .
27	QA ₂	QA ₂	CLKA Noninverting Differential Output 2. Terminate with 100Ω to $\overline{\text{QA}}_{\text{2}}$.
28	$\overline{\text{QA}}_{\text{1}}$	$\overline{\text{QA}}_{\text{1}}$	CLKA Inverting Differential Output 1. Terminate with 100Ω to QA ₁ .
29	QA ₁	QA ₁	CLKA Noninverting Differential Output 1. Terminate with 100Ω to $\overline{\text{QA}}_{\text{1}}$.
30	$\overline{\text{QA}}_{\text{0}}$	$\overline{\text{QA}}_{\text{0}}$	CLKA Inverting Differential Output 0. Terminate with 100Ω to QA ₀ .
31	QA ₀	QA ₀	CLKA Noninverting Differential Output 0. Terminate with 100Ω to $\overline{\text{QA}}_{\text{0}}$.
—	EP	EP	Exposed Pad. QFN package only. Internally connected to ground.

MAX9317/MAX9317A/MAX9317B/MAX9317C

Dual 1:5 Differential Clock Drivers with LVPECL Inputs and LVDS Outputs

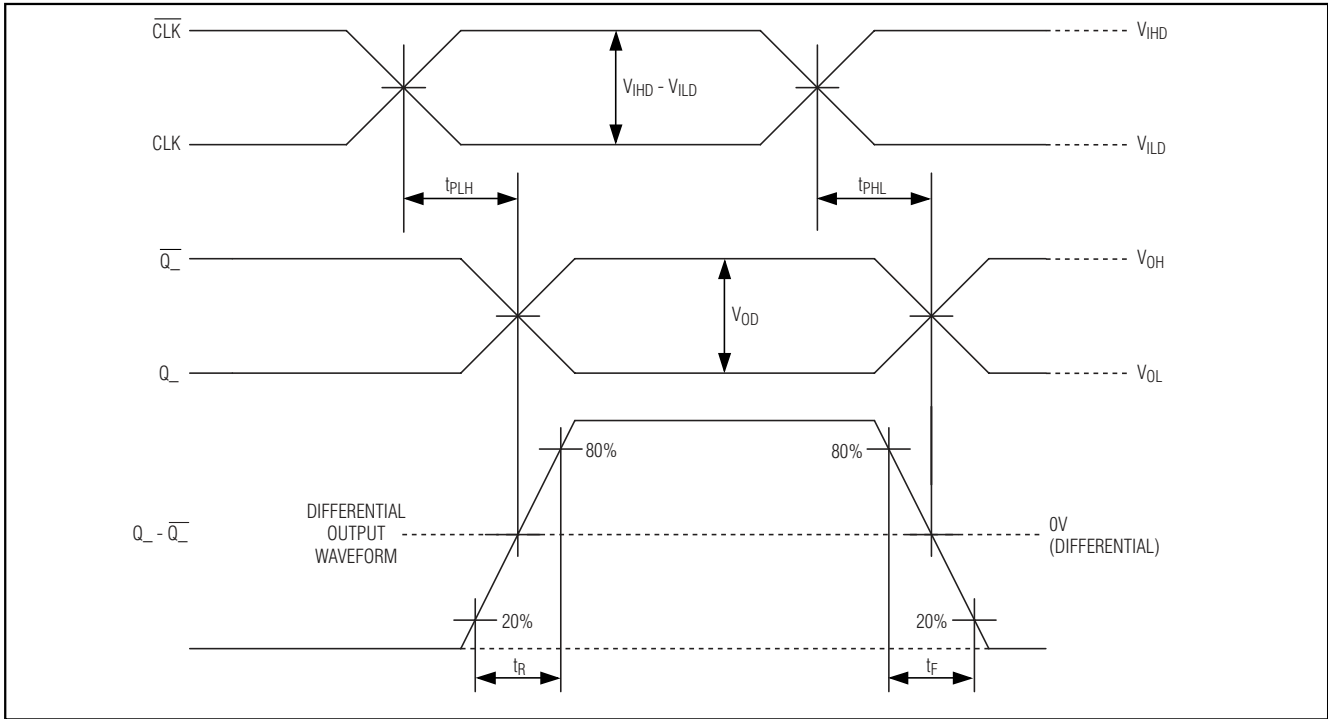


Figure 1. MAX9317 Timing Diagram

Detailed Description

The MAX9317 family of low-skew, 1-to-5 dual differential drivers are designed for clock or data distribution. Two independent 1-to-5 splitters accept a differential input signal and reproduce it on five separate differential LVDS outputs. The output drivers are guaranteed to operate at frequencies up to 1.0GHz with the LVDS output levels conforming to the EIA/TIA-644 standard.

The MAX9317/MAX9317A operate from a 2.375V to 2.625V power supply for use in 2.5V systems. The MAX9317B/MAX9317C operate from a 3.0V to 3.6V supply for 3.3V systems.

Differential LVPECL and LVDS Input

The MAX9317 family has two input differential pairs: $\overline{\text{CLKA}}$ and CLKA , and $\overline{\text{CLKB}}$ and CLKB . Each differential input pair can be configured or terminated independently. The inputs are designed to be driven by either LVPECL or LVDS signals with a maximum differential voltage of V_{CC} or 3.0V, whichever is less.

The MAX9317A/MAX9317C reduce external component count by having the input 50Ω termination resistors on chip. Configure the MAX9317A/MAX9317C to receive LVPECL signals by connecting V_{T-} to $V_{CC} - 2V$ (Figure 2(a)). Leaving the V_{T-} input floating configures the

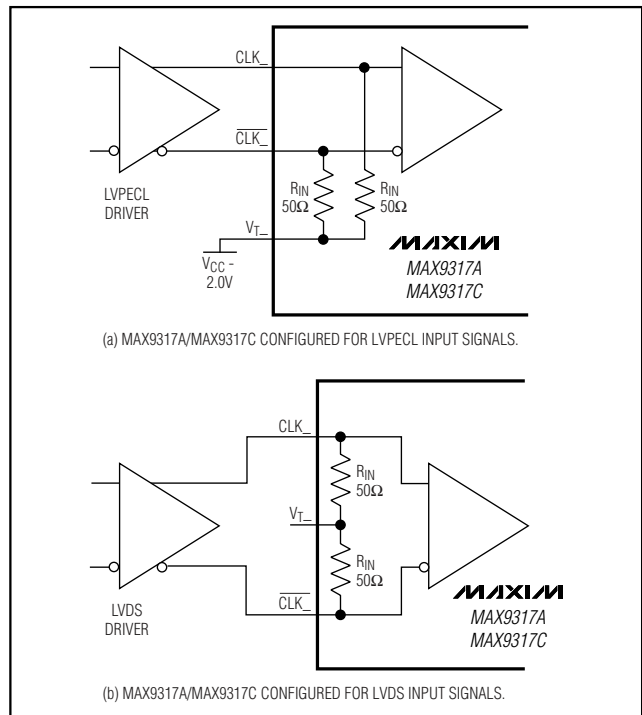
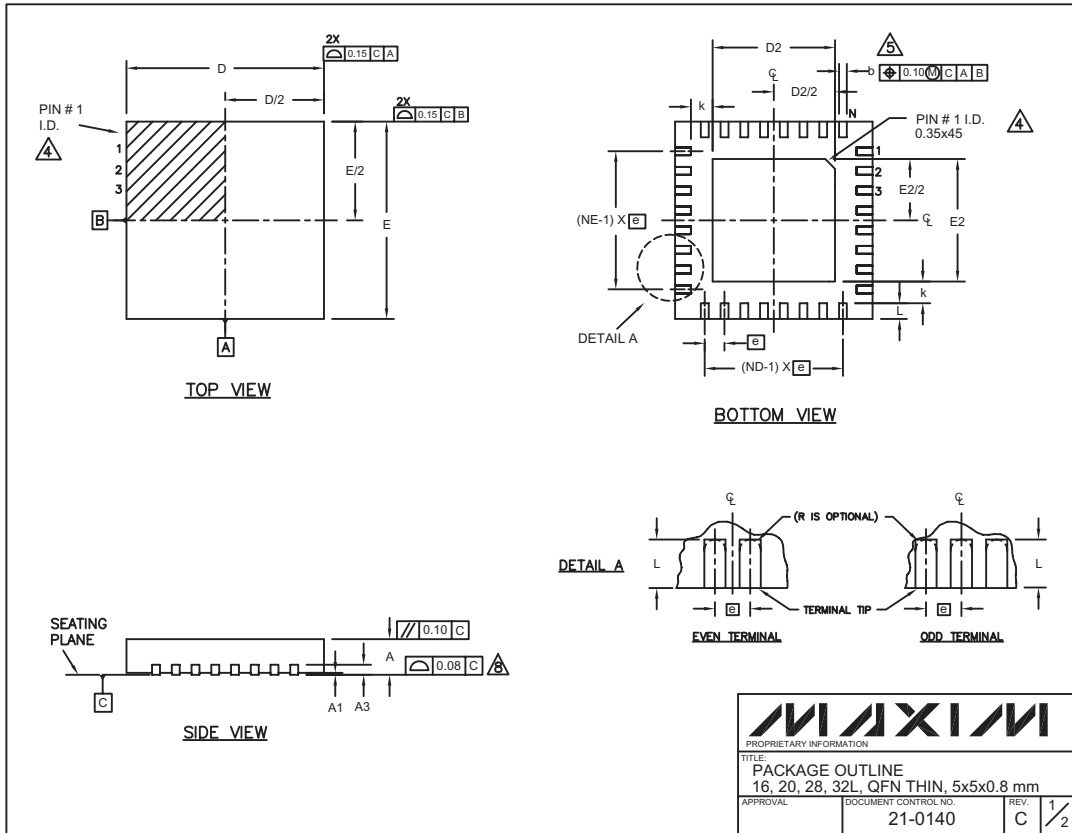


Figure 2. MAX9317A/MAX9317C Input Terminations

Dual 1:5 Differential Clock Drivers with LVPECL Inputs and LVDS Outputs

Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to www.maxim-ic.com/packages.)



QFN THIN 5x5x0.8 .EPS

Dual 1:5 Differential Clock Drivers with LVPECL Inputs and LVDS Outputs

Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to www.maxim-ic.com/packages.)

COMMON DIMENSIONS												
PKG. SYMBOL	16L 5x5			20L 5x5			28L 5x5			32L 5x5		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.70	0.75	0.80	0.70	0.75	0.80	0.70	0.75	0.80
A1	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05
A3	0.20 REF.			0.20 REF.			0.20 REF.			0.20 REF.		
b	0.25	0.30	0.35	0.25	0.30	0.35	0.20	0.25	0.30	0.20	0.25	0.30
D	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10
E	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10
e	0.80 BSC.			0.65 BSC.			0.50 BSC.			0.50 BSC.		
k	0.25	-	-	0.25	-	-	0.25	-	-	0.25	-	-
L	0.45	0.55	0.65	0.45	0.55	0.65	0.45	0.55	0.65	0.30	0.40	0.50
N	16			20			28			32		
ND	4			5			7			8		
NE	4			5			7			8		
JEDEC	WHHB			WHHC			WHHD-1			WHHD-2		

EXPOSED PAD VARIATIONS						
PKG. CODES	D2			E2		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
T1655-1	3.00	3.10	3.20	3.00	3.10	3.20
T2055-2	3.00	3.10	3.20	3.00	3.10	3.20
T2855-1	3.15	3.25	3.35	3.15	3.25	3.35
T2855-2	2.60	2.70	2.80	2.60	2.70	2.80
T3255-2	3.00	3.10	3.20	3.00	3.10	3.20

NOTES:

- DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.5M-1994.
- ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
- N IS THE TOTAL NUMBER OF TERMINALS.
- THE TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM TO JESD 95-1 SPP-012. DETAILS OF TERMINAL #1 IDENTIFIER ARE OPTIONAL, BUT MUST BE LOCATED WITHIN THE ZONE INDICATED. THE TERMINAL #1 IDENTIFIER MAY BE EITHER A MOLD OR MARKED FEATURE.
- DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.25 mm AND 0.30 mm FROM TERMINAL TIP.
- ND AND NE REFER TO THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY.
- DEPOPULATION IS POSSIBLE IN A SYMMETRICAL FASHION.
- COPLANARITY APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.
- DRAWING CONFORMS TO JEDEC MO220.
- WARPAGE SHALL NOT EXCEED 0.10 mm.

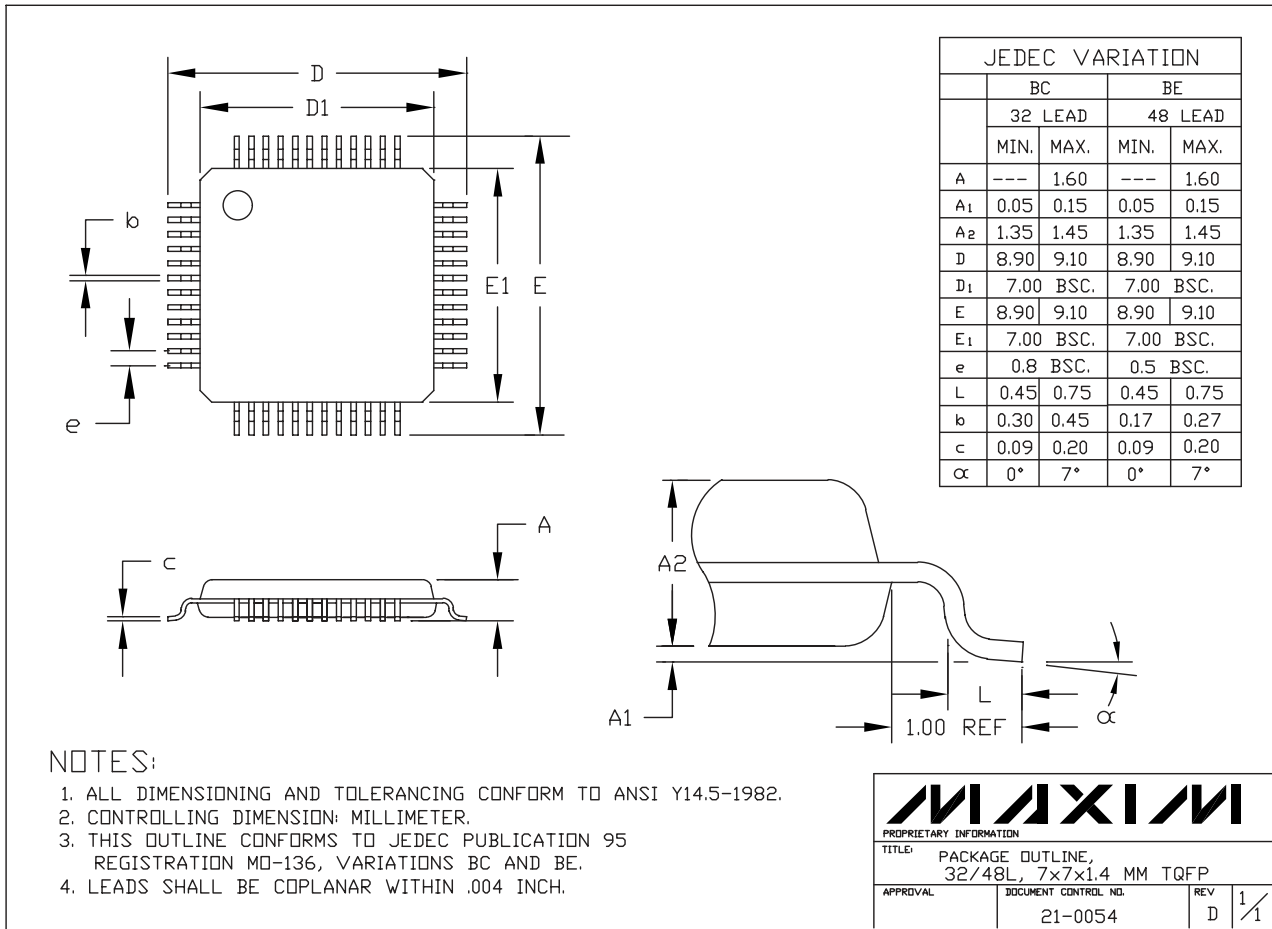
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MAX9317/MAX9317A/MAX9317B/MAX9317C

Dual 1:5 Differential Clock Drivers with LVPECL Inputs and LVDS Outputs

Package Information (continued)

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32L/48L_TQFP:EPS

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