ZERO DELAY, LOW SKEW BUFFER

MK2304-1

Description

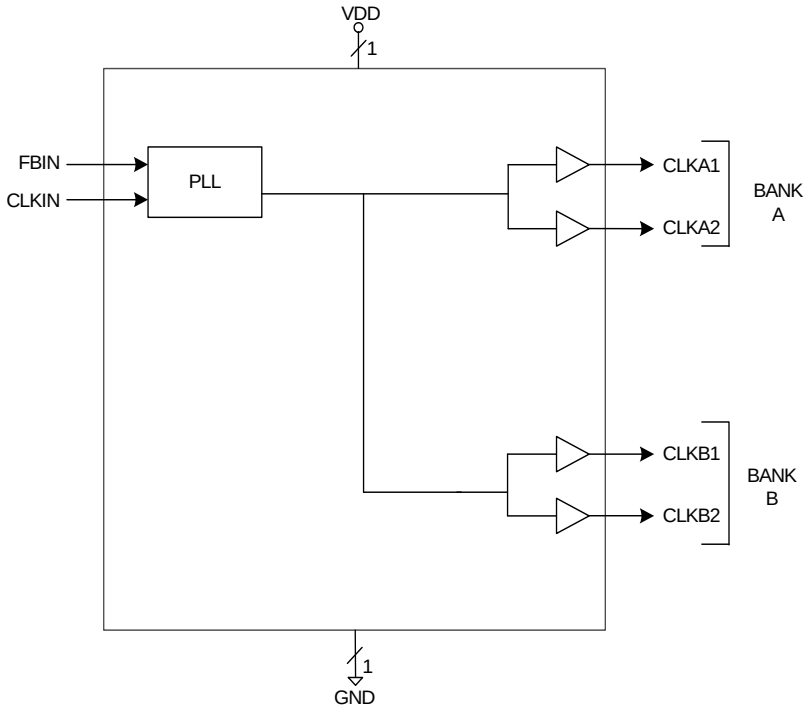
The MK2304-1 is a low jitter, low skew, high performance Phase Lock Loop (PLL) based zero delay buffer for high speed applications. Based on IDT's proprietary low jitter PLL techniques, the device provides four low skew outputs at speeds up to 133 MHz at 3.3 V. The MK2304-1 includes two banks of two outputs each 1X. In the zero delay mode, the rising edge of the input clock is aligned with the rising edges of all 4 outputs. Compared to competitive CMOS devices, the MK2304-1 has the lowest jitter.

IDT manufactures the largest variety of clock generators and buffers and is the largest clock supplier in the world.

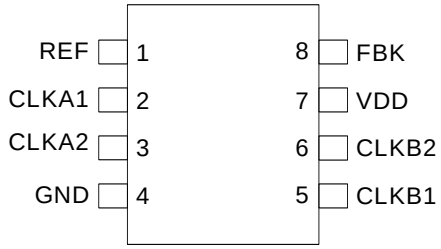
Features

- Packaged in 8-pin SOIC
- Zero input-output delay
- 2 banks of two 1X outputs
- Output to output skew is less than 200 ps
- Output clocks up to 133 MHz at 3.3 V
- Full CMOS outputs with 8 mA output drive capability at TTL levels at 3.3 V
- Spread Smart™ technology Works with Spread Spectrum clock generators
- Advanced, low power, sub micron CMOS process
- Operating voltage of 3.3 V
- Available in industrial temperature range

Block Diagram



Pin Assignment



8 Pin (150 mil) SOIC

Feedback Configuration Table

Feedback From	CLKA1:A2	CLKB1:B2
Bank A	CLKIN	CLKIN
Bank B	CLKIN	CLKIN

Pin Descriptions

Pin Number	Pin Name	Pin Type	Pin Description
1	REF	Input	Clock input. Connect to input clock source. 5 V tolerant input.
2	CLKA1	Output	Clock A1 output.
3	CLKA2	Output	Clock A2 output.
4	GND	Power	Connect to ground.
5	CLKB1	Output	Clock B1 output.
6	CLKB1	Output	Clock B2 output.
7	VDD	Power	3.3 V Power Supply.
8	FBK	Input	PLL feedback input.

External Components

The Mk2304-1 requires a minimum number of external components for proper operation. Decoupling capacitors of 0.1µF should be connected between VDD and GND, as close to the part as possible. A 33Ω series terminating resistor should be used on each clock output to reduce reflections.

Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the MK2304-1. These ratings, which are standard values for IDT commercially rated parts, are stress ratings only. Functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods can affect product reliability. Electrical parameters are guaranteed only over the recommended operating temperature range.

Item	Rating
Supply Voltage, VDD	7 V
All Inputs and Outputs, except CLKIN	-0.5 V to VDD+0.5 V
CLKIN	-0.5 V to +5.5 V
Ambient Operating Temperature (commercial)	0 to +70 °C
Ambient Operating Temperature (industrial)	-40 to +85 °C
Storage Temperature	-65 to +150 °C
Junction Temperature	175 °C
Soldering Temperature	260 °C

Recommended Operation Conditions

Parameter	Min.	Typ.	Max.	Units
Ambient Operating Temperature (commercial)	0		+70	°C
Ambient Operating Temperature (industrial)	-40		+85	°C
Power Supply Voltage (measured in respect to GND)	+3.0		+3.6	V

DC Electrical Characteristics

VDD=3.3 V ±10%, Commercial temperature 0 to +70° C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Operating Voltage	VDD		3.0		3.6	V
Input High Voltage	V_{IH}		2			V
Input Low Voltage	V_{IL}				0.8	V
Output High Voltage	V_{OH}	I_{OH} = -8 mA	2.4			V
Output Low Voltage	V_{OL}	I_{OL} = 8 mA			0.4	V
Operating Supply Current 100 MHz, CLKIN	IDD	No Load		45		mA
Short Circuit Current	I_{OS}	Each output		TBD		mA
Input Capacitance	C_{IN}	FBIN		7		pF

VDD=3.3 V ±10%, Industrial temperature -40 to +85° C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Operating Voltage	VDD		3.0		3.6	V
Input High Voltage	V_{IH}		2			V
Input Low Voltage	V_{IL}				0.8	V
Output High Voltage	V_{OH}	I_{OH} = -8 mA	2.4			V
Output Low Voltage	V_{OL}	I_{OL} = 8 mA			0.4	V
Operating Supply Current 100 MHz, CLKIN	IDD	No Load		45		mA
Short Circuit Current	I_{OS}	Each output		TBD		mA
Input Capacitance	C_{IN}	FBIN		7		pF

AC Electrical Characteristics

VDD = 3.3 V ±10%, Commercial Temperature 0 to +70° C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Output Frequency		FBIN to CLKA1, 30 pF Load	10		100	MHz
Output Frequency		FBIN to CLKA1, 15 pf Load	10		133	MHz
Output Rise Time	t_{OR}	0.8 to 2.0 V, C_L=30 pF			2.2	ns
Output Rise Time	t_{OR}	0.8 to 2.0 V, C_L=15 pF			1.5	ns
Output Fall Time	t_{OF}	0.8 to 2.0 V, C_L=30 pF			2.2	ns
Output Fall Time	t_{OF}	0.8 to 2.0 V, C_L=15 pF			1.5	ns
Output Clock Duty Cycle		At 1.4 V, CL=30 pf	40	50	60	%
Output Clock Duty Cycle		At 1.4 V, CL=15 pf	45	50	55	%
Device to Device skew, equally loaded		Rising edges at VDD/2			500	ps
Output to Output skew, equally loaded, On same bank		Rising edges at VDD/2			200	ps
Skew from Output Bank A to Output Bank B		All outputs equally loaded			400	ps
Delay CLKIN Rising Edge to FBIN Rising Edge		Measured at VDD/2			±250	ps
Maximum Absolute Jitter				300		ps
Cycle to Cycle Jitter		30 pF loads 66.67 MHz outputs			200	ps
		15pF loads 66.67 MHz outputs			175	ps
PLL Lock Time	t_{LOCK}	Stable power supply, valid clocks on CLKIN, FBIN			1	ms

VDD = 3.3V ±10%, Industrial Temperature -40 to +85° C

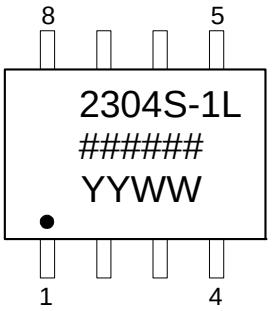
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Output Frequency		FBIN to CLKA1, 30 pF Load	10		100	MHz
Output Frequency		FBIN to CLKA1, 15 pf Load	10		133	MHz
Output Rise Time	t_{OR}	0.8 to 2.0 V, C_L=30 pF			2.5	ns
Output Rise Time	t_{OR}	0.8 to 2.0 V, C_L=15 pF			1.5	ns
Output Fall Time	t_{OF}	0.8 to 2.0 V, C_L=30 pF			2.5	ns
Output Fall Time	t_{OF}	0.8 to 2.0 V, C_L=15 pF			1.5	ns

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Output Clock Duty Cycle		At 1.4 V, CL=30 pf	40	50	60	%
Output Clock Duty Cycle		At 1.4 V, CL=15 pf	40	50	60	%
Device to Device skew, equally loaded		Rising edges at VDD/2			500	ps
Output to Output skew, equally loaded, On same bank		Rising edges at VDD/2 FIN=100 MHz			200	ps
Skew from Output Bank A to Output Bank B		All outputs equally loaded			400	ps
Delay CLKIN Rising Edge to FBIN Rising Edge		Measured at VDD/2			±250	ps
Maximum Absolute Jitter				300		ps
Cycle to Cycle Jitter		30 pF loads 66.67 MHz outputs			200	ps
		15 pF loads 66.67 MHz outputs			175	ps
PLL Lock Time	t_{LOCK}	Stable power supply, valid clocks on CLKIN, FBIN			1	ms

Thermal Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Thermal Resistance Junction to Ambient	θ_{JA}	Still air		120		°C/W
	θ_{JA}	1 m/s air flow		115		°C/W
	θ_{JA}	3 m/s air flow		105		°C/W
Thermal Resistance Junction to Case	θ_{JC}			58		°C/W

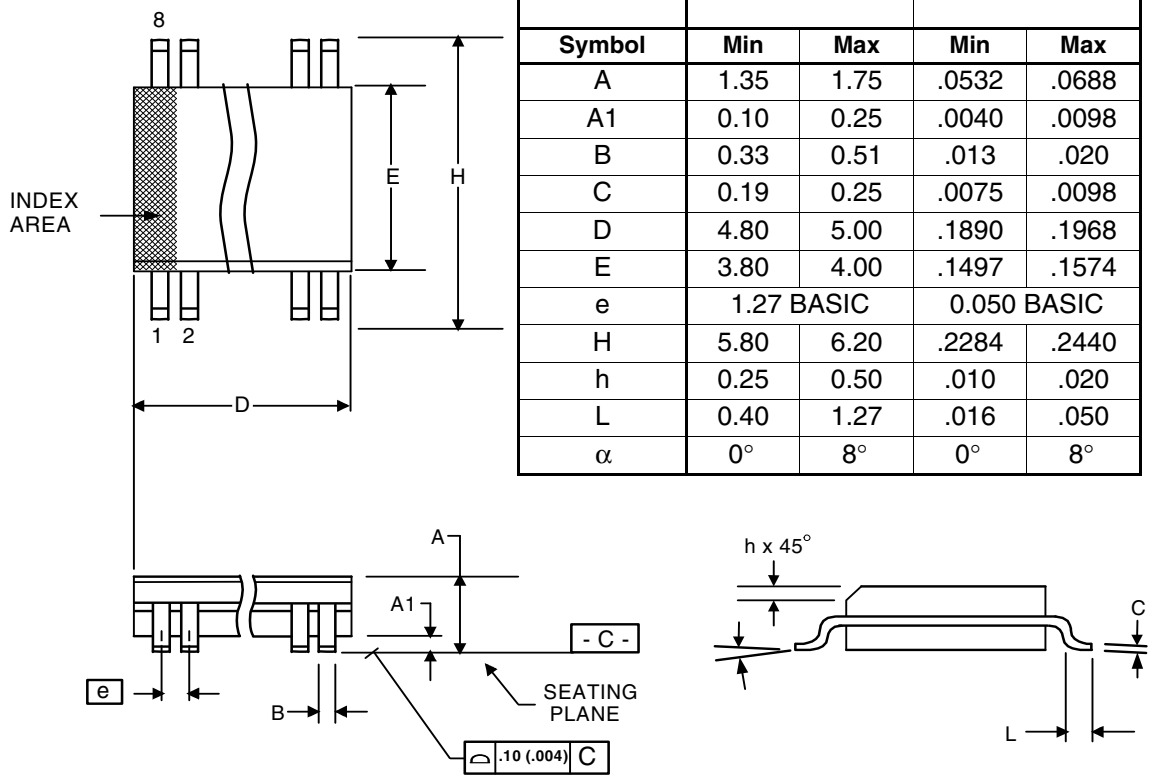
Marking Diagram (MK2304S-1LF)



Notes:
1. Line 1: part number
2. Line 2: ###### = lot number
3. Line 3: YYWW = date code.

Package Outline and Package Dimensions (8 pin SOIC, 150 Mil. Narrow Body)

Package dimensions are kept current with JEDEC Publication No. 95



	Millimeters		Inches	
Symbol	Min	Max	Min	Max
A	1.35	1.75	.0532	.0688
A1	0.10	0.25	.0040	.0098
B	0.33	0.51	.013	.020
C	0.19	0.25	.0075	.0098
D	4.80	5.00	.1890	.1968
E	3.80	4.00	.1497	.1574
e	1.27 BASIC		0.050 BASIC	
H	5.80	6.20	.2284	.2440
h	0.25	0.50	.010	.020
L	0.40	1.27	.016	.050
α	0°	8°	0°	8°

Ordering Information

Part / Order Number	Marking	Shipping Packaging	Package	Temperature
MK2304S-1LF	2304S-1L	Tubes	8-pin SOIC	0 to 70° C
MK2304S-1LFT	2304S-1L	Tape and Reel	8-pin SOIC	0 to 70° C
MK2304S-1ILF	2304S1IL	Tubes	8-pin SOIC	-40° to 85° C
MK2304S-1ILFT	2304S1IL	Tape and Reel	8-pin SOIC	-40° to 85° C

"LF" suffix to the part number are the Pb-Free configuration and are RoHS compliant.

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