LS7183 & LS7184 Encoder to Counter Interface Chips

Description:

The **LS7183** and **LS7184** allow incremental encoders to drive standard up/down counters. Connect the encoder quadrature outputs to the A & B inputs. The **LS7183** outputs can connect directly to the up and down clock inputs of counters such as 74193 or 40193. The **LS7184** outputs can connect directly to the Clock and Up/Dn inputs of counters such as 4516 or 74169.

The **LS7183** and **LS7184** are improved designs over the **LS7083** and **LS7084** products and should be considered first for all new product designs. The primary differences between the old and new LS chips are the addition of a X2 resolution multiplication, power supply operating range and improved output pulse timing characteristics.

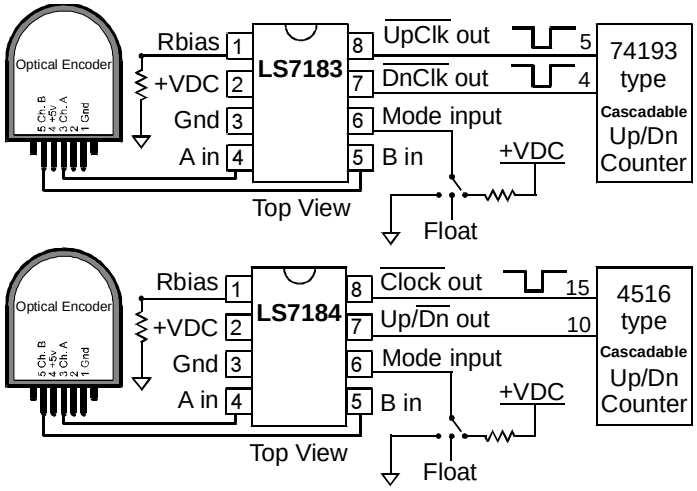
Please note: Rbias values for output pulse width timing are not the same as the **LS7083** and **LS7084** values.

Features:

- X4, X2 or X1 resolution multiplication
- TTL and CMOS compatible
- Low power (micro-amps)
- 8-pin DIP or SOIC package
- No external clocks required
- Drive standard Up/Dn counters
- Monolithic CMOS
- Operates from 3V to 5V power supply

Absolute Maximum Ratings:

Parameter	Min.	Max.	Units
Operating Temperature	-20	85	℃
Storage Temperature	-55	150	℃
Voltage @ Any Input	-.3	VCC+.3	Volts
Supply Voltage (VCC)		7	Volts



Pin Descriptions:

Pin 1 (Rbias Input):
Input for external component connection. A resistor connected between this input and supply voltage adjusts the output pulse width. See Rbias Resistor Value vs. Timing Table for further information.

Pins 4 & 5 (A & B Inputs):
Connect to the A and B quadrature outputs of the encoder. Both inputs have debounce filters. Minimum pulse width is set at 300ns. There is no maximum limit. Input current is less than 1µA. The A and B inputs can be swapped to reverse the direction of the external counters.

Pin 6 (Mode Input):
Mode is a 3-state input to select resolution X1, X2 or X4. The input quadrature clock rate is multiplied by factors of 1, 2 or 4 in X1, X2 or X4 modes respectively in producing the output Up/Dn clocks. X1, X2 or X4 modes are selected by input logic levels as follows:

- Mode = 0 VDC = X1 Selection
- Mode = +VDC = X2 Selection
- Mode = Float = X4 Selection

In X4 mode, one pulse is generated for each A/B state change. In X1 mode, one pulse is generated per quadrature cycle. In X2, two pulses per quadrature cycle.

LS7183 Pin 7 (Down Clock Output):
Normally high, low-true. The low level pulse width is set by pin 1. Down counts are enabled only when B leads A.

LS7184 Pin 7 (Up/Down Clock Output):
This output steers the external counter up or down. High = Up (A leads B), Low = Down (B leads A).

LS7183 Pin 8 (Up Clock Output):
Normally high, low-true. The low level pulse width is set by pin 1. Up counts are enabled only when A leads B.

LS7184 Pin 8 (Clock Output):
Normally high, low-true. The low level pulse width is set by pin 1. The external counter should count on the rising (high-going) edge of this output.

Surface Mount Package:
The 8-pin SOIC package has the same pin-out as the DIP version shown above.

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RBias Resistor Value vs. Timing (Typical):

Resistor	Pulse Width	Max A, B Freq. (X1)	Max A, B Freq. (X2)	Max A, B Freq. (X4)
20kOhm	500ns	1000kHz	500kHz	250kHz
220kOhm	3.0µs	167kHz	83kHz	42kHz
750kOhm	9.5µs	53kHz	26kHz	13kHz
2.0MOhm	28µs	18kHz	9.0kHz	4.5kHz
5.1MOhm	65µs	7.7kHz	3.8kHz	1.9kHz
8.2MOhm	119µs	4.2kHz	2.1kHz	1.1kHz
10MOhm	142µs	3.5kHz	1.8kHz	.9kHz

Transient Characteristics:

Parameter	Min.	Typ.	Max.	Units	Notes
Output Pulse Width	190	-	-	ns	
A,B Inputs					
Validation Delay	-	25	50	ns	VDD=5V
	-	50	100	ns	VDD=3V
Input to Output Delay	-	200	270	ns	VDD=3V
	-	110	150	ns	VDD=5V

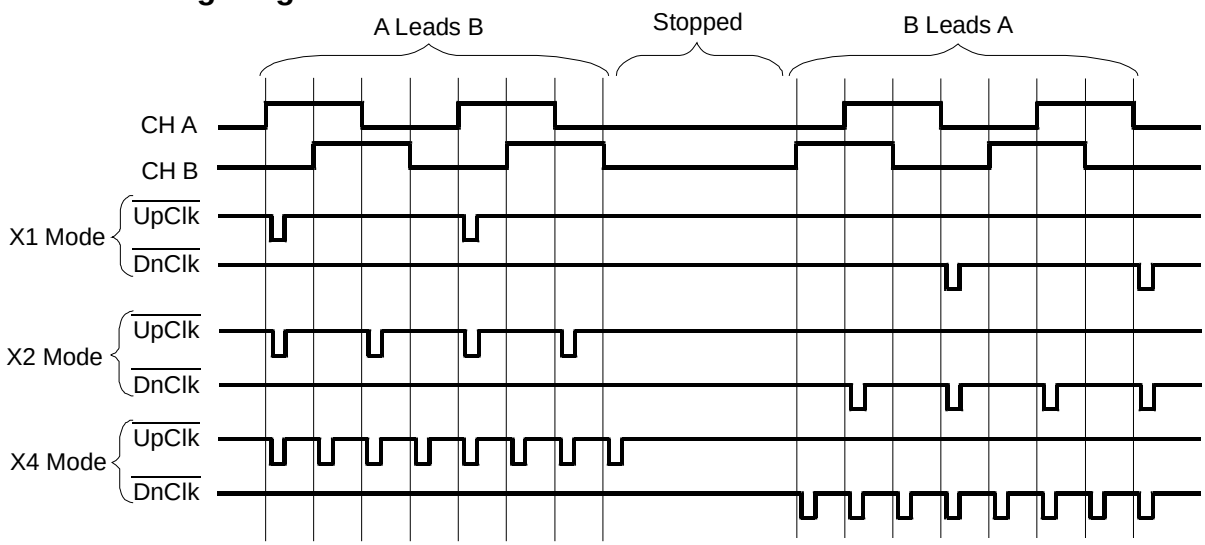
Electrical Specifications for 3VDC Operation:

Parameter	Min.	Typ.	Max.	Units	Notes
Supply Voltage	3.0	-	-	Volts	
Supply Current	-	30	45	mA	
Mode Input					
Logic 0	-	-	0.6	Volts	
Logic 1	VDD-0.6	-	-	Volts	
Logic Float	(VDD/2)-0.5	-	(VDD/2)-0.5	Volts	
A,B Inputs					
Logic 0	-	-	0.3VDD	Volts	
Logic 1	0.7VDD	-	-	Volts	
RBias Input					
External Resistor	5k	-	10M	Ohm	
All Outputs					
Sink Current	1.2	1.8	-	mA	Vout=0.5V
Source Current	-1.2	-1.8	-	mA	Vout=2.5V

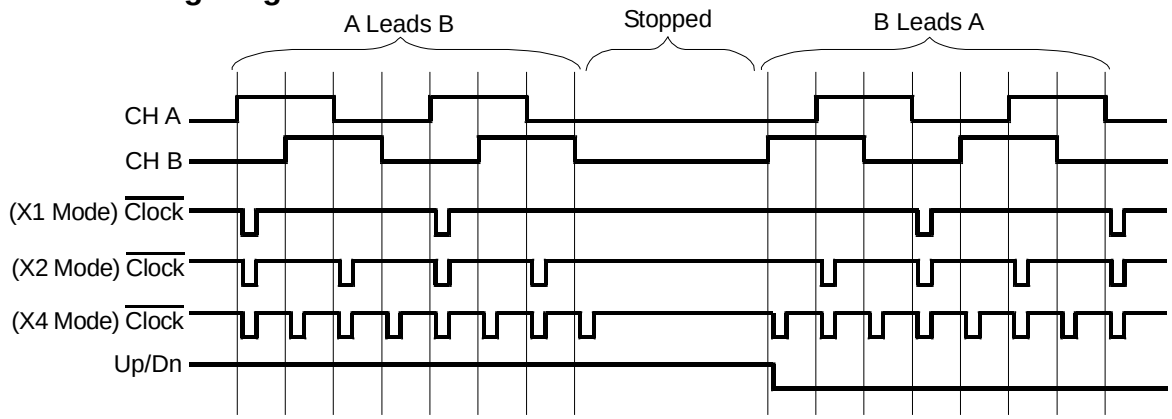
Electrical Specifications for 5VDC Operation:

Parameter	Min.	Typ.	Max.	Units	Notes
Supply Voltage	-	5.0	5.5	Volts	
Supply Current	-	110	150	µA	
Mode Input					
Logic 0	-	-	0.6	Volts	
Logic 1	VDD-0.6	-	-	Volts	
Logic Float	(VDD/2)-0.5	-	(VDD/2)-0.5	Volts	
A,B Inputs					
Logic 0	-	-	0.3VDD	Volts	
Logic 1	0.7VDD	-	-	Volts	
RBias Input					
External Resistor	5k	-	10M	Ohm	
All Outputs					
Sink Current	2.5	3.5	-	mA	Vout=0.5V
Source Current	-2.5	-3.5	-	mA	Vout=4.5V

LS7183 Timing Diagram:



LS7184 Timing Diagram:



Timing Diagram Notes:

The maximum time delay from the A or B input to the leading edge of any output is 270ns for 3VDC operation and 150ns for 5VDC operation. The pulse width of all clock outputs is set by the value of the Rbias resistor as shown in the table above. Typical rise or fall time of each logic output 10 to 20ns.

Ordering Information:

DIP Package (300mil):
LS7183-DIP or
LS7184-DIP

SOIC Package:
LS7183-SOIC or
LS7184-SOIC

Price:
$3.05 / 1
$2.45 / 25
$1.95 / 100
$1.65 / 500
$1.40 / 1K

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