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AL1401A
ADAT® Optical Encoder

OptoGen™ ADAT Optical Encoder AL1401A

General Description

The AL1401A OptoGen interface encodes four stereo pairs (8 channels) of digital audio and produces a single datastream suitable for transmission according to the industry-standard ADAT Optical protocol (U.S. patent number 5,297,181).

With an internal PLL to generate all needed clock signals, the AL1401A requires only wordclock (Fs) for proper operation.

A companion decoder, the AL1402 OptoRec™, is also available.

Use of the ADAT Optical interface (including the OptoGen and OptoRec) requires a license agreement (generally royalty-free) between the manufacturer and Wavefront Semiconductor. Details and agreement information are available upon request from Wavefront directly, or on our web site.

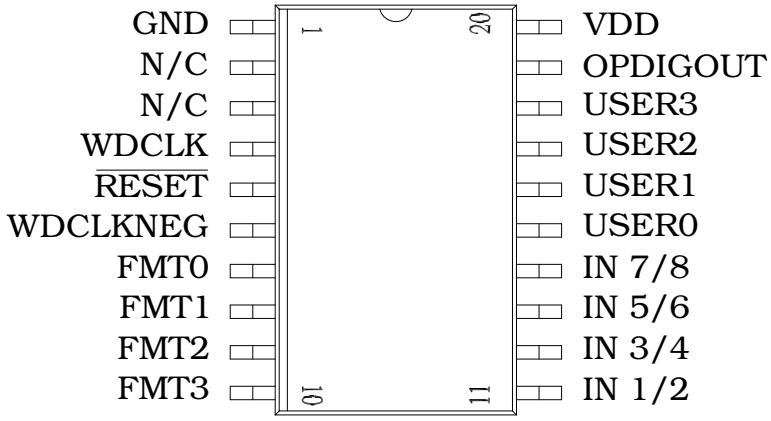
Features

- Compatible with ADAT Type I and II formats
- 4 stereo pairs as inputs using standard DAC formats
- 4 user bit inputs to transmit time-code, MIDI data, etc.
- Internal PLL generates all required clocks from wordclock

Applications

- Digital Mixing Boards
- Signal Processors
- Digital Effects Boxes
- Digital Recorders
- Computer Sound Boards
- Sound Reinforcement Products

Package



20 pin SOIC
300 mils wide

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Table of Contents

Pin Descriptions

Pin#	Name	Pin Type	Description
1	GND	Ground	Ground connection.
2	NC	None	No internal connection. For future compatibility, do not connect.
3	NC	None	No internal connection. For future compatibility, do not connect.
4	WDCLK	In	Wordclock input, used by PLL to derive other signals.
5	$\overline{\text{RESET}}$	In	Active low reset.
6	WDCLKNEG	In	Wordclock phase select: 1=falling start edge, 0=rising start edge.
7	FMT0	In	Format 0, sets data format.
8	FMT1	In	Format 1, sets data format.
9	FMT2	In	Format 2, sets data format.
10	FMT3	In	Format 3, sets data format.
11	IN 1/2	In	Channels 1&2 data input.
12	IN 3/4	In	Channels 3&4 data input.
13	IN 5/6	In	Channels 5&6 data input.
14	IN 7/8	In	Channels 7&8 data input.
15	USER0	In	User 0 data bit input. Used to transmit timecode.
16	USER1	In	User 1 data bit input. Used to transmit MIDI data.
17	USER2	In	User 2 data bit input. Used to indicate S/Mux.
18	USER3	In	User 3 data bit input. Reserved, tie low.
19	OPDIGOUT	Out	Output to optical transmitter.
20	V_{DD}	Power	V_{DD} power pin.

Electrical Characteristics

Symbol	Description	Min	Typ	Max	Units
Recommended Operating Conditions					
V_{DD}	Supply Voltage	4.5	5.0	5.5	V
I_{DD}	Supply Current		1.5		mA
GND	Ground		0		V
Fs	Sample rate	30	48	55	kHz
Temp	Temperature	0	25	70	°C
Inputs (WDCLK, WDCLKNEG, FMT0-3, IN1/2–7/8, USER0-3, RESET)					
V_{IH}	Logical "1" input voltage	0.75 V_{DD}			V
V_{IL}	Logical "0" input voltage			0.25 V_{DD}	V
I_{IH}	Logical "1" input current			1	µA
I_{IL}	Logical "0" input current			1	µA
C_{IN}	Logic input capacitance		5		pF
Outputs (OUT3-0, D7-0)					
V_{OH}	Logical "1" output voltage	0.9 V_{DD}			V
V_{OL}	Logical "0" output voltage			0.1 V_{DD}	V
I_{OH}	Logical "1" output current			-8	mA
I_{OL}	Logical "0" output current			8	mA

Architecture Details

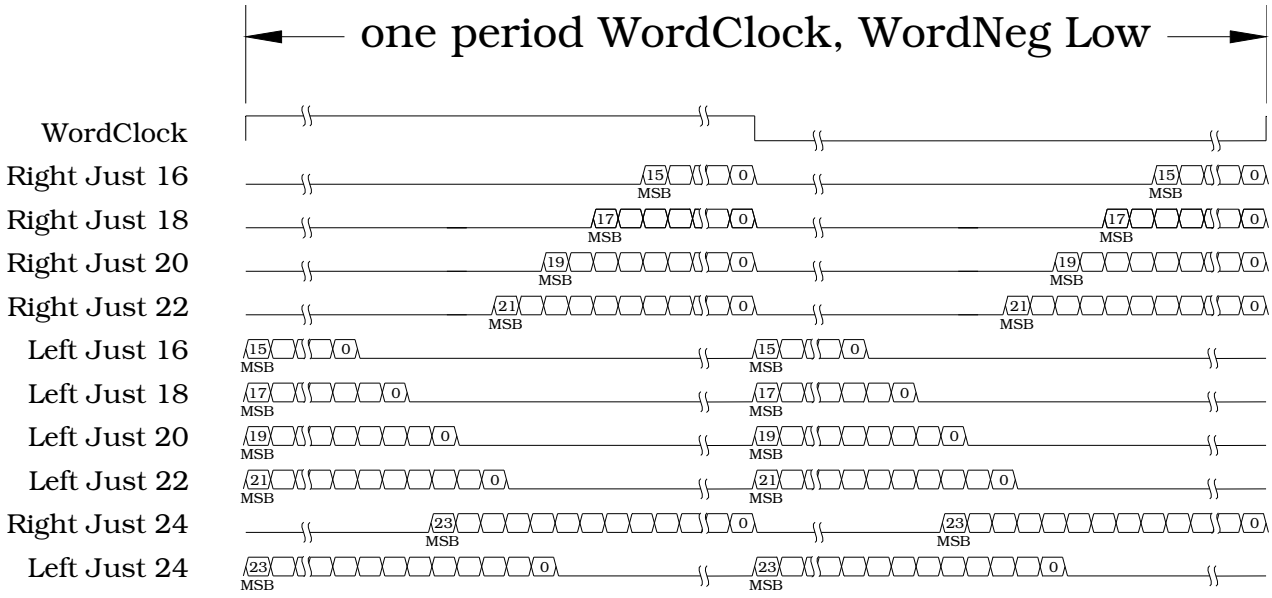
Serial Input Interface

The AL1401A OptoGen interface has been designed for ease of use and flexibility in systems designed to interface to the ADAT protocol. It supports both left and right justified 16, 18, 20, 22 and 24-bit data formats for ease of integration into existing devices as well as new devices. These formats allow it to operate in parallel with many standard DACs. The specific input format to be used is selected by the format pins FMT3 to FMT0.

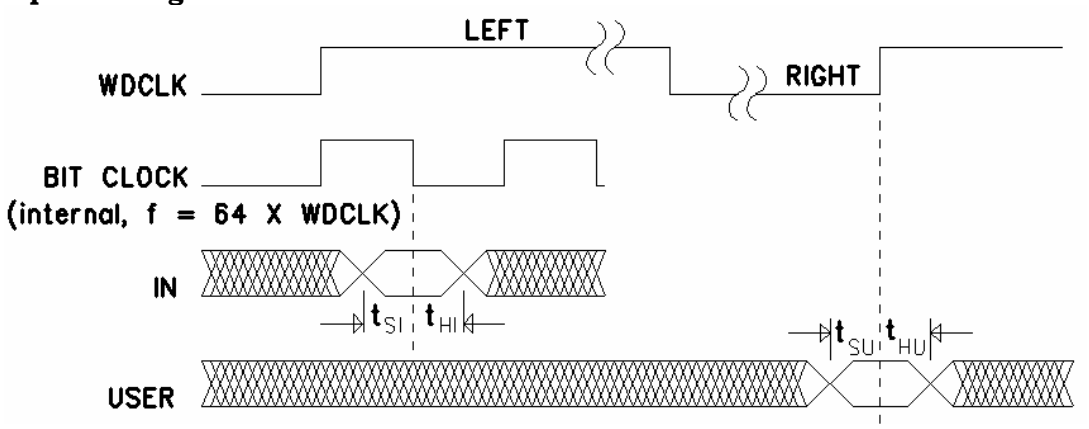
Serial Input Format Selection

FMT[3:0]	Format
0000	16-bit right justified
0001	18-bit right justified
0010	20-bit right justified
0011	22-bit right justified
0100	16-bit left justified
0101	18-bit left justified
0110	20-bit left justified
0111	22-bit left justified
1000	Reserved
1001	Reserved
1010	Reserved
1011	Reserved
1100	24-bit right justified
1101	24-bit left justified
1110	Reserved
1111	Mute

Serial Input Formats



Serial Input Timing



Symbol	Description	Min	Typ	Max	Units
t_{SI}	IN setup time relative to bit period center		10	30	ns
t_{HI}	IN hold time relative to bit period center		10	30	ns
t_{SU}	USER setup time relative to right channel WDCLK end			100	ns
t_{HU}	USER hold time relative to right channel WDCLK end			100	ns

Note: Above specifications hold after 2000 WDCLK cycles.

Wordclock Selection

With the use of the WDCLKNEG input, the user may choose the phase of the wordclock to apply to the OptoGen. When WDCLKNEG is low, OptoGen will expect the rising edge of WDCLK to signal a new period. When WDCLKNEG is high, OptoGen will expect the falling edge of WDCLK to signal a new period. In both cases, the first sample data received is the odd numbered (left) channel, and the second is the even numbered (right) channel.

ADAT Optical Datastream

The AL1401A provides support for both the ADAT Type I format (16-bit) and the ADAT Type II format (20-bit). Data lengths of up to 24 bits is supported. USER0 is used to transmit the ADAT format 32-bit timecode, USER1 is used to transmit MIDI data, USER2 indicates the presence of S/Mux data, USER3 is reserved and should be tied low. All user bits are sampled at the WDCLK edge that indicates the end of right channel data.

Reset Circuitry

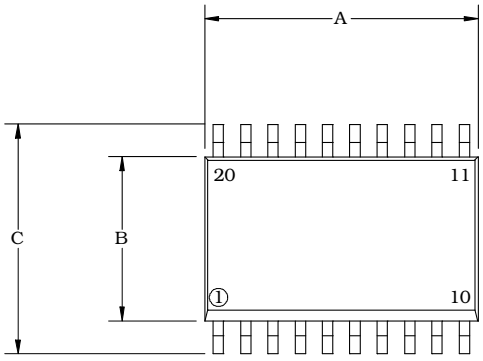
An OptoGen reset using the /Reset pin is asynchronous, and a minimum pulse width of 10ns is sufficient. This will reset all internal counters and state registers to their initial state and disrupt the OPDIGOUT datastream. However, PLL lock will not be disturbed.

Clock Generator and PLL

The OptoGen contains an internal PLL that locks to the rising edge of WDCLK and produces all necessary high frequency clocks and timing signals to operate the device. This high quality PLL will reject any high-frequency jitter on the incoming wordclock. Receiving a crystal-derived 48kHz on WDCLK, and audio data on all 8 input channels, the jitter was measured to be 630ps typical on OPDIGOUT.

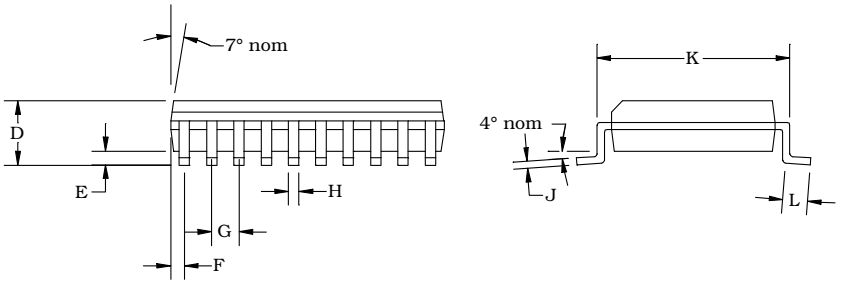
The PLL allows a simplified user interface and eliminates the need of running high frequency clocks to the part on PCB traces. This reduces unwanted RF noise and coupling problems that can occur when such clock signals are required on input pins for a device.

Package Dimensions



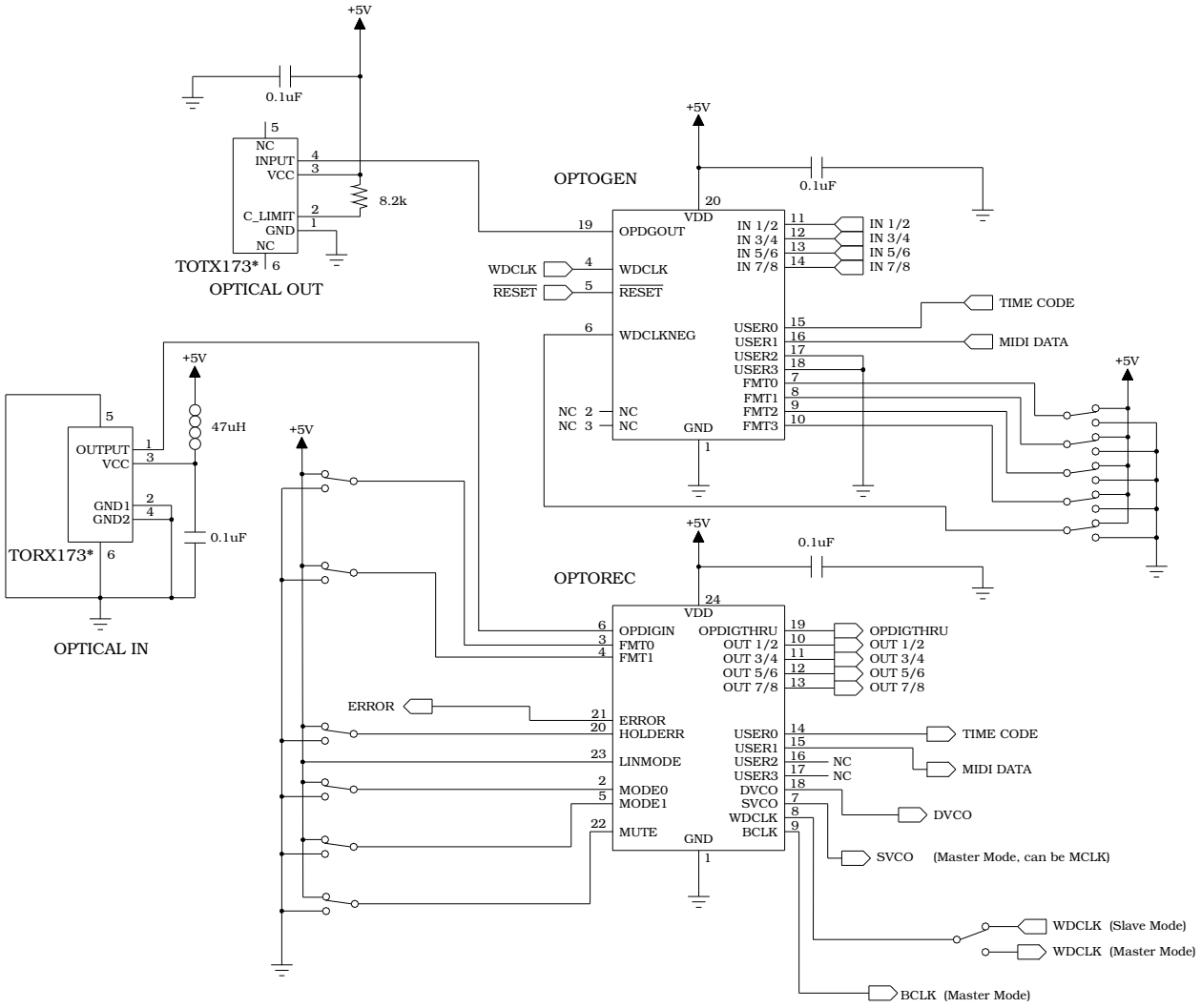
Dimensions (Typical)	Inches	Millimeters
A	0.504”	12.80
B	0.295”	7.50
C	0.406”	10.30
D	0.100”	2.50
E	0.008”	0.20
F	0.025”	0.64
G	0.050”	1.27
H	0.017”	0.42
J	0.011”	0.27
K	0.352”	8.94
L	0.033”	0.83

Note: Dimension “A” does not include mold flash, protrusions, or gate burrs.

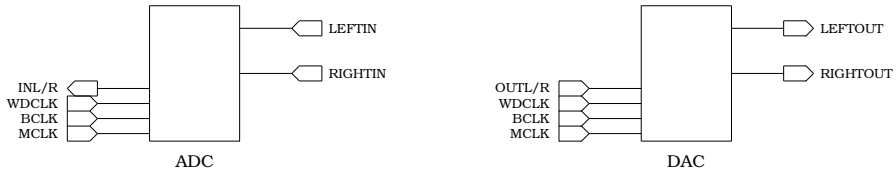


Sample Application Schematic

The following schematic shows the OptoGen and OptoRec in a typical application. The OptoGen accepts input from an ADC, then outputs data in the ADAT Optical format on the optical transmitters. The OptoRec receives ADAT Optical data on the optical receivers, then outputs data to a DAC.



* Optical I/O parts shown are Toshiba parts. The Sharp GP1F33RT or equivalent is also compatible.



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