HIGH-PERFORMANCE

LS SERIES

ENCODER/DECODER

WIRELESS MADE SIMPLE

LS SERIES ENCODER/DECODER DESIGN GUIDE

DESCRIPTION

The Linx LS Series encoders and decoders provide a simple, but reliable, protocol for the transmission of switch closures or button contacts. This series can find use in any simple, low-cost remote control application. Simply take a data line high on the encoder and a corresponding line will go high on the decoder. No programming or addressing makes integrating the LS extremely easy while maintaining a robust link.

FEATURES

- No addressing or programming
- Easy to use
- Very low current consumption
- Four data lines
- Easy serial interface
- Selectable baud rates
- High noise immunity
- Standard PDIP package

APPLICATIONS

- Range Testing
- Simple Remote Control
- Wire Elimination
- Remote Status Monitoring
- Lighting Control

PACKAGE

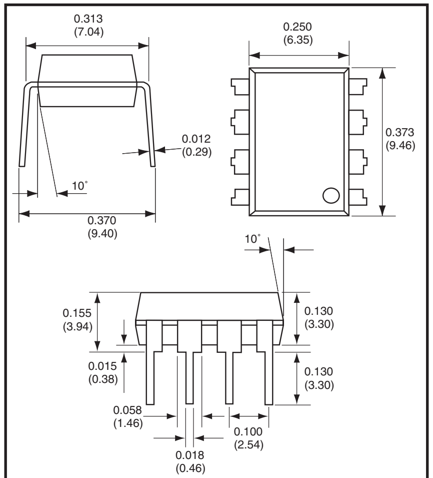

Figure 1: Package Dimensions

PCB LAYOUT

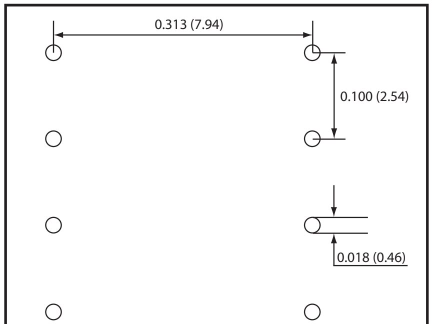

Figure 2: PCB Layout Dimensions

ORDERING INFORMATION

PART #	DESCRIPTION
LICAL-ENC-LS001	Low Security Encoder
LICAL-DEC-LS001	Low Security Decoder

Revised 12/22/04

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, V_{CC}	-0.3	to	+6.5	VDC
Max Current Sourced By Data Pins		25		mA
Max Current Sunk By Data Pins		25		mA
Operating Temperature	-40	to	+125	°C
Storage Temperature	-65	to	+150	°C
Any Input or Output Pin	-0.3	to	V_{CC} + 0.3	VDC
Max Current Into V_{CC}		250		mA
Max Current Out Of GND		300		mA

***NOTE* Exceeding any of the limits of this section may lead to permanent damage to the device. Furthermore, extended operation at these maximum ratings may reduce the life of this device.**

ELECTRICAL CHARACTERISTICS

Parameter	Designation	Min.	Typ.	Max.	Units	Notes
Supply Voltage	V_{CC}	2.0	---	5.5	VDC	
Supply Current	I_{CC}					
@ 2.0V V_{CC}		---	340	450	µA	1
@ 3.0V V_{CC}		---	500	700	µA	1
@5.0V V_{CC}		---	800	1100	µA	1
Sleep Current						
@ 2.0V V_{CC}		---	0.99	700	nA	
@ 3.0V V_{CC}		---	1.2	770	nA	
@ 5.0V V_{CC}		---	2.9	995	nA	
Input Low	V_{IL}	GND	---	(0.15)V_{CC}	V	2
Input High	V_{IH}	(0.8)V_{CC}	---	V_{CC}	V	3
Output Low	V_{OL}	---	---	0.6	V	
Output High	V_{OH}	V_{CC}-0.7	---	---	V	

Notes:

1. Current consumption with no active loads.
2. For 3V supply, (0.15 x 3.0) = 0.45V max.
3. For 3V supply, (0.8 x 3.0) = 2.4V min.

CAUTION

This product is a static-sensitive component. Always wear an ESD wrist strap and observe proper ESD handling procedures when working with this device. Failure to observe this precaution may result in device damage or failure.

PIN ASSIGNMENTS

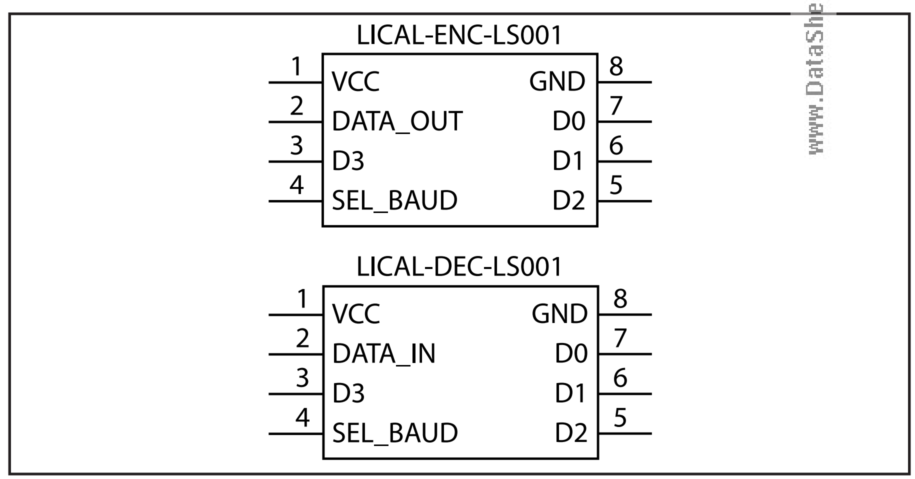

Figure 3: Encoder and Decoder Pin Assignments

ENCODER PIN ASSIGNMENTS

Pin Name	Pin Number	I/O	Description
VCC	1	—	Positive Power Supply
DATA_OUT	2	O	Serial Data Output
SEL_BAUD	4	I	Baud Rate Selection Pin
GND	8	—	Ground
D0 - D3	3, 5, 6, 7	I	Data Input Pins

DECODER PIN ASSIGNMENTS

Pin Name	Pin Number	I/O	Description
VCC	1	—	Positive Power Supply
DATA_OUT	2	I	Serial Data Input
SEL_BAUD	4	I	Baud Rate Selection Pin
GND	8	—	Ground
D0 - D3	3, 5, 6, 7	O	Data Output Pins

PIN DESCRIPTIONS

VDD

This is the positive power supply.

DATA_OUT

The encoder will output a serial data stream on this line.

DATA_IN

The decoder will monitor this line for data.

SEL_BAUD

This line is used to select the baud rate of the serial data stream. The state of the line allows the selection of one of two possible baud rates as shown in the adjoining chart.

SEL_BAUD	Baud Rate (bps)
0	2400
1	9600

GND

These lines are connected to ground.

Data Lines

The LS Series has three data lines, D0 through D3. When any of these lines goes high on the encoder, their states are recorded, encoded for transmission, and then reproduced on the outputs of the decoder.

PRODUCTION CONSIDERATIONS

The LS Series encoders and decoders are implemented in an industry standard 8-Lead Plastic Dual In-Line Package (8-PDIP). The package and layout dimensions are shown on Page 1. These components are leaded through-hole parts and may be hand or wave soldered.

THEORY OF OPERATION

The Linx LS Series encoder and decoder are designed to register button presses or contact closures. When a pin goes high on the encoder, a signal is sent to make a corresponding pin go high on the decoder. The outputs of the decoder can then be used to activate almost anything, from drive a LED or buzzer to activate digital circuitry.

The LS Series does not require any programming or addressing and its simplicity makes it a good choice for basic remote control devices that are designed to turn something on and off.

ENCODER OPERATION

Upon power-up the encoder enters sleep mode. As soon as one of the data lines goes high it will wake up and begin the transmit process.

First, the encoder will record the state of the data lines, encode for error correction and assemble the packet. It will then output the packet on the DATA_OUT line. The encoder will repeat the transmission process for as long as one of the data lines is high, otherwise it will go back to sleep. It will update the state of the data lines with each packet and it will finish the current transmission even if all of the lines are pulled to ground.

DECODER OPERATION

The LS decoder begins by waiting for the DATA_IN line to transition from low to high. At that point, the decoder will accept the data, check it for errors and confirm that the bytes are valid. If the data pass all of the checks, then the data bits are output on the decoder's data lines. If any of these checks fail, then the decoder will ignore the received packet and look for the next one.

The decoder has a built-in debounce circuit to guard against signal cutout. This is a timer that maintains the current state of the data lines until changed by a valid packet or until no valid packets are received for 131mS. After 131mS elapses the decoder pulls all of the data lines to ground and goes back to sleep. This helps protect devices attached to the decoder by smoothing out the output response. Rapid switching resulting from lost packets could cause damage to devices, such as relays or motors, that may be controlled by the decoder.

This debounce circuit helps in noisy environments and at the range limit of the transmitter and receiver where lost packets and cutouts are more frequent. The drawback is that there is the 131mS lag time between the end of the transmission and when the data lines are turned off. This is generally not a problem with manual remote control applications, but must be taken into account in applications where timing is critical.

APPLICATION EXAMPLE

The LS series encoders and decoders would typically be used in remote control applications to register button presses to activate circuitry in a remote device. Figure 4 shows an example application circuit.

A SPDT switch is used in both circuits to set the baud rate. This switch will pull the BAUD_SEL line to either ground or VCC for selection of one of the baud rates described in the Pin Descriptions section of this manual. The baud rate on both sides must match in order for the encoder and decoder to correctly operate.

Two pushbutton switches are connected to the data lines on the encoder. Since none of the data lines have internal pull resistors, external resistors are used to pull the data lines to ground when not in use. Without these resistors, the state of the data lines could not be guaranteed and performance may not be predictable. In this example, only two data lines are used so the other two are tied directly to ground. With this circuit, pressing either of the buttons will cause the data line to go high and initiate a transmission.

On the decoder side, a piezoelectric buzzer is attached directly to the D1 line. When the button connected to the D1 line on the encoder is pressed, the buzzer will sound. The D0 line is connected to a relay through a transistor buffer. The decoder can output 25mA, which is sufficient to drive small relays, but may not work for larger coils. The transistor is used to provide the higher current and voltage required to activate a larger relay. With this circuit, when the D0 line goes high it will turn on the transistor, which will energize the relay and connect the terminals.

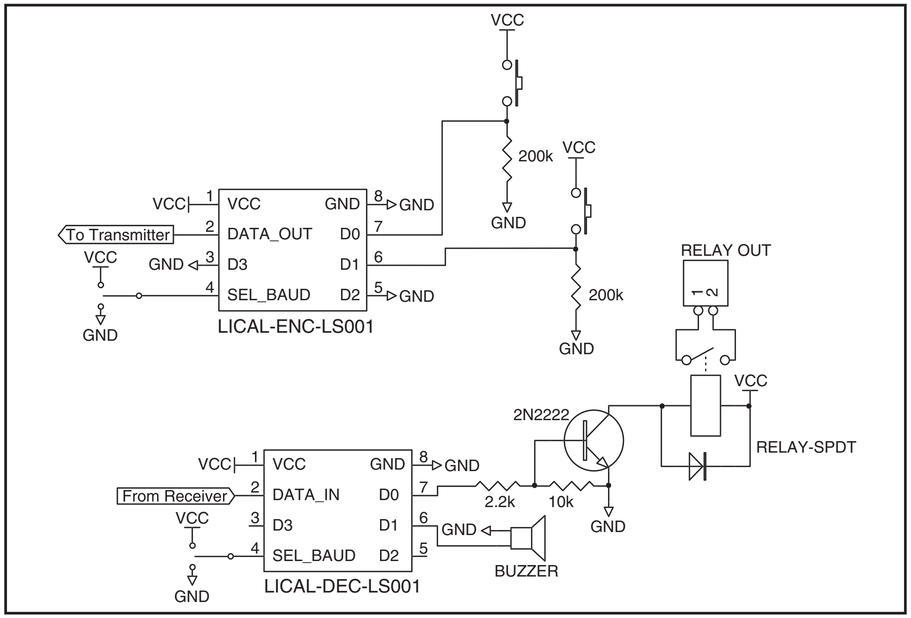

Figure 4: Application Circuits

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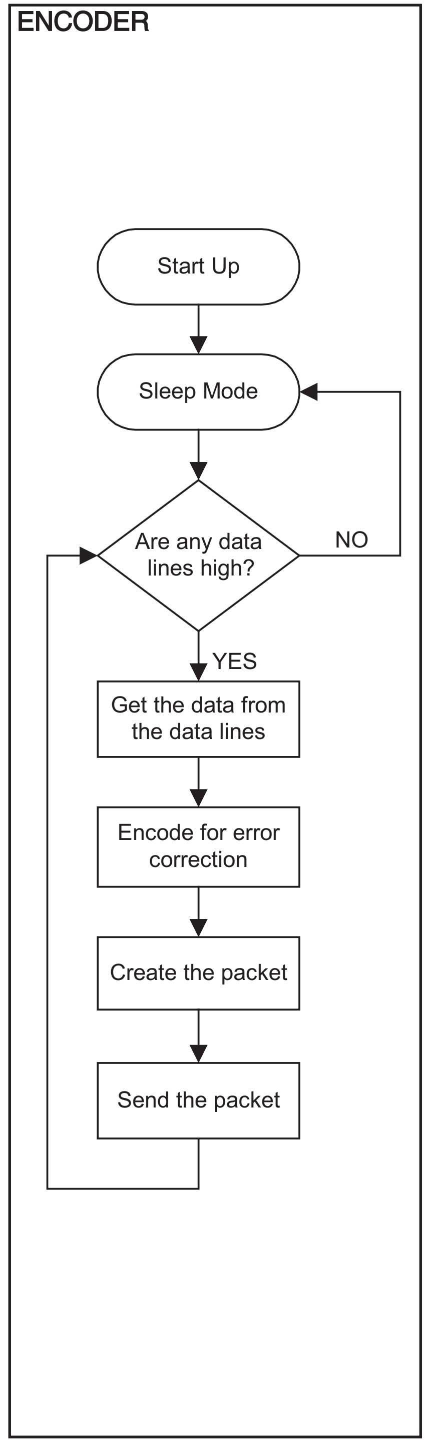

Figure 5: Encoder Flowchart

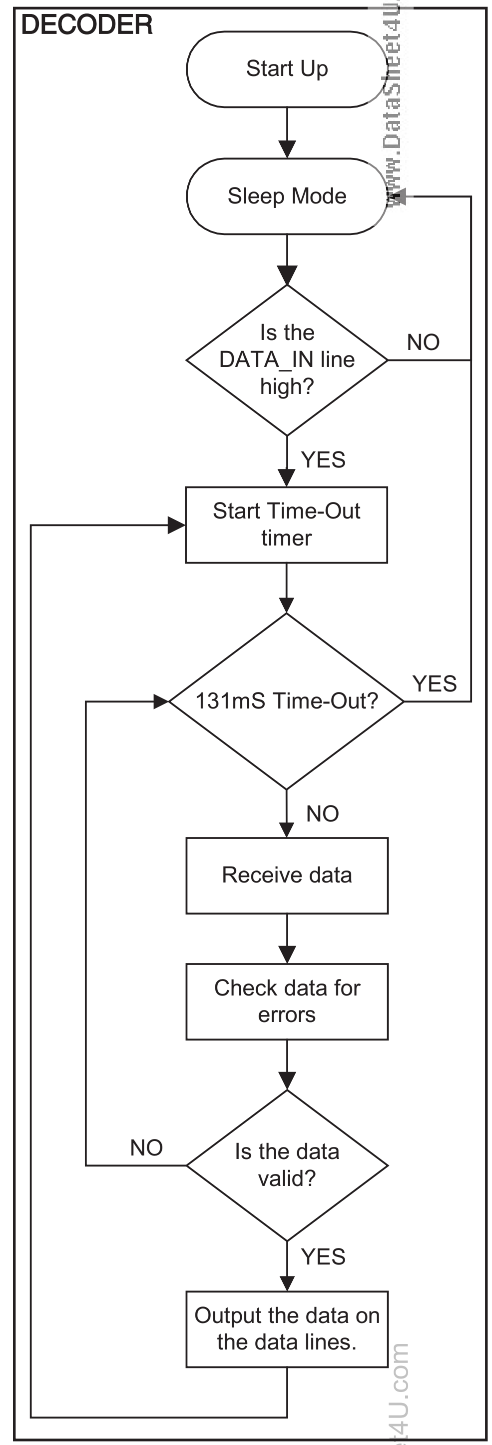

Figure 6: Decoder Flowchart

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