Linx TECHNOLOGIES

DS Series
Encoder/Decoder Module
Data Guide

Wireless made simple®

Warning: Some customers may want Linx radio frequency ("RF") products to control machinery or devices remotely, including machinery or devices that can cause death, bodily injuries, and/or property damage if improperly or inadvertently triggered, particularly in industrial settings or other applications implicating life-safety concerns ("Life and Property Safety Situations").

NO OEM LINX REMOTE CONTROL OR FUNCTION MODULE SHOULD EVER BE USED IN LIFE AND PROPERTY SAFETY SITUATIONS. No OEM Linx Remote Control or Function Module should be modified for Life and Property Safety Situations. Such modification cannot provide sufficient safety and will void the product's regulatory certification and warranty.

Customers may use our (non-Function) Modules, Antenna and Connectors as part of other systems in Life Safety Situations, but only with necessary and industry appropriate redundancies and in compliance with applicable safety standards, including without limitation, ANSI and NFPA standards. It is solely the responsibility of any Linx customer who uses one or more of these products to incorporate appropriate redundancies and safety standards for the Life and Property Safety Situation application.

Do not use this or any Linx product to trigger an action directly from the data line or RSSI lines without a protocol or encoder/decoder to validate the data. Without validation, any signal from another unrelated transmitter in the environment received by the module could inadvertently trigger the action.

All RF products are susceptible to RF interference that can prevent communication. RF products without frequency agility or hopping implemented are more subject to interference. This module does not have a frequency hopping protocol built in.

Do not use any Linx product over the limits in this data guide. Excessive voltage or extended operation at the maximum voltage could cause product failure. Exceeding the reflow temperature profile could cause product failure which is not immediately evident.

Do not make any physical or electrical modifications to any Linx product. This will void the warranty and regulatory and UL certifications and may cause product failure which is not immediately evident.

Ordering Information

Ordering Information	
Part Number	**Description**
LICAL-EDC-DS001	DS Series Encoder/Decoder
EVAL-xxx-DS	DS Series Evaluation Kit

Encoder/Decoders are supplied in tubes of 18 pcs.

Figure 2: Ordering Information

Absolute Maximum Ratings

Absolute Maximum Ratings				
Supply Voltage V_{CC}	–0.3	to	+6.5	VDC
Any Input or Output Pin	–0.3	to	V_{CC} + 0.3	VDC
Max. Current Sourced By Output Pins		25		mA
Max. Current Sunk By Output Pins		25		mA
Max. Current Into V_{CC}		250		mA
Max. Current Out Of GND		300		mA
Operating Temperature	–40	to	+85	°C
Storage Temperature	–65	to	+150	°C

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.

Figure 3: Absolute Maximum Ratings

Warning: This product incorporates numerous static-sensitive components. 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 module damage or failure.

Pin Assignments

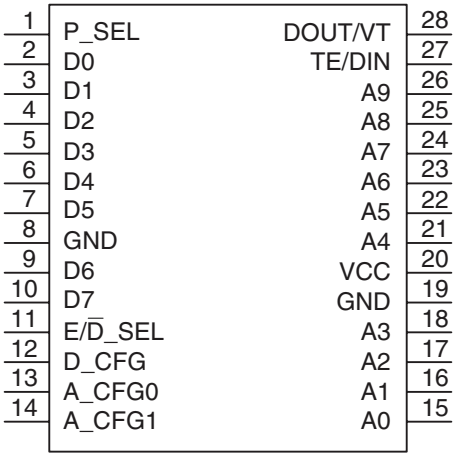

Figure 5: DS Series Encoder/Decoder Pinout (Top View)

Warning: None of the input lines have internal pull-up or pull-down resistors. The input lines must always be in a known state (either GND or V_{CC}) at all times or the operation may not be predictable. The designer must ensure that the input lines are never floating, either by using external resistors, by tying the lines directly to GND or V_{CC}, or by use of other circuits to control the line state.

Theory of Operation

The DS Series is a remote control encoder and decoder that offers two protocols in one part based on the state of the P_SEL line. The first protocol operates with the Holtek® HT640 encoder and HT658 decoder. The second is a serial protocol that offers more noise immunity and faster response time while keeping the simple addressing. The DS can operate as either an encoder or decoder based on the state of the E/$\overline{D}$_SEL line. It does not operate as both simultaneously.

When set as an encoder it monitors the state of the TE line. When the line is high the DS records the states of the data and address lines, assembles them into a packet and outputs the packet three times. The data lines can be connected to switches or contacts. The address lines can be set with DIP switches or cut traces on a PCB.

When set as a decoder the DS receives packets and validates them. The validation includes checking the bit timings and comparing the received address to the local address line settings. Two matching packets must be received consecutively. If the timings are good and the addresses match, the DS sets its data lines to match the received states. These lines can be connected to the application circuitry to be controlled.

When the TE/DIN line is low, the DS goes into a low power sleep mode.

> Note: The input lines on the DS are not tri-state. They must be pulled high or low and cannot be left floating. This is a key difference between the DS and the Holtek® parts.

Setting the Address

The DS Series has ten address lines. This allows the formation of up to 1,022 ($2^{10} - 2$) unique transmitter-receiver relationships.

> Note: The DS decoder rejects packets with addresses set to all high or all low. At least one address line must be different from the rest. The encoder does transmit all addresses, but the decoder rejects packets with all address lines set the same.

These lines may be hardwired or configured via a microprocessor, DIP switch or jumpers. The receiver's address line states must match the transmitter's exactly for a transmission to be recognized. If the addresses do not match, then the decoder takes no action.

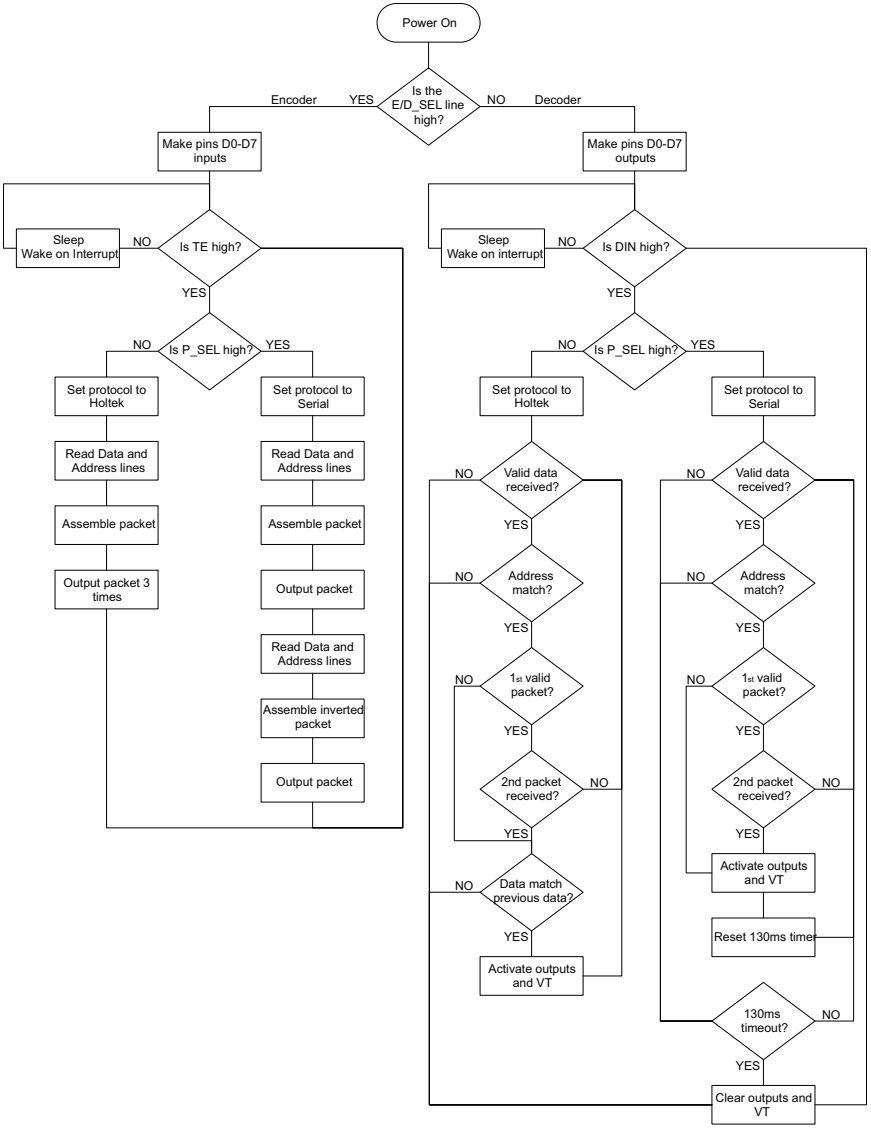

Figure 7: DS Series Encoder/Decoder Flowchart

Example packets are shown in Figure 10 with all lines set in a specific state.

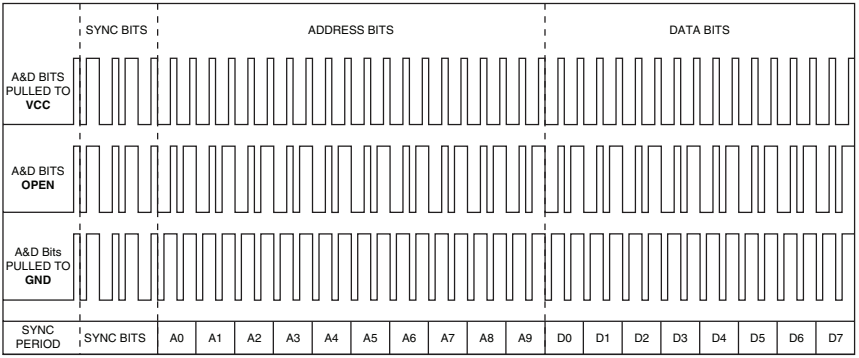

Figure 10: Holtek® Protocol Timing

Figure 11 shows the timings associated with the Holtek® protocol.

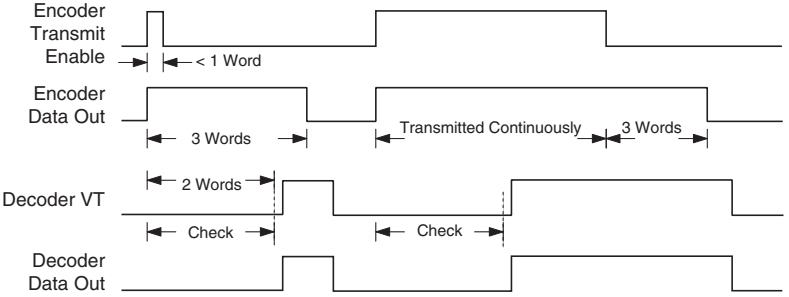

Figure 11: DS Series Timing

Serial Data and Packet Structure

The serial protocol encodes the address and data lines as binary bits that follow logic low and logic high voltage levels. The logic states of each line are recorded and placed into bytes. A checksum is calculated on the bytes and appended to the end of the packet. A preamble and a noise filter are added to the front. The packet is shown in Figure 14.

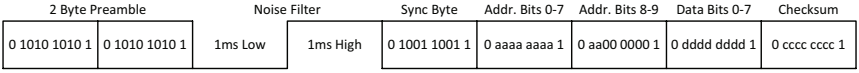

Figure 14: Serial Protocol Packet Structure

The bytes are output in serial fashion at 4,800bps. The DS outputs the packet twice, with the second packet being the logical inversion of the first. This ensures that the duty cycle of the data is always 50%. Adding in the blanking period between packets lowers the duty cycle. This is important for FCC certification where the transmitter output power level is a function of the data duty cycle.

This protocol only uses binary states, so the D_CFG, A_CFG0 and A_CFG1 lines are ignored.

The serial protocol is much more immune to bit edge jitter than the Holtek® protocol. This gives much better range and performance within that range. This also gives the DS better immunity to noise from motors, switching power supplies, high current drivers and other noise sources.

This protocol updates the data line states on every packet. This, combined with a faster data rate, give the serial protocol a much faster response time than the Holtek® protocol (36.5ms typical compared to 135ms).

The serial protocol compares two packets as part of the data validation, but also includes a timer that keeps the outputs stable in the case of mismatched packets. This prevents the outputs from turning off at the loss of one packet or when a data line is toggled while another one is active. This helps prevent chattering of relays and other electro-mechanical devices that are not designed for rapid switching. The outputs turn off after 130ms with no valid data.

Encoder Typical Application

Figure 15 shows a circuit using the DS Series configured as a Holtek® encoder. This configuration matches the Linx OEM products.

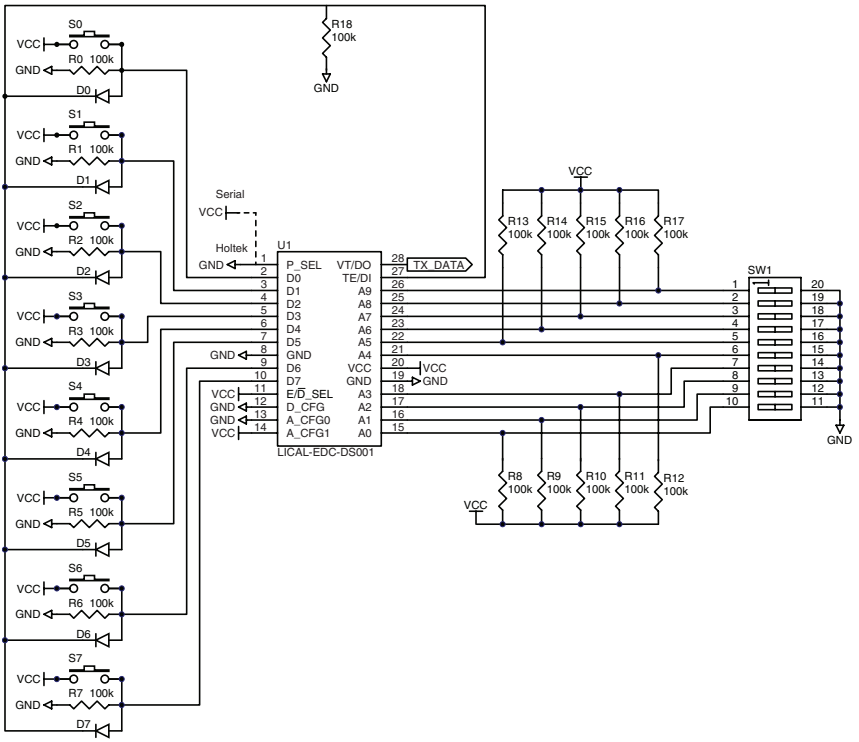

Figure 15: DS Series Typical Application as an Encoder

The P_SEL line is set to Holtek® data (pulling it to Vcc selects the Serial protocol. The E/$\overline{D}$_SEL line is pulled high to place the DS into Encoder Mode. The D_CFG is set so that a high on a data line is transmitted as a one bit and a low on the line is transmitted as an open bit. The A_CFG0 and A_CFG1 lines are set to give a high on an address line as an open bit and a low as a zero bit.

The data lines are bi-state, so they have to be high or low. They cannot be floating. Resistors to ground pull the lines low and buttons pull the lines high when pressed. Diodes are used to pull TE high when any button is pressed without activating any other line. This way, pushing any button causes the encoder to start outputting data.

The address lines are bi-state, so they have to be high or low. They cannot be floating. Resistors pull the lines high and DIP switches pull them low.

Recommended Pad Layout

The DS Series encoder/decoder is implemented in a 28-pin Shrink Small Outline Package (28-SSOP). The recommended layout dimensions are in Figure 17.

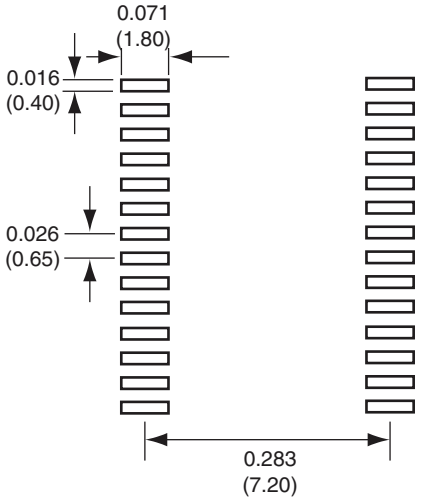

Figure 17: Recommended Footprint

Production Guidelines

These surface-mount components are designed to comply with standard reflow production methods. The recommended reflow profile is shown in Figure 18 and should not be exceeded, as permanent damage to the part may result.

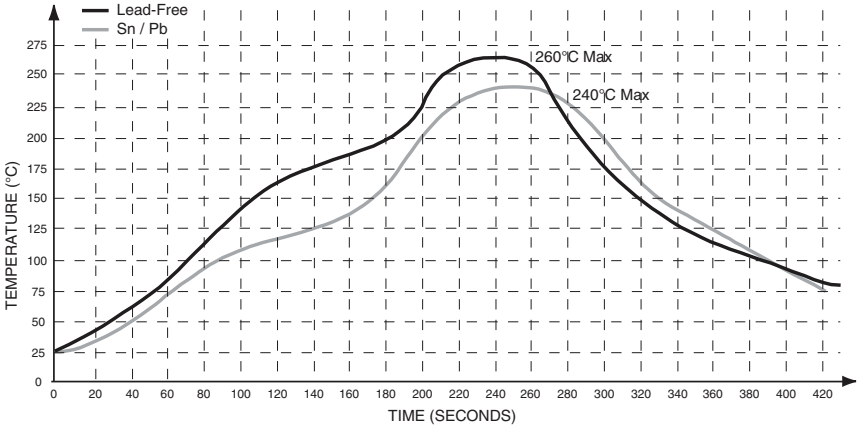

Figure 18: Recommended Solder Profile

Resources

Support

For technical support, product documentation, application notes, regulatory guidelines and software updates, visit www.linxtechnologies.com

RF Design Services

For customers who need help implementing Linx modules, Linx offers design services including board layout assistance, programming, certification advice and packaging design. For more complex RF solutions, Apex Wireless, a division of Linx Technologies, creates optimized designs with RF components and firmware selected for the customer's application. Call +1 800 736 6677 (+1 541 471 6256 if outside the United States) for more information.

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