



### Description

The ELM622 is an interface circuit for converting infrared control codes to an eight bit serial format. This device is well suited to applications that only require occasional input from humans, or where a hidden interface is desired.

When connected to a standard infrared receiver module, the ELM622 continually scans the data stream for Sony™ television control codes. If detected, the codes are retransmitted serially, with hardware handshaking. This data can then be used directly by logic circuits, or suitably buffered and transmitted on a standard RS232 connection.

For convenience, some of the control codes are translated to their ASCII equivalents before retransmission, allowing direct display of the common control signals on an ASCII terminal.

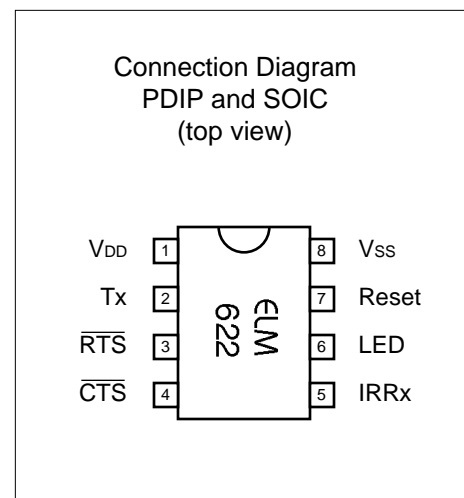
Many products that currently rely on a keyboard for input can benefit from the small size and simplicity that an ELM622 provides, and several others are likely to benefit from the at-a-distance control that this circuit offers.

### Applications

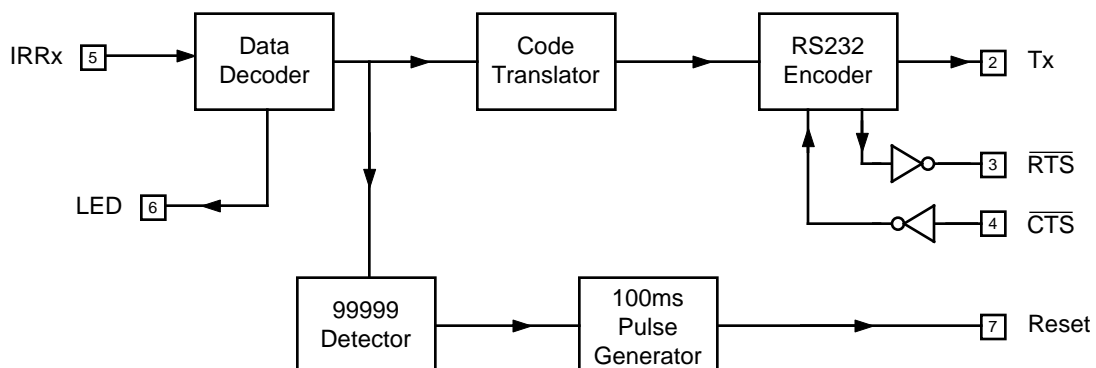
- Alternative to keyboard interface
- Hidden security system control
- Non-contact device control for safety
- Home automation receiver

### Features

- Low power CMOS design - typically 1mA at 5V
- RS232 formatted output at 9600 baud
- Hardware handshaking provided
- Signal received output for visual feedback
- Simple interface to standard receiver modules
- Works with universal TV remote transmitters
- Reset output on command
- High current drive outputs - up to 25 mA



### Block Diagram





## Pin Descriptions

### V<sub>DD</sub> (pin 1)

This pin is the positive supply pin, and should always be the most positive point in the circuit. Internal circuitry connected to this pin is used to provide power on reset of the microprocessor, so an external reset signal is not required. Refer to the Electrical Characteristics section for further information.

### Tx (pin 2)

The transmit data output. When a valid byte is received it is retransmitted from this pin at 9600 baud, least significant bit first, with one start bit, no parity bit, and one stop bit. The pin is normally held at a logic high level when in the idle state, and goes to true logic levels when transmitting data. The output is compatible with standard RS232 data transmission, when coupled through appropriate buffers (transistors or interface ICs such as the MAX232).

### $\overline{\text{RTS}}$ (pin 3)

$\overline{\text{RTS}}$  is the request to send handshaking output. When a valid byte is ready to be sent, this pin will be brought low and will remain at that level until the stop bit has been sent, or the send is aborted due to a time-out.

### $\overline{\text{CTS}}$ (pin 4)

This input pin is used to control the transmission of data. A logic low level allows sending, and a

high level forces the ELM622 to wait. The system waits no longer than about 2 seconds, however, before discarding the byte and reverting to the idle condition. The state of the pin is tested just prior to sending data, and is not monitored once data transmission begins.

### IRR<sub>x</sub> (pin 5)

The output of a standard 40KHz infrared receiver module is connected to this pin, through a series resistor of about 5K value. The output of such a module is normally at a high level, and switches to a logic low when modulated carrier is received.

### LED (pin 6)

This pin provides a logic high level output when a valid code has been received and remains at that level until the data has been sent by the ELM622. The output is suitable for driving an LED through a current limiting resistor.

### Reset (pin 7)

A high level 100msec wide pulse is output on this pin when the sequence 99999 is received. This can be used for special functions such as resetting the system, or momentarily triggering a control point.

### V<sub>SS</sub> (pin 8)

Circuit common is connected to this pin. This is the most negative point in the circuit.

## Ordering Information

These integrated circuits are available in either the 300 mil plastic DIP format, or in the 200 mil SOIC surface mount type of package. To order, add the appropriate suffix to the part number:

300 mil Plastic DIP..... ELM622P

200 mil SOIC..... ELM622SM

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## Absolute Maximum Ratings

Storage Temperature..... -65°C to +150°C  
 Ambient Temperature with  
 Power Applied..... -40°C to +85°C  
 Voltage on V<sub>DD</sub> with respect to V<sub>SS</sub>..... 0 to +7.5V  
 Voltage on any other pin with  
 respect to V<sub>SS</sub>..... -0.6V to (V<sub>DD</sub> + 0.6V)

Note:  
 Stresses beyond those listed here will likely damage the device. These values are given as a design guideline only. The ability to operate to these levels is neither inferred nor recommended.

## Electrical Characteristics

All values are for operation at 25°C and a 5V supply, unless otherwise noted. For further information, refer to note 1 below.

Characteristic	Minimum	Typical	Maximum	Units	Conditions
Supply Voltage, V <sub>DD</sub>	4.5	5.0	5.5	V	
V <sub>DD</sub> rate of rise	0.05			V/ms	see note 2
Average Supply Current, I <sub>DD</sub>		1.0	2.4	mA	see note 3
Input low voltage	V <sub>SS</sub>		0.15 V <sub>DD</sub>	V	
Input high voltage	0.85 V <sub>DD</sub>		V <sub>DD</sub>	V	
Output low voltage			0.6	V	Current (sink) = 8.7mA
Output high voltage	V <sub>DD</sub> - 0.7			V	Current (source) = 5.4mA
Reset Output Pulse Width	90	100	110	msec	see note 4
Transmit Baud Rate	9300	9600	9900	baud	see notes 4 and 5

### Notes:

1. This integrated circuit is produced with a Microchip Technology Inc.'s PIC12C5XX as the core embedded microcontroller. For further device specifications, and possibly clarification of those given, please refer to the appropriate Microchip documentation.
2. This spec must be met in order to ensure that a correct power on reset occurs. It is quite easily achieved using most common types of supplies, but may be violated if one uses a slowly varying supply voltage, as may be obtained through direct connection to solar cells, or some charge pump circuits.
3. Device only. Does not include any LED or drive currents.
4. Pulse timing is internally generated, and affected by both temperature and supply voltage. Times shown are the widest variation that can normally be expected.
5. Data is sent at this rate with eight data bits, no parity bit, and one stop bit. Process and temperature variations could typically result in as much as 3% error in this rate, but most UARTs would be tolerant of this. In high reliability applications, one might use the fact that the eighth data bit is always '0' to calibrate a timing loop to the ELM622's speed. The receiver could then compensate for variations in the data rate.



## Data Translation Table

To allow easier interfacing with computer equipment, some of the Sony™ control codes that are received by the ELM622 are replaced with their ASCII equivalents. Conversely, when keys representing these ASCII characters are received, the original number codes are sent.

Table 1 below summarizes the code values that are exchanged. All other codes received are re-transmitted without modification.

Received Codes		Are Transmitted As...		Also, the Codes...	
Value	Key Pressed	Value	ASCII Char	Received	Are Sent As
0	1	49	1	49	0
1	2	50	2	50	1
2	3	51	3	51	2
3	4	52	4	52	3
4	5	53	5	53	4
5	6	54	6	54	5
6	7	55	7	55	6
7	8	56	8	56	7
8	9	57	9	57	59
9	0	48	0	48	9
11	Enter	13	Carriage Return	13	11
21	Power	46	Decimal Point	46	21
59	Jump or Prev	8	Back Space		

Table 1. Data Translation Values

## Example Application

Figure 1 shows an example circuit using the ELM622. Keypresses on a television remote control transmitter are received by this circuit, interpreted, and retransmitted to a monitoring computer.

The television remote control used is one of the low cost universal types, set to generate Sony™ codes. This is often the default power-up mode for most of these remotes. Output is by way of a simple one transistor RS232 connection, with no handshaking. The auxiliary reset output is not used in this case, and power for the entire circuit is provided by a 5 volt regulated supply.

Operation is straight-forward. When a button on the remote is pressed, the serial data stream is detected by the infrared module and passed onto the ELM622 as a series of negative-going pulses. The data is then decoded, and if found to contain a Sony™ control code, is retransmitted. The type of receiver modules required are commonly available on the market, and are manufactured by companies such as Sharp™ or LiteOn™. A 40KHz module is required for a Sony™ infrared remote, although 38KHz ones have been used successfully.

In operation, ambient light can occasionally cause an infrared receiver's bias level to drift towards V<sub>ss</sub>, possibly tripping the ELM622's Schmitt trigger input. As the receiver output drifts high again, the Schmitt trigger

may not always reset, so that it might appear that there is carrier present when it is not. This condition is accounted for within the integrated circuit by momentarily changing pin 5 to a high level output before taking any measurements, thus resetting the trigger. The series resistor must be used on pin 5 to protect both circuits during this momentary high level pulse. Typically a value of 4.7K is sufficient.

The output of the ELM622 is shown coupled to a monitoring computer through a simple one transistor buffer circuit. The circuit uses the computer's idle transmit line as a source of negative voltage, and includes a diode for protection from backfeeds. Output connections are made through a standard DB25 female modem type connector with the pin numbers as shown.

This is all that is required to receive control codes from a standard infrared remote control, and to transmit them to a computer. At the computer, the data can be displayed using a terminal program, used to control the computer, or possibly used to control other devices. Alternatively, the ELM622 could simply be connected directly to a microcontroller, providing a very low parts count alternative to the use of keyboards...

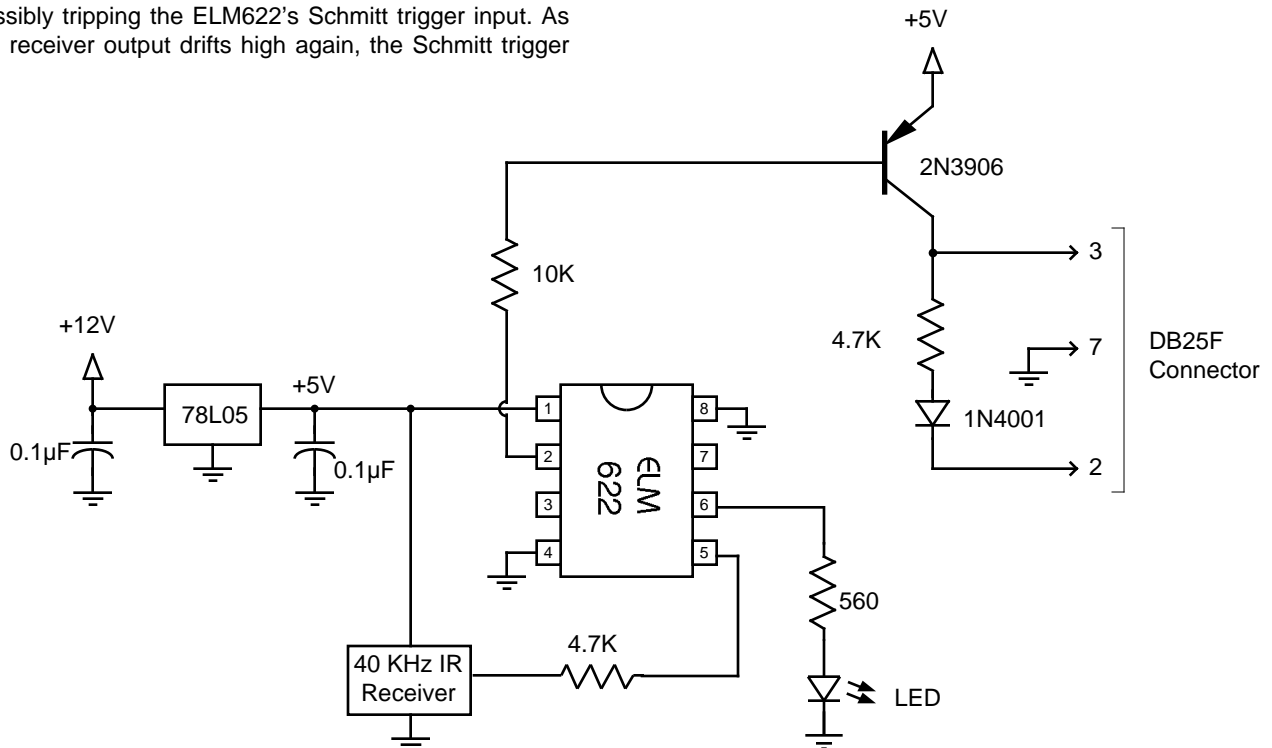


Figure 1. Infrared to RS232 Circuit