# ST3795 - NEC Encoder/Transmitter - Serial UART input

The main function of the ST3795 is to encode the serial input into NEC format remote control output. It can accept serial input from an external microcontroller or a PC for developing variety of applications like custom remote control or PC controlled NEC remote or emulation of any NEC remote.

Basic Working

ST3795 needs very few components to transmit NEC codes.

Below you can see an external microcontroller is sending serial data to the ST3795 and it is transmitting NEC format data.
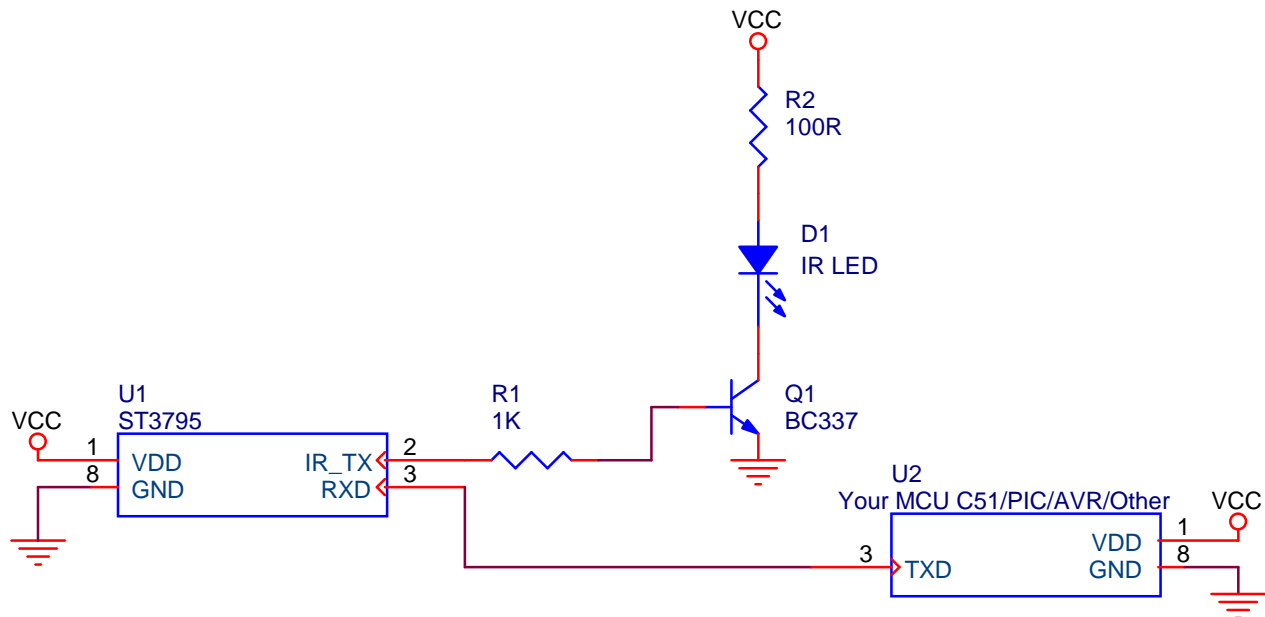

Specification

Parameter	Value
Working Voltage	3-5V DC
Current	10mA
Serial UART Interface	9600 bps, 8 bit data, no parity, 1 stop bit at 5V or 3V level
NEC Output Frequency	38 Khz IR modulated NEC format

ST3795 is a Microchip PIC Controller that is programmed by us and labeled to work as per details in this datasheet.

Pin Details

```
1-VDD          8-GND
2-IR_TX        7- N/C    N/C=No Connect
3-RXD          6- N/C
4-N/C          5- N/C
        ST3795
```
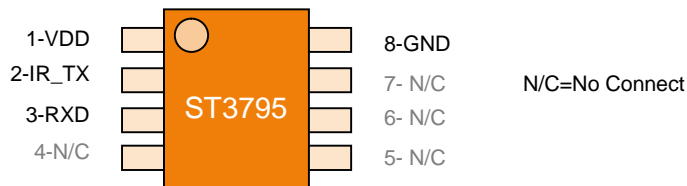
Pin#	Pin Name	Type	Notes
1	VDD	Supply	3 to 5V DC regulated power supply input
2	IR_TX	Output	Connect IR LED through NPN transistor
3	RXD	Input	Input serial UART data at 9600 bps at TTL level
4-7	N/C	Not Used	Not Connected, This pin is not used and should be left unconnected
8	GND	Ground	Power Supply Ground

Serial Data Input Format

When you want to send data to chip in serial at 9600 baud rate for transmission by NEC format, you will have to send total four bytes packet. NEC consist of 16 bit address and 8 bit data(command, keypress) information. 16 bit address of a remote is fixed while 8 bit data changes with each key press.

The packet starts from 0xCC which is start of packet identifier byte then comes address byte low, address byte high and then command byte. Once the IC receives all four byte it starts transmission of NEC remote control code as per data received. This way you can send any type of NEC code through this IC.

BYTE COUNT	HEX	Details
1	0xCC	Start of Packet Identifier
2	0xXX	Address Byte Low
3	0xXX	Address Byte High
4	0xXX	Command Byte

If you are working in C language, your microcontroller you would typically write below code to transmit a packet after you have initialize its UART to 9600 baud rate.
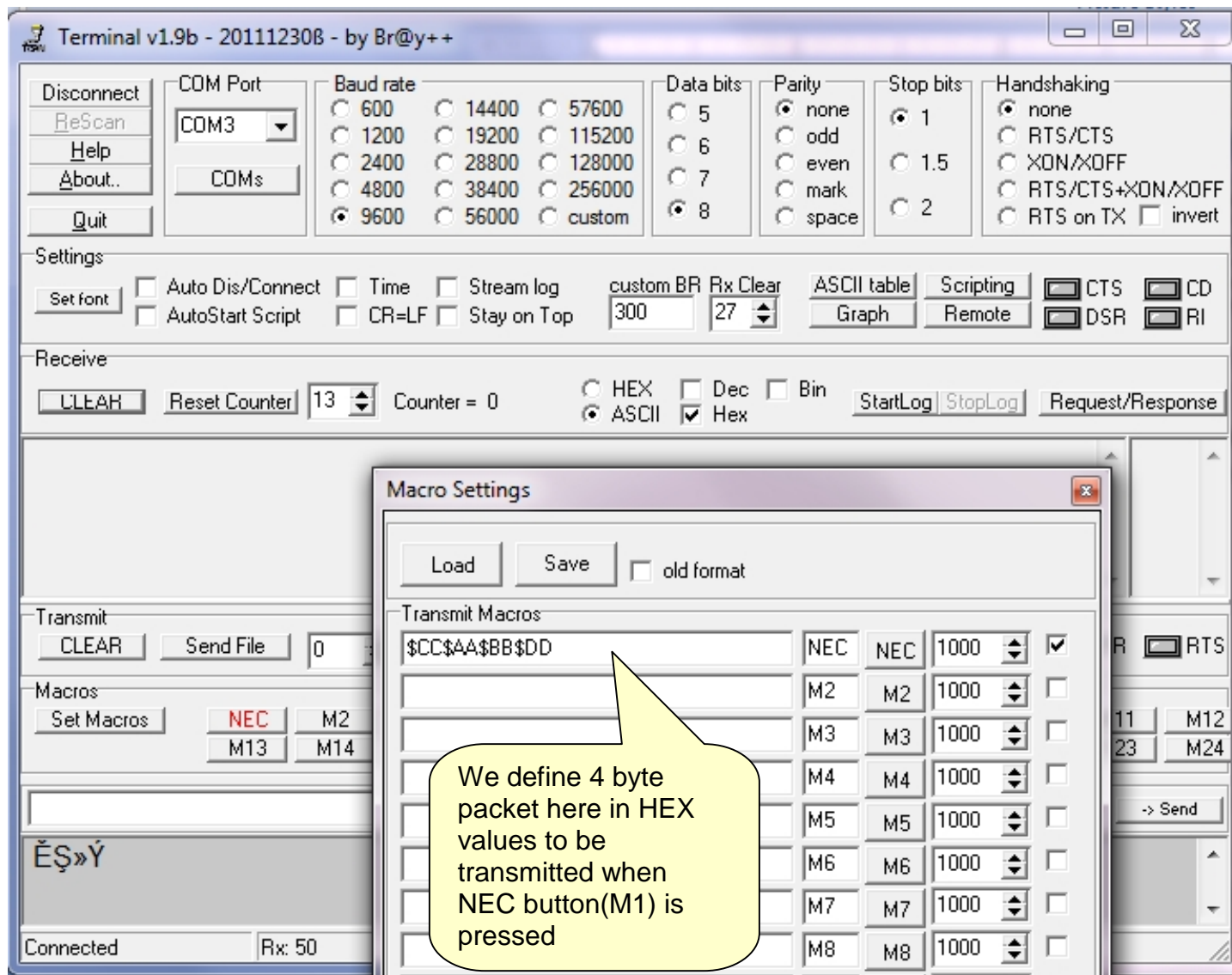
```
putchar(0xCC); // Start ID
putchar(0x50); // Address Low
putchar(0x31);// Address High
putchar(0x01);// Command
```

Using PC to transmit NEC code

When you want to use PC to transmit a NEC code through ST3795 you can use below software to transmit a packet.

To send a byte in hex format you can use $CC type declaration where the CC is a byte in hex value to be transmited.

Terminal Software http://www.sunrom.com/files/Terminal.exe

We define 4 byte packet here in HEX values to be transmitted when NEC button(M1) is pressed

Note: ST3795 can be connected to PC using MAX232 to serial port or using a USB to UART adapter.

NEC Infrared Transmission Protocol

The NEC IR transmission protocol uses pulse distance encoding of the message bits. Each pulse burst (mark – RC transmitter ON) is 562.5µs in length, at a carrier frequency of 38kHz (26.3µs).

Logical bits are transmitted as follows:
- Logical '0' – a 562.5µs pulse burst followed by a 562.5µs space, with a total transmit time of 1.125ms
- Logical '1' – a 562.5µs pulse burst followed by a 1.6875ms space, with a total transmit time of 2.25ms

When a key is pressed on the remote controller, the message transmitted consists of the following, in order:
- a 9ms leading pulse burst (16 times the pulse burst length used for a logical data bit)
- a 4.5ms space
- the 8-bit address low byte of the receiving device
- the 8-bit address high byte of the address
- the 8-bit command
- the 8-bit logical inverse of the command
- Final 562.5µs pulse burst to signify the end of message transmission.

The four bytes of data bits are each sent least significant bit first. Figure 1 illustrates the format of an NEC IR transmission frame, for an address of 0x00FF (0000000011111111b) and a command of ADh (10101101b).

Example message frame using the NEC IR transmission protocol.
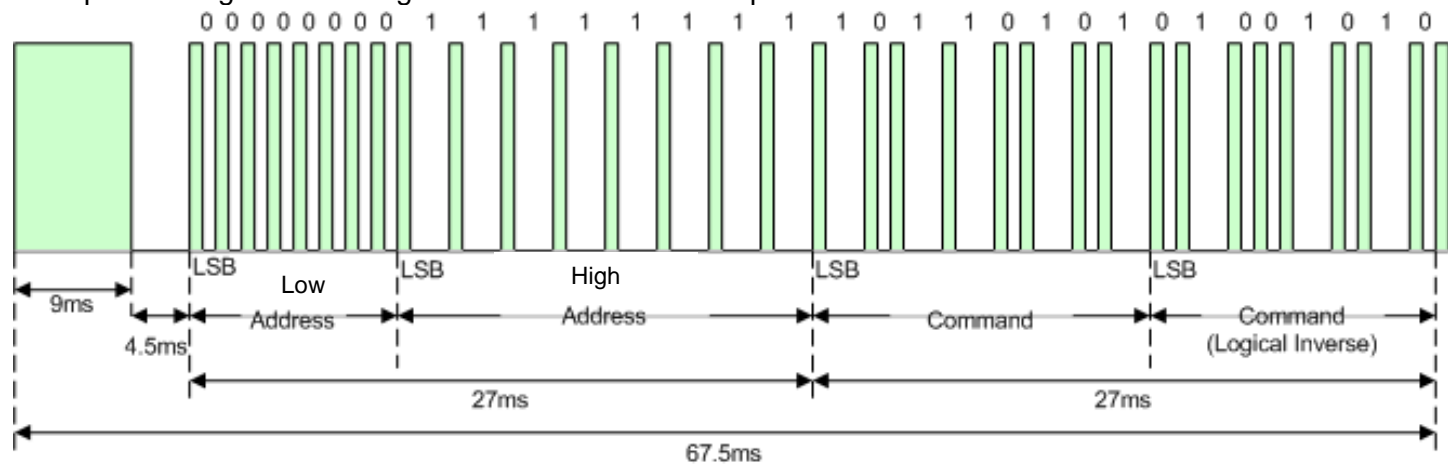
Notice from Figure 1 that it takes:

- 27ms to transmit both the 16 bits for the address (2 Bytes Low and High) and the 16 bits for the command (command + inverse). This comes from each of the 16 bit blocks ultimately containing eight '0's and eight '1's - giving (8 * 1.125ms) + (8 * 2.25ms).
- 67.5ms to fully transmit the message frame (discounting the final 562.5µs pulse burst that signifies the end of message).

Repeat Codes

If the key on the remote controller is kept depressed, a repeat code will be issued, typically around 40ms after the pulse burst that signified the end of the message.

A repeat code will continue to be sent out at 108ms intervals, until the key is finally released. The repeat code consists of the following, in order:

- a 9ms leading pulse burst
- a 2.25ms space
- a 562.5µs pulse burst to mark the end of the space (and hence end of the transmitted repeat code).

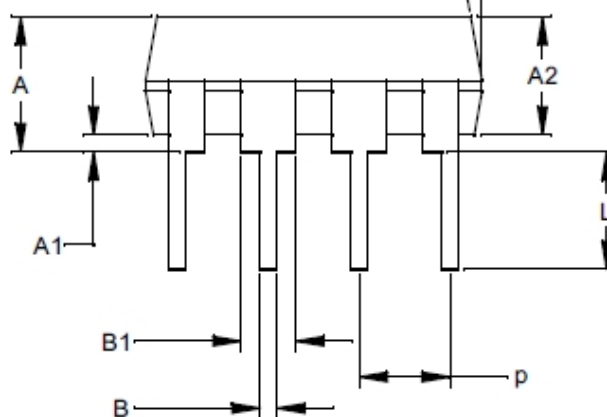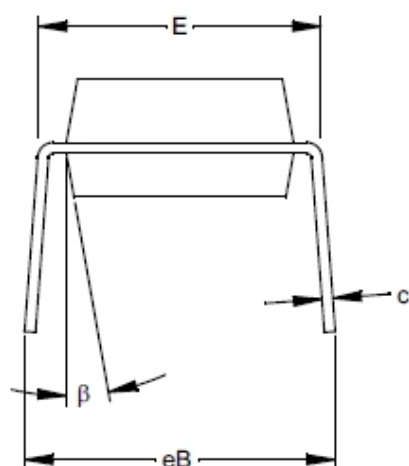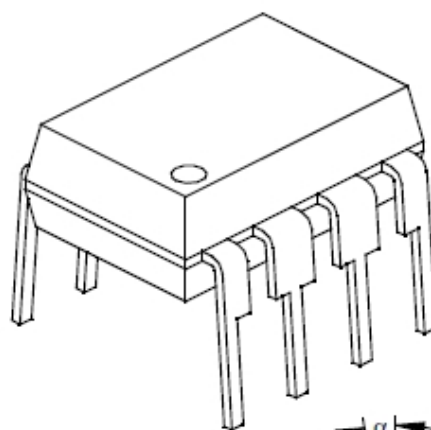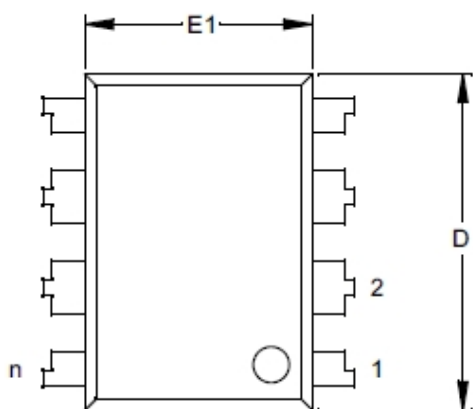Figure illustrates the transmission of two repeat codes after an initial message frame is sent.
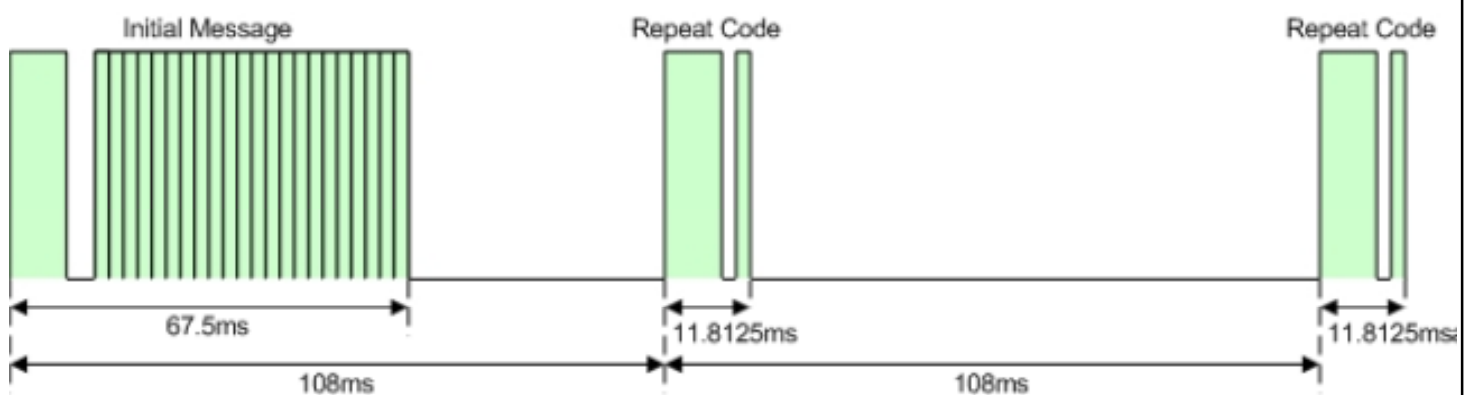
Screenshot of actual capture from NEC transmitted data, using Sunrom's IR Protocol Analyzer

Sunrom Technologies   Your Source for Embedded Systems   Visit us at www.sunrom.com
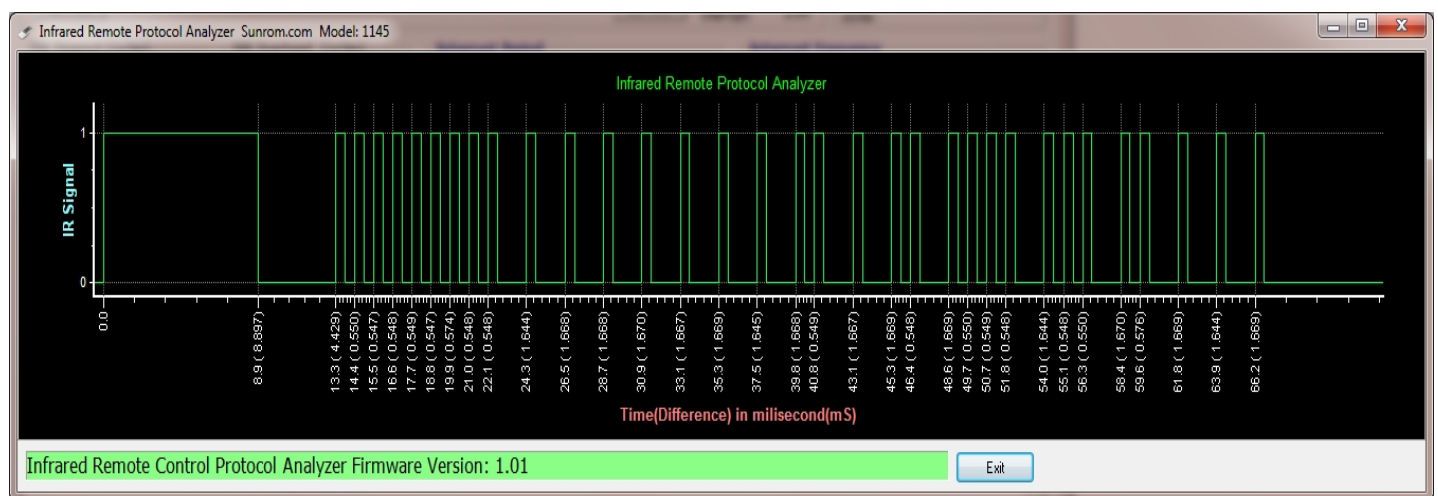
Dimensions DIP Package

8-Lead Plastic Dual In-line (P) – 300 mil (PDIP)

	Units	INCHES*			MILLIMETERS		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		8			8	
Pitch	p		.100			2.54	
Top to Seating Plane	A	.140	.155	.170	3.56	3.94	4.32
Molded Package Thickness	A2	.115	.130	.145	2.92	3.30	3.68
Base to Seating Plane	A1	.015			0.38		
Shoulder to Shoulder Width	E	.300	.313	.325	7.62	7.94	8.26
Molded Package Width	E1	.240	.250	.260	6.10	6.35	6.60
Overall Length	D	.360	.373	.385	9.14	9.46	9.78
Tip to Seating Plane	L	.125	.130	.135	3.18	3.30	3.43
Lead Thickness	c	.008	.012	.015	0.20	0.29	0.38
Upper Lead Width	B1	.045	.058	.070	1.14	1.46	1.78
Lower Lead Width	B	.014	.018	.022	0.36	0.46	0.56
Overall Row Spacing §	eB	.310	.370	.430	7.87	9.40	10.92
Mold Draft Angle Top	α	5	10	15	5	10	15
Mold Draft Angle Bottom	β	5	10	15	5	10	15

* Controlling Parameter
§ Significant Characteristic

Related Products

ST3679 - Infrared remote control decoder NEC format
http://www.sunrom.com/p-1044.html

NEC Remote Control
http://www.sunrom.com/remote-control-infrared/ir-remote-control-transmitter-nec-format

Remote control for transmitting NEC data

NEC Remote Decoder Serial Out board
 http://www.sunrom.com/p-1045.html

USB to Serial TTL
http://www.sunrom.com/usb-to-serial-rs232/usb-to-serial-ttl-board

Access ST3679 data to PC using this board, It installs virtual COM port on PC to which any terminal software can connect.

MAX232 Board
http://www.sunrom.com/usb-to-serial-rs232/max232-board

Convert TTL(3-5V) level data from ST3679 to RS232 level(+/- 12V) suitable for connected to serial port of PC.