RADIO FREQUENCY

TUTORIAL

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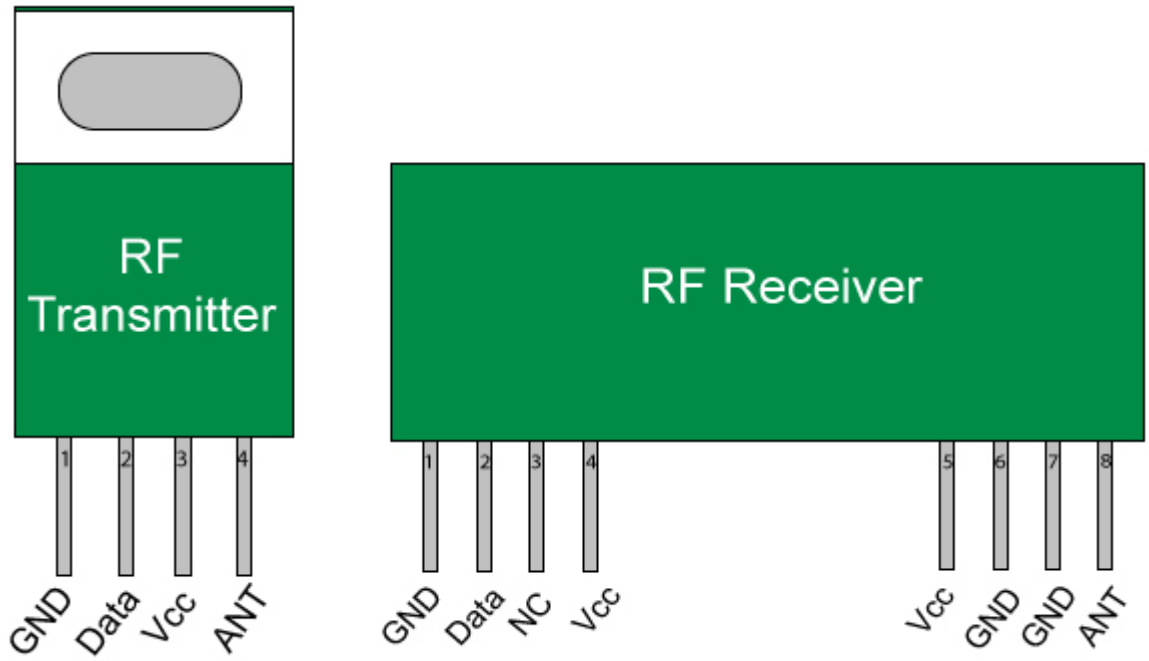
HI. Radio Frequency is the simple way of communicating wirelessly. In this tutorial you will learn how to communicate wirelessly using Radio Frequency.

INTRODUCTION:

Generally, for any wireless communications we need to know two things, transmitter and receiver. RF transmitter sends RF signals in terms of data serially and operates with a frequency of 434MHZ. see the pictures below.



Pin specifications:

Transmitter:

1.	**GND**	**Ground(0v)**
2.	**DATA**	**Serial Data Input**
3.	**VCC**	**Power supply(5v)**
4.	**ANTENNA**	**Antenna Wire**

Receiver:

1.	**GND**	**Ground(0v)**
2.	**DATA**	**Serial Data Output**
3.	**NC**	**Not Connected**
4.	**VCC**	**Power supply(5v)**
5.	**VCC**	**Power supply(5v)**
6.	**GND**	**Ground(0v)**
7.	**GND**	**Ground(0v)**
8.	**ANTENNA**	**Antenna Wire**

The question is how do you make use of these RF transmitter and receiver?

Suppose if you want to glow a LED which is present on the receiver part by using button on the receiver side, then where do you connect that LED? And where do you connect that button on transmitter side?

(You may say that you would connect button to the VCC, “Bad answer”)

If you observe the pin specifications of the transmitter and receiver modules, there you will find only 2nd pin of transmitter and 2nd pin of receiver are input and output pins. Unfortunately, those two pins are for serial data. Connecting a LED and Button for these pins is nonsense.

To make this possible we have to build a circuit and button should be connected to the circuit on the transmitter side giving serial data output for "transmitter" for transmitting the signal to "receiver".

And receiver should be connected with LED on the receiver side taking serial data as input from the "receiver".

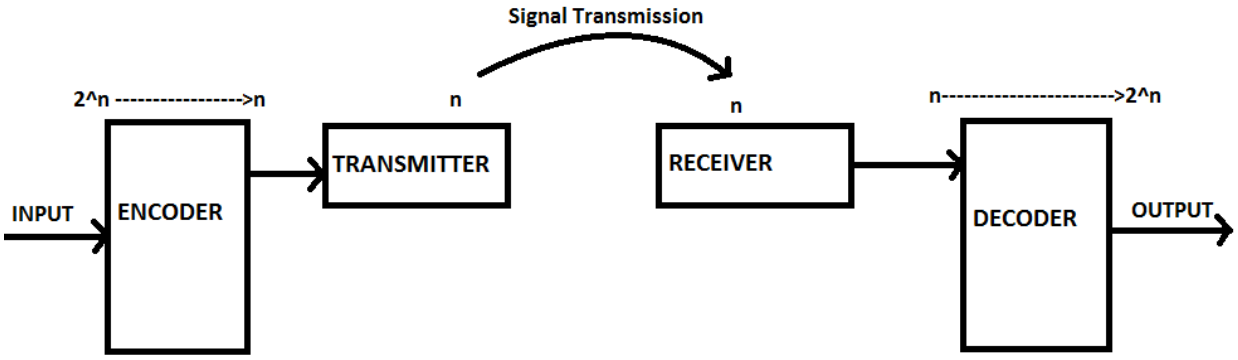
Button should be connected to the circuit on the transmitter side giving serial data output for transmitter for transmitting signal to receiver.

So we need to have two circuits, for transmitter side and another one for receiver side. But in the market, readymade circuits are available. Encoder and Decoder integrated circuits (IC s) are used generally while dealing with RF modules.

Encoder will convert "2^n bit" data inputs to "n bit" data outputs and these n bits will be sent via transmitter to the receiver part.

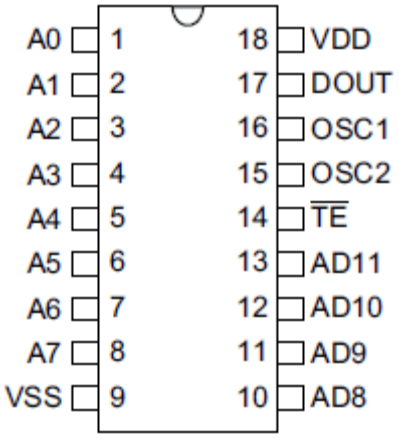
In the receiver section, receiver receives those n bits and sends to the decoder. Decoder will again convert "n bit" data inputs to" 2^n bit" data outputs for actual output.

See the diagram below.

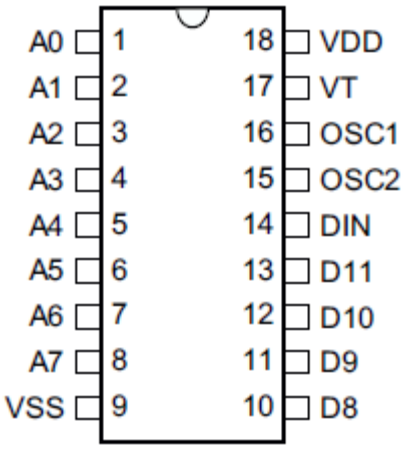


Now let us see how to connect encoders and decoders with receiver and transmitter modules.

Generally, we use HT12E (IC) as encoder and HT12D (IC) as decoder which are 4 channel. Here channel indicates the number of outputs and inputs available for that IC. Both IC's are 4channel, so we can connect four switches in the transmitter side and able to glow four different LED's which are connected in the receiver side. Mind that we can also have 8 channel IC's.



HT12E



HT12D

Pin specifications:

HT12E:

PIN number	Name	Description
1 – 8	A0----------A7	Address bits
9	VSS	Ground(0V)
10 – 13	AD8--------AD11	Input Pins
14	$\overline{TE}$	Transmission Enable
15 – 16	OSC1--------OSC2	Oscillators
17	DOUT	Serial Data Output
18	VDD	Power Supply(5V)

HT12D:

PIN number	Name	Description
1 – 8	A0----------A7	Address bits
9	VSS	Ground(0V)
10 – 13	D8--------D11	Output Pins
14	DIN	Serial Data Input

15 – 16	OSC1--------OSC2	Oscillators
17	VT	Valid Transmission
18	VDD	Power Supply(5V)

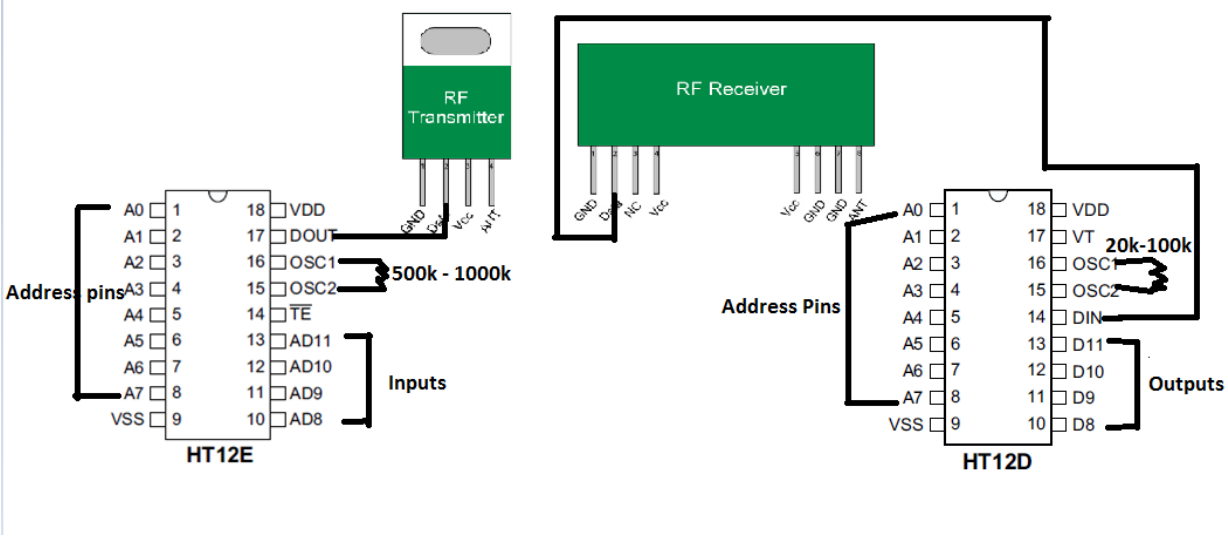
EXPLANATION OF PINS:

- 1-8 pins of both the IC's are address bits (8bit address). These pins are used for matching the address of the transmitter section and receiver section. Initially all the 8pins(bits) are set to one (default) like this 11111111. These bits are very useful for communicating between one transmitter and two or more receivers by setting different address bits. Suppose, if you want to set address like this 10101010. Then you have to ground corresponding pins (A0, A2, A4, and A6) and leave other pins as they are set to one default.
- 9^{th} pin of both the IC's should be grounded.
- 10-13 pins of HT12E are inputs and 10-13 pins of HT12D are outputs.
- 14^{th} pin of HT12E is Transmission Enable pin ($\overline{TE}$). If you put it in the ground then the sending of signals starts. If the pin is TE then you to have supply 5V for signal to start transmitting. But here the pin is $\overline{TE}$ (see the line above TE). And 14^{th} pin of HT12D is serial data. You have to connect this pin to the 2^{nd} pin of the receiver for receiving signal.
- 15^{th} and 16^{th} pins HT12E and HT12D are oscillator pins for frequency matching. Connect a resistor (any value between 500k to 1000k for HT12E and 20k to 100k for HT12D for better results) between the two pins.

- **17th pin of HT12E is serial data out. You have to connect this pin to the 2nd pin of the transmitter for signal transmission. 17th pin of HT12D is VT pin which valid transmission. It will automatically become high when the signal transmitted to receiver. Better connect a LED for this pin to check valid transmission.**
- **18th pin of both IC's is VDD for power supply (5V).**

See the circuit below

VCC, ground, inputs and outputs are mandatory. But those are not connected below.



Remember, as soon as the Transmission enable pin is provided with 0V (Ground) signal starts transmitting. You have to check for the Valid Transmission pin to go high which indicates the perfect signal transmission.

As the above IC's are of 4channel, connect 4 switches for input pins of HT12E and take corresponding outputs from decoder. If you press a switch which is connected to the 10^{th} pin (AD0 above) transmitter side then you will get 5V output from 10^{th} pin of receiver section. Nothing but you can easily control two motors connected to the 4output pins of receiver decoder by pressing the 4 switches connected to the 4 input pins of encoder of transmission section.

THANK YOU

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