



## ET- iLED 4x4-RGB

**ET-iLED4x4 RGB** is Board LED RGB 4x4 (16 LED) that serially connects 16-LED No.WS2812B together and colored resolution of each LED is 24-Bit Color RGB. It uses 1-Wire Interface as NZR type to control LED; it serially sends data. Data 0 or Data 1 is setup by Period that is the same as Signal Pulse; it uses 1 Signal Period per 1-Bit Data to setup Data 0 or Data 1 as required.

Board ET-iLED4x4-RGB designs Connector for using with Board MCU Arduino that is sold by ETT; moreover, it supports Board Raspberry Pi and standard Board MCU Arduino. There is standard Connector 10-PIN Block Type and Connector 3-Pin MALE (DIN) on board. Moreover, there is Circuit IR on board, user can write program to receive Signal Remote to control the operation of iLED on board; it provides example and Library for MCU Arduino. In the part of Power Supply, Board requires 5V and Current 1 Amp or higher to supply all 16-iLED. For Power Supply of Circuit IR, board uses Power Supply of Board MCU (3.3V-5V) that is connected with. So, it requires 2 sets of Power Supply; one is for Board MCU of user and another one (5V) is for Board ET-iLED4x4-RGB.

### 1. SPECIFICATIONS OF BOARD ET-iLED4x4-RGB

- Use Power Supply DC 5V and Current 1 Amp or higher (for supplying 16-LED)
- Board consumes Current 750mA approximately for all white 16-LED
- Input DI Pin of LED supports Signal TTL 5V
- Output IR gives Voltage 3.3V-5V, it depends on Power Supply from Board MCU that is supplied to IR through Pin VDD (Please look at schematic circuit of board)
- Have 16-RGB-LED No.WS2812B is serially connected on board
- IR No.TSOP4838 receives Signal Remote for long-distant control
- Connector Block 10-Pin on board is connected to control IR and iLED; and it is connected to Power Supply in the part of IR
- Connector 3-Pin MALE is connected to control iLED and it is connected to 5V Power Supply for iLED
- Connector Block 2-Pin is connected to external Power Supply to particularly provide iLED
- It designs holes on board to insert Pin Connector to support the connection with other Board MCU Arduino versions from ETT such as ET-BASY AVR EASY xx, ET-EASYxxx Stamp, ET-EASY MEGA1280,2560, including standard Board Arduino and Board Raspberry Pi on the market. User can choose and buy Pin Connector that accord with the current Board MCU version; it is OPTION that is not included in the package.

### 2. SPECIFICATIONS OF LED-RGB WS2812B

- Use 1-Wire CABLE I/O to control operation of LED
- Internal LED No.WS2812B consists of circuit to adjust signal reshaping, Circuit Drive, circuit to control Pixel RGB, Circuit Electric Reset and Circuit Power Lose Reset
- 1 White LED (Color=0xFFFFFF) consumes Current 60 Ma approximately
- 1 LED consists of 3 primary colors that are RGB; its Resolution is 24-Bit Color. The brightness of each color is 256 shades; so, 1 LED can show 16,777,216 shades of color. When scanning, the Frequency shouldn't less than 400 Hz/s.
- When sending each Data Bit as serial type, speed is at 800 Kbps
- Light of this LED is high stable and Output of each LED is Late type; it is still the old state until any new Color Data is sent out.



### 3. CONNECTOR POSITIONS OF MODULE ET-iLED4x4-RGB

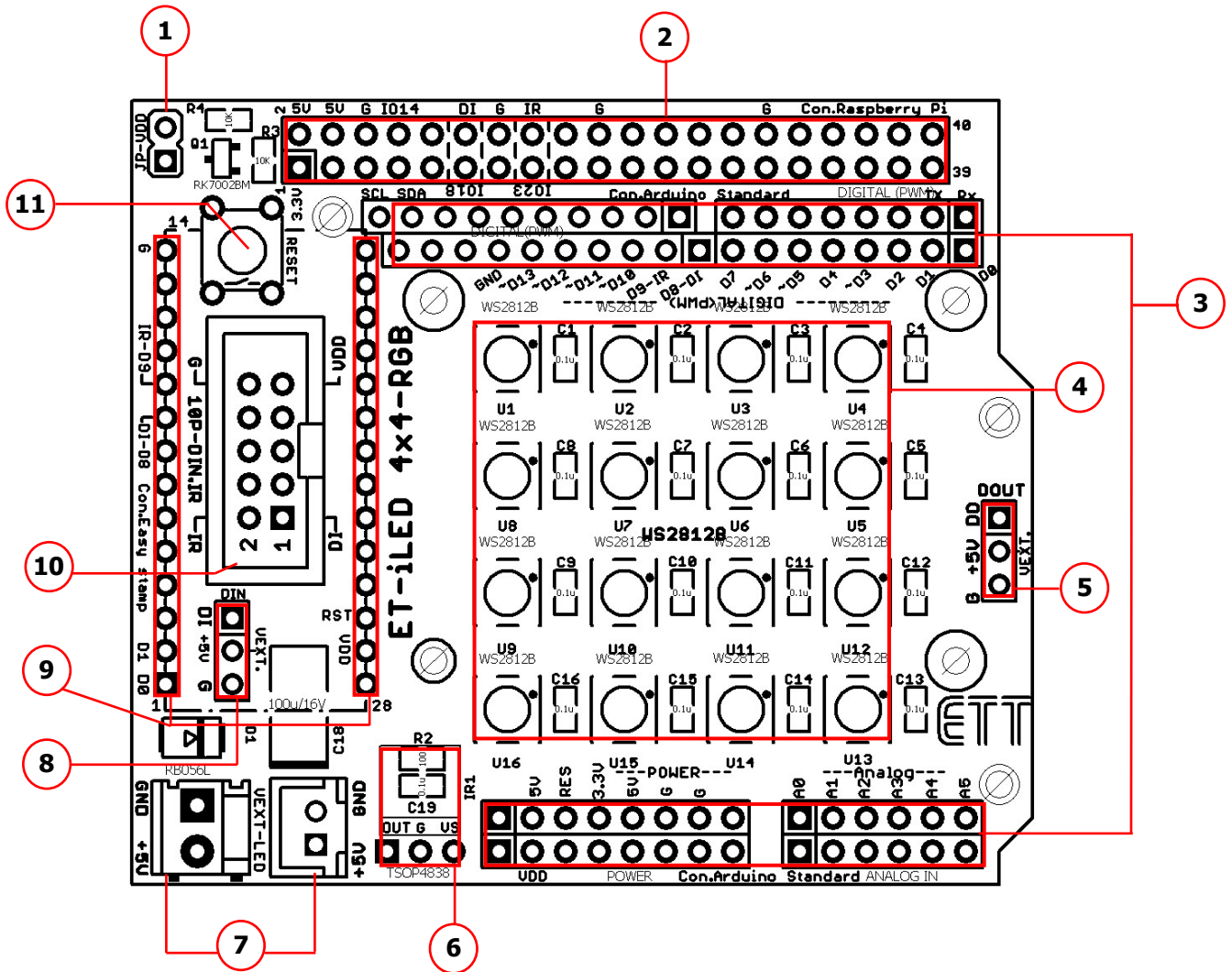
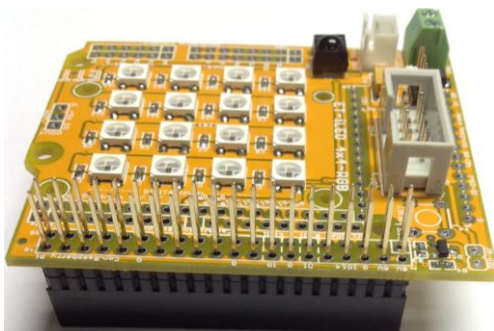
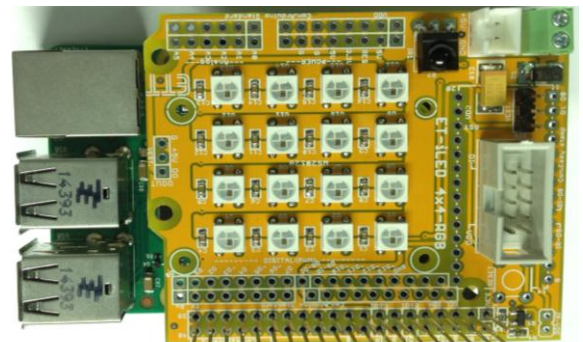


Figure shows Connector positions of Board ET-iLED4x4-RGB.

- (1) **JP-VDD (Option):** This Jumper connects Power Supply 3.3V from Board MCU Raspberry Pi to supply IR; this jumper is enabled when Board Raspberry Pi is used to control IR and iLED only. Normally, it doesn't provide any Jumper on board, it is OPTION; user may buy more or may solder the Wire Jumper directly.
- (2) **Con.Raspberry Pi (Option):** This position is provided for Connector 2x20 PIN FEMALE to connect to Board MCU Raspberry Pi to control the operation of Board iLED. This Connector is OPTION, it is not provided with board. The feature of connect Connectors between boards Raspberry Pi and Board iLED4x4 is shown below;



Insert Connector use for Board Raspberry Pi

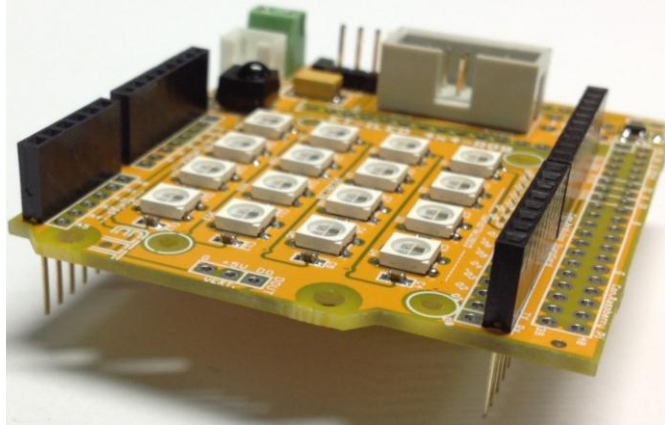


Board RGB is connected to Board Raspberry-Pi

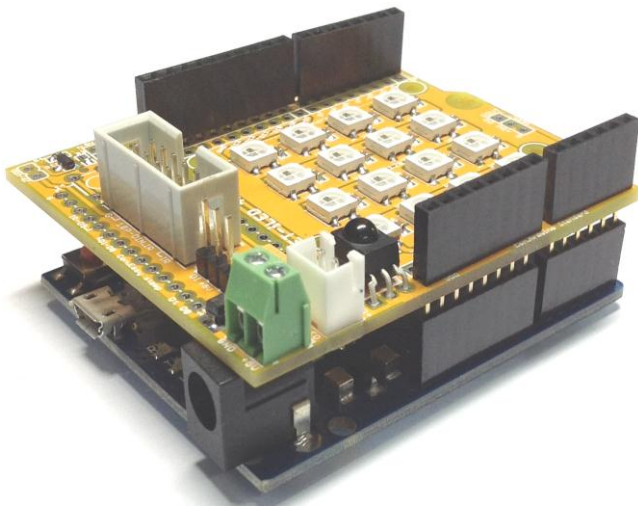


Pin arrangement accords with the standard of Board Raspberry Pi. Pin GPIO18 is used as Output and it is connected to Pin DI of iLED; Pin GPIO23 is used as Input and it is connected to Pin IR to receive Signal Remote. When using IR, it requires setting Jumper No.(1).

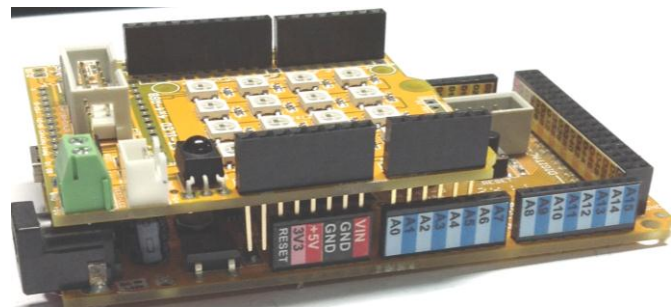
- (3) **Con.Arduino STD(Optional):** This position is provided for Connector MALE to connect with Board MCU Arduino Standard (outer row of both sides) to control the operation of Board iLED; or, it is connected with all-purpose print board (inner line of both sides). This Connector is OPTION, it is not provided with board. The feature of connection between Board Arduino Standard and Board iLED4x4 is shown below;



Insert Connector use for Board Arduino Standard



Connection with Board Arduino Standard



Connection with Board ET-EASY MEGA1280 (Compatible Pin)

Pin arrangement accords with the standard of Board Arduino Standard. Pin Digital D8 is used as Output and it is connected to Pin DI of iLED; Pin Digital D9 is used as Input and it is connected to Pin IR to receive Signal Remote.

- (4) **iLED4x4:** This 16-iLED is serially connected and the direction of connecting all 16-iLED is shows below. When writing program, it has to refer to the position of iLED below; it starts from position 0-15.

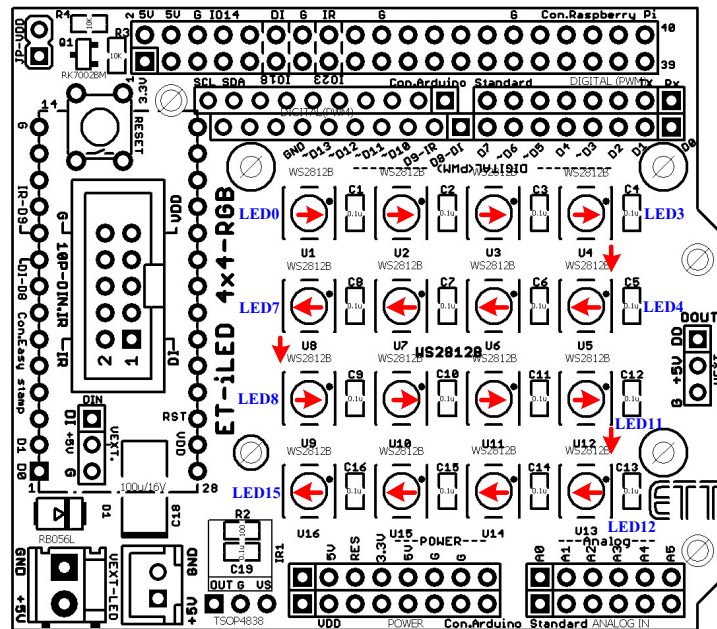
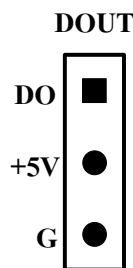


Figure show positions of connecting iLED as serial type internal Board ET-iLED4x4-RGB.

- (5) **Con.DOUT (Option):** This position is provided for Connector 3 PIN to connect Signal OUTPUT of LED15 to Input DI of LED0 of another board; it adds more LED in the circuit. This Connector is OPTION, it is not provided with board. Pin arrangement of Connector is shown below;

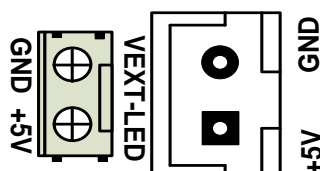


**DO:** It is Pin OUTPUT for sending Serial Data Bit Color of iLED; it is connected to Pin DI of another board.

**+5V:** It is Pin Power Supply for iLED to supply to board (at the same position of Connector VEXT-LED)

**GND:** It is Pin GROUND.

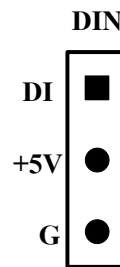
- (6) **IR Receiver:** It receives external Signal Remote to control the operation of iLED; user has to write program for receiving signal by self.
- (7) **VEXT-LED:** This Connector receives external Voltage +5V to supply all 16-LED only; the Power Supply should provide at least Current 1A. There are 2 types of Connector; Terminal and Block 2 Pin. User is free to choose any type of Connector as require; but please be careful, don't alternately connect Connector. Pin arrangement of Connector is shown below;







- (8) **Con.DIN:** This Connector 3 PIN MALE receives Signal to control iLED through Pin DI from external Board MCU that has different Connector from standard Connector on board. Pin arrangement of Connector is shown below;

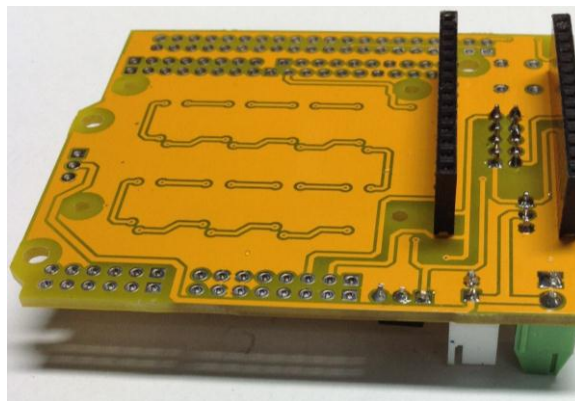


**DI:** This Pin INPUT receives Signal Serial Data Bit Color to control iLED; it supports Signal TTL 5V.

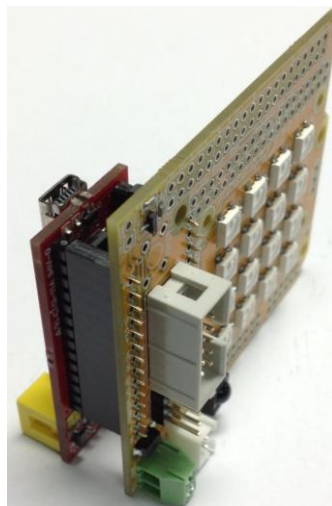
**+5V:** This Pin receives external DC 5V to supply all 16-iLED (at the same position of Connector VEXT-LED).

**GND:** It is Pin GROUND.

- (9) **Con.Easy Stamp(Optional):** This position is provided for 2 of Connector 1x14 FEMALE to connect with Board MCU Arduino of ETT “ET-Easyxxx STAMP This Connector is OPTION, it is not provided with board. When connected with Board MCU, it has to connect underneath Board iLED as shown below;



Insert Connector use for Board Arduino ET-Easyxxx STAMP

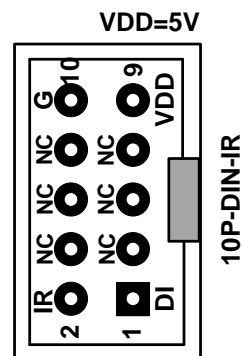


It shows how to connect with Board Arduino ET-Easyxxx STAMP

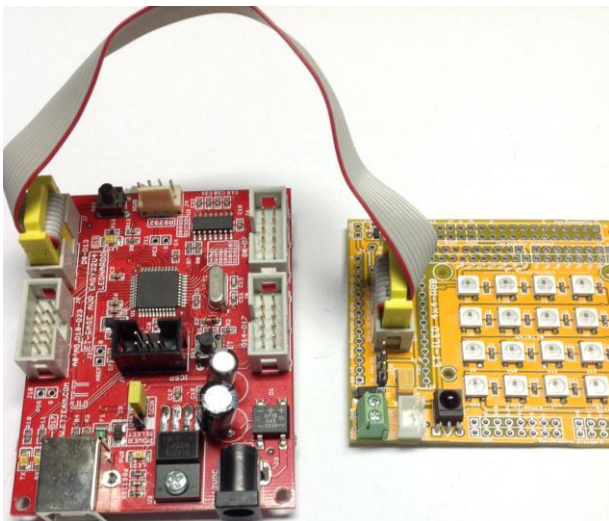


Pin arrangement accords with the standard of Board ET-EASYxxxST. Pin Digital D8 is used as OUTPUT and it is connected to Pin DI of iLED; Pin Digital D9 is use as INPUT and it is connected to Pin IR to receive Signal Remote. For Power Supply of Board MCU, if it does not connect to Connector USB of Board MCU, it can connect to Pin VDD(9) and Pin GND(10) of Connector No.10 on Board iLED; in this case, it uses Power Supply 5V.

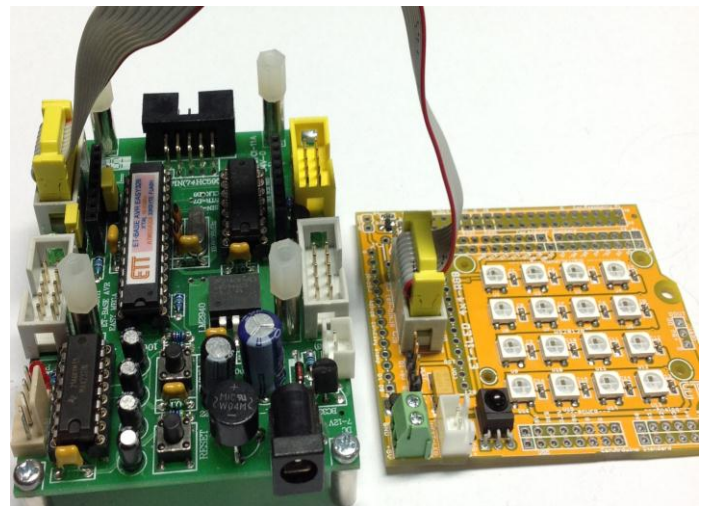
- (10) **10P-DIN-IR:** This Connector Block 10Pin receives Signal to control iLED through Pin DI(Pin1); it sends the Signal IR (Pin2) that received from Remote to Board MCU. Example of Board MCU Arduino that supports this Connector is ET-BASE AVR EASY32U4 LEONADO and ET-BASE AVR EASY MEGAxix; in this case, it can use Pair Cable 10Pin to connect Signal between Board MCU and iLED directly. Pin arrangement of this Connector is shown below;



When connecting Board MCU, it has to choose Connector Block Digital [8...13] (according to the example). In this case, Pin Digital D8 that is used as Pin Control is connected to Pin DI of iLED and Pin Digital D9 that is used as Pin for receiving Signal IR is connected to Pin IR. For Pin 9 and 10, it is pulled from Board MCU to be Power Supply for IR.



Connection with Board Arduino ET-BASE AVR EASY32U-4



Connection with Board Arduino ET-BASE AVR EASYxxx

- (11) **SW.RES(Optional):** This Push Button SW. resets Board MCU Arduino; it has an effect on Board that is connected at Connector No.3 (Board MCU Arduino Standard) and No.9 (Board MCU Arduino of ETT ET-EasyxxxST) only. This SW. is OPTION, it is not provided with board.

**\*OPTION:** The product is not provided with board, user needs to buy the product by self.



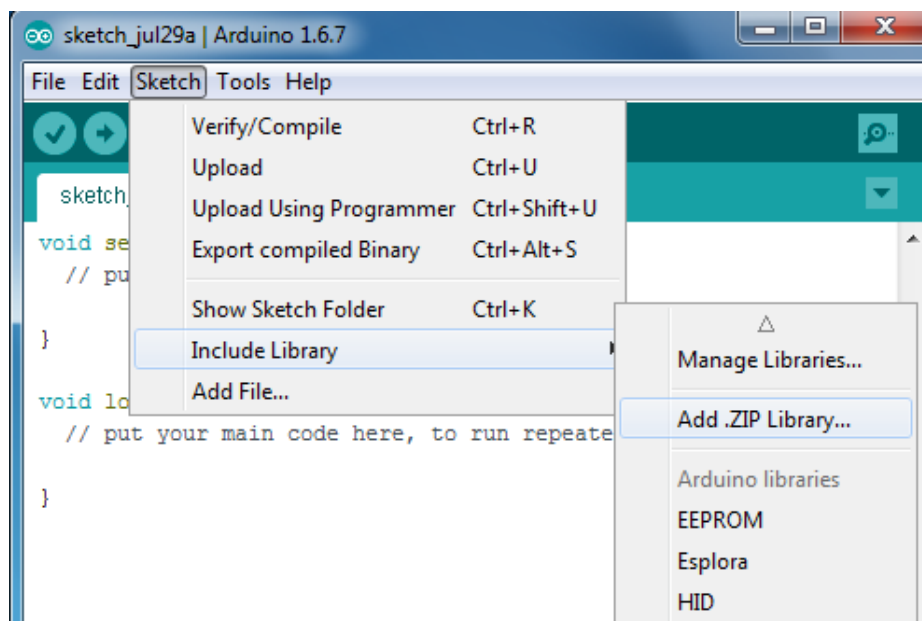
#### 4. EXAMPLE PROGRAMS

Example Programs that are provided with CD are the example of Board ARduino such as example of controlling iLED directly, or example of using Remote to control long-distance. This Example Arduino provides the finished Library regarding the use of IR and iLED completely; so, user only calls functions in Library correctly, it is unnecessary to learn operation of IR and iLED.

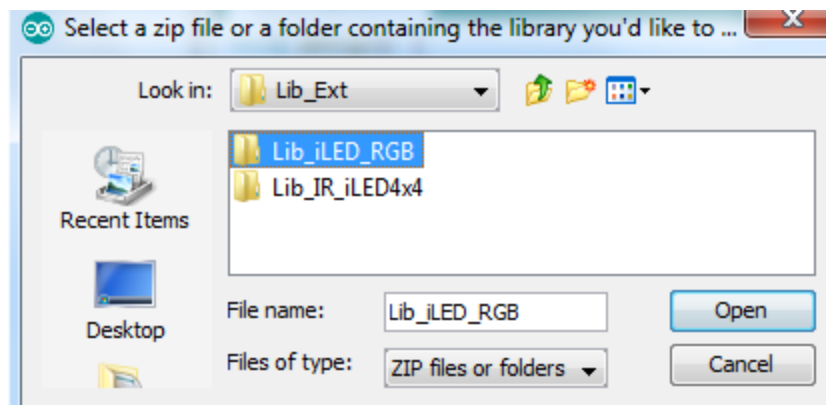
For Example of Raspberry Pi, please follow English Data Sheet that is provided with CD; it only controls iLED but it does not show how to use in the part of IR.

When running Example Program Aduino, it has to open any example program first; next, add Library of Arduino in CD such as Folder “*Lib\_iLED\_RGB*” (for iLED) and Folder “*Lib\_IR\_iLED4x4*” (for IR) to be recognized by Compiler. It does this process only one time, it is unnecessary to do this process for other example programs that are added later; user can compile and download example programs into MCU instantly. The process of adding Library and running example programs is described below;

- 1) Open Program Arduino, go to Menu *Sketch*, choose *Include Library* and then choose *Add.ZIP Library...*

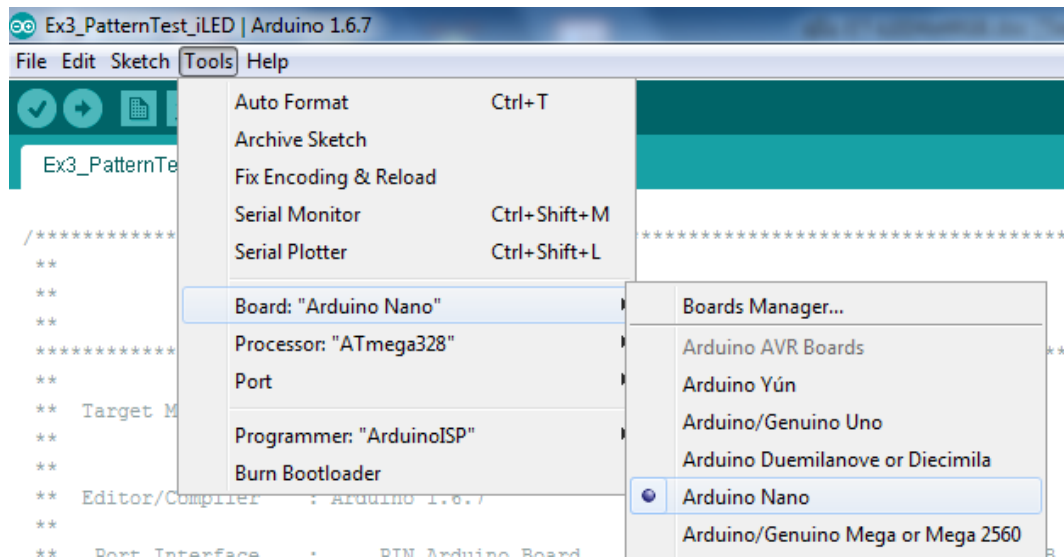


- 2) A window appears as shown below. Browse Folder that stores Library, click Folder for adding file and then click Open; in this case, it can add 1 Folder each time. Please look at the picture below, user has to add both folders into the program.

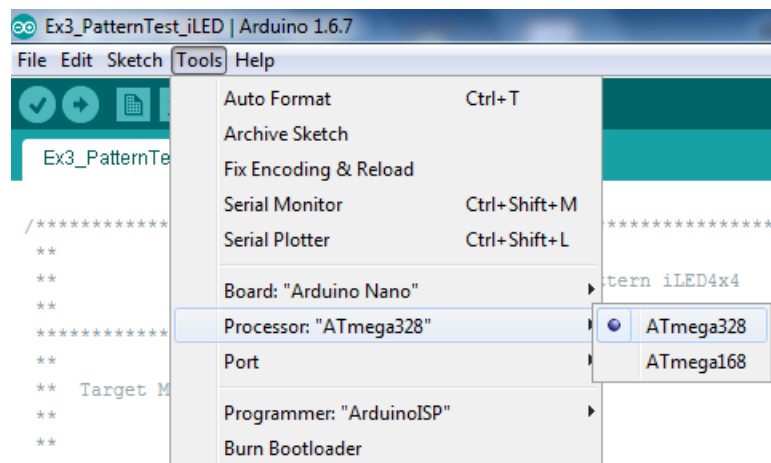




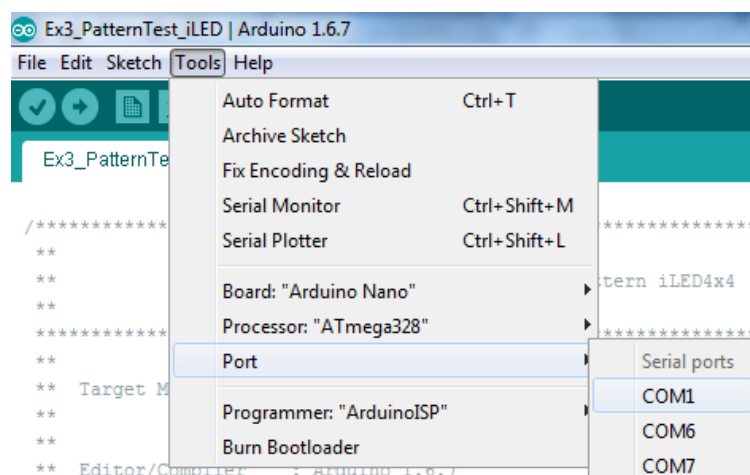
- 3) After added Library completely, open any example program; in this case, it opens *Ex3\_PatternTest\_iLED.ino*. Next, go to Menu Tool, choose board version; in this case, the example program is used with Board ET-EASY328 that accords with Firmware version Arduino Nano as shown below;



- 4) Go to Menu Tool again, choose Processor No. that is used with Board ET-EASY328; in this case, it is ATmega328 as shows below.




- 5) Go to Menu Tool again, choose Com Port that is connected with Board ET-EASY328; in this case, it is COM1.






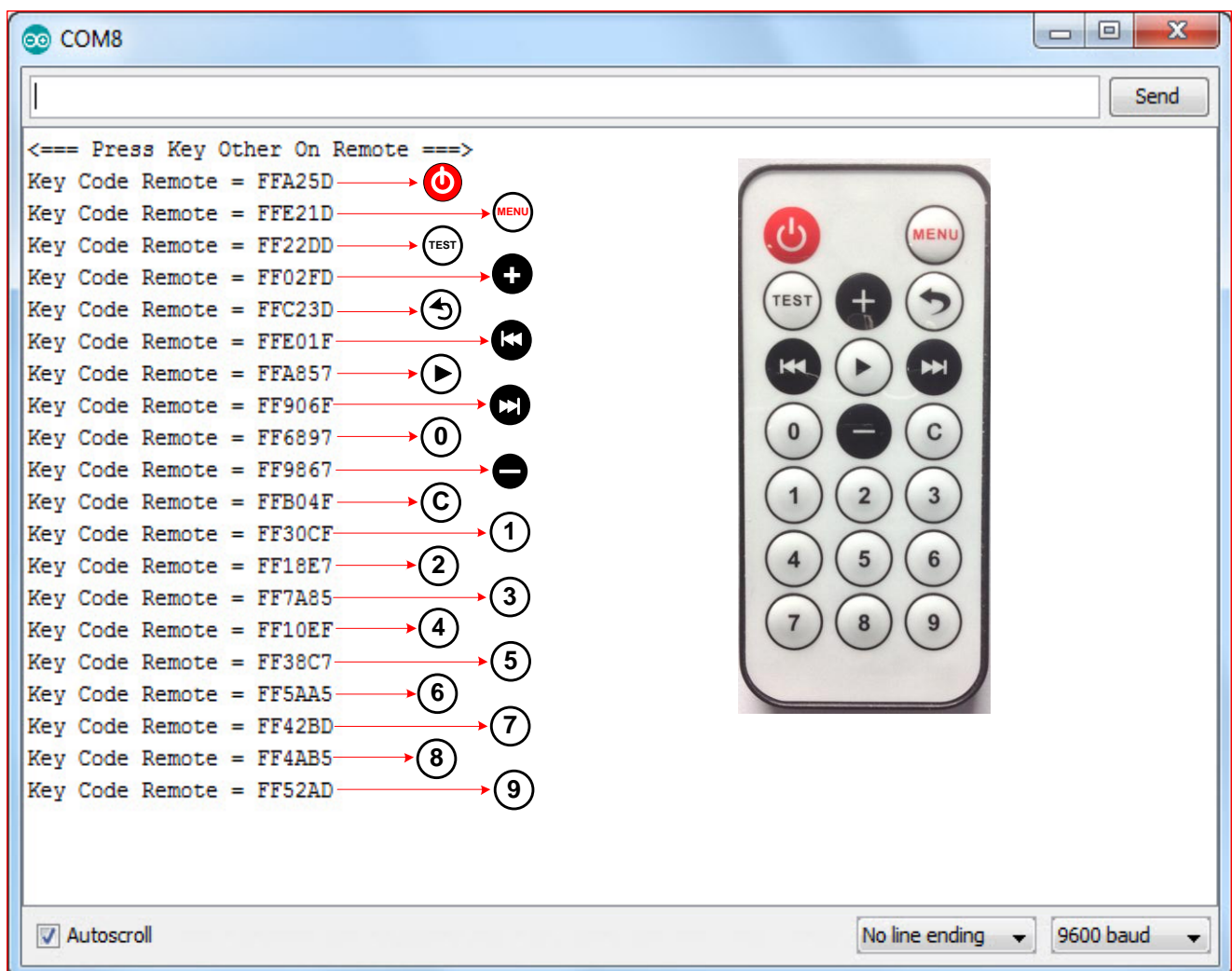


- 6) Click Button  to compile and download program into MCU.
- 7) Provide Power Supply into Board ET-iLED4x4-RGB, iLED is lit up (ON) (it has to provide Power Supply to both boards at the same time).

#### 4.1 Description of Example Arduino

**Ex1\_Rd\_Key\_Remote:** This example illustrates how to read Key Code of Remote of ETT; this Remote is OPTION, user can order from ETT to test the operation. Please look at the picture below, it shows values of Key Code that are read and user can use these values instantly without running this program to read any Key Code from Remote any more. If using other Remote, it has to run this example program to read Key Code of Key and store values first; next, it uses these values to replace Key Code of the 2<sup>nd</sup> Program Example (Ex2\_Remote\_iLED); and finally, user can use the Remote to test the 2<sup>nd</sup> Example Program without any error.

When running this Example Program, it has to point the Remote to Signal IR Receiver on board (it should not turn IR Receiver toward the neon light because the reading of Key Code may be error). Next, open Serial Monitor of Aduino (  ), set Baud Rate at 9600, and then presses any key of the Remote as required. The Key Code of the pressed key will be shown on the Monitor in the format of HEX Code. Please look at the picture below, it shows Key Code of Remote from ETT, it can be used with the 2<sup>nd</sup> Example Program without editing any program.

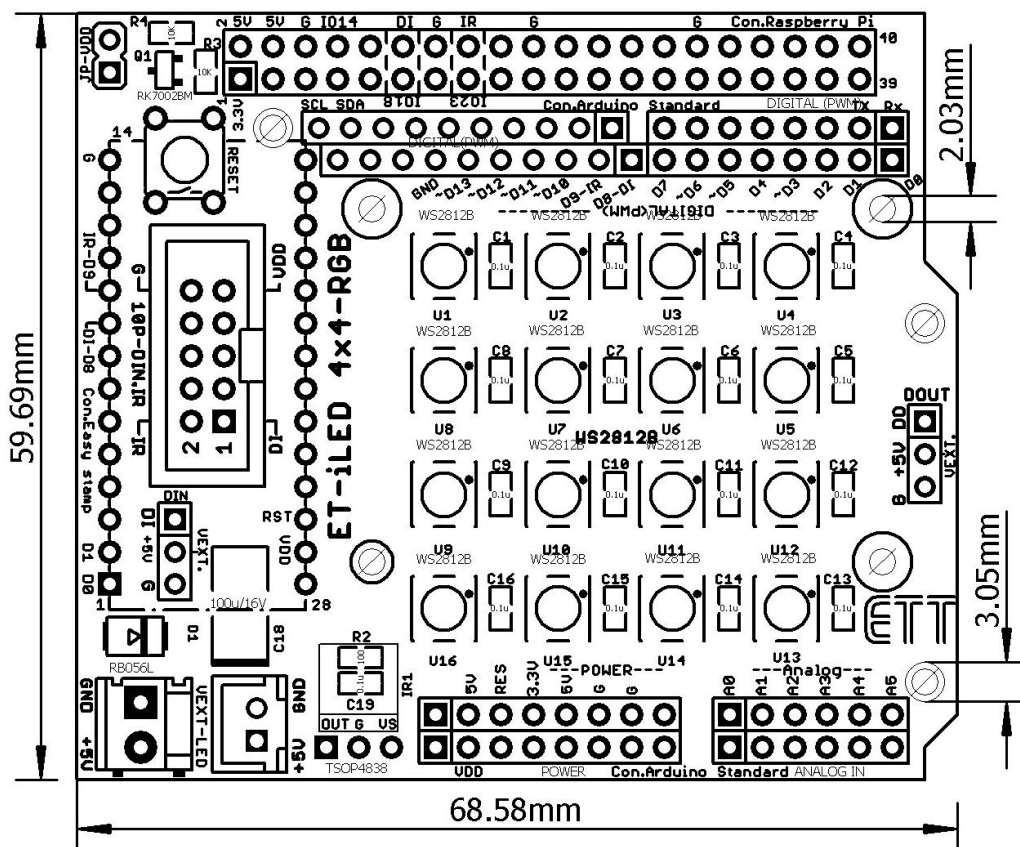


**Ex2\_Remote\_iLED:** This example program uses Remote to control the operation of iLED. It uses the value of Key Code that is read in the 1<sup>st</sup> Example Program to check if it matches with the pressing Remote of user. If yes, it makes all 16-iLED be lit up(ON). When successfully loaded program into Board MCU and provided Power Supply to the part of Board iLED completely, user should press Remote No.1-4 button by button and, all 16-iLED is lit up and its color will be changed according to the pressed button. If user requires turn off all 16-iLED, it has to press the red button on Remote. When pressing the Button + or -, it adjusts the colored brightness of the current LED.

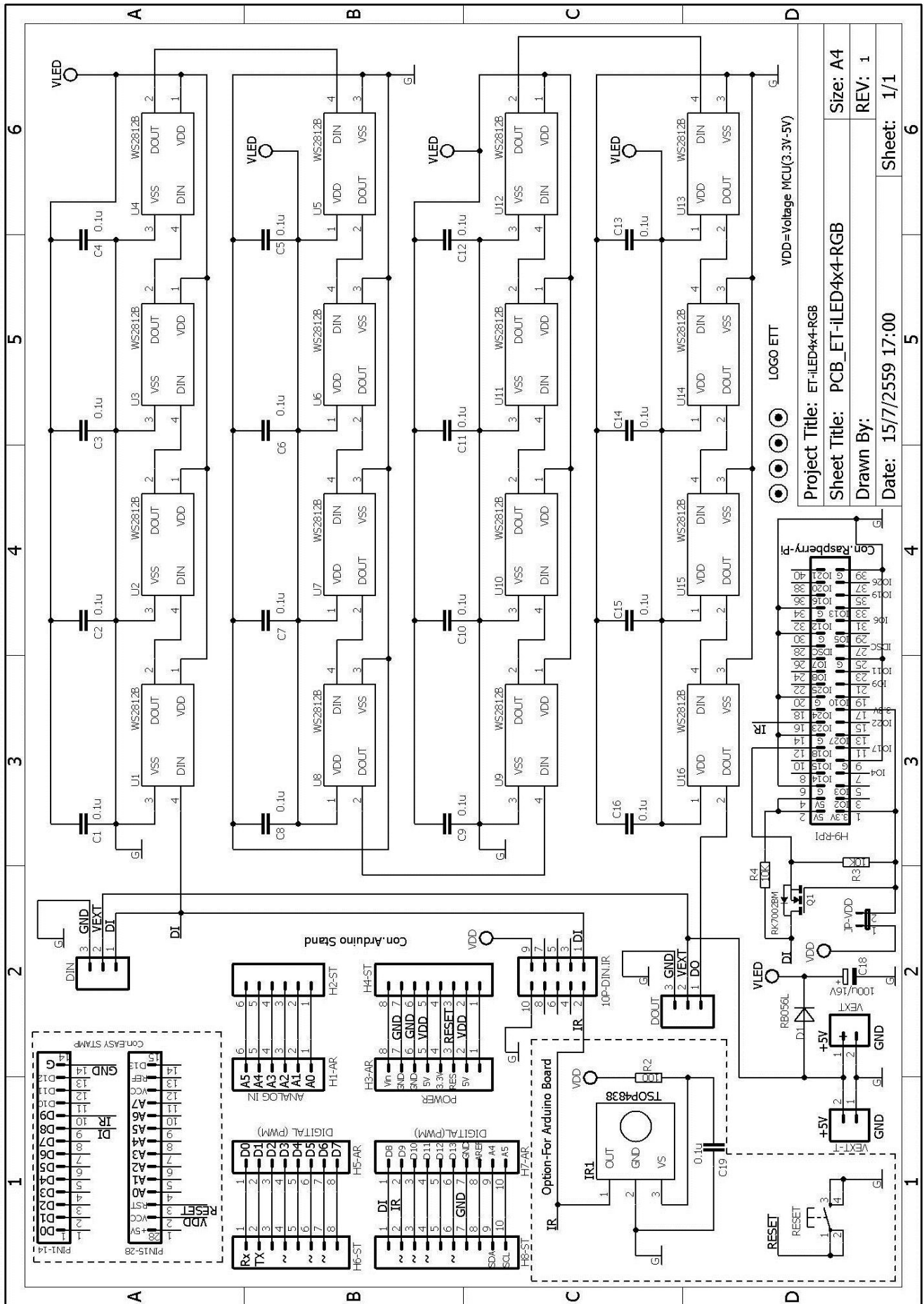
**Ex3\_PatternTest\_iLED:** This Example Program is not use in the part of IR, but it controls the operation of all 16-iLED directly. It controls iLED to be lit up (ON) according the specified pattern.

**Ex4\_DofTest\_iLED:** This Example Program is similar to the 3<sup>rd</sup> Example Program because it is not related to any IR; it controls ON/OFF LED at the specified position. This program is not complicated, so user can understand how to use Library of iLED easily.

Please note that reference of some Example Program is 24-Bit Color Code, but reference of some example program is to divide the color code into 3 byte; in this case, user it free to choose any reference because Library supports them. If user wants to know what functions of Library are, please open *File .h* and *File .cpp* of the Library.



### Dimension of Board ET-iLED4x4-RGB



Circuit of Board ET-iLED4x4-RGB