- **Introduce**

The LE-1600 is a 16-way LED expansion board based on MassDuino , the main chip is MD-8088. MD-8088 integrates a wealth of digital peripherals and analog peripherals, it offers great flexibility and play space for the users of the product design. LE -1600 using SPI communication with main processor, its benefits can save a lot of ports. If you have a need, in this way can also extend other modules from the control board, such as the sensor module , ADC acquisition module and so on. MD-8088 chip is editable in the Arduino environment, so we can use a USB to serial cable for LE-1600 for upgrade firmware. The module is high performance low power, low cost , and it support secondary development.

About MassDuino , please refer to: http://www.inhaos.com/uploadfile/otherpic/UM-MASSDUINO-V01-EN.pdf

- **Features**

- ➢ Can be program in the Arduino environment, very easy to use
- ➢ Support secondary development
- ➢ 8K bytes of in-system programmable FLASH, innovative data encryption technology
- ➢ 504 bytes of data FLASH, support byte read (simulate E2PROM)
- ➢ 1K SRAM bytes on-chip
- ➢ Programmable synchronous / asynchronous USART
- ➢ Can work in master / slave mode SPI Serial Interface
- ➢ I2C -compatible two-wire serial communication interface protocols , supporting master and slave device mode
- ➢ 32 8it general purpose working registers
- ➢ Support the expansion of the chip in-circuit debugging functions
- ➢ By SWD interface programming for FLASH, EEPROM, system configuration area , the ISP function
- ➢ Up to 30 programmable I / O
- ➢ High-performance, low -power and low-cost

- **SPI communication ports**

When we use the LE-1600, we can use the DuPong cable to connect it to the master chip SPI communication port

	LE-1600	Arduino UNO R3	Description
Pin Connection	VCC	VCC/3.3V	Operating Voltage
	CS	IO8	Chip Select Port
	MOSI	D11	SPI Interface
	MISO	D12	
	SCK	D13	
	GND	GND	GND

- **Pin Description**

MassDuino upload port , upload sketch via Arduino USB2SERIAL Light cable

SPI communication port
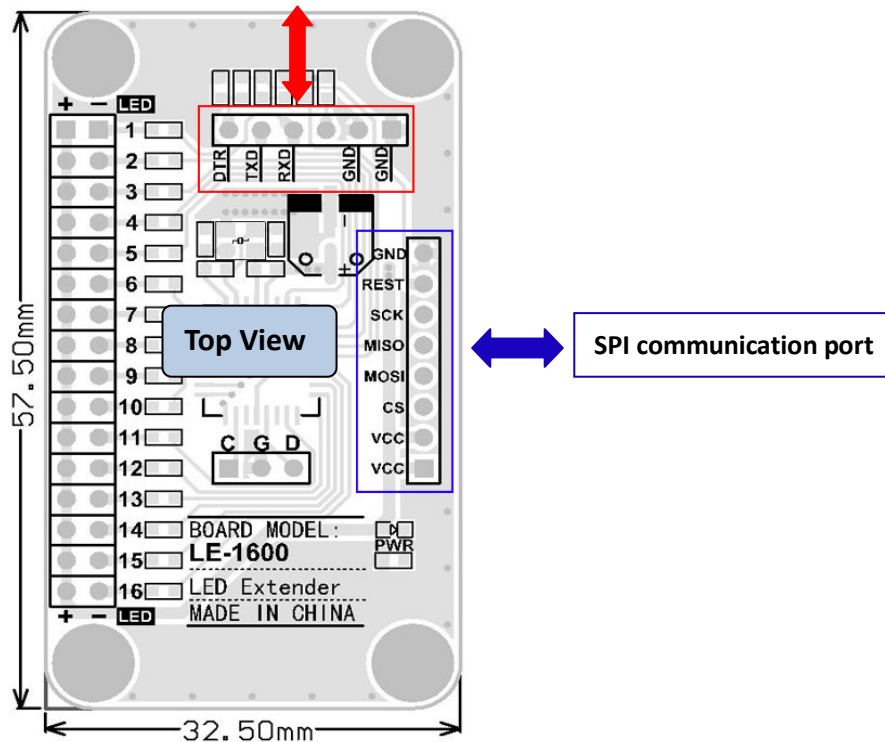
- **SPI Protocol**

The LE-1600 was working in SPI Slave mode , after power on , the chip will wait for command form SPI Master ,then implement it if the it received valid command.

The communication protocol as below:

Package Format:								
Name	**CMD ID**	**PARA_LEN**	**PARA_0**	**PARA_1**	**PARA_2**	**PARA_3**	**PARA_4**	**CKS**
No. of the Bytes	0	1	2	3	4	5	6	7
Length (Bytes)	1	1	5					1
Value Range	0~255	0~255	0~255					0~255
Description	CMD type	CMD Valid length	Parameter, fill 0x00 for the invalid data					Bitwise NOT operation for sum of byte0 to byte6

In the master side , the SPI initial code as below:

```
//SPI Master side , to communication to LE-6000
#include <SPI.h>

int LE_1600_SS = 8; // assign SPI CS pin, in this code the SPI D8 connect to LE-1600's SS Pin

void setup (void)
{
   pinMode(LE_1600_SS, OUTPUT);          // set SS pin is output
   digitalWrite(LE_1600_SS, HIGH);         // set SS pin to high , pull low the SS pin during SPI communication
   SPI.setClockDivider(SPI_CLOCK_DIV8);   // set SPI clock to 2MHz
   SPI.begin ();        // Start SPI communication
}
```

LE-1600 supported command as below:

Command List:								
Description	Command ID	Para_Len	PARA_0	PARA_1	PARA_2	PARA_3	PARA_4	Description
TURNED_LED_ON	0xFE	2	LED16 to 9	LED 8 to 1				Turned specified LED ON , High bit ON , Other bit no change
TURNED_LED_OFF	0xFD	2	LED16 to 9	LED 8 to 1				Turned specified LED OFF , High bit OFF, Other bit no change
SET_LED_VALUE	0xFC	2	LED16 to 9	LED 8 to 1				High bit LED ON, Low Bit LED Off
SET_LED_FLASH	0xFB	5	LED16 to 9	LED 8 to 1	LED ON (x50mS)	LED OFF (x50mS)	Repeat times (0 = always flash)	Turned specified LED flash , high bit enable flash mode , low bit no change, if repeat times = 0, the LED will alwasys flash

- **Arduino Source Code**

  Two code will coming with this board:

  1, LE_1600.rar

  This is arduino source code for LE-1600 , to development the LE-1600 , user need to install MassDuino driver, and write code in arduino , and upload sketch via USB2SERIAL light cable, the relational link as below:

  MassDuino support package: http://www.inhaos.com/downcount.php?download_id=139

  USB2SERIAL Light cable: http://www.inhaos.com/uploadfile/otherpic/DOC-BUONO-USB2SERIAL-V01-EN.pdf

  2, LE_1600_UNO_MASTER.rar

  This is arduino source code for UNO , the UNO will working with LE-1600, this code demo how to use LE-1600 in Arduino.

  All code can be download from www.inhaos.com

- **Application:**

  - Extend IO and save code for UNO to drive many leds
  - Arduino car / robotics
  - Color LED drive
  - State indication
  - Toy

- **Contact us**

  1111 Oakmont Drive #C, San Jose, CA 95117

  Contact: John Huang

  Tel No: +1-408-981-6615

  E-mail: support@inhaos.com