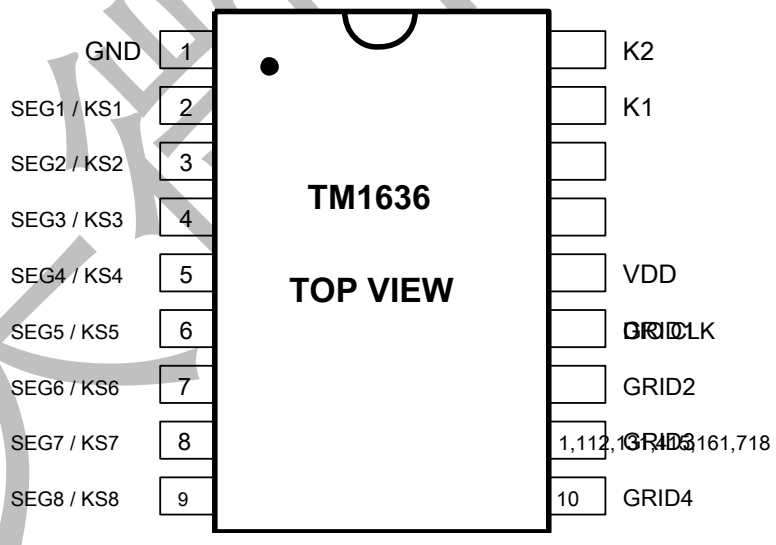
Characterization

LED (light emitting diode display) TM1636 scan interface is a keyboard with dedicated drive control circuit, internal MCU integrated digital interface, data latches, LED high voltage driver, keyboard scanning circuit. This product is excellent performance, reliable quality. Mainly used in display driver stove, microwave ovens and small appliances products. Using the DIP18 package.

Features

- Using power CMOS process
- Display mode (field 8 × 4 bits), digital output support for common anode
- Key scan (2 × 8bit)
- A luminance adjustment circuit (8 adjustable duty cycle)
- A serial interface (CLK, DIO)
- Oscillation mode: Built-in RC oscillator (450KHz ± 5%)
- Built-reset circuit
- Built-in automatic blanking circuit
- Package: DIP18

Pinning information



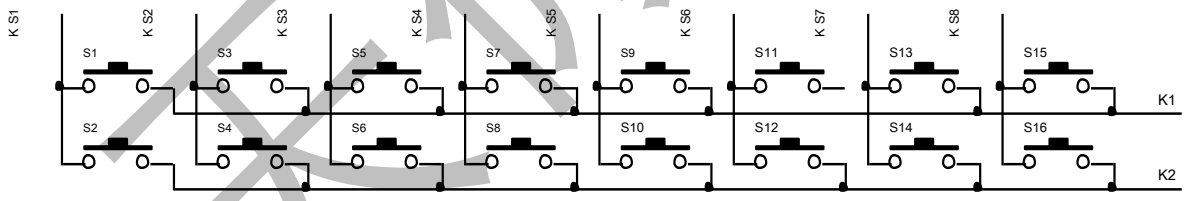
Pin Function

symbol	Name Pin No.		Explanation
DIO	Data input / output Out	15	Serial data input / output, the input data is at a low level of variation SLCK, SCLK are transmitted at a high level, the internal one byte per transmission chip will produce an ACK on the ninth clock
CLK	Clock input	16	The rising edge of the input / output data
K1 ~ K2	17-18 key scan data input pin of the input data in the display period after the end of the latch		
SEG1 / KS1 ~ SEG8 / KS8 output (para)		2-9	Segment output (also used as key scan), N tube open drain output
GRID4 ~ GRID1	Output (bit)	10-13-bit output, P open drain output pipe	
VDD	Power Logic	14	5V ± 10%
GND	Logically	1	Then systematically

In the dry season or drying environment, prone to static electricity, electrostatic discharge can damage integrated circuits, microelectronic day is recommended to take all appropriate measures to deal with the prevention of IC damage if improper handling and welding, or may cause ESD performance degradation, the chip does not work.

Key scan data read

Key scan matrix is 8 × 2bit, as follows:



In There When the button is pressed, the read key number It is as follows:

	SEG1	SEG2	SEG3	SEG4	SEG5	SEG6	SEG7	SEG8
K1	1110_11 11	0110_11 11	1010_11 11	0010_11 11	1100_11 11	0100_11 11	1000_11 11	0000_11 11
K2	1111_01 11	0111_01 11	1011_01 11	0011_01 11	1101_01 11	0101_01 11	1001_01 11	0001_01 11

Note: When no key is pressed, the read key data: 1111_1111

And a display mode display register address

The register stores transferred from an external device via the serial interface to the TM1636 data, addresses 00H-03H of 4-byte units, SGE and the corresponding chip of the contact pins GRID LED lamp, assigned as shown below:

LED display data write time, in accordance with the address from the display from low to high, from high to low data byte operations.

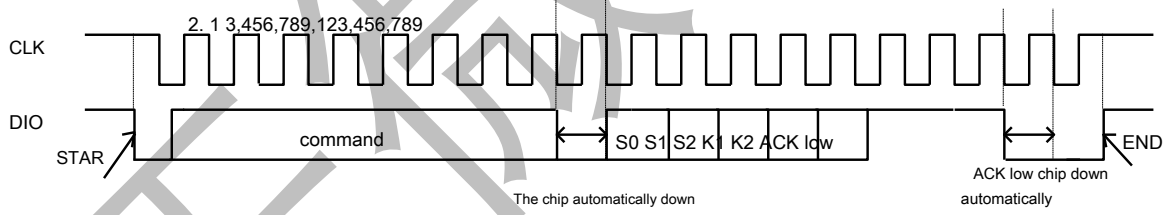
SEG1	SEG2	SEG3	SEG4	SEG5	SEG6	SEG7	SEG8	
xxHL (low nibble)				xxHU (high nibble)				
B0	B1	B2	B3	B4	B5	B6	B7	
00HL				00HU				GRID1
01HL				01HU				GRID2
02HL				02HU				GRID3
03HL				03HU				GRID4

Interface Description

The microprocessor via the data bus interface and two-wire communications TM1636, when the CLK input when the data is at the high level, the signal must be maintained on DIO; only the clock signal CLK is on the low level, the signal to the DIO change. Start condition data is input CLK is high, DIO from high to low; CLK to end conditions is high, DIO from low to high.

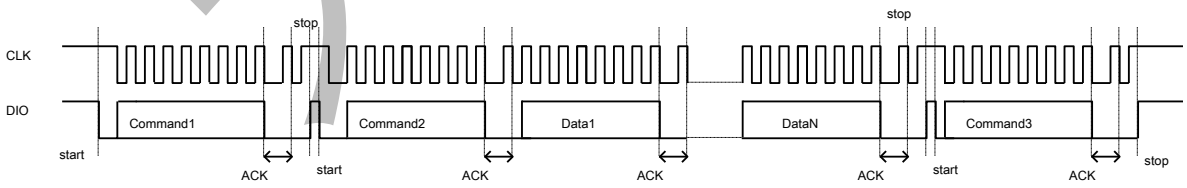
TM1636 data transmission with a response signal ACK, when the data transmission is correct, the falling edge of the eighth clock, the chip generates an acknowledge signal ACK to DIO pin low, DIO released after the end of the ninth clock port line.

1, FIG instruction data transmission process is as follows (read key data timing)



Command: read key command; S0, S1, S2, K1, K2 composition encoded key information, S0, S1, S2 coding for the SEG, K1, K2 coding keys K1 and K2.

2, SRAM write data address plus the automatic mode 1



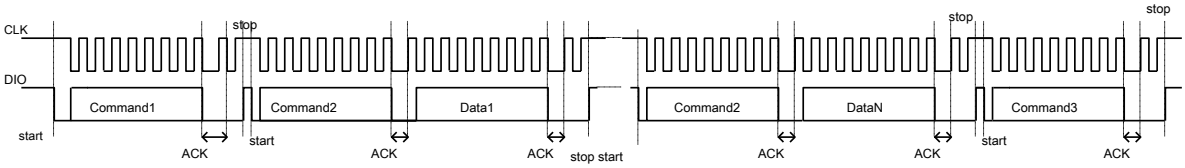
Command1: setting data Command2:

setting addresses Data1 ~ N:

transmitting display data Command3:

controlling a display

3, SRAM write data in fixed address mode



Command1: setting data Command2:

setting addresses Data1 ~ N:

transmitting display data Command3:

controlling a display

Data Directive

Command is used to set display mode and the drive status LED.

DIO first byte of the input falling edge of the STB as an instruction. After decoding, take the highest B7, B6 two bits to distinguish different instructions.

B7	B6	instruction
0	1	Data Command Set
1	0	Display control command set
1	1	Address Command Set

If the instruction or data transfer STB is set high, the serial communication is initialized, and the instruction or data being transferred is invalid (before transmission of instructions or data remains valid).

1, the command data set

This command is used to set the data writing and reading, B1, and B0 bit set 01 or 11 is not allowed.

MSB LSB

B7	B6	B5	B4	B3	B2	B1	B0					Features	Explanation
0	1	Unrelated items fill 0								0	0	0 data write mode the write data is provided to the display register	
0	1									1	0		Key scan data read
0	1								0			Address mode is set to increase	Automatic address incrementing
0	1								1				Fixed address
0	1							0				Test mode setting (within Department use)	Normal mode
0	1							1					Test Mode

2, the address setting command provided

MSB LSB

B7	B6	B5	B4	B3	B2	B1	B0					Display address
1	1	Unrelated items fill 0						0	0	0	0	00H
1	1							0	0	0	1	01H
1	1							0	0	1	0	02H
1	1							0	0	1	1	03H

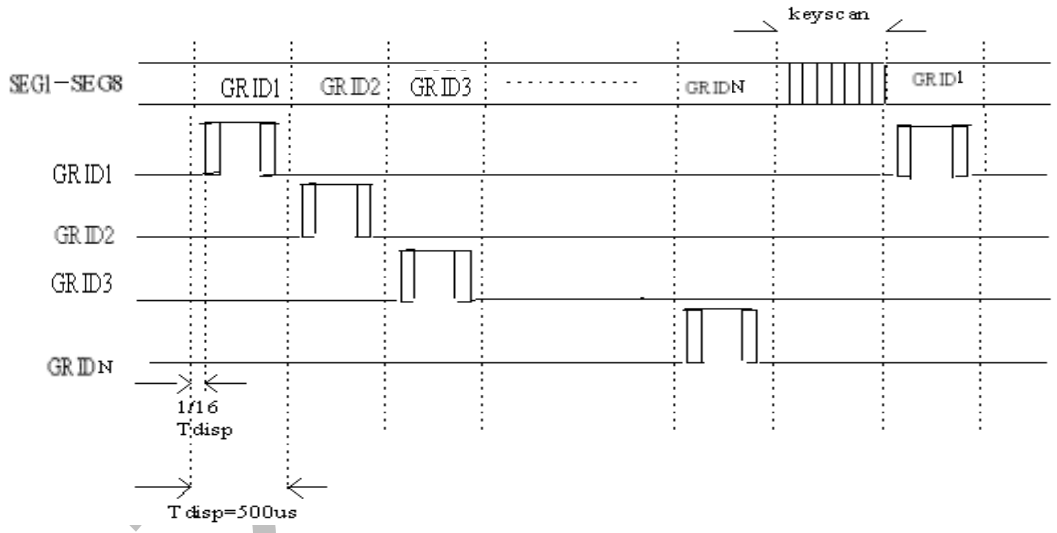
This command is used to set the display address register; C4H or higher if the address is set, the data is ignored until a valid address is set; when the power, the default address to 00H.

3, display control

MSB LSB

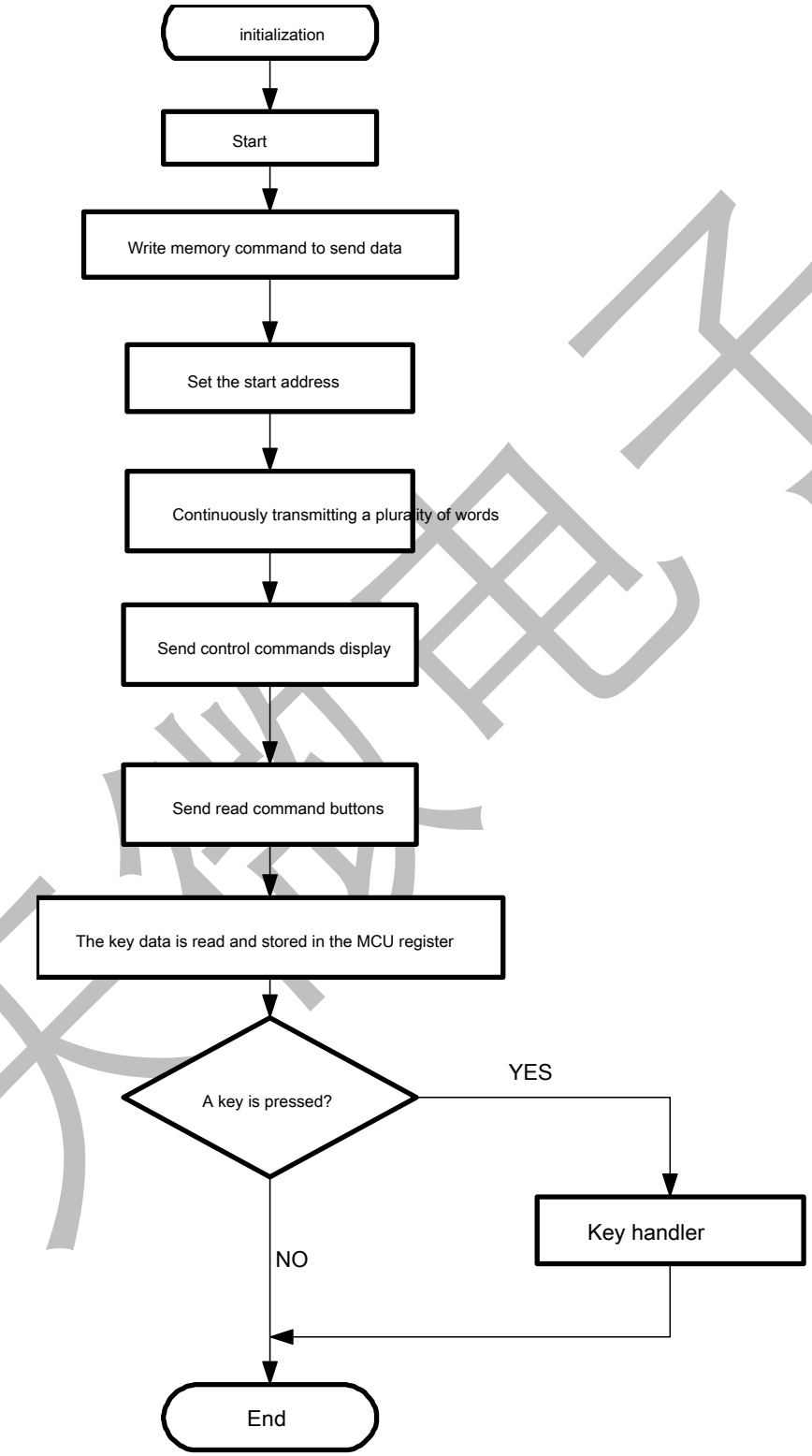
B7	B6	B5	B4	B3	B2	B1	B0	Features	Explanation
1	0	Unrelated items fill 0		0	0	0	Setting the number of Extinction		Setting a pulse width of 1/16
1	0			0	0	1			Setting a pulse width of 2/16
1	0			0	1	0			Setting a pulse width of 4/16
1	0			0	1	1			Setting a pulse width of 10/16
1	0			1	0	0			Setting a pulse width of 11/16
1	0			1	0	1			Set pulse width 12/16
1	0			1	1	0			Setting a pulse width of 13/16
1	0			1	1	1			Setting a pulse width of 14/16
1	0		0				Display switch		Display Off
1	0		1						Open display

Display and key retrace period

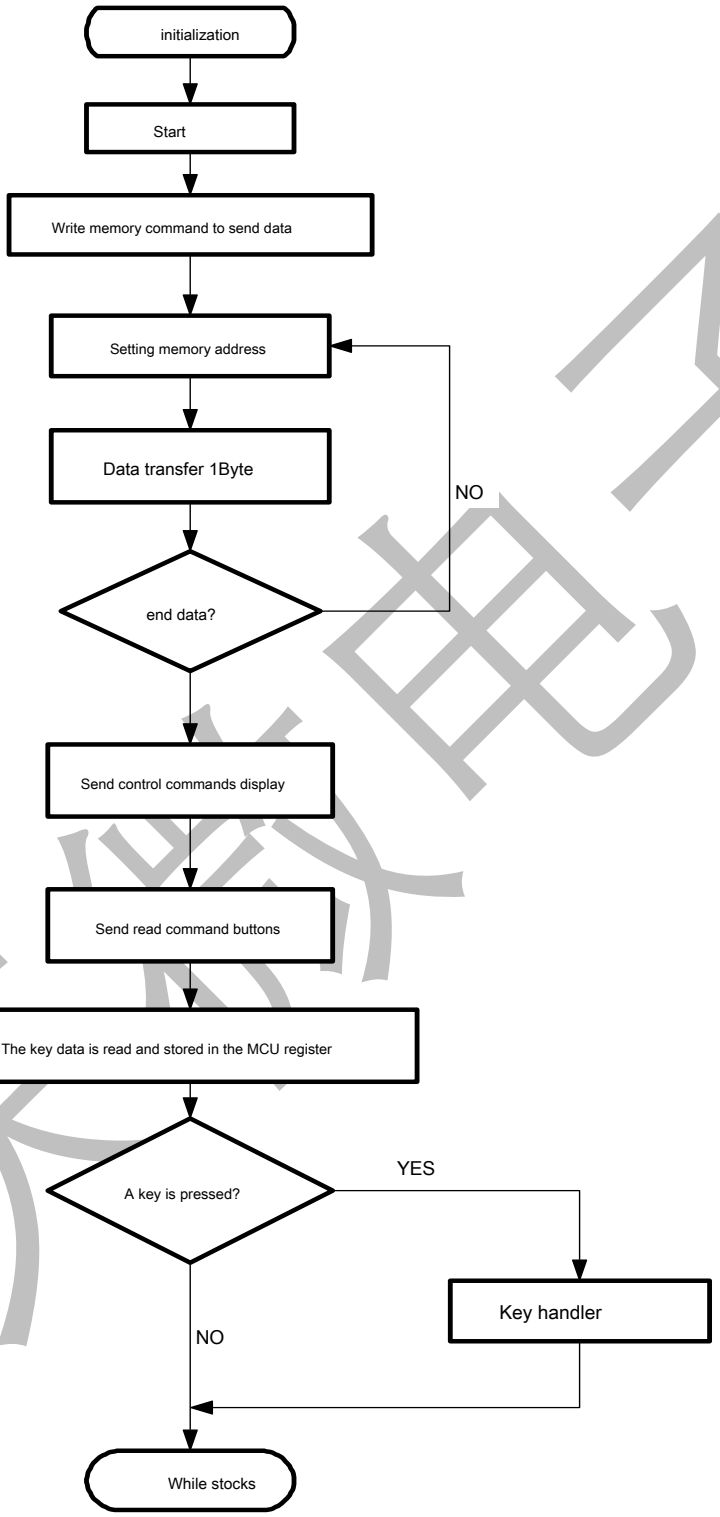


Program flow chart

An automatic mode using the address program flow chart :



Fixed address programming flow chart:



Reference program

```
/ *
* Copyright information: Shenzhen days Microelectronics
* file name: TM1636
* SCM Model: AT89S52
* Development Environment: Keil uVision3
* Crystal shock Frequency: 11.0592M
* Program features: all the TM1636 display register addresses all 0xFF filled with data, and display the open, then the key value is read.
* /
# include <reg52.h>
# include <intrins.h> //
Define port sbit clk = P1 ^ 2;
sbit dio = P1 ^ 1;


/// ====================================== void Delay_us
(unsigned int i)                                    // nus delay
{
        for (; i> 0; i--)
    _nop_ ();}


/// ====================================== void I2CStart (void)
                                                    // start 1636
{
        clk = 1; dio = 1;
      Delay_us (2); dio =
      0;}


/// ========================================== void I2Cask (void)
                                                    // 1636 responses
{
     clk = 0; Delay_us
      (5);                                          5us // delay after the falling edge of the eighth clock, the start signal ACK determination
      while (dio);
        clk = 1;
     Delay_us (2);
        clk = 0;}

/// ====================================== void I2CStop (void)
                                                    // Stop 1636
```

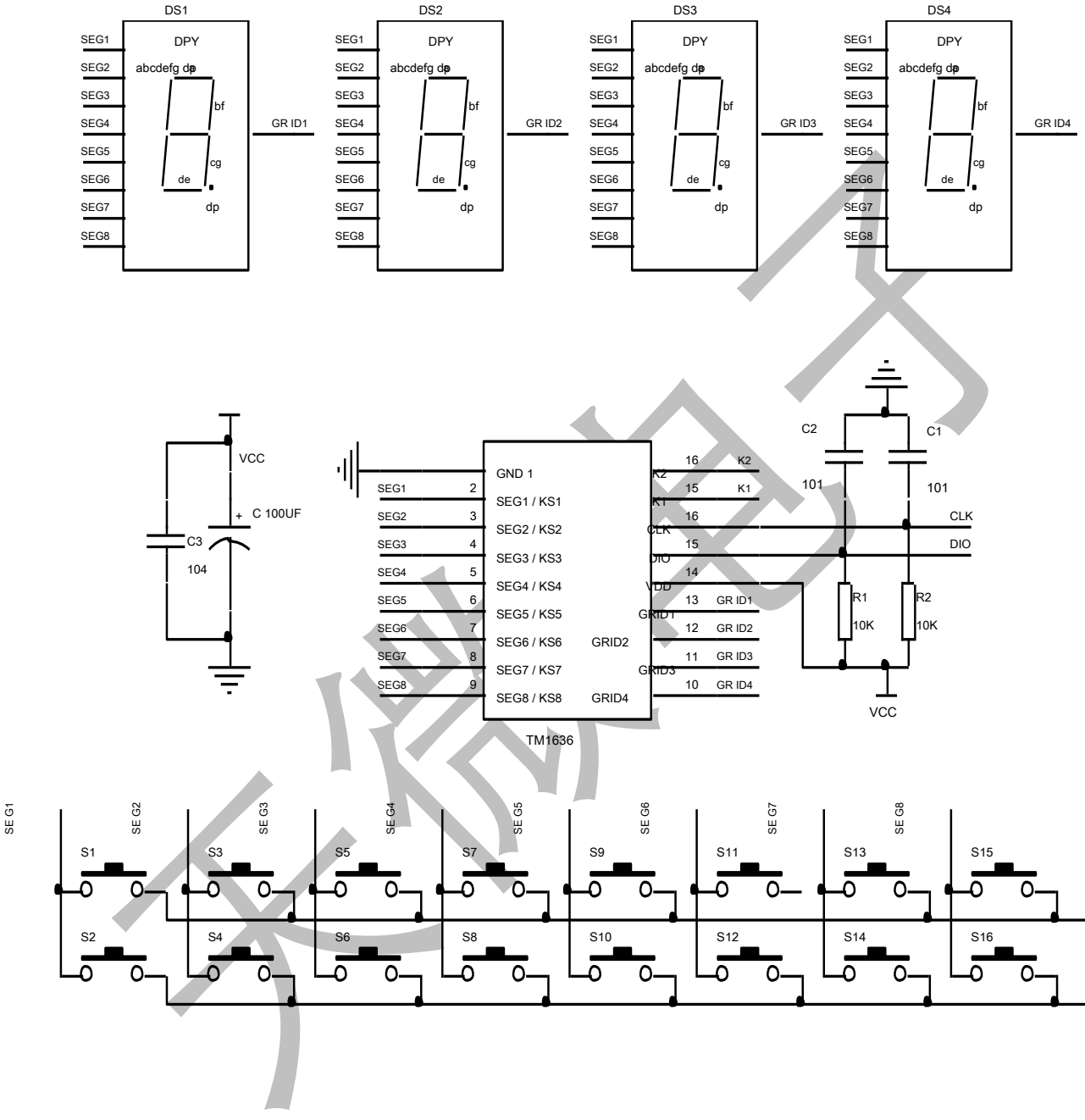
```
{
        clk = 0; Delay_us
      (2); dio = 0;
      Delay_us (2); clk =
      1; Delay_us (2); dio
      = 1;}




/// ======================================== void I2CWrByte
(unsigned char oneByte ) {// write a byte

    unsigned char i;
       for (i = 0; i <8; i ++) {
            clk = 0;
             if (oneByte & 0x01)          // low in the former
             {
                  dio = 1;}
              else {


                  dio = 0;}

             Delay_us (3); oneByte =
          oneByte >> 1; clk = 1; Delay_us (3);}}



/// ---------------------------------------- -unsigned char
ScanKey (void)                                    // read keys
{
      unsigned char rekey, rkey, i;
          I2CStart (); I2CWrByte
          (0x42);                                  // read key commands
          I2Cask (); dio
          = 1;                                     // pulled keys before reading the data line
          for (i = 0; i <8; i ++)                  // start reading from low
          {     clk = 0;
                rekey = rekey >> 1;
              Delay_us (30);
```

```
                clk = 1; if
                (dio) {

                        rekey = rekey | 0x80;} else {



                        rekey = rekey | 0x00;}

                Delay_us (30);}
        I2Cask (); I2CStop (); return
        (rekey);}



/// ============================================== = void SmgDisplay (void)
                                                    // write display register
{
    unsigned char i; I2CStart
    ();
    I2CWrByte (0x40);                               // 40H automatically increment the address mode, 44H fixed address mode, since the program uses
Plus 1 mode
    I2Cask (); I2CStop ();
    I2CStart (); I2CWrByte
    (0xc0);
                                                    // Sets the first address,
    I2Cask ();

      for (i = 0; i <4; i ++)                       // address from Canada, do not have to write every address
      {
            I2CWrByte (0xff);                       // send data
            I2Cask ();}

      I2CStop ();

      I2CStart (); I2CWrByte
      (0x8f);                                       // open display, maximum brightness
      I2Cask ();
    I2CStop ();}


/// ============================================
```

```
void init ()                                    // initialization routine
{
    } // Initialize slightly


/// ============================================== void main (void) {


    unsigned char keydate; init ();
                                                //initialization
    SmgDisplay ();                              // write register and open display
    while (1) {

        keydate = Scankey ();                   // read the key value, the key value is not read out process.
    }}

// ========== end ==================================
```

FIG hardware connection

The digital control circuit diagram of the common-connected digital



Electrical parameters

1, the limit Parameters (Ta = 25 ℃, Vss = 0 V)

parameter	symbol	range	unit
Logic supply voltage	VDD	-0.5 + 7.0	V
Logic Input Voltage	VI1	-0.5 ~ VDD + 0.5	V
LED SEG driving sink current	IO1	50	mA
Pull current driver LED GRID	IO2	200	mA
Power loss	PD	400	mW
Operating temperature	Topt	- 40 to +85	℃
Storage temperature	Tstg	- 65 + 150	℃

2, normal Operating range (Ta = -40 ~ + 8 5 ℃, Vss = 0 V)

parameter	symbol	Least	Typical	Max	Unit	Test Conditions
Logic supply voltage	VDD		5		V	-
High-level input voltage	VIH	0.7 VDD	- VDD		V	-
Low level input voltage	VIL	0	-	0.3 VDD	V	-

3, electrical Characteristics (Ta = -40 ~ + 85 ℃ , VDD = 4 . 5 ~ 5. 5 V, Vs s = 0 V)

parameter	Symbol	Min	Typical	Max	Unit	Test Conditions
GRID driving pull-up current	Ioh1	80	120	180	mA	GRID1 ~ GRID4, Vo = vdd-2V
	Ioh2	80	140	200	mA	GRID1 ~ GRID4, Vo = vdd-3V
SEG foot drive sink current	IOL1	20	30	50	mA	SEG1 ~ SEG8 Vo = 0.3V
DOUT pin output low current	Idout	4	-	- mA		VO = 0.4V, dout
High output current permissible amount	Itolsg	-	-	5	%	VO = VDD - 3V, GRID1 ~ GRID4

Output pull-down resistor	RL		10		KΩ	K1 ~ K2
Input Current	II	-	- ± 1		μA	VI = VDD / VSS
High-level input voltage	VIH	0.7 VDD	-		V	CLK, DIN
Low level input voltage	VIL	-	-	0.3 VDD	V	CLK, DIN
Hysteresis voltage	VH	-	0.35	- V		CLK, DIN
Dynamic current consumption	IDDdyn	-	-	5	mA	No load, display off

4, the switch Characteristics (Ta = -40 ~ + 8 5 ℃, VD D = 4.5 ~ 5.5 V)

parameter	Symbol	Min	Typical	Max	Unit		Test Conditions	
The oscillation frequency	fosc	-	450	-	KHz			
Propagation delay time	tPLZ	-	-	300	ns		CLK → DIO	
	tPZL	-	-	100	ns		CL = 15pF, RL = 10K Ω	
Rise Time	TTZH 1	-	-	2	μs	CL = 300p F	SEG1 ~ SEG11	
	TTZH 2	-	-	0.5	μs		GRID1 ~ GRID4	
Fall Time	TTHZ	-	-	120	μs		CL = 300pF, SEGn, GRIDn	
The maximum clock frequency	Fmax	1	-	-	MHz		50% duty cycle	
Input capacitance	CI	-	-	15	pF		-	

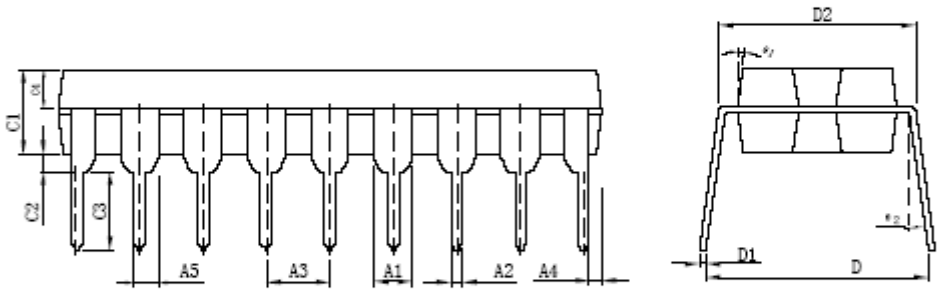
Timing Characteristics (Ta = -40 ~ + 85 ℃, VDD = 4.5 ~ 5.5 V)

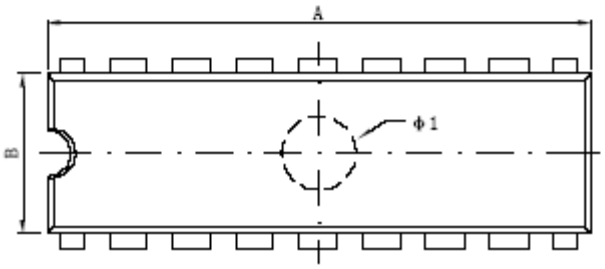
parameter	symbol	Min	Typ	Max	Unit	Test Conditions	
Clock pulse width	PWCLK	400	-	-	ns	-	
The gate pulse width	PWSTB	1	-	-	μs	-	
Data setup time	tSETUP	100	-	-	ns	-	
Data Hold Time	tHOLD	100	-	-	ns	-	
waiting time	tWAIT	1	-	-	μs	CLK ↑ → CLK ↓	

A schematic view of an IC package

DIP18

尺寸 / 标注	最 小 (mm)	最 大 (mm)	尺寸 / 标注	最 小 (mm)	最 大 (mm)
A	21.90	22.10	C3	3.4	3.6
A1	1.40TYP		C4	1.58TYP	
A2	0.43	0.57	D	8.10	8.60
A3	2.54TYP		D1	0.20	0.35
A4	0.59TYP		D2	7.62	7.87
A5	0.95TYP		Φ1	3.0TYP	
B	6.3	6.5	θ1	8° TYP	
C1	3.4	3.6	θ2	5° TYP	
C2	0.6	0.8			





Modify the description

version	Modified Date	Modify the description
V1.0	2010-05-06	Original Issue
V1.1	2012-08-16	1, modified typeset format 2, adding reference 3 routine, modify the description of the ACK signal
V1.2	2012-09-27	Description increase TM1636 display register address
V1.3	2014-06-04	Modifying the drive current Pin Description