HM1628
LED Driver IC Product

Specification

Specification Revision History ：

Version	Data	Description
2010-01-A	2010-01	Replace the new template
2012-01-B1	2012-01	Increase in the number and history

1、GENERAL DESCRIPTION

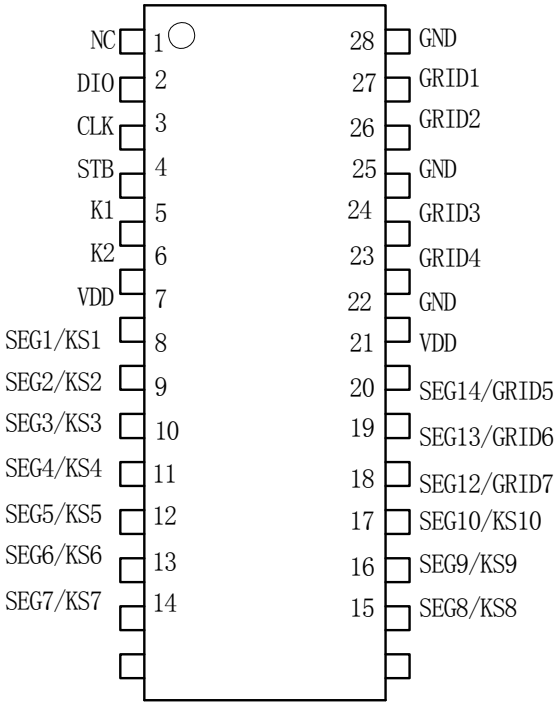
HM1628 is an LED Controller driven on a 1/5 to 1/8 duty factor. 10 segment output lines, 4 grid output lines, 3 segment/ grid output lines, one display memory, control circuit, key scan circuit are all incorporated into a single chip to build a highly reliable peripheral device for a single chip microcomputer. Serial data is fed to HM1628 via a three-line serial interface. Housed in a 28 pins SOP Package, HM1628 pin assignments and application circuit are optimized for easy PCB Layout and cost saving advantages.

Features

- CMOS technology
- Low power consumption
- Multiple display modes (10 segment, 7 grid to 13 segment, 4 grid)
- Key scanning (10 x 2 Matrix)
- 8-step dimming circuitry
- Serial interface for clock, data input, data output, strobe pins
- Built-in RC oscillator: （450KHz±5%）
- Available in 28 pins, SOP

2、BLOCK DIAGRAM AND PIN DESCRIPTION

2.1、PIN CONFIGURATIONS



2.2、PIN DESCRIPTION

Pin No.	Pin Name	Description
1	NC	
2	DIO	Data input Pin This pin inputs serial data at the rising edge of the shift clock (starting from the lower bit) Data Output pin(N-Channel, Open-Drain)
3	CLK	Clock input Pin .This pin reads serial data at the rising edge and outputs data at the falling edge.
4	STB	Serial Interface Strobe Pin The data input after the STB has fallen is processed as a command. When this pin is "HIGH", CLK is ignored.
5,6	K1,K2	Key Data input Pins The data sent to these pins are latched at the end of the display cycle.(Internal Pull-Low Resistor)
22,25,28	GND	Ground Pin
8～17	SEG1/KS1～ SEG10/KS10	Segment Output Pins(p-channel, open drain) Also acts as the Key Source
18～20	SEG12/GRID7 ～ SEG14/GRID6	Segment/Grid Output Pins
7,21	VDD	Power Supply
26,27, 23,24	GRID1～ GRID4	Grid Output Pins

3、ELECTRICAL PARAMETER

3.1、 ABSOLUTE MAXIMUM RATINGS (Unless otherwise stated, Ta=25℃, GND=0V)

Characteristic	Symbol	Conditions	Value	Unit
Supply Voltage	V_{DD}		-0.3 to +7	V
Input Voltage	V_{I1}		-0.3 to V_{DD}+0.3	V
Drive output current	I_{O1}	Grid	+200	mA
	I_{O2}	segment	-50	
Operating Temperature	Topr		-40～+80	℃
Storage Temperature	Tstg		-65～+150	℃
Power Dissipation	P_D		400	mW
Soldering Temperature	T_L	10s	250	℃

3.2、RECOMMENDED OPERATING RANGE （Ta= -20℃～+70℃，GND=0V）

Parameter	Symbol	Min.	Typ.	Max.	Unit
Logic supply voltage	V_{DD}	3	5	5.5	V
High-level input voltage	V_{IH}	0.7V_{DD}	-	V_{DD}	V
Low-level input voltage	V_{IL}	0	-	0.3V_{DD}	V

3.3、ELECTRICAL CHARACTERISTICS

3.3.1 DC CHARACTERISTICS （Ta= -20℃～+70℃，V_{DD}=4.5V～5.5V ,GND=0V）

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
High-level output current	I_{OH1}	Seg1/KS1～Seg10/KS10, V_O=V_{DD}-2V	-20	-25	-40	mA
	I_{OH2}	Seg1/KS1～Seg10/KS10, V_O=V_{DD}-3V	-20	-30	-50	mA
Low-level output current	I_{OL1}	Grid1～Grid4,V_O= 0.3V	80	140	-	mA
Low-level output current	I_{DATA}	V_O=0.4V, DIO	4	8	-	mA
Segment High-level output current tolerance	I_{TOLSG}	V_O=V_{DD}-3V, Seg1/KS1～Seg10/KS10	-	-	5	%
Input current	I_I	V_I=V_{DD}/GND	-	-	±1	uA
High-level input voltage	V_{IH}	CLK、DIO、STB	0.7V_{DD}	-		V
Low-level input voltage	V_{IL}	CLK、DIO、STB	-	-	0.3V_{DD}	V
Hysteresis Voltage	V_H	CLK、DIO、STB	-	0.35	-	V
Dynamic current dissipation	I_{DD}dyn	No load , display off	-	-	5	mA
Pull-down Resistor	RL	K1~K2	-	10	-	KΩ

3.3.2 SWITCHING CHARACTERISTICS（Ta= -20℃～+70℃，V_{DD}=4.5V～5.5V）

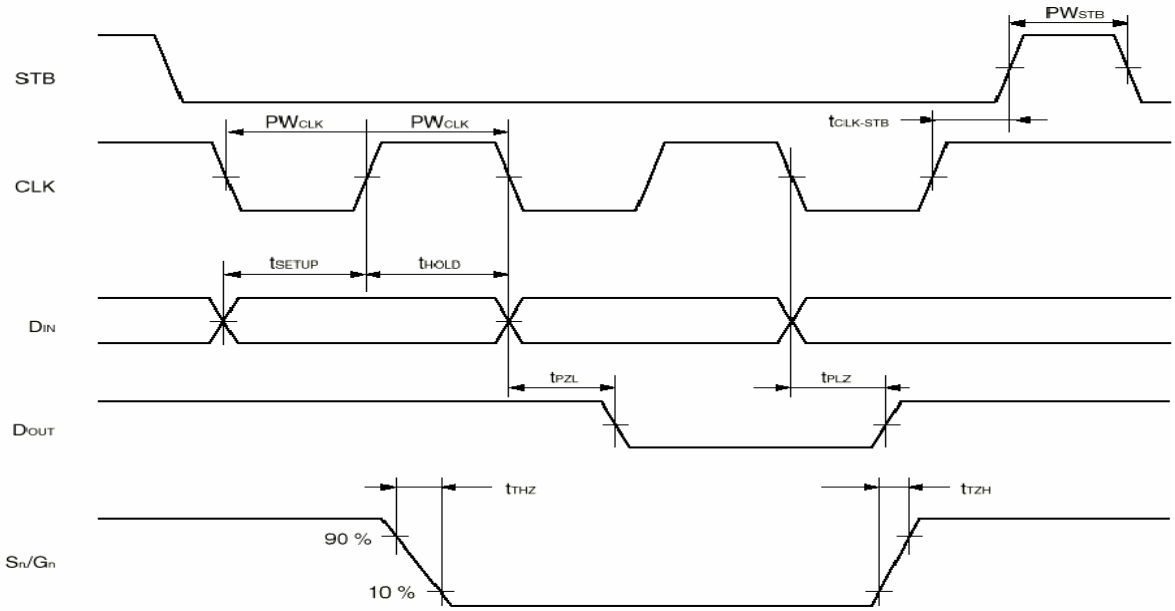
Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Oscillation frequency	f_{OSC}			-	450	-	KHz
Propagation delay	t_{PLZ}	CLK→DIO CL=15pF, R_L=10KΩ		-	-	300	ns
	t_{PZL}			-	-	100	ns
Rise Time	T_{TZH1}	CL=300pF	Seg1/KS1～Seg10/KS10	-	-	2	us
	T_{TZH2}		Grid1～Grid4	-	-	0.5	us
Fall Time	T_{THZ}	CL=300pF、Segn、Gridn		-	-	120	us
Maximum clock frequency	Fmax	Duty=50%		1	-	-	MHz
Input capacitance	C_I	-		-	-	15	pF

3.3.3 TIMING CHARACTERISTICS（Ta= -20℃～+70℃，V_{DD}=4.5V～5.5V）

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Clock pulse width	PWCLK	-	400	-	-	ns
STB pulse width	PWSTB	-	1	-	-	μs
Set-up time for data	t_{SETUP}	-	100	-	-	ns
Hold time for data	t_{HOLD}	-	100	-	-	ns
Propagation delay CLK to STB	$t_{CLK\ STB}$	CLK↑→STB↑	1	-	-	μs
Wait time	t_{WAIT}	CLK↑→CLK↓	1	-	-	μs

4、FUNCTION DESCRIPTION

4.1、Switching characteristic waveform



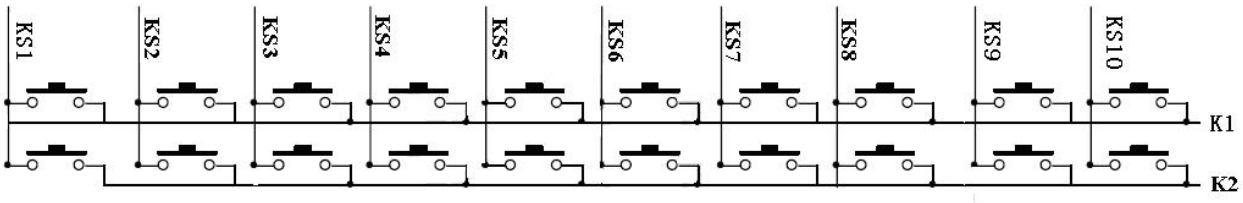
4.2、DISPLAY MODE AND RAM ADDRESS

Data transmitted from an external device to HM1628 via the serial interface are stored in the Display RAM and are assigned addresses. The RAM addresses of HM1628 are given below in 8 bits unit.

SEG1	SEG2	SEG3	SEG4	SEG5	SEG6	SEG7	SEG8	SEG9	SEG10	X	SEG12	SEG13	SEG14	X	X	
xxHL(Lower 4bits)				xxHU(Higher 4 bits)				xxHL(Lower 4bits)				xxHU(Higher 4 bits)				
B0	B1	B2	B3	B4	B5	B6	B7	B0	B1	B2	B3	B4	B5	B6	B7	
00HL				00HU				01HL				01HU				DIG1
02HL				02HU				03HL				03HU				DIG2
04HL				04HU				05HL				05HU				DIG3
06HL				06HU				07HL				07HU				DIG4
08HL				08HU				09HL				09HU				DIG5
0AHL				0AHU				0BHL				0BHU				DIG6
0CHL				0CHU				0DHL				0DHU				DIG7

4.3、KEY MATRIX & KEY INPUT DATA STORAGE RAM

Key Matrix consists of 10 x 2 array as shown below:



Each data entered by each key is stored as follows and read by a READ Command, starting from the last significant bit. When the most significant bit of the data (b0) has been read, the least significant bit of the next data (b7) is read, b6 and b7 do not care.

B0	B1	B2	B3	B4	B5	B6	B7	
K1	K2	X	K1	K2	X	0	0	
KS1			KS2			0	0	BYTE1
KS3			KS4			0	0	BYTE2
KS5			KS6			0	0	BYTE3
KS7			KS8			0	0	BYTE4
KS9			KS10			0	0	BYTE5

4.4、COMMANDS DESCRIPTION

A command is the first byte (b0 to b7) inputted to HM1628 via the DIO Pin after STB Pin has changed from HIGH to LOW State. If for some reason the STB Pin is set to HIGH while data or commands are being transmitted, the serial communication is initialized, and the data/commands being transmitted are considered invalid.

（1）DISPLAY MODE SETTING COMMANDS

HM1628 provides 2 display mode settings as shown in the diagram below: As stated earlier a command is the first one byte (b0 to b7) transmitted to HM1628 via the DIO Pin when STB is LOW. However, for these commands, the bit 3 to bit 6 (b2 to b5) are ignored, bit 7 & bit 8 (b6 to b7) are given a value of 0.

The Display Mode Setting Commands determine the number of segments and grids to be used (10 to 13 segments, 7 to 4 grids). A display command ON must be executed in order to resume display. If the same mode setting is selected, no command execution is take place, therefore, nothing happens.

When Power is turned ON, the 7-grid, 10-segment modes is selected.

MSB LSB

0	0	-	-	-	-	b1	b0

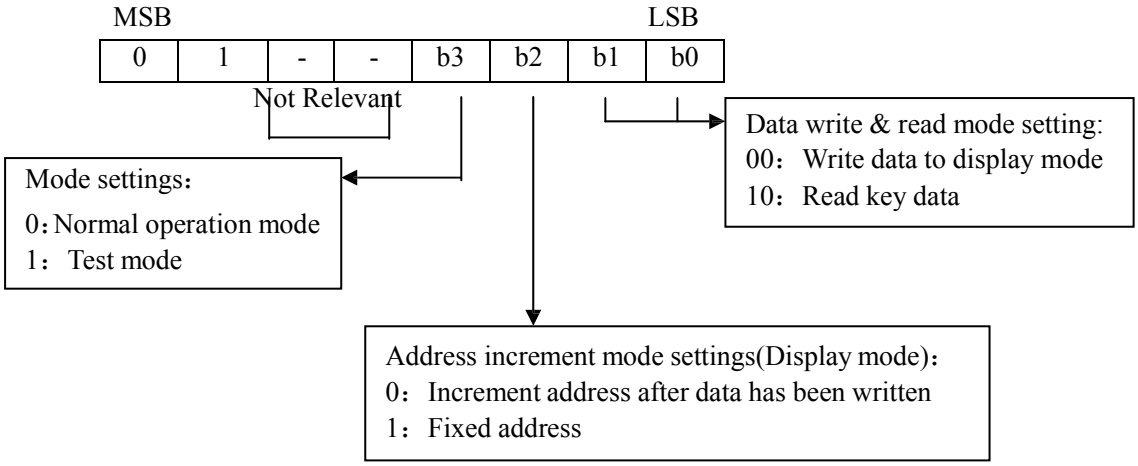
Not Relevant

00	4digits，13segments
01	5 digits ，12 segments
10	6 digits ，11 segments
11	7 digits ，10 segments

（2）DATA SETTING COMMANDS

The Data Setting Commands executes the Data Write or Data Read Modes for HM1628. The data Setting Command, the bits 5 and 6 (b4, b5) are ignored, bit 7 (b6) is given the value of 1 while bit 8 (b7) is given the value of 0. Please refer to the diagram below.

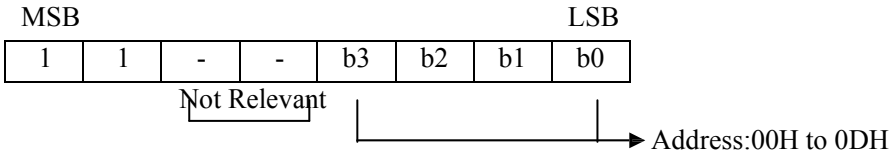
When power is turned ON, bit 4 to bit 1 (b3 to b0) are given the value of 0.



（3）ADDRESS SETTING COMMANDS

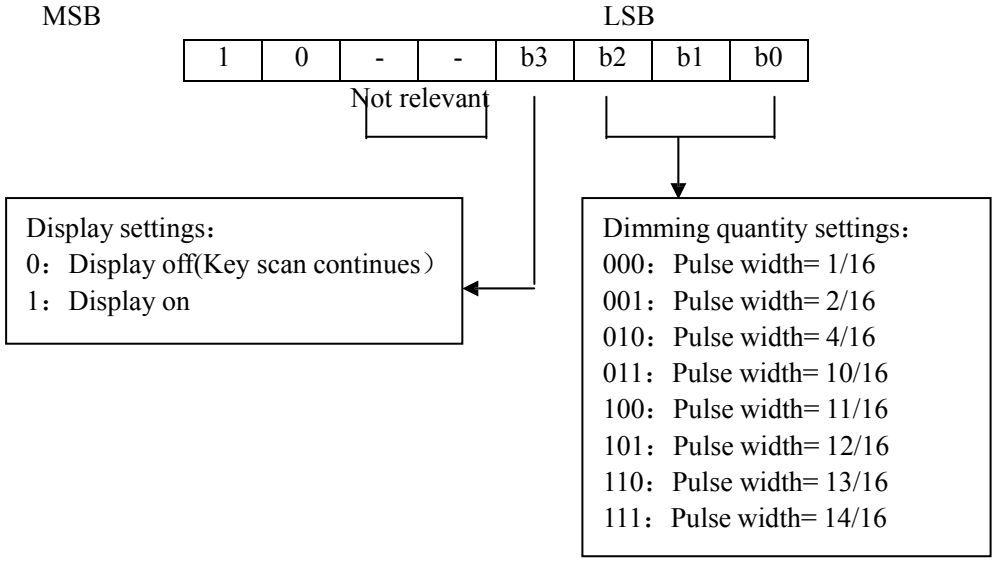
Address Setting Commands are used to set the address of the display memory. The address is considered valid if it has a value of 00H to 0DH. If the address is set to 0EH or higher, the data is ignored until a valid address is set. When power is turned ON, the address is set at 00H.

Please refer to the diagram below:



（4）DISPLAY CONTROL COMMANDS

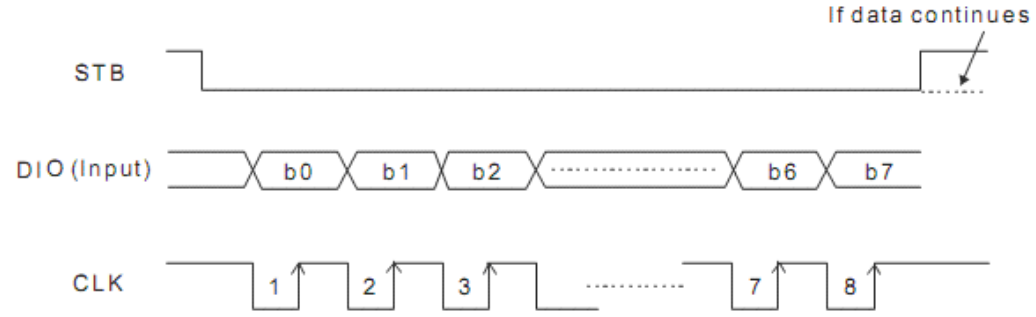
The Display Control Commands are used to turn ON or OFF a display. It also used to set the pulse width. Please refer to the diagram below. When the power is turned ON, a 1/16 pulse width is selected and the displayed is turned OFF (the key scanning is started).



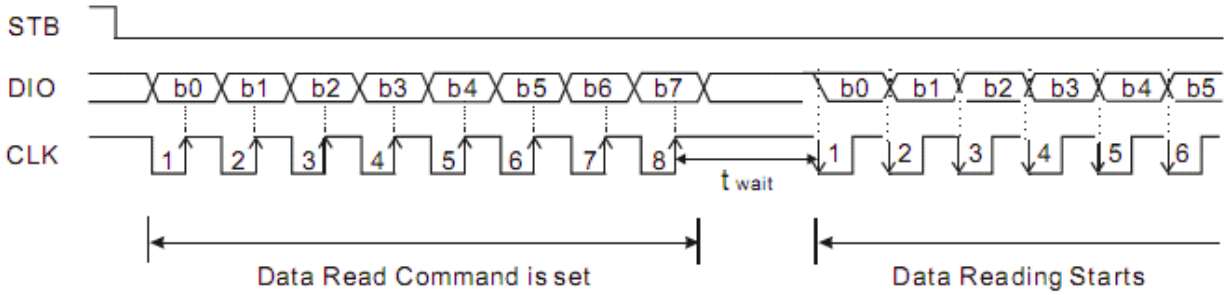
4.5、SERIAL COMMUNICATION FORMAT

The following diagram shows the HM1628 serial communication format. The DIO Pin is an N-channel, open-drain output pin, therefore, it is highly recommended that an external pull-up resistor (1KΩ to 10KΩ) must be connected to DIO.

- **RECEPTION DATA(COMMAND WRITE)**



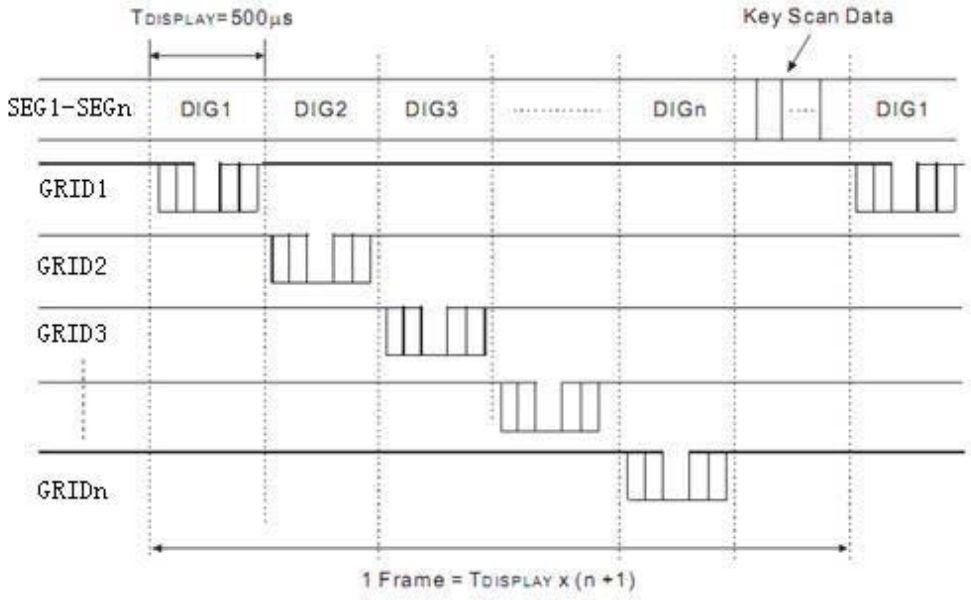
- **TRANSMISSION (DATA READ)**



where: twait (waiting time) ≥ 1μs

It must be noted that when the data is read, the waiting time (twait) between the rising of the eighth clock that has set the command and the falling of the first clock that has read the data is greater or equal to 1μs.

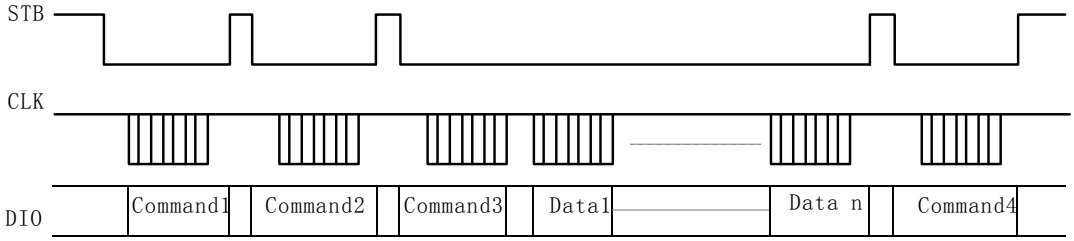
4.6、SCANNING AND DISPLAY TIMING



4.7、The serial data transfer in the applications

- **Address increasing mode**

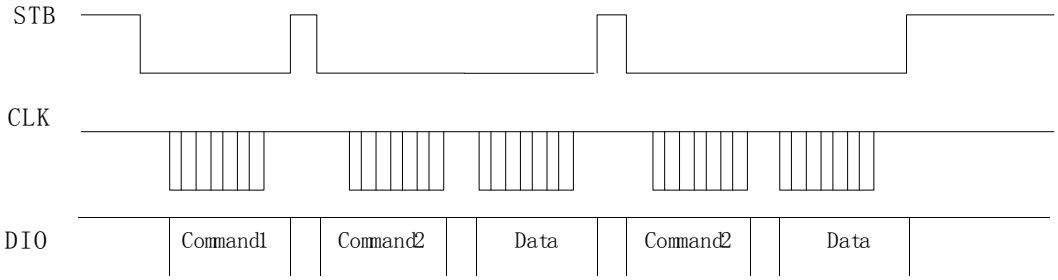
Display memory is updated by incrementing addresses. Please refer to the following diagram.



where:
Command 1: Display mode setting command
Command 2: Data setting command
Command 3: Address setting command
Data 1 to n: Transfer display data (14 bytes max.)
Command 4: Display control command

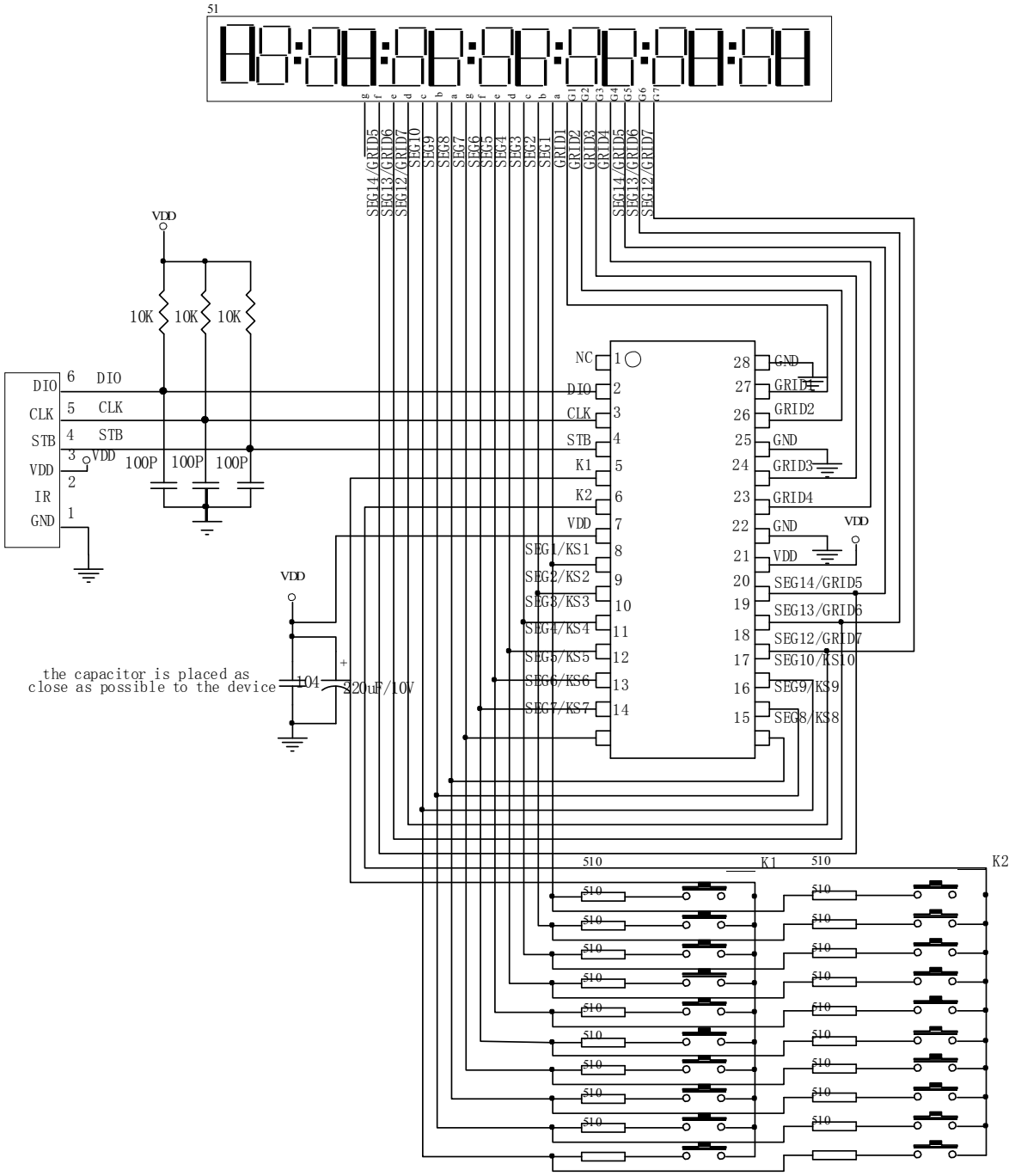
- **Fixing address**

The following diagram shows the waveforms when updating specific addresses.



where:
Command 2: Data setting command
Command 3: Address setting command
Data : display data

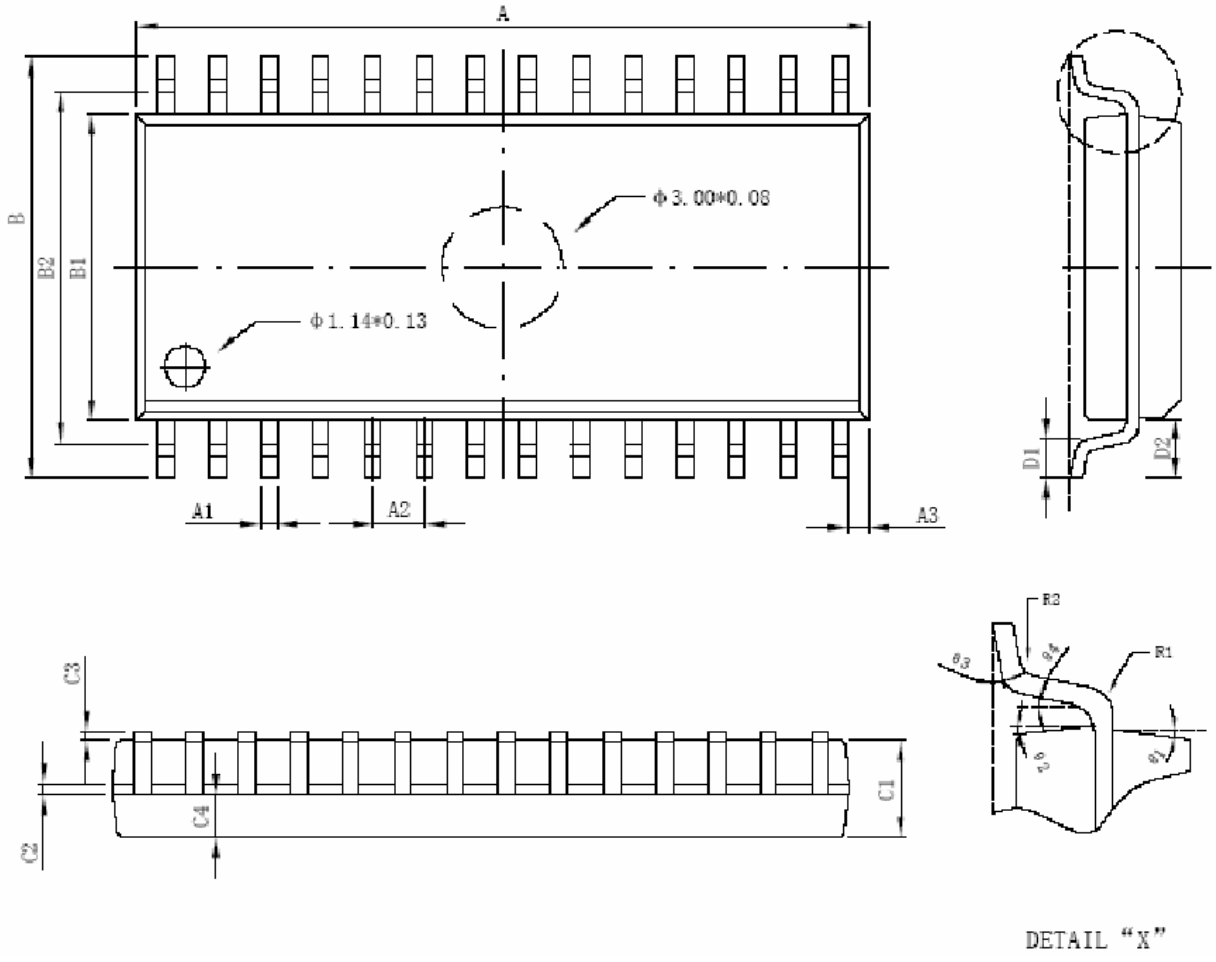
5、TYPICAL APPLICATION CIRCUIT AND FUNCTION DESCRIPTION



6、PACKAGE INFORMATION

6.1、SOP28

尺寸 / 标注	最 小（mm）	最 大（mm）	尺寸 / 标注	最 小（mm）	最 大（mm）
A	17.83	18.03	C4	1.043TYP	
A1	0.4064TYP		D1	0.70	0.90
A2	1.27TYP		D2	1.395TYP	
A3	0.51TYP		R1	0.508TYP	
B	9.90	10.50	R2	0.508TYP	
B1	7.42	7.62	θ1	7° TYP	
B2	8.9TYP		θ2	5° TYP	
C1	2.24	2.44	θ3	4° TYP	
C2	0.204	0.33	θ4	10° TYP	
C3	0.10	0.25			



7、STATEMENTS AND NOTES:

7.1、The name and content of Hazardous substances or Elements in the product

Part name	Hazardous substances or Elements					
	Lead and lead compounds	Mercury and mercury compounds	Cadmium and cadmium compounds	Hexavalent chromium compounds	Polybrominated biphenyls	Polybrominated biphenyl ethers
Lead frame	○	○	○	○	○	○
Plastic resin	○	○	○	○	○	○
Chip	○	○	○	○	○	○
The lead	○	○	○	○	○	○
Plastic sheet installed	○	○	○	○	○	○
explanation	○: Indicates that the content of hazardous substances or elements in the detection limit of the following the SJ/T11363-2006 standard。 ×: Indicates that the content of hazardous substances or elements exceeding the SJ/T11363-2006 Standard limit requirements。					

7.2 NOTION:

Recommended carefully reading this information before the use of this product;
The information in this document are subject to change without notice;
This information is using to the reference only, the company is not responsible for any loss;
The company is not responsible for the any infringement of the third party patents or other rights of the responsibility.