



AiP1722 15 Seg*4 Com LCD Driver with Backlight Driver

Product Specification

Specification Revision History:

Version	Date	Description
2023-08-A1	2023-08	New



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1、General Description

AiP1722 is a single-chip controller/driver for LCD. It consists of 15 segment output circuits and 4 common output circuits. The AiP1722 chip contains a backlight driver block using 64 steps PWM control with software instructions.

The AiP1722 chip contains a 3-line serial interface so that it can connect straight to a MCU.

Features:

- Using Low consume CMOS process
- Display mode: 4×15 LCD driver
- 3 LED Driver with 64 PWM, can be used in LCD backlight driver Symphony
- 1/2 or 1/3 LCD drive bias Optional
- LCD operating voltage is adjustable for adjusting the brightness of the LCD screen
- Serial interface: CLK, STB, DIN
- Oscillation mode: Built-in RC oscillator (typical oscillation frequency $128\text{KHz} \pm 5\%$)
- Built-in power-on reset circuit
- Package: SOP24

Ordering Information:

Tube packing specifications:

Part number	Packaging form	Marking code	Tube quantity	Boxed tube quantity	Boxed quantity	Notes
AiP1722SA24.TB	SOP24	AiP1722	30 PCS/tube	80 tube/box	2400 PCS/box	Dimensions of plastic enclosure: 15.4mm×7.5mm Pin spacing: 1.27mm

Reel packing specifications:

Part number	Packaging form	Marking code	Reel quantity	Boxed reel quantity	Notes
AiP1722SA24.TR	SOP24	AiP1722	1250 PCS/reel	1250 PCS/box	Dimensions of plastic enclosure: 15.4mm×7.5mm Pin spacing: 1.27mm

Note: If the physical information is inconsistent with the ordering information, please refer to the actual product.



2、Block Diagram And Pin Description

2.1、Block Diagram

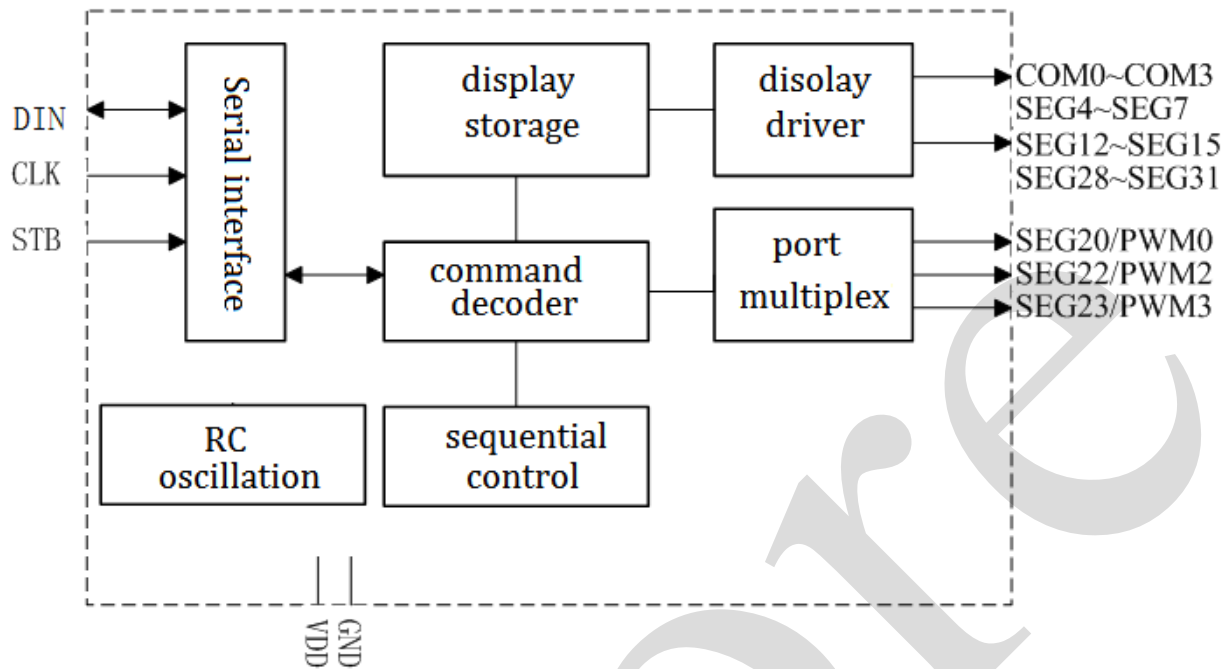


Figure 1. Functional block diagram

2.2、Pin Configurations

1	VDD	COM0	24
2	DIN	COM1	23
3	CLK	COM2	22
4	STB	COM3	21
5	GND	SEG4	20
6	SEG31	SEG5	19
7	SEG30	SEG6	18
8	SEG29	SEG7	17
9	SEG28	SEG12	16
10	SEG23/PWM3	SEG13	15
11	SEG22/PWM2	SEG14	14
12	SEG20/PWM0	SEG15	13

Figure 2. Pin Configurations



2.3、Pin Description

Pin No.	Pin Name	Description
1	VDD	Power supply
2	DIN	Serial data line This pin inputs serial data at the rising edge of the shift clock(starting from the lower)
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	GND	Ground Pin
6~9	SEG31 ~ SEG28	Segment Output Pins
10~12	SEG23/PWM3 SEG22/PWM2 SEG20/PWM0	Segment output / PWM output Composite port It can be configured as segment output or PWM output port respectively. When it is used as PWM output, it has 16 levels of PWM, which can be used for backlight driving of LCD.
13~20	SEG15~SEG12 SEG7~SEG4	Segment output LCD segment drive output
21~24	COM3 ~ COM0	LCD common drive output.



3、Electrical Parameter

3.1、Absolute Maximum Ratings

($T_{amb}=25^{\circ}\text{C}$, all voltage referenced to GND, unless otherwise specified.)

Parameter	Symbol	Conditions	Value	Unit
Logic Supply Voltage	VDD	-	-0.5 ~ +6.0	V
Logic input voltage	VIN	-	-0.5 ~ VDD + 0.5	V
Ambient temperature	T_{amb}	-	-40 ~ +85	$^{\circ}\text{C}$
Storage temperature	T_{stg}	-	-65 ~ +150	$^{\circ}\text{C}$
Soldering Temperature	T_L	10s	260	$^{\circ}\text{C}$

3.2、Recommended Operating Range

($T_{amb}=-40 \sim +85^{\circ}\text{C}$, GND=0V.)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Logic Supply Voltage	VDD	2.7	5	5.5	V
High-level input voltage	V_{IH}	0.7VDD	-	VDD	V
Low-level input voltage	V_{IL}	0	-	0.2VDD	V

3.3、Electrical Characteristics

3.3.1、DC Characteristics

($T_{amb}=-40 \sim +85^{\circ}\text{C}$, GND=0V, VDD=5V.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Low-level output current	I_{OL1}	COM0 ~ COM3, VO=0.5V	150	250	-	μA
High-level output current	I_{OH1}	COM0 ~ COM3, VO=4.5V	-120	-150	-	μA
Low-level output current	I_{OL2}	COM0 ~ COM3, VO=0.5V	120	200	-	μA
High-level output current	I_{OH2}	COM0 ~ COM3, VO=4.5V	-70	-100	-	μA
Low-level output current	I_{OL3}	PWM0 ~ PWM3 (output state), VO = 1V	30	60	-	mA
PWM High-level output current	I_{OH3}	PWM0 ~ PWM3 (set to output mode), VO=3V	-15	-25	-	mA
Input current	I_{IN}	VIN=VDD/GND CLK, DIN, STB	-	-	± 2	μA
High-level output current	V_{IH}	CLK, DIN, STB	0.7VDD	-	-	V
Low-level output current	V_{IL}	CLK, DIN, STB	-	-	0.2VDD	V
Hysteresis voltage	V_H	CLK, DIN, STB	-	0.35	-	V
Dynamic current consumption	I_{DDdyn}	No load, display off	-	-	1	mA



3.3.2、Switching Characteristics

($T_{amb}=-40\sim+85^{\circ}\text{C}$, GND=0V, VDD=5V.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Oscillation frequency	f_{osc}	-	-	128	-	KHz
Maximum clock frequency	f_{max}	Duty=50%	1	-	-	MHz
Input capacitance	C_I	CLK, DIN, STB	-	-	15	pF

3.3.3、Timing Characteristics

($T_{amb}=-40\sim+85^{\circ}\text{C}$, GND=0V, VDD=5V.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Clock pulse width	PW _{CLK}	-	400	-	-	ns
STB pulse width	PW _{STB}	-	1	-	-	us
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 $\uparrow$ →STB $\uparrow$	1	-	-	us



4、Function Description

4.1、Switching Characteristic Waveform

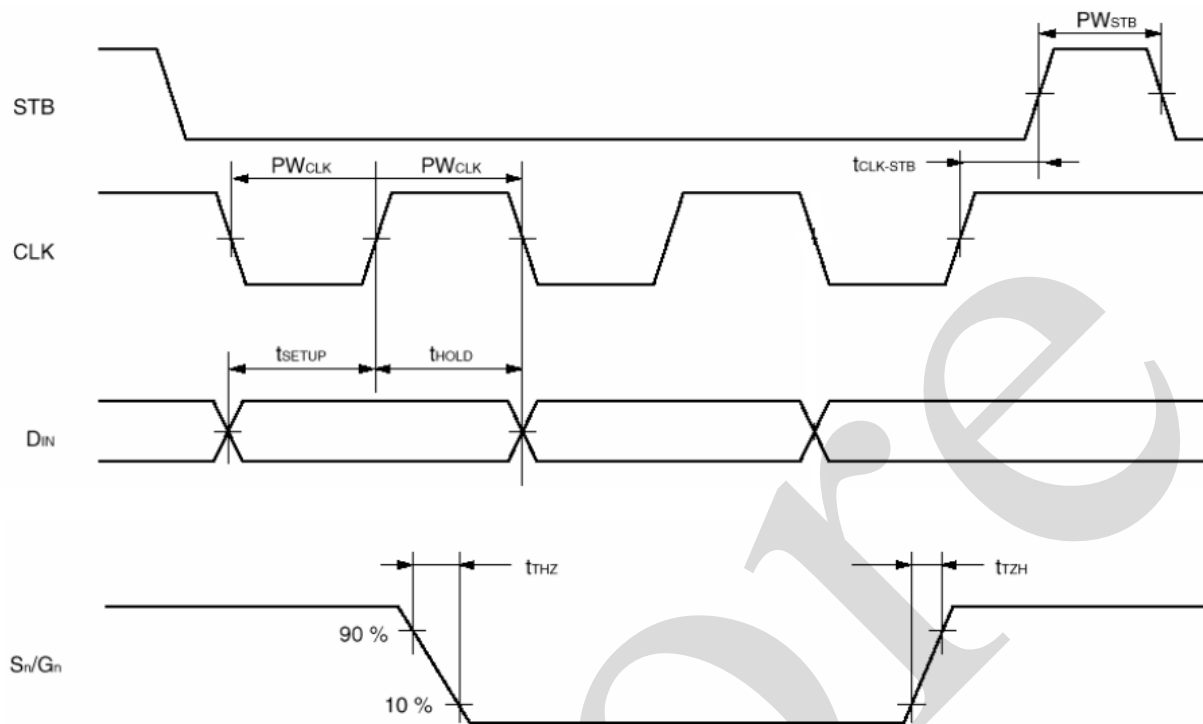


Figure 3. Timing Diagram



4.2、Display Mode And RAM Address

Data transmitted from an external device to AiP1722 via the serial interface are stored in the Display RAM and are assigned addresses.

When writing LCD display data, operate from low address to high address and from low byte to high byte.

COM0	COM1	COM2	COM3	COM0	COM1	COM2	COM3	Address bit RAM address
SEG4				SEG5				02H
SEG6				SEG7				03H
SEG12				SEG13				06H
SEG14				SEG15				07H
SEG20				—				0AH
SEG22				SEG23				0BH
SEG28				SEG29				0EH
SEG30				SEG31				0FH
Bit0	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7	bit

Table 1. Display Register Address Allocation Table

4.3、Port Control Register

4.3.1、PWM Register Instructions

Command (B1B0)	Register	High Low
00	PWM0	XXb5b4_b3b2b1b0
10	PWM2	XXb5b4_b3b2b1b0
11	PWM3	XXb5b4_b3b2b1b0

PWM0-PWM3 register instructions:

b5b4_b3b2b1b0	PWM Pulse Width Setting
00H	0
01H ~ 3EH	1/64 ~ 62/64
3FH	1

Note: When power is turned on, the initial state of all registers is set at 0.

4.4、Commands Description

A command is first byte(b0 to b7)inputted to AiP1722 via the DIN Pin after STB Pin has changed from high to low state.

B7	B6	Instructions
0	0	Display setting command
0	1	Data setting commands



1	0	Display control commands
1	1	Address setting commands

If the STB is set to high level when an instruction or data is transmitted, serial communication is initialized and the instruction or data is being transmitted. Invalid (previously transmitted instructions or data remain valid).

4.4.1、Display Setting Commands

After the working mode is set, it is not allowed to switch the working mode during use.

MSB				LSB			
0	0	b5	b4	0	0	0	0

b5b4	PWM output port/SEG output setting
00	SEG20、SEG22、SEG23
01	SEG20、SEG22、PWM3
10	SEG22、PWM2、PWM3
11	PWM0、PWM2、PWM3

Note: When power is turned on, the initial state of all registers is set at 0.

4.4.2、Data Setting Commands

MSB				LSB				Function	Instructions
B7	B6	B5	B4	B3	B2	B1	B0		
0	1	00		—	—	0	0	Data write mode setting	Writing data to the display register
0	1			—	—	0	1		Writing data to PWM register
0	1			—	0	—	—	Address increment mode setting	Increment address after data has been written
0	1			—	1	—	—		Fixed address
0	1			0	—	—	—	Testing mode settings	Normal operation mode
0	1			1	—	—	—		Test mode

4.4.3、Address Setting

MSB				LSB				Address
B7	B6	B5	B4	B3	B2	B1	B0	
1	1	00		0	0	0	0	00H
1	1			0	0	1	0	02H
1	1			0	0	1	1	03H
1	1			0	1	1	0	06H
1	1			0	1	1	1	07H
1	1			1	0	1	0	0AH
1	1			1	0	1	1	0BH



1	1		1	1	1	0	0EH
1	1		1	1	1	1	0FH

b3b2b1b0: Address of display register/backlight drive setting register. This instruction is used to set the address of the display register or the backlight drive setting register. At power-on, the address is set to 00H.

Set the address of the display register. When the address is set to 10H or higher, the data is ignored until the effective address is set (00H~0FH).

Set the address of the backlight drive setting register. When the address is set to 08H or higher, b3 data is ignored, and the effective address is set in the range of (00H~07H).

Address selection: determine the object of this address operation according to the latest valid data setting instruction. If the data setting instruction is the mode of writing data to the display register, then this address is set to the display register address; If the data setting instruction is to write data to the PWM control register mode, then this address is set to the address of the backlight drive setting register.



4.4.4、Display Control

MSB				LSB			
1	0	0	b4	b3	b2	b1	b0

b4: Display switch position; 1: Display on 0: Display off

b3: LCD drive bias setting bits; 1: 1/2 bias 0: 1/3 bias

b2b1b0: LCD Operating voltage setting bit:

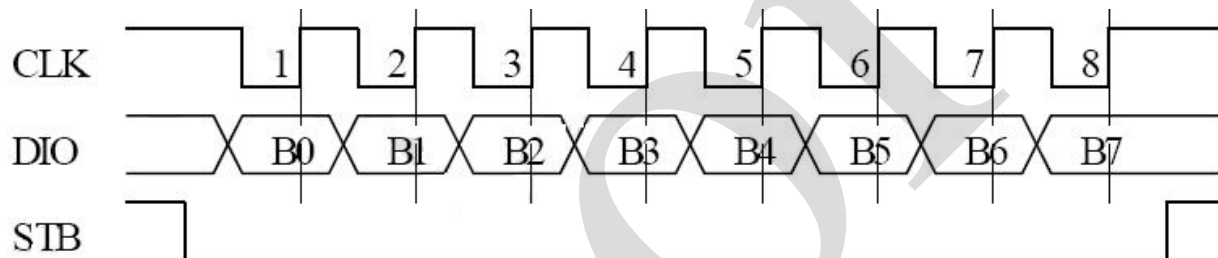
When b2b1b0 equal to 111, the working voltage equal to VDD (VDD for the chip's operating voltage). When VDD is equal to 5V and b3 is equal to 1, regulating voltage is of range of about 2.24V-5V; b3 is equal to 0 (1/3 bias), regulating voltage range is about 2.88-5V.

Note: After power on, b5b4b3b2b1b0 is set to 00111.

4.5、Serial Data Transmission Format

Receive 1 BIT data and operate on the rising edge of the clock.

4.5.1、Data Reception (write data)





4.6、PWM Applications

4.6.1、PWM Output

The PWM output port is controlled according to the flow of fig. 5, and the waveforms of LED1 and LED2 can be observed with an oscilloscope, as shown in fig. 6:

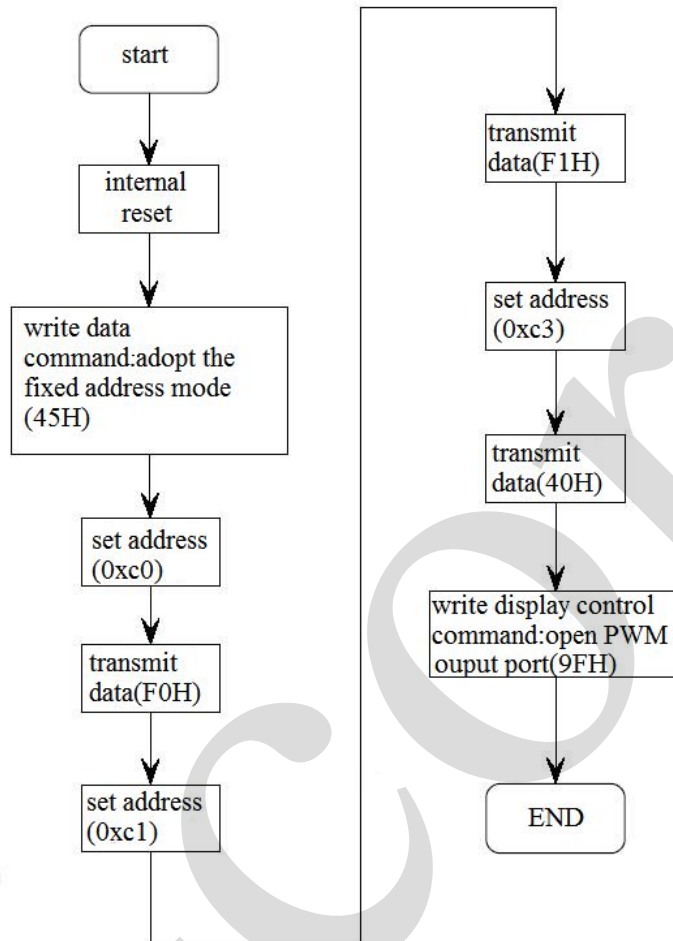


Figure 5. Flowchart of control PWM output port

The wave observed by oscilloscope:

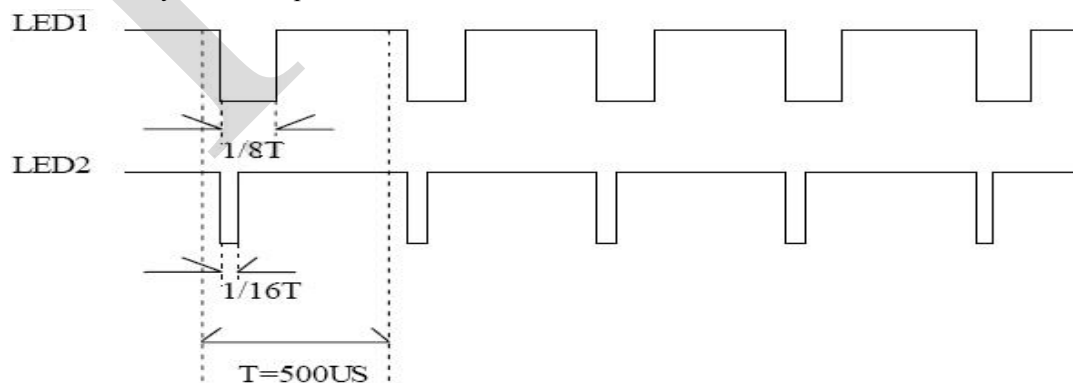


Figure 6



Three channel PWM outputs are open drain output of N tube. When measured the waveform of LED1-3, the pull-up resistor must be added. LED2 port output waveform is $1/16T$ with reference to FIG. 8. The width is set to T when LED1 writing 0FH in the address C0H. When writing to the address 40H in C3H, the resulting pulse width is $1/8T$ and simple formula given below:

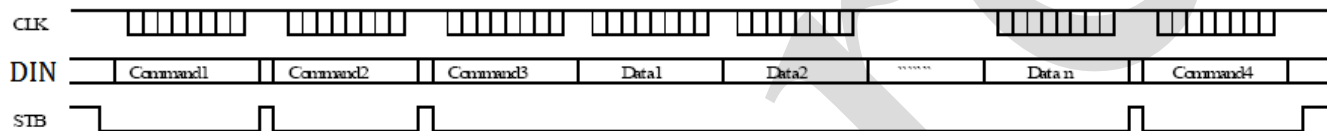
$$t = mn \times T$$

- t Output pulse width, T is a constant (about 500us)
- m Negative Duty set by the LED1, LED2, LED3 (Low value defining the entire period (T))
- n Negative Duty set by the LED123 (Low value defining the whole cycle (mT))

4.7、Typical Transmission Format Of Serial Data When In Application

4.7.1、Address Add Mode

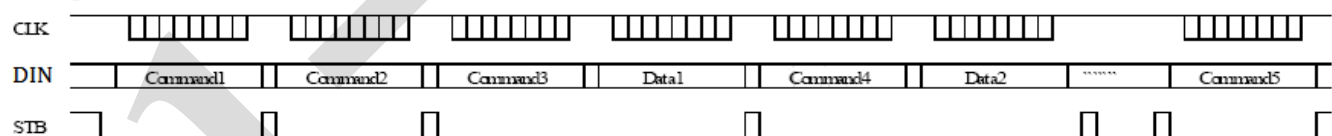
Use address auto increment mode, set the address is actually the starting address of the transmitted data stream is stored. Starting Address Command word has been sent, “STB” do not need to set high follow by the transfer of data, most 14BYTE, and data transfer is completed before the “STB” is set high.



- Command1: Set Display Mode
- Command2: Set Data Command
- Command3: Set display address
- Data1~n: Transmit display data to the Command3 address and the following addresses (Up to 14 bytes)
- Command4: Display control command

4.7.2、Fixed Address Mode

Use fixed address mode, set the address which is actually a set of stored data to be transferred 1BYTE. After address been sent, “STB” do not need to set high, 1BYTE data need to transfer followly, and the “STB” is set high when data transfer is completed. Then re-set the address where the second data need to be stored, most 14BYTE data transfer is completed, “STB” is set high at last.

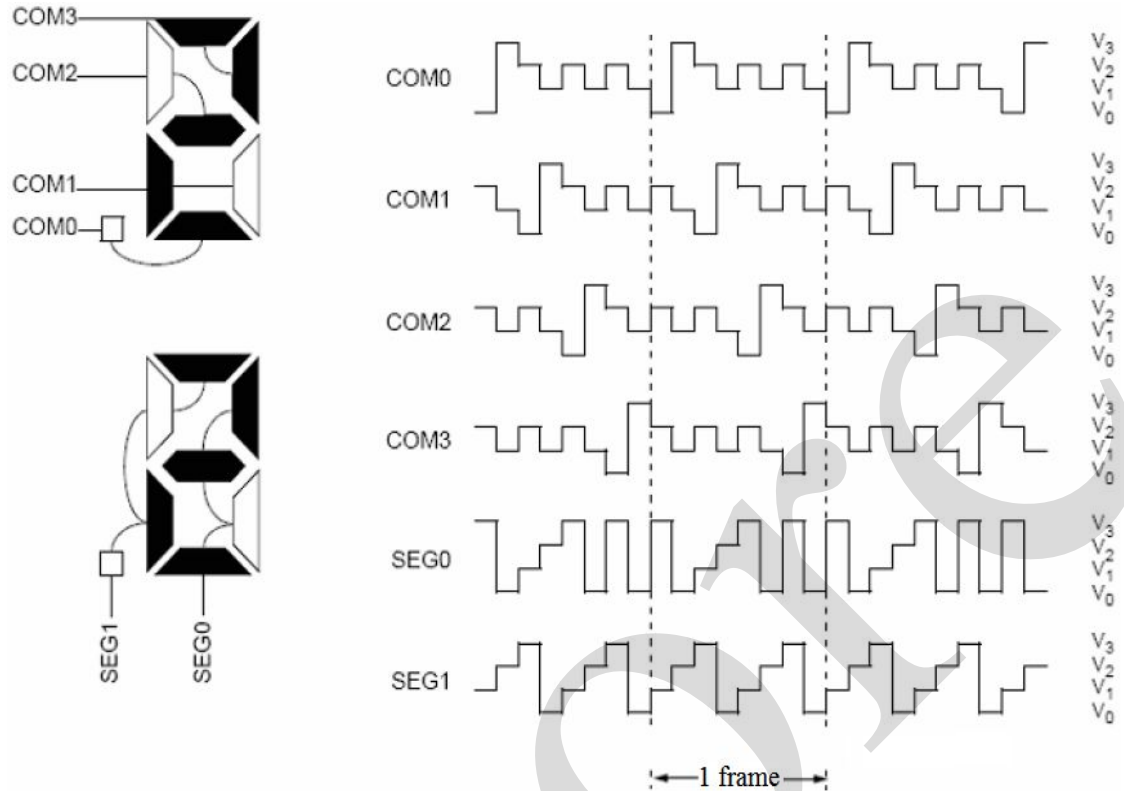


- Command1: Set Display Mode
- Command2: Set Data Command
- Command3: Set display address 1
- Data1: Transmitting display data 1 to the Command3 addresses
- Command4: Set display address 2
- Data2: Transmitting display data 2 to the Command4 addresses
- Command5: Display control command



4.8、Pin Drive Waveforms:

Using the waveform which displayed “2”,when 1/4 multiplexing and 1/3 bias drive:



V₃=VDD (VDD supply voltage for the LCD)

V₂=2/3VDD

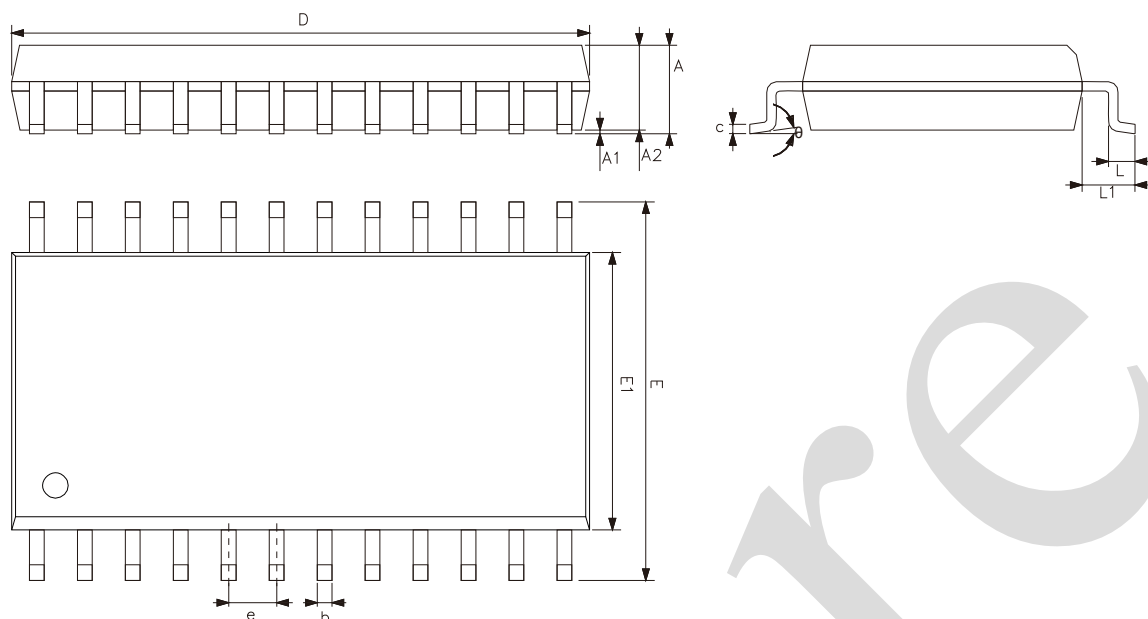
V₁=1/3VDD

V₀=0



6、Package Information

6.1、SOP24



Symbol	Dimensions (mm)	
	Min.	Max.
A	2.35	2.65
A1	0.10	0.30
A2	2.13	2.44
b	0.39	0.47
c	0.25	0.30
D	15.19	15.55
E	10.10	10.57
E1	7.40	7.62
e	1.27	
L	0.41	1.00
L1	1.30	1.50
θ	0°	8°



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	Dibutyl phthalate	Butylbenzyl phthalate	Di-2-ethylhexyl phthalate	Diisobutyl phthalate
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、Notes

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