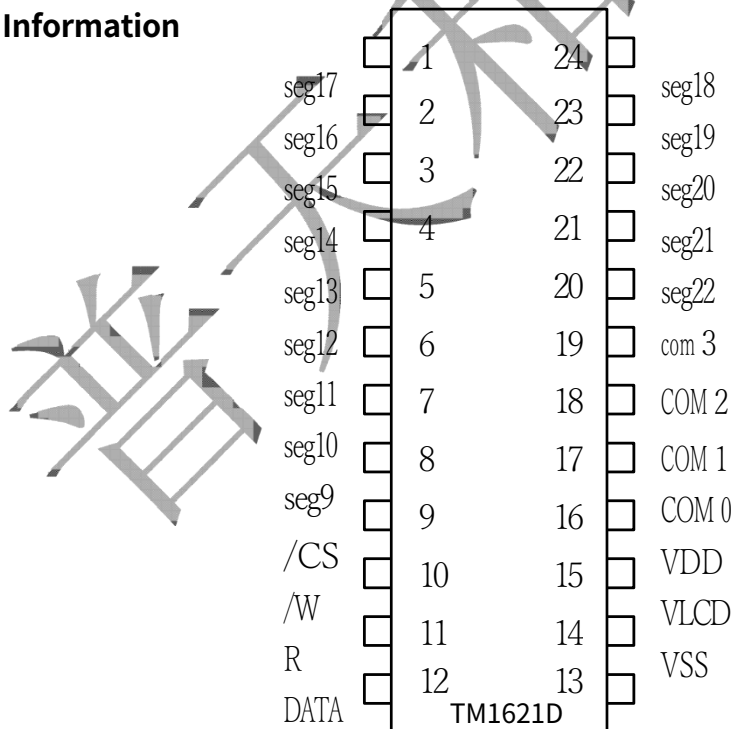# 14x4   LCD Driver   TM1621D

Characterization

The TM1621D is a 56-point, memory-image and multi-function LCD driver. The software configuration features of the TM1621D make it suitable for a wide range of LCD applications, including LCD modules and display subsystems. The communication timing between the host controller and the TM1621D is simple, and the TM1621D also has a power-saving command to reduce system power consumption.

Functional Features

➢ Operating Voltage 2.4~5.2V
➢ Embedded 256KHz RC oscillator
➢ Selectable 1/2 or 1/3 bias voltage and 1/2, 1/3 or 1/4 duty cycle
➢ On-chip time-based frequency source
➢ The power save command can be used to reduce power consumption
➢ One 14x4 LCD Driver
➢ An embedded 14x4-bit display RAM Memory
➢ 3-wire serial interface
➢ On-chip LCD driver frequency source
➢ Software configuration features
➢ Data Mode and Command Mode Instructions
➢ Two data access modes
➢ The VLCD pin is provided for adjusting the LCD operating voltage.
➢ Package: SOP24

Pin Information

Pin				
seg17	2	23	seg18
seg16	3	22	seg19
seg15			seg20
seg14	4	21	seg21
seg13	5	20	seg22
seg12	6	19	com 3
seg11	7	18	COM 2
seg10	8	17	COM 1
seg9	9	16	COM 0
/CS	10	15	VDD
/WR	11	14	VLCD
DATA	12	13	VSS

Pin 1 ... 24

TM1621D

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V1.0

Pin Description

pin number	pin name	I/O	Function Description
10	/CS	I	Chip select input, connected to a pull-up resistor. When /CS is high, the data and command to write TM1621D are invalid, and the serial interface circuit is reset; when /CS is low and as an input, the data and command to write TM1621D are invalid; when /CS is low and as an input, the data and command to write TM1621D are invalid. The data and commands are valid
11	/WR	I	WRITE pulse input, connected to a pull-up resistor. On the rising edge of the /WR signal, the number of digits on the DATA line It is written to TM1621D.
12	DATA	I/O	Serial data input/output with external pull-up resistor
13	VSS	I	Negative power, ground
14	VLCD	I	LCD power input
15	VDD	I	positive supply (electricity)
16-19	COM0 to COM3	O	LCD Common Output
1 to 9 20-24	SEG9 to SEG22	O	LCD segment output port

In the dry season or dry use of the environment, easy to generate a lot of static electricity, electrostatic discharge may damage the integrated circuit, it is recommended to take all appropriate integrated circuit preventive measures, if improper operation and welding, may cause ESD damage or performance degradation, the chip can not work properly.

Absolute maximum rating range

	parameters	realm	unit (of measure)
VDD	Logic supply voltage	VSS-0.3 to VSS+5.5	V
VIN	Logic Input Voltage	VSS-0.3 to VDD+0.3	V
Topr	Operating Temperature Range	-25 to +75	°C
Tstg	Storage temperature range	-50 to +120	°C
ESD	Human Body Mode (HBM)	4000	V
	Machine mode (MM)	400	V

DC gas parameters

notation	descriptive	test condition VDD	Condition	minimum value	typical value	maximum values	unit (of measure)
VDD	operating voltage			2.4		5.2	V
IDD	Operating Current	3V	without load On-chip RC oscillator		150	300	uA
		5V			300	600	uA
IDD	Operating Current	3V	No load crystal oscillator		60	120	uA
		5V			120	240	uA
IDD	Operating Current	3V	No load External clock source		100	200	uA
		5V			200	400	uA
ISTB	Standby Current	3V	No load power saving mode		0.1	5	uA
		5V			0.3	10	uA
VIL	Input Low Level Voltage	3V	DATA,/WR. /CS	0		0.6	V
		5V		0		1.0	V

VIH	Input High Level Voltage	3V	DATA,/WR. /CS	2.4		3.0	V
		5V		4.0		5.0	V
IOL1	DATA	3V	VOL=0.3V	0.5	1.2		mA
		5V	VOL=0.5V	1.3	2.6		mA
IOH1	DATA	3V	VOH = 2.7V	-0.4	-0.8		mA
		5V	VOH = 4.5V	-0.9	-1.8		mA
IOL2	LCD Common Port Leakage Current	3V	VOL=0.3V	80	150		uA
		5V	VOL=0.5V	150	250		uA
IOH2	LCD Common Port Source Current	3V	VOH = 2.7V	-80	-1,120.		uA
		5V	VOH = 4.5V	-1,120.	-200		uA
IOL3	LCD segment pin leakage current	3V	VOL=0.3V	60	120		uA
		5V	VOL=0.5V	120	200		uA
IOH3	LCD segment pin source current	3V	VOH = 2.7V	-40	-70		uA
		5V	VOH = 4.5V	-70	-100		uA
RPH	pull-up resistor	3V	DATA,/WR. /CS	40	80	150	Kohm
		5V		30	60	100	Kohm

AC Electrical Characteristics

notation	Description	test condition		minimum value	typical value	maximum values	unit (of measure)
		VDD	prerequisite				
fSYS1	system clock	3V	On-chip RC oscillator		256		KHz
		5V			256		KHz
fSYS2	system clock	3V	crystal oscillator		32.768		KHz
		5V			32.768		KHz
fSYS3	system clock	3V	External Clock Source		256		KHz
		5V			256		KHz
fLCD	LCD clock		On-chip RC oscillation tool		fSYS1/1024		Hz
			crystal oscillator		fSYS2 /128		Hz
tCOM	COM Clock Week period		n:number of COMs		n/ fLCD		s
fCLK	serial Data	3V				300	KHz
		5V				500	KHz
tDLY	DATA output delay time	3V					us
		5V				1	us

system structure

Display memory (RAM)

The static display memory (RAM) stores the displayed data in a 23x4-bit format, but only the display memories corresponding to SEG9 to SEG22 are useful. the data in the RAM is directly mapped to the LCD driver.

14x4 LCD Driver TM1621D

RAM 映象图

2. System oscillator

The TM1621D system clock is used to generate the LCD driver clock. The on-chip RC oscillator (256KHz) generates the clock source. Executing SYS DIS command can stop the system clock and LCD bias generator work, SYS DIS command only applies to the on-chip RC oscillator, when the system clock stops working, the LCD will display blank.LCD OFF command is used to turn off the LCD bias generator, when the LCD bias generator is turned off, the SYS DIS command can be used to reduce the power consumption of the system, which makes SYS DIS as the SYS DIS is a power saving command. The TM1621D is in SYS DIS state when the system starts to power up.

3、LCD Driver

The TM1621D is a 56 (14x4) dot LCD driver that can be software configured to 1/2 or 1/3 LCD driver bias and 2, 3, or 4 common ports, a feature that makes the TM1621D suitable for a wide range of LCD applications.The LCD driver clock is generated by dividing the system clock, and the frequency value of the LCD driver clock is maintained at 256 Hz.LCD See the following table for driver related commands.

name (of a thing)	command code	Functional Description
LCD OFF	10000000010X	Turn off the LCD output
LCD ON	10000000011X	Turn on the LCD output

BIAS&COM	1000010abXcX	c=0: 1/2 bias selectable c=1: 1/3 bias selectable ab=00: 2 common ports available ab=01: 3 common ports available ab=10: 4 common ports optional

Bold 100, i.e. **''100''**, indicates the command mode type. If you execute consecutive commands, the mode type code of other commands will be ignored except the first one.LCD OFF command disables the LCD bias generator to turn off the LCD display, while LCD ON command makes the LCD bias generator effective to turn on the LCD display.BIAS&COM is the command related to the LCD module, which makes the TM1621D compatible with most of the LCD modules. LCD modules.

4. Order format

The TM1621D can be set up with software. Two modes of commands configure the TM1621D and transmit the data displayed by the LCD. The configuration mode of the TM1621D is called Command Mode and has a type code of 100. Command Mode consists of a System Configuration command, a System Frequency Selection command, an LCD Configuration command, and an Operation command. The following table shows the data and command mode type code tables.

manipulate	paradigm	type code
WRITE	digital	101
COMMAND	command	100

Mode commands shall be run before data or commands are transmitted, and the command mode code, **100**, shall be ignored if successive commands are executed. When the system is in the Discontinuous Command Mode or Discontinuous Address Data Mode, pin/CS shall be set to **"1"** and the previous operating mode shall be reset. When pin/CS returns to **"0"**, the new operating mode type code shall run first.

5. Interface

The TM1621D has only three pins for interfacing. Pin/CS is used to initialize the serial interface circuitry and terminate communication between the host controller and the TM1621D. When pin/CS is set to **"1"**, data and commands between the host controller and the TM1621D are invalidated and initialized. The serial interface of the TM1621D must be initialized with a high level pulse before generating a mode command or mode transition. Pin DATA is the serial data input/output pin; read/write data and write commands are routed through pin DATA. Pin /WR is the Write Clock Input pin, where data, addresses and commands on pin DATA are written to the TM1621D on the rising edge of the /WR signal.
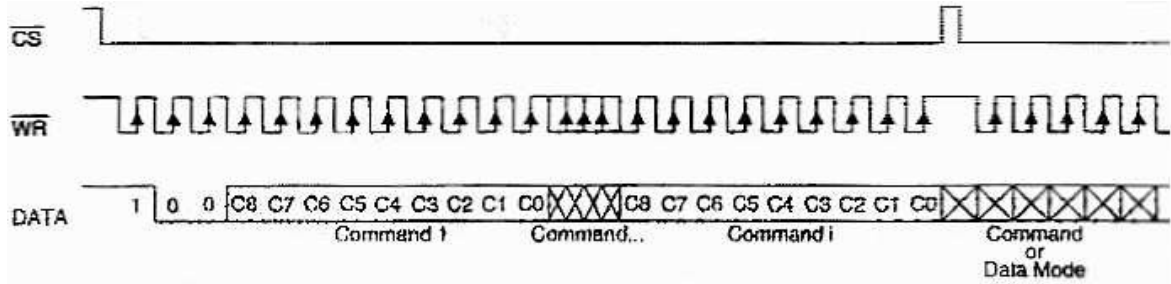
6. Timing diagram

WRITE mode (command code **101**)
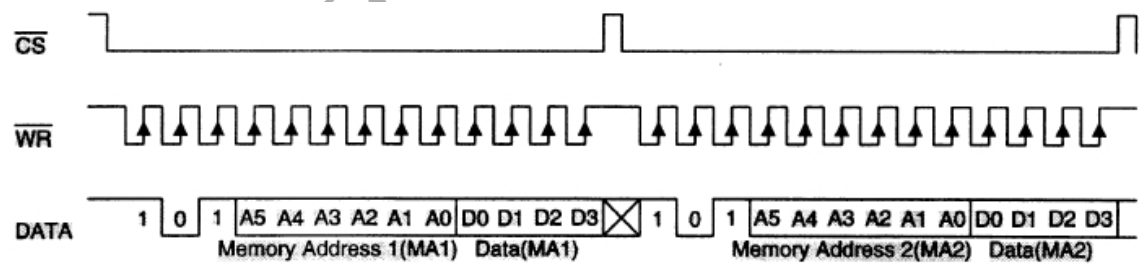

WRITE mode (write sequential address)

14x4　LCD Driver　　　TM1621D
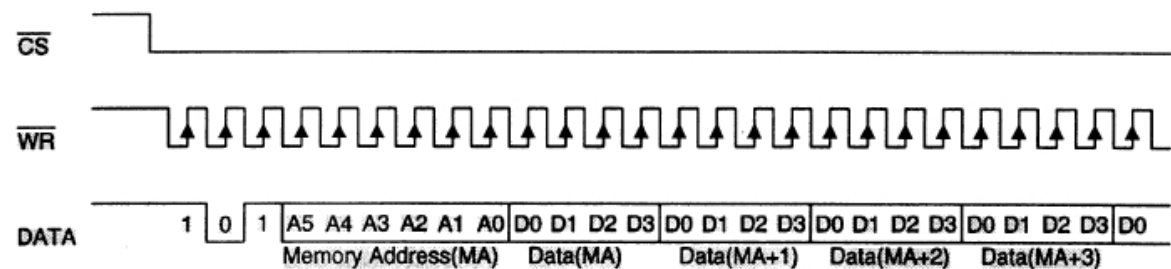
Command mode (command code **100**)

Command Overview

command name	Command Code	D/C	Function Description	Reset missing on power-up leave out
WRITE	**101** a5a4a3a2a1a0d0d1d2d3	D	Write data to RAM	
SYS DIS	10000000000X	C	Turn off the system oscillator and LCD bias. generator	Y
SYS EN	10000000001X	C	Turn on the system oscillator	
LCD OFF	10000000010X	C	Turn off the LCD bias generator.	Y
LCD ON	10000000011X	C	Turn on the LCD bias generator	
XTAL 32K	100000101XXX	C	System Clock Source Crystals	
RC 256K	100000110XXX	C	System clock source on-chip RC oscillator	Y
BIAS1/2	1000010abX0X	C	LCD 1/2 bias option ab=00: 2 common ports ab=01: 3 common ports ab=10:4 public ports	
	Note: X: 0 or 1; a5 to a0: RAM address; d3 to d0: RAM data			
BIAS 1/3	1000010abX1X	C	LCD 1/3 Bias Option ab=00: 2 common ports ab=01: 3 common ports ab=10:4 public ports	
TOPT	10011100000X	C	test pattern	
TNORMAL	10011100011X	C	normal mode	Y

D/C data/command mode

　　All bold numbers, i.e., 101 and 100, are mode commands. 100 is the command mode type code, which is used if successive commands are run, except for the first command. command, the mode type code of other commands will be ignored. It is recommended to initialize the TM1621D with the host controller after a power-on reset because if the power-on reset fails, the TM1621D will not work properly.
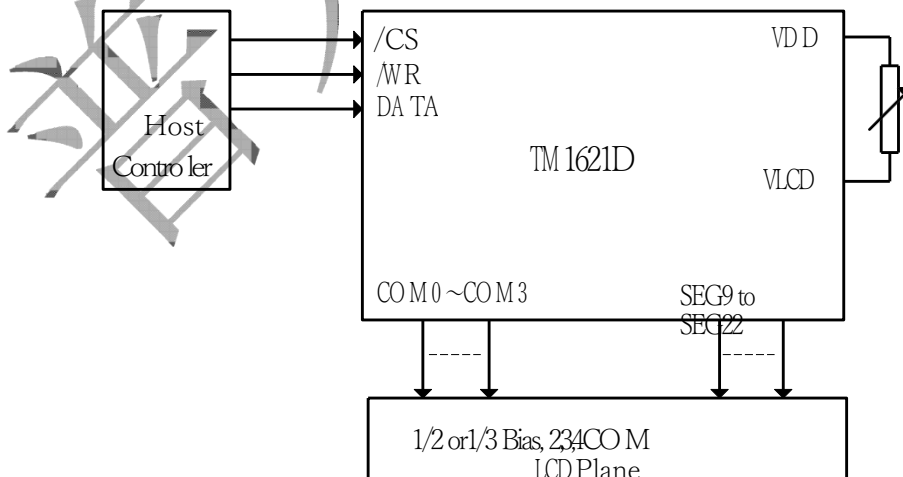
Pin Driver Waveforms

Gives a waveform that displays "2" using 1/4 multiplexing with 1/3 bias drive:
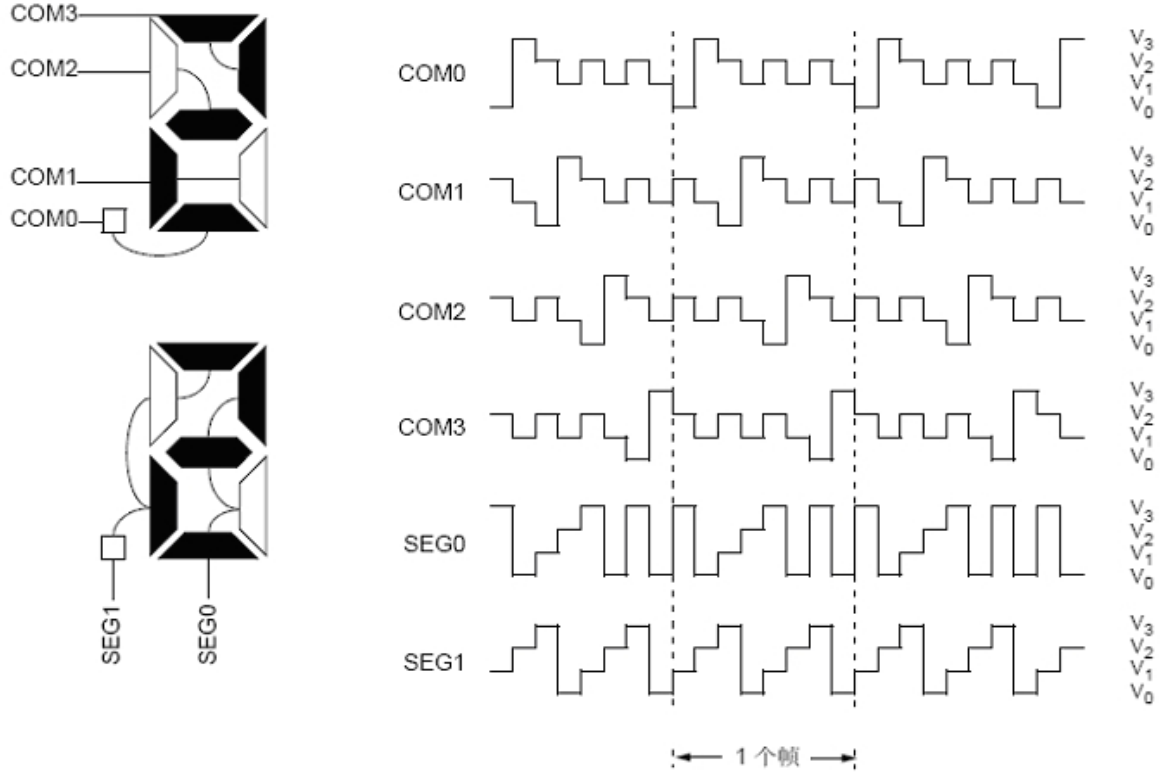
V2=2/3VDD
V1=1/3VDD
V0=0

Peripheral Application Block Diagram

The main controller and the TM1621D form a display system, see the figure below.

Note: 1. The voltage at the VLCD pin must be less than the voltage at the VDD pin;

2.VR resistor is used to adjust the gray scale of LCD display, when VDD=5V, VLCD=4V, VR is generally selected as 15KΩ (±).

(20%).

Package Outline Diagram

SOP24

标注 \ 尺寸	最 小（mm）	最 大（mm）	标注 \ 尺寸	最 小（mm）	最 大（mm）
A	15.28	15.48	C4	0.86TYP	
A1	0.406TYP		D	1.34TYP	
A2	1.27TYP		D1	0.33TYP	
A3	0.50TYP		D2	0.70	0.90
B	9.90	10.50	R1	0.25TYP	
B1	7.42	7.62	R2	0.25TYP	
B2	8.7TYP		θ1	7° TYP	
C1	2.13	2.23	θ2	7° TYP	
C2	0.204	0.33	θ3	4° TYP	
C3	0.10	0.25	θ4	10° TYP	

DETAIL "X"

9
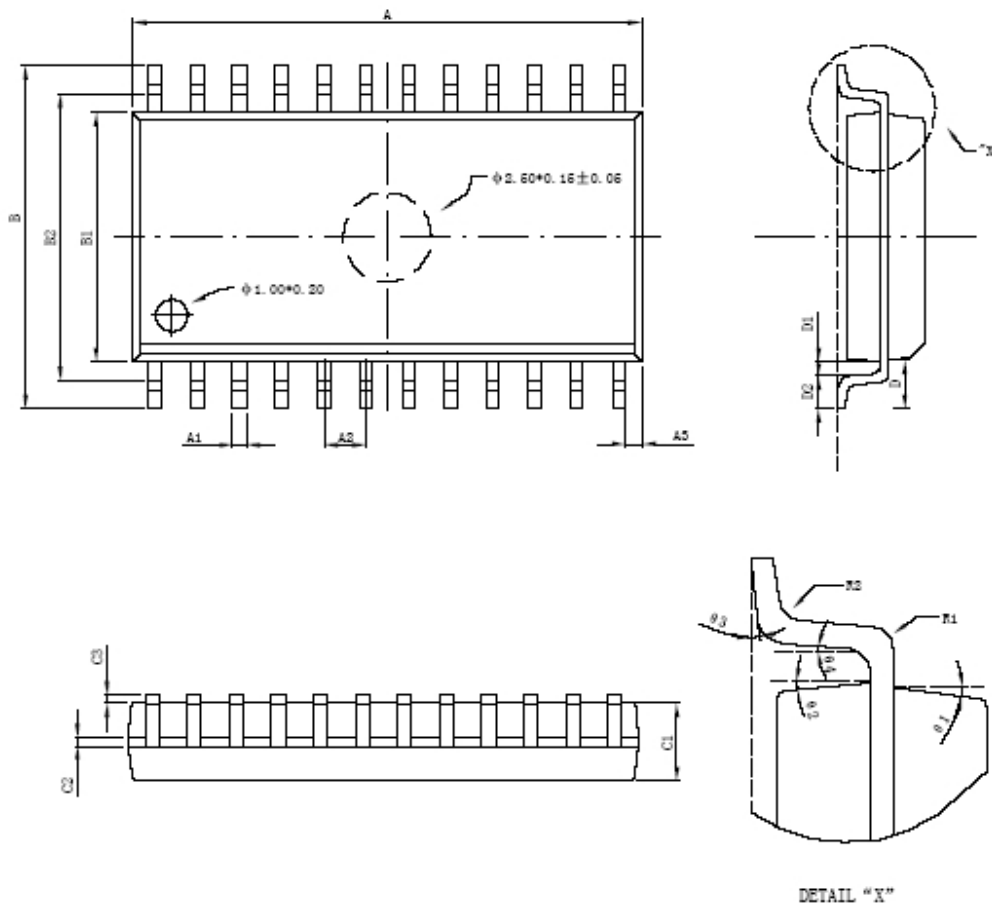
revision history (of a document, web page etc)

releases	Issue date	Introduction to the revision
V1.0	2012-03-20	Official Release