

PRECISE DISPLAY

XIAMEN PRECISE DISPLAY CO., LTD.

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

PART NUMBER:

PCM1602KS-FL-GBW-01

DATE:

2016.03.28

1.0 MECHANICAL SPECS

1. Overall Module Size	80.0mm(W) x 36.0mm(H) x max 13.5mm(D) for LED backlight version
2. Dot Size	0.56mm(W) x 0.61mm(H)
3. Dot Pitch	0.61mm(W) x 0.66mm(H)
4. Duty	1/16
5. Controller IC	ST7066U-A
6. LC Fluid Options	STN
7. Polarizer Options	Positive and Transflective
8. Viewing Angle	6:00 o'clock
9. Backlight Options	LED(Yellow-Green)
10. Temperature Range Options	WideTemp (Operating: -20°C ~ 70°C, Storage:-30°C ~ 80°C)

2.0 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min	Typ	Max	Unit
Operating temperature (Standard)	Top	0	-	50	°C
Storage temperature (Standard)	Tst	-10	-	60	°C
Operating temperature (Wide temperature)	Top	-20	-	70	°C
Storage temperature (Wide temperature)	Tst	-30	-	80	°C

3.0 ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Power Supply Voltage	V _{DD}	-	4.7	5.0	5.5	V _{DD}
Power Supply Current	I _{DD}	V _{DD} =5.0V,	10	18	25	mA
“H” level input	V _{IH}	-	0.7* V _{DD}	-	V _{DD}	V
“L” level input	V _{IL}	-	V _{SS}	-	0.6	V

4.0 OPTICAL CHARACTERISTICS (Ta=25°C, Vdd= 5.0V±0.25V, STN LC fluid)

Item	Symbol	Condition	Min	Typ	Max	Unit
Viewing angle (horizontal)	θ	$Cr \geq 2.0$	-60	-	35	deg
Viewing angle (vertical)	ϕ	$Cr \geq 2.0$	-40	-	40	deg
Contrast Ratio	Cr	$\phi=0^\circ, \theta=0^\circ$	-	6	-	
Response time (rise)	Tr	$\phi=0^\circ, \theta=0^\circ$	-	150	250	ms
Response time (fall)	Tf	$\phi=0^\circ, \theta=0^\circ$	-	150	250	ms

6.0 PIN ASSIGNMENT
P1:

Pin No.	Symbol	Function
1	RX	RS232(TTL)Serial input port
2	Vss	Ground
3	VDD	Supply Voltage(+5V)

P2:

Pin No.	Symbol	Function
1	SPISS	SPI Slave Select(NC in I2C mode)
2	SDO	NO Connect
3	SCK/SCL	Serial Clock
4	SDI/SDA	Serial Data in(SPI)/Serial Data(I2C)
5	Vss	Ground
6	VDD	Supply Voltage(+5V)

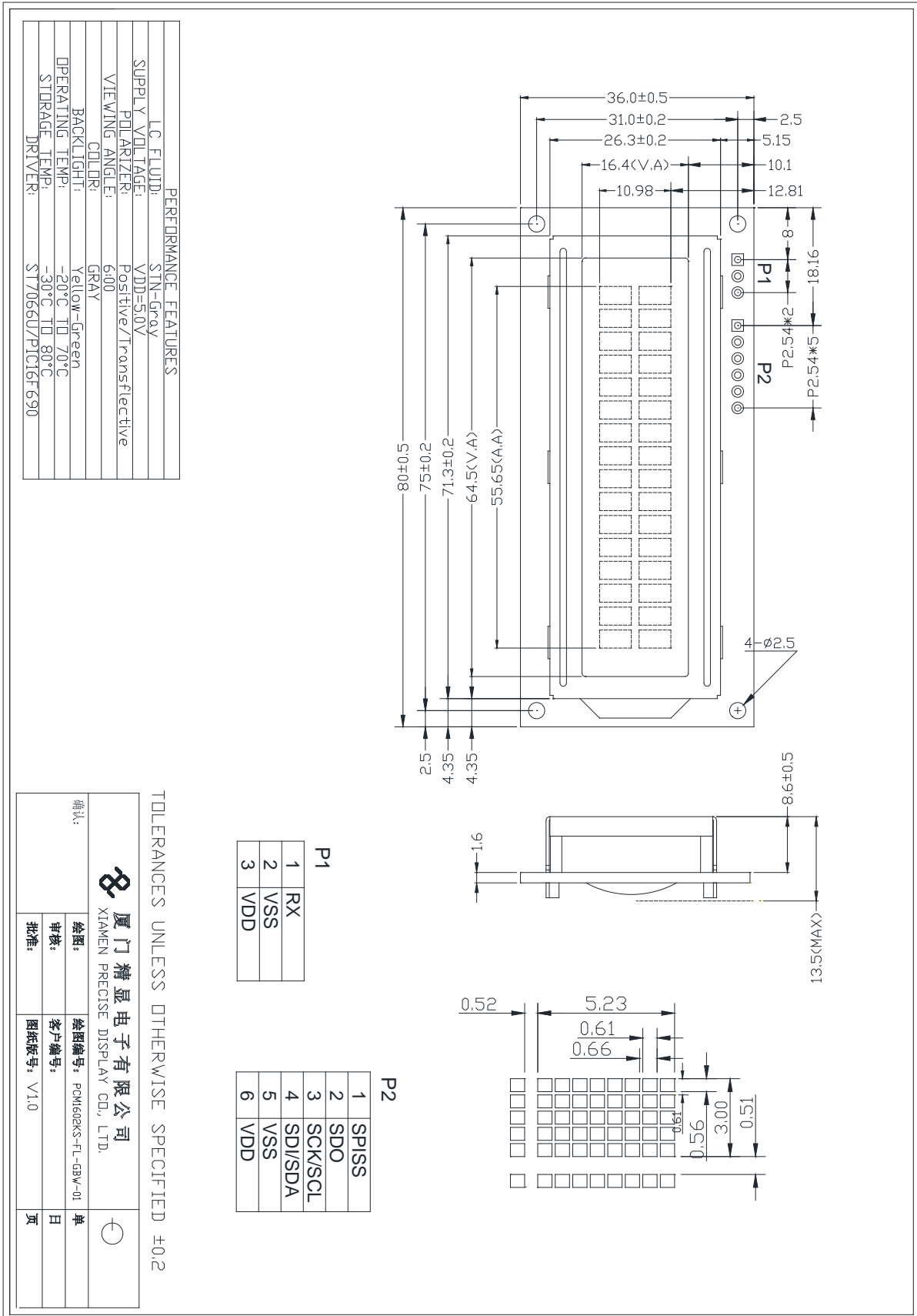
7.0 Communication Selection

To enter the I2C mode Short R2

To enter the SPI mode Short R1

To enter the RS232 mode Open R1, R2 (default)

8.0 MECHANICAL DIAGRAM



9.0 RELIABILITY TEST

Storage Condition	Content	Evaluations and Assessment*			
		Current Consumption	Oozing	Contrast	Other Appearances
Operation at high temperature and humidity	40°C,90% RH,240hrs	Twice initial value or less	none	More than 80% of initial value	No abnormality
High temperature storage	60°C, 240hrs	Twice initial value or less	none	More than 80% of initial value	No abnormality
Low temperature storage	-20°C, 240hrs	Twice initial value or less		More than 80% of initial value	No abnormality

*Evaluations and assessment to be made two hours after returning to room temperature (25°C±5°C).

*The LCDs subjected to the test must not have dew condensation.

10.0 INTRODUCTION

The Serial Interface is capable of communicating in I²C, SPI or RS232/TTL format. In this chapter, a detailed description is provided for each protocol.

I²C Communication

The default I²C address is 0x50 (50hex). The I²C address can be changed to any 8-bit value by command function, with the exception that the LSB (least significant bit) must always be '0'. Once the I²C address has been changed, it will be saved in the system memory, and it will revert back to the default address if either RS232 or SPI protocol is selected.

The I2C interface is capable of receiving data at up to 100 KHz-clock rate.

SPI Communication

The SPI mode has a normally high level idle clock; data sampled on the rising edge of the clock and Slave Select is enabled.

RS232 Communication

The RS232 signal must be 5V, TTL compatible. The communication format is 8-bit data, one stop bit, no parity and no hand shaking. The default BAUD rate is 9600, and it is changeable with a command function, once the BAUD rate is changed, it will be saved in the system memory, and it can be reversed back to default BAUD rate if either I²C or SPI protocol is selected.

1.1 Changing the I²C Slave Address

Syntax hexadecimal 0xFE 0x62 [adr]

Parameter	Parameter	Length	Description
	[adr]	1 byte	New I ² C address, 0x00 – 0xFE The LSB is always '0'.

This command sets the I2C address, the address must be an even number, (LSB = 0). The address change requires 20 microseconds to take effect; therefore, the subsequent input must have an appropriate delay. The default I²C address can be restored if SPI or RS232 is selected as the communication mode.

Default 0x50

1.2 Changing BAUD Rate

Syntax hexadecimal 0xFE 0x61 [baud]

Parameter	Parameter	Length	Description
	[baud]	1 byte	New RS232 BAUD Rate, 1 - 8

This command sets the RS232 BAUD rate, the single byte parameter select the desired BAUD rate as in the table below. The new BAUD rate requires 20 microsecond to take effect, therefore, the subsequent input must have an appropriate delay. The default BAUD rate can be restored if I2C or SPI is selected as the communication mode. Illegal parameter input will be discarded.

Default 9600 BAUD

Parameter	BAUD
1	300
2	1200
3	2400
4	9600
5	14400
6	19.2K
7	57.6K
8	115.2K

2 BUILD-IN FUNCTIONS

Introduction

There several build-in functions in the serial interface to facilitate the LCD control, These functions eliminate the needs for end user to understand the HD44780 instruction set and timing requirements. It also provides control for features that are not accessible with a serial connection.

2.1 Turn On Display

Syntax hexadecimal 0xFE 0x41

Parameter	Parameter	Length	Description
	None	None	Turn on LCD screen

This command turn on the LCD display screen, the display text is not altered.
Default LCD screen is on

2.2 Turn Off Display

Syntax hexadecimal 0xFE 0x42

Parameter	Parameter	Length	Description
	None	None	Turn off LCD screen

This command turn off the LCD display screen, the display text is not altered.
Default LCD screen is on

2.3 Set Cursor Position

Syntax hexadecimal 0xFE 0x45 [pos]

Parameter	Parameter	Length	Description
	[pos]	1 byte	Put cursor at location specified by [pos], 0x00 to 0x67

This command moves the cursor to a specified location where the next character will be displayed. A typical cursor position for a 4-line display is show below; a cursor position outside these ranges will not be viewable.

	Column 1	...	Column 20
Line 1	0x00	...	0x13
Line 2	0x40	...	0x53
Line 3	0x14	...	0x27
Line 4	0x54	...	0x67

.Default After a reset, the cursor is on position 0x00.

2.4 Home Cursor

Syntax hexadecimal 0xFE 0x46

Parameter	Parameter	Length	Description
	None	None	Position cursor at line 1 column 1

This command move the cursor to line 1, column 1 of the LCD screen, the display text is not altered.
Default None

2.5 Turn On Underline Cursor

Syntax hexadecimal 0xFE 0x47

Parameter	Parameter	Length	Description
	None	None	Turn on underline cursor

This command turn on the underline cursor, the cursor position is where the next character will appear.
Default The underline cursor is off.

2.6 Turn Off Underline Cursor

Syntax hexadecimal 0xFE 0x48

Parameter	Parameter	Length	Description
	None	None	Turn off underline cursor

This command turn off the underline cursor.
Default The underline cursor is off.

2.7 Move Cursor Left One Space

Syntax hexadecimal 0xFE 0x49

Parameter	Parameter	Length	Description
	None	None	Move cursor left 1 space

This command move the cursor position left 1 space, regardless the cursor is displayed or not, and the displayed character is not altered
Default None

2.8 Move Cursor Right One Space

Syntax hexadecimal 0xFE 0x4A

Parameter	Parameter	Length	Description
	None	None	Move cursor right 1 space

This command move the cursor position right 1 space, regardless the cursor is displayed or not, and the displayed character is not altered

Default None

2.9 Turn On Blinking Cursor

Syntax hexadecimal 0xFE 0x4B

Parameter	Parameter	Length	Description
	None	None	Turn on the blinking cursor

This command turn on the blinking cursor, both the cursor and the character on the cursor will blink.

Default The blinking cursor is off.

2.10 Turn Off Blinking Cursor

Syntax hexadecimal 0xFE 0x4C

Parameter	Parameter	Length	Description
	None	None	Turn off the blinking cursor

These commands turn off the blinking cursor.

Default The blinking cursor is off.

2.11 Back Space

Syntax hexadecimal 0xFE 0x4E

Parameter	Parameter	Length	Description
	None	None	Move cursor back one space and delete the character on the cursor.

This command is destructive backspace, the cursor is moved back one space and the character on the cursor is deleted.

Default None.

2.12 Clear Screen

Syntax hexadecimal 0xFE 0x51

Parameter	Parameter	Length	Description
	None	None	Clear LCD and move cursor to line 1 column 1.

This command clears the entire display and place the cursor at line 1 column 1.
Default None.

2.13 Set Display Contrast

Syntax hexadecimal 0xFE 0x52 [contrast]

Parameter	Parameter	Length	Description
	[contrast]	1 byte	Set the display contrast, value between 1 to 50

This command set the LCD character display contrast, the contrast setting is between 1 to 50, where 50 is the Highest contrast.

Default Default contrast value is 40.

2.14 Set Backlight Brightness

Syntax hexadecimal 0xFE 0x53 [brightness]

Parameter	Parameter	Length	Description
	[brightness]	1 byte	Set the LCD backlight brightness level, value between 1 to 16

This command set the LCD display backlight brightness level, the value is between 1 to 16.

Default Default contrast value is 1.

2.15 Load Custom Characters

Syntax hexadecimal 0xFE 0x54 [addr] [d0 ...d7]

Parameter	Parameter	Length	Description
	[addr]	1 byte	Custom character address, 0 – 7
	[D0..D7]	8 bytes	Custom character pattern bit map

There are spaces for eight user defined custom characters, this command load the custom character into one of the eight locations. The custom character pattern is bit mapped into 8 data bytes, the bit map for Spanish character ‘¿’ is shown in table below, to display the custom character, user simply enter the address of the character (0 to 8).

Default None.

Bit	7	6	5	4	3	2	1	0	Hex
Byte 1	0	0	0	0	0	1	0	0	0x04
Byte 2	0	0	0	0	0	0	0	0	0x00
Byte 3	0	0	0	0	0	1	0	0	0x04
Byte 4	0	0	0	0	1	0	0	0	0x08
Byte 5	0	0	0	1	0	0	0	0	0x10
Byte 6	0	0	0	1	0	0	0	1	0x11
Byte 7	0	0	0	0	1	1	1	0	0x0E
Byte 8	0	0	0	0	0	0	0	0	0x00

2.16 Shift Display to the Left

Syntax hexadecimal 0xFE 0x55

Parameter	Parameter	Length	Description
	None	None	Shift the LCD screen to the left one Place.

This command shift the display one place to the left, the cursor position also moves with the display, and the display data is not altered.

Default None

2.17 Shift Display to the Right

Syntax hexadecimal 0xFE 0x56

Parameter	Parameter	Length	Description
	None	None	Shift the LCD screen to the right one Place.

This command shift the display one place to the right, the cursor position also moves with the display, and the display data is not altered.

Default None

2.18 Display Firmware Version Number

Syntax hexadecimal 0xFE 0x70

Parameter	Parameter	Length	Description
	None	None	Display the firmware version number.

This command displays the micro-controller firmware version number.

Default None.

2.19 Display RS232 Baud Rate

Syntax hexadecimal 0xFE 0x71

Parameter	Parameter	Length	Description
	None	None	Display Baud Rate

This command displays the current RS232 BAUD rate.

Default None.

2.20 Display I²C Address

Syntax hexadecimal 0xFE 0x72

Parameter	Parameter	Length	Description
	None	None	Display I ² C Address

This command display the current I²C slave address.

Default None.

2.21 Direct HD44780 Command

Syntax hexadecimal 0xFE 0xFE [cmd]

Parameter	Parameter	Length	Description
	[cmd]	1 byte	Direct interface to the LCD controller, HD44780.

This command is for advanced programmer, it allows LCD instruction to send directly to the HD44780 controller.
Default None.

3 ASCII TEXT

To display normal text, just enter its ASCII number, a number from 0x00 to 0x07 displays the user defined custom character, 0x20 to 0x7F displays the stand set of characters. And numbers from 0xA0 to 0xFD display characters and symbols that are factory-masked on the HD44780 controller and 0xFE is reserved for function command.

Table of Commands

Prefix	CMD	Param	Description
0xFE	0x41	None	Display on
0xFE	0x42	None	Display off
0xFE	0x45	1 Byte	Set cursor
0xFE	0x46	None	Cursor home
0xFE	0x47	None	Underline cursor on
0xFE	0x48	None	Underline cursor off
0xFE	0x49	None	Move cursor left one place
0xFE	0x4A	None	Move cursor right one place
0xFE	0x4B	None	Blinking cursor on
0xFE	0x4C	None	Blinking cursor off
0xFE	0x4E	None	Backspace
0xFE	0x51	None	Clear screen
0xFE	0x52	1 Byte	Set contrast
0xFE	0x53	1 Byte	Set backlight brightness
0xFE	0x54	9 Byte	Load custom character
0xFE	0x55	None	Move display one place to the left
0xFE	0x56	None	Move display one place to the right
0xFE	0x61	1 Byte	Change RS232 BAUD rate 232
0xFE	0x62	1 Byte	Change I2C address 设置 I2C
0xFE	0x70	None	Display firmware version number
0xFE	0x71	None	Display RS232 BAUD rate 显示 232 波特率
0xFE	0x72	None	Display I2C address 显示 I2C
0xFE	0xFE	1 Byte	Send control byte to LCD

11.0 STANDARD CHARACTER PATTERNS

Lower 4 Bits \ Upper 4 Bits	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
xxxx0000	CG RAM (1)		0	a	P	`	P				-	夕	≡	α	ρ	
xxxx0001	(2)		!	1	A	Q	a	q			。	ア	チ	△	△	q
xxxx0010	(3)		"	2	B	R	b	r			「	イ	ツ	×	β	θ
xxxx0011	(4)		#	3	C	S	c	s			」	ウ	テ	ε	ε	∞
xxxx0100	(5)		\$	4	D	T	d	t			、	エ	ト	ト	μ	Ω
xxxx0101	(6)		%	5	E	U	e	u			・	オ	ナ	1	ε	ü
xxxx0110	(7)		&	6	F	V	f	v			ヲ	カ	ニ	ヨ	ρ	Σ
xxxx0111	(8)		'	7	G	W	g	w			ア	キ	ヌ	ラ	g	π
xxxx1000	(1)		(	8	H	X	h	x			イ	ク	ネ	リ	γ	∞
xxxx1001	(2)		)	9	I	Y	i	y			ウ	ケ	ル	ル	γ	γ
xxxx1010	(3)		*	:	J	Z	j	z			エ	コ	ハ	レ	j	≠
xxxx1011	(4)		+	;	K	[	k	<			オ	サ	ヒ	ロ	°	≠
xxxx1100	(5)		,	<	L	¥	l	l			カ	シ	フ	ワ	≠	≠
xxxx1101	(6)		-	=	M	]	m	}			ユ	ヌ	ハ	ン	≠	÷
xxxx1110	(7)		.	>	N	^	n	→			ヨ	セ	ホ	°	≠	
xxxx1111	(8)		/	?	O	_	o	←			ッ	ソ	マ	°	ö	■

Note: The character generator RAM is the RAM with which the user can rewrite character patterns by program.