



PRODUCT SPECIFICATION

MONO LCD MODULE
MODEL: NLCMC216I

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1. Features

The features of LCD are as follows

- * Display mode : FSTN/Reflective/Positive
- * Controller IC : ST7032i
- * Display format : 16x2 Characters
- * Interface Input Data : I²C
- * Driving Method : 1/16Duty, 1/5Bias
- * Viewing Direction : 6 O'clock
- * Backlight : Without

2. MECHANICAL SPECIFICATIONS

Item	Specification	Unit
Module Size	54(W) x26(H) x2.85MAX(T)	mm
Viewing Area	50(W) x 16(H)	mm
Activity Area	46.7(W)x10(H)	mm
Character Font	5X8 Dots	-
Character Size	2.45(W)x4.75(H)	mm
Character Pitch	2.95(W)x5.25(H)	mm
Dot Size	0.45(W)x0.55(H)	mm

3. ELECTRICAL SPECIFICATIONS

3-1 ABSOLUTE MAXIMUM RATINGS (Ta = 25 °C)

Item	Symbol	Standard Value			Unit
		Min.	Typ.	Max.	
Supply Voltage For Logic	V _{DD} – V _{SS}	-0.3	-	6.0	V
Supply Voltage For LCD Drive	V _{OP} = V _{DD} –V ₀	7.0-V _{SS}	-	-0.3+V _{SS}	V
Input Voltage	V _{in}	-0.3	-	V _{DD} +0.3	V
Operating Temp.	T _{op}	-20	-	+70	°C
Storage Temp.	T _{st}	-30	-	+80	°C

*. NOTE: The response time will be extremely slow when the operating temperature is around -10°C, and the back ground will become darker at high temperature operating.

3-2 ELECTRICAL CHARACTERISTICS**3-2-1.DC CHARACTERISTICS (VDD=3.3V, Ta=25°C)**

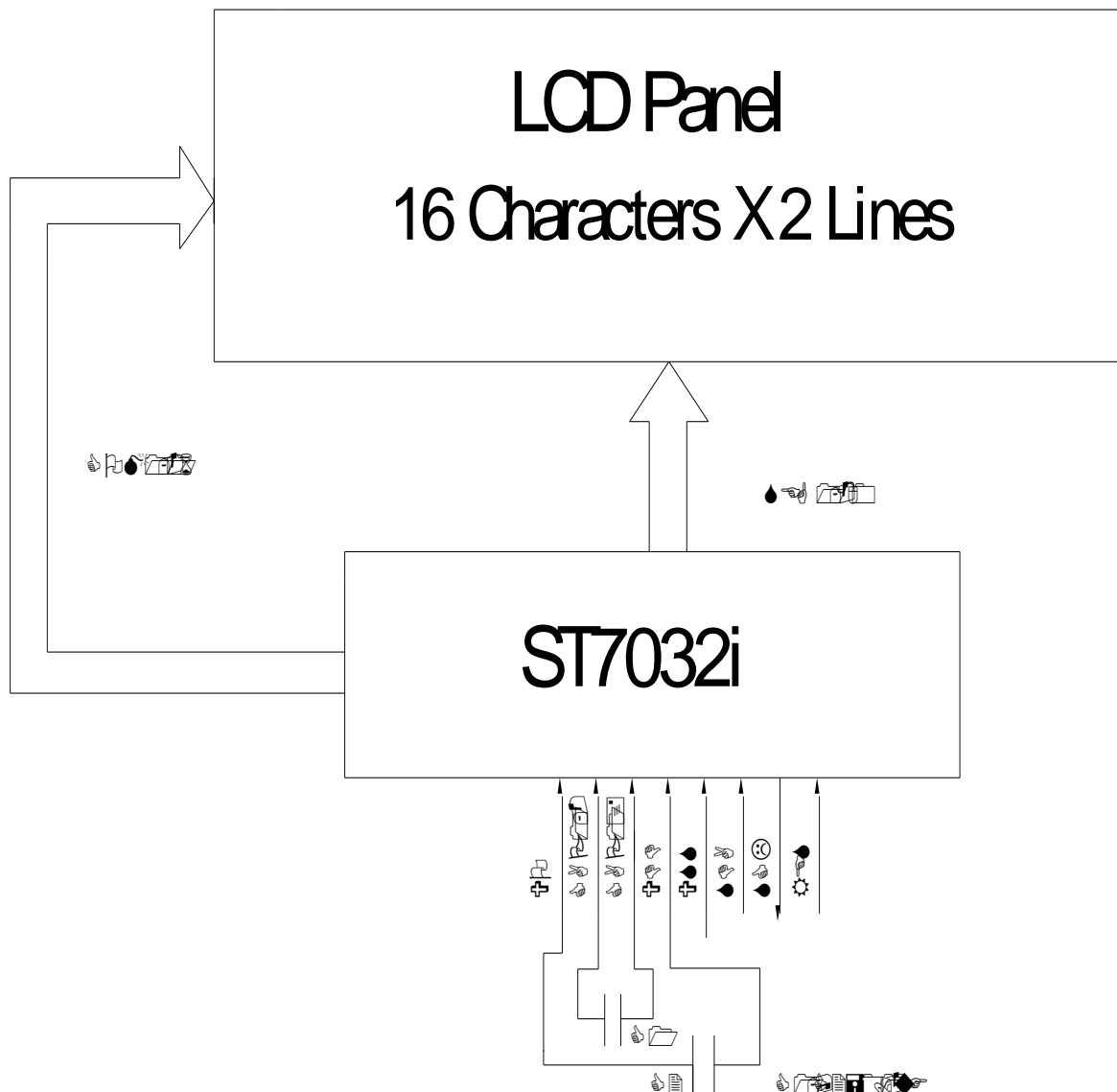
Item		Symbol	Test Condition	Min.	Typ.	Max.	Unit
Logic supply Voltage		$V_{DD} - V_{SS}$	$V_{DD} = 3.0V$ $T_a = 25\text{ }^\circ\text{C}$	2.5	3.0	3.3	V
LCD Drive		$V_{OP}=V_{LCD}$		4.5	4.8	5.1	V
Input Voltage	"H" Level	V_{IH}		$0.7 V_{DD}$	-	V_{DD}	V
	"L" Level	V_{IL}		-0.3	-	0.8	V
Frame Frequency		f_{FLM}		-	60	-	KHz
Current Consumption		I_{DD}		-	0.26	-	mA

4 . TERMINAL FUNCTIONS AND BLOCK DIAGRAM

4-1. INTERFACE PIN FUNCTION DESCRIPTION

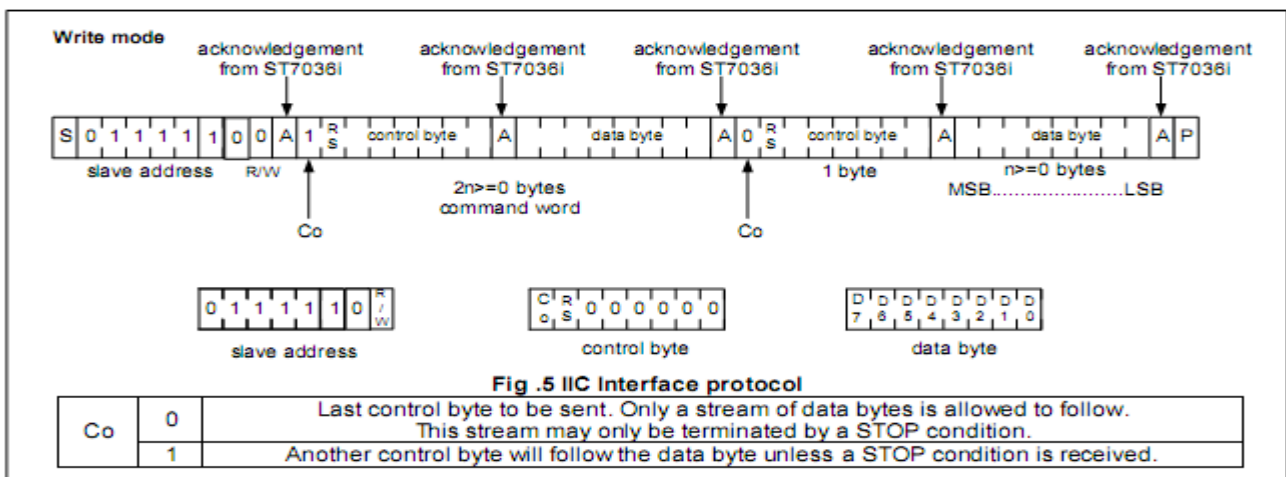
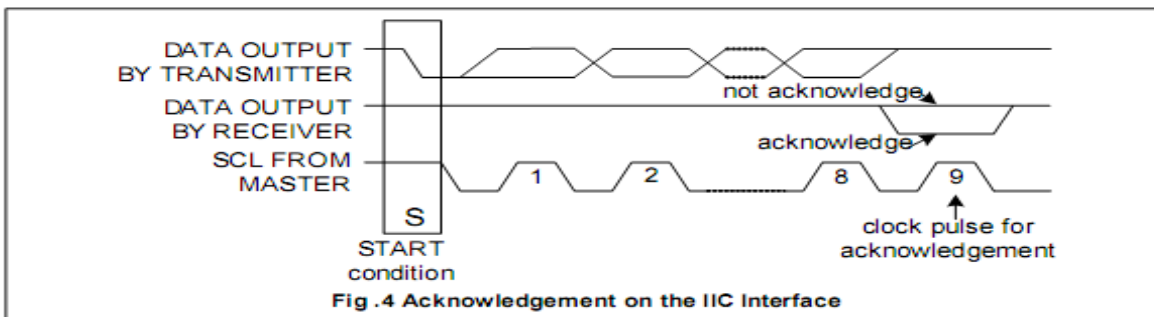
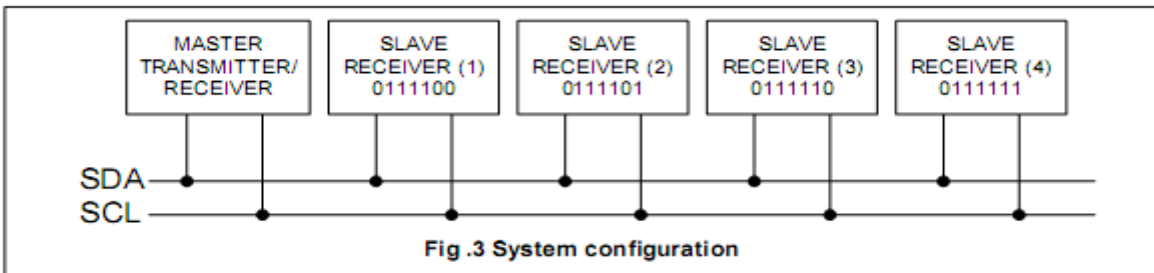
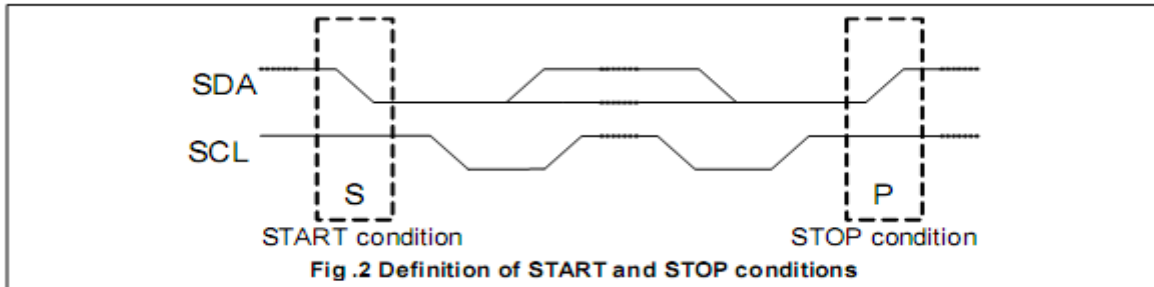
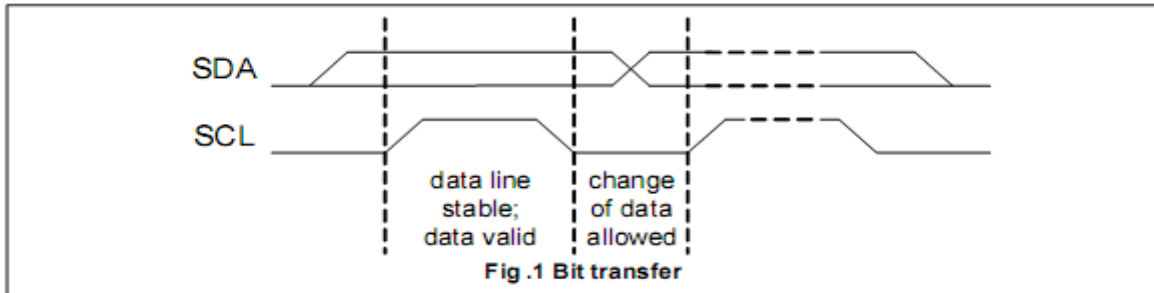
PIN NO.	SYMBOL	FUNCIONS
1	RES	Reset pin
2	SCL	Serial clock input
3	SDA	Serial data input
4	VSS	Ground
5	VDD(3.0V)	Supply voltage for logical circuit
6	CAP1+	For voltage booster circuit (vdd-vss), External capacitor about 0.1-0.47uF.
7	CAP1-	
8	VO	DC/DC Voltage converter.

4-2. BLOCK DIAGRAM



5. TIMING CHARACTERISTICS

5-1. AC Characteristics



6. COMMAND LIST

6.1 command table

(when "EXT" option pin connect to Vss, the instruction set follow below table)

Instruction	Instruction Code											Description	Instruction Execution Time		
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	OSC=380kHz		OSC=540kHz	OSC=700kHz	
Clear Display	0	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.08 ms	0.76 ms	0.59 ms
Return Home	0	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.08 ms	0.76 ms	0.59 ms
Entry Mode Set	0	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	26.3 μs	18.5 μs	14.3 μs
Display ON/OFF	0	0	0	0	0	0	1	D	C	B		D=1:entire display on C=1:cursor on B=1:cursor position on	26.3 μs	18.5 μs	14.3 μs
Function Set	0	0	0	0	1	DL	N	DH	IS2	IS1		DL: interface data is 8/4 bits N: number of line is 2/1 DH: double height font IS[2:1]: instruction table select	26.3 μs	18.5 μs	14.3 μs
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0		Set DDRAM address in address counter	26.3 μs	18.5 μs	14.3 μs
Read Busy Flag and Address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0		Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0	0	0
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0		Write data into internal RAM (DDRAM/CGRAM/ICONRAM)	26.3 μs	18.5 μs	14.3 μs
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0		Read data from internal RAM (DDRAM/CGRAM/ICONRAM)	26.3 μs	18.5 μs	14.3 μs

Instruction table 0(IS[2:1]=[0,0])

Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	X	X	S/C and R/L: Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	26.3 μs	18.5 μs	14.3 μs
Set CGRAM	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	26.3 μs	18.5 μs	14.3 μs

Instruction table 1(IS[2:1]=[0,1])

Bias Set	0	0	0	0	0	1	BS	1	0	FX	BS=1:1/4 bias BS=0:1/5 bias FX: fixed on high in 3-line application and fixed on low in other applications.	26.3 μs	18.5 μs	14.3 μs
Set ICON Address	0	0	0	1	0	0	AC3	AC2	AC1	AC0	Set ICON address in address counter.	26.3 μs	18.5 μs	14.3 μs
Power/ICON Control/ Contrast Set	0	0	0	1	0	1	Ion	Bon	C5	C4	Ion: ICON display on/off Bon: set booster circuit on/off C5,C4: Contrast set for internal follower mode.	26.3 μs	18.5 μs	14.3 μs
Follower Control	0	0	0	1	1	0	Fon	Rab 2	Rab 1	Rab 0	Fon: set follower circuit on/off Rab2~0: select follower amplified ratio.	26.3 μs	18.5 μs	14.3 μs
Contrast Set	0	0	0	1	1	1	C3	C2	C1	C0	Contrast set for internal follower mode.	26.3 μs	18.5 μs	14.3 μs

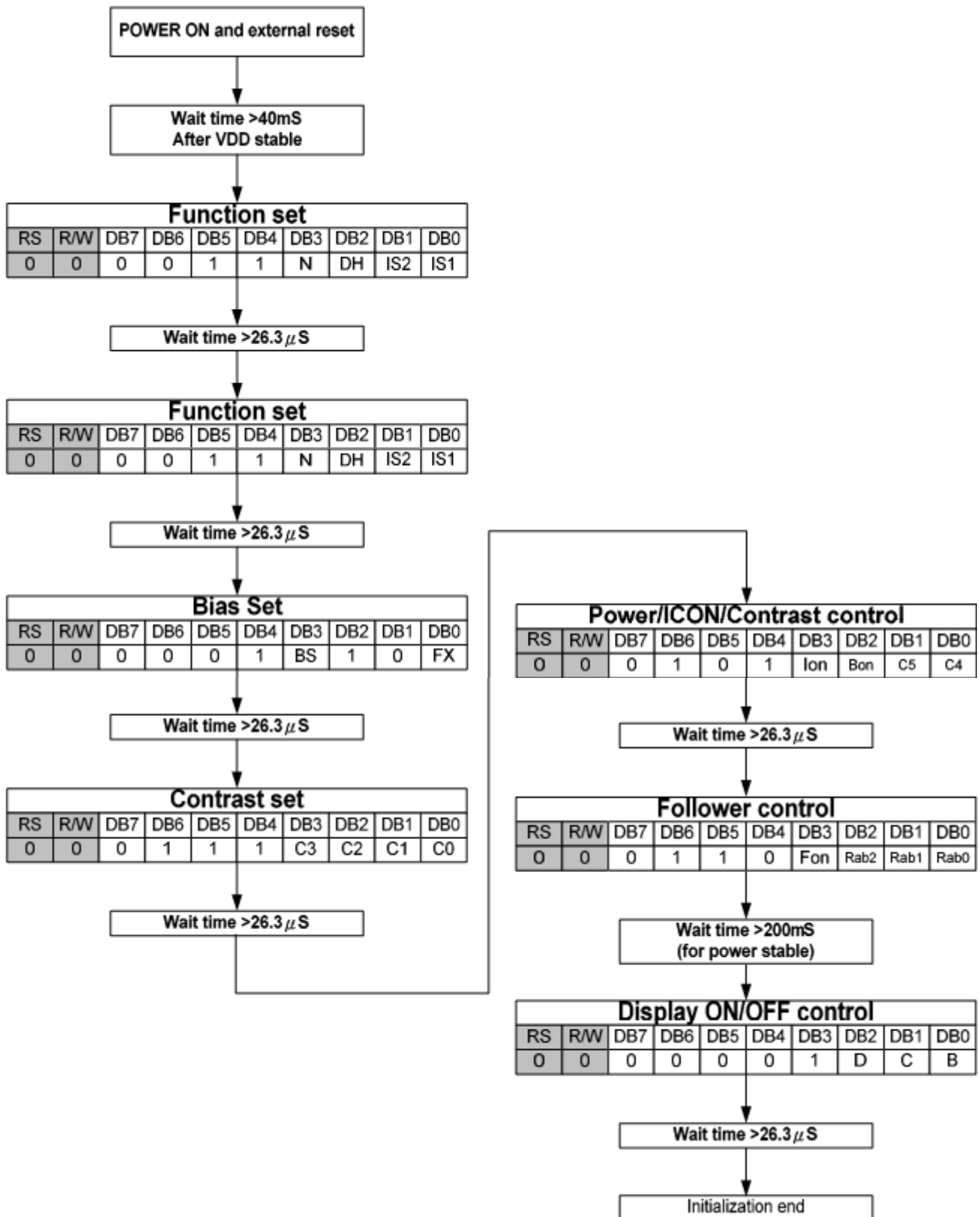
Instruction table 2(IS[2:1]=[1,0])

Double Height Position Select	0	0	0	0	0	1	UD	X	X	X	UD: Double height position select	26.3 μs	18.5 μs	14.3 μs
Reserved	0	0	0	1	X	X	X	X	X	X	Do not use (reserved for test)	26.3 μs	18.5 μs	14.3 μs

Instruction table 3(IS[2:1]=[1,1]):Do not use (reserved for test)

6.2 Initialization sequence

- Serial interface & IIC interface (fosc = 380kHz)



7. CHARACTER GENERATOR ROM

b7-b4 b3-b0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	Q	W	Y	0	Q	P	N	F	G	E	—	3	3	3	3	3
0001	J	T	L	1	A	O	a	9	Q	a	a	7	7	4	3	3
0010	8	8	"	2	B	R	b	m	8	E	T	4	9	3	3	3
0011	P	7	*	3	C	S	c	s	3	3	1	9	7	E	3	3
0100	d	7	*	4	D	T	d	t	3	3	v	1	1	1	3	3
0101	↑	4	%	5	E	U	e	u	3	3	.	3	3	1	3	3
0110	↓	0	&	6	F	V	F	V	3	3	7	7	3	3	7	7
0111	+	A	7	7	G	W	g	w	3	3	7	7	3	7	3	3
1000	e	E	C	8	H	X	h	x	3	3	4	3	3	3	3	3
1001	7	7	7	9	I	Y	i	y	3	3	*	7	7	7	7	3
1010	7	3	*	*	J	Z	j	z	3	3	3	3	3	3	3	3
1011	L	7	+	*	K	L	k	l	1	3	*	7	3	3	3	3
1100	U	3	.	<	L	7	l	l	1	3	*	3	3	3	3	3
1101	.	7	—	=	M	7	m	7	1	3	3	3	3	3	3	3
1110	3	3	.	>	N	3	n	3	3	3	3	3	3	3	3	3
1111	3	3	/	?	O	—	o	+	3	3	3	3	3	3	3	3

10. HANDLING PRECAUTION

(1) Mounting Method

The panel of the LCD Module consists of two thin glass plates with polarizer, which easily get damaged since the Module is fixed by utilizing fitting holes in the printed circuit board. Extreme care should be taken when handling the LCD Modules.

(2) Caution of LCD handling & cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Tricolor trifler thane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Kenton
- Aromatics

(3) Caution against static charge

The LCD Module use C-MOS LSI drivers, so we recommend that you connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on. And ground your body, Work/assembly table. And assembly equipment to protect against static electricity.

(4) Packaging

- Modules use LCD elements, and must be treated as such. Avoid intense shock and falls from a height.
- To prevent modules from degradation. Do not operate or store them exposed directly to sunshine or high temperature/humidity.

(5) Caution for operation

- It is indispensable to drive LCD's within the specified voltage limit since the higher voltage than the limits shorten LCD life. An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, Which will come back in the specified operating temperature range.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

Usage under the relative condition of 40°C, 50%RH or less is required.

(6) Storage

In the case of storing for a long period of time (for instance.) For years) for the purpose or replacement use, the following ways are recommended.

- Storage in a polyethylene bag with sealed so as not to enter fresh air outside in it, And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping temperature in the specified storage temperature range.
- Storing with no touch on polarizer surface by the anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery)

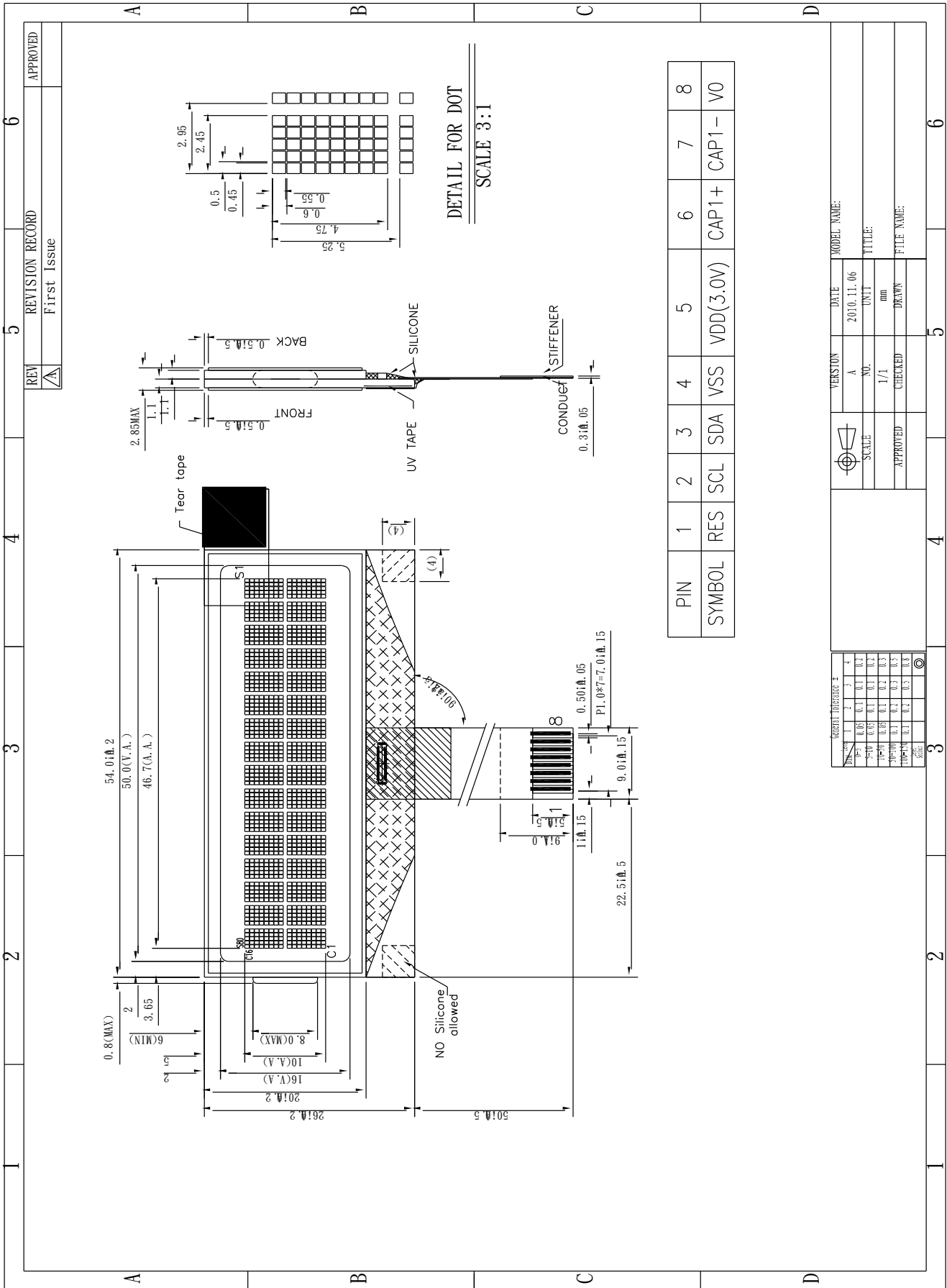
(7) Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol.

Which should be burned up later.

- When any liquid crystal leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

11. OUTLINE DIMENSION



PIN	1	2	3	4	5	6	7	8
SYMBOL	RES	SCL	SDA	VSS	VDD(3.0V)	CAP1+	CAP1-	V0

REVISION		DATE	MODEL NAME:
REV	NO.		
A	1/1	2010.11.06	
SCALE		UNIT	TITLE:
		mm	
APPROVED		CHECKED	DRWNN
			FILE NAME: