



CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model: CG9162D - _ _ - _ _ - _ _ - _

Revision	00
Engineering	Timothy Chan
Date	14 JAN 2019
Our Reference	X9065

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MODE OF DISPLAY**Display mode**

- ☐ TN positive
☐ TN negative
 STN : ☐ Yellow green
 ☐ Grey
 ☐ Blue (negative)
☐ FSTN positive
☐ FSTN negative

Display condition

- ☐ Reflective type
☐ Transflective type
☐ Transmissive type
☐ Others

Viewing direction

- ☐ 6 O' clock
☐ 12 O' clock
☐ 3 O' clock
☐ 9 O' clock

LCD MODULE NUMBER NOTATION:

CG9162D - N N - S R - N 6 - T
 | | | | | | | |
 (1) (2) (3) (4) (5) (6) (7) (8)

*(1)---Model number of standard LCD Modules

*(2)---Backlight type

- N – No backlight
 E – EL backlight
 L – Side-lited LED backlight
 M – Array LED backlight
 C – CCFL

*(3)---Backlight color

- N – No backlight
 A – Amber
 B – Blue
 O – Orange
 W – White
 Y – Yellow green

*(4)---Display mode

- T – TN
 V – TN (Negative)
 S – STN Yellow green
 G – STN Grey
 B – STN Blue (Negative)
 F – FSTN
 N – FSTN (Negative)
 E – EBTN (Negative)

*(5)---Rear polarizer type

- R – Reflective
 F – Transflective
 T – Transmissive

*(6)---Temperature range

- N – Normal
 W – Extended

*(7)---Viewing direction

- 6 – 6 O'clock
 2 – 12 O'clock
 3 – 3 O'clock
 9 – 9 O'clock

*(8)---Special code for other requirements
 (Can be omitted if not used)

GENERAL DESCRIPTION

Display mode	:	16 characters x 2 lines LCD module
Interface	:	8-bit parallel
Driving method	:	1/16 duty, 1/5 bias
Controller IC	:	ST7032 or equivalent
For the detailed information, please refer to the IC specifications		

MECHANICAL DIMENSIONS

Item		Unit	Item	Dimension	Unit
Outline Dimension		mm	Viewing Area	79.0(L)x16.1(W)	mm
No backlight (N)	83.0(L)x27.4(W)x2.9MAX.(H)	mm	Character Size	4.20(L)x6.75(W)	mm
Yellow-Green backlight (L)	83.0(L)x27.4(W)x7.2MAX.(H)	mm	Character Pitch	4.75(L)x7.50(W)	mm
White and Blue backlight (L)	88.5(L)x27.4(W)x7.2MAX.(H)	mm	Dot Size	0.8(L)x0.8(W)	mm

CONNECTOR PIN ASSIGNMENT

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	V0	Supply voltage for LCD	9	DB2	Data bus line
2	VDD	Logic power supply	10	DB1	Data bus line
3	GND	Power supply (0V,ground)	11	DB0	Data bus line
4	DB7	Data bus line	12	E	Chip enable signal
5	DB6	Data bus line	13	R/W	Read/Write select
6	DB5	Data bus line	14	RS	Register select input
7	DB4	Data bus line	15	(*)A	Supply voltage for backlight (+)
8	DB3	Data bus line	16	(*)K	Supply voltage for backlight (-)

Note (*): Pin A, K are used for LED backlight version.

Technical drawing of a 14-pin D-sub connector. The drawing includes a top view, a side view, and a detail view of the pin assembly.

Top View Dimensions:

- Overall width: 83.0 ± 0.5
- Pin pitch: $1.27 \times (14 - 1) = 16.51$
- Pin 1 location: 16.1 ± 0.3 (V.A.)
- Pin 14 location: 14.25 (A.A.)
- Pin 7 location: 76.2 (A.A.)
- Pin 12 location: 79.0 ± 0.3 (V.A.)
- Pin 13 location: 2.43
- Pin 14 location: 1.50
- Pin 15 location: 19.10
- Pin 16 location: 27.4 ± 0.5
- Pin 17 location: 39.17
- Pin 18 location: 2.00
- Pin 19 location: 3.40
- Pin 20 location: 1.0 MAX

Side View Dimensions:

- Overall height: 70.00
- Pin height: 6.50
- Pin pitch: 0.50
- Pin 1 location: 2.00
- Pin 14 location: 0.50
- Pin 7 location: 2.00
- Pin 12 location: 0.50
- Pin 13 location: 0.50
- Pin 14 location: 0.50
- Pin 15 location: 0.50
- Pin 16 location: 0.50
- Pin 17 location: 0.50
- Pin 18 location: 0.50
- Pin 19 location: 0.50
- Pin 20 location: 0.50

Detail View Dimensions:

- Pin height: 4.75
- Pin pitch: 4.20
- Pin 1 location: 0.8
- Pin 14 location: 0.85
- Pin 7 location: 0.85
- Pin 12 location: 0.85
- Pin 13 location: 0.85
- Pin 14 location: 0.85
- Pin 15 location: 0.85
- Pin 16 location: 0.85
- Pin 17 location: 0.85
- Pin 18 location: 0.85
- Pin 19 location: 0.85
- Pin 20 location: 0.85

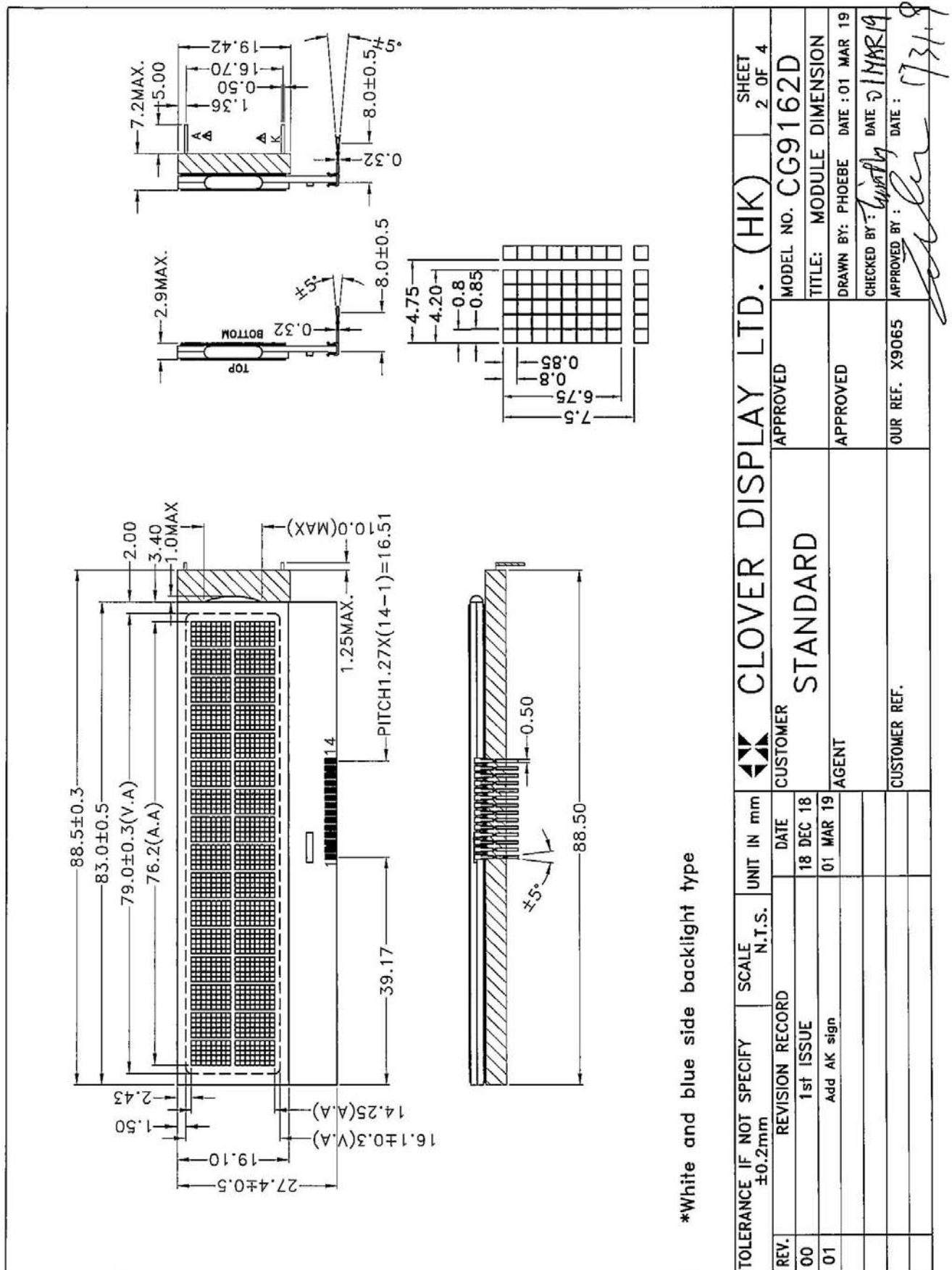
Assembly Details:

- Pin 1 location: 2.9 MAX
- Pin 14 location: 7.2 MAX
- Pin 7 location: 24.92
- Pin 12 location: 0.60
- Pin 13 location: 1.10
- Pin 14 location: 0.32
- Pin 15 location: 8.0 ± 0.5
- Pin 16 location: 8.0 ± 0.5
- Pin 17 location: 8.0 ± 0.5
- Pin 18 location: 8.0 ± 0.5
- Pin 19 location: 8.0 ± 0.5
- Pin 20 location: 8.0 ± 0.5

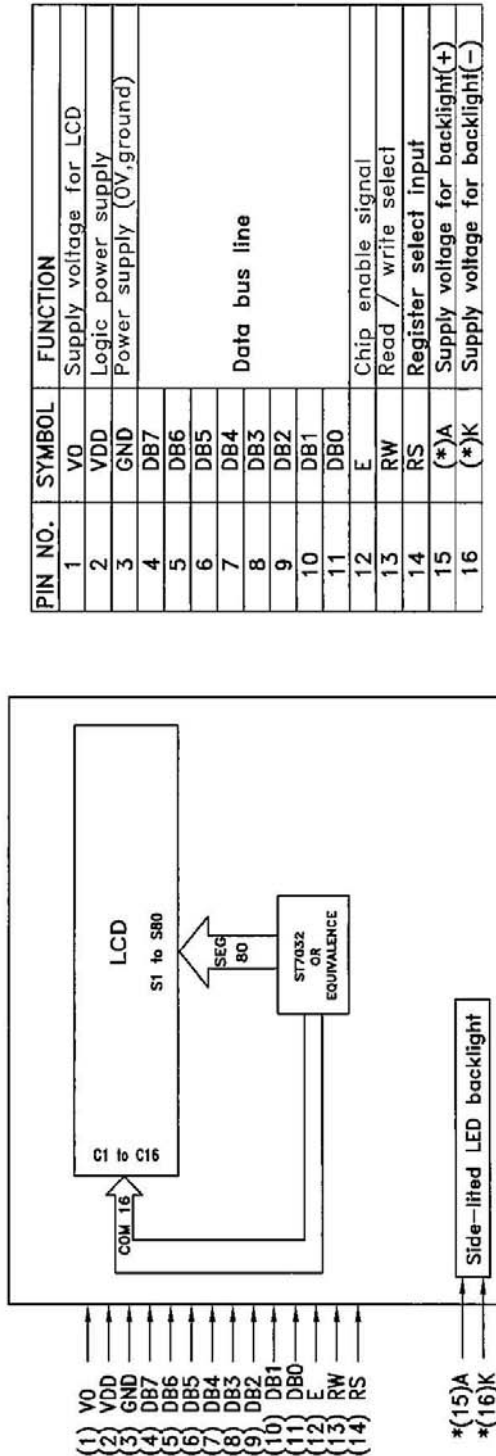
*No backlight and yellow green backlight types

TOLERANCE IF NOT SPECIFY $\pm 0.2 \text{ mm}$		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)		SHEET 1 OF 4
REV.	REVISION RECORD	DATE	CUSTOMER	APPROVED	MODEL NO. CG9162D	
00	1st ISSUE	18 DEC 18	STANDARD		TITLE: MODULE DIMENSION	
01	Add AK sign	01 MAR 19	AGENT	APPROVED	DRAWN BY: PHOEBE	DATE: 01 MAR 19
					CHECKED BY: Timothy	DATE: 01 MAR 19
			CUSTOMER REF.	OUR REF. X9065	APPROVED BY: [Signature]	DATE: 1/3/19

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COUNTER DRAWING OF PIN OUT & BLOCK DIAGRA



Note (*): pinA,K are used for backlight version only

TOLERANCE IF NOT SPECIFY ±0.2mm		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)		SHEET 3 OF 4
REV.	REVISION RECORD	DATE	CUSTOMER	APPROVED	MODEL NO. CG9162D	
00	1st ISSUE	18 DEC 18	AGENT	APPROVED	TITLE: PIN OUT & BLOCK DIAGRAM	
01	Add AK sign	01 MAR 19			DRAWN BY: PHOEBE DATE: 01 MAR 19	
					CHECKED BY: <i>Justin</i> DATE: 01 MAR 19	
			CUSTOMER REF.	OUR REF. X9065	APPROVED BY: <i>John</i> DATE: 13/1/19	

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, Ta=25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	VDD	4.75	5.0	5.25	V
Supply Current	IDD	—	0.24	—	mA
Input Voltage for LCD (*)	V0	4.3	4.5	4.7	V
“H”Level Input Voltage	VIH	0.8VDD	—	VDD	V
“L”Level Input Voltage	VIL	—	—	0.2VDD	V

Note (*): There is tolerance in optimum LCD driving voltage during production and it will be within the specified range. The corresponding LCD voltage = VDD –V0

Side-lited LED**Constant voltage driving:**

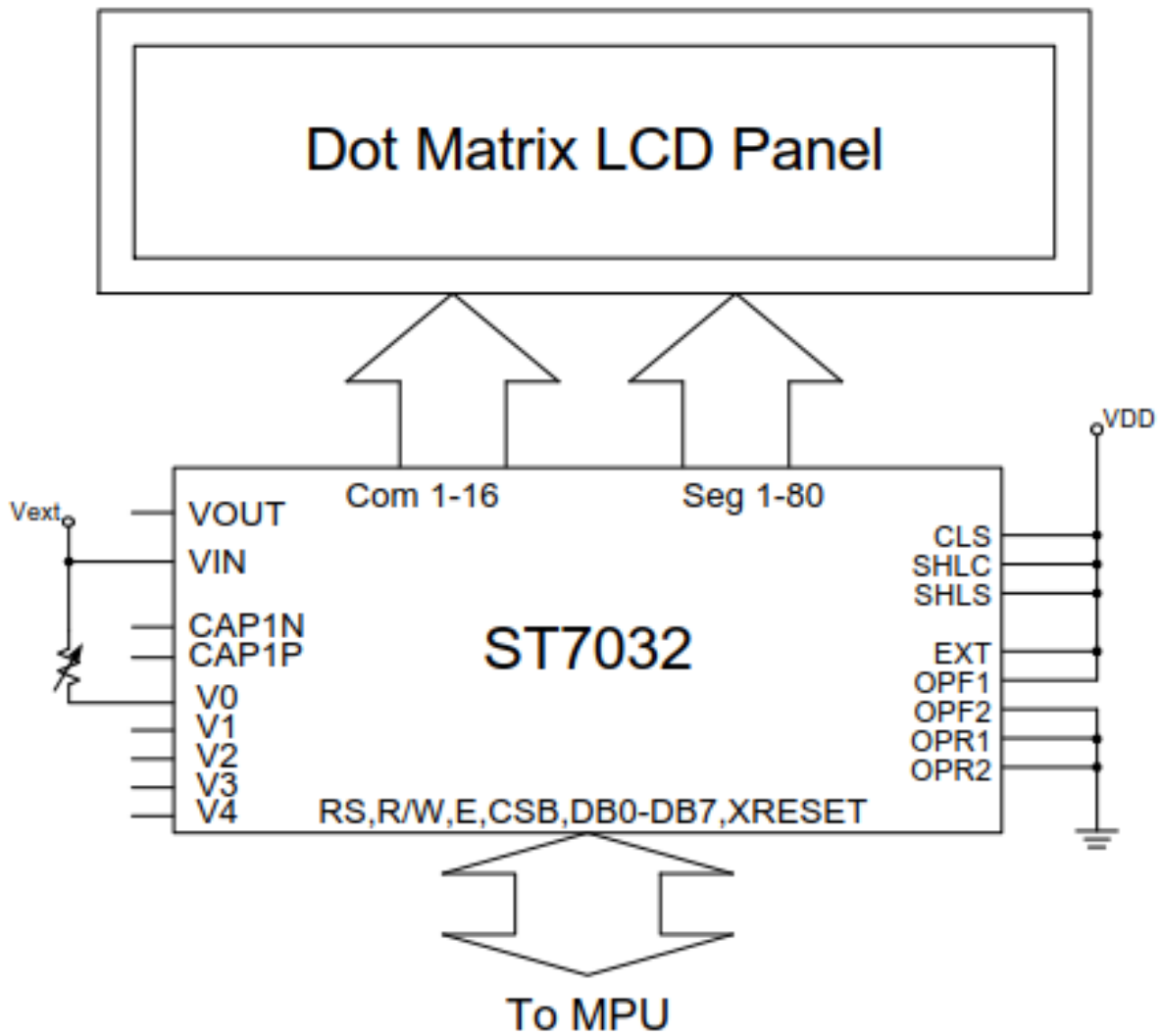
Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
White Backlight current	I _{BL}	—	35	40	mA	V _{BL} = 5.0V
Blue Backlight current	I _{BL}	—	35	40	mA	V _{BL} = 5.0V
Yellow-Green Backlight current	I _{BL}	—	50	55	mA	V _{BL} = 5.0V

ABSOLUTE MAXIMUM RATINGS

Please make sure not to exceed the following maximum rating values under the worst application conditions

Item	Symbol	Rating (for normal temperature)	Rating (for wide temperature)	Unit
Supply Voltage	VDD	-0.3 to 7	-0.3 to 7	V
Input Voltage	VT	-0.3 to VDD +0.3	-0.3 to VDD +0.3	V
Operating Temperature	T _{opr}	0 to 50	-20 to 70	°C
Storage Temperature	T _{stg}	-10 to 60	-30 to 80	°C

REFERENCE CIRCUIT EXAMPLE



INSTRUCTIONS TABLE

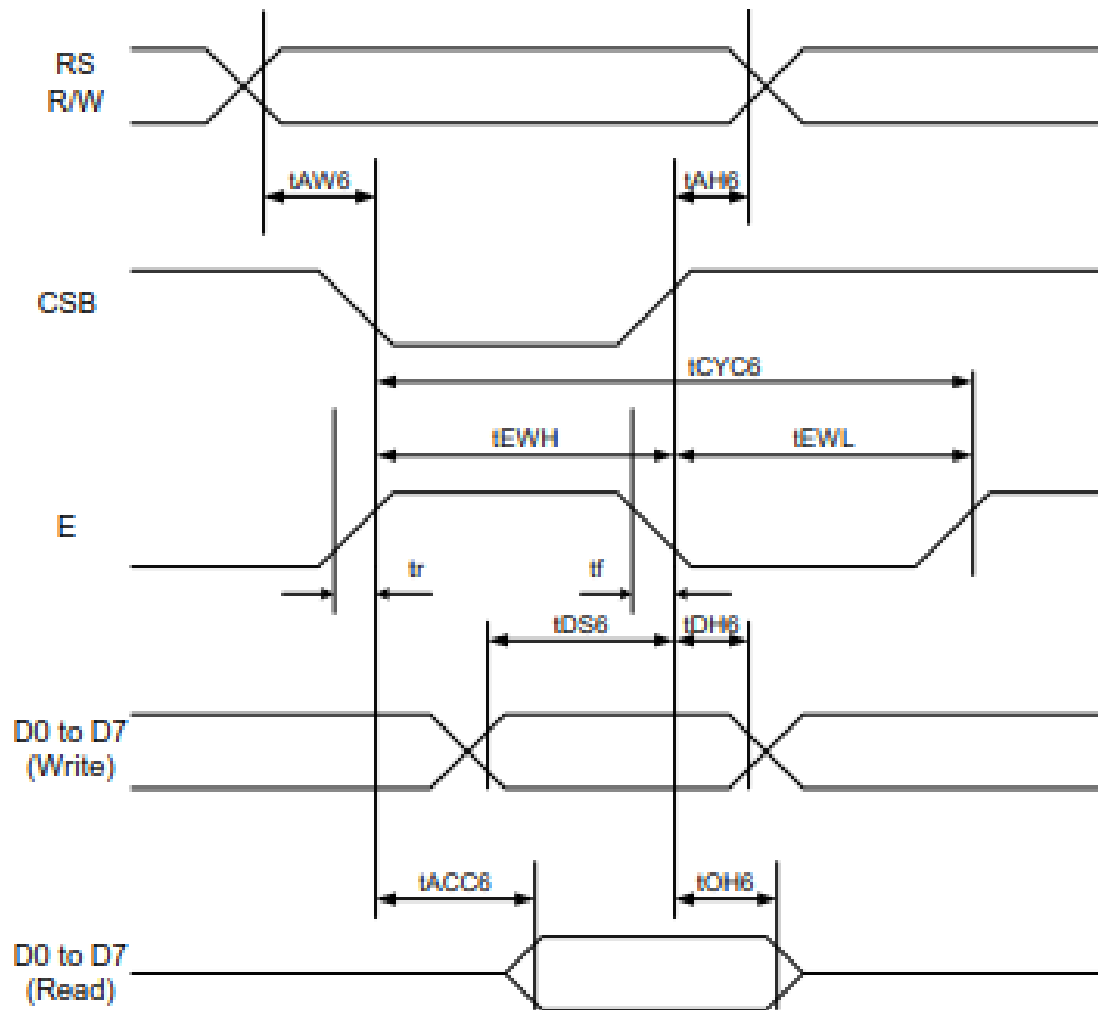
Instruction	Instruction Code										Description	Instruction Execution Time		
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		OSC=380KHz	OSC=540kHz	OSC=700KHz
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.08 ms	0.76 ms	0.59 ms
Return Home	0	0	0	0	0	0	0	0	1	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	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	26.3 us	18.5 us	14.3 us
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 us	18.5 us	14.3 us
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 us	18.5 us	14.3 us
Function Set	0	0	0	0	1	DL	N	x	x	x	DL: interface data is 8/4 bits N: number of line is 2/1	26.3 us	18.5 us	14.3 us
Set CGRAM	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	26.3 us	18.5 us	14.3 us
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	26.3 us	18.5 us	14.3 us
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)	26.3 us	18.5 us	14.3 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM)	26.3 us	18.5 us	14.3 us

DISPLAY DATA RAM

ST7032-0D Correspondence between Character Codes and Character Patterns

b7-b4 b3-b0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	!	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N
0001	O	P	Q	R	S	T	U	V	W	X	Y	Z	[\]	^
0010	_	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n
0011	o	p	q	r	s	t	u	v	w	x	y	z	{		}	~
0100	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
0101	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0110	P	Q	R	S	T	U	V	W	X	Y	Z	[\]	^	_
0111	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
1000	p	q	r	s	t	u	v	w	x	y	z	{		}	~	0
1001	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?	@
1010	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1011	Q	R	S	T	U	V	W	X	Y	Z	[\]	^	_	`
1100	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p
1101	q	r	s	t	u	v	w	x	y	z	{		}	~	0	1
1110	2	3	4	5	6	7	8	9	:	;	<	=	>	?	@	A
1111	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q

8-BIT INTERFACE TIMING DIAGRAM (6800 INTERFACE)



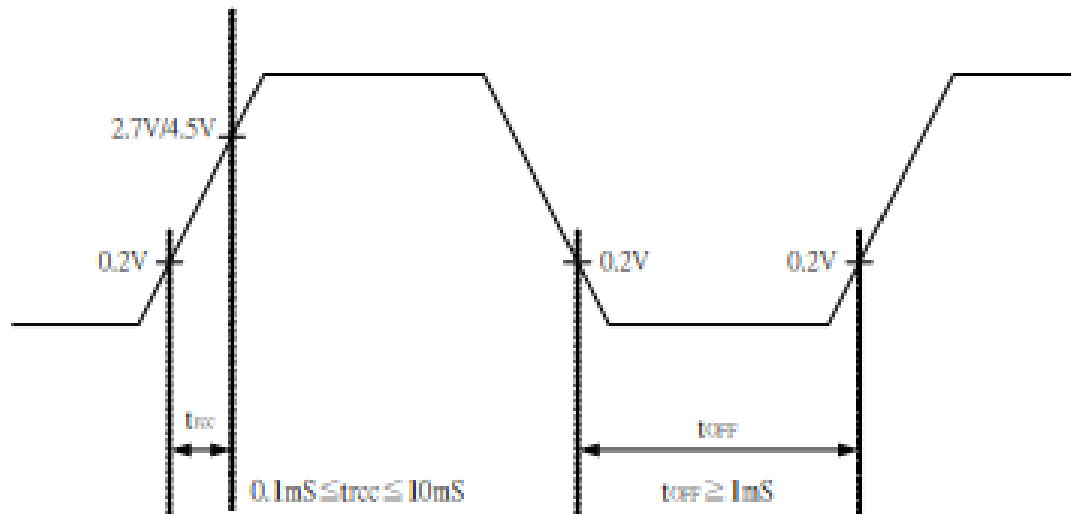
(Ta = -30°C to 85°C)

Item	Signal	Symbol	Condition	VDD=2.7 to 4.5V Rating		VDD=4.5 to 5.5V Rating		Units
				Min.	Max.	Min.	Max.	
Address hold time	RS	t_{AH6}	—	20	-	20	-	ns
Address setup time	RS	t_{AW6}		20	-	20	-	
System cycle time	RS	t_{CYC6}	—	400	-	280	-	ns
Data setup time	D0 to D7	t_{DS6}	—	100	-	80	-	ns
Data hold time	D0 to D7	t_{DH6}		40	-	20	-	
Access time	D0 to D7	t_{ACC6}	CL = 100 pF	-	500	-	400	ns
Output disable time	D0 to D7	t_{OH6}		300	-	150	-	
Enable Rise/Fall time	E	t_r, t_f	—	-	20	-	20	ns
Enable H pulse time	E	t_{EWH}	—	200	-	120	-	ns
Enable L pulse time	E	t_{EWL}	—	150	-	130	-	ns

Note: All timing is specified using 20% and 80% of VDD as the reference.

Power Supply Conditions Using Internal Reset Circuit

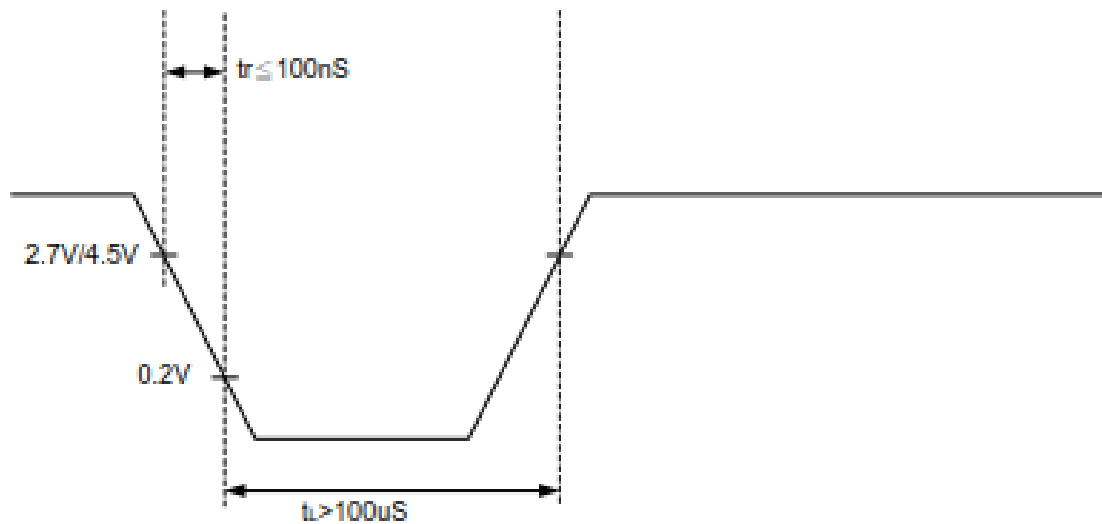
● Internal Power Supply Reset



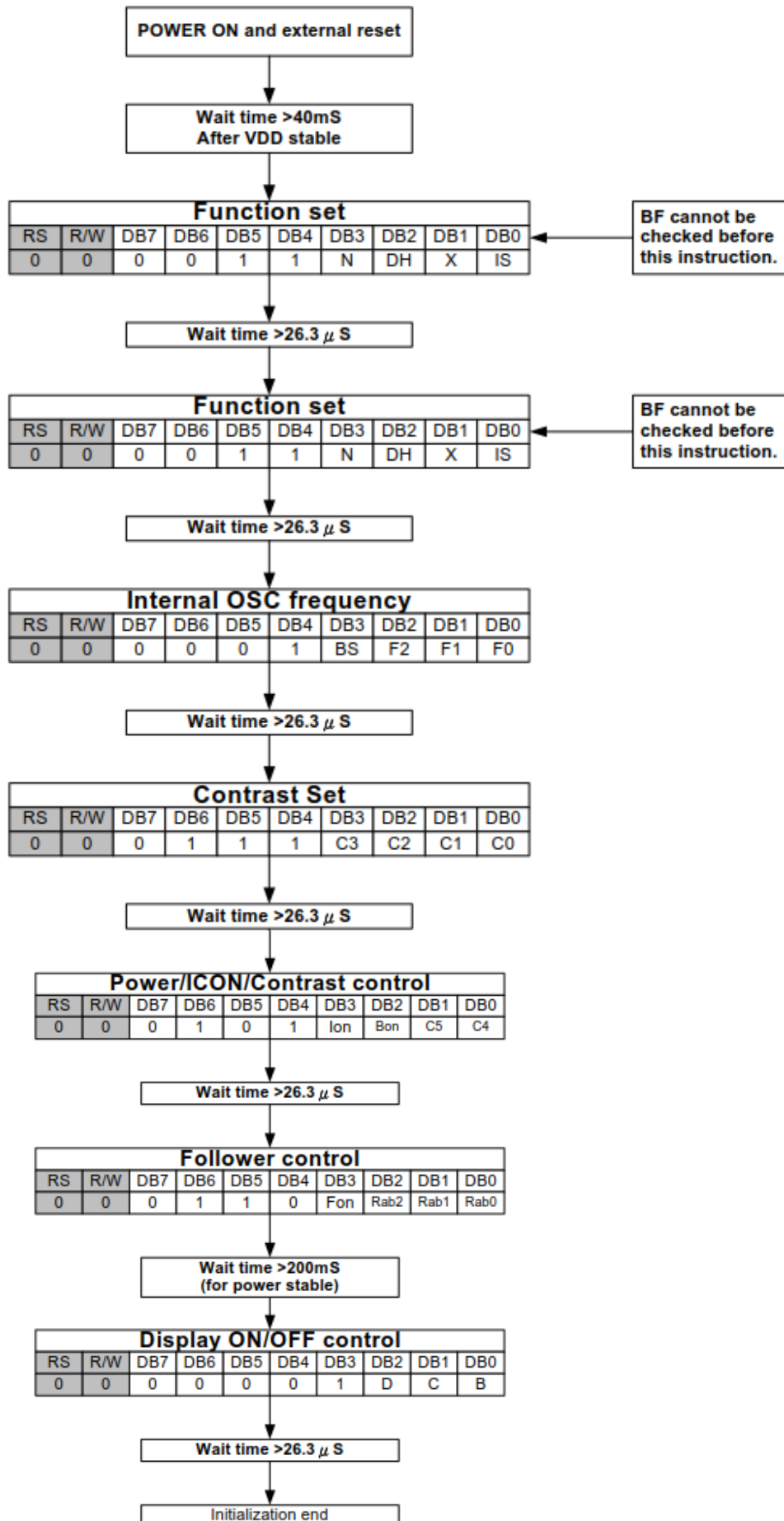
Notes:

- t_{off} compensates for the power oscillation period caused by momentary power supply oscillations.
- Specified at 4.5V for 5V operation, and at 2.7V for 3V operation.
- If 2.7V/4.5V is not reached during 3V/5V operation, internal reset circuit will not operate normally.

● Hardware reset(XRESET)



Initialization for 8-Bit Interface



ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION: POWER SUPPLY = $V_{OP} / 64 \text{ Hz}$
 TEMPERATURE = $23 \pm 5 \text{ }^{\circ}\text{C}$
 RELATIVE HUMIDITY = $60 \pm 20 \%$

ITEM	SYMBOL	UNIT	TYP. STN
RESPONSE TIME	Ton	ms	150
	Toff	ms	190
CONTRAST RATIO	Cr	-	115
VIEWING ANGLE (Cr ≥ 2)	V3:00	$^{\circ}$	45
	V6:00	$^{\circ}$	70
	V9:00	$^{\circ}$	45
	V12:00	$^{\circ}$	60

THE ELECTRO-OPTICAL CHARACTERISTICS ARE MEASURED VALUE BUT NOT GUARANTEED ONES.

RELIABILITY OF LCD MODULE

NO.	Item	TEST CONDITION FOR NORMAL TEMPERATURE	TEST CONDITION FOR WIDE TEMPERATURE	TIME
1	High temperature operating	50 $^{\circ}\text{C}$	70 $^{\circ}\text{C}$	240 hours
2	Low temperature operating	0 $^{\circ}\text{C}$	-20 $^{\circ}\text{C}$	240 hours
3	High temperature storage	60 $^{\circ}\text{C}$	80 $^{\circ}\text{C}$	240 hours
4	Low temperature storage	-10 $^{\circ}\text{C}$	-30 $^{\circ}\text{C}$	240 hours
5	Temperature-humidity storage	40 $^{\circ}\text{C}$ 90% R.H.	60 $^{\circ}\text{C}$ 90% R.H.	96 hours
6	Temperature cycling	-10 $^{\circ}\text{C}$ to 60 $^{\circ}\text{C}$ 30 Min Dwell	-30 $^{\circ}\text{C}$ to 80 $^{\circ}\text{C}$ 30 Min Dwell	5 cycle
7	Vibration Test at LCM Level	Freq 10-55 Hz Sweep rate: 10-55-10 at 1 min Sweep mode Linear Displacement: 2 mm p-p 1 Hour each for X, Y, Z	Freq 10-55 Hz Sweep rate: 10-55-10 at 1 min Sweep mode Linear Displacement: 2 mm p-p 1 Hour each for X, Y, Z	—

Inspection condition:

No. 1 ~ 6:

The samples should be placed in room temperature for 2 hours before inspection.

Acceptance criteria:

No non-conformance found in functional and cosmetic.

SAMPLING METHOD

SAMPLING PLAN: ANSI/ASQ Z1.4

CLASS OF AQL: LEVEL II/ SINGLE SAMPLING
 MAJOR-0.65% MINOR – 1.5%

QUALITY STANDARD

DEFECT	CRITERIA	TYPE	FIGURE
SHORT CIRCUIT	-	MAJOR	-
MISSING SEGMENT	-	MAJOR	-
UNEVEN / POOR CONTRAST	-	MAJOR	-
CROSS TALK	-	MAJOR	-
PIN HOLE	$MAX(a,b) \leq 1 / 4 W$ DOT MATRIX: IF $0.6 \leq W$, $MAX(a,b) < 0.3$ IF $0.4 \leq W < 0.6$, $MAX(a,b) < 0.25$ IF $W < 0.4$, $MAX(a,b) < 0.2$	MINOR	1
EXCESS SEGMENT	$MAX(c,d) \leq 1 / 4 T$	MINOR	1
BUBBLES	$d^* \geq 0.2$ QTY=0	MINOR	2
BLACKS SPOTS	$d \leq 0.3$ N.A.** $0.3 < d \leq 0.4$ QTY ≤ 1 $0.4 < d$ QTY=0	MINOR	2
LINE SCRATCHES	$x \geq 0.7$ $y \geq 0.05$ QTY=0	MINOR	3
BLACK LINE	$x \geq 0.7$ $y \geq 0.05$ QTY=0	MINOR	3

*d = MAX (d₁,d₂)

** N. A . = NOT APPLICABLE

DEFECT TABLE : B

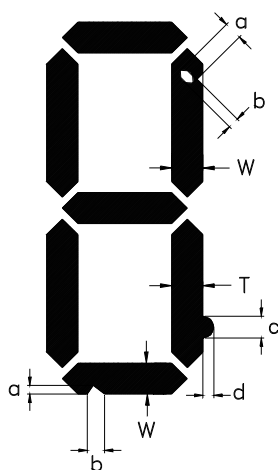
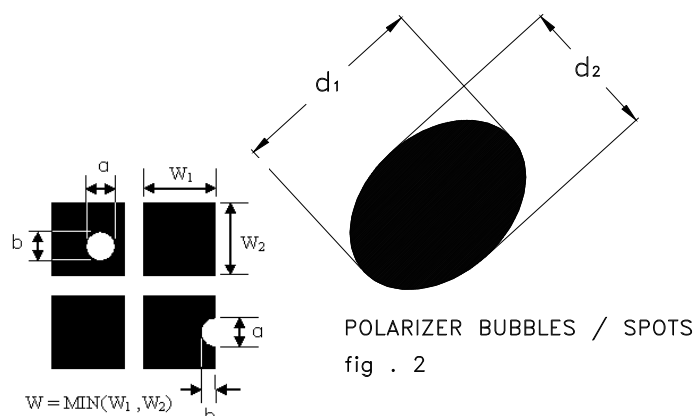


fig . 1

POLARIZER BUBBLES / SPOTS
fig . 2LINE SCRATCHES / BLACK LINE
fig . 3

QUALITY STANDARD (CONT .)

DEFECT		CRITERIA	TYPE	FIGURE
CHIPS	CONTACT EDGE	$e \leq 1/2T$ $f \leq 1/3W$ $g \leq 3.5$	MINOR	4
	BOTTOM GLASS	$p \leq 1.0$ $q \leq 3.5$ $r \leq 1/2T$		4
	CORNER	$a \leq 1.5$ $b \leq W$		4
	TOP GLASS	$a \leq 3.0$ $b \leq 1/2T$ $c \leq 1/3W$		5
GLASS PROTRUSION		$a \leq 1/4 W$	MINOR	6
RAINBOW		-	MINOR	-

UNLESS STATE OTHERWISE , ALL UNIT ARE IN MILLIMETER .

DEFECT TABLE : B

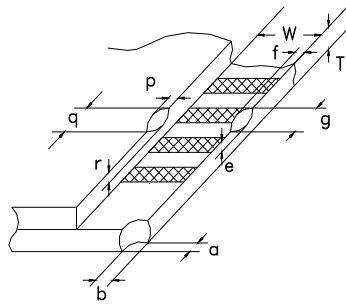


fig . 4

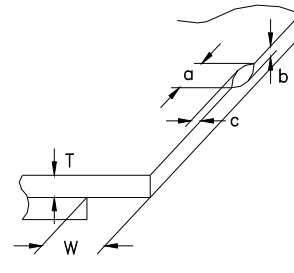


fig . 5

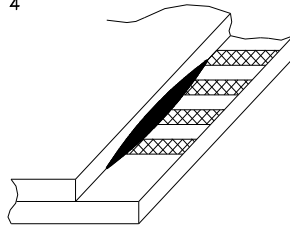


fig . 6

HANDLING PRECAUTIONS

(1) CAUTION OF LCD HANDLING & CLEANING

Use soft cloth with solvent (recommended below) to clean the display surface and wipe lightly.

- Isopropyl alcohol, ethyl alcohol, trichlorotrifluoroethane

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

-water, ketone, aromatics

(2) CAUTION AGAINST STATIC CHARGE

The LCD modules use CMOS LSI drivers, so customers are recommended that any unused input terminal would be connected to V_{DD} or V_{SS} , do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

Remove the protective film slowly and, if possible, under ESD control device like ion blower and humidity of working room should be kept over 50%RH to reduce risk of static charge.

(3) PACKAGING

Avoid intense shock and falls from a height and do not operate or store them exposed direct to sunshine or high temperature/humidity.

(4) CAUTION FOR OPERATION

It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life. The use of direct current drive should be avoided because an electrochemical reaction due to direct current causes LCD's undesirable deterioration.

Response time will be extremely delayed at low temperature, and LCD's show dark color at high temperature. However those phenomena do not mean malfunction or out of order with LCD's.

Some font will be abnormally displayed when the display area is pushed hard during operation. But it resumes normal condition after turning off once.

(5) SOLDERING (for Pin type)

It is recommended to complete dip soldering at 270 °C or hand soldering at 280 °C within 3 seconds. The soldering position is at least 3mm apart from the pin head. Wave or reflow soldering are not recommended. Metal pins should not be soldered for more than 3 times and each soldering should be done after cool down of metal pins

(6) SAFETY

For crash damaged or unnecessary LCD's, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol and should be burned up later.

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

WARRANTY

CLOVER will replace or repair any of her LCD module in accordance with her LCD specification for a period of one year from date of shipment. The warranty liability of Clover is limited to repair and/or replacement. Clover will not be responsible for any subsequent or consequential event.