高華電子顯示（深圳）有限公司
CLOVER CHINA DISPLAY (SHENZHEN) LIMITED

LCD MODULE SPECIFICATION

Model : ZCG9864A - _ _ - _ _ - _ _ - _

Revision	02
Engineering	Liu Jie
Date	10 Mar 2010
Our Reference	ZX90906X

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MODE OF DISPLAY

Display mode	**Display condition**	**Viewing direction**
STN : ☐ Yellow green	☐ Reflective type	☐ 6 O' clock
☐ Grey	☐ Transflective type	☐ 12 O' clock
☐ Blue (negative)	☐ Transmissive type	☐ 3 O' clock
☐ FSTN positive	☐ Others	☐ 9 O' clock
☐ FSTN negative		

LCD MODULE NUMBER NOTATION:

ZCG9864A- 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)
*(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 : 98 x 64 dots, Graphic COG LCD module

Interface : Serial

Driving method : 1/65 duty, 1/9 bias

Controller IC : Sitronix ST7565P-G or equivalent
For the detailed information, please refer to the IC specifications.

MECHANICAL DIMENSIONS

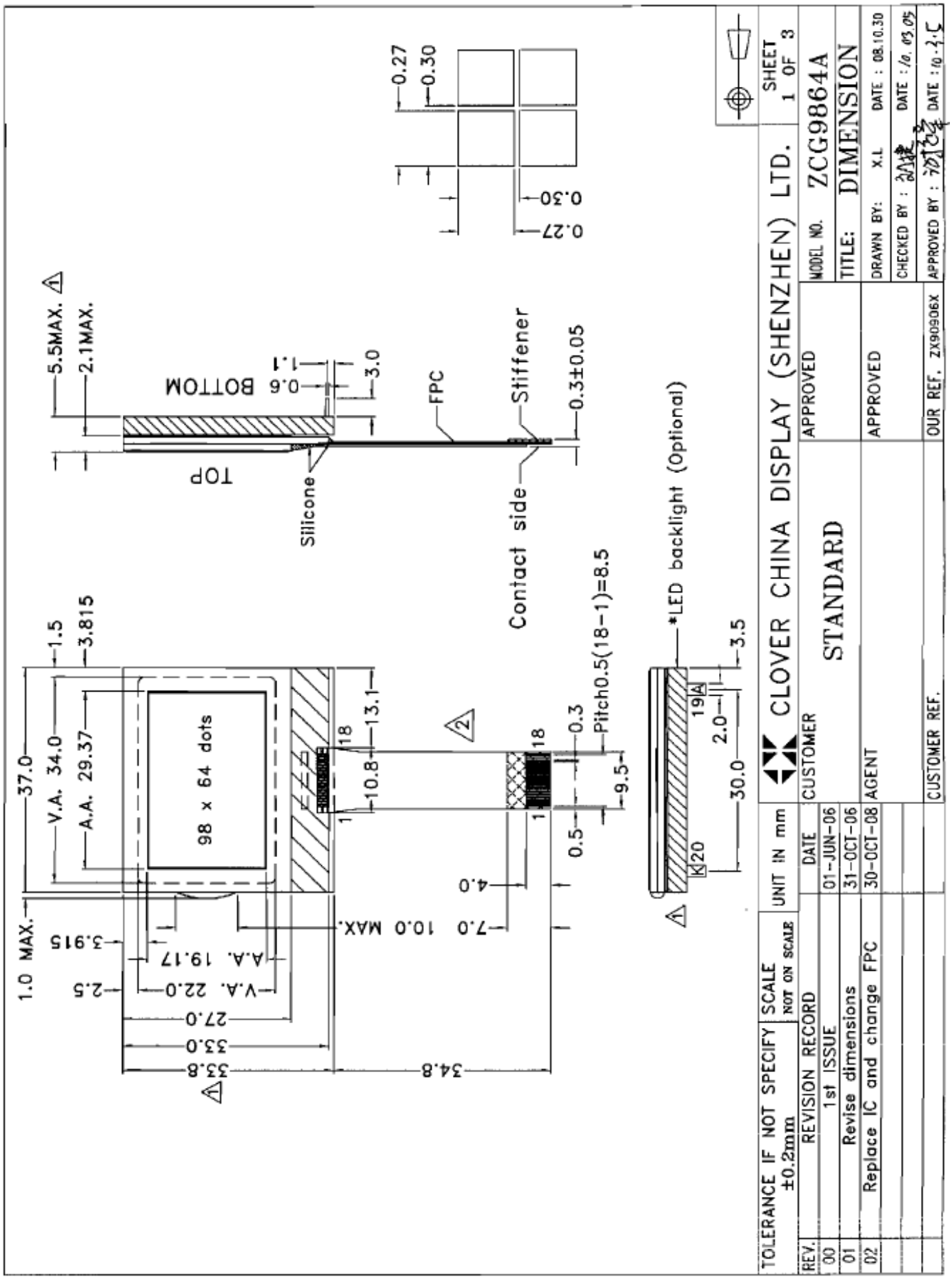
Item	Dimension	Unit	Item	Dimension	Unit
Outline Dimension			Viewing Area	34.0(L)x22.0(W)	mm
No Backlight (N)	37.0(L)x33.0(W)x2.1max.(H)	mm	Dot Pitch	0.30(L)x0.30(W)	mm
LED Sided Backlight(L)	37.0(L)x33.8(W)x5.5max.(H)	mm	Dot Size	0.27(L)x0.27(W)	mm

CONNECTOR PIN ASSIGNMENT

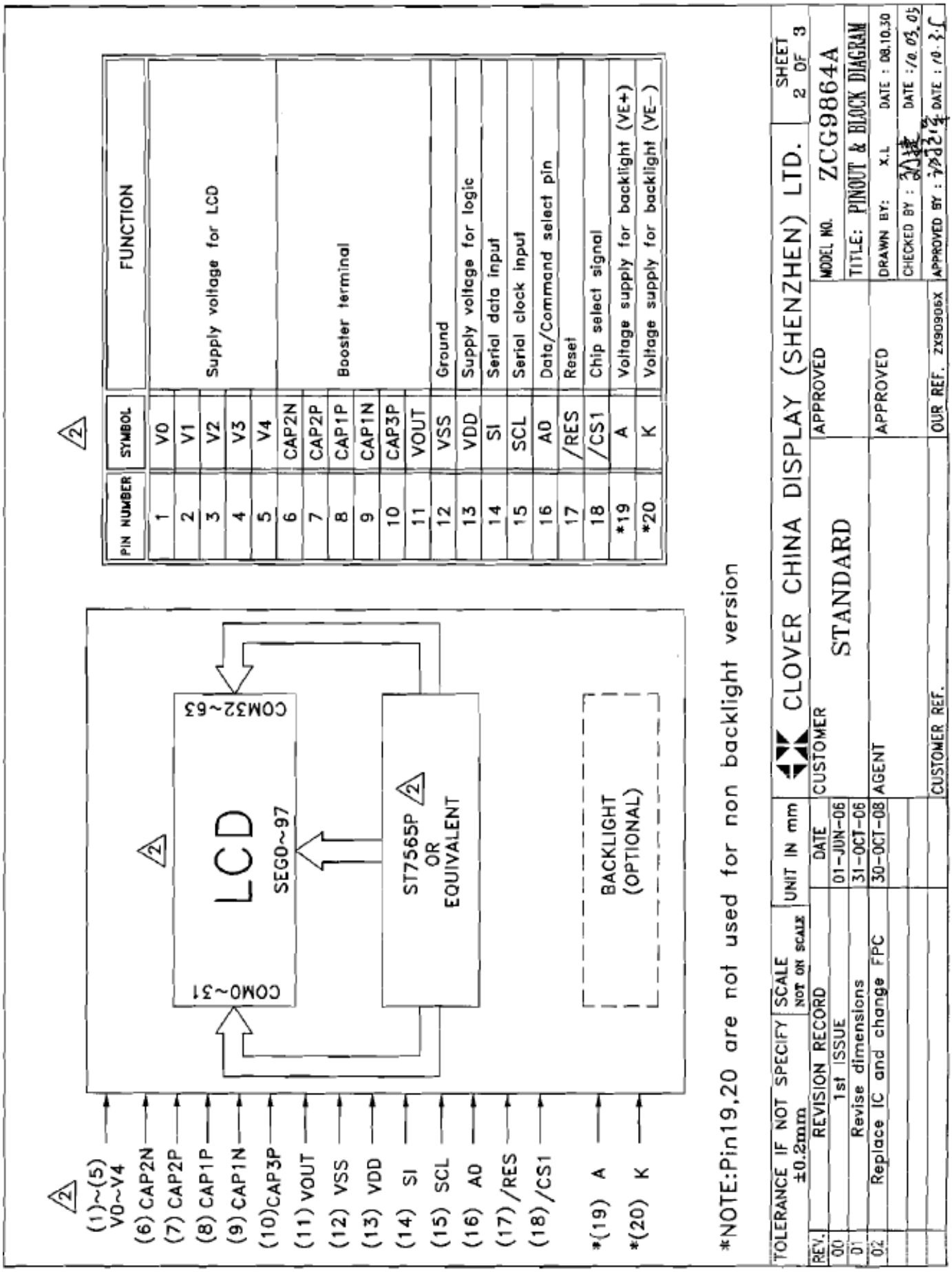
Pin No.	Symbol	Function
1	V0	Supply voltage for LCD driver
2	V1	
3	V2	
4	V3	
5	V4	
6	CAP2N	Booster terminal
7	CAP2P	
8	CAP1P	
9	CAP1N	
10	CAP3P	
11	Vout	
12	VSS	Ground (0V)
13	VDD	Supply voltage for logic
14	SI	Serial data input
15	SCL	Serial clock input
16	A0	Data / Command select pin
17	/RES	Reset
18	/CS1	Chip select signal
* 19	A	Voltage supply for backlight (VE+)
* 20	K	Voltage supply for backlight (VE-)

Note (*): Pin 19, 20 are used for backlight version.

COUNTER DRAWING OF MODULE DIMENSION



COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM



PIN NUMBER	SYMBOL	FUNCTION
1	V0	Supply voltage for LCD
2	V1	
3	V2	
4	V3	
5	V4	
6	CAP2N	Booster terminal
7	CAP2P	
8	CAP1P	
9	CAP1N	
10	CAP3P	
11	VOUT	
12	VSS	Ground
13	VDD	Supply voltage for logic
14	SI	Serial data input
15	SCL	Serial clock input
16	A0	Data/Command select pin
17	/RES	Reset
18	/CS1	Chip select signal
*19	A	Voltage supply for backlight (VE+)
*20	K	Voltage supply for backlight (VE-)

REV.	REVISION RECORD	DATE
00	1st ISSUE	01-JUN-06
01	Revise dimensions	31-OCT-06
02	Replace IC and change FPC	30-OCT-08

TOLERANCE IF NOT SPECIFY ±0.2mm | SCALE NOT ON SCALE | UNIT IN mm | CUSTOMER | AGENT | CUSTOMER REF.

APPROVED | APPROVED | OUR REF. ZX90905X

MODEL NO. ZCG9864A

DRAWN BY: X.L DATE : 08.10.30

CHECKED BY : DATE :

APPROVED BY : DATE :

ABSOLUTE MAXIMUM RATINGS

Please make sure not to exceed the following maximum rating values under the worst application conditions.
Unless othenwise noted,Vss=0V

Parameter		Symbol	Conditions	Unit
Power Supply Voltage		VDD	0.3 ~ 3.6	V
Power supply voltage (VDD standard)		VDD2	0.3 ~ 3.6	V
Power supply voltage (VDD standard)		V0, VOUT	0.3 ~ 14.5	V
Power supply voltage (VDD standard)		V1, V2, V3, V4	V0 to 0.3	V
Operating temperature		TOPR	–30 to +85	℃
Storage temperature	Bare chip	TSTR	–65 to +150	℃

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, Ta=25℃

Item	Symbol	MIN.	TYP.	MAX.	Unit	Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage for Logic	VDD	2.75	3.0	3.25	V	"H"Level Input Voltage	VIH	0.8VDD	—	VDD	V
Supply Current for Logic	IDD	—	180	300	μA	"L"Level Input Voltage	VIL	0	—	0.2VDD	V
Operating Voltage for LCD	VLCD	7.8	8.0	8.2	V	—	—	—	—	—	—
Side-lited LED Backlight Forward Voltage (VF)						**Side-lited LED Backlight Forward Current (IF)**					
White	VBL	3.3	3.5	3.7	V	White	IBL	—	30	50	mA
Blue	VBL	3.3	3.5	3.7	V	Blue	IBL	—	30	50	mA
Yellow Green	VBL	—	—	—	V	Yellow Green	IBL	—	—	—	mA

INSTRUCTIONS TABLE

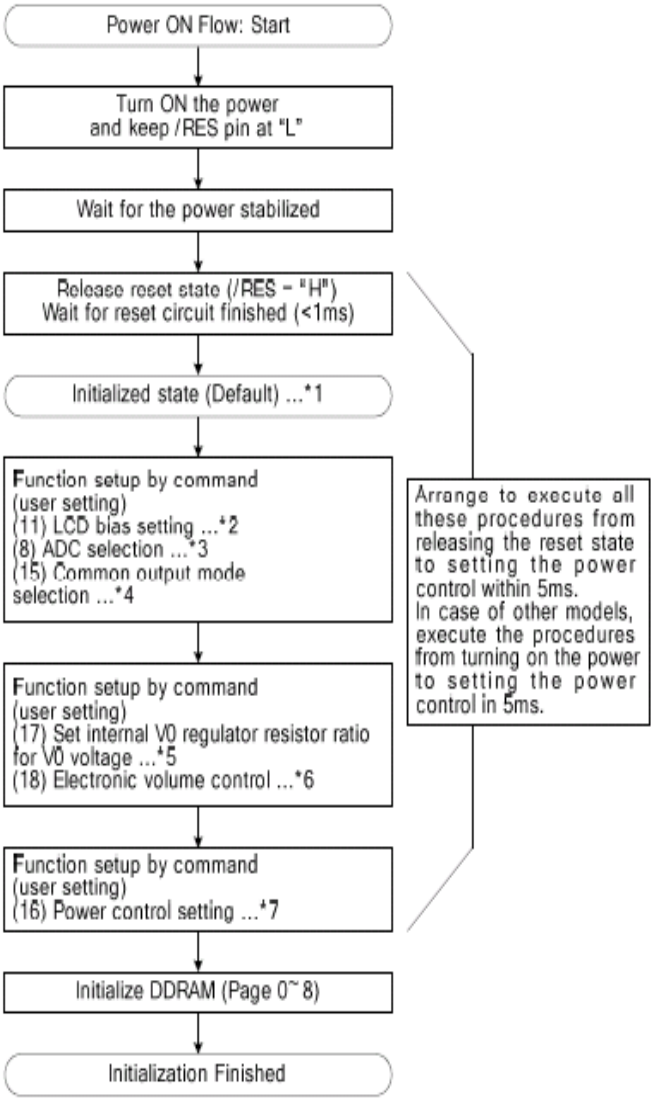
Command	Command Code										Function
	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0	
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0 1	LCD display ON/OFF 0: OFF, 1: ON
(2) Display start line set	0	1	0	0	1	Display start address						Sets the display RAM display start line address
(3) Page address set	0	1	0	1	0	1	1	Page address				Sets the display RAM page address
(4) Column address set upper bit Column address set lower bit	0 0	1 1	0 0	0 0	0 0	0 0	1 0	Most significant column address Least significant column address				Sets the most significant 4 bits of the display RAM column address. Sets the least significant 4 bits of the display RAM column address.
(5) Status read	0	0	1	Status				0	0	0	0	Reads the status data
(6) Display data write	1	1	0	Write data								Writes to the display RAM
(7) Display data read	1	0	1	Read data								Reads from the display RAM
(8) ADC select	0	1	0	1	0	1	0	0	0	0	0 1	Sets the display RAM address SEG output correspondence 0: normal, 1: reverse
(9) Display normal/ reverse	0	1	0	1	0	1	0	0	1	1	0 1	Sets the LCD display normal/ reverse 0: normal, 1: reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0 1	Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	0	0	1	0 1	Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565P)
(12) Read/modify/write	0	1	0	1	1	1	0	0	0	0	0	Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	1	0	1	1	1	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	Internal reset
(15) Common output mode select	0	1	0	1	1	0	0	0 1	*	*	*	Select COM output scan direction 0: normal direction 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode			Select internal power supply operating mode
(17) Vo voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set Electronic volume register set	0	1	0	1 0	0 0	0 Electronic volume value	0	0	0	0	1	Set the Vo output voltage electronic volume register
(19) Static indicator ON/OFF Static indicator register set	0	1	0	1 0	0 0	1 0	0 0	1 0	1 0	0 0	0 1 Mode	0: OFF, 1: ON Set the flashing mode
(20) Booster ratio set	0	1	0	1 0	1 0	1 0	1 0	1 0	0 0	0 step-up value	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
(21) Power saver												Display OFF and display all points ON compound command
(22) NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
(23) Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command

COMMAND DESCRIPTION

(1) Initialization

Note: With this IC, when the power is applied, LCD driving non-selective potentials V_2 and V_3 (SEG pin) and V_1 and V_4 (COM pin) are output through the LCD driving output pins SEG and COM. When electric charge is remaining in the smoothing capacitor connecting between the LCD driving voltage output pins (V_0 ~ V_4) and the V_{SS} pin, the picture on the display may become totally dark instantaneously when the power is turned on. To avoid occurrence of such a failure, we recommend the following flow when turning on the power.

1. When the built-in power is being used immediately after turning on the power:

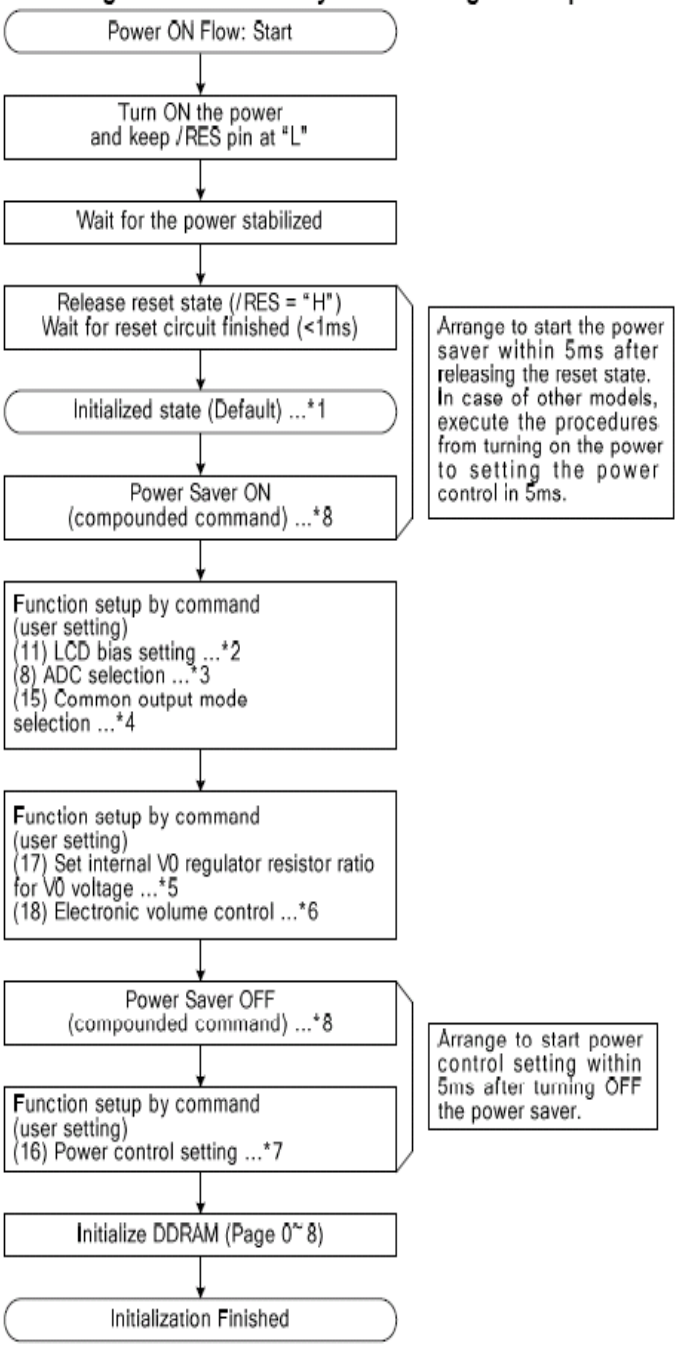


* The target time of 5ms will result to vary depending on the panel characteristics and the capacitance of the smoothing capacitor. Therefore, we suggest you to conduct an operation check using the actual equipment.

Notes: Refer to respective sections or paragraphs listed below.

*1: Description of functions; Resetting circuit
*2: Command description; LCD bias setting
*3: Command description; ADC selection
*4: Command description; Common output state selection
*5: Description of functions; Power circuit & Command description; Setting the built-in resistance radio for regulation of the V0 voltage
*6: Description of functions; Power circuit & Command description; Electronic volume control
*7: Description of functions; Power circuit & Command description; Power control setting

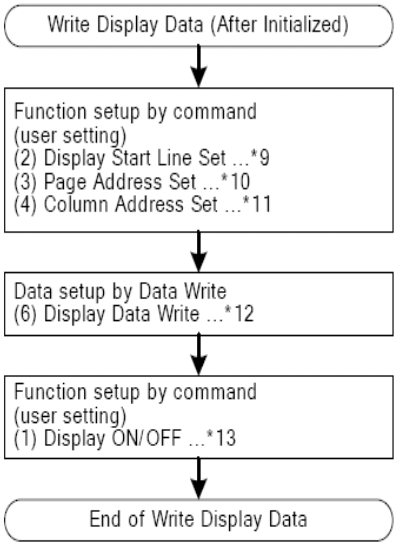
2. When the built-in power is not being used immediately after turning on the power:



* The target time of 5ms will result to vary depending on the panel characteristics and the capacitance of the smoothing capacitor. Therefore, we suggest you to conduct an operation check using the actual equipment.

Notes: Refer to respective sections or paragraphs listed below.
*1: Description of functions; Resetting circuit
*2: Command description; LCD bias setting
*3: Command description; ADC selection
*4: Command description; Common output state selection
*5: Description of functions; Power circuit & Command description; Setting the built-in resistance radio for regulation of the V0 voltage
*6: Description of functions; Power circuit & Command description; Electronic volume control
*7: Description of functions; Power circuit & Command description; Power control setting
*8: The power saver ON state can either be in sleep state or stand-by state.
Command description; Power saver START (multiple commands)

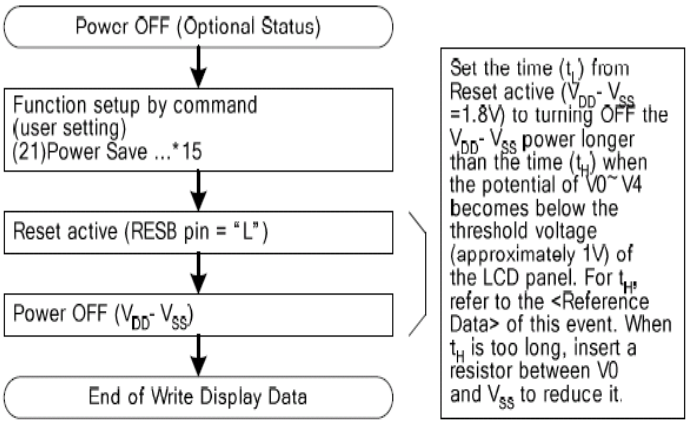
(2) Data Display



Notes: Reference items

*9: Command Description; Display start line set
*10: Command Description; Page address set
*11: Command Description; Column address set
*12: Command Description; Display data write
*13: Command Description; Display ON/OFF
Avoid displaying all the data at the data display start (when the display is ON) in white.

(3) Power OFF *14



Notes: Reference items

*14: The logic circuit of this IC's power supply VDD - VSS controls the driver of the LCD power supply VSS – V0. So, if the power supply VDD - VSS is cut off when the LCD power supply VSS – V0 has still any residual voltage, the driver (COM. SEG) may output any uncontrolled voltage. When turning off the power, observe the following basic procedures:
• After turning off the internal power supply, make sure that the potential V0 ~ V4 has become below the threshold voltage of the LCD panel, and then turn off this IC's power supply (VDD - VSS). 6. Description of Function, 6.7 Power Circuit

*15: After inputting the power save command, be sure to reset the function using the /RES terminal until the power supply VDD - VSS is turned off. 7. Command Description (20) Power Save

*16: After inputting the power save command, do not reset the function using the /RES terminal until the power supply VDD - VSS is turned off. 7. Command Description (20) Power Save

DC CHARACTERISTICS

Unless otherwise specified, V_{SS} = 0 V, V_{DD} = 3.0 V ± 10%, Ta = –30 to 85℃

Item		Symbol	Condition		Rating			Units	Applicable Pin
					Min.	Typ.	Max.		
Operating Voltage (1)		V_{DD}			1.8	—	3.3	V	V_{SS}*1
Operating Voltage (2)		V_{DD2}	(Relative to V_{SS})		2.4	—	3.3	V	V_{SS}
High-level Input Voltage		V_{IHC}			0.8 x V_{DD}	—	V_{DD}	V	*3
Low-level Input Voltage		V_{ILC}			V_{SS}	—	0.2 x V_{DD}	V	*3
High-level Output Voltage		V_{OHC}	I_{OH} = –0.5 mA		0.8 x V_{DD}	—	V_{DD}	V	*4
Low-level Output Voltage		V_{OLC}	I_{OL} = 0.5 mA		V_{SS}	—	0.2 x V_{DD}	V	*4
Input leakage current		I_{LI}	V_{IN} = V_{DD} or V_{SS}		–1.0	—	1.0	μA	*5
Output leakage current		I_{LO}	V_{IN} = V_{DD} or V_{SS}		–3.0	—	3.0	μA	*6
Liquid Crystal Driver ON Resistance		R_{ON}	Ta = 25℃ (Relative to V_{SS})	V_0 = 13.0 V	—	2.0	3.5	KΩ	SEGn COMn *7
				V_0 = 8.0 V	—	3.2	5.4		
Static Consumption Current		I_{SSQ}	V_0 = 13.0 V (Relative to V_{SS})		—	0.01	2	μA	V_{DD}, V_{DD2}
Output Leakage Current		I_{SQ}			—	0.01	10	μA	V0
Input Terminal Capacitance		C_{IN}	Ta = 25℃ , f = 1 MHz		—	5.0	8.0	pF	
Oscillator Frequency	Internal Oscillator	f_{OSC}	1/65 duty 1/33 duty	Ta = 25℃	17	20	24	kHz	*8
	External Input	f_{CL}			17	20	24	kHz	CL
	Internal Oscillator	f_{OSC}	1/49 duty 1/53 duty 1/55 duty	Ta = 25℃	25	30	35	kHz	*8
	External Input	f_{CL}			25	30	35	kHz	CL

TIMING CHARACTERISTICS

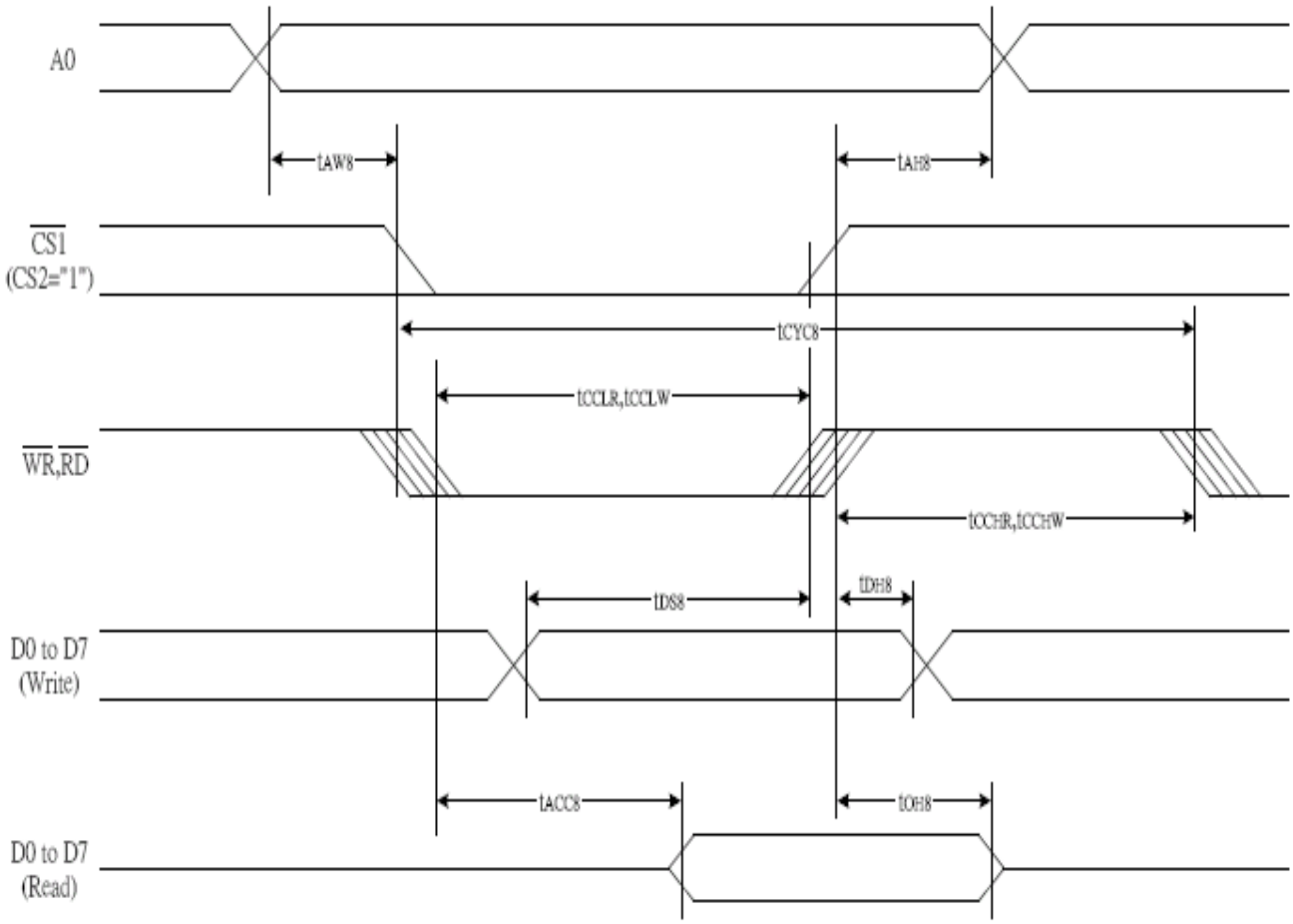


Figure 37

Table 24

(V_{DD} = 3.3V, Ta = –30 to 85℃)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t_{AH8}		0	—	Ns
Address setup time		t_{AW8}		0	—	
System cycle time		t_{CYC8}		240	—	
Enable L pulse width (WRITE)	WR	t_{CCLW}		80	—	
Enable H pulse width (WRITE)		t_{CCHW}		80	—	
Enable L pulse width (READ)	RD	t_{CCLR}		140	—	
Enable H pulse width (READ)		t_{CCHR}		80		
WRITE Data setup time	D0 to D7	t_{DS8}		40	—	
WRITE Address hold time		t_{DH8}		0	—	
READ access time		t_{ACC8}	C_L = 100 pF	—	70	
READ Output disable time		t_{OH8}	C_L = 100 pF	5	50	

DISPLAY DATA RAM

The display data RAM stores the dot data for the LCD. It has a 65 (8 page x 8 bit +1) x 132 bit structure.
As is shown in Figure 3, the D7 to D0 display data from the MPU corresponds to the LCD display common direction; there are few constraints at the time of display data transfer when multiple ST7565P are used, thus and display structures can be created easily and with a high degree of freedom.
Moreover, reading from and writing to the display RAM from the MPU side is performed through the I/O buffer, which is an independent operation from signal reading for the liquid crystal driver. Consequently, even if the display data RAM is accessed asynchronously during liquid crystal display, it will not cause adverse effects on the display (such as flickering).

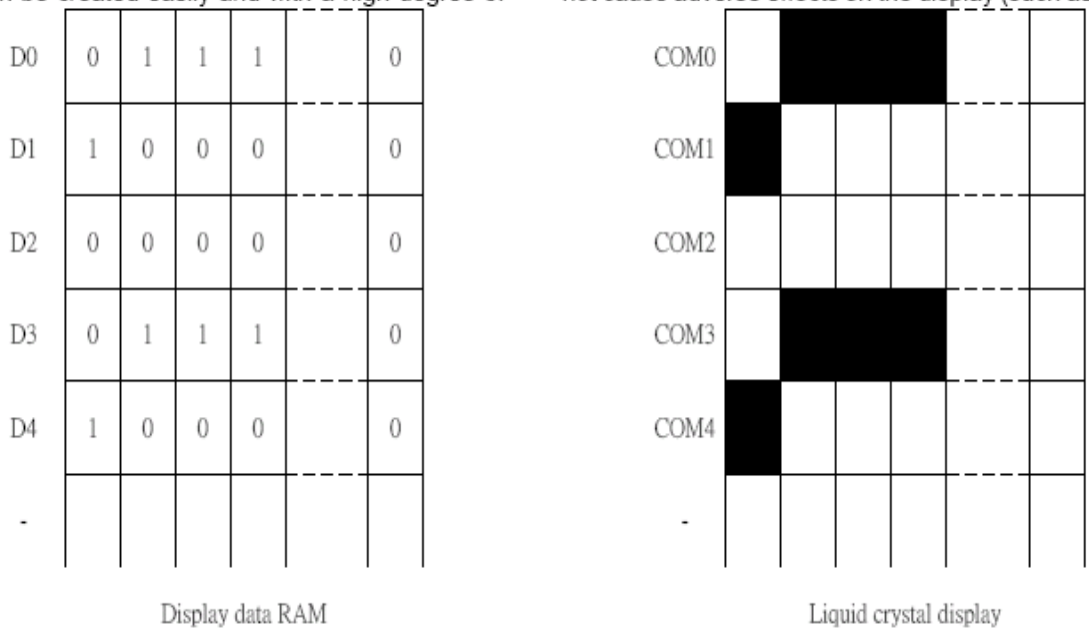


Figure 3

The Page Address Circuit

Page address of the display data RAM is specified through the Page Address Set Command. The page address must be specified again when changing pages to perform access.

Page address 8 (D3, D2, D1, D0 = 1, 0, 0, 0) is a special RAM for icons, and only display data D0 is used.
(see Figure 4)

The Column Addresses

The display data RAM column address is specified by the Column Address Set command. The specified column address is incremented (+1) with each display data read/write command. This allows the MPU display data to be accessed continuously. Moreover, the incrementing of column addresses stops with 83H. Because the column address is independent of the page address, when moving, for example, from page 0 column 83H to page 1 column 00H, it is necessary to respective both the page address and the column address.
Furthermore, as is shown in Table 4, the ADC command (segment driver direction select command) can be used to reverse the relationship between the display data RAM column address and the segment output. Because of this, the constraints on the IC layout when the LCD module is assembled can be minimized. As is shown in Figure 4,

Table 4

SEG Output ADC	SEG0		SEG 131
(D0) "0"	0 (H)	→ Column Address →	83 (H)
(D0) "1"	83 (H)	← Column Address ←	0 (H)

The Line Address Circuit

The line address circuit, as shown in Table 4, specifies the line address relating to the COM output when the contents of the display data RAM are displayed. Using the display start line address set command, what is normally the top line of the display can be specified (this is the COM0 output when the common output mode is normal, and the COM63 output for ST7565P , the detail is shown page.11 The display area is a 65 line area for the ST7565P.
If the line addresses are changed dynamically using the display start line address set command, screen scrolling, page swapping, etc. can be performed.

ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION: POWER SUPPLY = VOP / 64 Hz
TEMPERATURE = 23 ± 5 °C
RELATIVE HUMIDITY = 60 ± 20 %

ITEM	SYMBOL	UNIT	TYP	DEFINITION
RESPONSE TIME	T_{on}	ms	220	APPEND 2
	T_{off}	ms	280	APPEND 2
D.C. RESISTANCE	R_{LC}	MΩ	100	APPEND 3
CURRENT CONSUMPTION	I_{op}	μA	100	APPEND 3
CONTRAST RATIO	C_r	-	12	-
VIEWING ANGLE ($C_r \geq 2$)	$V_{3:00}$	°	40	APPEND 4
	$V_{6:00}$	°	70	APPEND 4
	$V_{9:00}$	°	40	APPEND 4
	$V_{12:00}$	°	50	APPEND 4

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

RELIABILITY OF LCD MODULE

ITEM	TEST CONDITION	TIME
High temperature operating	50°C	240 hours
Low temperature operating	0°C	240 hours
High temperature storage	60°C	240 hours
Low temperature storage	-10°C	240 hours
Temperature-humidity storage	40°C 90% R.H.	96 hours
Temperature cycling	-10°C <=> 60°C 30 MIN DWELL	5 cycles
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	—

SAMPLING METHOD

SAMPLING PLAN: MIL-STD 105E

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) ≤ 1 / 4 W	MINOR	1
EXCESS SEGMENT	MAX(c,d) ≤ 1 / 4 T	MINOR	1
BUBBLES	d*≤ 0.2 QTY=2	MINOR	2
BLACKS SPOTS	d ≤ 0.2 QTY≤2 0.2<d≤0.3 QTY≤1 d>0.3 QTY=0	MINOR	2
LINE SCRATCHES	x≤0.5 y≤0.05 QTY=1	MINOR	3
BLACK LINE	x≤0.5 y≤0.05 QTY=1	MINOR	3

*d = MAX (d_1,d_2) ** N. A . = NOT APPLICABLE DEFECT TABLE : B

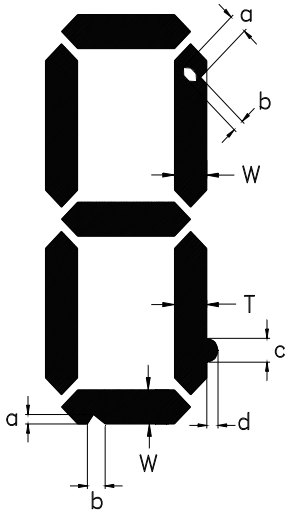
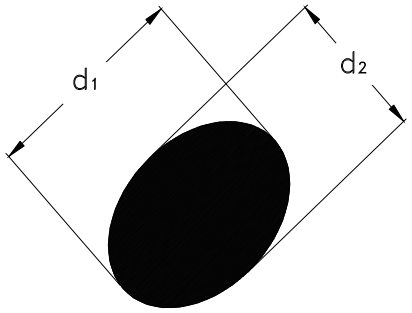
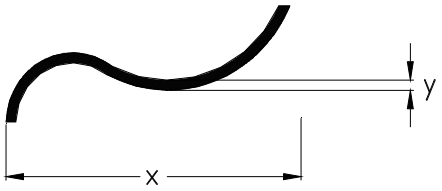


fig . 1



POLARIZER BUBBLES / SPOTS

fig . 2



LINE SCRATCHES / BLACK LINE

fig . 3

QUALITY STANDARD (CONT .)

DEFECT		CRITERIA	TYPE	FIGURE
CHIPS	CONTACT EDGE	e≤1/2T f<1/4W g<2.0	MINOR	4
	BOTTOM GLASS	p<0.5 q<2.0 r<1/2T		4
	CORNER	a≤1.5 b≤1/2W		4
	TOP GLASS	a<2.5 b<1/2T c<1/3W		5
GLASS PROTRUSION		a <1/5 W	MINOR	6
RAINBOW		-	MINOR	-

UNLESS STATE OTHERWISE , ALL UNIT ARE IN MILLIMETER . DEFECT TABLE : B

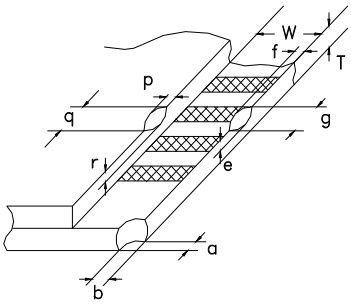


fig . 4

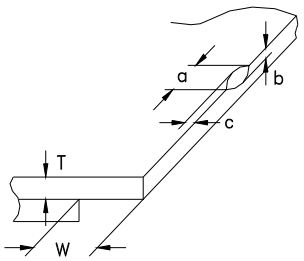


fig . 5

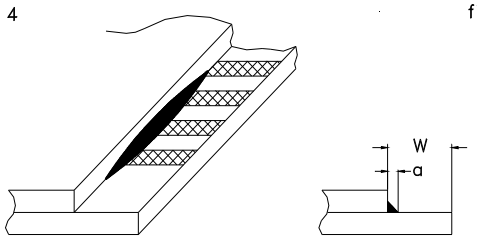


fig . 6

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, trichlorotriflorothane

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 recommend 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 ^{o}C or hand soldering at 280 ^{o}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

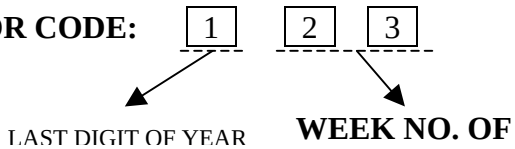
CLOVER CHINA will replace or repair any of her LCD module in accordance with her LCD specification for a period of one year from date of shipment. The warranty liability of CLOVER CHINA is limited to repair and/or replacement. CLOVER CHINA will not be responsible for any subsequent or consequential event.

APPENDIX

LOT INDICATION OF LCD MODULE

CODING SYSTEM:

3-DIGIT COLOR CODE:



COLOR CODE:

	COLOR
0	BLACK
1	BROWN
2	RED
3	ORANGE
4	YELLOW
5	GREEN
6	BLUE
7	PURPLE
8	GREY
9	WHITE

LOCATION AS SHOWN BELOW: