CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model: CG12864F - _ _ - _ _ - _ _ - _

Revision	00
Engineering	Timothy Chan
Date	25 November 2021
Our Reference	X9071D

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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:

CG12864F- 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 : 128 X 64 dots, Graphic COG LCD module

Interface : 8-bit parallel

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

Controller IC : I-CORE AIP31565CR or equivalent
For the detailed information, please refer to the IC specifications.

MECHANICAL DIMENSIONS

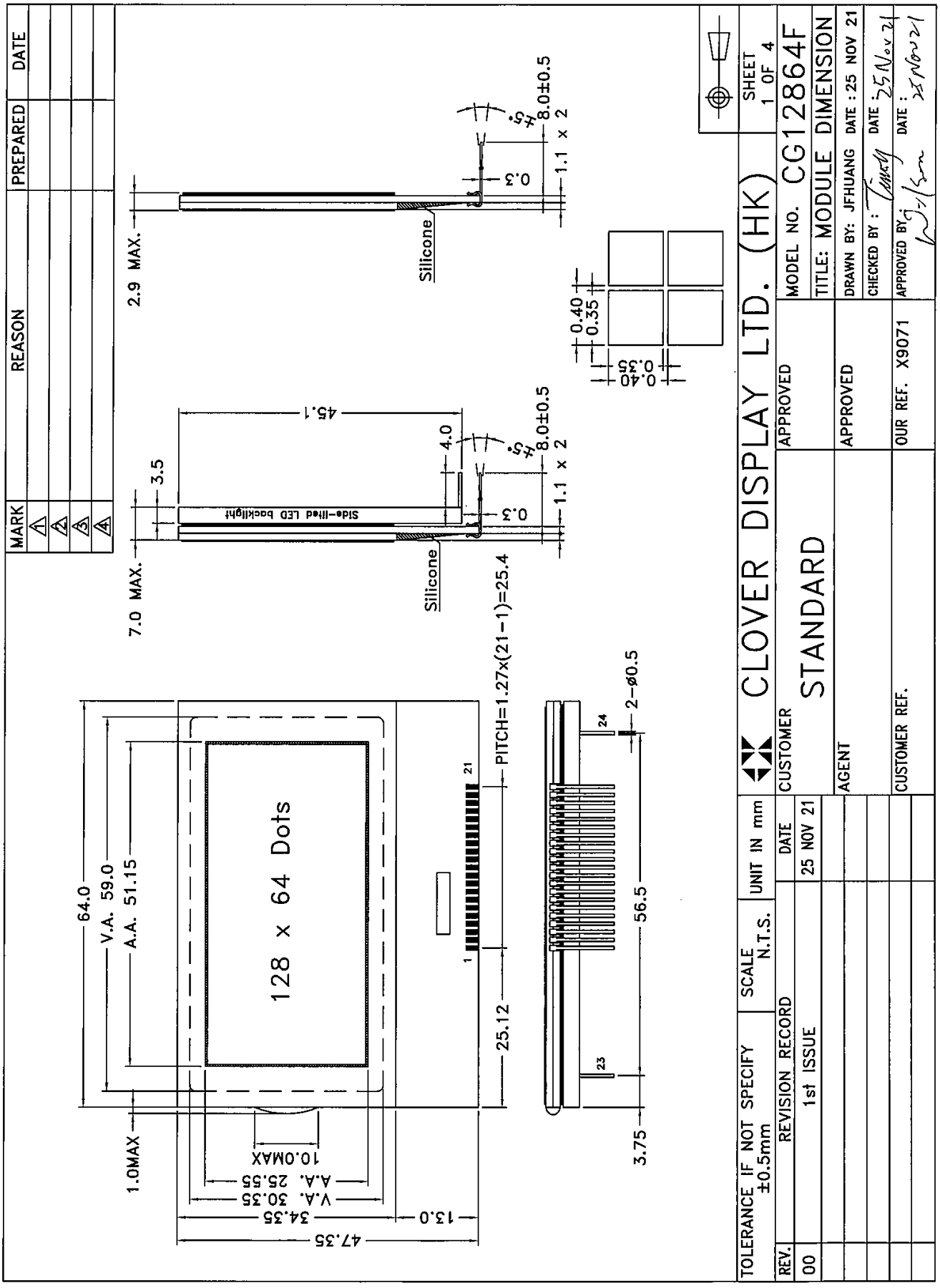
Item	Dimension	Unit	Item	Dimension	Unit
Outline Dimension			Viewing Area	59.0 (L)x30.35(W)	mm
No Backlight (N)	64.0(L)x47.35(W)x2.9max.(H)	mm	Dot Pitch	0.4(L)x0.4(W)	mm
LED Sided Backlight(L)	64.0(L)x47.35(W)x7.0max.(H)	mm	Dot Size	0.35(L)x0.35(W)	mm

CONNECTOR PIN ASSIGNMENT

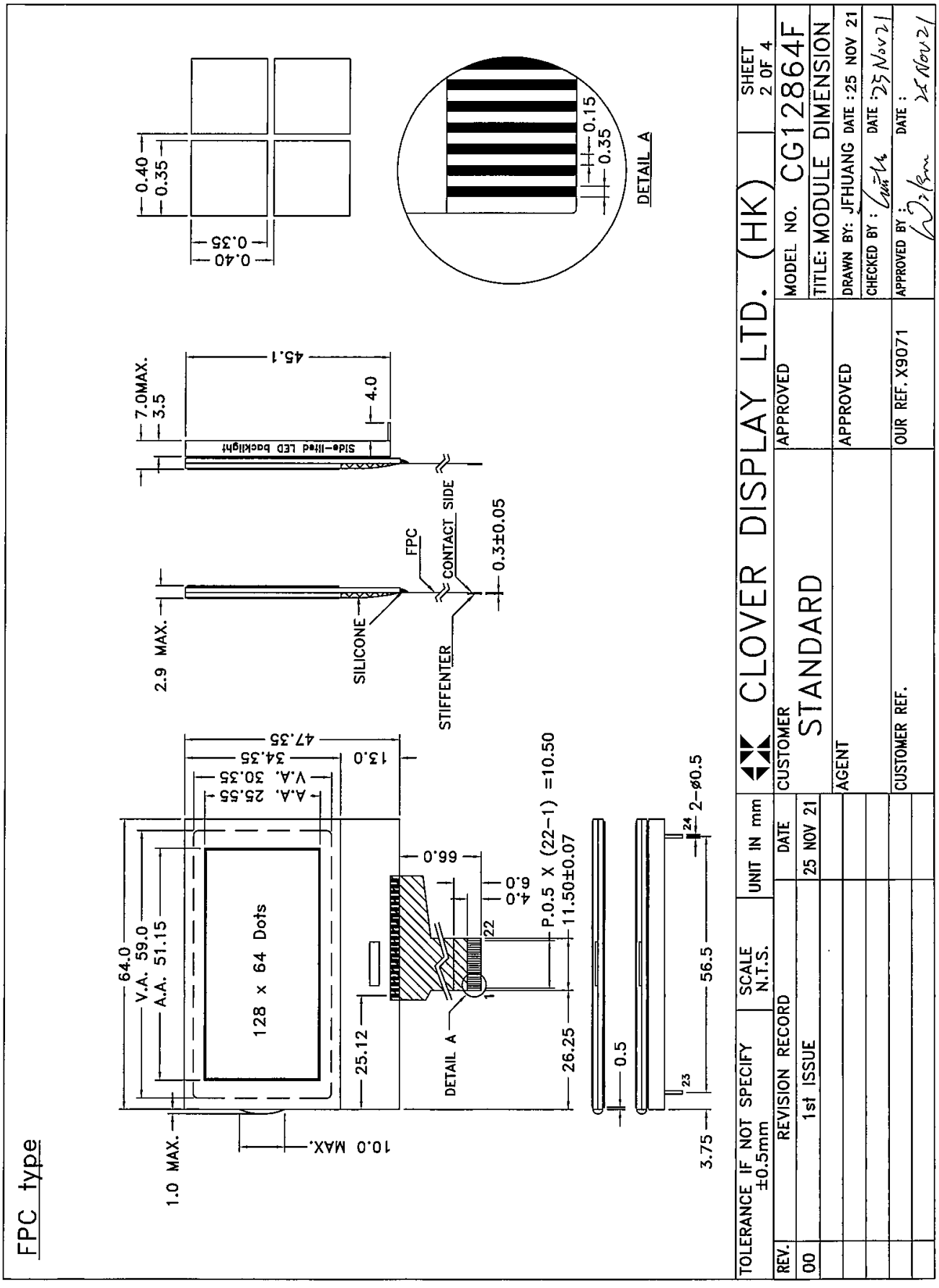
Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	V0	Power supply for LCD	13	DB3	Data bus
2	V1		14	DB2	
3	V2		15	DB1	
4	V3		16	DB0	
5	V4		17	/RD(E)	Read signal
6	VOUT	Voltage converter input	18	/WR(R/W)	Write signal
7	VSS	Ground	19	A0	Register select input
8	VDD	Power supply for logic	20	/RES	External reset input
9	D7(SI)	Data bus	21	CS2	Chip select
10	D6(SCL)		* 22	NC	No connection
11	DB5		* 23	A	Supply voltage for backlight (+VE)
12	DB4		* 24	K	Supply voltage for backlight (-VE)

Note (*) : Pin 23,24 are for backlight versions only.

COUNTER DRAWING OF MODULE DIMENSION

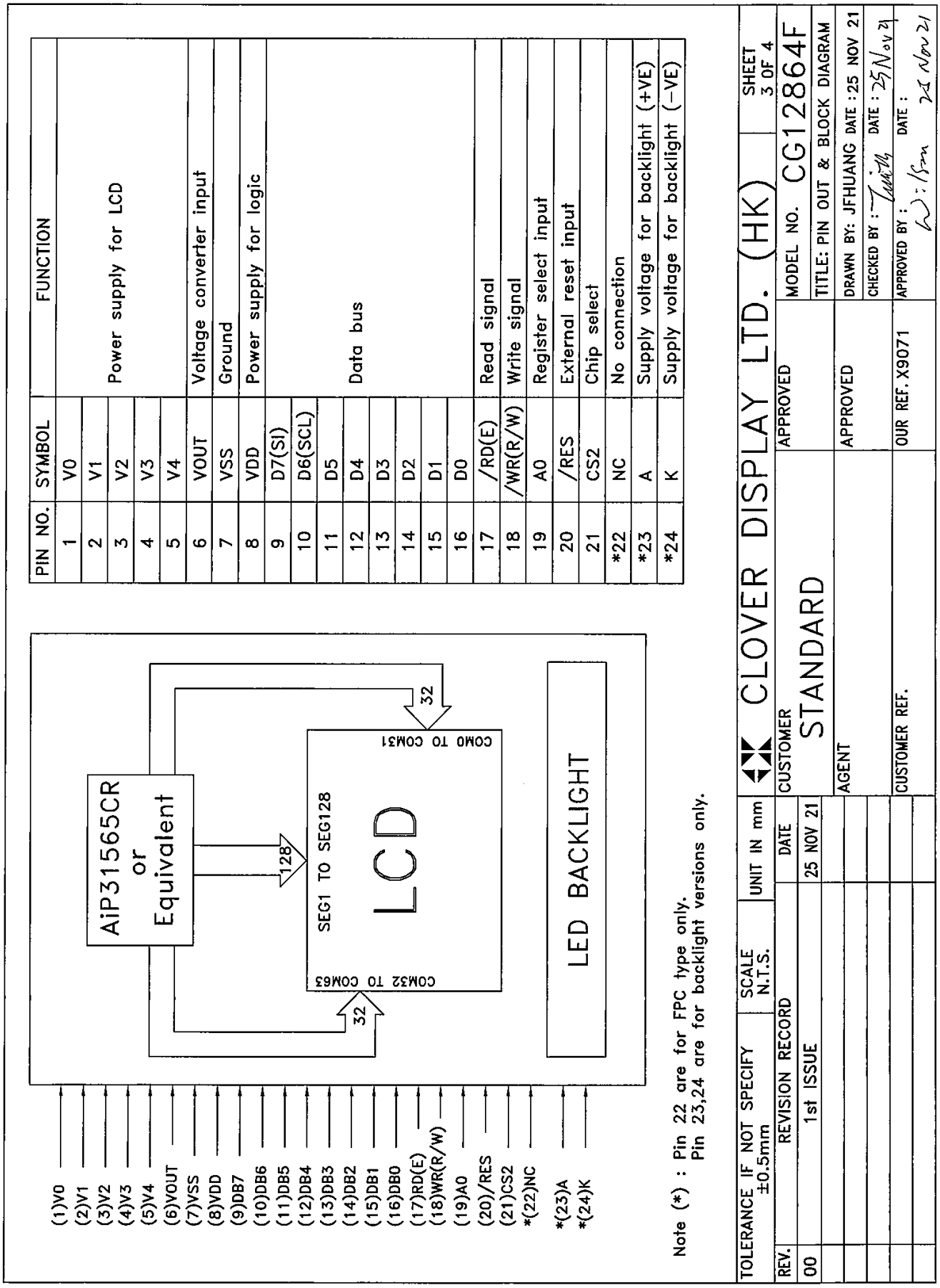


COUNTER DRAWING OF MODULE DIMENSION 2



***Special Code F must be used for FPC type**

COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM



1. General specification

Display mode	: 128 X 64 dots graphic COG LCD module
Interface	: 8 bit parallel
Driving method	: 1/65 duty , 1/9 bias

2. Electrical specification

Supply voltage for logic(VDD)	: 3.0V
Operating voltage for LCD(VLCD)	: 12.0V

3. Mechanical specification

Dot size	: 0.35 (L) X 0.35 (W)
Dot pitch	: 0.40 (L) X 0.40 (W)
Viewing area	: 59.0 (L) X 30.35 (W)
Module dimension	: 64.0 (L) X 47.35 (W) X 7.0 MAX.(H) (Side-lited backlight)
Side-lited LED	: 64.0 (L) X 47.35 (W) X 2.9 MAX.(H) (No backlight)

4. Backlight specification

Backlight type	: Side-lited LED
Backlight color	: White
Supply voltage for backlight	: 3.5V@30mA

TOLERANCE IF NOT SPECIFY ±0.5mm	SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)		SHEET 4 OF 4
REV.	REVISION RECORD	DATE	CUSTOMER STANDARD	APPROVED	MODEL NO. CG12864F
00	1st ISSUE	25 NOV 21			TITLE: SPECIFICATION
			AGENT	APPROVED	DRAWN BY: JFHUANG DATE :25 NOV 21
					CHECKED BY : DATE : 25Nov21
			CUSTOMER REF.	OUR REF. X9071	APPROVED BY : DATE : 25Nov21

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, @Ta=25℃

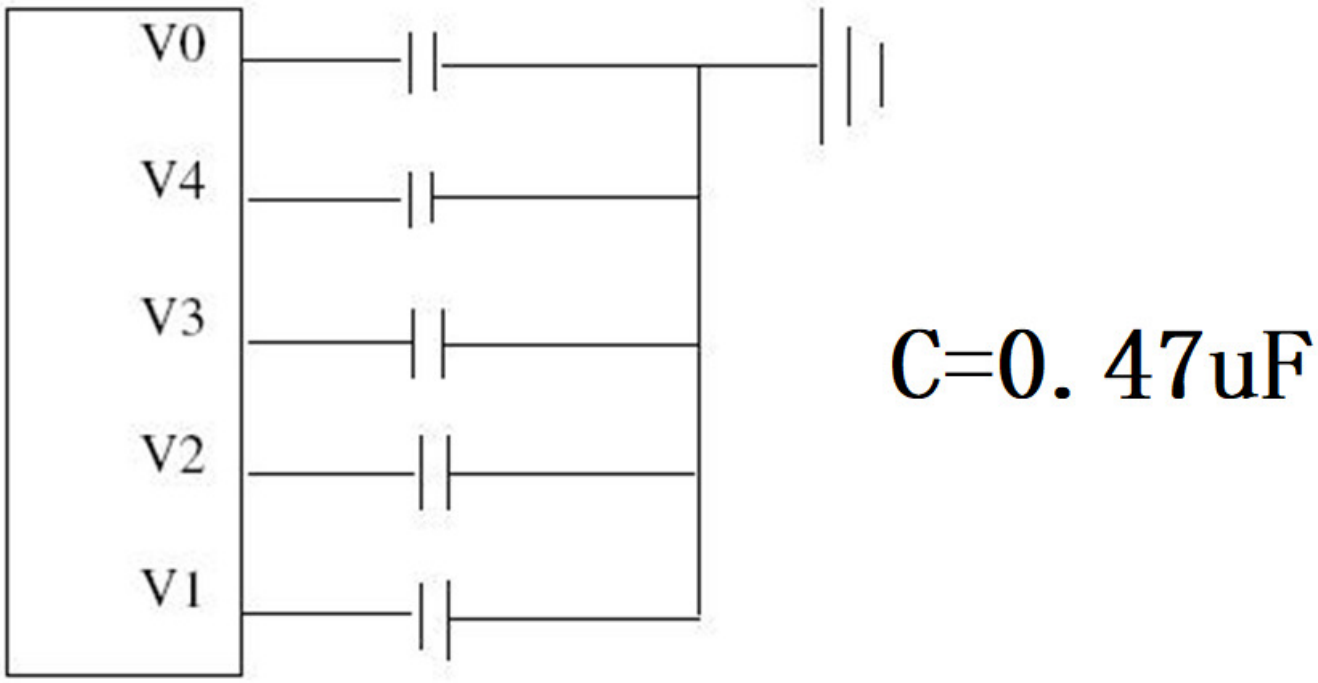
Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage for Logic	VDD	2.75	3.0	3.25	V
Supply Current for Logic	IDD	—	9.4	—	μA
Operating Voltage for LCD	VLCD	11.4	12	12.6	V
'High' Level Input Voltage	VIH	0.8VDD	—	VDD	V
'Low' Level Input Voltage	VIL	VSS	—	0.2VDD	V

Side/Array BL:

Constant voltage driving:

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Backlight current	I_{BL}	26	30	35	mA	V_{BL} = 3.5V

REFERENCE CIRCUIT EXAMPLE



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 3.6	-0.3 to 3.6	V
Operating Temperature	Topr	0 to 50	-20 to 70	℃
Storage Temperature	Tstg	-10 to 60	-30 to 80	℃

INSTRUCTIONS TABLE

Instruction	A0	R/W	Command Byte								Description
			D7	D6	D5	D4	D3	D2	D1	D0	
Display ON/OFF	0	0	1	0	1	0	1	1	1	D	D=1, display ON D=0, display OFF
Set Start Line	0	0	0	1	S5	S4	S3	S2	S1	S0	Set display start line
Set Page Address	0	0	1	0	1	1	Y3	Y2	Y1	Y0	Set page address
Set Column Address	0	0	0	0	0	1	X7	X6	X5	X4	Set column address (MSB)
	0	0	0	0	0	0	X3	X2	X1	X0	Set column address (LSB)
Read Status	0	1	BUSY	MX	D	RST	0	0	0	0	Read IC Status
Write Data	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write display data to RAM
Read Data	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read display data from RAM
SEG Direction	0	0	1	0	1	0	0	0	0	MX	Set scan direction of SEG MX=1, reverse direction MX=0, normal direction
Inverse Display	0	0	1	0	1	0	0	1	1	INV	INV =1, inverse display INV =0, normal display
All Pixel ON	0	0	1	0	1	0	0	1	0	AP	AP=1, set all pixel ON AP=0, normal display
Bias Select	0	0	1	0	1	0	0	0	1	BS	Select bias setting 0=1/9; 1=1/7 (at 1/65 duty)
Read-modify-Write	0	0	1	1	1	0	0	0	0	0	Column address increment: Read:+0 , Write:+1
END	0	0	1	1	1	0	1	1	1	0	Exit Read-modify-Write mode

RESET	0	0	1	1	1	0	0	0	1	0	Software reset
COM Direction	0	0	1	1	0	0	MY	-	-	-	Set output direction of COM MY=1, reverse direction MY=0, normal direction
Power Control	0	0	0	0	1	0	1	VB	VR	VF	Control built-in power circuit ON/OFF
Regulation Ratio	0	0	0	0	1	0	0	RR2	RR1	RR0	Select regulation resistor ratio
Set EV	0	0	1	0	0	0	0	0	0	1	Double command!! Set electronic volume (EV) level
	0	0	0	0	EV5	EV4	EV3	EV2	EV1	EV0	
Power Save Mode Set	0	0	1	0	1	0	1	1	0	MD	MD=0, sleep mode MD=1, normal
	0	0	0	0	0	0	0	0	0	0	
Power Save	0	0	Compound Command								Display OFF + All Pixel ON
Set Booster	0	0	1	1	1	1	1	0	0	0	Double command!! Set booster level: BL[1:0]=(0,0),×2,×3,×4 BL[1:0]=(0,1),×5 BL[1:0]=(1,1),×6
	0	0	0	0	0	0	0	0	BL1	BL0	
NOP	0	0	1	1	1	0	0	0	1	1	No operation
Test	0	0	1	1	1	1	-	-	-	-	Do NOT use. Reserved for testing.

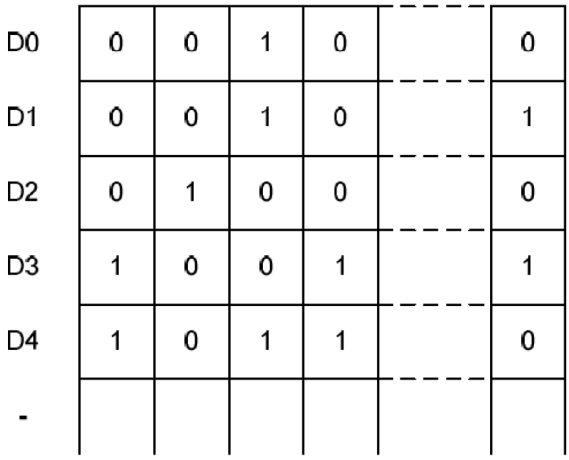
Note: Symbol "-" means this bit can be "H" or "L".

RECOMMENDED INITIAL SETTINGS

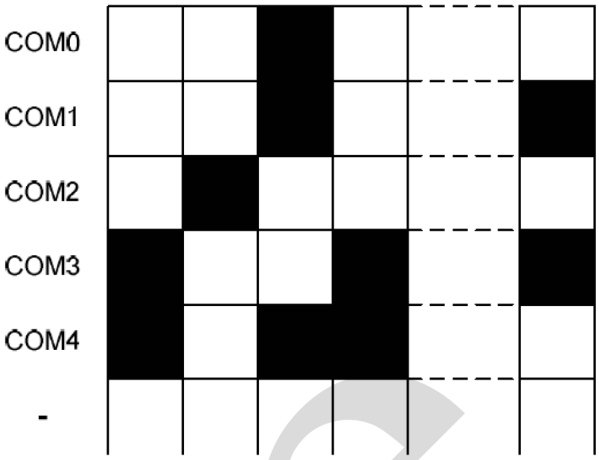
LCD Bias Select : A2H
ADC Select: A0H
Common output mode select : C0H
Regulator Resistor Select : 27H
Electronic volume register set : 31H
Power control set: 2BH

DISPLAY DATA RAM

AiP31565CR is built-in a RAM with 65×132 bit capacity which stores the display data. The display data RAM (DDRAM) store the dot data of the LCD. It is an addressable array with 132 columns by 65 rows (8-page with 8-bit and 1-page with 1-bit).The X-address is directly related to the column output number. Each pixel can be selected when the page and column addresses are specified. The rows are divided into: 8 pages (Page-0~Page-7) each with 8 lines (for COM0~63) and Page-8 with only 1 line (COMS, for icon). The display data (D7~D0) corresponds to the LCD common-line direction and D0 is on top. All pages can be accessed through D7~D0 directly except icon page. Icon RAM uses only 1-bit of data bus (D0). The microprocessor can write to and read from (only Parallel interfaces) DDRAM by the I/O buffer. Since the LCD controller operates independently, data can be written into DDRAM at the same time as data is being displayed without causing the LCD flicker or data-conflict.



Display Data RAM



Liquid Crystal Display

READ / WRITE CHARACTERISTICS (6800 SERIES)

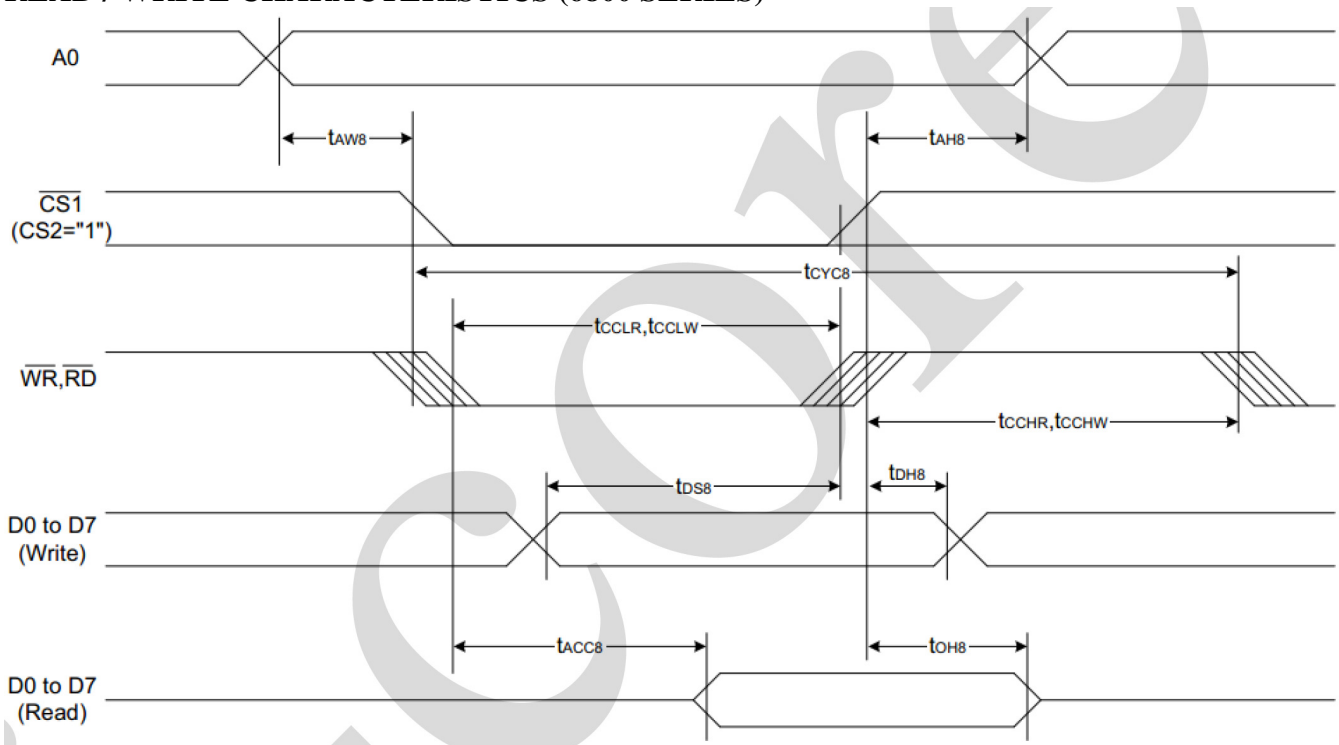


FIG 1、8080MPU

READ / WRITE CHARACTERISTICS (8080 SERIES)

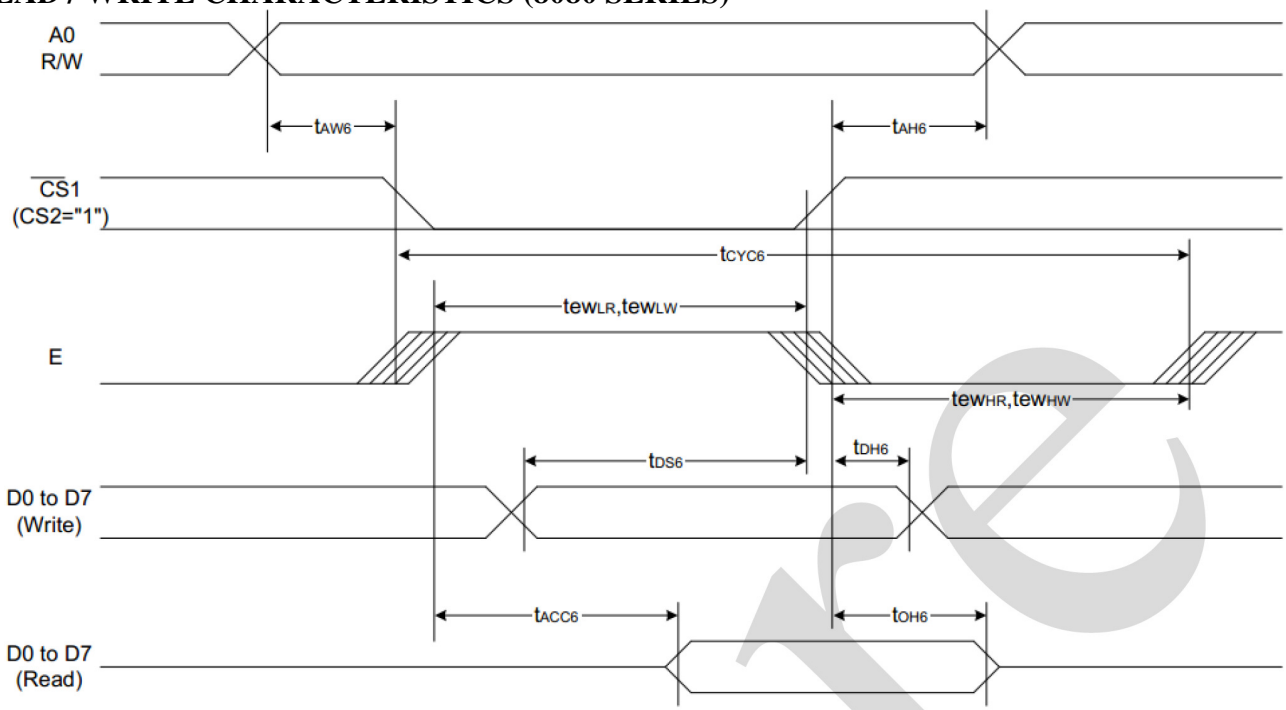


FIG 2、6800MPU

PARALLEL INTERFACE TIMING CHARACTERISTICS

VDD=3.3V,T_{amb}=25℃

Address hold time	t_{AH8}、t_{AH6}	A0,FIG 1、2	0	-	-	ns
Address setup time	t_{AW8}、t_{AW6}		0	-	-	ns
System cycle time	t_{CYC8}、t_{CYC6}	WR(E),FIG 1、2	240	-	-	ns
Enable L pulse width (WRITE)	t_{CCLW}、tew_{LW}		80	-	-	ns
Enable H pulse width (WRITE)	t_{CCHW}、tew_{HW}		80	-	-	ns
Enable L pulse width (READ)	t_{CCLR}、tew_{LR}	RD(E),FIG 1、2	80	-	-	ns
Enable H pulse width (READ)	t_{CCHR}、tew_{HR}		140	-	-	ns
WRITE Data setup time	t_{DS8}、t_{DS6}	D0 to D7 C_L=100pF FIG 1、2	40	-	-	ns
WRITE Address hold time	t_{DH8}、t_{DH6}		0	-	-	ns
READ access time	t_{ACC8}、t_{ACC6}		-	-	70	ns
READ Output disable time	t_{OH8}、t_{OH6}		5	-	50	ns
4-line SPI Clock Period	t_{SCYC}	SCL,FIG 3	50	-	-	ns
SCL “H” pulse width	t_{SHW}		25	-	-	ns
SCL “L” pulse width	t_{SLW}		25	-	-	ns
Address setup time	t_{SAS}	A0,FIG 3	20	-	-	ns
Address hold time	t_{SAH}		10	-	-	ns
Data setup time	t_{SDS}	SI,FIG 3	20	-	-	ns
Data hold time	t_{SDH}		10	-	-	ns
CS-SCL time	t_{CCSS}	CS,FIG 3	20	-	-	ns
	t_{CSH}		40	-	-	ns

RESET INPUT TIMING

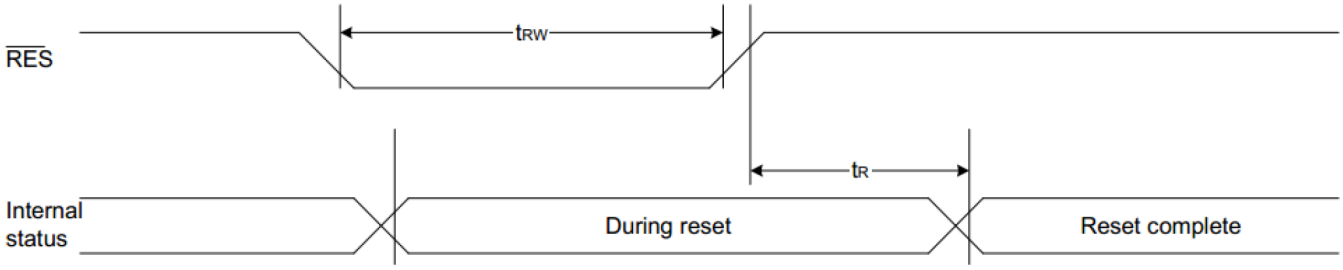


FIG 4、Reset Timing

Reset time	t_R	FIG 4	-	-	1.0	us
Reset “L” pulse width	t_{RW}	/RES,FIG 4	1.0	-	-	us

THE RESET CIRCUIT

Setting /RES to "L" can initialize internal function. While /RES is "L", no instruction except read status can be accepted./RES pin must connect to the reset pin of MPU and initialization by /RES pin is essential before operating. Please note the hardware reset is not same as the software reset. When /RES becomes "L", the hardware reset procedure will start. When RESET instruction is executed, the software reset procedure will start. The procedure is listed below:

Procedure	Hardware Reset	Software Reset
Display OFF:D=0, all SEGs/COMs output at VSS	V	X
Normal Display:INV=0, AP=0	V	X
SEG Normal Direction:MX=0	V	X
Clear Serial Counter and Shift Register (if using Serial Interface)	V	X
Bias Selection:BS=0	V	X
Booster Level BL=0	V	X
Exit Power Saving Mode	V	X
Power Control OFF:VB=0, VR=0, VF=0	V	X
Exit Read-modify-Write mode	V	V
Static Indicator OFF	V	V
Static Indicator Register SIR[1:0]=(0,0)	V	V
Start Line S[5:0]=0	V	V
Column Address X[7:0]=0	V	V
Page Address Y[3:0]=0	V	V
COM Normal Direction: MY=0	V	V
V0 Regulation Ratio RR[2:0]=(1,0,0)	V	V
EV[5:0]=(1,0,0,0,0,0)	V	V
Exit Test Mode	V	V

After power-on, RAM data are undefined and the display status is "Display OFF". It's better to initialize whole DDRAM (ex:fill all 00h or write the display pattern) before turning the Display ON. Besides, the power is not stable at the time that the power is just turned ON. A hardware reset is needed to initialize those internal registers after the power is stable.

ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION: POWER SUPPLY = V_{OP} / 64 Hz
TEMPERATURE = 23 ± 5 ℃
RELATIVE HUMIDITY = 60 ± 20 %

ITEM	SYMBOL	UNIT	TYP. STN
RESPONSE TIME	Ton	ms	220
	Toff	ms	280
CONTRAST RATIO	Cr	-	12
VIEWING ANGLE (6 O'clock) Cr ≥ 2	V3:00	°	40
	V6:00	°	70
	V9:00	°	40
	V12:00	°	50

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

RELIABILITY OF LCD MODULE

ITEM	TEST CONDITION FOR NORMAL TEMPERATURE	TEST CONDITION FOR WIDE TEMPERATURE	TIME
High temperature operating	50°C	70°C	240 hours
Low temperature operating	0°C	-20°C	240 hours
High temperature storage	60°C	80°C	240 hours
Low temperature storage	-10°C	-30°C	240 hours
Temperature-humidity storage	40°C 90% R.H.	60°C 90% R.H.	96 hours
Temperature cycling	-10°C to 60°C 30 Min Dwell	-30°C to 80°C 30 Min Dwell	5 cycle
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	—

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) £ 1 / 3 W DOT MATRIX: IF 0.6 < W , MAX(a,b) < 0.3 N.A.** IF 0.4 < W < 0.6, MAX(a,b) < 0.25 N.A.**IF W < 0.4, MAX(a,b) < 0.2 N.A.**	MINOR	1
EXCESS SEGMENT	MAX(c,d) ≤ 1 / 3 T	MINOR	1
BUBBLES	d* ≥ 0.7 QTY=0	MINOR	2
BLACKS SPOTS	d ≤ 0.7 N.A.** 0.7<d≤0.8 QTY≤2 0.8<d QTY=0	MINOR	2
LINE SCRATCHES	x≥0.7 y≥0.05 QTY=0	MINOR	3
BLACK LINE	x≥0.7 y≥0.05 QTY=0	MINOR	3

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

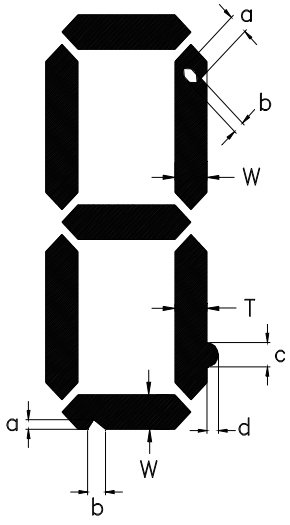
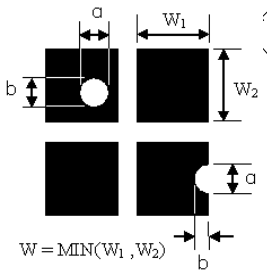
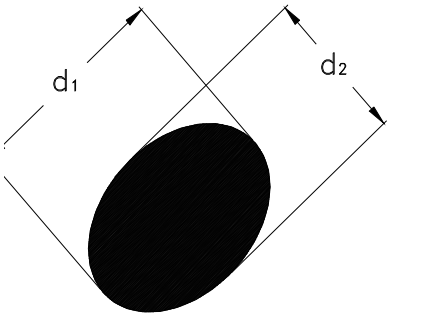
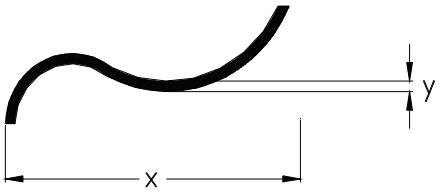


fig . 1





POLARIZER BUBBLES / SPOTS
fig . 2



LINE SCRATCHES / BLACK LINE
fig . 3

QUALITY STANDARD (CONT .)

DEFECT		CRITERIA	TYPE	FIGURE
CHIPS	CONTACT EDGE	e≤T f≤1/2W g:N.A.	MINOR	4
	BOTTOM GLASS	p≤V.A.*** q:N.A. r≤T		4
	CORNER	a:N.A. b≤W		4
	TOP GLASS	a:N.A. b≤T c≤W		5
GLASS PROTRUSION		a ≤ 1/3 W	MINOR	6
RAINBOW		-	MINOR	-

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

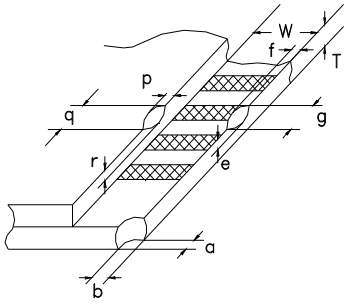


fig . 4

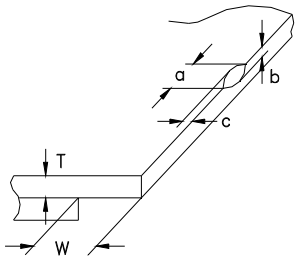


fig . 5

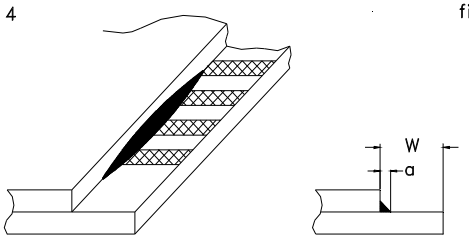


fig . 6

HANDLING PRECAUTIONS

(1) CAUTION OF LCD HANDLING & CLEANING

The polarizing plate on the surface of the panel is made from organic substances. Be very careful for chemicals not to touch the plate or it leads the polarizing plate to deteriorate.

If the use of a chemical is unavoidable, wipe the panel lightly with soft materials, such as gauze and absorbent cotton, soaked in a solvent.

*Usable solvent: Alcohol (ethanol, IPA and the like)
*Appropriate solvent: Ketones, ethyl alcohol

Avoid wiping with a dry cloth, since it could damage the surface of the polarizing plate and others.
Do not expose to direct sunlight or fluorescent light for a long time

(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.

(3) ESD PRECAUTION

Inputs and outputs are protected against electrostatic discharge in normal handling. However, to be totally safe, it is recommended to take normal precautions appropriate to handling LCM module. For example: product surface grounding.

Always take ESD precaution when handling the *LCD Module*. Components are exposed for direct finger touches and can be damaged unless ESD precaution is taken.

(4) PACKAGING

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

(5) CAUTION FOR OPERATION

The viewing angle can be adjusted by varying the LCD driving voltage VO.

Driving voltage should be kept within specified range, excess voltage shortens display life.

Response time increases with decrease in temperature.

Display may turn black or dark Blue at temperature above its operational range; this is however not destructive and the display will return to normal once the temperature falls back to range.

Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear “fractured”. They will recover once the display is turned off.

Condensation at terminals will cause malfunction and possible electrochemical reaction. Relative humidity of the environment should therefore be kept below 60%.

(6) SAFETY

Liquid crystal may leak out of a damaged LCD, it is recommended to wash off the liquid crystal by using solvents such as acetone or ethanol and should be burned up later.

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

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.

SPECIFICATION REVISION RECORD

Revision No.	**Description**	**Date** (DD/MM/YY)
00	1st Issue	25/11/21