



CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model: CG12864G - _ _ - _ _ - _ _ - _

Revision	00
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Date	29 OCT 2021
Our Reference	9072

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MODE OF DISPLAY**Display mode**

- 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:CG12864G- 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
G – Green
R – Red
M – RGB

*(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 : Serial

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

Controller IC : Sitronix ST7567 or equivalent
For the detailed information, please refer to the IC specifications

MECHANICAL DIMENSIONS

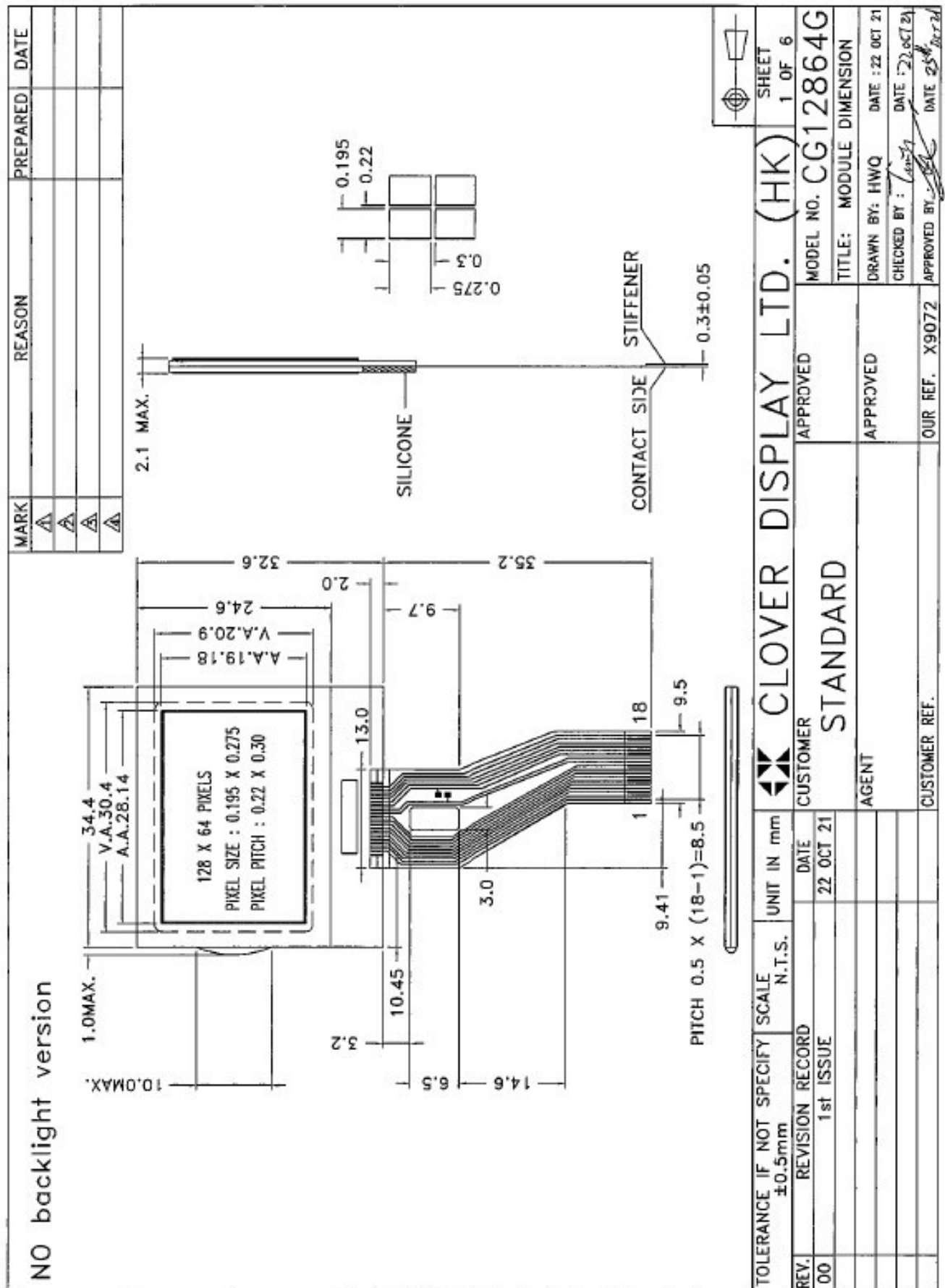
Item	Dimension	Unit	Item	Dimension	Unit
Outline Dimension			Viewing Area	30.4(L)x20.9(W)	mm
No Backlight (N)	34.4(L)x32.6(W)x2.2max(H)	mm	Dot Pitch	0.22(L)x0.30(W)	mm
LED Sided Backlight(L)	34.4(L)x32.6(W)x5.8max(H)	mm	Dot Size	0.195(L)x0.275(W)	mm
RGB Backlight	34.4(L)x32.6(W)x6.5max(H)	mm			

CONNECTOR PIN ASSIGNMENT

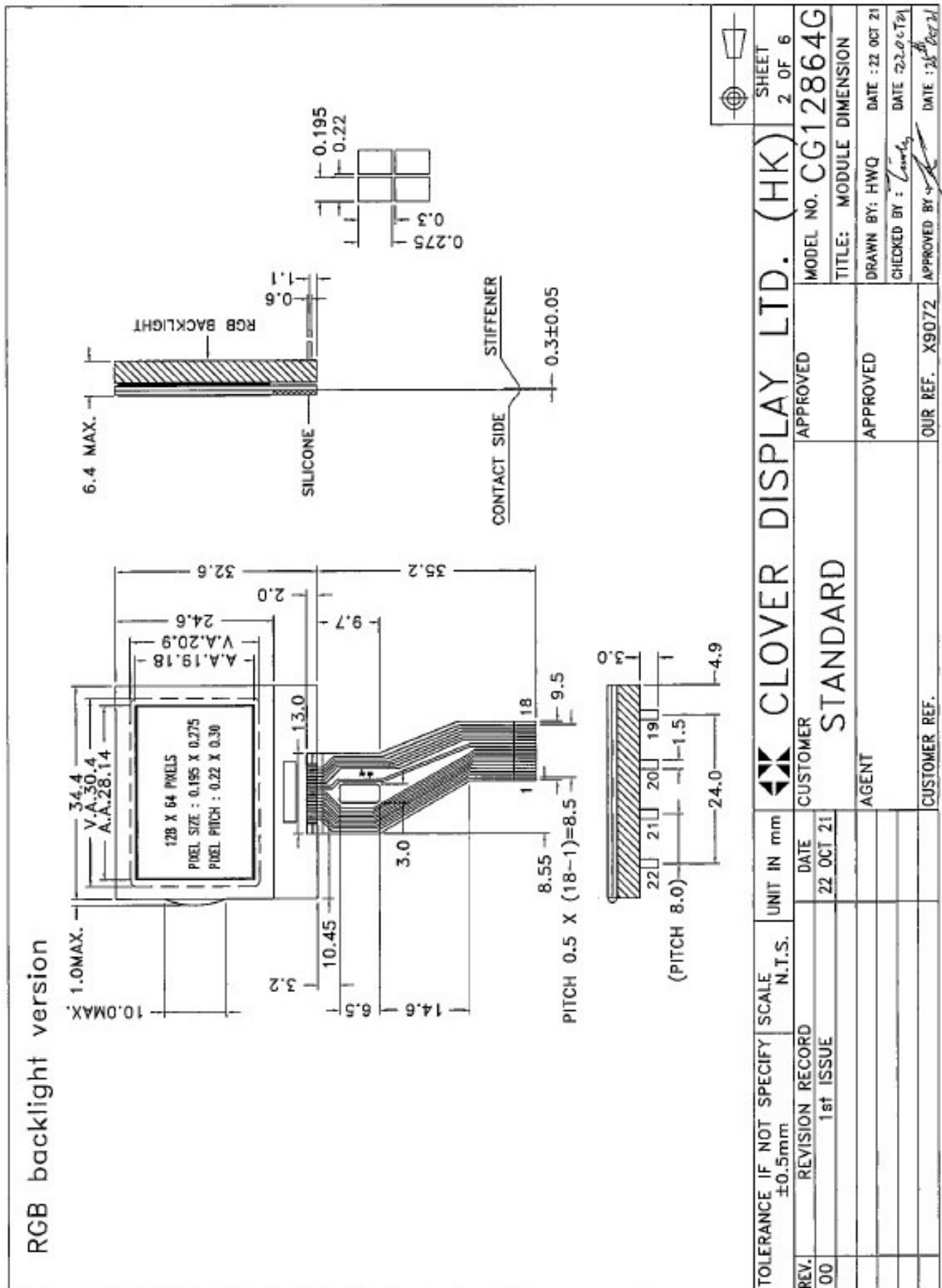
Pin No.	Symbol	Function
1	NC	No Connection
2	NC	
3	NC	
4	NC	
5	VG	LCD driving voltage
6	NC	No Connection
7	NC	
8	XV0	LCD driving voltage
9	V0	LCD driving voltage
10	NC	No Connection
11	NC	
12	VSS	Ground
13	VDD	Power Supply for Logic
14	D7(SI)	Serial Data Input pin
15	D6(SCL)	Serial Clock Input pin
16	A0	Data Control Signal
17	RSTB	Hardware reset input pin
18	CSB	Chip Select input pin
(*)19	A(side-lited LED)	Supply voltage for backlight (+VE)
(*)20	K(side-lited LED)	Supply voltage for backlight (-VE)
(*)19	A(RGB)	Supply voltage for backlight (+VE)
(*)20	KR(RGB)	Supply voltage for backlight (-VE)
(*)21	KG(RGB)	Supply voltage for backlight (-VE)
(*)22	KB(RGB)	Supply voltage for backlight (-VE)

Note (*): Pin 19, 20,21,22 are for backlight versions only.

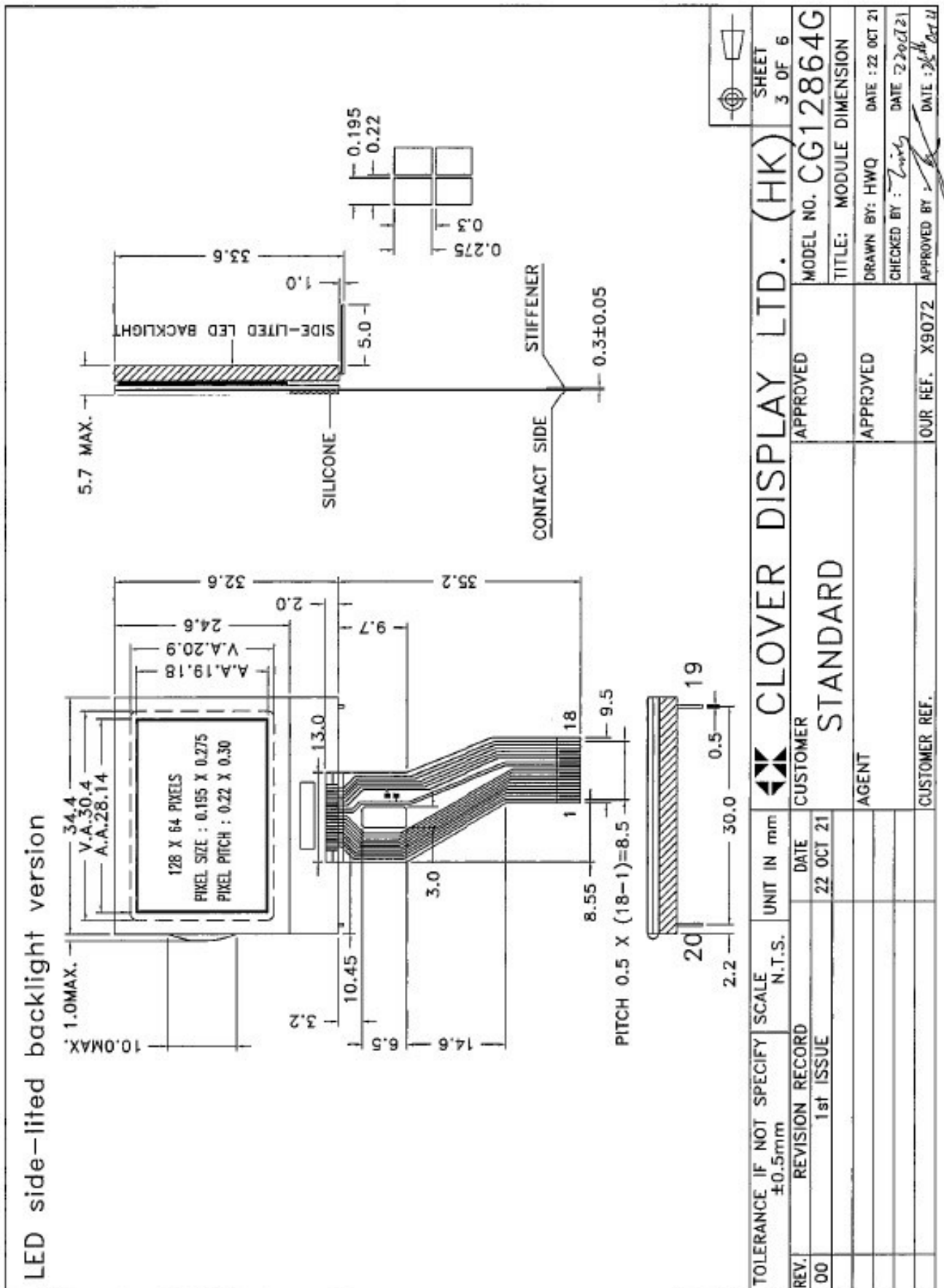
**COUNTER DRAWING OF MODULE DIMENSION
(NO BACKLIGHT VERSION)**



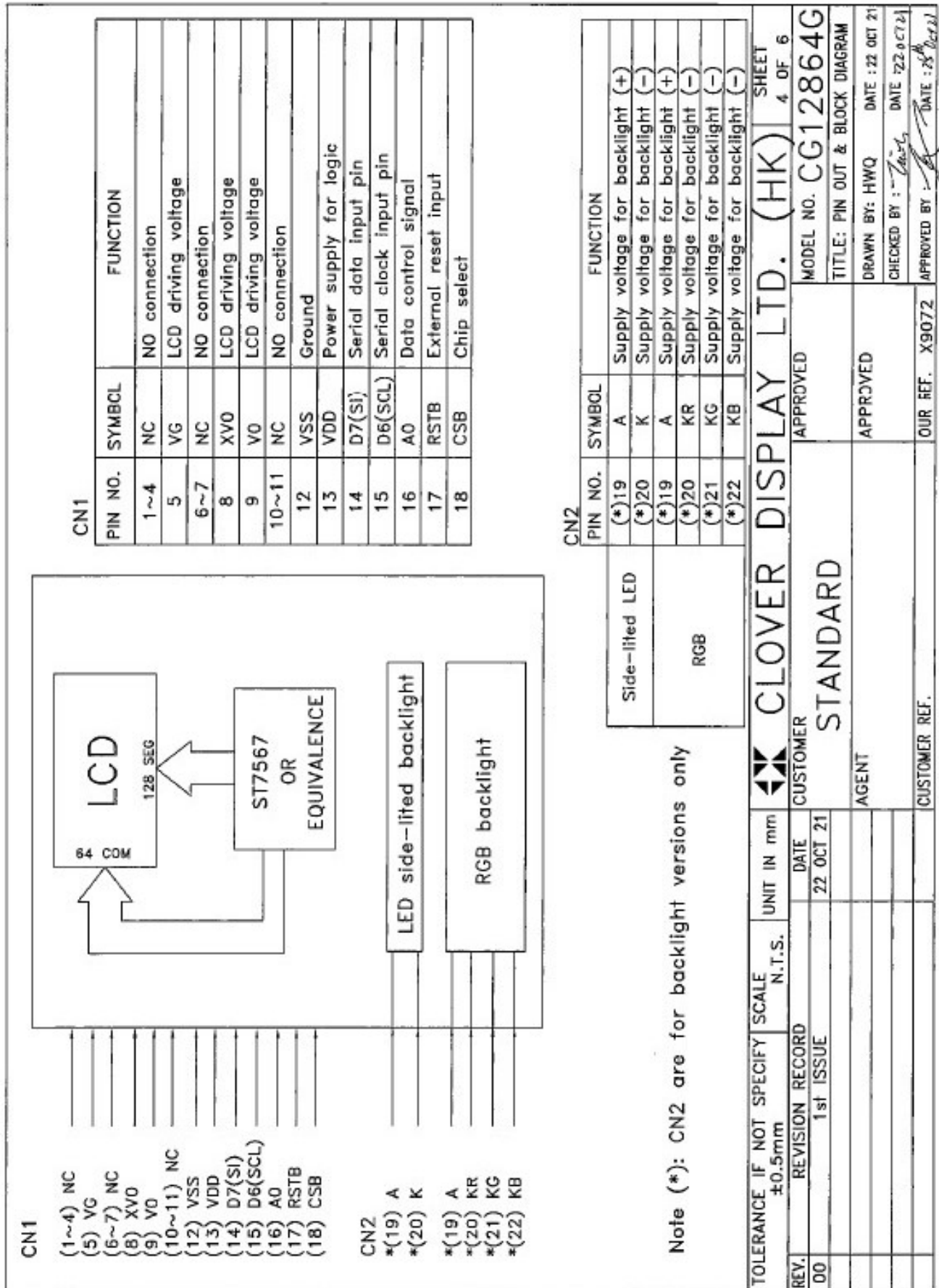
COUNTER DRAWING OF MODULE DIMENSION (RGB BACKLIGHT VERSION)



COUNTER DRAWING OF MODULE DIMENSION (LED SIDE-LITED BACKLIGHT VERSION)



COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, @Ta=25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage for Logic	VDD	2.8	3.0	3.2	V
Supply Current for Logic	IDD	—	0.22	0.33	mA
Operating Voltage for LCD (*)	VLCD	11.4	12	12.6	V
‘High’ Level Input Voltage	VIH	0.7VDD	—	VDD	V
‘Low’ Level Input Voltage	VIL	VSS	—	0.3VDD	V

Note (*): There is tolerance in optimum LCD driving voltage during production and it will be within the specified range. Please refer to Connection Example (4X Boosting Circuit)

Side Backlight:

Constant voltage driving:

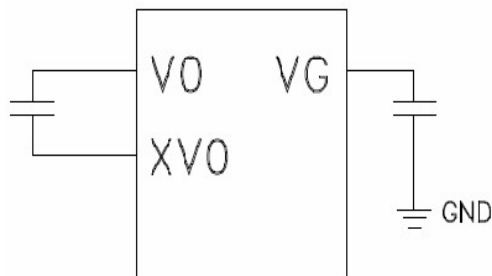
Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Red	I _{BL}	—	20	30	mA	V _{BL} = 3.5V
White	I _{BL}	—	12	14	mA	V _{BL} = 3.5V
Green	I _{BL}	—	20	30	mA	V _{BL} = 3.5V
Blue	I _{BL}	—	20	30	mA	V _{BL} = 3.5V

RGB Backlight:

Constant voltage driving:

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Red	I _{BL}	—	14	20	mA	V _{BL} = 5.0V
Green	I _{BL}	—	22	30	mA	V _{BL} = 5.0V
Blue	I _{BL}	—	10	16	mA	V _{BL} = 5.0V

REFERENCE CIRCUIT EXAMPLE



Item	Value	Unit
C	1.0	μF

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	°C
Storage Temperature	Tstg	-10 to 60	-30 to 80	°C

INSTRUCTIONS

INSTRUCTION	A0	R/W (RWR)	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
(1) Display ON/OFF	0	0	1	0	1	0	1	1	1	D	D=1, display ON D=0, display OFF
(2) Set Start Line	0	0	0	1	S5	S4	S3	S2	S1	S0	Set display start line
(3) Set Page Address	0	0	1	0	1	1	Y3	Y2	Y1	Y0	Set page address
(4) 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)
(5) Read Status	0	1	0	MX	D	RST	0	0	0	0	Read IC Status
(6) Write Data	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write display data to RAM
(7) Read Data	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read display data from RAM
(8) 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
(9) Inverse Display	0	0	1	0	1	0	0	1	1	INV	INV =1, inverse display INV =0, normal display
(10) All Pixel ON	0	0	1	0	1	0	0	1	0	AP	AP=1, set all pixel ON AP=0, normal display
(11) 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)
(12) Read-modify-Write	0	0	1	1	1	0	0	0	0	0	Column address increment: Read:+0 , Write:+1
(13) END	0	0	1	1	1	0	1	1	1	0	Exit Read-modify-Write mode
(14) RESET	0	0	1	1	1	0	0	0	1	0	Software reset
(15) COM Direction	0	0	1	1	0	0	MY	-	-	-	Set output direction of COM MY=1, reverse direction MY=0, normal direction
(16) Power Control	0	0	0	0	1	0	1	VB	VR	VF	Control built-in power circuit ON/OFF
(17) Regulation Ratio	0	0	0	0	1	0	0	RR2	RR1	RR0	Select regulation resistor ratio
(18) Set EV	0	0	1	0	0	0	0	0	0	1	Double command!! Set
	0	0	0	0	EV5	EV4	EV3	EV2	EV1	EV0	electronic volume (EV) level
(19) Set Booster	0	0	1	1	1	1	1	0	0	0	Double command
	0	0	0	0	0	0	0	0	0	BL	Set booster level: BL=0: 4X BL=1: 5X
(20) Power Save	0	0	Compound Command								Display OFF + All Pixel ON
(21) NOP	0	0	1	1	1	0	0	0	1	1	No operation
(22) Test	0	0	1	1	1	1	1	1	1	TE	Test Command Moe TE=0: releasing test command mode TE=1: entering test command mode

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

RECOMMENDED SETTINGS

LCD Bias Set : A2H

ADC Select : A0H

Common Output Mode Select : C8H

V0 Voltage Regulator Internal Resistor Ratio Set : 27H

Set the V0 output voltage: 81H

Electronic Volume Register Set : 2FH

Power Control Set: 2FH

Display Start Line Set : 40H

Booster Ratio Set : F8H , 01H

DISPLAY DATA RAM (DDRAM)

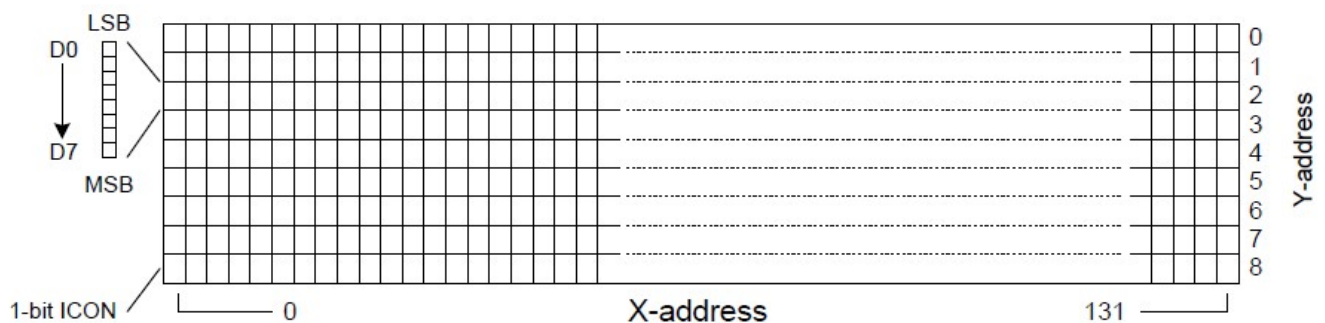
ST7567 is built-in a RAM with 65X132 bit capacity which stores the display data. The display data RAM (DDRAM) store the dot data of the LCD. It is an addressable array with 132 columns by 65 rows (8-page with 8-bit and 1-page with 1-bit). The X-address is directly related to the column output number. Each pixel can be selected when the page and column addresses are specified (please refer to Fig 7 for detailed illustration). 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 D[7:0] directly except icon page. Icon RAM uses only 1-bit of data bus (D0). Refer to Fig 8 for detailed illustration. 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.

D0	0	1	1	1		0
D1	1	0	0	0		0
D2	0	0	0	0		0
D3	0	1	1	1		0
D4	1	0	0	0		0
-						

Display Data RAM

COM0						
COM1						
COM2						
COM3						
COM4						
-						

Liquid Crystal Display



DISPLAY DATA RAM MAP

The relation between DDRAM and outputs with different MX or MY setting is shown below.

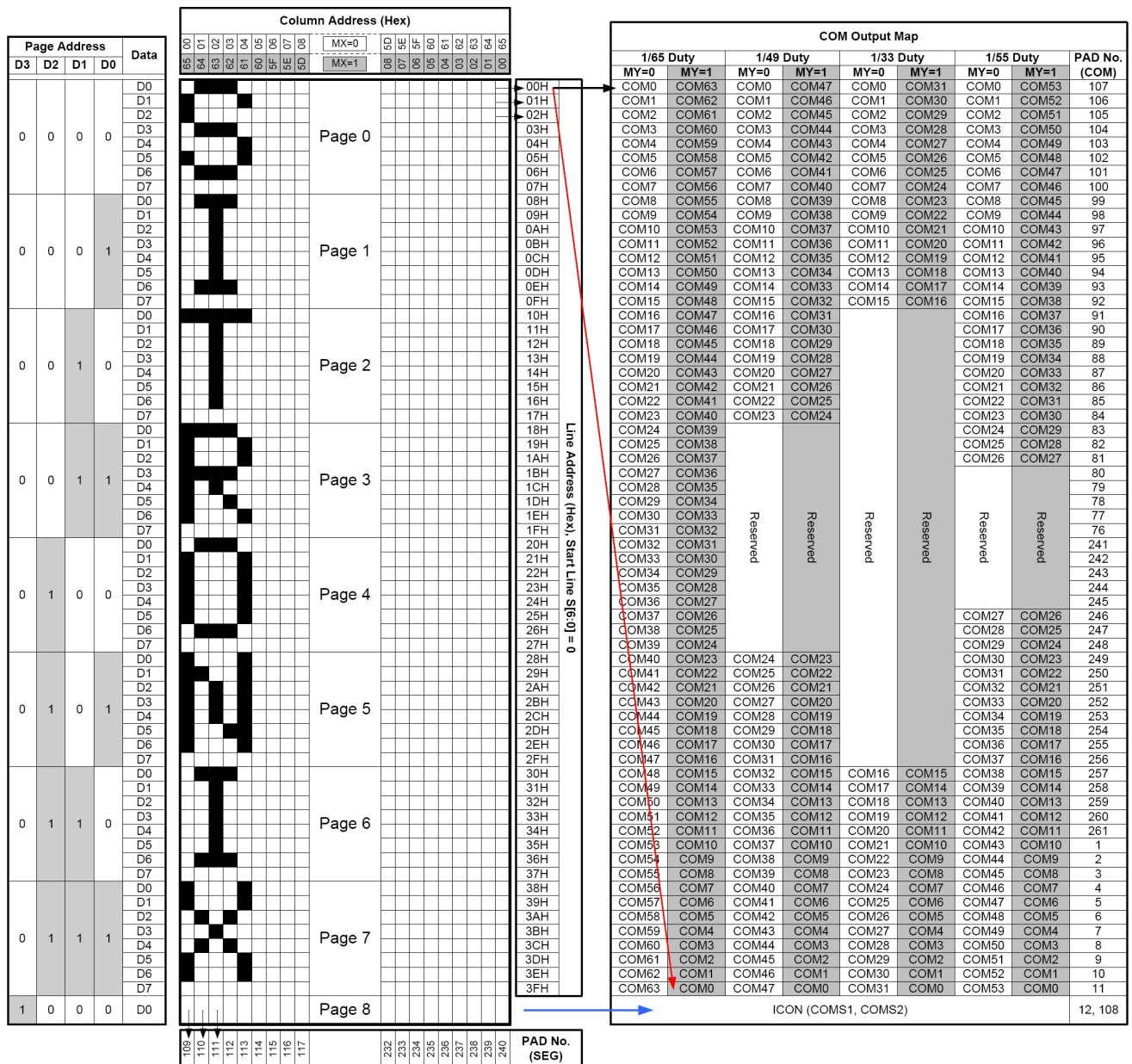
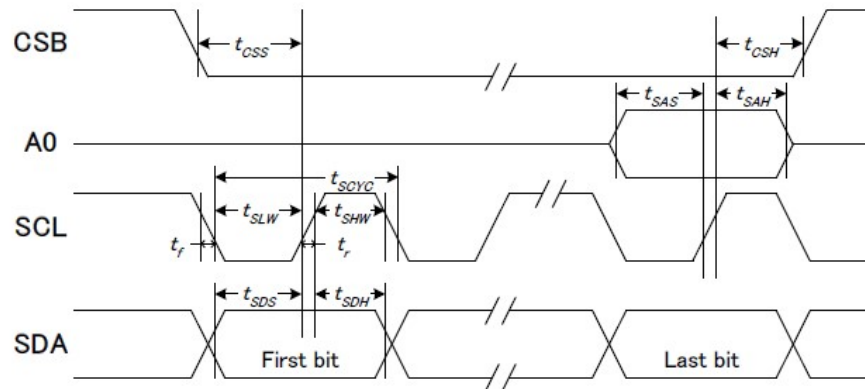


Fig 9. DDRAM and Output Map (COM/SEG)

SERIAL INTERFACE TIMING DIAGRAM

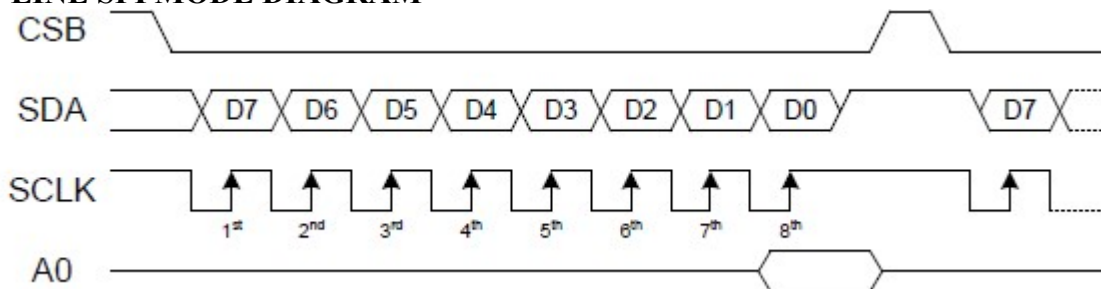


Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock period	SCLK	tSCYC		100	—	ns
SCLK "H" pulse width		tSHW		50	—	
SCLK "L" pulse width		tSLW		50	—	
Address setup time	A0	tSAS		30	—	
Address hold time		tSAH		20	—	
Data setup time	SDA	tSDS		30	—	
Data hold time		tSDH		20	—	
CSB-SCLK time	CSB	tCSS		30	—	
CSB-SCLK time		tCSH		60	—	

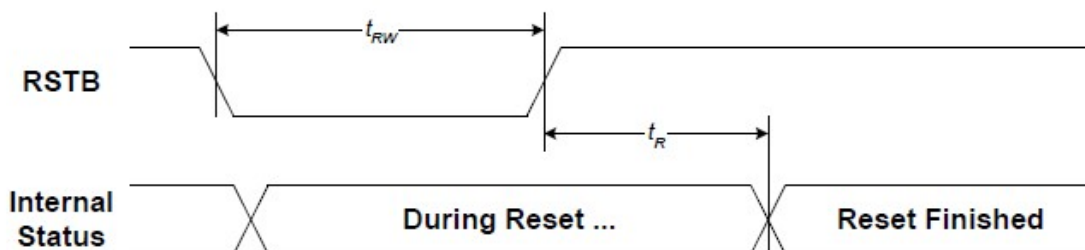
*1 The input signal rise and fall time(t_r, t_f) are specified at 15 ns or less.

*2 All timing is specified using 20% and 80% of V_{dd1} as the standard.

4-LINE SPI MODE DIAGRAM



RESET TIMING DIAGRAM



RESET TIMING

Item	Symbol	Condition	Min.	Max.	Unit
Reset time	tR		—	2.0	us
Reset "L" pulse width	tRW		2.0	—	

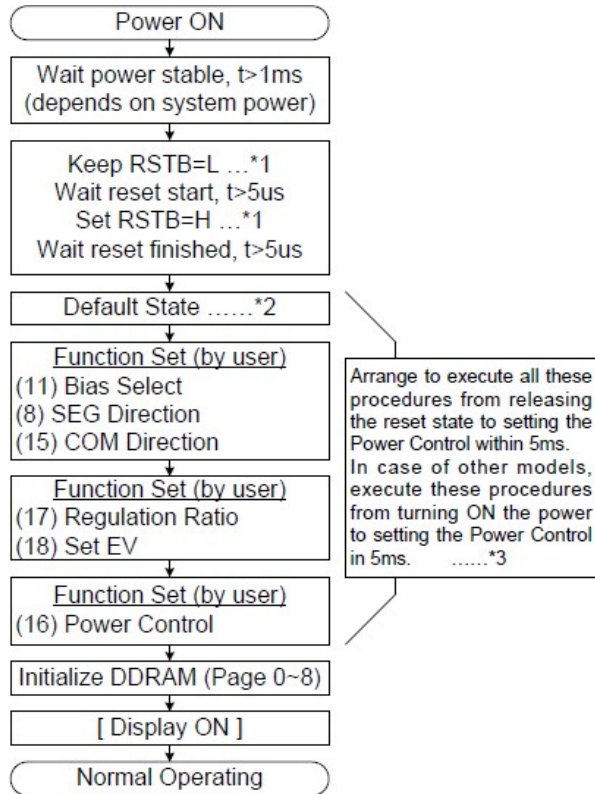
THE RESET CIRCUIT

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

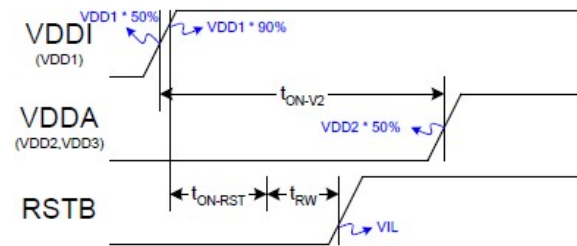
Procedure	Hardware Reset	Software Reset
Display OFF: D=0, all SEGs/COMs output at VSS	V	X
Normal Display: INV=0, AP=0	V	X
SEG Normal Direction: MX=0	V	X
Clear Serial Counter and Shift Register (if using Serial Interface)	V	X
Bias Selection: BS=0	V	X
Booster Level BL=0	V	X
Exit Power Saving Mode	V	X
Power Control OFF: VB=0, VR=0, VF=0	V	X
Exit Read-modify-Write mode	V	V
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: TE=0	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.

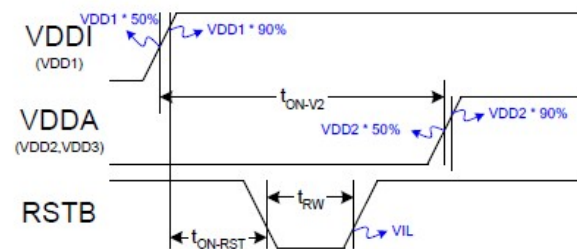
INITIALIZATION METHOD



Case 1: RSTB=L while Power ON



Case 2: RSTB=H while Power ON



Note: The detailed description can be found in the respective sections listed below.

1. Please refer to the timing specification of t_{RW} and t_R .
2. Refer to Section RESET CIRCUIT.
3. The 5ms requirement depends on the characteristics of LCD panel and the external component of the power circuit. It is recommended to check with the real products with external component.
4. The detailed instruction functionality is described in Section 9. INSTRUCTION DESCRIPTION;
5. Power stable is defined as the time that the later power (VDD1 or VDDA) reaches 90% of its rated voltage.

ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION: POWER SUPPLY = V_{OP} / 64 Hz
 TEMPERATURE = 23 ± 5 °C
 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	—

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	$\text{MAX}(a,b) \leq 1/3 W$ DOT MATRIX: IF $0.6 \leq W$, $\text{MAX}(a,b) < 0.3 \text{ N.A.}^{**}$ IF $0.4 \leq W < 0.6$, $\text{MAX}(a,b) < 0.25 \text{ N.A.}^{**}$ IF $W < 0.4$, $\text{MAX}(a,b) < 0.2 \text{ N.A.}^{**}$	MINOR	1
EXCESS SEGMENT	$\text{MAX}(c,d) \leq 1/3 T$	MINOR	1
BUBBLES	$d^* \geq 0.5$ QTY=0	MINOR	2
SPOTS	$d \leq 0.6 \text{ N.A.}^{**}$ $0.6 < d \leq 0.7$ QTY ≤ 2 $0.7 < d$ 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 : E

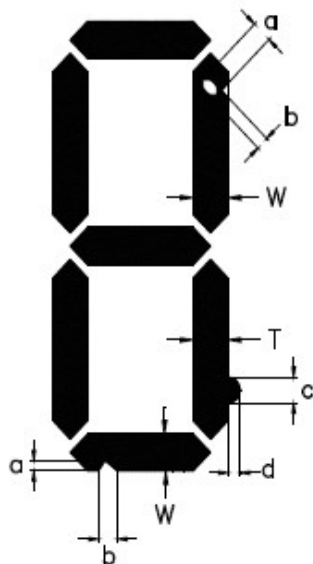
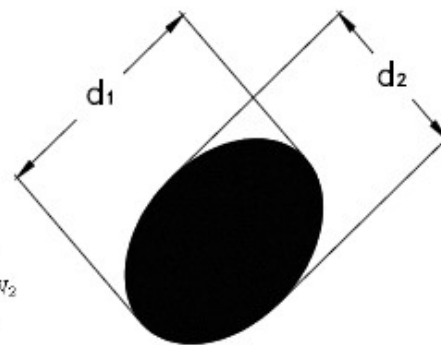
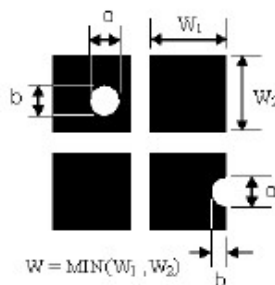
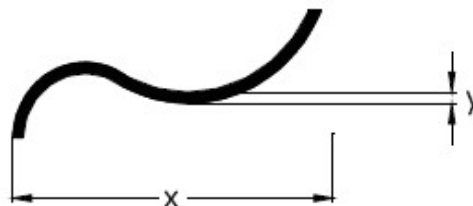


fig . 1



POLARIZER BUBBLES / SPOTS

fig . 2



LINE SCRATCHES / BLACK LINE

QUALITY STANDARD (CONT .)

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

UNLESS STATE OTHERWISE , ALL UNIT ARE IN MILLIMETER .

***CANNOT EXTEND IN V.A.

DEFECT TABLE : E

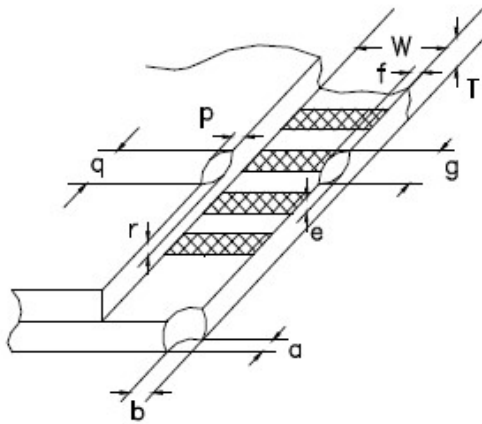


fig . 4

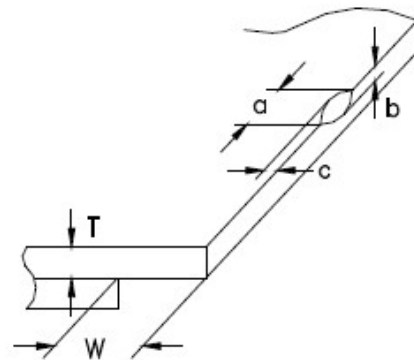


fig . 5

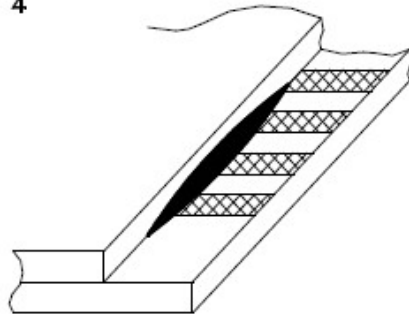
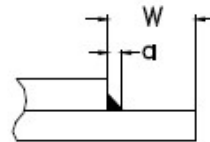


fig . 6



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

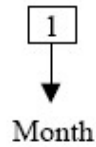
CLOVER will replace or repair any of her LCD module in accordance with her LCD specification for a period of one year from date of shipment. The warranty liability of Clover is limited to repair and/or replacement. Clover will not be responsible for any subsequent or consequential event.

APPENDIX

LOT INDICATION OF LCD MODULE

CODING SYSTEM:

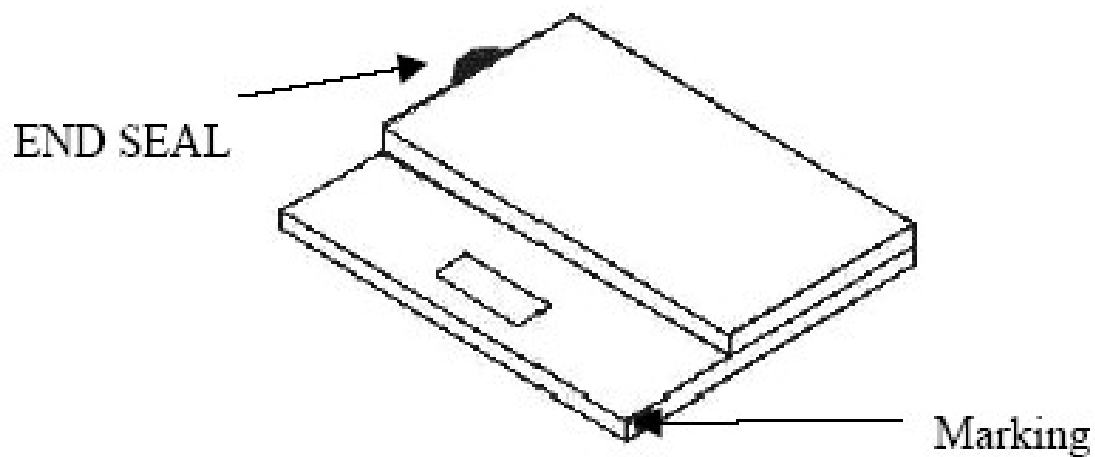
1 DIGIT COLOR CODE:



COLOR CODE:

MONTH	COLOR	
1	BROWN	棕
2	RED	紅
3	ORANGE	橙
4	YELLOW	黃
5	GREEN	綠
6	BLUE	藍
7	PURPLE	紫
8	GREY	灰
9	WHITE	白
10	BLACK	黑
11	GOLD	金
12	SILVER	銀

LOCATION AS SHOWN BELOW:



For internal use ONLY
SPECIFICATION REVISION RECORD

Revision No.	Description	Date(DD/MM/YY)
00	1 st Issue	29/10/21