



CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model : CV12024A - _ _ _ - _ _ _ - _ _ _ - _ _

Revision	00
Engineering	Timmy Kwan
Date	4 September 2007
Our Reference	X4952

ADDRESS : ROOM 1006, 10/F WESTIN CENTRE, 26 HUNG TO ROAD, KWUN TONG,
KOWLOON, HONG KONG.

TEL : (852) 2341 3238 (SALES OFFICE) (852) 2342 8228 (GENERAL OFFICE)

FAX : (852) 2357 4237 (SALES OFFICE) (852) 2341 8785 (GENERAL OFFICE)

E-MAIL : cdl@cloverdisplay.com

URL : <http://www.cloverdisplay.com>

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:

CV12024A- MY - S F - 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)

- T – Touch panel (Analog)
- P – Touch panel (Digital)

GENERAL DESCRIPTION

Display mode	:	120x24 dots graphic COB LCD module
Fonts type built in	:	Chinese Traditional & Simplified, English, Europeans Eastern & Western, Japanese, Korean, Latin, Greek, Arabic & Symbol
Interface	:	4 bits parallel
Driving method	:	1/24 duty , 1/5 bias
Backlight	:	Side-lited LED / white
Controller IC	:	CHIPMAST ET7010 or equivalent For the detailed information, please refer to the IC specifications.

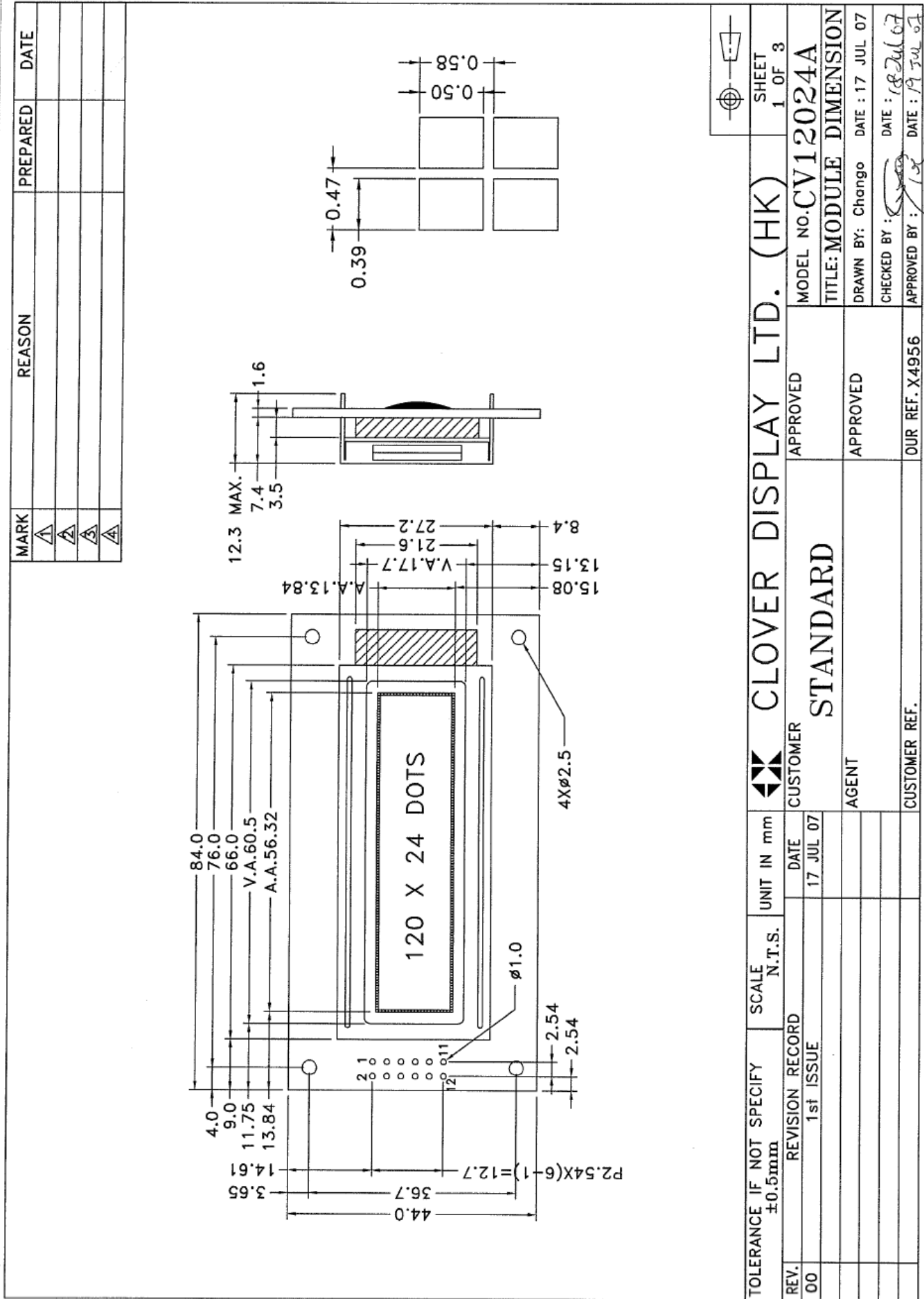
MECHANICAL DIMENSIONS

Item	Dimension	Unit	Item	Dimension	Unit
Outline Dimension	84.0(L) X 44.0(W) X 12.3MAX.(H)	mm	Viewing Area	60.5 (L)x17.7 (W)	mm
Dot Pitch	0.47 (L)x0.58(W)	mm	Dot Size	0.39(L)x0.5(W)	mm

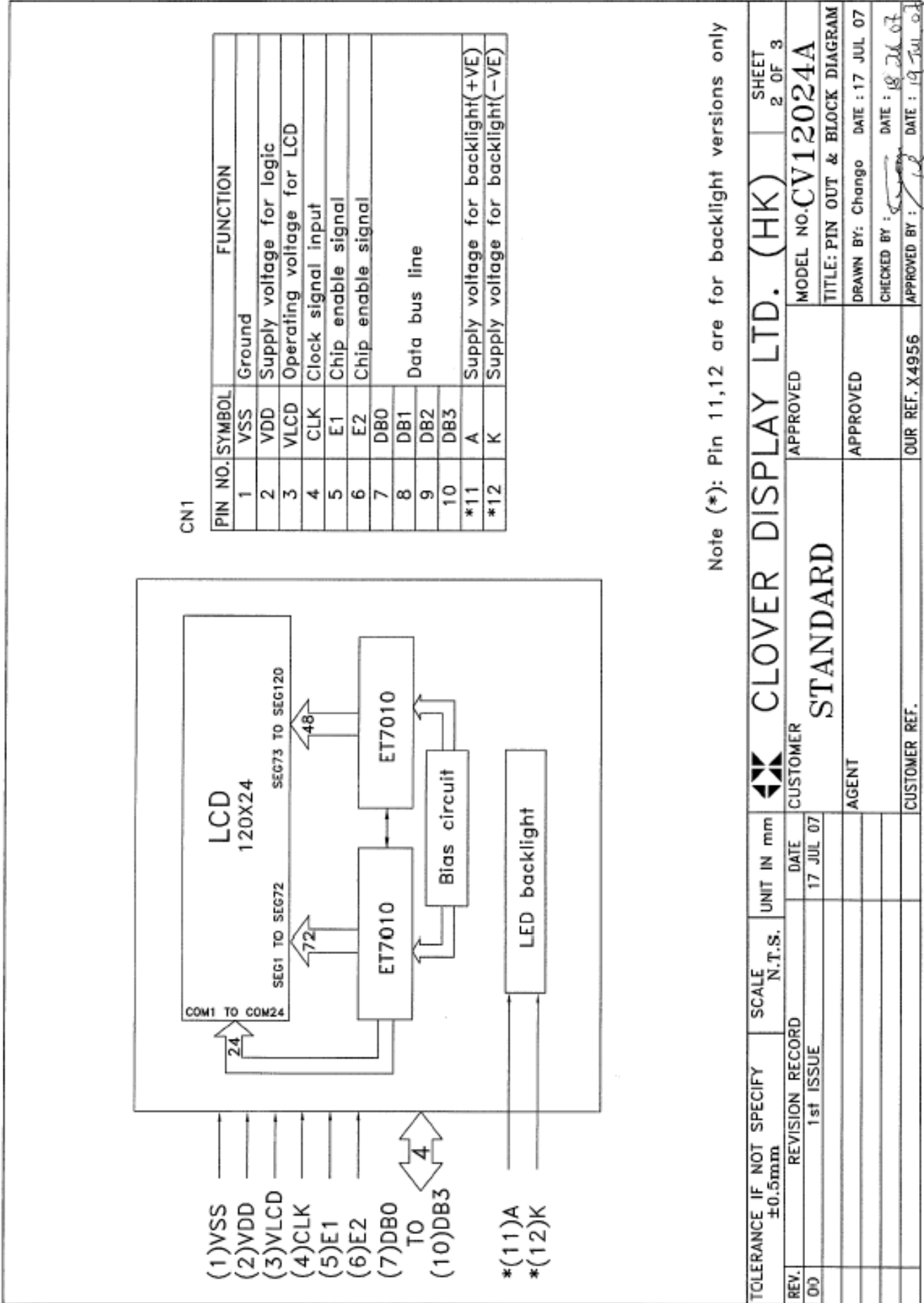
CONNECTOR PIN ASSIGNMENT

Pin No.	Symbol	Function
1	VSS	Ground
2	VDD	Supply voltage for logic
3	VLCD	Operating voltage for LCD
4	CLK	Clock signal input
5	E1	Chip enable signal
6	E2	Chip enable signal
7	DB0	Data bus line
8	DB1	
9	DB2	
10	DB3	
11	A	Supply voltage for backlight(BL+)
12	K	Supply voltage for backlight(BL-)

COUNTER DRAWING OF MODULE DIMENSION



COUNTER DRAWING OF BLOCK DIAGRAM



Note (*): Pin 11,12 are for backlight versions only

TOLERANCE IF NOT SPECIFY ±0.5mm	SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)	SHEET 2 OF 3
REV. 00	REVISION RECORD 1st ISSUE	DATE 17 JUL 07	CUSTOMER STANDARD	MODEL NO. CV12024A
			AGENT	TITLE: PIN OUT & BLOCK DIAGRAM
			CUSTOMER REF.	DRAWN BY: Change DATE: 17 JUL 07
				CHECKED BY: DATE: 18 Jul 07
				APPROVED BY: DATE: 19 Jul 07
			OUR REF. X4956	APPROVED
				APPROVED

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, Ta=25

Item	Symbol	MIN.	TYP.	MAX.	Unit	Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage for Logic	VDD	4.75	5.0	5.25	V	“H”Level Input Voltage	VIH	0.8VDD	-	VDD	V
Supply Current for Logic	IDD	-	0.22	0.44	mA	“L”Level Input Voltage	VIL	VSS	-	0.2VDD	V
Operating voltage for LCD (*)	VLCD	4.8	5.0	5.2	V	-	-	-	-	-	-
EL Backlight Voltage (VEL)											
EL (@ Frequency 400Hz)	VBL	-	-	-	Vrms	-	-	-	-	-	-
Side-lited LED Backlight Forward Voltage (VF)						Side-lited LED Backlight Forward Current (IF)					
White	VBL	-	5.0	-	V	White	IBL	30	35	40	mA
Blue	VBL	-	-	-	V	Blue	IBL	-	-	-	mA
Yellow Green	VBL	-	-	-	V	Yellow Green	IBL	-	-	-	mA

Note(*): The module VLCD 5.0±0.2V represents operating voltage of LCD for optimum contrast.

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 range	V _{DD}	-0.3 to 7.0	-0.3 to 7.0	V
	V _{LCD}	-0.3 to 8.0	-0.3 to 8.0	V
Input voltage range	V _{IN}	-0.3 to VDD+0.3	-0.3 to VDD+0.3	V
Operating Temperature	T _{opr}	0 to 50	-20 to 70	
Storage Temperature	T _{stg}	-10 to 60	-30 to 80	

COMMANDS TABLE

1-byte CMD

Name	CMD code										Function
	R/W	Hex	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	
Continue	W	00H	0	0	0	0	0	0	0	0	Continue to access the DDRAM or CGROM data
Reset	W	01H	0	0	0	0	0	0	0	1	Device reset; the device will ready after 4 system clocks.
Write++	W	20H	0	0	1	0	0	0	0	0	Writing data to memory then auto increment address
Read++	W	21H	0	0	1	0	0	0	0	1	Reading data from memory then auto increment address
RDTWR++	W	22H	0	0	1	0	0	0	1	0	The first Reading data from memory, second writing to memory then auto increment address
WRTRD++	W	23H	0	0	1	0	0	0	1	1	The first writing data to memory, second reading from memory then auto increment address
LPage	W	1xH	0	0	0	1	P3	P2	P1	P0	DDRAM page address setting
LColumn	W		1	A6	A5	A4	A3	A2	A1	A0	DDRAM column address setting

2-byte CMD

Name	R/W	Hex	CMD code														PWR initial	Function		
			First byte								Second byte									
			b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂			b ₁	b ₀
SYS0	W	30H	0	0	1	1	0	0	0	0	-	-	-	-	LRM	UDM	---- -xxx	System control register0		
SYS1	W	31H	0	0	1	1	0	0	0	1	-	-	-	-	CA	-	DT[1:0]	---- 0-xx	System control register1	
SYS2	W	32H	0	0	1	1	0	0	1	0	M[1:0]	-	BO	-	-	-	-	00-0 ----	System control register2	
STARTL	W	33H	0	0	1	1	0	0	1	1	-	-	St5	St4	St3	St2	St1	St0	--00 0000	LCD scan starting line
Frame	W	34H	0	0	1	1	0	1	0	0	Fr[7:0]						1111 1111	Frame rate counter		
CLine	R	3DH	0	0	1	1	1	1	0	1	RD	-	L5	L4	L3	L2	L1	L0	---- ----	Current-line

3-byte CMD

Name	R/W	CMD code																		Function						
		First byte						Second byte						Third byte												
		b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	b ₇	b ₆		b ₅	b ₄	b ₃	b ₂	b ₁	b ₀
MAddress	W	0	1	-	-	A ₁₉	A ₁₈	A ₁₇	A ₁₆	A ₁₅	A ₁₄	A ₁₃	A ₁₂	A ₁₁	A ₁₀	A ₉	A ₈	A ₇	A ₆	A ₅	A ₄	A ₃	A ₂	A ₁	A ₀	Setting CGROM memory started address

System Control Register0 (30H)

Name	CMD code														PWR initial	Function		
	R/W	First byte							Second byte									
		b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	b ₇	b ₆	b ₅	b ₄	b ₃			b ₂	b ₁
SYS0	W	0	0	1	1	0	0	0	0	-	-	-	-	-	LRM	UDM	---- -xxx	System control register0

UDM: Common mirror select

0: Normal

1: Common mirror (Common will scroll to 0 if Cn+# > 63)

Duty	Common						
16	Cn	Cn+1	Cn+2	-----	Cn+13	Cn+14	Cn+15
	Cn+15	Cn+14	Cn+13	-----	Cn+2	Cn+1	Cn
24	Cn	Cn+1	Cn+2	-----	Cn+21	Cn+22	Cn+23
	Cn+23	Cn+22	Cn+21	-----	Cn+2	Cn+1	Cn
32	Cn	Cn+1	Cn+2	-----	Cn+29	Cn+30	Cn+31
	Cn+31	Cn+30	Cn+29	-----	Cn+2	Cn+1	Cn
48	Cn	Cn+1	Cn+2	-----	Cn+45	Cn+46	Cn+47
	Cn+47	Cn+46	Cn+45	-----	Cn+2	Cn+1	Cn
64	Cn	Cn+1	Cn+2	-----	Cn+61	Cn+62	Cn+63
	Cn+63	Cn+62	Cn+61	-----	Cn+2	Cn+1	Cn

2: Data mirror (mirror every 8 common, n=0~56)

Duty	Common							
16/24/32	Cn	Cn+1	Cn+2	Cn+3	Cn+4	Cn+5	Cn+6	Cn+7
48/64	Cn+7	Cn+6	Cn+5	Cn+4	Cn+3	Cn+2	Cn+1	Cn

3: Reserved

LRM: This option ***inverts*** relation of assignment between Display data RAM ***column*** address and segment outputs.

0: Normal

1: Segment mirror

Duty	SEG0	SEG1	SEG2	---	SEG62	SEG63	---	SEG70	SEG71	---	SEG78	SEG79
16	SEG79	SEG78	SEG77	---	SEG17	SEG16	---	SEG9	SEG8	---	SEG1	SEG0
24	SEG71	SEG70	SEG69	---	SEG9	SEG8	---	SEG1	SEG0	X	X	X
32	SEG63	SEG62	SEG61	---	SEG1	SEG0	X	X	X	X	X	X

System Control Register1 (31H)

Name	CMD code																PWR initial	Function	
	R/W	First byte								Second byte									
		b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁			b ₀
SYS1	W	0	0	1	1	0	0	0	1	-	-	-	-	CA	-	DT[1:0]	---- 0-xx	System control register1	

CA & DT[1:0]: Duty select (include cascading)

CA	DT[1:0]	Duty	SEGxCOM
0	00	1/16	80x16
0	01	1/24	72x24
0	10	1/32	64x32
1	00	1/32	160x32
1	01	1/48	144x48
1	10	1/64	128x64

Ps. DT[1:0]=11 is reserved.

System Control Register2 (32H)

Name	CMD code																PWR initial	Function	
	R/W	First byte								Second byte									
		b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁			b ₀
SYS2	W	0	0	1	1	0	0	1	0	M[1:0]	-	BO	-	-	-	-	00-0 ----	System control register2	

BO: LCD ON/OFF

0: OFF

1: ON

Oscillator table M[1:0] :

M1	M0	Oscillating method
0	0	Disable
0	1	External R & Built-in C (35KHz)
1	0	Crystal 32768Hz
1	1	Reserved

LCD Scan starting line (33H)

Name	CMD code																PWR initial	Function	
	R/W	First byte								Second byte									
		b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁			b ₀
StartL	W	0	0	1	1	0	0	1	1	-	-	St5	St4	St3	St2	St1	St0	--00 0000	LCD scan starting line

St[5:0]: This register is a pointer which determines the start line corresponding to COM0 for display of data in the Display Data RAM.

Frame rate Register (34H)

Name	CMD code																PWR initial	Function	
	R/W	First byte								Second byte									
		b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁			b ₀
Frame	W	0	0	1	1	0	1	0	0	Fr[7:0]								1111 1111	Frame rate counter

Frame Rate= 32768/(Fr+1)/duty (duty depend on R1 bit3,1,0)

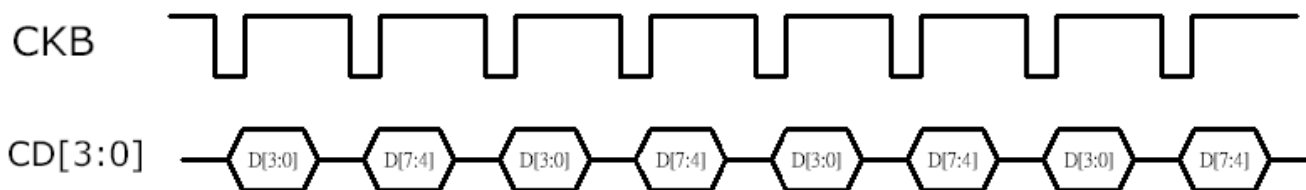
Current-line Register (3DH)

Name	CMD code																PWR initial	Function	
	R/W	First byte								Second byte									
		b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁			b ₀
CLine	R	0	0	1	1	1	1	0	1	RD	-	L5	L4	L3	L2	L1	L0	---- ----	Current line

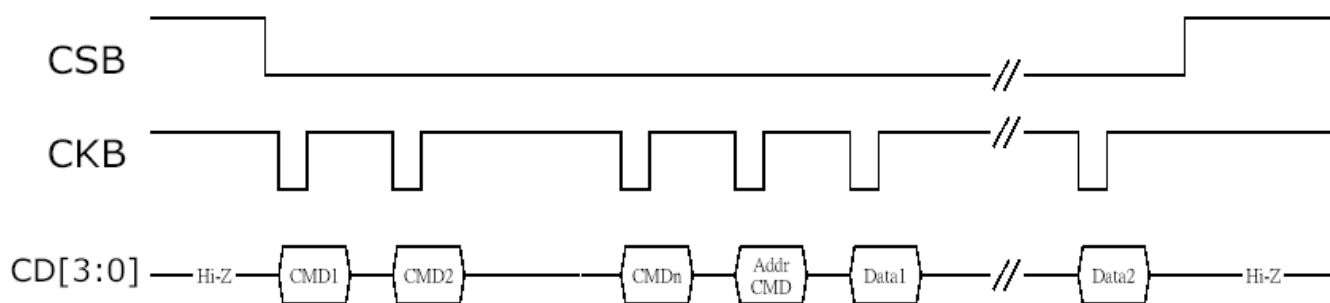
L[5:0]: This register is a pointer which line scan out now.

RD: Device Ready flag. 1: ready 0: not ready

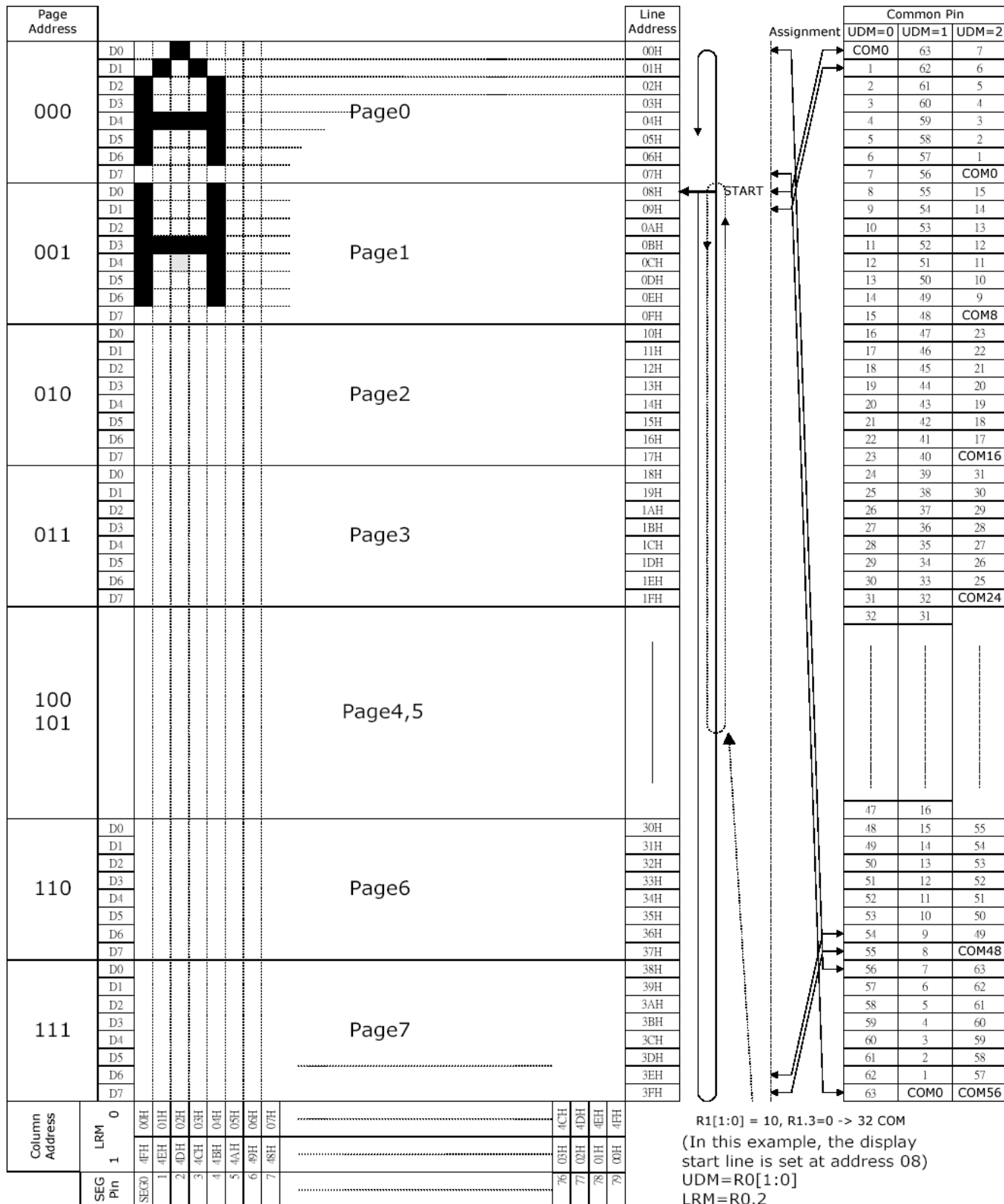
DATA SEQUENCE MODE

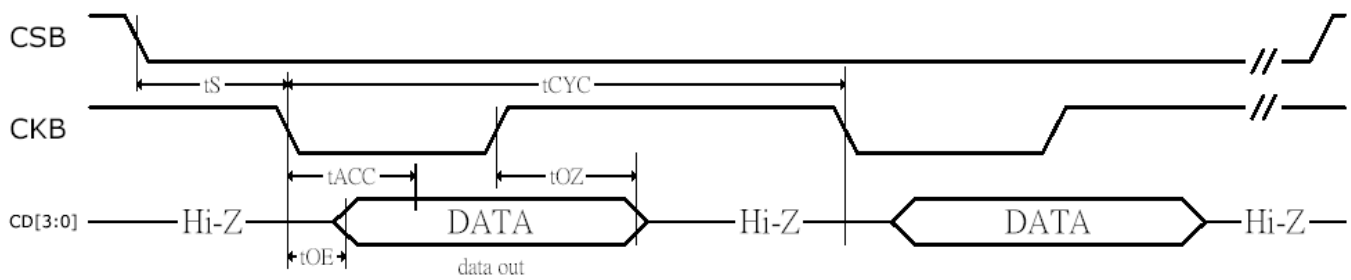
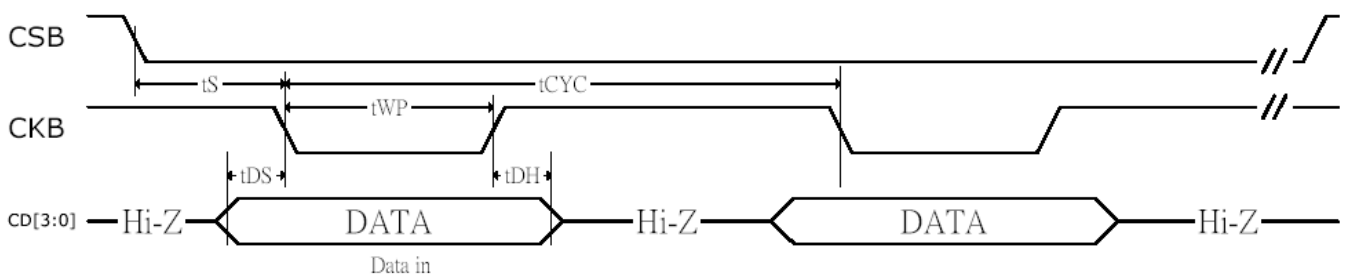


COMMAND WAVEFORM



DISPLAY DATA RAM



READ MODE DIAGRAM**WRITE MODE DIAGRAM****TIMING CHARACTERISTICS**

Name	Content	Min.	Typ.	Max.	Units
tS	CKB setup time	0	-	-	ns
tOE	Output Enable time	0	-	250	ns
tACC	Data Access time	0	-	250	ns
tOZ	Data Disable time	0	-	250	ns
tWP	Write pulse width time	250	-	-	ns
tDH	Data Hold time	250	-	-	ns
tCYC	Read/Write cycles time	1	-	-	us
tE	The time between End of CSB and last Data	1	-	-	us
tBI	Byte to Byte interval	1	-	-	us

CHARACTER CODES AND CHARACTER PATTERN

GP3: Unicode 16(H) x 16(W) Font, contains English, Range FF01H ~ FFE6H.

0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
!	"	#	\$	%	&	'	()	*	+	,	-	.	/	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?	@		
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	[\]	^	_	`	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	{		}	~	␣	␣	
。	「	」	、	・	ヲ	アイウ	エ	オ	カ	キ	ク	ケ	コ	サ	シ	ス	セ	ソ	タ													
チ	ツ	テ	ト	ナ	ニ	ヌ	ネ	ノ	ハ	ヒ	フ	ヘ	ホ	マ	ミ	ム	メ	モ	ヤ	ユ	ヨ	ラ	リ	ル	レ	ロ	ワ	ン	゛	゜	␣	
␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	
␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣
£	␣	␣	␣	¥	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣

GP4: Unicode 12(H) x 12(W) ITALIC Font, contains English, Latin, Eastern/Western European Languages, Range 0020H ~ 01FFH.

0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F					
!	"	#	\$	%	&	'	()	*	+	,	-	.	/	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?	@						
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	[\]	^	_	`					
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	{		}	~	␣	␣					
␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣				
;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;			
À	Á	Â	Ã	Ä	Å	Æ	Ç	È	É	Ê	Ë	Ì	Í	Î	Ï	Ð	Ñ	Ò	Ó	Ô	Õ	Ö	×	Ø	Ù	Ú	Û	Ü	Ý	Þ	ß	à				
á	â	ã	ä	å	æ	ç	è	é	ê	ë	ì	í	î	ï	ð	ñ	ò	ó	ô	õ	ö	÷	ø	ù	ú	û	ü	ý	þ	ÿ	À	Á				
ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā			
ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ			
ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ			
ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ		
ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	
ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	
ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ

GP5: Unicode 12(H) x 12(W) Font, contains English, Latin, Eastern/Western European Languages, Greek, Slav, Arabic, Range 0020H ~ 11F9H.

0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F								
!	"	#	\$	%	&	'	()	*	+	,	-	.	/	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?	@									
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	[\]	^	_	`								
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	{		}	~	␣	␣								
␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣						
;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;					
À	Á	Â	Ã	Ä	Å	Æ	Ç	È	É	Ê	Ë	Ì	Í	Î	Ï	Ð	Ñ	Ò	Ó	Ô	Õ	Ö	×	Ø	Ù	Ú	Û	Ü	Ý	Þ	ß	à							
á	â	ã	ä	å	æ	ç	è	é	ê	ë	ì	í	î	ï	ð	ñ	ò	ó	ô	õ	ö	÷	ø	ù	ú	û	ü	ý	þ	ÿ	À	Á							
ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā					
ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ				
ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ			
ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ		
ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	
ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ	ǻ

GP8: Unicode 12(H)x12(W) Font, contains Traditional/Simple Chinese, Range 4E00H ~ 9FA5H.

n	1	2	3	4	5	6	7	8	9	Δ	R	C	D	E	F	n	1	2	3	4	5	6	7	8	9	Δ	R	C	D	E	F		
北	丁	号	七	上	尸	方	丈	三	上	下	开	不	与	巧	丑	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	
人	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	
刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	
刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁	刁

GP9: Unicode 12(H) x 12(W) Font, contains Korean, Range AC00H ~ D7A3H.

GP10: Unicode 12(H) x 12(W) Font, contains CJK, English, Symbol, ..., Range F900H ~ FFFCH.

n	1	2	3	4	5	6	7	8	9	A	B	C	D	E	n	1	2	3	4	5	6	7	8	9	A	B	C	D	E		
豈	更	車	賈	滑	申	句	龜	龜	梨	金	喇	奈	懶	懶	羅	羅	螺	裸	選	樂	洛	烙	瑤	落	酪	駱	亂	卵	攔	欄	蘭
窟	崑	濫	藍	捲	拉	臆	蠟	廊	朗	浪	狼	郎	來	冷	勞	撻	櫛	爐	盧	老	盞	稜	綾	菱	涼	梁	諒	練	練	蘭	錄
鹿	論	壘	弄	籠	牢	磊	駱	雷	壘	屢	樓	淚	漏	累	纒	陋	勒	肋	凜	掠	稜	綾	涼	梁	諒	練	練	蘭	錄	錄	
怒	率	異	北	礎	便	復	不	泌	數	索	參	塞	省	葉	說	殺	辰	沈	拾	若	掠	稜	綾	涼	梁	諒	練	練	蘭	錄	
呂	說	廉	念	捻	殮	兼	獵	令	固	寧	嶺	伶	瑩	玲	聆	鈴	零	靈	嶺	例	禮	體	隸	惡	了	僚	寮	尿	料	樂	
燎	療	夢	遠	龍	暈	阮	劉	扭	柳	流	溜	琉	留	硫	琉	類	六	戮	陸	倫	嶺	淋	臨	立	笠	粒	狀	丈	識	什	
易	李	梨	泥	理	痢	罹	裡	里	離	離	兀	殼	殼	塔	塚	崎	崎	崎	崎	崎	崎	崎	崎	崎	崎	崎	崎	崎	崎	崎	
切	度	拓	糖	宅	洞	景	輻	行	降	見	廡	兀	殼	殼	塔	塚	崎	崎	崎	崎	崎	崎	崎	崎	崎	崎	崎	崎	崎	崎	
藉	姓	諸	赴	逸	都	銖	銖	銖	銖	銖	銖	銖	銖	銖	銖	銖	銖	銖	銖	銖	銖	銖	銖	銖	銖	銖	銖	銖	銖	銖	

ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION: POWER SUPPLY = $V_{OP} / 64 \text{ Hz}$
 TEMPERATURE = $22 \pm 5 \text{ }^\circ\text{C}$
 RELATIVE HUMIDITY = $60 \pm 15 \%$

ITEM	SYMBOL	UNIT	TYP. TN	TYP. STN
RESPONSE TIME	T _{on}	ms	140	170
	T _{off}	ms	180	220
CONTRAST RATIO	Cr	-	7	15
VIEWING ANGLE (Cr ≥ 2)	V _{3:00}	°	70	40
	V _{6:00}	°	43	70
	V _{9:00}	°	70	40
	V _{12:00}	°	3	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	—

QUALITY STANDARD OF LCD MODULE

1.0	Sampling Method		
	Sampling Plan : MIL STD 105 E Class of AQL : Level II/Single Sampling Critical : 0.25% Major 0.65% Minor 1.5%		
2.0	Defect Group	Failure Category	Failure Reasons
	Critical Defect 0.25%(AQL)	Malfunction	Open Short Burnt or dead component Missing part/improper part P.C.B. Broken
	Major Defect 0.65%(AQL)	Poor Insulation	Potential short High current Component damage or scratched or Lying too close improper coating
		Poor Conduction	Damage joint Wrong polarity Wrong spec. part Uneven/intermittent contact Loose part Copper peeling Rust or corrosion or dirt's
	Minor Defect 1.5%(AQL)	Cosmetic Defect	Minor scratch Flux residue Thin solder Poor plating Poor marking Crack solder Poor bending Poor packing Wrong size

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.

(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) 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.

(4) 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%.

(5) 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 leaks 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.