



CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model : CV24064A - _ _ - _ _ - _ _ - _

Revision	11
Engineering	Timmy Kwan
Date	02 September 2010
Our Reference	4948

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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:

CV24064A - 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 : 240 x 64 dots, graphic COB LCD module
 Interface : 8-bit parallel
 Driving method : 1/64 duty, 1/9 bias
 Controller IC : TOSHIBA T6963C or equivalent
 For the detailed information, please refer to the IC specifications.

MECHANICAL DIMENSIONS

Item	Dimension	Unit	Item	Dimension	Unit
Outline Dimension (LED Backlight version)	180.0(L)x 65.0(W)x17.0(H)	mm	Dot Pitch	0.53(L)x0.53(W)	mm
Outline Dimension (No Backlight version)	180.0(L)x 65.0(W)x10.0(H)	mm	Dot Size	0.48(L)x0.48(W)	mm
Outline Dimension (CCFL Backlight version)	186.0(L)x 65.0(W)x17.0(H)	mm	Viewing Area	132.0(L)x39.0(W)	mm

CONNECTOR PIN ASSIGNMENT (CN1)

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	FG	Frame Ground	12	DB1	Data Bus Line
2	GND	Ground	13	DB2	Data Bus Line
3	VDD	Supply voltage for logic	14	DB3	Data Bus Line
4(*)	VO	Input voltage for LCD	15	DB4	Data Bus Line
5	/WR	Write enable	16	DB5	Data Bus Line
6	/RD	Read enable	17	DB6	Data Bus Line
7	/CE	Chip Enable	18	DB7	Data Bus Line
8	C/D	Register Select Input	19	FS	Font Select Input
9	NC	NO Connection	20	NC	NO Connection
10	/RST	Reset Signal	A(**)	BL+	Supply voltage for backlight (+ve)
11	DB0	Data Bus Line	K(**)	BL-	Supply voltage for backlight (-ve)

Note:

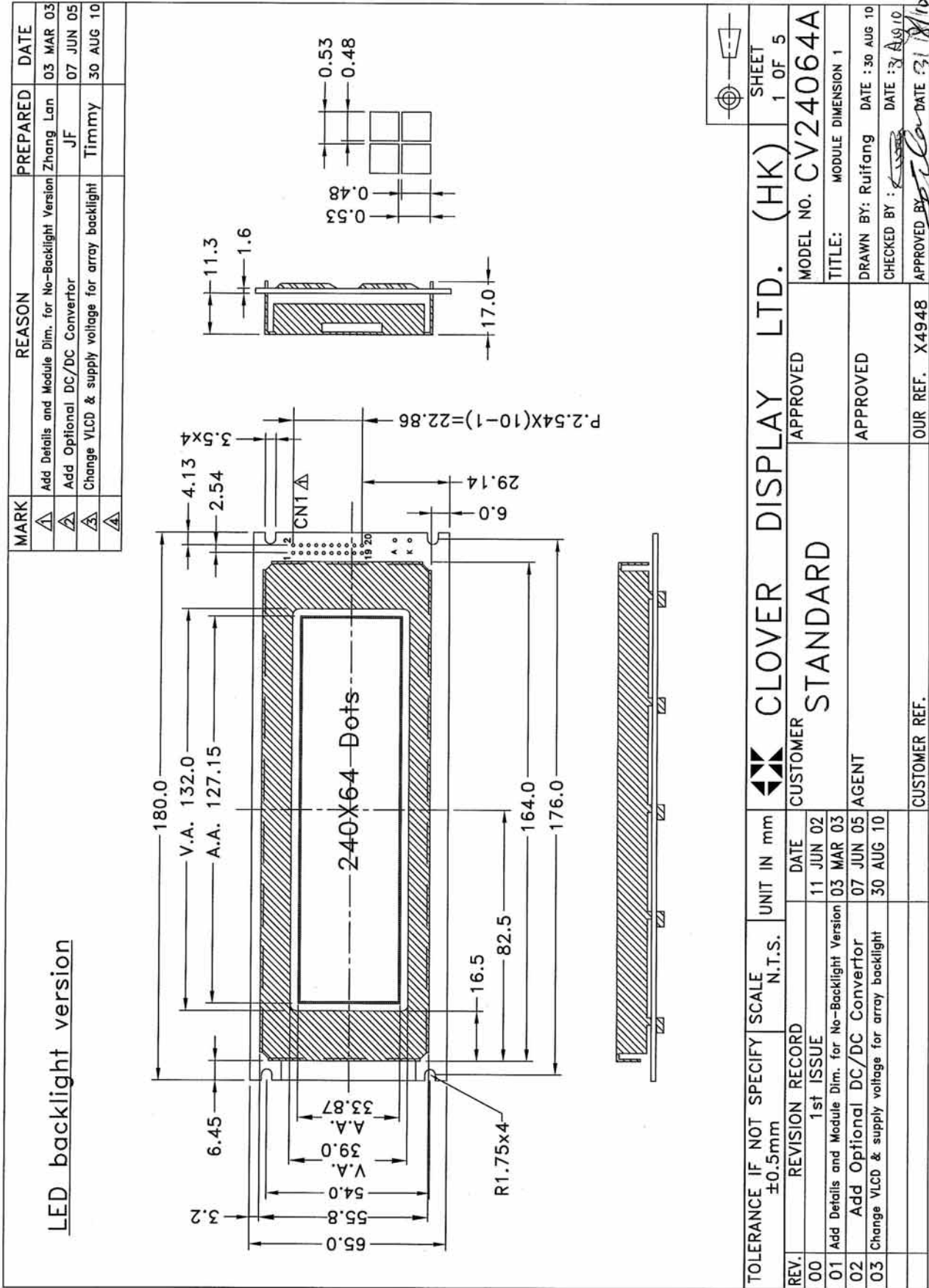
(*) No connection when using internal converter

(**) Used for LED backlight version

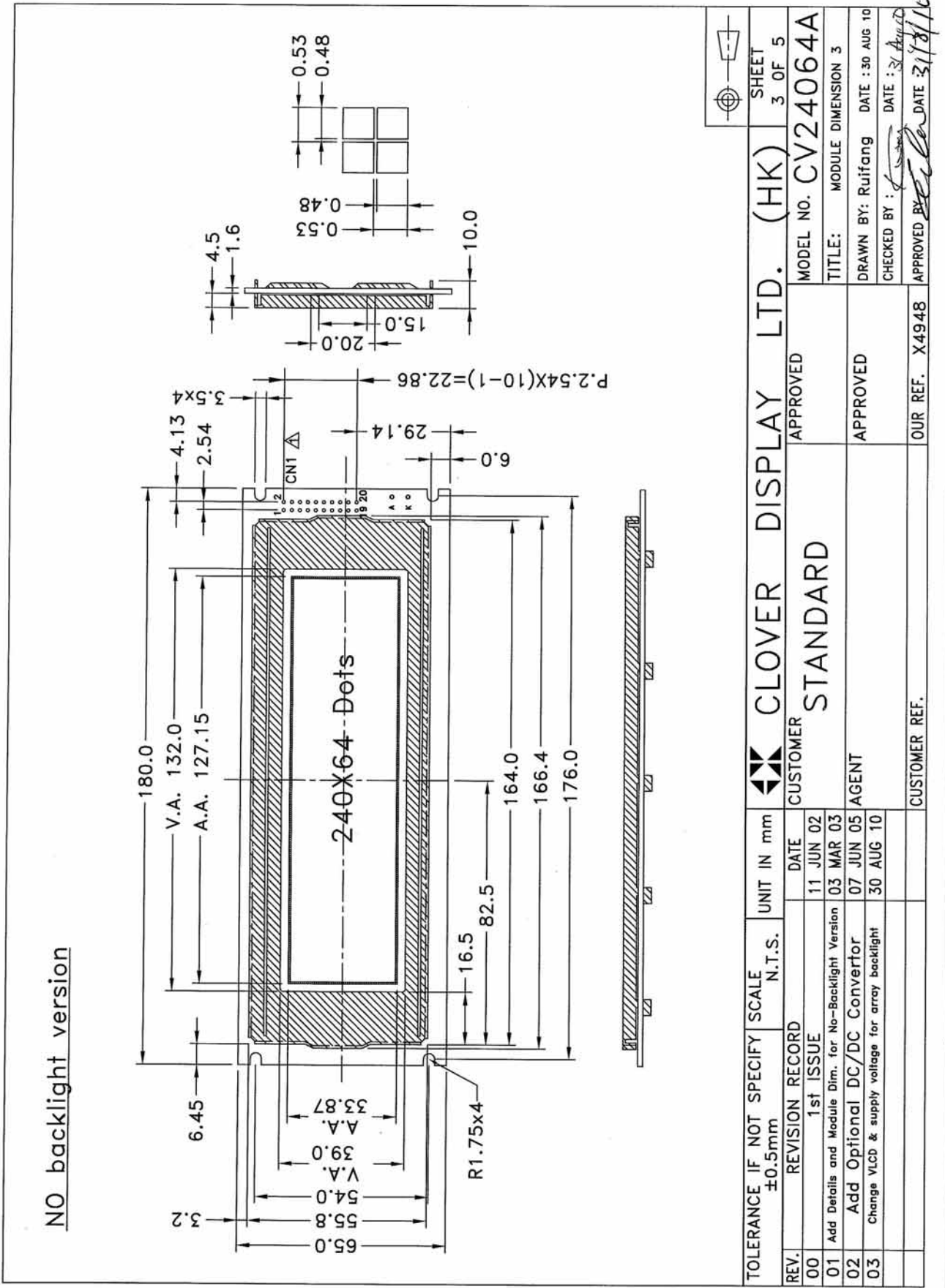
CONNECTOR PIN ASSIGNMENT (CN2), FOR CCFL BACKLIGHT VERSION ONLY

Pin No.	Symbol	Function
1	BL1	Power Supply for CCFL (HV)
2	NC	No connection
3	BL2	Power Supply for CCFL (GND)

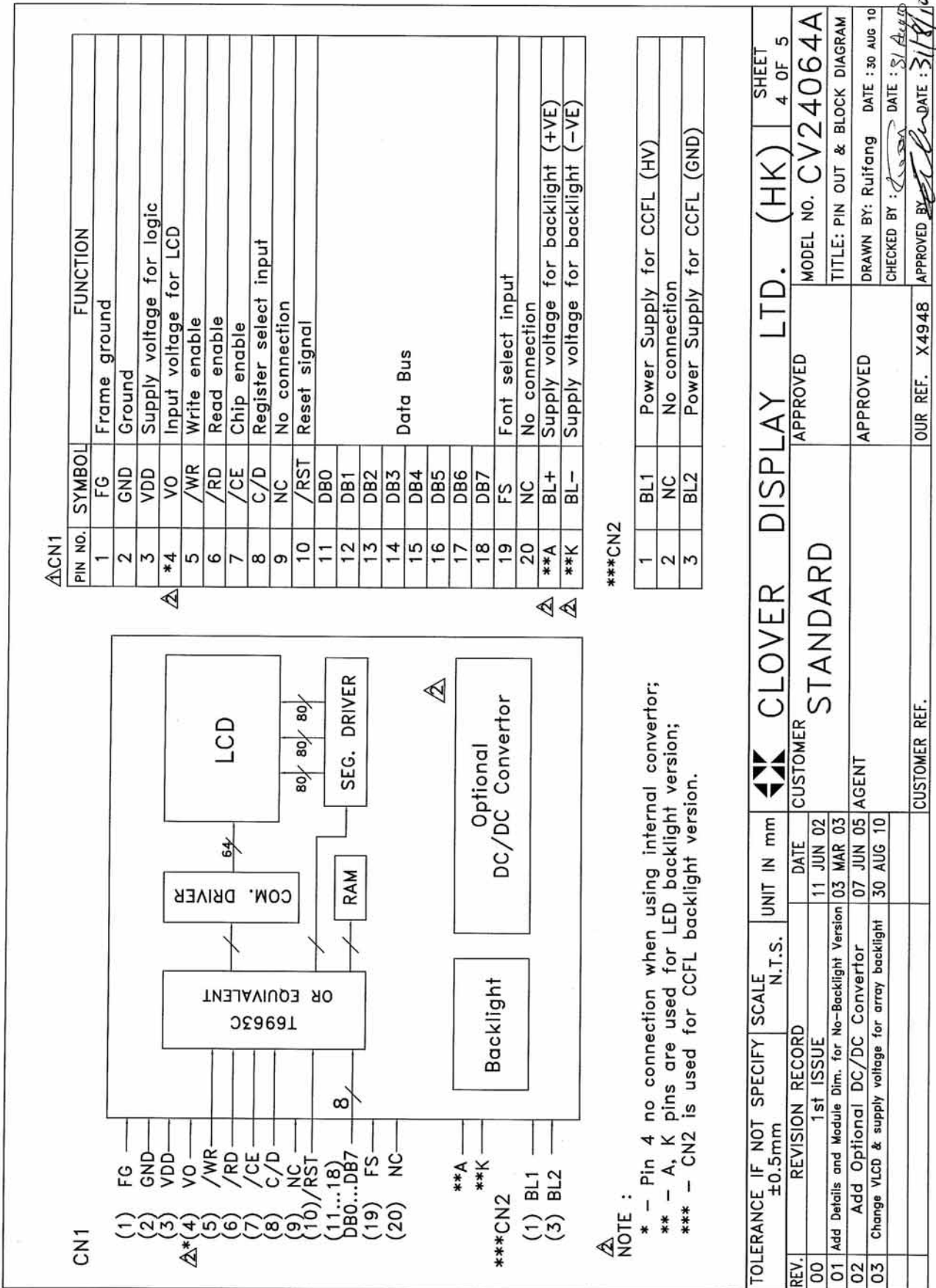
COUNTER DRAWING OF MODULE DIMENSION (SIDE / ARRAY BACKLIGHT)



COUNTER DRAWING OF MODULE DIMENSION (NO-BLACKLIGHT)



COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM



PIN NO.	SYMBOL	FUNCTION
1	FG	Frame ground
2	GND	Ground
3	VDD	Supply voltage for logic
*4	VO	Input voltage for LCD
5	/WR	Write enable
6	/RD	Read enable
7	/CE	Chip enable
8	C/D	Register select input
9	NC	No connection
10	/RST	Reset signal
11	DB0	Data Bus
12	DB1	
13	DB2	
14	DB3	
15	DB4	
16	DB5	
17	DB6	
18	DB7	
19	FS	Font select input
20	NC	No connection
**A	BL+	Supply voltage for backlight (+VE)
**K	BL-	Supply voltage for backlight (-VE)

***CN2

1	BL1	Power Supply for CCFL (HV)
2	NC	No connection
3	BL2	Power Supply for CCFL (GND)

NOTE :

- * - Pin 4 no connection when using internal convertor;
- ** - A, K pins are used for LED backlight version;
- *** - CN2 is used for CCFL backlight version.

TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)		SHEET 4 OF 5
REV.	REVISION RECORD		DATE	APPROVED		MODEL NO. CV24064A
00	1st ISSUE		11 JUN 02	CUSTOMER		TITLE: PIN OUT & BLOCK DIAGRAM
01	Add Details and Module Dim. for No-Backlight Version		03 MAR 03	APPROVED		DRAWN BY: Ruifang DATE : 30 AUG 10
02	Add Optional DC/DC Converter		07 JUN 05	AGENT		CHECKED BY : DATE : 31 Aug 10
03	Change VLCD & supply voltage for array backlight		30 AUG 10	OUR REF. X4948		APPROVED BY : DATE : 31/8/10
CUSTOMER REF.			CUSTOMER REF.			

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, @Ta=25

Item	Symbol	MIN.	TYP.	MAX.	Unit	Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	VDD	4.75	5.0	5.25	v	“H”Level Input Voltage	VIH	VDD- 2.2	-	VDD	V
Supply Current	IDD	-	18.4	27.7	mA	“L”Level Input Voltage	VIL	0	-	0.8	V
Input voltage for LCD (*)	VO	-10.2	-11.0	-11.8	v	-	-	-	-	-	-

Note(*): The module VO $-11V\pm 5\%$ represents input voltage of LCD.

The corresponding LCD voltage = VDD-VO, is $16V\pm 5\%$ for optimum contrast.

Constant current driving:

Side-lited LED

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
White	VBL	3.8	4.0	4.2	V	IBL=30x2mA

Array LED

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Yellow Green	VBL	7.6	8.0	8.4	V	IBL=270mA

CCFL backlight

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
White	VBL	-	200	250	V _{rms}	IBL=5.0mArms

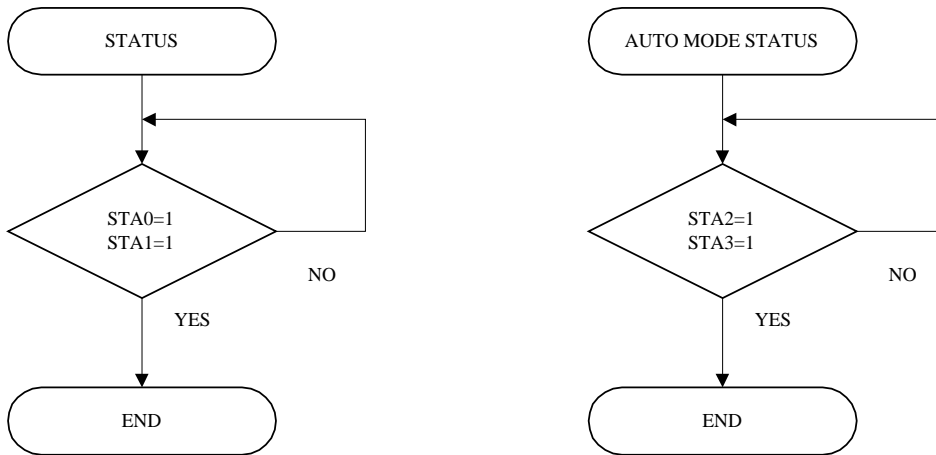
ABSOLUTE MAXIMUM RATINGS

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

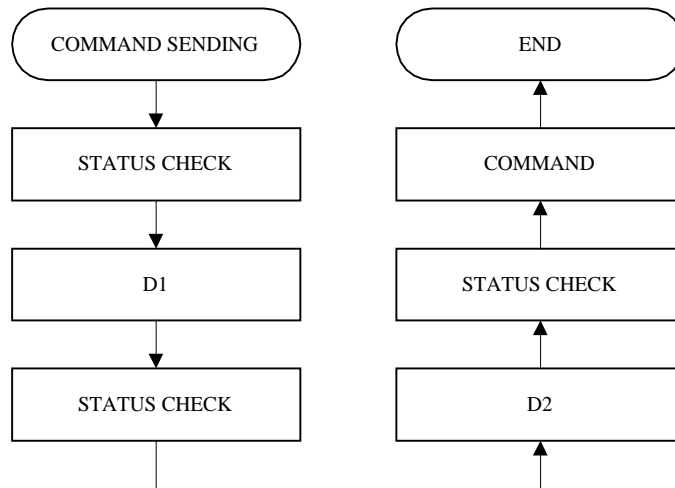
Item	Symbol	Rating (for normal temperature)	Rating (for wide temperature)	Unit
Supply Voltage	VDD	-0.3 to 7.0	-0.3 to 7.0	V
Input Voltage	V _T	-0.3 to VDD +0.3	-0.3 to VDD +0.3	V
Operating Temperature	T _{opr}	0 to 50	-20 to 70	
Storage Temperature	T _{stg}	-10 to 60	-30 to 80	

FLOWCHART OF COMMUNICATIONS WITH MPU

Status Read



Data Set



INSTRUCTIONS

Instruction	C/D	RD	WR	Code								D1	D2	Description
				DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0			
Status read	1	0	1	STA7	STA6	STA5	STA4	STA3	STA2	STA1	STA0	-	-	STA0: Check capability of command execution STA1: Check capability of data read/write STA2: Check capability of auto mode data read STA3: Check capability of auto mode data write STA4: Not use STA5: Check capability of controller operation STA6: Error flag. Using screen peek/copy command STA7: Check the condition blink
Register Set	1	1	0	0	0	1	0	0	0	0	1	X address	Y address	Cursor pointer set
	1	1	0	0	0	1	0	0	0	1	0	Data	00H	Offset register set
	1	1	0	0	0	1	0	0	1	0	0	Lo address	Hi address	Address pointer set
Control Word Set	1	1	0	0	1	0	0	0	0	0	0	Lo address	Hi address	Text home address set
	1	1	0	0	1	0	0	0	0	0	1	Columns	00H	Text area set
	1	1	0	0	1	0	0	0	0	1	0	Lo address	Hi address	Graphic home address set
	1	1	0	0	1	0	0	0	0	1	1	Columns	00H	Graphic area set
Mode Set	1	1	0	1	0	0	0	x	0	0	0	-	-	“OR” mode
	1	1	0	1	0	0	0	x	0	0	1	-	-	“XOR” mode
	1	1	0	1	0	0	0	x	0	1	1	-	-	“AND” mode
	1	1	0	1	0	0	0	x	1	0	0	-	-	Text attribute” mode
	1	1	0	1	0	0	0	0	x	x	x	-	-	Internal CG RAM mode
	1	1	0	1	0	0	0	1	x	x	x	-	-	External CG Ram mode
Display Mode	1	1	0	1	0	0	1	0	0	0	0	-	-	Display off
	1	1	0	1	0	0	1	x	x	1	0	-	-	Cursor on, blink off
	1	1	0	1	0	0	1	x	x	1	1	-	-	Cursor on, blink on
	1	1	0	1	0	0	1	0	1	x	x	-	-	Text on, graphic off
	1	1	0	1	0	0	1	1	0	x	x	-	-	Text off, graphic on
	1	1	0	1	0	0	1	1	1	x	x	-	-	Text on, graphic on
Cursor Pattern Select	1	1	0	1	0	1	0	0	0	0	0	-	-	1 line cursor
	1	1	0	1	0	1	0	0	0	0	1	-	-	2 lines cursor
	1	1	0	1	0	1	0	0	0	1	0	-	-	3 lines cursor
	1	1	0	1	0	1	0	0	0	1	1	-	-	4 lines cursor
	1	1	0	1	0	1	0	0	1	0	0	-	-	5 lines cursor
	1	1	0	1	0	1	0	0	1	0	1	-	-	6 lines cursor
	1	1	0	1	0	1	0	0	1	1	0	-	-	7 lines cursor
	1	1	0	1	0	1	0	0	1	1	1	-	-	8 lines cursor
Data Auto Read/Write	1	1	0	1	0	1	1	0	0	0	0	-	-	Data auto write set
	1	1	0	1	0	1	1	0	0	0	1	-	-	Data auto read set
	1	1	0	1	0	1	1	0	0	1	0	-	-	Auto reset
Data Read/Write	1	1	0	1	1	0	0	0	0	0	0	Data	-	Data write and ADP increment
	1	1	0	1	1	0	0	0	0	0	1	-	-	Data read and ADP increment
	1	1	0	1	1	0	0	0	0	1	0	Data	-	Data write and ADP decrement
	1	1	0	1	1	0	0	0	0	1	1	-	-	Data read and ADP decrement
	1	1	0	1	1	0	0	0	1	0	0	Data	-	Data write and ADP nonverbal
1	1	0	1	1	0	0	0	1	0	1	-	-	Data read and ADP nonverbal	
Screen Peek	1	1	0	1	1	1	0	0	0	0	0	-	-	Screen peek
Screen Copy	1	1	0	1	1	1	0	1	0	0	0	-	-	Screen copy
Bit Set/Reset	1	1	0	1	1	1	1	0	x	x	x	-	-	bit reset
	1	1	0	1	1	1	1	1	x	x	x	-	-	bit set
	1	1	0	1	1	1	1	x	0	0	0	-	-	bit0 (LSB)
	1	1	0	1	1	1	1	x	0	0	1	-	-	bit1
	1	1	0	1	1	1	1	x	0	1	0	-	-	bit2
	1	1	0	1	1	1	1	x	0	1	1	-	-	bit3
	1	1	0	1	1	1	1	x	1	0	0	-	-	bit4
	1	1	0	1	1	1	1	x	1	0	1	-	-	bit5
	1	1	0	1	1	1	1	x	1	1	0	-	-	bit6
1	1	0	1	1	1	1	x	1	1	1	-	-	bit7 (MSB)	

ADDRESS CONFIGURATION OF DISPLAY DATA RAM

(1) Set Text Home Address

The starting address in the external display RAM for text display is defined by this command. The text home address indicates the leftmost and uppermost position.

The relationship between external display RAM address and display position

TH		TH + CL
TH + TA		TH + TA + CL
(TH + TA) + TA		TH + 2TA + CL
(TH + 2TA) + TA		TH + 3TA + CL
TH + (n-1) TA		TH + (n-1) TA + CL

TH : Text home address

TA : Text area number (columns)

CL : Columns are fixed by hardware (pin-programmable).

(Example)

Text home address : 0000H
 Text area : 0020H
 MD2 = H, MD3 = H : 32 columns
 $\overline{\text{DUAL}} = \text{H}$, MDS = L, MD0 = L, MD1 = H : 4 lines

0000H	0001H		001EH	001FH
0020H	0021H		003EH	002FH
0040H	0041H		005EH	005FH
0060H	0061H		007EH	007FH

(2) Set Graphic Home Address

The starting address of the external display RAM used for graphic display is defined by this command. The graphic home address indicates the leftmost and uppermost position.

The relationship between external display RAM address and display position

GH		GH + CL
GH + GA		GH + GA + CL
(GH + GA) + GA		GH + 2GA + CL
(GH + 2GA) + GA		GH + 3GA + CL
GH + (n-1) GA		GH + (n-1) GA + CL

GH : Graphic home address

GA : Graphic area number (columns)

CL : Columns are fixed by hardware (pin-programmable).

(Example)

Graphic home address : 0000H

Graphic area : 0020H

MD2 = H, MD3 = H : 32 columns

$\overline{\text{DUAL}} = \text{H}$, MDS = L, MD0 = H, MD1 = H : 2 lines

0000H	0001H		001EH	001FH
0020H	0021H		003EH	003FH
0040H	0041H		005EH	005FH
0060H	0061H		007EH	007FH
0080H	0081H		009EH	009FH
00A0H	00A1H		00BEH	00BFH
00C0H	00C1H		00DEH	00DFH
00E0H	00E1H		00FEH	00FFH
0100H	0101H		011EH	011FH
0120H	0121H		013EH	013FH
0140H	0141H		015EH	015FH
0160H	0161H		017EH	017FH
0180H	0181H		019EH	019FH
01A0H	01A1H		01BEH	01BFH
01C0H	01C1H		01DEH	01DFH
01E0H	01E1H		01FEH	01FFH

(3) Set Text Area

The display columns are defined by the hardware setting. This command can be used to adjust the columns of the display.

(Example)

LCD size : 20 columns, 4 lines
 Text home address : 0000H
 Text area : 0014H
 MD2 = H, MD3 = H : 32 columns
 $\overline{\text{DUAL}} = \text{H}$, MDS = L, MD0 = L, MD1 = H : 4 lines

0000	0001	.....	0013	0014	.....	001F
0014	0015	.....	0027	0028	.....	0033
0028	0029	.....	003B	003C	.....	0047
003C	003D	.....	004F	0050	.....	005B

← LCD →

(4) Set Graphic Area

The display columns are defined by the hardware setting. This command can be used to adjust the columns of the graphic display.

(Example)

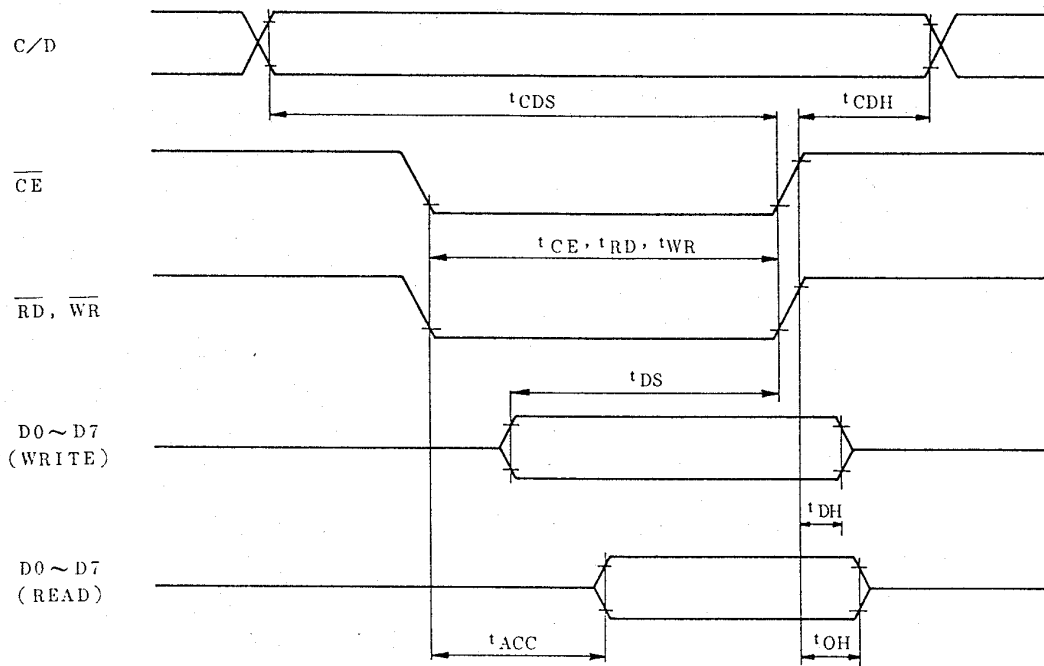
LCD size : 20 columns, 2 lines
 Graphic home address : 0000H
 Graphic area : 0014H
 MD2 = H, MD3 = H : 32 columns
 $\overline{\text{DUAL}} = \text{H}$, MDS = L, MD0 = H, MD1 = H : 2 lines

0000	0001	.....	0013	0014	.....	001F
0014	0015	.....	0027	0028	.....	0033
0028	0029	.....	003B	003C	.....	0047
003C	003D	.....	004F	0050	.....	005B
0050	0051	.....	0063	0064	.....	006F
0064	0065	.....	0077	0078	.....	0083
0078	0079	.....	008B	008C	.....	0097
008C	008D	.....	009F	00A0	.....	00AB
00A0	00A1	.....	00B3	00B4	.....	00BF
00B4	00B5	.....	00C7	00C8	.....	00D3
00C8	00C9	.....	00DB	00DC	.....	00E7
00DC	00DD	.....	00EF	00F0	.....	00FD
00F0	00F1	.....	0103	0104	.....	011F
0104	0105	.....	0127	0128	.....	0123
0128	0129	.....	013B	013C	.....	0147
013C	013D	.....	014F	0150	.....	015B

← LCD →

TIMING CHARACTERISTICS OF COMPATIBLE CONTROLLER CHIPS

Bus Timing



Unless otherwise specified, $V_{DD}=5.0V\pm 10\%$, $V_{SS}=0V$, $T_a=-10\sim 70^\circ C$

ITEM	SYMBOL	TEST CONDITION	MIN.	MAX.	UNIT
C/D Set Up Time	t_{CDS}		100	-	ns
C/D Hold Time	t_{CDH}		10	-	ns
CE, RD, WR Pulse Width	t_{CE}, t_{RD}, t_{WR}		80	-	ns
Data Set Up Time	t_{DS}		80	-	ns
Data Hold Time	t_{DH}		40	-	ns
Access Time	t_{ACC}		-	150	ns
Output Hold Time	t_{OH}		10	50	ns

ELECTRO-OPTICAL CHARACTERISTICS

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

ITEM	SYMBOL	UNIT	TYP. TN	TYP. STN
RESPONSE TIME	T_{on}	ms	100	200
	T_{off}	ms	80	200
CONTRAST RATIO	Cr	-	10	10
VIEWING ANGLE (6 O'clock) ($Cr \geq 2$)	V3:00	$^\circ$	20	20
	V6:00	$^\circ$	20	40
	V9:00	$^\circ$	20	20
	V12:00	$^\circ$	10	10

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 cycles

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 of 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 dirty
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

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.

(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) 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.