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	SPECIFICATION	APPLICABLE GROUP TFT Liquid Crystal Display Group

DEVICE SPECIFICATION FOR

TFT-LCD Module

MODEL No.

LQ181E1DG01

☐ CUSTOMER'S APPROVAL

DATE _____

BY _____

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RECORDS OF REVISION

LQ181E1DG01

SPEC No.	DATE	REVISED No.	PAGE	SUMMARY	NOTE
LD-10407	Jun,25,1998	-	-	-	1st Issue
LD-10407 A	Aug,19,1998	▲1	4	Revision : Pin No. 69	
		▲2	4	Revision : Pin No. 70	

1. Application

This specification applies to a color 18.1 SXGA TFT-LCD module.

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2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, control circuit, power supply circuit and a back light unit. Graphics and texts can be displayed on a 1280×3×1024 dots panel with about 16 million colors (6bit + FRC 2bit)by supplying 48 bit data signals(8bit×2pixel×RGB) or 96 bit data signals(8bit×4pixel×RGB), two display enable signals, two dot clock signals, +5V DC and +12V DC supply voltages for TFT-LCD panel driving and supply voltage for back light.

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	46 (Diagonal)	cm
	18.1 (Diagonal)	inch
Active area	359.0 (H)×287.2 (V)	mm
Pixel format	1280 (H)×1024 (V)	pixel
	(1 pixel=R+G+B dots)	
Pixel pitch	0.2805 (H)×0.2805 (V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally white	
Unit outline dimensions *1	414 (W)×335 (H)×24 (D)	mm
Mass	3520±80	g
Surface treatment	Anti-glare and hard-coating 2H (Haze value = 28)	

*1.Note: excluding back light cables.

The thickness of module (D) doesn't contain the projection.

Outline dimensions is shown in Fig.1.

4. Input Terminals

4-1. TFT-LCD panel driving

CN1 (Interface signals and +5VDC／+12VDC power supply)

Using connector : SD-53493-1400 (Molex-Japan Co., Ltd.)

Mating connector : SD-52777-1400 (Molex-Japan Co., Ltd.)

Pin No.	Symbol	Function	Remark
1	GND	Gnd	
2	GND	Gnd	
3	GND	Gnd	
4	GND	Gnd	
5	RC7	RED Data Signal of Left Pixels (MSB)	
6	RA7	RED Data Signal of Left Pixels (MSB)	
7	RC6	RED Data Signal of Left Pixels	
8	RA6	RED Data Signal of Left Pixels	
9	RC5	RED Data Signal of Left Pixels	
10	RA5	RED Data Signal of Left Pixels	
11	RC4	RED Data Signal of Left Pixels	
12	RA4	RED Data Signal of Left Pixels	
13	Vcc	+5V power supply	
14	Vcc	+5V power supply	
15	RC3	RED Data Signal of Left Pixels	
16	RA3	RED Data Signal of Left Pixels	
17	RC2	RED Data Signal of Left Pixels	
18	RA2	RED Data Signal of Left Pixels	
19	RC1	RED Data Signal of Left Pixels	
20	RA1	RED Data Signal of Left Pixels	
21	RC0	RED Data Signal of Left Pixels (LSB)	
22	RA0	RED Data Signal of Left Pixels (LSB)	
23	GND	Gnd	
24	GND	Gnd	
25	GC7	GREEN Data Signal of Left Pixels (MSB)	
26	GA7	GREEN Data Signal of Left Pixels (MSB)	
27	GC6	GREEN Data Signal of Left Pixels	
28	GA6	GREEN Data Signal of Left Pixels	
29	GC5	GREEN Data Signal of Left Pixels	
30	GA5	GREEN Data Signal of Left Pixels	
31	GC4	GREEN Data Signal of Left Pixels	
32	GA4	GREEN Data Signal of Left Pixels	
33	Vcc	+5V power supply	
34	Vcc	+5V power supply	
35	GC3	GREEN Data Signal of Left Pixels	
36	GA3	GREEN Data Signal of Left Pixels	
37	GC2	GREEN Data Signal of Left Pixels	
38	GA2	GREEN Data Signal of Left Pixels	
39	GC1	GREEN Data Signal of Left Pixels	
40	GA1	GREEN Data Signal of Left Pixels	
41	GC0	GREEN Data Signal of Left Pixels (LSB)	
42	GA0	GREEN Data Signal of Left Pixels (LSB)	
43	GND	Gnd	
44	GND	Gnd	
45	BC7	BLUE Data Signal of Left Pixels (MSB)	
46	BA7	BLUE Data Signal of Left Pixels (MSB)	
47	BC6	BLUE Data Signal of Left Pixels	
48	BA6	BLUE Data Signal of Left Pixels	
49	BC5	BLUE Data Signal of Left Pixels	

50	BA5	BLUE Data Signal of Left Pixels	
51	BC4	BLUE Data Signal of Left Pixels	
52	BA4	BLUE Data Signal of Left Pixels	
53	Vcc	+5V power supply	
54	Vcc	+5V power supply	
55	BC3	BLUE Data Signal of Left Pixels	
56	BA3	BLUE Data Signal of Left Pixels	
57	BC2	BLUE Data Signal of Left Pixels	
58	BA2	BLUE Data Signal of Left Pixels	
59	BC1	BLUE Data Signal of Left Pixels	
60	BA1	BLUE Data Signal of Left Pixels	
61	BC0	BLUE Data Signal of Left Pixels (LSB)	
62	BA0	BLUE Data Signal of Left Pixels (LSB)	
63	GND	Gnd	
64	GND	Gnd	
65	DEB	Data enable signal (Signal to settle the display position)	
66	DEA	Data enable signal (Signal to settle the display position)	
67	Vcc	+5V power supply	
68	Vcc	+5V power supply	
69	CLKB	Sampling clock (Right)	▲1
70	CLKA	Sampling clock (Left)	▲2
71	GND	Gnd	
72	GND	Gnd	
73	RD7	RED Data Signal of Right Pixels (MSB)	
74	RB7	RED Data Signal of Right Pixels (MSB)	
75	RD6	RED Data Signal of Right Pixels	
76	RB6	RED Data Signal of Right Pixels	
77	RD5	RED Data Signal of Right Pixels	
78	RB5	RED Data Signal of Right Pixels	
79	RD4	RED Data Signal of Right Pixels	
80	RB4	RED Data Signal of Right Pixels	
81	Vcc	+5V power supply	
82	Vcc	+5V power supply	
83	RD3	RED Data Signal of Right Pixels	
84	RB3	RED Data Signal of Right Pixels	
85	RD2	RED Data Signal of Right Pixels	
86	RB2	RED Data Signal of Right Pixels	
87	RD1	RED Data Signal of Right Pixels	
88	RB1	RED Data Signal of Right Pixels	
89	RD0	RED Data Signal of Right Pixels (LSB)	
90	RB0	RED Data Signal of Right Pixels (LSB)	
91	GND	Gnd	
92	GND	Gnd	
93	GD7	GREEN Data Signal of Right Pixels (MSB)	
94	GB7	GREEN Data Signal of Right Pixels (MSB)	
95	GD6	GREEN Data Signal of Right Pixels	
96	GB6	GREEN Data Signal of Right Pixels	
97	GD5	GREEN Data Signal of Right Pixels	
98	GB5	GREEN Data Signal of Right Pixels	
99	GD4	GREEN Data Signal of Right Pixels	
100	GB4	GREEN Data Signal of Right Pixels	
101	Vcc	+5V power supply	
102	Vcc	+5V power supply	
103	GD3	GREEN Data Signal of Right Pixels	
104	GB3	GREEN Data Signal of Right Pixels	
105	GD2	GREEN Data Signal of Right Pixels	

106	GB2	GREEN Data Signal of Right Pixels	
107	GD1	GREEN Data Signal of Right Pixels	
108	GB1	GREEN Data Signal of Right Pixels	
109	GD0	GREEN Data Signal of Right Pixels (LSB)	
110	GB0	GREEN Data Signal of Right Pixels (LSB)	
111	GND	Gnd	
112	GND	Gnd	
113	BD7	BLUE Data Signal of Right Pixels (MSB)	
114	BB7	BLUE Data Signal of Right Pixels (MSB)	
115	BD6	BLUE Data Signal of Right Pixels	
116	BB6	BLUE Data Signal of Right Pixels	
117	BD5	BLUE Data Signal of Right Pixels	
118	BB5	BLUE Data Signal of Right Pixels	
119	BD4	BLUE Data Signal of Right Pixels	
120	BB4	BLUE Data Signal of Right Pixels	
121	Vcc	+5V power supply	
122	Vcc	+5V power supply	
123	BD3	BLUE Data Signal of Right Pixels	
124	BB3	BLUE Data Signal of Right Pixels	
125	BD2	BLUE Data Signal of Right Pixels	
126	BB2	BLUE Data Signal of Right Pixels	
127	BD1	BLUE Data Signal of Right Pixels	
128	BB1	BLUE Data Signal of Right Pixels	
129	BD0	BLUE Data Signal of Right Pixels (LSB)	
130	BB0	BLUE Data Signal of Right Pixels (LSB)	
131	GND	Gnd	
132	GND	Gnd	
133	BLON	Back Light Status ＊1	Output
134	MODE	H：2pixel mode L：4pixel mode	
135	GND	Gnd	
136	GND	Gnd	
137	Vdd	+12V power supply	
138	Vdd	+12V power supply	
139	Vdd	+12V power supply	
140	Vdd	+12V power supply	

＊1 When Vcc and Vdd are turned on, the output signal BLON goes to high typically 212 milliseconds later. The maximum output current is 1 milliampere.

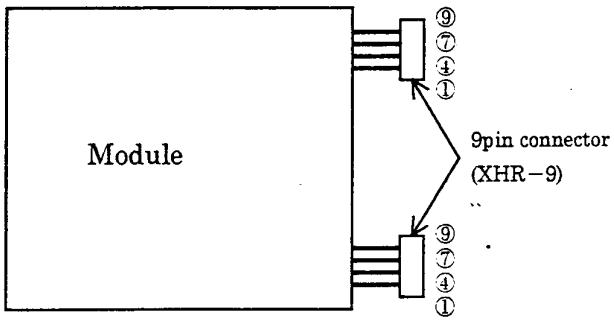
4-2. Back light driving

CN 2, 3

The module-side connector : XHR－9 (JST)

The user-side connector : S9B－XH－A (JST)

Pin no.	symbol	function
1	V_{HIGH}	Power supply for lamp A (High voltage side)
2	NC	This is electrically opened.
3	NC	This is electrically opened.
4	V_{HIGH}	Power supply for lamp B (High voltage side)
5	NC	This is electrically opened.
6	NC	This is electrically opened.
7	V_{LOW}	Power supply for lamp B (Low voltage side)
8	NC	This is electrically opened.
9	V_{LOW}	Power supply for lamp A (Low voltage side)



5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings	Unit	Remark
Input voltage	V_I	Ta=25℃	－0.3 ～ +3.55	V	【Note1】
+5.0V supply voltage	Vcc	Ta=25℃	0 ～ ＋ 6	V	
+12.0V supply voltage	Vdd	Ta=25℃	0 ～ ＋ 14	V	
Storage temperature	Tstg	－	－25 ～ ＋60	℃	【Note2】
Operating temperature (Ambient)	Topa	－	0 ～ ＋50	℃	

【Note1】 CLKA, CLKB, RA0～RA7, GA0～GA7, BA0～BA7, RB0～RB7, GB0～GB7, BB0～BB7, RC0～RC7, GC0～GC7, BC0～BC7, RD0～RD7, GD0～GD7, BD0～BD7, DEA, DEB, MODE

【Note2】 Humidity : 95%RH Max. (Ta≦40℃)

Maximum wet-bulb temperature at 39℃ or less. (Ta>40℃)

No condensation.

6. Electrical Characteristics

6-1. TFT-LCD panel driving Ta=25℃

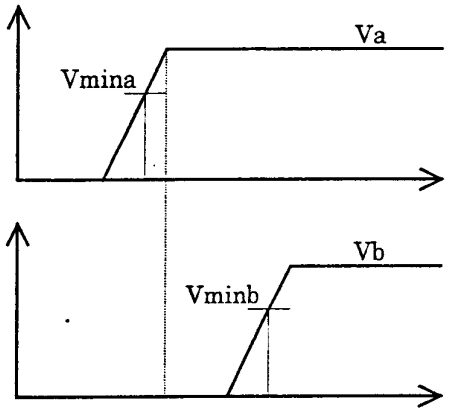
Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Vcc	Supply voltage	Vcc	+4.5	+5.0	+5.5	V	【Note1】
	Current dissipation	Icc	—	170	550	mA	【Note2】
Vdd	Supply voltage	Vdd	+10.8	+12.0	+13.2	V	【Note1】
	Current dissipation	Idd	—	300	640	mA	【Note2】
Permissive input ripple voltage		V_{RF}	—	—	100	mVp-p	Vcc=+5.0V
Input voltage (Low)		V_{IL}	0	—	+0.6	V	【Note3】
Input voltage (High)		V_{IH}	+2.7	—	+3.3	V	【Note3】
Input current (Low)		I_{IL}	—	—	10	μA	V_I=GND 【Note3】
Input current (High)		I_{IH}	—	—	10	μA	V_I=Vcc 【Note3】
Output voltage (Low)		V_{OL}	—	—	10	V	I_{OL}=-1mA
Output voltage (High)		V_{OH}	—	—	10	V	I_{OH}=1mA

【Note1】

1) On sequence of two power supplies
(sequence free)

i The case of (Va, Vb) = (Vcc,Vdd) power A
(Vmina, Vminb) = (4.5V, 10.8V)

ii The case of (Va, Vb) = (Vdd,Vcc)
(Vmina, Vminb) = (10.8V, 4.5 V) power B

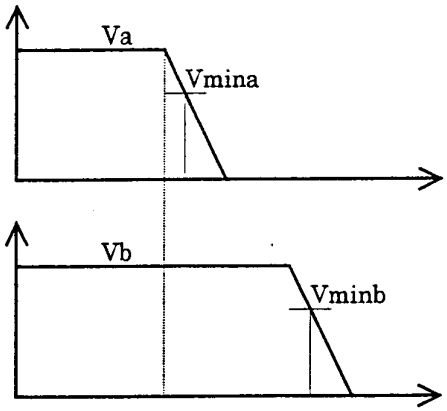


The LCD module turns on when (power A ≧ Vmina) and (power B ≧ Vminb).

2) Off sequence of two power supplies
(sequence free)

i The case of (Va, Vb) = (Vcc,Vdd) power A
(Vmina, Vminb) = (4.5V, 10.8V)

ii The case of (Va, Vb) = (Vdd,Vcc)
(Vmina, Vminb) = (10.8V, 4.5 V) power B



The LCD module shuts down when (power A ≦ Vmina) or (power B ≦ Vminb).

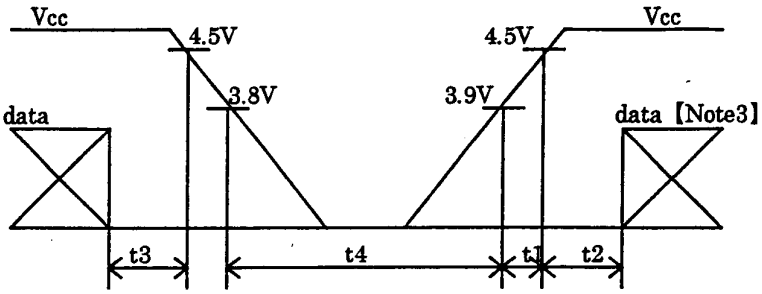
3) On-off sequences of Vcc and data

0<t1≦10ms

0<t2≦10ms

0<t3≦1s

t4≧1s



4) Dip conditions for supply voltage

The case of Vp=Vcc

(Vmin,Vth) = (4.5V,3.8V)

1) 3.8V≦Vcc<4.5V

td≦10ms

2) Vcc<3.8V

This case is described below *1.

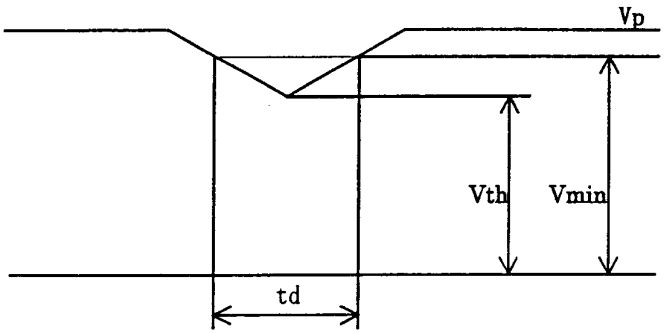
The case of Vp=Vdd

(Vmin,Vth) = (10.8V,4.2V)

1) 4.2V≦Vdd<10.8V

td≦10ms

2) Vdd<4.2V



*1 The LCD module shuts down when (Vcc < Vth) or (Vdd < Vth).

If they(Vcc,Vdd) recover, the LCD module turns on following the 2 power sequence.

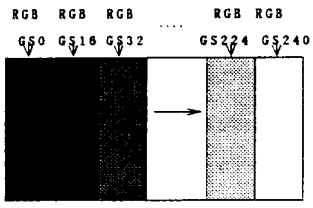
【Note2】 Typical current situation : 16-gray-bar pattern

Vcc=+5.0V, Vdd=+12.0V

Gray scale : GS(16N)

N=0～15

The explanation of each gray scale ,GS(16n), is described below section 8.



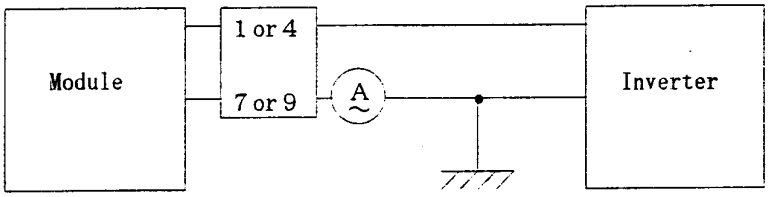
【Note3】 CLKA, CLKB, RA0～RA7, GA0～GA7, BA0～BA7, RB0～RB7, GB0～GB7, BB0～BB7, RC0～RC7, GC0～GC7, BC0～BC7, RD0～RD7, GD0～GD7, BD0～BD7, DEA, DEB, MODE

6-2. Back light driving

The back light system is an edge-lighting type with four CCFTs (Cold Cathode Fluorescent Tube). The characteristics of the lamp are shown in the following table.The value mentioned below is at the case of one CCFT.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Lamp current range	I_L	—	—	6.0	mArms	【Note1】
Lamp voltage	V_L	—	850	—	Vrms	Ta=25℃
Lamp power consumption	P_L	—	5.1	—	W	【Note2】
Lamp frequency	F_L	30	35	60	KHz	【Note3】
Kick-off voltage	Vs	—	—	1400	Vrms	Ta=25℃ 【Note4】
		—	—	1800	Vrms	Ta=0℃ 【Note4】
Lamp life time	T_L	30000	50000	—	hour	【Note5】

【Note1】 A lamp can be light in the range of lamp current shown above.
Maximum rating for current is measured by high frequency current measurement equipment connected to V_{LOW} at circuit showed below. (Note : To keep enough kick-off voltage and necessary steady voltage for CCFT.)
Lamp frequency : 30～60kHz
Ambient temperature : 0～50℃



* 7, 9 pin is V_{LOW}

【Note2】 Referential data per one CCFT by calculation ($I_L \times V_L$).
The data don't include loss at inverter.

【Note3】 Lamp frequency may produce interference with horizontal synchronous frequency, and this may cause beat on the display. Therefore lamp frequency shall be detached as much as possible from the horizontal synchronous frequency and from the harmonics of horizontal synchronous to avoid interference.

【Note4】 The voltage above this value should be applied to the lamp for more than 1 second to startup. Otherwise the lamp may not be turned on.

【Note5】 Lamp life time is defined as the time when either ① or ② occurs in the continuous operation under the condition of Ta=25℃ and I_L=(6.0)mArms.

① Brightness becomes 50% of the original value under standard condition.

② Kick-off voltage at Ta=0℃ exceeds maximum value, (1800)Vrms.

《Note》 The performance of the back light, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp.When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the back light and the inverter (miss-lighting, flicker, etc.) never occurs. When you confirm it, the module should be operated in the same condition as it is installed in your instrument.

7. Timing characteristics of input signals

7-1-1. 2pixel mode timing characteristics

Timing diagrams of input signal are shown in Fig.2.

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	—	55	60	MHz	【Note1】
	High time	Tch	3	—	—	ns	
	Low time	Tcl	3	—	—	ns	
	Skew	Tcsq	-1	0	1	clock	
Data	Setup time	Tds	4	—	—	ns	
	Hold time	Tdh	3	—	—	ns	
Data enable signal	Setup time	Tes	4	—	—	ns	
	Hold time	Teh	3	—	—	ns	
	Horizontal period	TH	648	848	928	clock	
			14	15	—	μs	
	Horizontal period (High)	THd	640	640	640	clock	
	Vertical period	TV	1026	1066	1080	line	【Note2】
	Vertical period (High)	TVd	1024	1024	1024	line	

【Note1】 Two pixel-data are sampled at the same time.

【Note2】 In case of using the long vertical period, the deterioration of display quality, flicker etc., may be occurred.

7-1-2. 4pixel mode timing characteristics

Timing diagrams of input signal are shown in Fig.3.

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	—	27.5	30	MHz	【Note3】
	High time	Tch	3	—	—	ns	
	Low time	Tcl	3	—	—	ns	
	Skew	Tcsq	-1	0	1	clock	
Data	Setup time	Tds	4	—	—	ns	
	Hold time	Tdh	3	—	—	ns	
Data enable signal	Setup time	Tes	4	—	—	ns	
	Hold time	Teh	3	—	—	ns	
	Horizontal period	TH	324	424	464	clock	
			14	15	—	μs	
	Horizontal period (High)	THd	320	320	320	clock	
	Vertical period	TV	1026	1066	1080	line	【Note4】
	Vertical period (High)	TVd	1024	1024	1024	line	

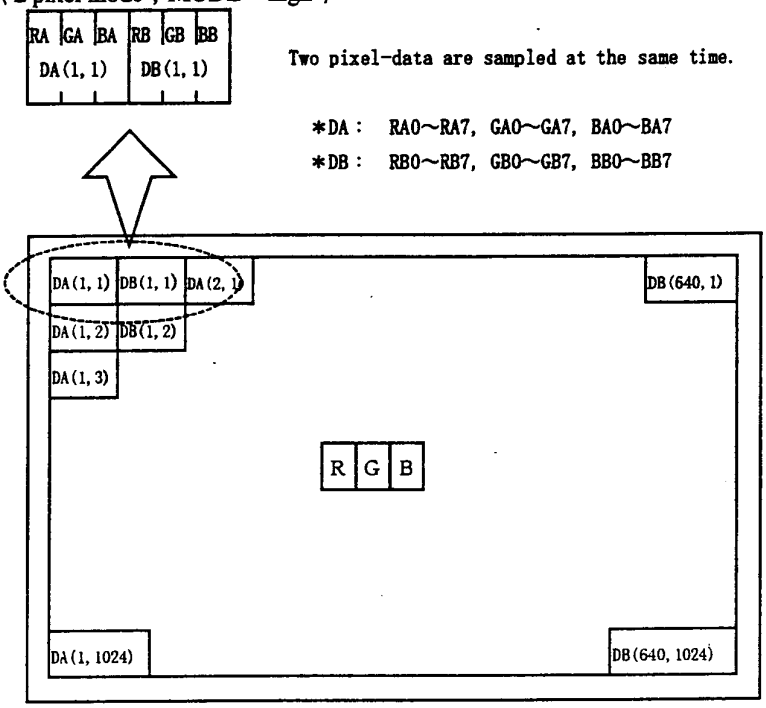
【Note3】 Four pixel-data are sampled at the same time.

【Note4】 In case of using the long vertical period, the deterioration of display quality, flicker etc., may be occurred.

7-2 Input Data Signals and Display Position on the screen

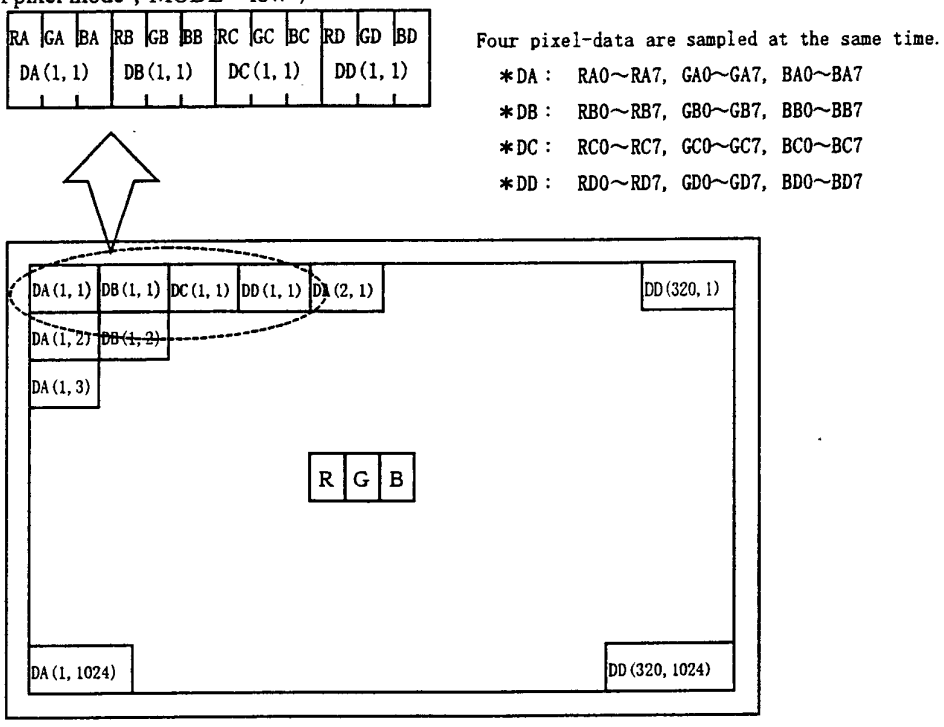
Graphics and texts can be displayed on a 1280 × 3× 1024 dots panel with 16M colors by supplying 48／96 bit data signal (8bit/color [253gray scale] x 3 x 2 pixels／4pixels).

7-2-1 〈2 pixel mode ; MODE="high"〉



Display position of input data (H, V)

7-2-2 〈4 pixel mode ; MODE="low"〉



Display position of input data(H, V)

8. Input Signals, Basic Display Colors and Gray Scale of Each Color

	Colors & Gray scale	Gray Scale	Data signal																									
			RA0	RA1	RA2	RA3	RA4	RA5	RA6	RA7	GA0	GA1	GA2	GA3	GA4	GA5	GA6	GA7	BA0	BA1	BA2	BA3	BA4	BA5	BA6	BA7
			RB0	RB1	RB2	RB3	RB4	RB5	RB6	RB7	GB0	GB1	GB2	GB3	GB4	GB5	GB6	GB7	BB0	BB1	BB2	BB3	BB4	BB5	BB6	BB7
			RC0	RC1	RC2	RC3	RC4	RC5	RC6	RC7	GC0	GC1	GC2	GC3	GC4	GC5	GC6	GC7	BC0	BC1	BC2	BC3	BC4	BC5	BC6	BC7
			RD0	RD1	RD2	RD3	RD4	RD5	RD6	RD7	GD0	GD1	GD2	GD3	GD4	GD5	GD6	GD7	BD0	BD1	BD2	BD3	BD4	BD5	BD6	BD7
Basic Color	Black	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1
	Green	–	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	–	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1	X	X	1	1	1	1	1	1
	Red	–	X	X	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	–	X	X	1	1	1	1	1	1	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1
	Yellow	–	X	X	1	1	1	1	1	1	X	X	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	–	X	X	1	1	1	1	1	1	X	X	1	1	1	1	1	1	X	X	1	1	1	1	1	1
Gray Scale of Red	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓					↓								↓								↓			
	⇩	↓					↓								↓								↓			
	Brighter	GS250	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS251	1	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS252	X	X	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓					↓								↓								↓			
	⇩	↓					↓								↓								↓			
	Brighter	GS250	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0
	⇩	GS251	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0
	Green	GS252	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale of Blue	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	⇧	↓					↓								↓								↓			
	⇩	↓					↓								↓								↓			
	Brighter	GS250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1
	⇩	GS251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1
	Blue	GS252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1

0 :Low level voltage, 1 : High level voltage, X : Don't care.

Each basic color can be displayed in 253 gray scales from 8 bit data signals. According to the combination of total 24 bit data signals, the 16-million-color display can be achieved on the screen.

If the least 2 significant bits are set to 0, the FRC becomes in no operation.

9. Optical Characteristics

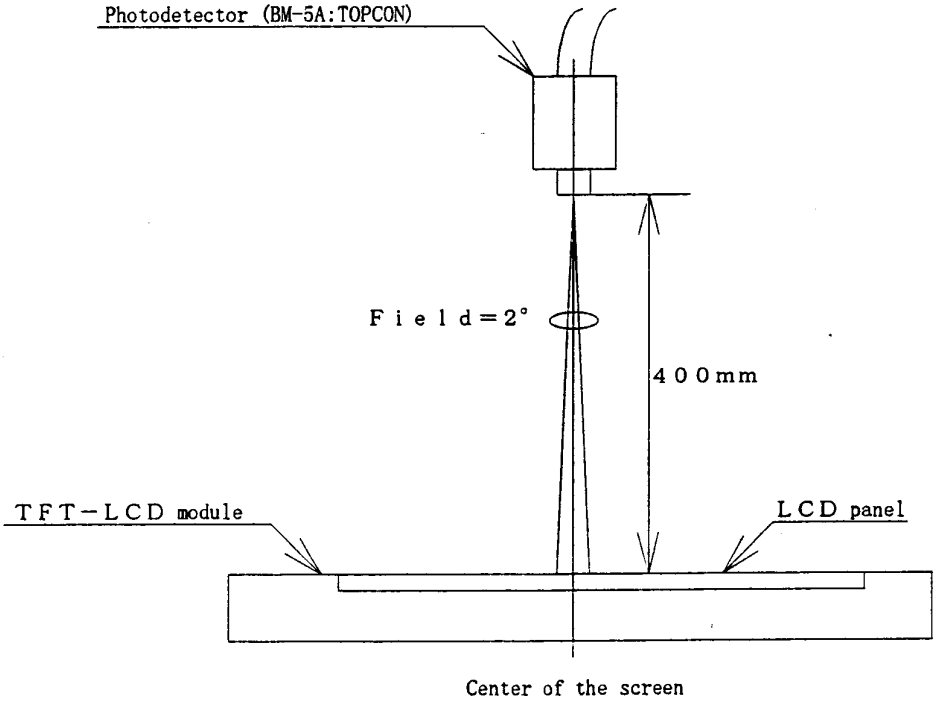
Ta=25℃, Vcc=+5V, Vdd=+12V

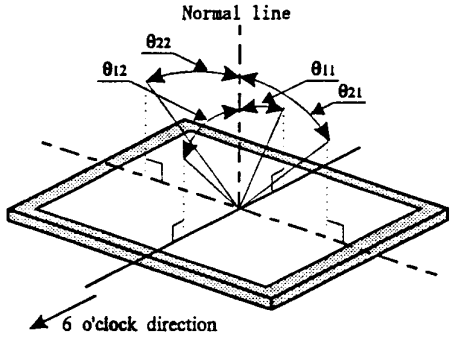
Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Vertical	θ 11	CR≧5	50	70		Deg.	【Note1,4】
		θ 12		35	40		Deg.	
	Horizontal	θ 21, θ 22		60	70		Deg.	
Contrast ratio		C R	θ =0°	150	230	—		【Note2,4】
Response Time	Rise	τ r		—	10	25	m s	【Note3,4】
	Decay	τ d		—	35	50	m s	
Chromaticity of White		Wx		—	0.304	—	—	【Note4】
		Wy		—	0.314	—	—	
Chromaticity of red		Rx		—	0.62	—	—	
		Ry		—	0.33	—	—	
Chromaticity of Green		Gx		—	0.30	—	—	
		Gy		—	0.60	—	—	
Chromaticity of blue		Bx		—	0.14	—	—	
		By		—	0.09	—	—	
Luminance of white		YL		150	180	—	cd/m^2	IL=6.0mA rms 【Note4】
White Uniformity		δ w		—	—	1.25	—	【Note5】

※The measurement shall be executed 30 minutes after lighting at rating.

The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Fig.4 below.

【Note1】 Definitions of viewing angle range:





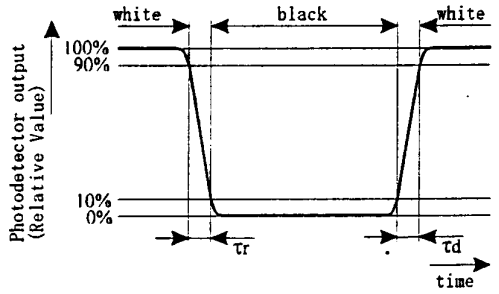
【Note2】 Definition of contrast ratio:

The contrast ratio is defined as the following.

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

【Note3】 Definition of response time:

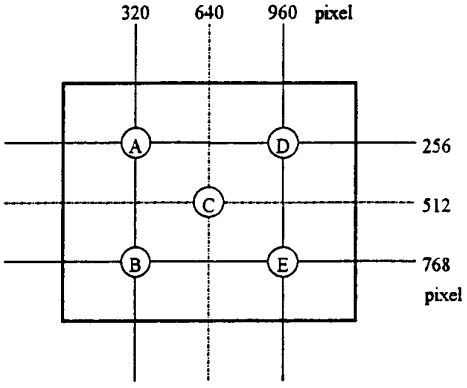
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".



【Note4】 This shall be measured at center of the screen.

【Note5】 Definition of white uniformity:

White uniformity is defined as the following with five measurements (A~E).



$$\delta_W = \frac{\text{Maximum Luminance of five points (brightness)}}{\text{Minimum Luminance of five points (brightness)}}$$

10. Handling Precautions

a) Be sure to turn off the power supply when inserting or disconnecting the cable.

b) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.

c) Since the front polarize is easily damaged, pay attention not to scratch it.

d) Since long contact with water may cause discoloration or spots, wipe off water drop immediately.

e) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.

f) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.

g) Since CMOS LSI is used in this module, take care of static electricity and take the human earth into consideration when handling.

h) Make sure the four mounting holes of the module are grounded sufficiently. Take electro-magnetic interference (EMI) into consideration.

i) The module has some printed circuit boards (PCBs) on the back side. Take care to keep them form any stress or pressure when handling or installing the module; otherwise some of electronic parts on the PCBs may be damaged.

j) Observe all other precautionary requirements in handling components.

k) When some pressure is added onto the module from rear side constantly, it causes display non-uniformity issue , functional defect, etc. So, please avoid such design.

l) Giving a press to the panel in operation for wiping it and so on may cause temporary dark spots or some kinds of degradation.

Once turn off the power supply and turn on after several scores of seconds again, and the problem will be recovered.

11. Packing form

a) Piling number of cartons : maximum 12 cartons

b) Packing quantity in one carton : 1 module

c) Carton size : 585mm(W) × 506mm(H)× 120mm(D)

d) Total mass of one carton filled with full modules : 5kg

12. Reliability test items

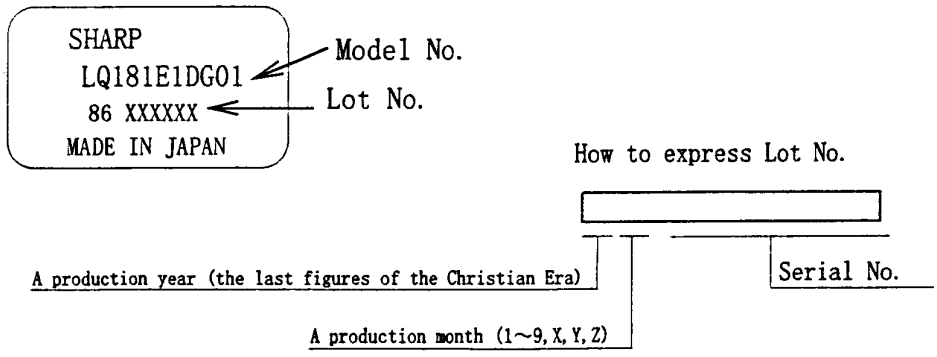
No.	Test item	Conditions
1	High temperature storage test	Ta=60℃ 240h
2	Low temperature storage test	Ta=-25℃ 240h
3	High temperature & high humidity operation test	Ta=40℃ ; 95%RH 240h (No condensation)
4	High temperature operation test	Ta=50℃ 240h (The panel temp. must be less than 60℃)
5	Low temperature operation test	Ta=0℃ 240H
6	Vibration test (non- operating)	Frequency : 10～57Hz/Vibration width (one side) : 0.075mm : 58～500Hz/Gravity : 9.8m/s^2 Sweep time : 11hours Test period : 3 hours (1 hour for each direction of X,Y,Z)
7	Shock test (non- operating)	Max. gravity : 490m/s^2 Pulse width : 11ms, sine wave Direction : ±X, ±Y, ±Z, once for each direction.

【Result Evaluation Criteria】

Under the display quality test conditions with normal operation state, these shall be no change which may affect practical display function.

13. Others

1) Lot No. and indication Label:



2) Adjusting volume have been set optimally before shipment, so do not change any adjusted value. If adjusted value is changed, the specification may not be satisfied.

3) Disassembling the module can cause permanent damage and should be strictly avoided.

4) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.

5) When any question or issue occurs , it shall be solved by mutual discussion.

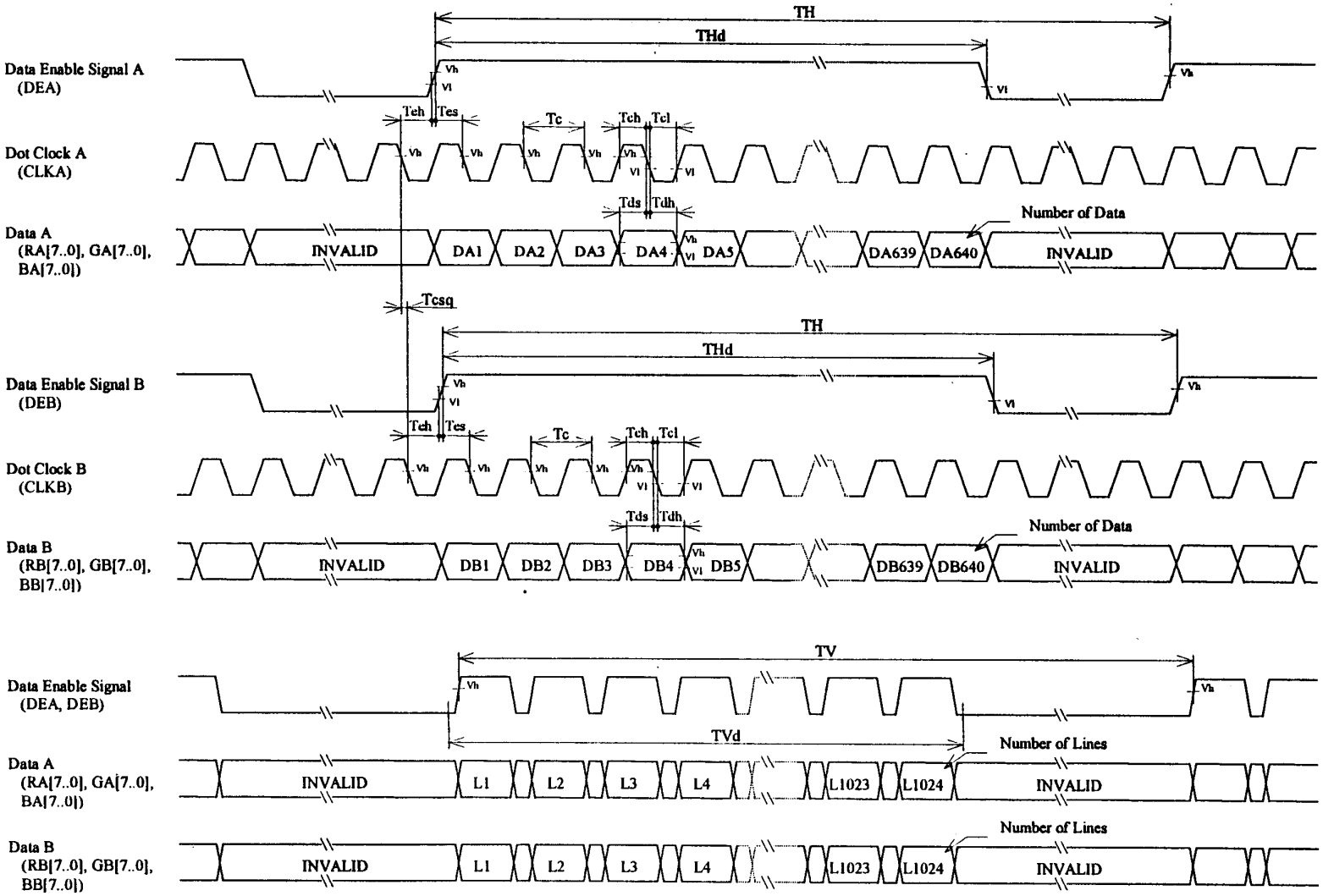


Fig. 2 2-pixel mode

Note : The following signal pins must be connected to the GND :

RC[7..0], GC[7..0], BC[7..0], RD[7..0], GD[7..0], BD[7..0]

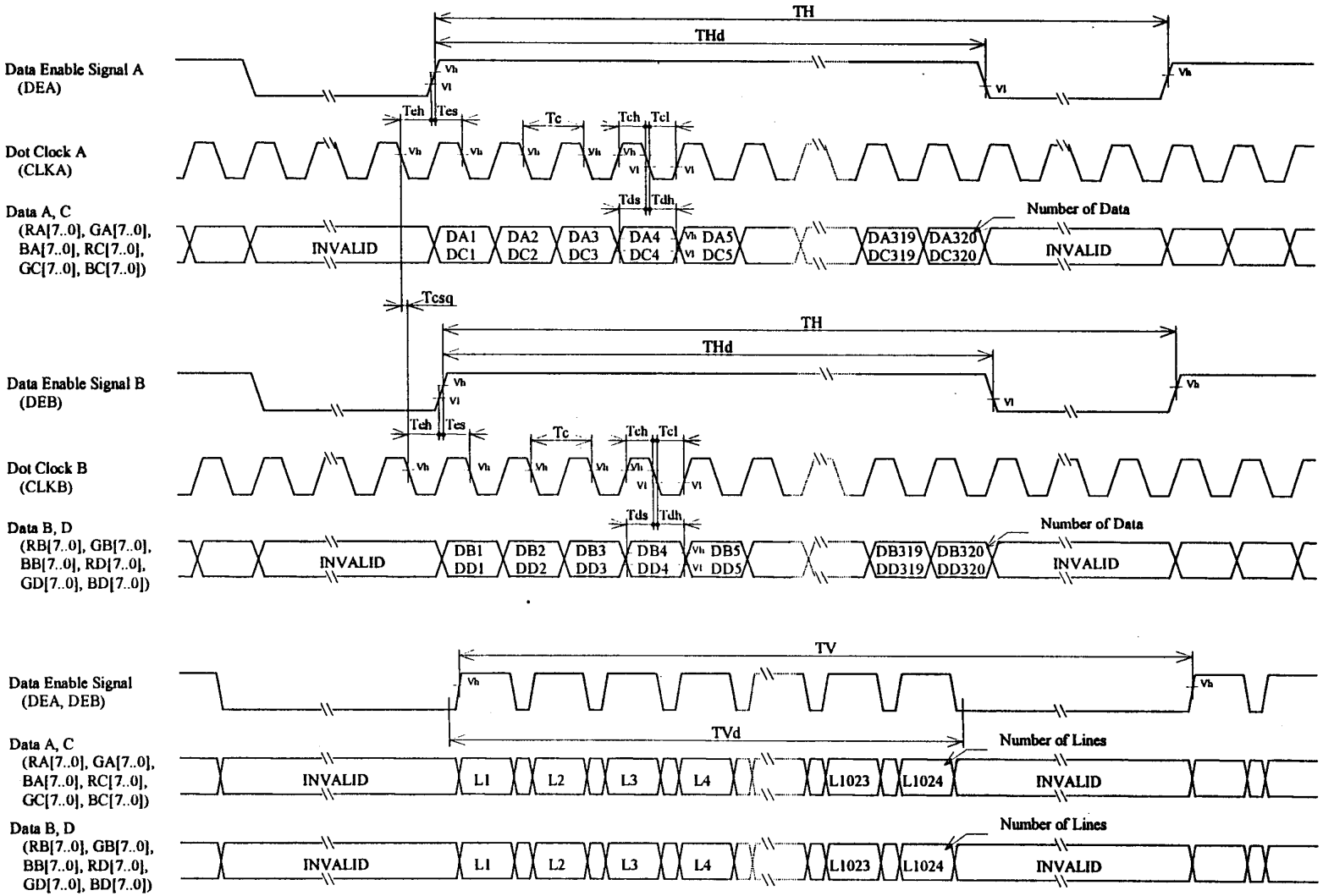
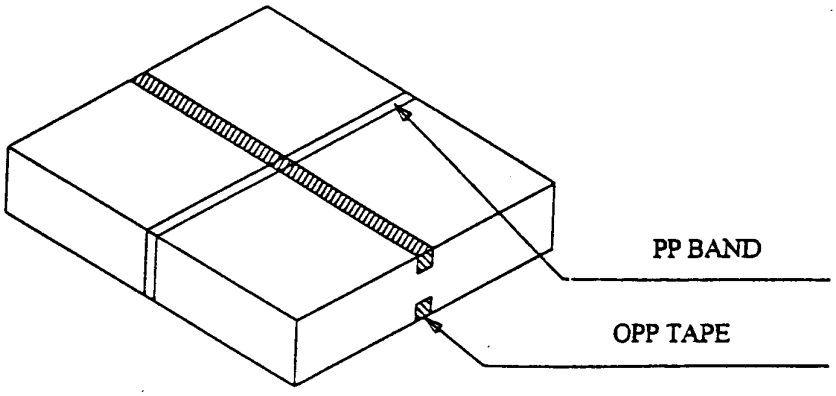
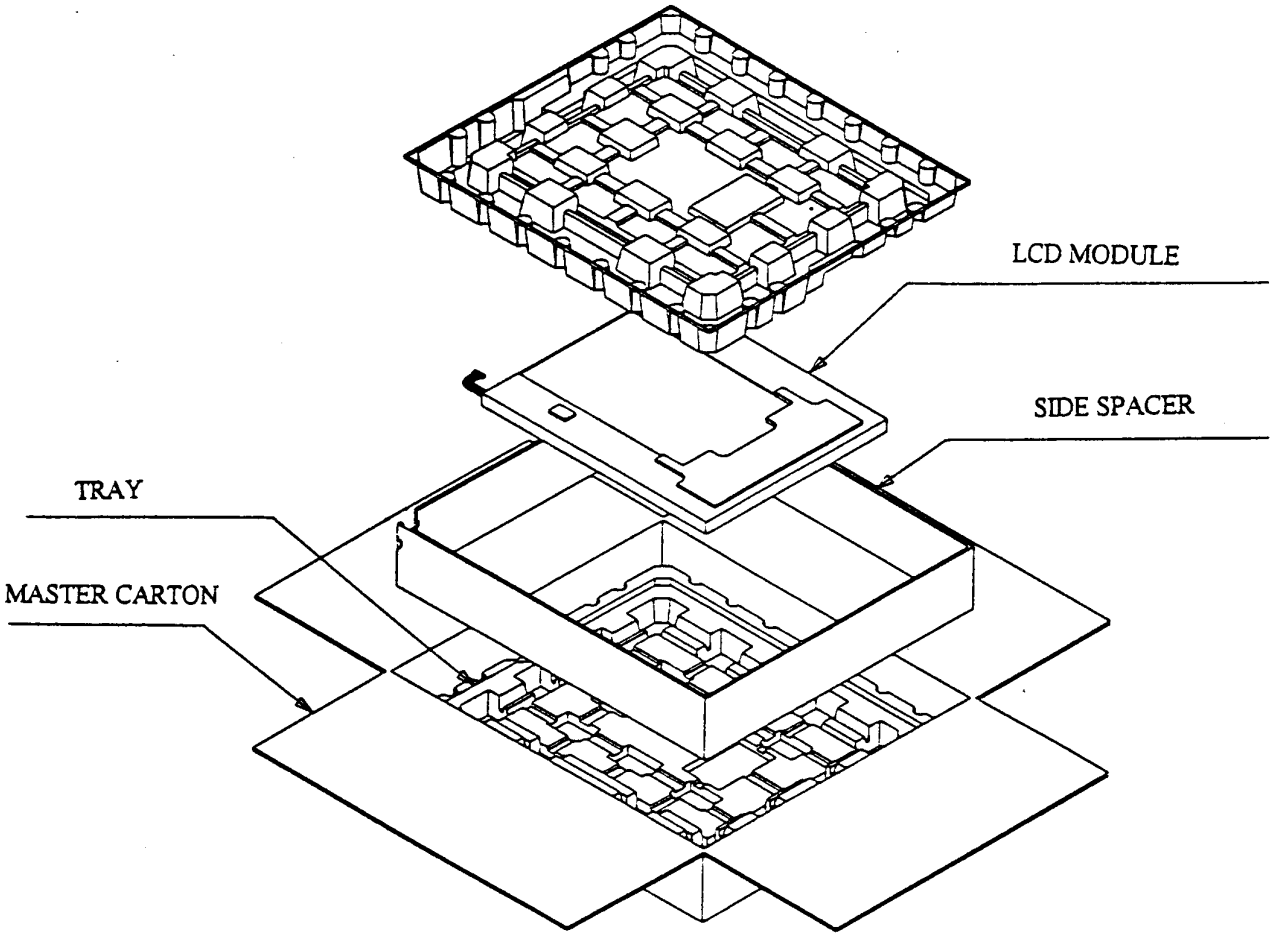


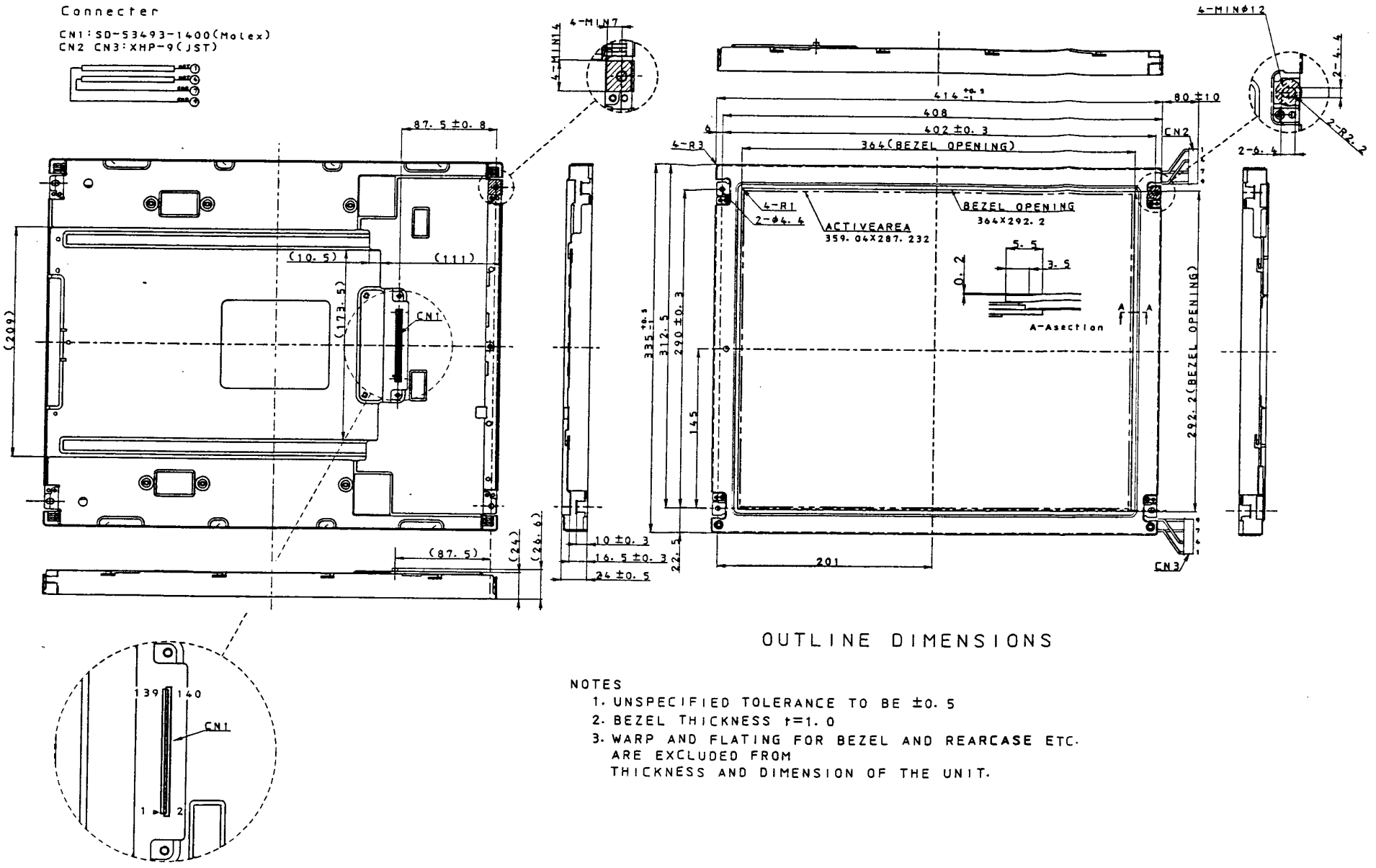
Fig. 3 4-pixel mode



PACAGE FIGURE



PACAGE FORM



OUTLINE DIMENSIONS

NOTES

1. UNSPECIFIED TOLERANCE TO BE ±0.5
2. BEZEL THICKNESS t=1.0
3. WARP AND FLATING FOR BEZEL AND REARCASE ETC. ARE EXCLUDED FROM THICKNESS AND DIMENSION OF THE UNIT.

TFT, LCD, LQ181E1DG01