ORIENT DISPLAY

Your Total LCD Solution Provider

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SPECIFICATION
FOR
LCD MODULE

MODULE NO: AFS240320TG-2.4-AD10011
REVISION NO: 00

Customer's Approval:

	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)	YLH	2011-4-1
CHECKED BY	FR.LI	2011-4-1
APPROVED BY	SEAN	2011-4-1

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DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
00	Apr-1-2011	First Issue	Ylh

CONTENTS

1. Features & Mechanical Specifications

Item	Contents	Unit
	LCD	
LCD Type	TFT /Transmissive /Normal White	--
Viewing direction	6 O'clock	--
Backlight	4 Chip White LED in parallel	--
Interface	8080-16 parallel bus interface	--
Driver IC	HX8347D	--
Outline Dimension	42.72(W) × 60.26(H) × 3.3(T)	mm
Glass area (W×H×T)	40.32 ×56.26 × 1.0	mm
Active area (W×H)	36.72 × 48.96	mm
Number of Dots	240(RGB) × 320	--
Dot pitch (W×H)	0.051 × 0.153	mm
Pixel pitch (W×H)	0.153 × 0.153	mm
Operating Temperature	-20 ～ +70	℃
Storage temperature	-30 ～ +80	℃

2. Dimensional Outline

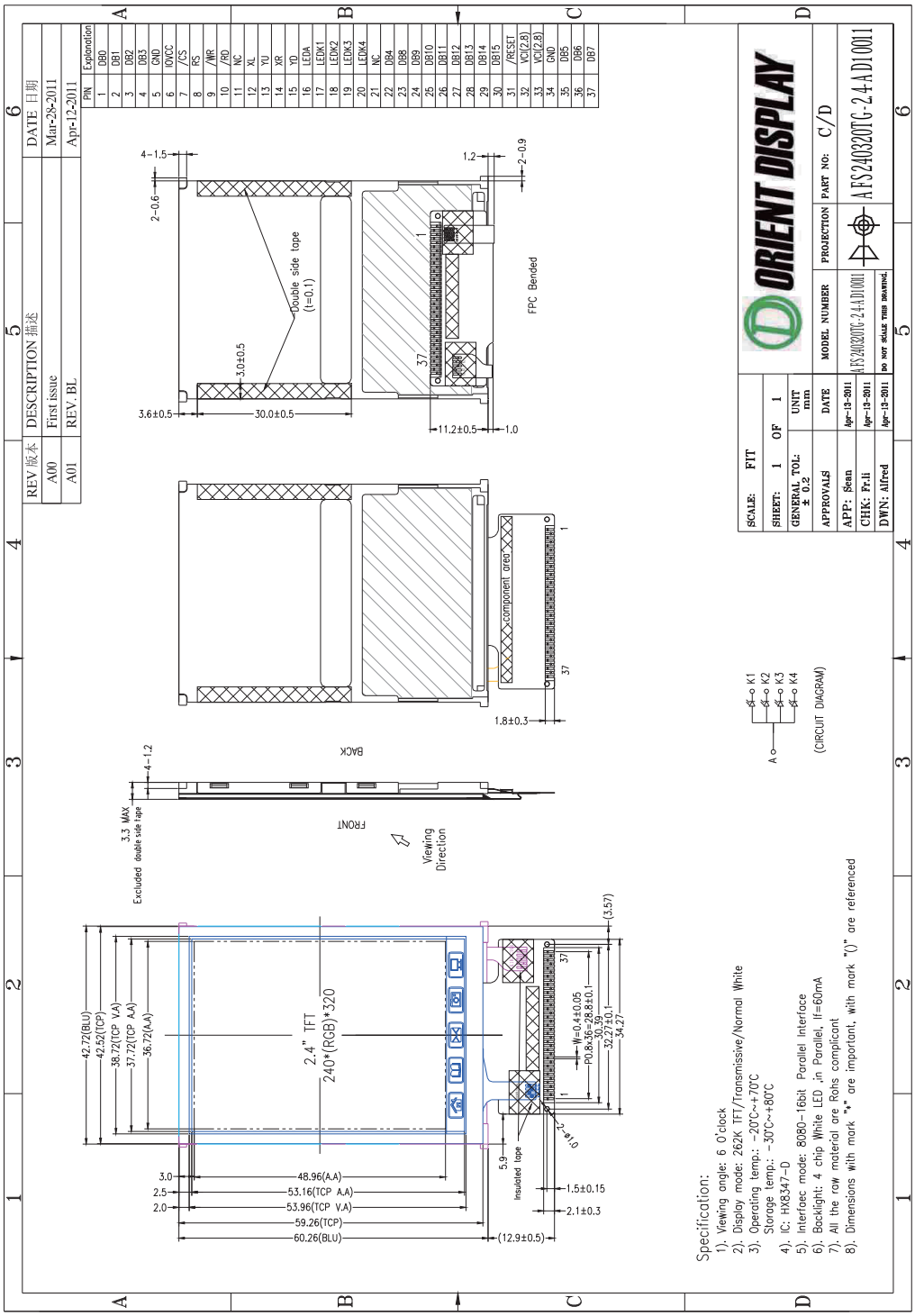


Figure 1. Dimensional outline

3. Block Diagram

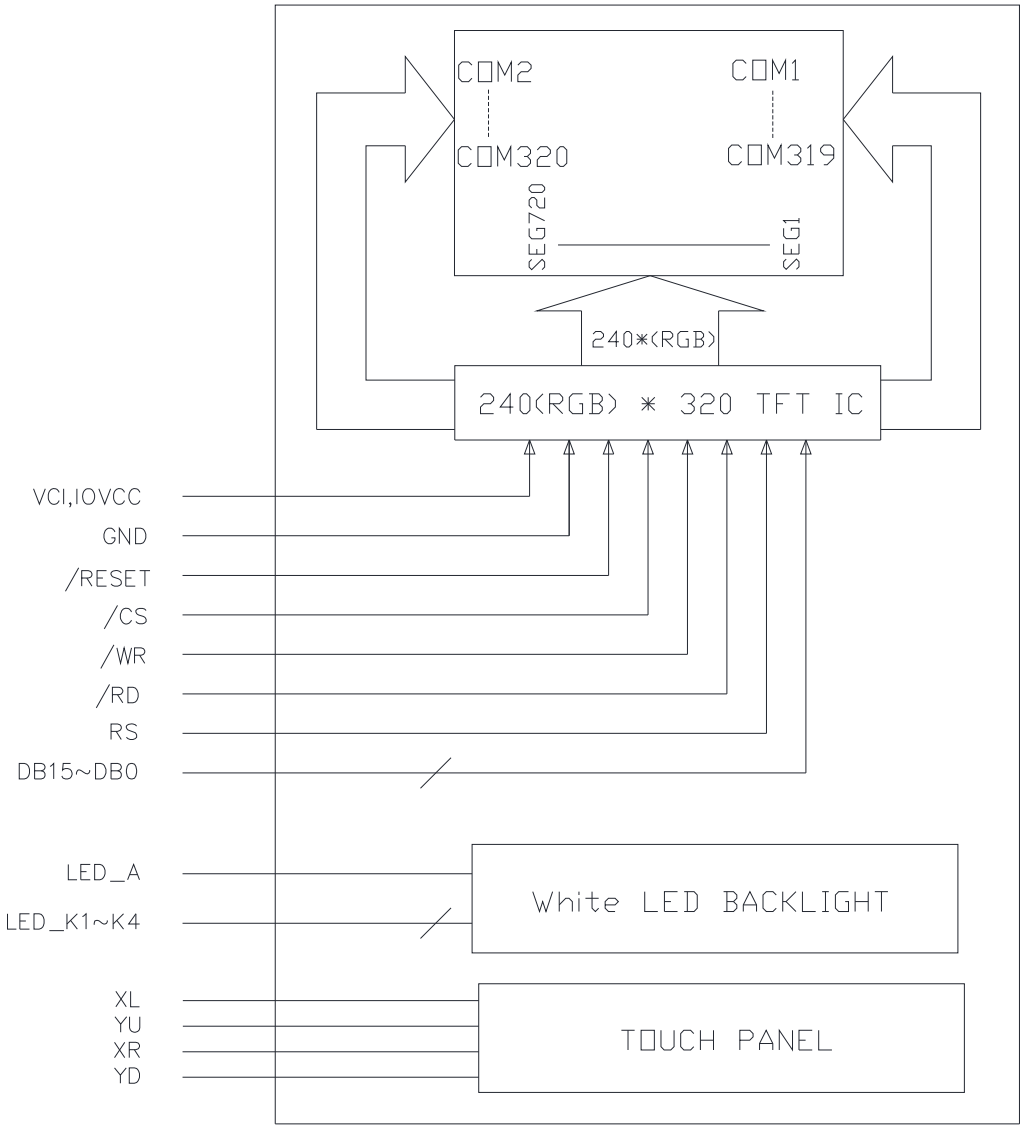


Figure 2. Block diagram

4. Pin Description

PIN No.	SYMBOL	Function
1~4	DB0~DB3	Data Bus
5	GND	Ground
6	IOVCC	Digital IO Pad power supply
7	/CS	Chip Select input pin. (Active Low)
8	RS	Data or command select pin. "H": Date, "L": Command.
9	/WR	Write signal input pin. (Active Low)
10	/RD	Read signal input pin. (Active Low)
11	NC	No connection
12	XL	Touch panel XL position
13	YU	Touch panel YU position
14	XR	Touch panel XR position
15	YD	Touch panel YD position
16	LED_A	Backlight LED Anode
17~20	LED_K1~K4	Backlight LED Cathode
21	NC	No connection
22	DB4	Data Bus
23~30	DB8~DB15	Data Bus
31	/RESET	Reset pin. (Active Low)
32	VCI	Analog power supply
33	VCI	Analog power supply
34	GND	Ground
35~37	DB5~DB7	Data Bus

5. Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply Voltage range	VCI	-0.3 to +4.6	V
Supply Voltage range	IOVCC	-0.3 to +4.6	V
Operating Temperature range	TOP	-20 to +70	℃
Storage Temperature range	TST	-30 to +80	℃

6. Electrical Characteristics

DC Characteristics

Item	Symbol	Min.	Type.	Max.	Unit
Logic Supply Voltage	VCI	2.3	2.8	3.3	V
Logic Supply Voltage	IOVCC	1.65	1.8	3.3	V

7. Backlight Characteristics

White LED × 4 **(Ta = 25°C)**

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	IF = 60mA	-	3.2	-	V
Uniformity	△Bp	-	80	-	-	%
Luminance for LCD	Lv	IF = 60mA	3500	-	-	cd/m^2

8. Electro-Optical Characteristics

Item		Symbol	Conditions	Specifications			Unit	Note
				Min.	Typ.	Max.		
Transmittance		T%	Viewing normal angle $\theta_X = \theta_Y = 0°$	-	5.0	-	%	All left side data are based on CMI's following condition – 1.LC : TN 2.Light Source :CMI LED BLU 3.Film : 日東 NPF TEG 1465DU 4.Machine : DMS 803
Contrast Ratio		CR		-	250	-		
Response Time (by Quick)		$T_{on} + T_{off}$		-	30	-	ms	
Viewing Angle	Hor.	θ_{X+}	Center CR>10	-	45	-	deg.	
		θ_{X-}		-	45	-		
	Ver.	θ_{Y+}		-	45	-		
		θ_{Y-}		-	20	-		
CF only Color Chromaticity (CIE 1931)	Red	X_R	Viewing normal angle $\theta_X = \theta_Y = 0°$	0.592	0.612	0.632		1.Under C light Simulation 2.NTSC 56%
		Y_R		0.309	0.329	0.349		
	Green	X_G		0.279	0.299	0.319		
		Y_G		0.547	0.567	0.587		
	Blue	X_B		0.124	0.144	0.164		
		Y_B		0.090	0.110	0.130		
	White	X_W		0.288	0.308	0.328		
		Y_W		0.305	0.325	0.345		

*Note (1) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

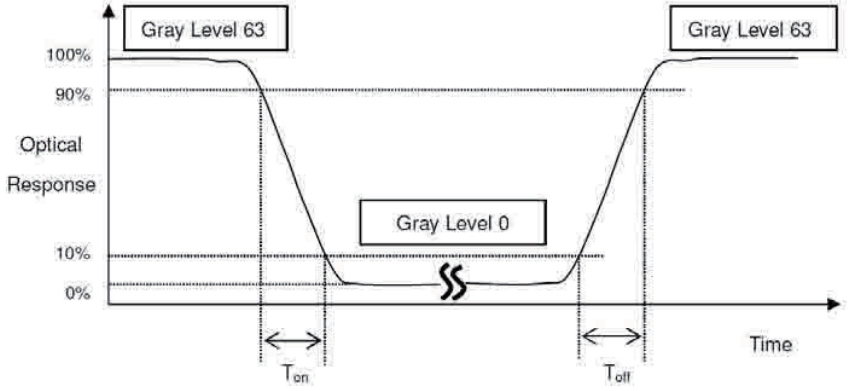
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

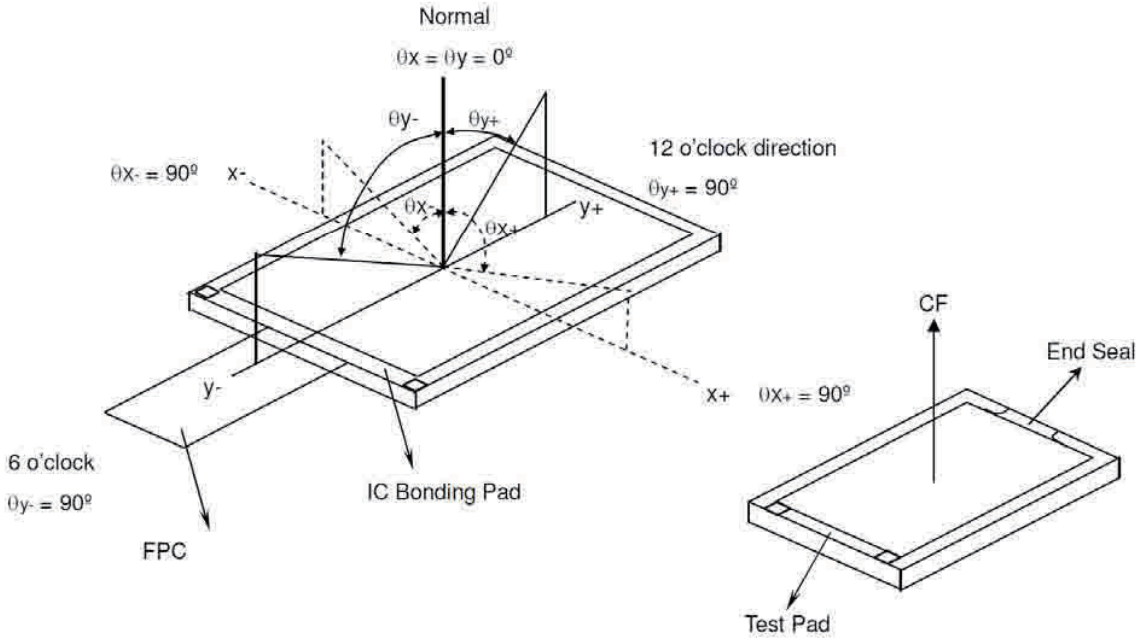
CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (5).

*Note (2) Definition of Response Time (T_{on}, T_{off}):

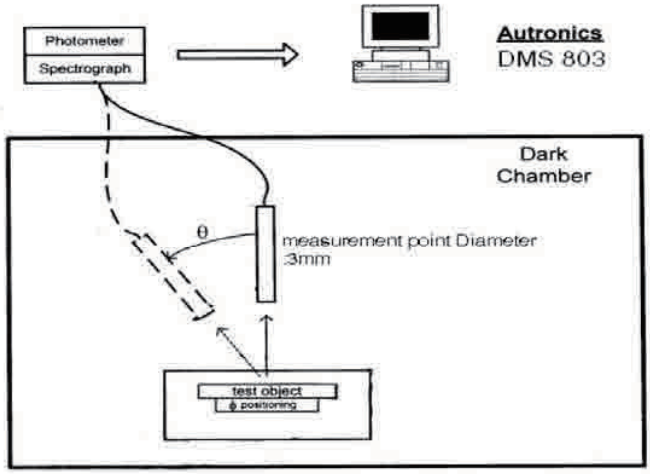


*Note(3) Definition of Viewing Angle

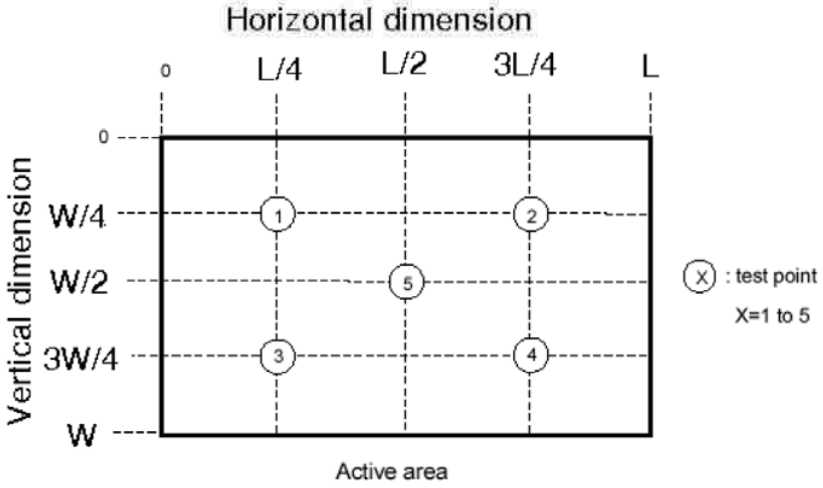


*Note (4) Measurement Set-Up:

The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



*Note (5)



9. Instruction Description

(Hex)	Operation Code	W/R	Upper Code	Lower Code								Comment
			D[17:8]	D7	D6	D5	D4	D3	D2	D1	D0	
00	Himax ID	R	-	0	1	0	0	0	1	1	1	-
01	Display Mode control	W/R	-	DP_STB(0)	DP_STB_S(0)	-	-	SCROL (0)	IDMON (0)	INVON (0)	PTLON (0)	-
02	Column address start 2	W/R	-	SC[15:8] (8'b0000_0000)								-
03	Column address start 1	W/R	-	SC[7:0] (8'b0000_0000)								-
04	Column address end 2	W/R	-	EC[15:8] (8'b0000_0000)								-
05	Column address end 1	W/R	-	EC[7:0] (8'b1110_1111)								-
06	Row address start 2	W/R	-	SP[15:8] (8'b0000_0000)								-
07	Row address start 1	W/R	-	SP[7:0] (8'b0000_00000)								-
08	Row address end 2	W/R	-	EP[15:8] (8'b0000_0001)								-
09	Row address end 1	W/R	-	EP[7:0] (8'b0011_1111)								-
0A	Partial area start row 2	W/R	-	PSL[15:8] (8'b0000_0000)								-
0B	Partial area start row 1	W/R	-	PSL[7:0] (8'b0000_00000)								-
0C	Partial area end row 2	W/R	-	PEL[15:8] (8'b0000_0001)								-
0D	Partial area end row 1	W/R	-	PEL[7:0] (8'b0011_1111)								-
0E	Vertical Scroll Top fixed area 2	W/R	-	TFA[15:8] (8'b0000_0000)								-
0F	Vertical Scroll Top fixed area 1	W/R	-	TFA[7:0] (8'b0000_0000)								-
10	Vertical Scroll height area 2	W/R	-	VSA[15:8] (8'b0000_0001)								-
11	Vertical Scroll height area 1	W/R	-	VSA[7:0] (8'b0100_0000)								-
12	Vertical Scroll Button area 2	W/R	-	BFA[15:8] (8'b0000_0000)								-
13	Vertical Scroll Button area 1	W/R	-	BFA [7:0] (8'b0000_0000)								-
14	Vertical Scroll Start address 2	W/R	-	VSP [15:8] (8'b0000_0000)								-
15	Vertical Scroll Start address 1	W/R	-	VSP [7:0] (8'b0000_0000)								-
16	Memory Access control	W/R	-	MY(0)	MX(0)	MV(0)	ML(0)	BGR(0)	-	-	-	-
17	COLMOD	W/R	-	CSEL[3:0] (4b'0110)				-	IFPF[2:0] (3b'110)			-
18	OSC Control 2	W/R	-	I/PI_RADJ1[3:0] (3b'0011)				N/P_RADJ0[3:0](4b'0100)				-
19	OSC Control 1	W/R	-	-	-	-	-	-	-	-	OSC_EN(0)	-
1A	Power Control 1	W/R	-	-	-	-	-	-	BT[2:0] (001)			-
1B	Power Control 2	W/R	-	-	-	VRH[5:0] (01_1011)_4.8V						-
1C	Power Control 3	W/R	-	-	-	-	-	-	AP[2:0] (011)			-
1D	Power Control 4	W/R	-	-	I/PI_FS0[2:0](100)			-	N/P_FS0[2:0]](100)			-
1E	Power Control 5	W/R	-	-	I/PI_FS1[2:0]](100)			-	N/P_FS1[2:0]](100)			-
1F	Power Control 6	W/R	-	GASEN(1)	VCOMG(0)	-	PON(0)	DK(1)	XDK(0)	DDVDH_TRI(0)	STB(1)	-
22	SRAM Write Control	W/R	SRAM Write									-
23	VCOM Control 1	W/R	-	VMF[7:0](1000_0000)								-
24	VCOM Control 2	W/R	-	VMH[7:0](0111_0001)								-
25	VCOM Control 3	W/R	-	VML[7:0](0010_1111)								-
26	Display Control 1	W/R	-	--	-	-	-	ISC[3:0](0001)				-
27	Display Control 2	W/R	-	PT[1:0](10)		PTV[1:0](10)		-	-	PTG(1)	REF(1)	-
28	Display Control 3	W/R	-	-	-	GON(1)	DTE(0)	D[1:0] (00)		-	-	-

(Hex)	Operation Code	W/R	Upper Code	Lower Code								Comment
			D[17:8]	D7	D6	D5	D4	D3	D2	D1	D0	
29	Frame Rate control 1	W/R	-	I/P1_RTN[3:0](0010)				N/P_RTN[3:0](0010)				-
2A	Frame Rate Control 2	W/R	-	-	-	I/P1_DIV[1:0](00)		-	-	N/P_DIV[1:0](00)		-
2B	Frame Rate Control 3	W/R	-	N/P_DUM[7:0] (8'b'0001_1100)								-
2C	Frame Rate Control 4	W/R	-	I/P1_DUM[7:0] (8'b'0001_1100)								-
2D	Cycle Control 1	W/R	-	GDON[7:0] (8'b0000_1101)								-
2E	Cycle Control 2	W/R	-	GDOF[7:0] (8'b0111_0000)								-
2F	Display inversion	W/R	-	-	I/P1_NW[2:0](3'b'001)			-	N/P_NW[2:0] (3'b'001)			-
31	RGB interface control 1	W/R	-	-	-	-	-	-	-	RCM[1:0](00)		-
32	RGB interface control 2	W/R	-	-	-	-	-	DPL (0)	HSPL (0)	VSPL (0)	EPL (0)	-
33	RGB interface control 3	W/R	-	HBP[7:0]								-
34	RGB interface control 4	W/R	-	HBP[8:8]		VBP[5:0]						-
36	Panel Characteristic	W/R	-	-	-	-	-	SS_Panel	GS_Panel	REV_Panel	BGR_Panel	-
38	OTP Control 1	W/R	-	OTP_PTM[1:0]		OTP_VARDJ[1:0]		OTP_POR	OTP_OTPEN	OTP_PPROG	OTP_PWE	-
39	OTP Control 2	W/R	-	-	-	-	-	-	OTP_YA2	OTP_YA1	OTP_YA0	-
3A	OTP Control 3	W/R	-	-	-	-	OTP_XA4	OTP_XA3	OTP_XA2	OTP_XA1	OTP_XA0	-
3C	CABC Control 1	W/R	-	DBV[7:0](8'h00)								-
3D	CABC Control 2	W/R	-	-	-	BCTRL (0)	-	DD (0)	BL (0)	-	-	-
3E	CABC Control 3	W/R	-	-	-	-	-	-	-	C1 (0)	C0 (0)	-
3F	CABC Control 4	W/R	-	CMB[7:0](8'h00)								-
40	r1 Control (1)	W/R	-	-	-	VRP0[5:0] (6'b00_0001)						-
41	r1 Control (2)	W/R	-	-	-	VRP1[5:0] (6'b00_1110)						-
42	r1 Control (3)	W/R	-	-	-	VRP2[5:0] (6'b01_0001)						-
43	r1 Control (4)	W/R	-	-	-	VRP3[5:0] (6'b01_1010)						-
44	r1 Control (5)	W/R	-	-	-	VRP4[5:0] (6'b01_1000)						-
45	r1 Control (6)	W/R	-	-	-	VRP5[5:0] (6'b10_0100)						-
46	r1 Control (7)	W/R	-	PRP0[6:0] (7'b001_0101)								-
47	r1 Control (8)	W/R	-	PRP1[6:0] (7'b110_0101)								-
48	r1 Control (9)	W/R	-	-	-	-	PKP0[4:0] (5'b0_1011)					-
49	r1 Control (10)	W/R	-	-	-	-	PKP1[4:0] (5'b1_100)					-
4A	r1 Control (11)	W/R	-	-	-	-	PKP2[4:0] (5'b1_1001)					-
4B	r1 Control (12)	W/R	-	-	-	-	PKP3[4:0] (5'b1_1010)					-
4C	r1 Control (13)	W/R	-	-	-	-	PKP4[4:0] (5'b1_1000)					-
50	r1 Control (14)	W/R	-	-	-	VRN0[5:0] (6'b01_1011)						-
51	r1 Control (15)	W/R	-	-	-	VRN1[5:0] (6'b10_0111)						-
52	r1 Control (16)	W/R	-	-	-	VRN2[5:0] (6'b10_0101)						-
53	r1 Control (17)	W/R	-	-	-	VRN3[5:0] (6'b10_1110)						-
54	r1 Control (18)	W/R	-	-	-	VRN4[5:0] (6'b11_0001)						-
55	r1 Control (19)	W/R	-	-	-	VRN5[5:0] (6'b11_1110)						-
56	r1 Control (20)	W/R	-	-	PRN0[6:0] (7'b001_1010)							-
57	r1 Control (21)	W/R	-	-	PRN1[6:0] (7'b110_1010)							-
58	r1 Control (22)	W/R	-	-	-	PKN0[4:0] (5'b0_0111)						-
59	r1 Control (23)	W/R	-	-	-	PKN1[4:0] (5'b0_0101)						-
5A	r1 Control (24)	W/R	-	-	-	PKN2[4:0] (5'b0_0110)						-
5B	r1 Control (25)	W/R	-	-	-	PKN3[4:0] (5'b0_1011)						-
5C	r1 Control (26)	W/R	-	-	-	PKN4[4:0] (5'b1_0100)						-
5D	r1 Control (27)	W/R	-	CGMN1[1:0] (11)		CGMN0[1:0](00)		CGMP1[1:0](11)		CGMP0[1:0](00)		-
60	TE Control	W/R	-	-	-		TE_mode(0)	TEOE(0)		-	-	-
E4	Power saving 1	W/R	-	EQ_S1[7:0]								-
E5	Power saving 2	W/R	-	EQ_S2[7:0]								-
E6	Power saving 3	W/R	-	EQ_S3[7:0]								-
E7	Power saving 4	W/R	-	EQ_S4[7:0]								-
E8	Source OP control_Normal	W/R	-	OPON_N[7:0]								-

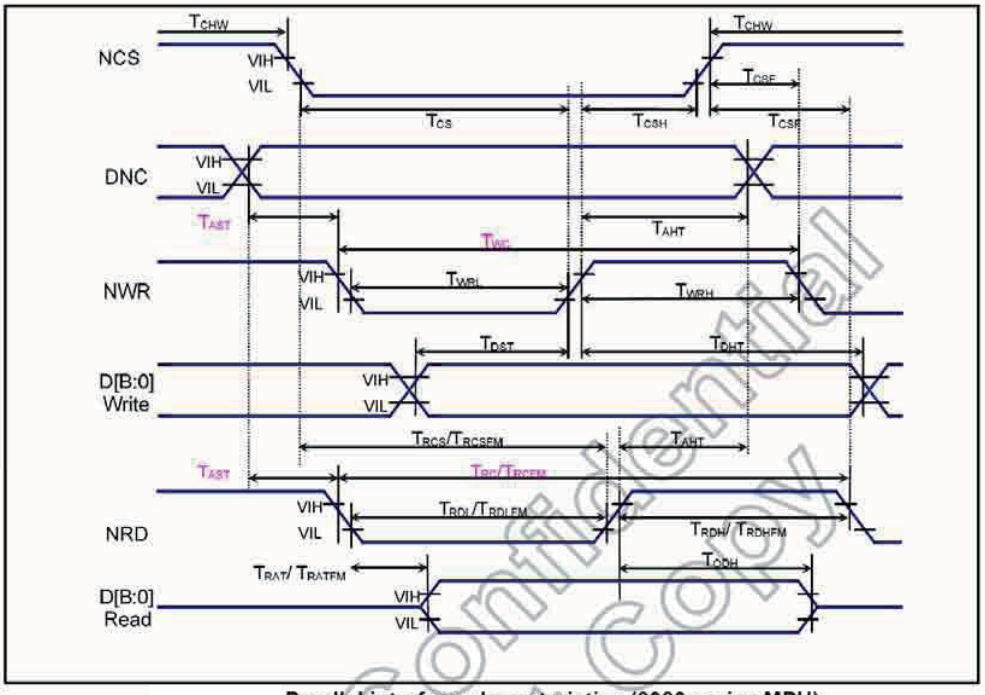
(Hex)	Operation Code	W/R	Upper Code	Lower Code								Comment
			D[17:8]	D7	D6	D5	D4	D3	D2	D1	D0	
E9	Source OP control_IDLE	W/R	-	OPON_I[7:0]								-
EA	Power control internal use (1)	W/R	-	STBA[15:8]								-
EB	Power control internal use (2)	W/R	-	STBA[7:0]								-
EC	Source control internal use (1)	W/R	-	PTBA[15:8]								-
ED	Source control internal use (2)	W/R	-	PTBA[7:0]								-
FF	Page select	W/R	-	-	-	-	-	-	-	PAGE_SEL[1:0] (00)		-

List table of command set page 0

(Hex)	Operation Code	W/R	Upper Code	Lower Code								Comment
			D[17:8]	D7	D6	D5	D4	D3	D2	D1	D0	
C3	CABC Control 5	W/R	-	0	PWMDIV[2:0](000)			1	1	INPLUS (1)	1	-
C5	CABC Control 6	W/R	-	PWM_PERIOD[7:0] (43d)								-
C7	CABC Control 7	W/R	-	-	DIM_FRAME[6:0] (20)							-
C8	Gain select register 0	W/R	-	-	DBG0[6:0](40)							-
CC	Gain select register 1	W/R	-	-	DBG1[6:0](3C)							-
CD	Gain select register 2	W/R	-	-	DBG2[6:0](38)							-
CE	Gain select register 3	W/R	-	-	DBG3[6:0](34)							-
CF	Gain select register 4	W/R	-	-	DBG4[6:0](33)							-
D0	Gain select register 5	W/R	-	-	DBG5[6:0](32)							-
D1	Gain select register 6	W/R	-	-	DBG6[6:0](2B)							-
D2	Gain select register 7	W/R	-	-	DBG7[6:0](24)							-
D3	Gain select register 8	W/R	-	-	DBG8[6:0](22)							-
FF	Page select	W/R	-	-	-	-	-	-	-	PAGE_SEL[1:0] (00)		-

List table of command set page 1

10. AC Characteristics



Parallel interface characteristics (8080-series MPU)

(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.3V to 3.3V, T_A = -30 to 70° C)

Signal	Symbol	Parameter	Min.	Max.	Unit	Description
DNC_SCL	tAST	Address setup time	0	-	ns	-
	tAHT	Address hold time (Write/Read)	10	-		
NCS	tCHW	Chip select "H" pulse width	0	-	ns	-
	tCS	Chip select setup time (Write)	15	-		
	tRCS	Chip select setup time (Read ID)	45	-		
	tRCSFM	Chip select setup time (Read FM)	355	-		
	tCSF	Chip select wait time (Write/Read)	10	-		
	tCSH	Chip select hold time	10	-		
NWR_SCL	tWC	Write cycle	66	-	ns	-
	tWRH	Control pulse "H" duration	15	-		
	tWRL	Control pulse "L" duration	15	-		
NRD(ID)	tRC	Read cycle (ID)	160	-	ns	When read ID data
	tRDH	Control pulse "H" duration (ID)	90	-		
	tRDL	Control pulse "L" duration (ID)	45	-		
NRD(FM)	tRCFM	Read cycle (FM)	450	-	ns	When read from frame memory
	tRDHFM	Control pulse "H" duration (FM)	90	-		
	tRDLFM	Control pulse "L" duration (FM)	355	-		
DB17 to DB0	tDST	Data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	tDHT	Data hold time	10	-		
	tRAT	Read access time (ID)	-	40		
	tRATFM	Read access time (FM)	-	340		
	tODH	Output disable time	20	80		

Note: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.
Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

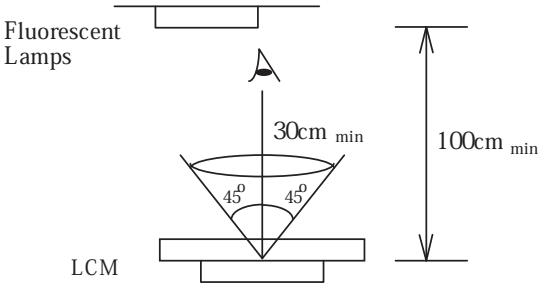
11.Quality Specifications

All The raw material are Rohs complicant.

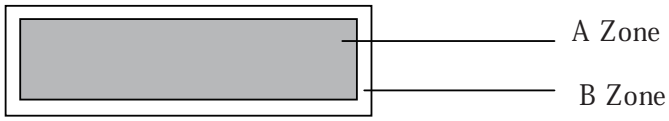
11.1 Standard of the product appearance test

Manner of appearance test: The inspection should be performed in using 20W x 2 fluorescent lamps. Distance between LCM and fluorescent lamps should be 100 cm or more. Distance between LCM and inspector eyes should be 30 cm or more.

Viewing direction for inspection is 45° from vertical against LCM.



Definition of zone:



A Zone: viewing area
B Zone: outside viewing area

11.2 Specification of quality assurance

AQL inspection standard

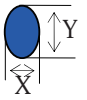
Sampling method: MIL-STD-105E, Level II, single sampling

Defect classification (Note: * is not including)

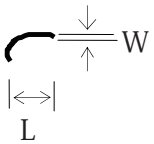
Classify	Item		Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)	2	
		Back-light	1,8	
	Non-display	Flat cable or pin reverse	10	
		Wrong or missing component	11	
Minor	Display state	Background color deviation	2	1.0
		Black spot and dust	3	
		Line defect, Scratch	4	
		Rainbow	5	
		Chip	6	
		Pin hole	7	
	Polarizer	Protruded	12	
		Bubble and foreign material	3	
	Soldering	Poor connection	9	
	Wire	Poor connection	10	
	TAB	Position, Bonding strength	13	

Note on defect classification

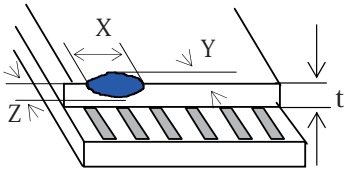
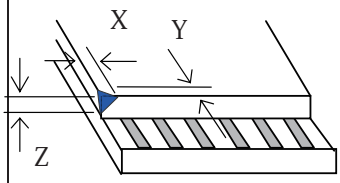
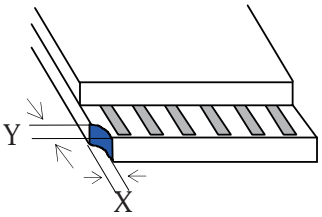
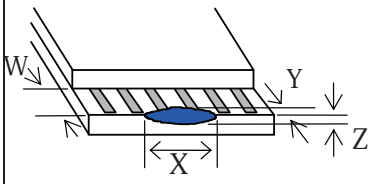
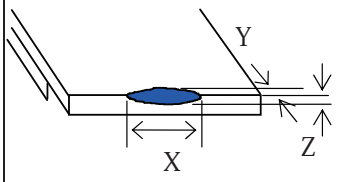
<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th></tr>
<tr><td rowspan="6">1</td><td>Short or open circuit</td><td rowspan="6">Not allow</td></tr>
<tr><td>LC leakage</td></tr>
<tr><td>Flickering</td></tr>
<tr><td>No display</td></tr>
<tr><td>Wrong viewing direction</td></tr>
<tr><td>Wrong Back-light</td></tr>
<tr><td rowspan="2">2</td><td>Contrast defect</td><td rowspan="2">Refer to approval sample</td></tr>
<tr><td>Background color deviation</td></tr>
<tr><td>3</td><td>Point defect,
Black spot, dust
(including Polarizer)

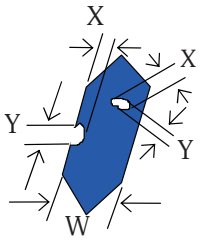
$\phi = (X+Y)/2$</td><td> 

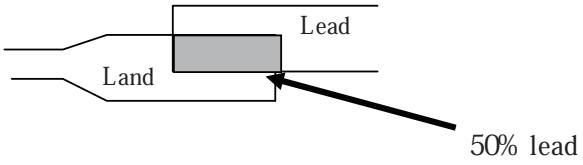
<table>
<tr><th>Point
Size</th><th>Acceptable Qty.</th></tr>
<tr><td>$\phi \leq 0.10$</td><td>Disregard</td></tr>
<tr><td>$0.10 < \phi \leq 0.20$</td><td>3</td></tr>
<tr><td>$0.20 < \phi \leq 0.25$</td><td>2</td></tr>
<tr><td>$0.25 < \phi \leq 0.30$</td><td>1</td></tr>
<tr><td>$\phi > 0.30$</td><td>0</td></tr>
</table>
Unit：mm</td></tr>
<tr><td>4</td><td>Line defect,

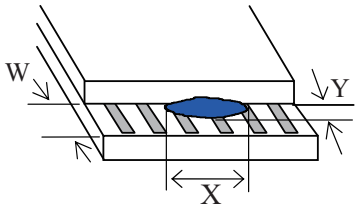
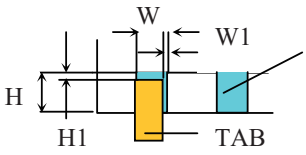
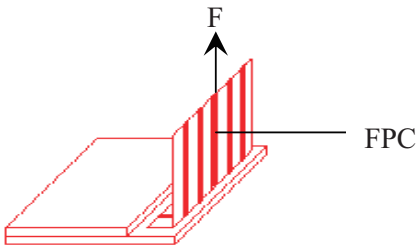
Scratch</td><td> 

<table>
<tr><th colspan="2">Line</th><th>Acceptable Qty.</th></tr>
<tr><td>L</td><td>W</td><td></td></tr>
<tr><td>---</td><td>$0.015 \geq W$</td><td>Disregard</td></tr>
<tr><td>$3.0 \geq L$</td><td>$0.03 \geq W$</td><td rowspan="2">2</td></tr>
<tr><td>$2.0 \geq L$</td><td>$0.05 \geq W$</td></tr>
<tr><td>$1.0 \geq L$</td><td>$0.1 > W$</td><td>1</td></tr>
<tr><td>---</td><td>$0.05 < W$</td><td>Applied as point defect</td></tr>
</table>
Unit: mm</td></tr>
<tr><td>5</td><td>Rainbow</td><td>Not more than two color changes across the viewing area.</td></tr>
</table>

No	Item	Criterion
6	Chip Remark: X: Length direction Y: Short direction Z: Thickness direction t: Glass thickness W: Terminal Width	 Acceptable criterion X: ≤2 mm; Y: 0.5 mm; Z: ≤t/2  Acceptable criterion X: ≤2 mm; Y: 0.5 mm; Z: ≤t  Acceptable criterion X: ≤3 mm; Y: ≤2 mm; Z: ≤t shall not reach to ITO  Acceptable criterion X: Disregard; Y: ≤0.2 mm; Z: ≤t  Acceptable criterion X: ≤5 mm; Y: ≤2 mm; Z: ≤t/3

<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th></tr>
<tr><td>7</td><td>Segment
pattern
W = Segment width
ϕ = (X+Y)/2</td><td>(1) Pin hole
⊠ < 0.10mm is acceptable.
 

<table>
<tr><th>Point Size</th><th>Acceptable Qty</th></tr>
<tr><td>ϕ ≤1/4W</td><td>Disregard</td></tr>
<tr><td>1/4W<ϕ≤1/2W</td><td>1</td></tr>
<tr><td>ϕ>1/2W</td><td>0</td></tr>
</table>
Unit: mm</td></tr>
<tr><td>8</td><td>Back-light</td><td>(1) The color of backlight should correspond its specification.
(2) Not allow flickering</td></tr>
<tr><td>9</td><td>Soldering</td><td>(1) Not allow heavy dirty and solder ball on PCB.
(The size of dirty refer to point and dust defect)
(2) Over 50% of lead should be soldered on Land.
 
</td></tr>
<tr><td>10</td><td>Wire</td><td>(1) Copper wire should not be rusted
(2) Not allow crack on copper wire connection.
(3) Not allow reversing the position of the flat cable.
(4) Not allow exposed copper wire inside the flat cable.</td></tr>
<tr><td>11*</td><td>PCB</td><td>(1) Not allow screw rust or damage.
(2) Not allow missing or wrong putting of component.</td></tr>
</table>

No	Item	Criterion
12	Protruded W: Terminal Width	 Acceptable criteria: Y ≤ 0.4
13	TAB	1. Position  W1≤1/3W H1≤1/3H 2 FPC bonding strength test  P (=F/FPC bonding width) ≥650gf/cm ,(speed rate: 1mm/min) 5pcs per SOA (shipment)
14	Total no. of acceptable Defect	A. Zone Maximum 2 minor non-conformities per one unit. Defect distance: each point to be separated over 10mm B. Zone It is acceptable when it is no trouble for quality and assembly in customer's end product.

11.3 Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	48	No abnormalities in functions and appearance
High temp. Operating	70°C	48	
Low temp. Storage	-30°C	48	
Low temp. Operating	-20°C	48	
Humidity	60°C/ 90%RH	48	
Temp. Cycle	-30°C ← 25°C →80°C (60 min ← 5 min → 60min)	10cycles	

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (20±8°C), normal humidity (below 65% RH), and in the area not exposed to direct sun light.

11.4 Precaution for using LCD/LCM

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isoproply alcohol, ethyl alcohol or trichlorotriflorothane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not made any modification on the PCB without consulting ORIENT DISPLAY.
5. When mounting a LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: 280°C$\pm$10°C
4. Soldering time: 3 to 4 second.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

1. The viewing angle can be adjusted by varying the LCD driving voltage Vo.
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.
6. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7. For long-term storage over 40°C is required, the relative humidity should be kept below 60%, and avoid direct sunlight.

Limited Warranty

ORIENT DISPLAY LCDs and modules are not consumer products, but may be incorporated by OD's customers into consumer products or components thereof, OD does not warrant that its LCDs and components are fit for any such particular purpose.

1. The liability of OD is limited to repair or replacement on the terms set forth below. OD will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between OD and the customer, OD will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with OD general LCD inspection standard. (Copies available on request)
2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.
3. In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the failures or defect.