ORIENT DISPLAY

Your Total LCD Solution Provider

http://www.orientdisplay.com

SPECIFICATION
FOR
LCD MODULE

MODULE NO: AFS240320TG-2.0-Y100001
REVISION NO: 01

Customer's Approval:

	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)	Fr. Li	2011-11-02
CHECKED BY	Sean	2011-11-02
APPROVED BY	Rio	2011-11-02

Orient Display (N.A.) Ltd.
145 Royal Crest Court Unit 42, Markham, ON, Canada L3R 9Z4
Tel: 905-477-1166 Fax: 905-477-1782

Orient Display (USA) Corp.
1315 NW Mall St. Suite 5, Issaquah, WA, USA 98027
Tel: 425-392-6880 Fax: 425-557-6560

DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
00	Nov-16-2010	First Issue	Fr.li
01	Nov-02-2011	Changed “Pin Description”	Fr.li

CONTENTS

1. Features & Mechanical Specifications

Item	Contents	Unit
	LCD	
LCD Type	TFT /Transmissive /Normally White	--
Viewing direction	12:00	--
Backlight	White LED x 3in Parallel	--
Interface	8080-8/16(default)bit parallel bus interface	--
Driver IC	HX8347D	--
Outline Dimension	36.8(W) × 51.9(H) × 2.4(T)	mm
Glass area (W×H×T)	34.0 × 44.55 /48.38 × 0.5	mm
Active area (W×H)	30.6 × 40.8	mm
Number of Dots	240(RGB) × 320	--
Dot pitch (W×H)	0.0425 × 0.1275	mm
Pixel pitch (W×H)	0.1275 ×0.1275	mm
Operating Temperature	-20 ～ +70	℃
Storage temperature	-30 ～ +80	℃

2. Dimensional Outline

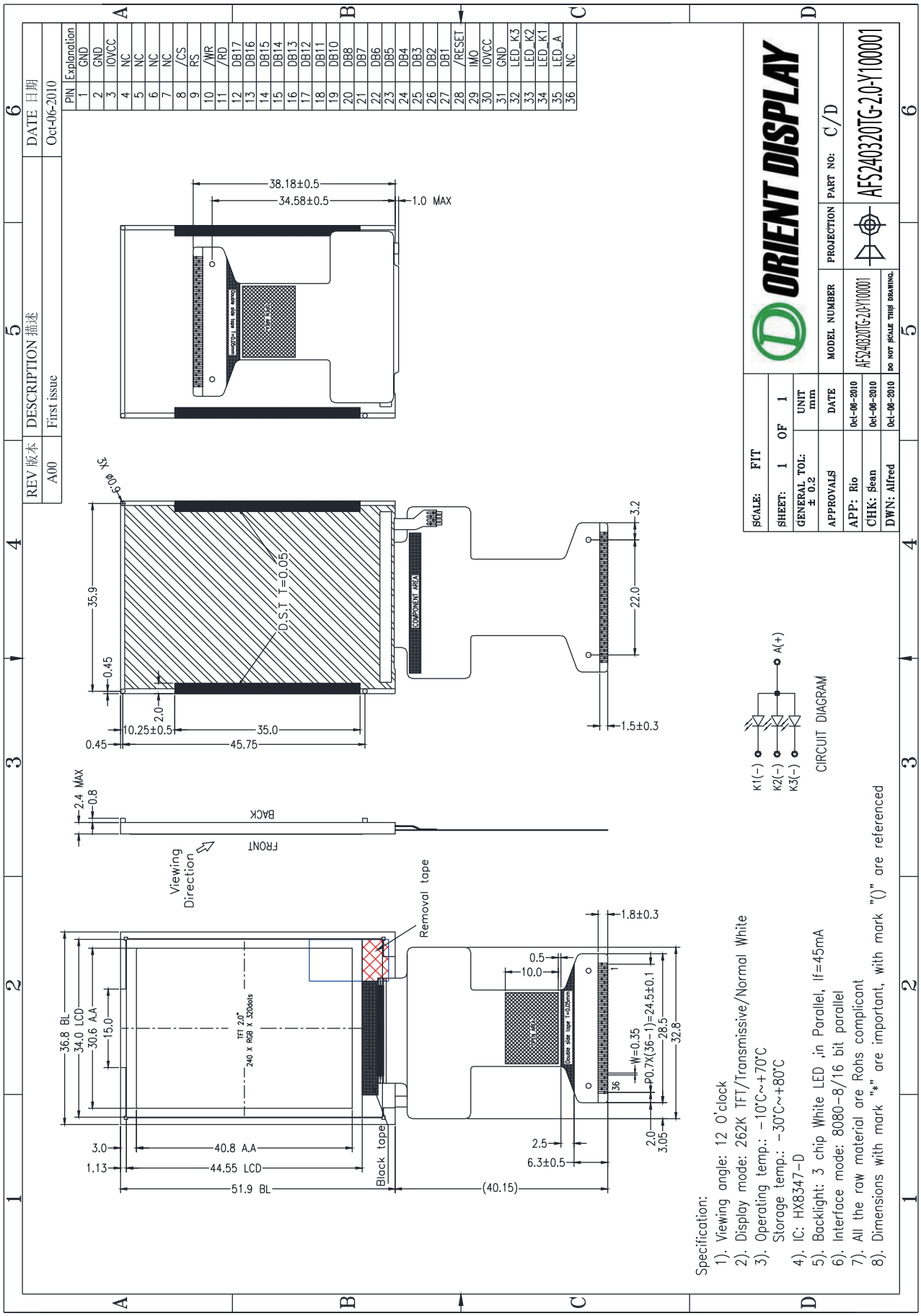


Figure 1. Dimensional outline

3. Block Diagram

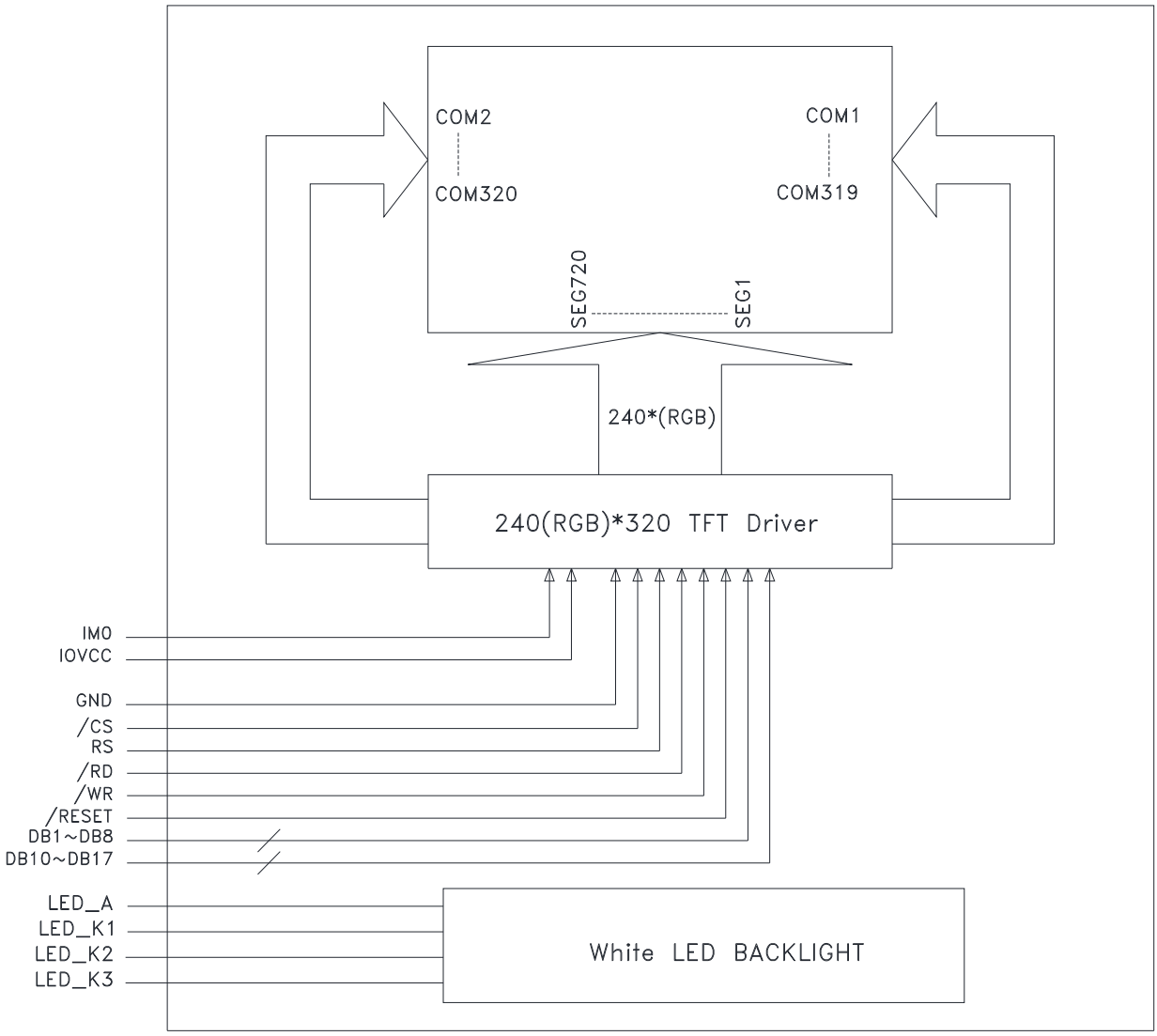


Figure 2. Block diagram

4. Pin Description

PIN No.	SYMBOL	Function
1,2	GND	Ground
3	IOVCC	Power Supplay
4~7	NC	No Connection
8	/CS	Chip Select Signal ("Low" enable)
9	RS	Command / parameter or display data selection pin. Low : Command High : Parameter or display data
10	/WR	Write signal.
11	/RD	Read signal.
12~19	DB17~DB10	Data Bus
20~27	DB8~DB1	Data Bus
28	/RESET	Reset pin. (Active Low)
29	IM0	MPU system interface mode. Please See **"Interface Note"**
30	IOVCC	Power Supplay
31	GND	Ground
32	LED_K1	Backlight LED1 Cathode
33	LED_K2	Backlight LED2 Cathode
34	LED_K3	Backlight LED3 Cathode
35	LED_A	Backlight LED Anode
36	NC	No Connection

Interface Note:

IM0	Interface Mode
1	8080-8bit interface: DB17~DB10
0	8080-16bit interface: DB17～DB10, DB8～DB1

1. Unused pins should connect to GND.

5. Absolute Maximum Ratings

Item	Symbol	Rating	Unit
I/O 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
I/O supply voltage	IOVCC	2.3	2.8	3.3	V

7. Backlight Characteristics

White LED × 3 in parallel **(Ta = 25°C)**

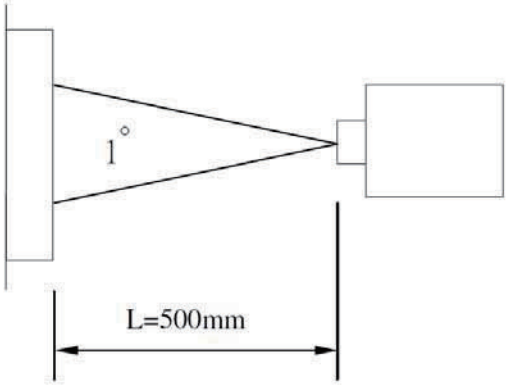
Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	IF=45mA	-	3.2	-	V
Uniformity	△Bp	-	80	-	-	%
Luminance for LCD	Lv	IF=45mA	3400	-	-	cd/m^2

8. Electro-Optical Characteristics

(Note1 , Note2)
(Using CPT LC+ EWV Polarizer+Corresponding Backlight, reference only)

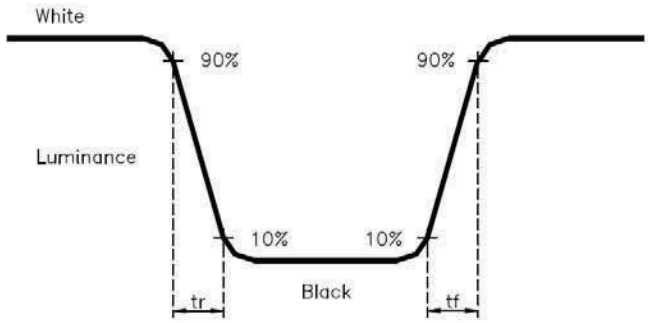
ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Transmittance		T		5.1	5.7		%	
Contrast Ratio		CR	*1)	300	450	--	--	Note 3
Response Time		Tr+ Tf	*3)	- -	25	35	ms	Note 4
Viewing Angle	Vertical	θ *2)	CR≧10	--	55	--		
				--	65	--		Note 5
	Horizontal	ϕ *2)		--	65	--		
				--	65	--		
Color Filter Chromacicity	White	x	$\theta=\phi=0^\circ$	(0.290)	(0.310)	(0.330)		Note 6
		y		(0.325)	(0.345)	(0.365)		
		Y		(29.0)	(32.0)	(35.0)		
	Red	x	$\theta=\phi=0^\circ$	(0.635)	(0.655)	(0.675)		
		y		(0.312)	(0.332)	(0.352)		
		Y		(15.2)	(18.2)	(21.2)		
	Green	x	$\theta=\phi=0^\circ$	(0.301)	(0.321)	(0.341)		
		y		(0.550)	(0.570)	(0.590)		
		Y		(58.1)	(62.1)	(66.1)		
	Blue	x	$\theta=\phi=0^\circ$	(0.114)	(0.134)	(0.154)		
		y		(0.117)	(0.137)	(0.157)		
		Y		(12.6)	(15.6)	(18.6)		
	NTSC			(50%)	(56%)	-		

Note 1.Ambient condition：25℃±2℃，60±10%RH，under 10 Lunx in the darkroom。
Note 2.Measure device：BM-5A (TOPCON)，viewing cone=1°，I_L=20mA。

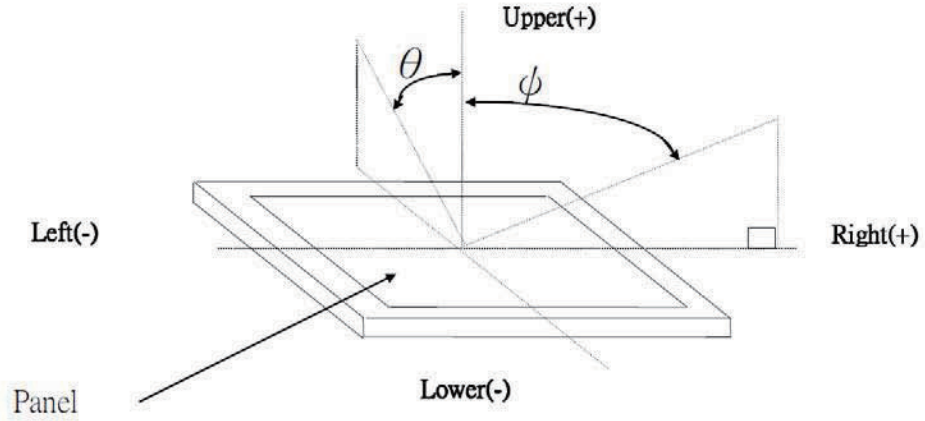


Note 3. Definition of Contrast Ratio：
CR = White Luminance (ON) / Black Luminance (OFF)

Note 4. Definition of response time : The response time is defined as the time interval between the 10% and 90% amplitudes.



Note 5. Definition of view angle(θ , ψ) :



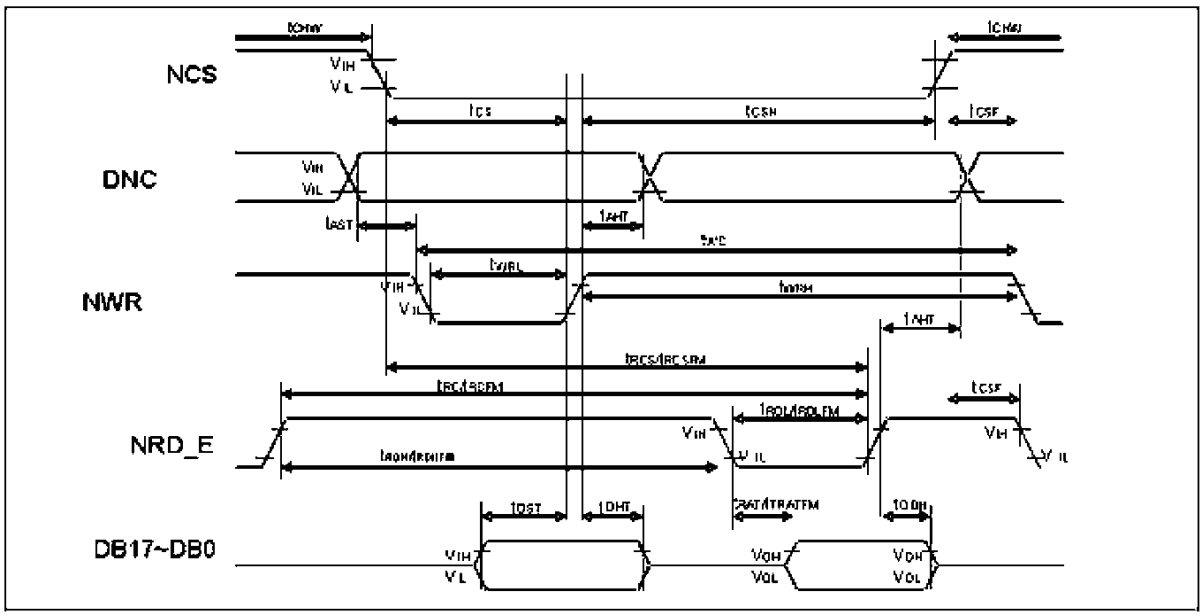
Note 6. Light source: C light.

9. Instruction Description

Register No.	Register	W/R	Upper Code	Lower Code								Comment
			D[17:8]	D7	D6	D5	D4	D3	D2	D1	D0	
R00h	Himax ID	R	-	0	1	0	0	0	1	1	1	
R01h	Display Mode control	W/R	-	DP_STB(0)	DP_STB_S(0)	-	-	SCROL(0)	IDMON(0)	INVON(0)	PTLON(0)	
R02h	Column address start 2	W/R	-	SC[15:8] (8'b0000_0000)								
R03h	Column address start 1	W/R	-	SC[7:0] (8'b0000_0000)								
R04h	Column address end 2	W/R	-	EC[15:8] (8'b0000_0000)								
R05h	Column address end 1	W/R	-	EC[7:0] (8'b1110_1111)								
R06h	Row address start 2	W/R	-	SP[15:8] (8'b0000_0000)								
R07h	Row address start 1	W/R	-	SP[7:0] (8'b0000_00000)								
R08h	Row address end 2	W/R	-	EP[15:8] (8'b0000_0001)								
R09h	Row address end 1	W/R	-	EP[7:0] (8'b0011_1111)								
R0Ah	Partial area start row 2	W/R	-	PSL[15:8] (8'b0000_0000)								
R0Bh	Partial area start row 1	W/R	-	PSL[7:0] (8'b0000_00000)								
R0Ch	Partial area end row 2	W/R	-	PEL[15:8] (8'b0000_0001)								
R0Dh	Partial area end row 1	W/R	-	PEL[7:0] (8'b0011_1111)								
R0Eh	Vertical Scroll Top fixed area 2	W/R	-	TFA[15:8] (8'b0000_0000)								
R0Fh	Vertical Scroll Top fixed area 1	W/R	-	TFA[7:0] (8'b0000_0000)								
R10h	Vertical Scroll height area 2	W/R	-	VSA[15:8] (8'b0000_0001)								
R11h	Vertical Scroll height area 1	W/R	-	VSA[7:0] (8'b0100_0000)								
R12h	Vertical Scroll Button area 2	W/R	-	BFA[15:8] (8'b0000_0000)								
R13h	Vertical Scroll Button area 1	W/R	-	BFA [7:0] (8'b0000_0000)								
R14h	Vertical Scroll Start address 2	W/R	-	VSP [15:8] (8'b0000_0000)								
R15h	Vertical Scroll Start address 1	W/R	-	VSP [7:0] (8'b0000_0000)								
R16h	Memory Access control	W/R	-	MY(0)	MX(0)	MV(0)	-	BGR(0)	-	-	-	
R17h	COLMOD	W/R	-	CSEL[3:0] (4b'0110)				-	IFPF[2:0] (3b'110)			
R18h	OSC Control 2	W/R	-	I/PI_RADJ1[3:0] (3b'0011)				N/P_RADJ0[3:0](4b'0100)				*
R19h	OSC Control 1	W/R	-	-	-	-	-	-	-	-	OSC_EN(0)	
R1Ah	Power Control 1	W/R	-	-	-	-	-	-	BT[2:0] (001)			
R1Bh	Power Control 2	W/R	-	-	-	VRH[5:0] (01_1011)_4.8V						
R1Ch	Power Control 3	W/R	-	-	-	-	-	-	AP[2:0] (011)			
R1Dh	Power Control 4	W/R	-	-	I/PI_FS0[2:0](100)			-	N/P_FS0[2:0])(100)			
R1Eh	Power Control 5	W/R	-	-	I/PI_FS1[2:0])(100)			-	N/P_FS1[2:0])(100)			
R1Fh	Power Control 6	W/R	-	GASEN(1)	VCOMG(0)	-	PON(0)	DK(1)	XDK(0)	DDVDH_TRI(0)	STB(1)	
R22h	SRAM Write Control	W/R	SRAM Write									
R23h	VCOM Control 1	W/R	-	VMF[7:0](1000_0000)								
R24h	VCOM Control 2	W/R	-	VMH[7:0](0010_1111)								
R25h	VCOM Control 3	W/R	-	VML[7:0](0101_0111)								
R26h	Display Control 1	W/R	-	--	-	-	-	ISC[3:0](0011)				
R27h	Display Control 2	W/R	-	PT[1:0](10)		PTV[1:0](01)		-	-	PTG(1)	REF(1)	

Register No.	Register	W/R	Upper Code	Lower Code								Comment
			D[17:8]	D7	D6	D5	D4	D3	D2	D1	D0	
R28h	Display Control 3	W/R	-	-	-	GON(1)	DTE(0)	D[1:0] (00)		-	-	
R29h	Frame Rate control 1	W/R	-	I/PI_RTN[3:0](0010)				N/P_RTN[3:0](0010)				
R2Ah	Frame Rate Control 2	W/R	-	-	-	I/PI_DIV[1:0](00)		-	-	N/P_DIV[1:0](00)		
R2Bh	Frame Rate Control 3	W/R	-	N/P_DUM[7:0] (8b'0001_1100)								
R2Ch	Frame Rate Control 4	W/R	-	I/PI_DUM[7:0] (8b'0001_1100)								
R2Dh	Cycle Control 1	W/R	-	GDON[7:0] (8'b0000_1101)								
R2Eh	Cycle Control 2	W/R	-	GDOF[7:0] (8'b0111_0000)								
R2Fh	Display inversion	W/R	-	-	I/PI_NW[2:0](3b'001)			-	N/P_NW[2:0] (3b'001)			
R31h	RGB interface control 1	W/R	-	-	-	-	-	-	-	RCM[1:0](00)		
R32h	RGB interface control 2	W/R	-	-	-	-	-	DPL (0)	HSPL (0)	VSPL (0)	EPL (0)	
R33h	RGB interface control 3	W/R	-	HBP[7:0]								
R34h	RGB interface control 4	W/R	-	HBP[9:8]		VBP[5:0]						
R36h	Panel Characteristic	W/R	-	-	-	-	-	SS_Panel	GS_Panel	REV_Panel	BGR_Panel	
R38h	OTP Control 1	W/R	-	OTP_PTM[1:0]		OTP_VARDJ[1:0]		OTP_POR	OTP_OTPEN	OTP_PPROG	OTP_PWE	
R39h	OTP Control 2	W/R	-	-	-	-	-	-	OTP_YA2	OTP_YA1	OTP_YA0	
R3Ah	OTP Control 3	W/R	-	-	-	-	OTP_XA4	OTP_XA3	OTP_XA2	OTP_XA1	OTP_XA0	
R3Bh	OTP Control 4	R		OTP_READ[7:0]								
R3Ch	CABC Control 1	W/R	-	DBV[7:0](8'h00)								
R3Dh	CABC Control 2	W/R	-	-	-	BCTRL (0)	-	DD (0)	BL (0)	-	-	
R3Eh	CABC Control 3	W/R	-	-	-	-	-	-	-	C1 (0)	C0 (0)	
R3Fh	CABC Control 4	W/R	-	CMB[7:0](8'h00)								
R40h	r1 Control (1)	W/R	-	-	-	VRP0[5:0] (6'b00_0001)						
R41h	r1 Control (2)	W/R	-	-	-	VRP1[5:0] (6'b00_1110)						
R42h	r1 Control (3)	W/R	-	-	-	VRP2[5:0] (6'b01_0001)						
R43h	r1 Control (4)	W/R	-	-	-	VRP3[5:0] (6'b01_1010)						
R44h	r1 Control (5)	W/R	-	-	-	VRP4[5:0] (6'b01_1000)						
R45h	r1 Control (6)	W/R	-	-	-	VRP5[5:0] (6'b10_0100)						
R46h	r1 Control (7)	W/R	-	-	PRP0[6:0] (7'b001_0101)							
R47h	r1 Control (8)	W/R	-	-	PRP1[6:0] (7'b110_0101)							
R48h	r1 Control (9)	W/R	-	-	-	-	PKP0[4:0] (5'b0_1011)					
R49h	r1 Control (10)	W/R	-	-	-	-	PKP1[4:0] (5'b1_100)					
R4Ah	r1 Control (11)	W/R	-	-	-	-	PKP2[4:0] (5'b1_1001)					
R4Bh	r1 Control (12)	W/R	-	-	-	-	PKP3[4:0] (5'b1_1010)					
R4Ch	r1 Control (13)	W/R	-	-	-	-	PKP4[4:0] (5'b1_1000)					
R50h	r1 Control (18)	W/R	-	-	-	VRN0[5:0] (6'b01_1011)						
R51h	r1 Control (19)	W/R	-	-	-	VRN1[5:0] (6'b10_0111)						
R52h	r1 Control (20)	W/R	-	-	-	VRN2[5:0] (6'b10_0101)						
R53h	r1 Control (21)	W/R	-	-	-	VRN3[5:0] (6'b10_1110)						
R54h	r1 Control (22)	W/R	-	-	-	VRN4[5:0] (6'b11_0001)						
R55h	r1 Control (23)	W/R	-	-	-	VRN5[5:0] (6'b11_1110)						
R56h	r1 Control (24)	W/R	-	-	PRN0[6:0] (7'b001_1010)							
R57h	r1 Control (25)	W/R	-	-	PRN1[6:0] (7'b110_1010)							
R58h	r1 Control (26)	W/R	-	-	-	PKN0[4:0] (5'b0_0111)						
R59h	r1 Control (27)	W/R	-	-	-	PKN1[4:0] (5'b0_0101)						
R5Ah	r1 Control (28)	W/R	-	-	-	PKN2[4:0] (5'b0_0110)						
R5Bh	r1 Control (29)	W/R	-	-	-	PKN3[4:0] (5'b0_1011)						
R5Ch	r1 Control (30)	W/R	-	-	-	PKN4[4:0] (5'b1_0100)						
R5Dh	r1 Control (35)	W/R	-	CGMN1[1:0] (11)		CGMN0[1:0](00)		CGMP1[1:0](11)		CGMP0[1:0](00)		
R60h	TE Control	W/R	-	-	-		TE_mode (0)	TEOE (0)		-	-	

10. AC Characteristics



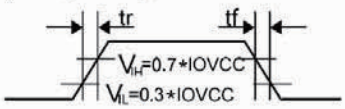
Parallel Interface Characteristics (8080-Series MPU)

(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3V, Ta = -30 to 70° C)

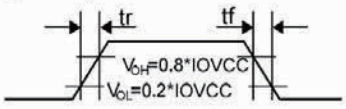
Signal	Symbol	Parameter	Min.	Max.	Unit	Description
DNC_SCL	t_{AST}	Address setup time	0	-	ns	-
	t_{AHT}	Address hold time (Write/Read)	10	-		
NCS	t_{CHW}	Chip select "H" pulse width	0	-	ns	-
	t_{CS}	Chip select setup time (Write)	15	-		
	t_{RCS}	Chip select setup time (Read ID)	45	-		
	t_{RCSFM}	Chip select setup time (Read FM)	355	-		
	t_{CSF}	Chip select wait time (Write/Read)	10	-		
	t_{CSH}	Chip select hold time	10	-		
NWR_SCL	t_{WC}	Write cycle	66	-	ns	-
	t_{WRH}	Control pulse "H" duration	15	-		
	t_{WRL}	Control pulse "L" duration	15	-		
NRD(ID)	t_{RC}	Read cycle (ID)	160	-	ns	When read ID data
	t_{RDH}	Control pulse "H" duration (ID)	90	-		
	t_{RDL}	Control pulse "L" duration (ID)	45	-		
NRD(FM)	t_{RCFM}	Read cycle (FM)	450	-	ns	When read from frame memory
	t_{RDHFM}	Control pulse "H" duration (FM)	90	-		
	t_{RDLFM}	Control pulse "L" duration (FM)	355	-		
DB17 to DB0	t_{DST}	Data setup time	10	-	ns	For maximum C_L=30pF For minimum C_L=8pF
	t_{DHT}	Data hold time	10	-		
	t_{RAT}	Read access time (ID)	-	40		
	t_{RATFM}	Read access time (FM)	-	340		
	t_{ODH}	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.

Input Signal Slope



Output Signal Slope



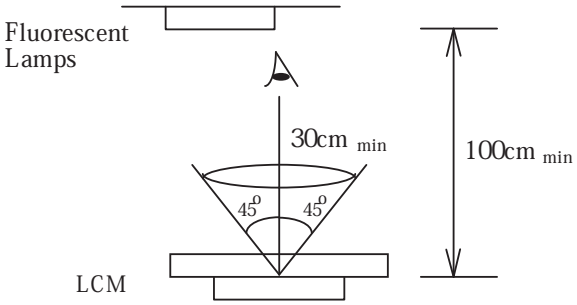
11.Quality Specifications

All The raw material are Rohs complicant.

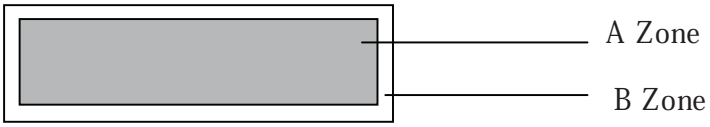
11.1 Standard of the product appearance test

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

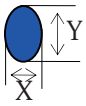
Sampling method: MIL-STD-105E, Level II, single sampling

Defect classification (Note: * is not including)

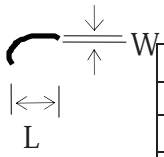
Classify	Item		Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)	2	
		Back-light	1,8	
	Non-display	Flat cable or pin reverse	10	
		Wrong or missing component	11	
Minor	Display state	Background 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

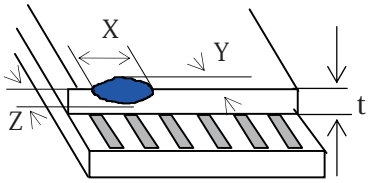
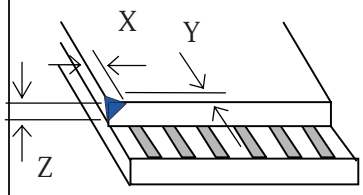
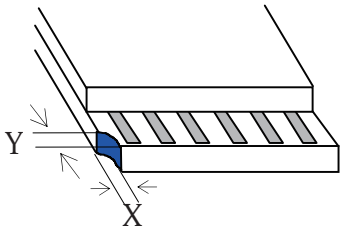
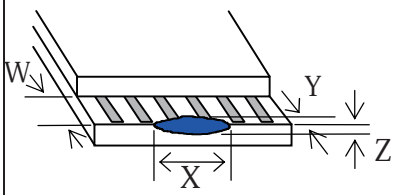
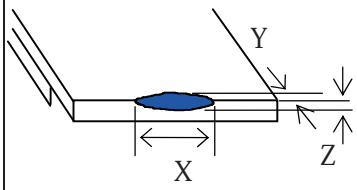
<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th></tr>
<tr><td rowspan="6">1</td><td>Short or open circuit</td><td rowspan="6">Not allow</td></tr>
<tr><td>LC leakage</td></tr>
<tr><td>Flickering</td></tr>
<tr><td>No display</td></tr>
<tr><td>Wrong viewing direction</td></tr>
<tr><td>Wrong Back-light</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)

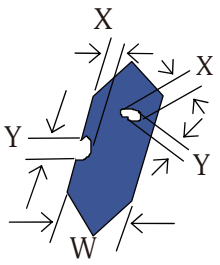
$\phi=(X+Y)/2$</td><td> 

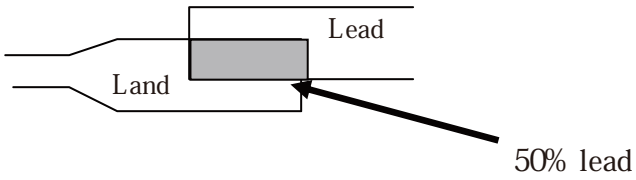
<table>
<tr><th>Point Size</th><th>Acceptable Qty.</th></tr>
<tr><td>$\phi\leq$ .10</td><td>Disregard</td></tr>
<tr><td>0.10<$\phi\leq$0.20</td><td>3</td></tr>
<tr><td>0.20<$\phi\leq$0.25</td><td>2</td></tr>
<tr><td>0.25<$\phi\leq$0.30</td><td>1</td></tr>
<tr><td>ϕ>0.30</td><td>0</td></tr>
</table>
Unit：mm</td></tr>
<tr><td>4</td><td>Line defect,

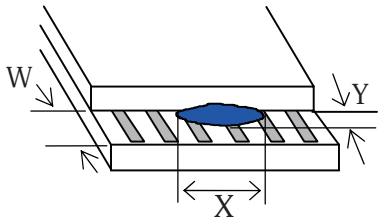
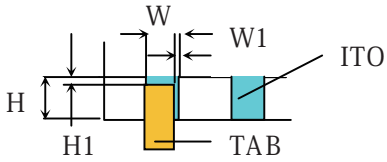
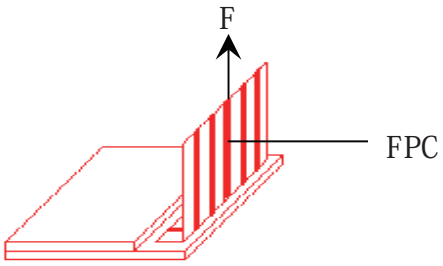
Scratch</td><td> 

<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>0.02≥W</td><td>Disregard</td></tr>
<tr><td>4.0≥L</td><td>0.03≥W>0.02</td><td rowspan="2">2</td></tr>
<tr><td>2.0≥L</td><td>0.05≥W>0.03</td></tr>
<tr><td>1.0≥L</td><td>0.1＞W>0.05</td><td>1</td></tr>
<tr><td>---</td><td>0.1<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; Y: 0.5mm; Z: ≤t/2  Acceptable criterion X: ≤2; Y: 0.5mm; Z: ≤t  Acceptable criterion X: ≤3; Y: ≤2; Z: ≤t shall not reach to ITO  Acceptable criterion X: Disregard; Y: ≤0.2; Z: ≤t  Acceptable criterion X: ≤5; Y: ≤2; 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
ϕ < 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	60°C	48	No abnormalities in functions and appearance
High temp. Operating	50°C	48	
Low temp. Storage	-20°C	48	
Low temp. Operating	-10°C	48	
Humidity	40°C/90%RH	48	
Temp. Cycle	-20°C ← 25°C → 60°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.