ALL SHORE INDUSTRIES

ASI-T-350EA8RCY6/A

Item	Specification	Unit
LCD Type	TFT / Transmissive / Normally white	/
Size	3.5	Inch
Viewing Direction	12:00 (without image inversion and least brightness change)	O'clock
Gray Scale Inversion Direction	6:00 (contrast peak located at)	O'clock
LCM (W × H × D)	76.90 × 63.90 × 5.10	mm^3
Active Area (W × H)	70.08 × 52.56	mm^2
Pixel Pitch	0.219 × 0.219	mm^2
Number of Dots	320 (RGB) × 240	/
Driver IC	HX8238D	/
Backlight Type	6LEDs	/
Interface Type	(1) 24-bit Parallel RGB	/
	(2) CCIR	
	(3) YUV	
Color Depth	16.7M	/
Pixel Configuration	R.G.B Vertical Stripe	/
Top Polarizer Surface Treatment	Anti-glare	/
Input Voltage	3.3	V
With / Without TSP	With CTP	/
TP Surface Treatment	Glare	/
Weight	TBD	g

ALL SHORE INDUSTRIES

■ REVISION RECORD

REV NO.	REV DATE	CONTENTS	REVISED PAGE NO.
1.0	2019-10-17	First Release	
1.1	2020-05-18	1. Modify the IC driver, From: FT5446DQS to FT5446-P03.	P.5
		2. Add firmware version in CTP notes.	P.5
		3. Spec. correction only, products have no changes.	P.5
		3.1. Add chamfering size of CTP.	P.5
		3.2. Add bending area of TFT FPC.	P.5
		3.3. Add double side EMI coating of CTP FPC.	P.5
1.2	2021-12-23	Spec. correction only, products have no changes.	
		1. Correct the temperature of operation and storage, From: -20℃~70℃ to -20℃~85℃ From: -30℃~80℃ to -30℃~85℃.	P.6, P.26
		2. Correct the surface luminance, From: 200cd/m^2 (min.), 255cd/m^2 (typ.), To: 680cd/m^2 (min.), 850cd/m^2 (typ.).	P.7
1.3	2021-12-30	1. Correct the dimension of LCM O.D, From: 80.80x80.80x6.20mm, To: 76.90x63.90x5.10mm. Spec. correction only, products have no changes.	P.4
		2. Add CIE (x, y) chromaticity of red, green and blue.	P.7

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- GENERAL INFORMATION
- EXTERNAL DIMENSIONS
- ABSOLUTE MAXIMUM RATINGS
- ELECTRICAL CHARACTERISTICS
- BACKLIGHT CHARACTERISTICS
- ELECTRO-OPTICAL CHARACTERISTICS
- INTERFACE DESCRIPTION
- APPLICATION NOTES
- CTP SPECIFICATIONS
- RELIABILITY TEST
- INSPECTION CRITERION
- PRECAUTIONS FOR USING LCD MODULES

■ GENERAL INFORMATION

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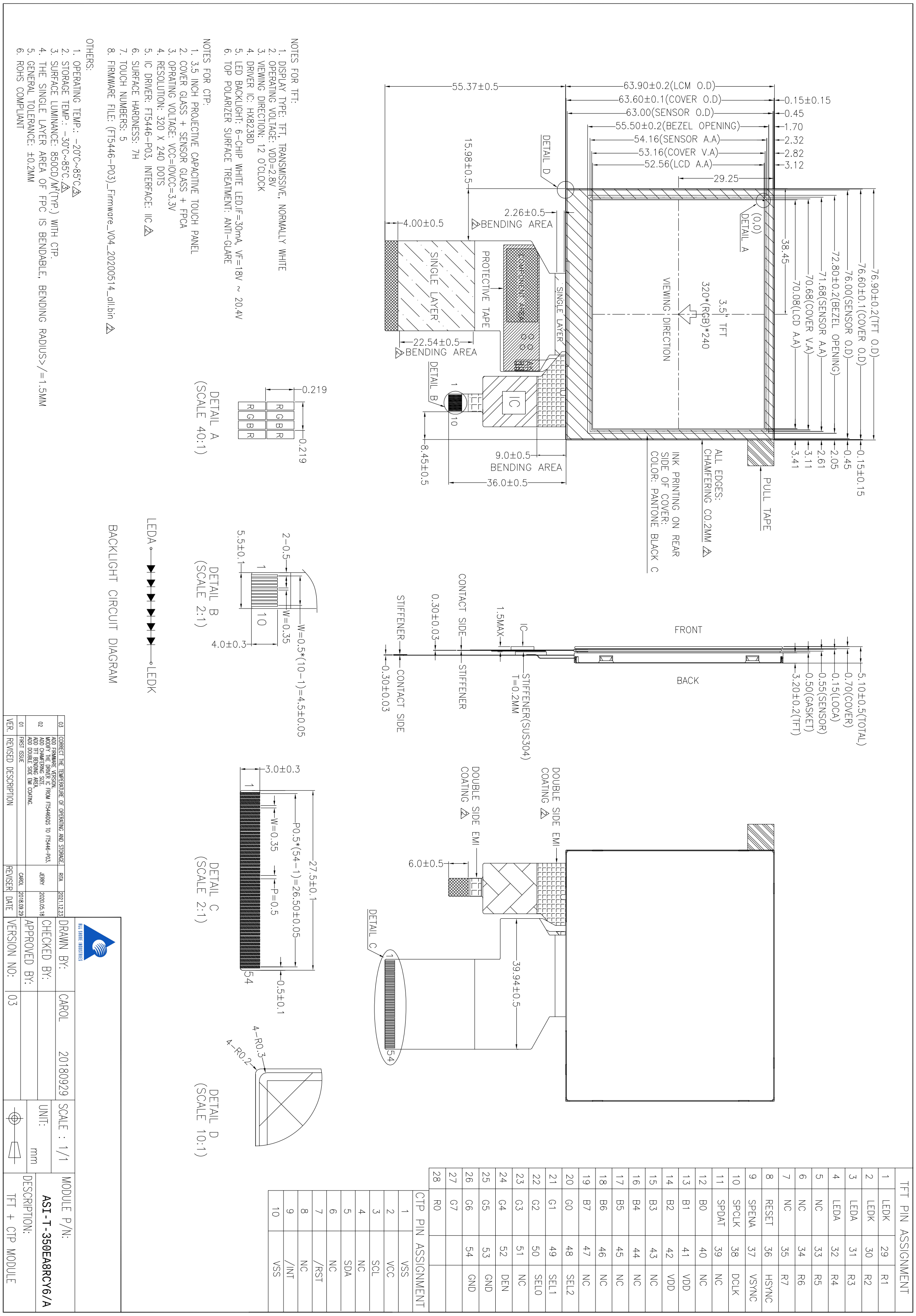
Backlight Type	6LEDs	/
Interface Type	(1) 24-bit Parallel RGB	/
	(2) CCIR	
	(3) YUV	
Color Depth	16.7M	/
Pixel Configuration	R.G.B Vertical Stripe	/
Top Polarizer Surface Treatment	Anti-glare	/
Input Voltage	3.3	V
With / Without TSP	With CTP	/
TP Surface Treatment	Glare	/
Weight	TBD	g

Note 1: ROHS compliant;
Note 2: LCM weight tolerance: ±5%.

■ EXTERNAL DIMENSIONS



TFT PIN ASSIGNMENT

1	LEDK	29	R1
2	LEDK	30	R2
3	LEDA	31	R3
4	LEDA	32	R4
5	NC	33	R5
6	NC	34	R6
7	NC	35	R7
8	RESET	36	HSYNC
9	SPENA	37	VSYNC
10	SPCLK	38	DCLK
11	SPDAT	39	NC
12	B0	40	NC
13	B1	41	VDD
14	B2	42	VDD
15	B3	43	NC
16	B4	44	NC
17	B5	45	NC
18	B6	46	NC
19	B7	47	NC
20	G0	48	SEL2
21	G1	49	SEL1
22	G2	50	SEL0
23	G3	51	NC
24	G4	52	DEN
25	G5	53	GND
26	G6	54	GND
27	G7		
28	R0		

CTP PIN ASSIGNMENT

1	VSS
2	VCC
3	SCL
4	NC
5	SDA
6	NC
7	/RST
8	NC
9	/INT
10	VSS

■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min.	Max.	Unit
Power Supply Voltage	VDD	-0.3	4.0	V
Logic Input Signal Voltage	VIN	-0.3	VDD+0.3	V
Operating Temperature	TOP	-20	85	℃
Storage Temperature	TST	-30	85	℃

■ ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Power Supply Voltage	VDD	3.0	3.3	3.6	V	
LCD Power Current	IDD	18	28	45	mA	
Input Voltage “H” Level	VIH	0.8VDD	-	VDD	V	
Input Voltage “L” Level	VIL	GND	-	0.2VDD	V	
Output Voltage “H” Level	VOH	0.8VDD	-	VDD	V	
Output Voltage “L” Level	VOL	GND	-	0.2VDD	V	

■ BACKLIGHT CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Forward Voltage	Vf	-	19.2	20.4	V	Ta=25±2℃, 60%RH±5%
Forward Current	If	-	30	-	mA	
Power Consumption	WBL	-	576	-	mW	
Operating Life Time	-	30000	50000	-	Hrs	

Note: Operating life time means brightness goes down to 50% initial brightness;
The life time of LED will be reduced if LED is driven by high current, high ambient temperature and humidity conditions;
Typical operating life time is an estimated data.

■ ELECTRO-OPTICAL CHARACTERISTICS

Ta=25°C±2°C. VDD=3.3V, If=30mA.

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	Notes
Response Time		Tr + Tf	θ=0°	-	50	80	ms	FIG 1, 2	4
Contrast Ratio		Cr		200	350	-	---	FIG 1, 3	1
Luminance Uniformity		δ White		75	80	-	%	FIG 1, 3	3
Surface Luminance		Lv		680	850	-	cd/m²	FIG 1, 3	2
Viewing Angle Range		θ	Ø = 90°	30	40	-	deg	FIG 1, 4	1, 6
			Ø = 270°	50	60	-	deg		
			Ø = 0°	50	60	-	deg		
			Ø = 180°	50	60	-	deg		
CIE (x, y) Chromaticity	Red	x	θ=0°	0.566	0.616	0.666	---	FIG 1, 3	5
		y		0.316	0.366	0.416			
	Green	x		0.305	0.355	0.405			
		y		0.544	0.594	0.644			
	Blue	x		0.093	0.143	0.193			
		y		0.063	0.113	0.163			
	White	x		0.285	0.335	0.385			
		y		0.326	0.376	0.426			
NTSC		-	-	-	50	-	%	-	-

Note 1. Contrast Ratio (CR) is defined by following formula. For more information see FIG 3.

$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Average Surface Luminance with all black pixels (P1, P2, P3, P4, P5)}}$$

Note 2. Surface luminance is the LCD surface luminance with all pixels displaying white state. For more information see FIG 3.

Lv = Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)

Note 3. The uniformity in surface luminance (δ White) is determined by measuring luminance at each test position 1 through 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance. For more information see FIG 3.

$$\delta \text{ White} = \frac{\text{Minimum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Maximum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}$$

Note 4. Response time is the time required for the display to transition from white to black (Rise Time, Tr) and from black to white (Fall Time, Tf). For additional information see FIG 2.

Note 5. CIE (x,y) chromaticity, color coordinates measured at center point of LCD.

Note 6. Viewing angle is the angle at which the contrast ratio is greater than a specific value. For TFT module, the specific value of contrast ratio is 10. For monochrome module, the specific value of contrast ratio is 2. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 4.

Note 7. For viewing angle and response time testing, the testing data is based on Autronic-Melchers's ConoScope. Series Instruments. For contrast ratio, Surface luminance, Luminance uniformity, and CIE, the test data is based on TOPCON's BM-5 photo detector.

FIG 1. The setup of optical measurement.
The optical characteristics should be measured in a stable, windless, and dark room.

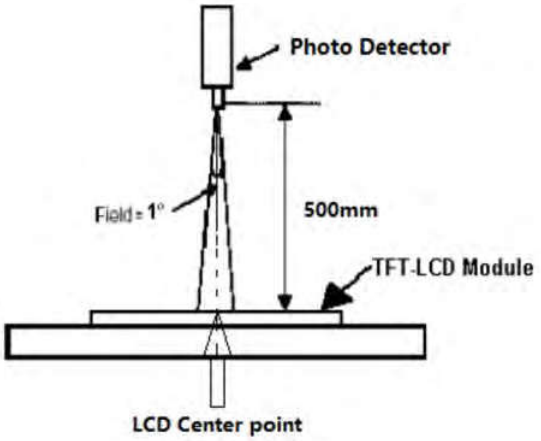


FIG 2. The Definition of Response Time

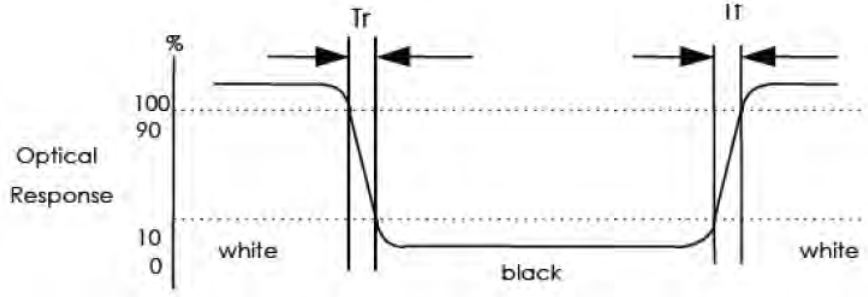
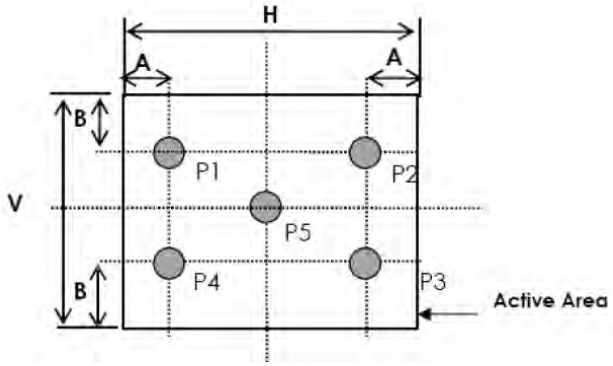
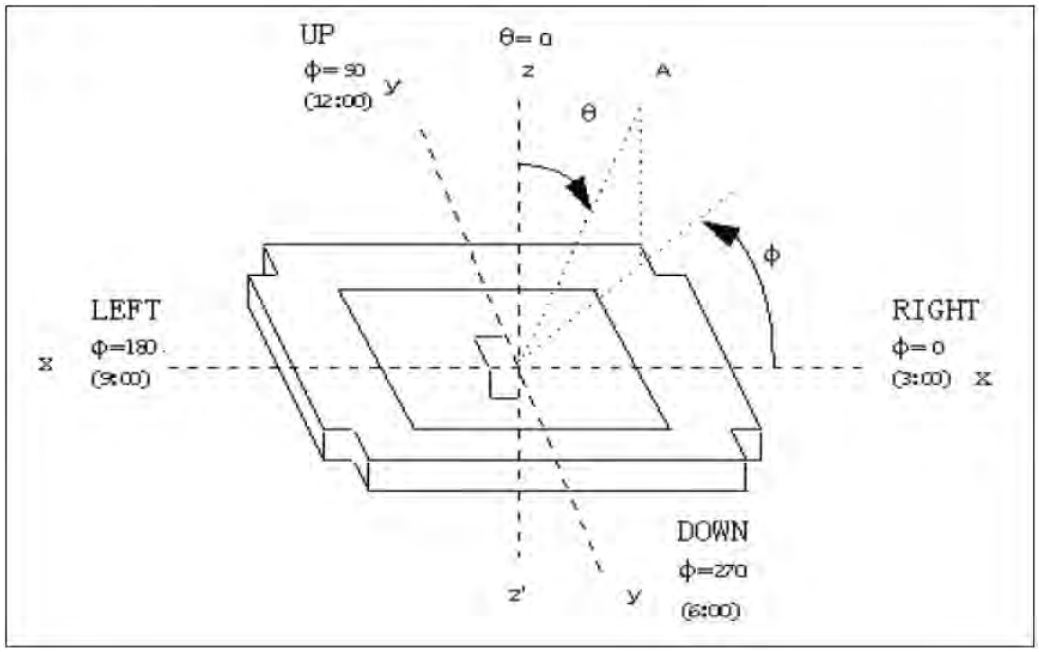


FIG 3. Measuring method for contrast ratio, surface luminance, Luminance uniformity, CIE (x,y) chromaticity.



A: H/6
B: V/6
H, V: Active Area
Light spot size Ø =7mm, 500mm distance from the LCD surface to detector lens.
Measurement instrument is TOPCON's luminance meter BM-5.

FIG 4. The definition of viewing angle



■ INTERFACE DESCRIPTION

Pin No.	Symbol	I/O/P	Description
1	LEDK	P	Cathode of LED backlight.
2	LEDK	P	Cathode of LED backlight.
3	LEDA	P	Anode of LED backlight.
4	LEDA	P	Anode of LED backlight.
5	NC	-	No connection.
6	NC	-	No connection.
7	NC	-	No connection.
8	RESET	I	Reset pin.
9	SPENA	I	SPI interface data enable signal.
10	SPCLK	I	SPI interface data clock.
11	SPDAT	I	SPI interface data.
12	B0	I	Blue data bit 0.
13	B1	I	Blue data bit 1.
14	B2	I	Blue data bit 2.
15	B3	I	Blue data bit 3.
16	B4	I	Blue data bit 4.
17	B5	I	Blue data bit 5.
18	B6	I	Blue data bit 6.
19	B7	I	Blue data bit 7.
20	G0	I	Green data bit 0.
21	G1	I	Green data bit 1.
22	G2	I	Green data bit 2.
23	G3	I	Green data bit 3.
24	G4	I	Green data bit 4.
25	G5	I	Green data bit 5.
26	G6	I	Green data bit 6.
27	G7	I	Green data bit 7.
28	R0	I	Red data bit 0.
29	R1	I	Red data bit 1.
30	R2	I	Red data bit 2.
31	R3	I	Red data bit 3.
32	R4	I	Red data bit 4.
33	R5	I	Red data bit 5.
34	R6	I	Red data bit 6.
35	R7	I	Red data bit 7.
36	HSYNC	I	Horizontal sync input.
37	VSYNC	I	Vertical sync input.
38	DCLK	I	Dot data clock.

39	NC	-	No connection.
40	NC	-	No connection.
41	VDD	P	Power supply voltage.
42	VDD	P	Power supply voltage.
43	NC	-	No connection.
44	NC	-	No connection.
45	NC	-	No connection.
46	NC	-	No connection.
47	NC	-	No connection.
48	SEL2	I	Control the input data format/floating.
49	SEL1	I	Control the input data format.
50	SEL0	I	Control the input data format.
51	NC	-	No connection.
52	DEN	I	Data enable input.
53	GND	P	Ground.
54	GND	P	Ground.

Note 1: The mode control (SEL2) not use, it can't control CCIR601 interface, if not use CCIR601, it can floating.

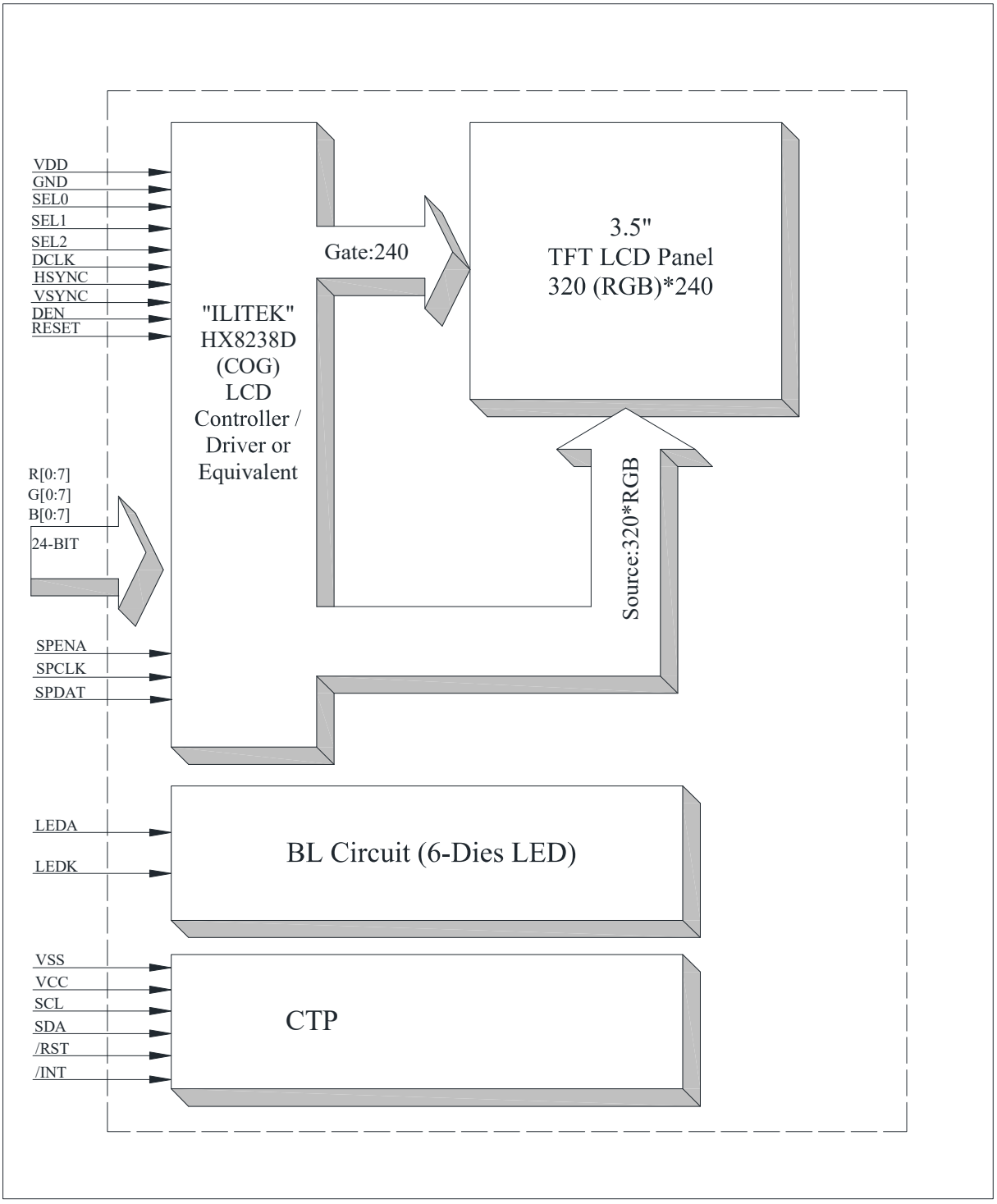
Note 2: For digital RGB input data format, both SYNC mode and DE+SYNC mode are supported. If DE signal is fixed low, SYNC mode is used. Otherwise, DE+SYNC mode is used. Suggest used SYNC mode. Suggest the DE signal usually pull low.

Note 3: If select serial RGB or CCIR601/656 input mode is selected, only DX0-DX7 used, and the other short to GND, only selected serial RGB, CCIR601/656 interface, DX BUS will enable, digital input mode DX0 is LSB and DX7 is MSB.

Note 4: Control the input data format:

SEL2	SEL1	SEL0	Interface Mode
0	0	0	Parallel-RGB data format interface (Only support stripe type color filter)
0	0	1	Serial-RGB data format
0	1	0	CCIR 656 data format (640RGB)
0	1	1	CCIR 656 data format (720RGB)
1	0	0	YUV mode A data format (Cr-Y-Cb-Y)
1	0	1	YUV mode A data format (Cr-Y-Cb-Y)
1	1	0	YUV mode B data format (Cb-Y-Cr-Y)
1	1	1	YUV mode B data format (Cb-Y-Cr-Y)

■ BLOCK DIAGRAM



■ APPLICATION NOTES

1. AC Characteristics

(Unless otherwise specified, Voltage Referenced to V_{SS}, V_{DDIO}=2.2V, Ta=25°C)

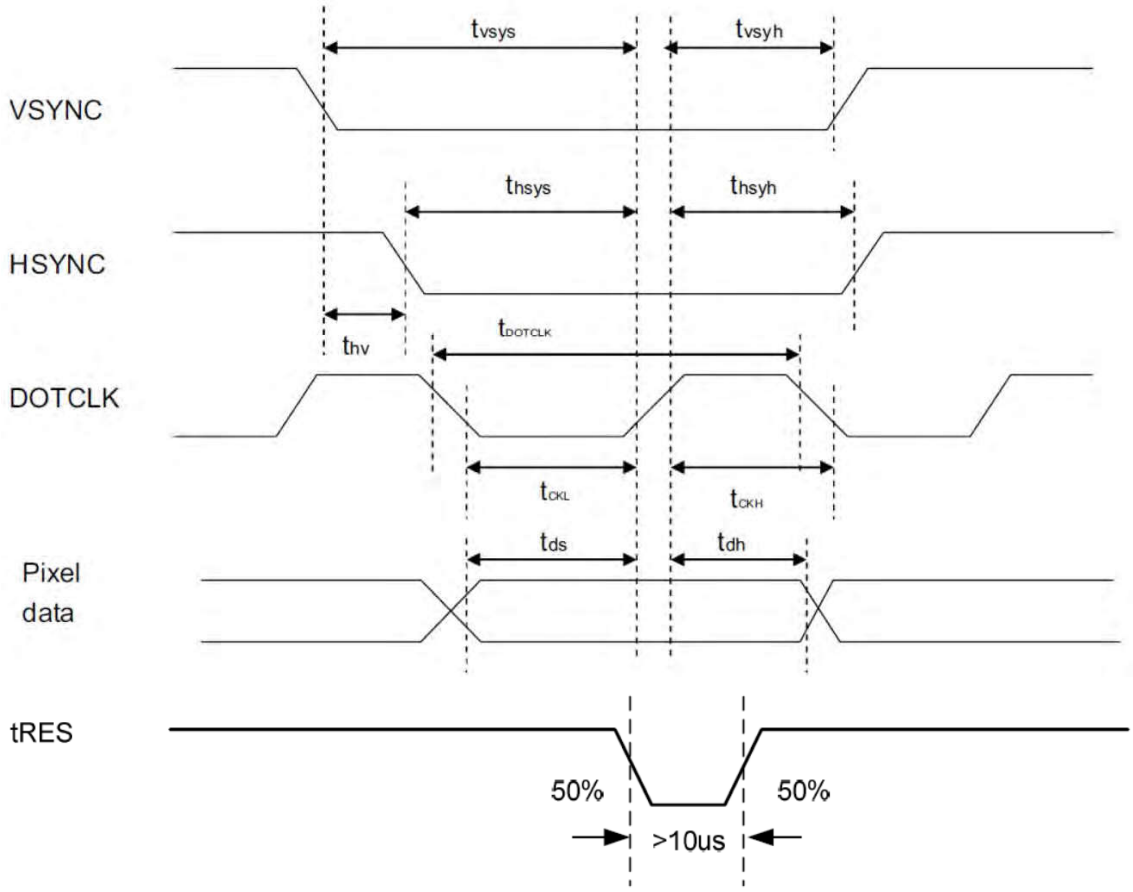
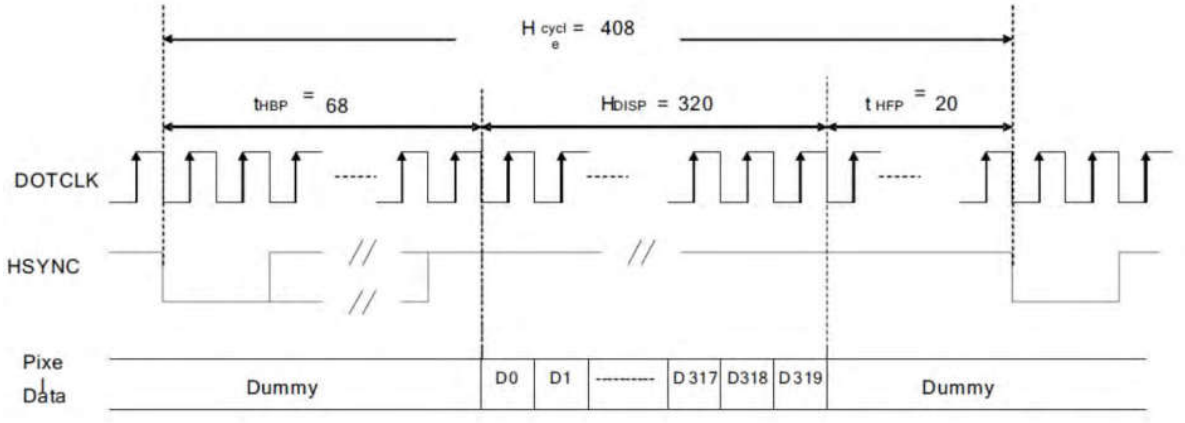


Figure 1. Pixel Timing

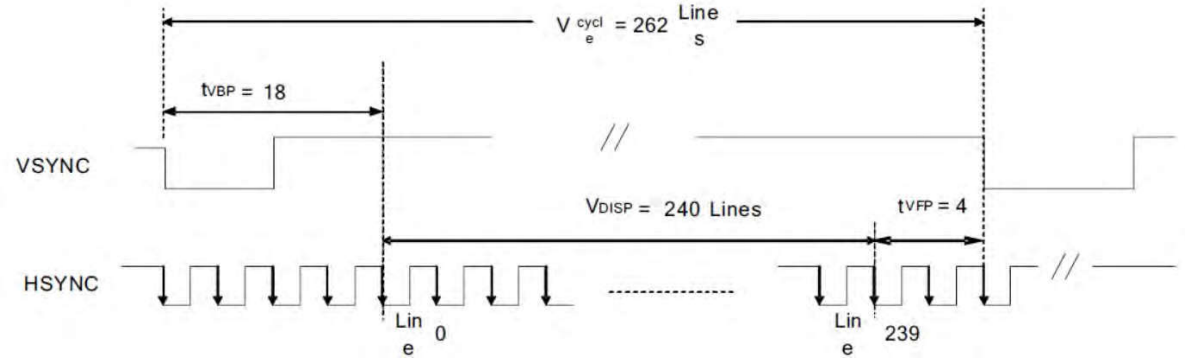
Characteristics	Symbol	Min.		Typ.		Max.		Unit
		24 bit	8 bit	24 bit	8 bit	24 bit	8 bit	
DOTCLK Frequency	fDOTCLK	-	-	6.5	19.5	10	30	MHz
DOTCLK Period	tDOTCLK	100	33.3	154	51.3	-	-	ns
Vertical Sync Setup Time	tvsys	20	10	-	-	-	-	ns
Vertical Sync Hold Time	tvsyh	20	10	-	-	-	-	ns
Horizontal Sync Setup Time	thsys	20	10	-	-	-	-	ns
Horizontal Sync Hold Time	thsyh	20	10	-	-	-	-	ns
Phase difference of Sync Signal Falling Edge	thv	1		-		240		tDOTCLK
DOTCLK Low Period	tCKL	50	15	-	-	-	-	ns
DOTCLK High Period	tCKH	50	15	-	-	-	-	ns
Data Setup Time	tds	12	10	-	-	-	-	ns
Data hold Time	tdh	12	10	-	-	-	-	ns
Reset pulse width	tRES	10		-		-		us

Note: External clock source must be provided to DOTCLK pin of HX8238-D. The driver will not operate if absent of the clocking signal.

Table 1. Pixel Timing



a) Horizontal Data Transaction Timing

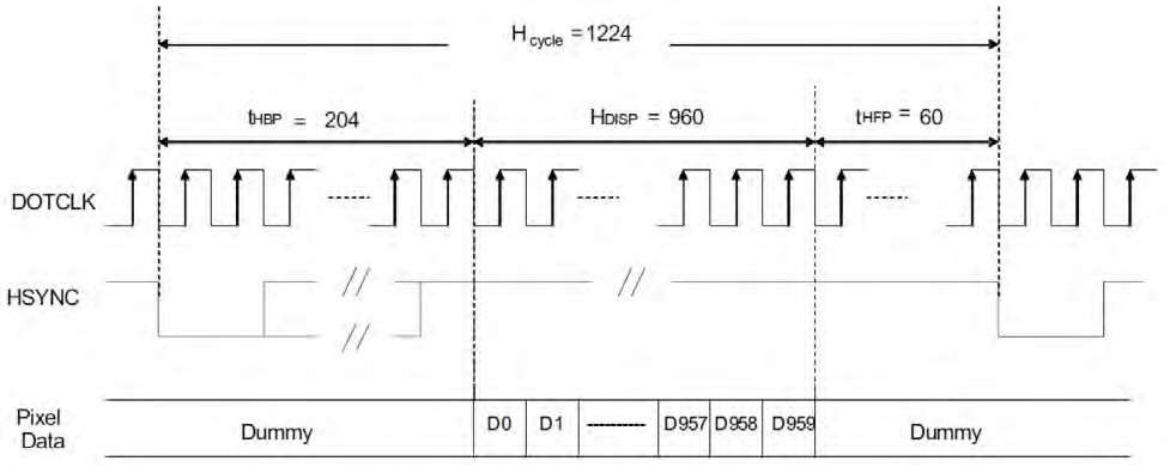


b) Vertical Data Transaction Timing

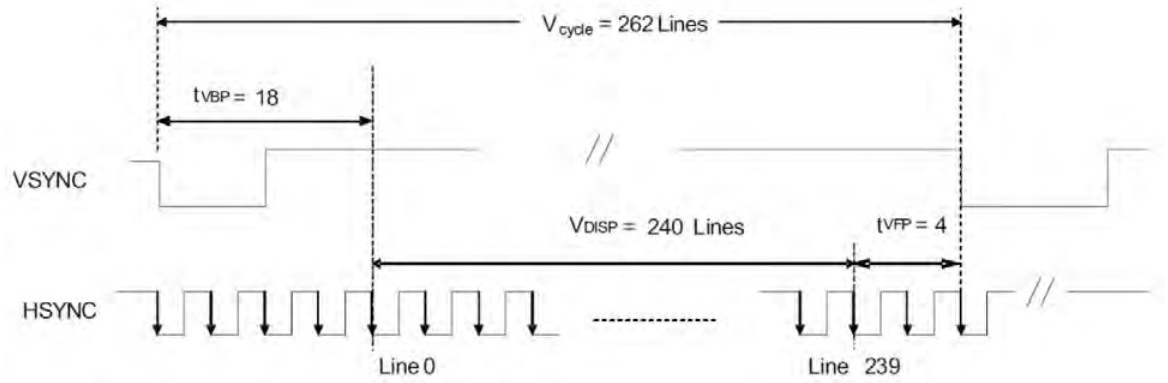
Figure 2. Data Transaction Timing in Parallel RGB (24 bit) Interface (SYNC Mode)

Characteristics		Symbol	Min-		Typ.		Max.		Unit
			24 bit	8 bit	24 bit	8 bit	24 bit	8 bit	
DOTCLK Frequency		fDOTCLK	-	-	6.5	19.5	10	30	MHz
DOTCLK Period		tDOTCLK	100	33.3	154	51.3	-	-	ns
Horizontal Frequency (Line)		fH	-		14.9		22.35		KHz
Vertical Frequency (Refresh)		fV	-		60		90		Hz
Horizontal Back Porch		tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal Front Porch		tHFP	-	-	20	60	-	-	tDOTCLK
Horizontal Data Start Point		tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal Blanking Period		tHBP + tHFP	-	-	88	264	-	-	tDOTCLK
Horizontal Display Area		HDISP	-	-	320	960	-	-	tDOTCLK
Horizontal Cycle		Hcycle	-	-	408	1224	450	1350	tDOTCLK
Vertical Back Porch		tVBP	-		18		-		Lines
Vertical Front Porch		tVFP	-		4		-		Lines
Vertical Data Start Point		tVBP	-		18		-		Lines
Vertical Blanking Period		tVBP + tVFP	-		22		-		Lines
Vertical Display Area	NTSC	VDISP	-		240		-		Lines
	PAL				280(PALM=0)				
					288(PALM=1)				
Vertical Cycle	NTSC	Vcycle	-		262		350		Lines
	PAL				313				

Table 2. Data Transaction Timing in Normal Operating Mode



a) Horizontal Data Transaction Timing



b) Vertical Data Transaction Timing

Figure 3. Data Transaction Timing in Serial RGB (8 bit) Interface (SYNC Mode)

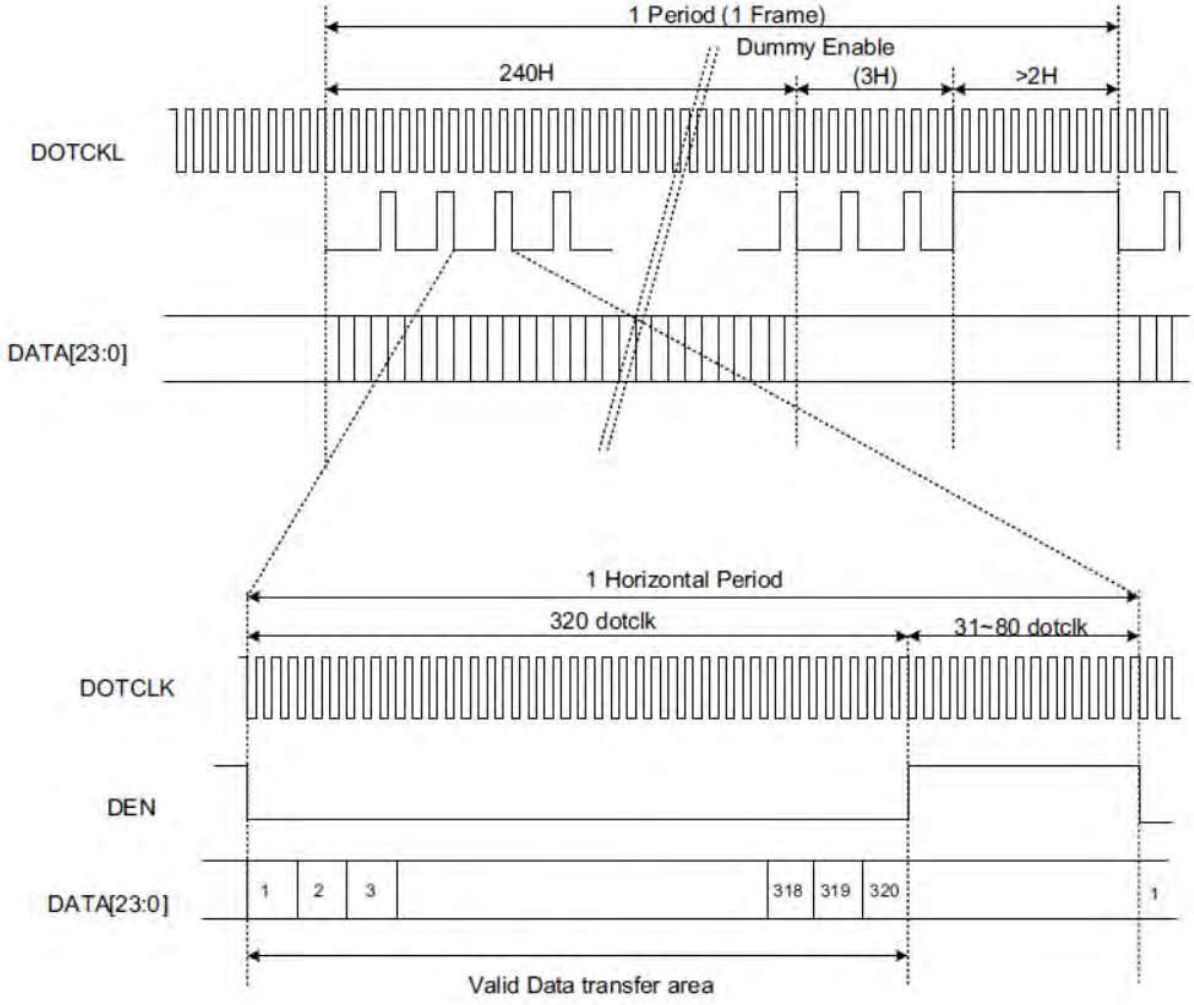
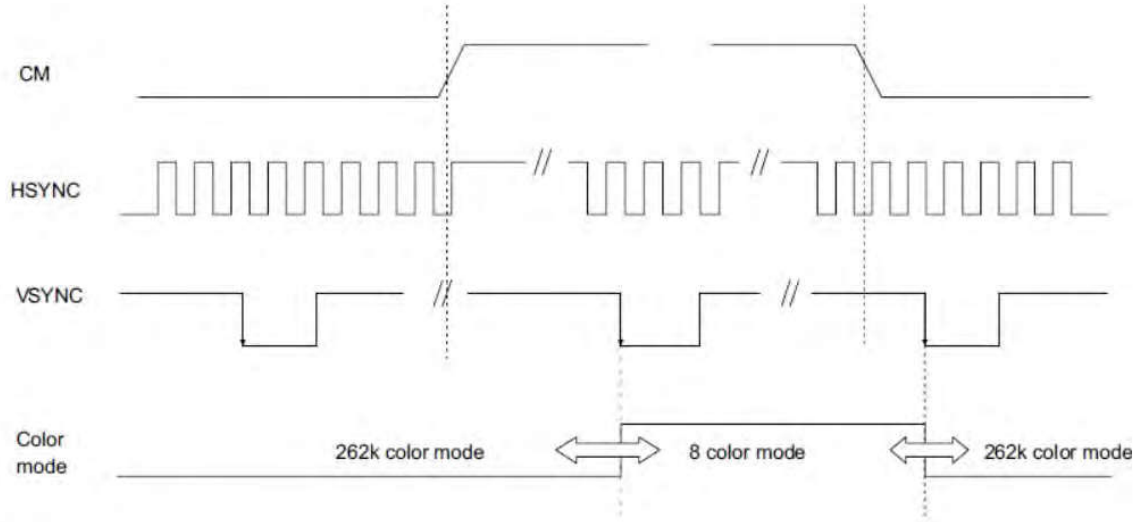


Figure 4. Signal Timing in DE Mode



Note: The color mode conversion starts at the first falling edge of VSYNC after stage change of CM.

Figure 5. Color Mode Conversion Timing

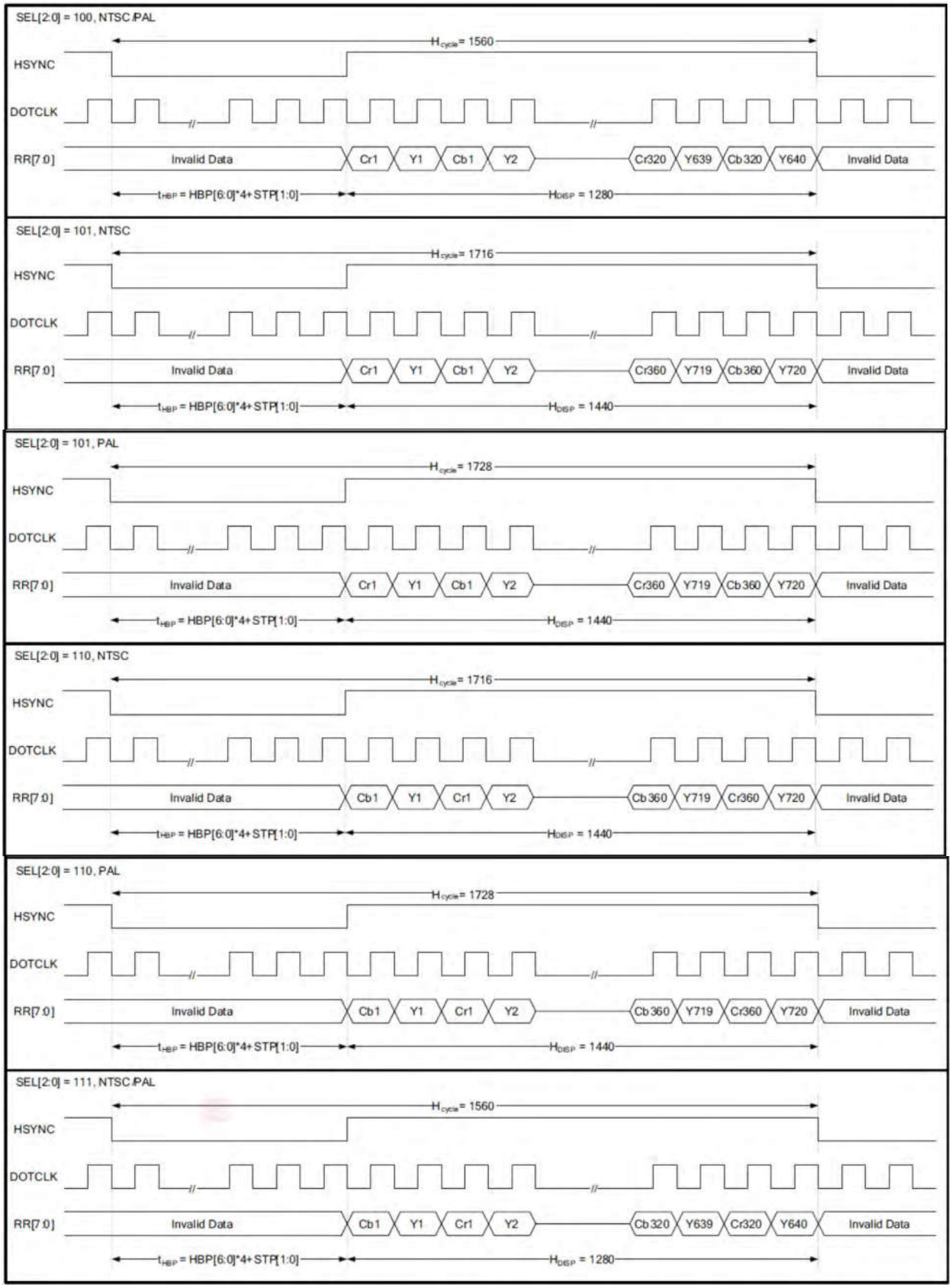


Figure 6. CCIR601 Horizontal Timing

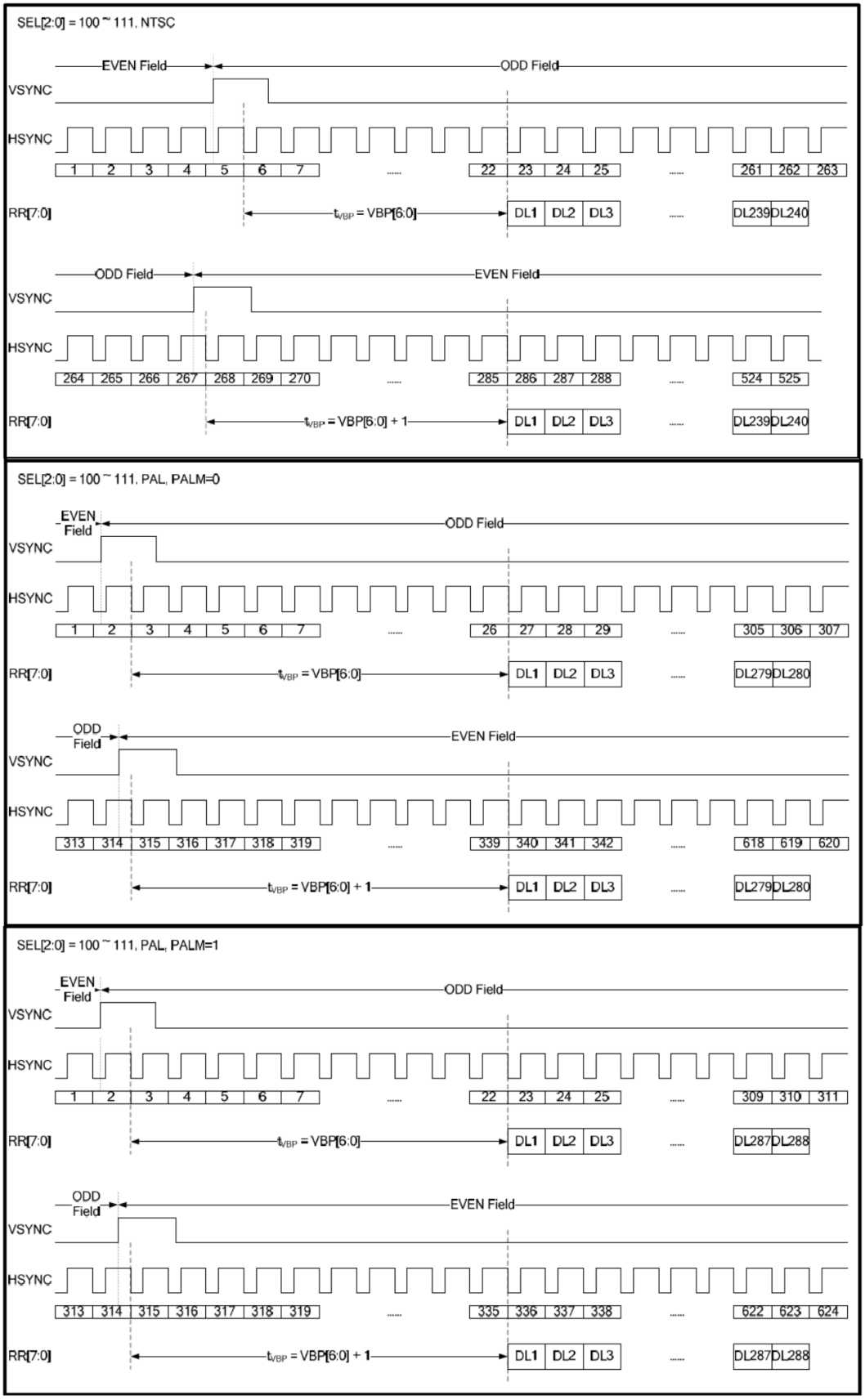


Figure 7 CCIR601 Vertical Timing

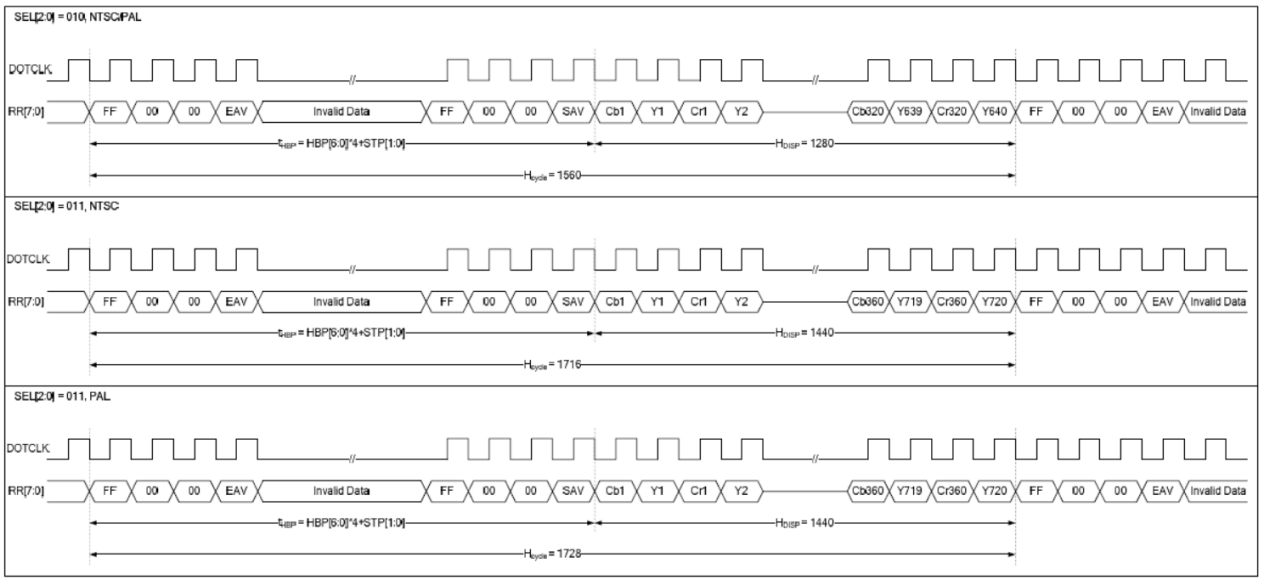
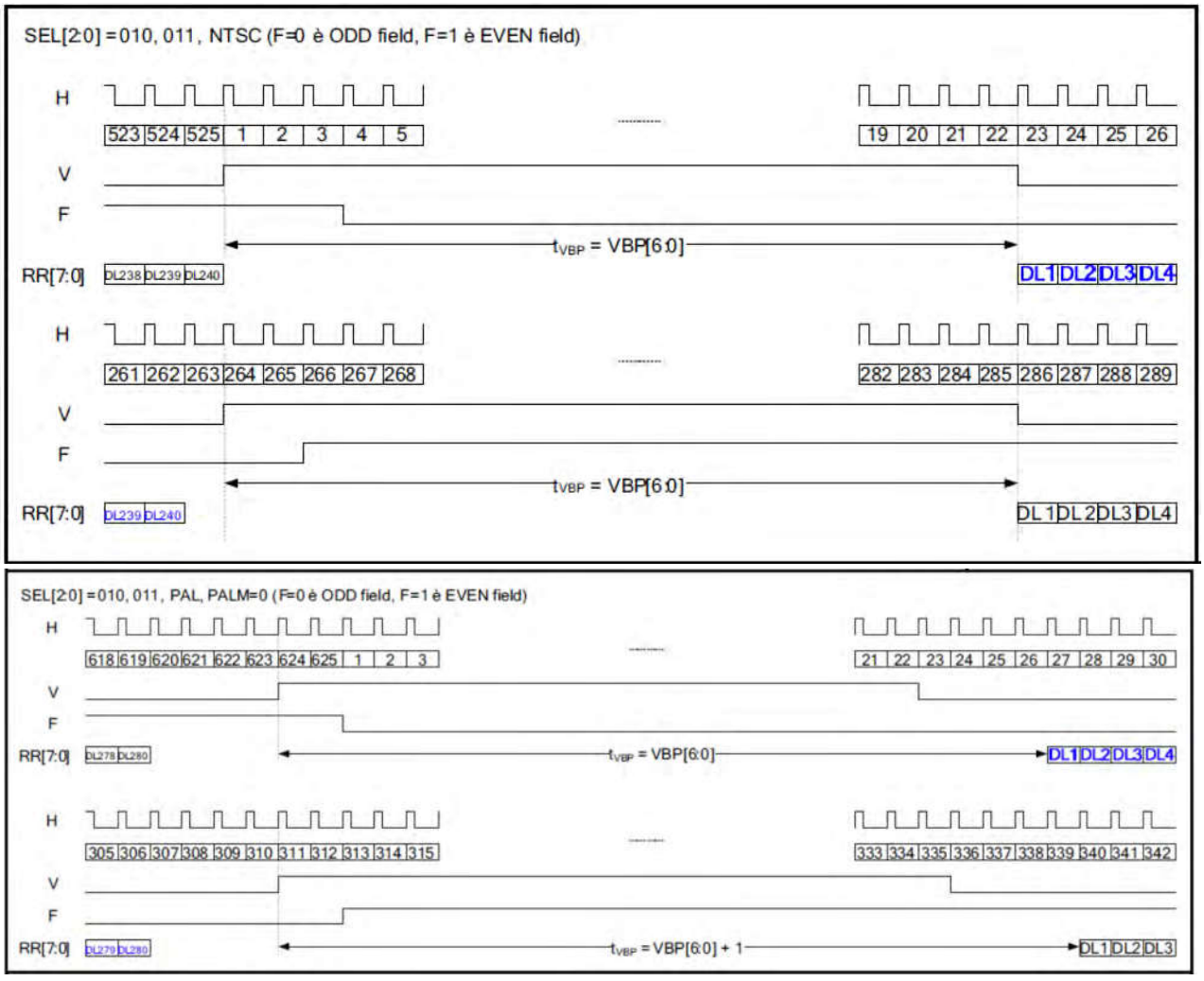


Figure 8. CCIR656 Horizontal Timing



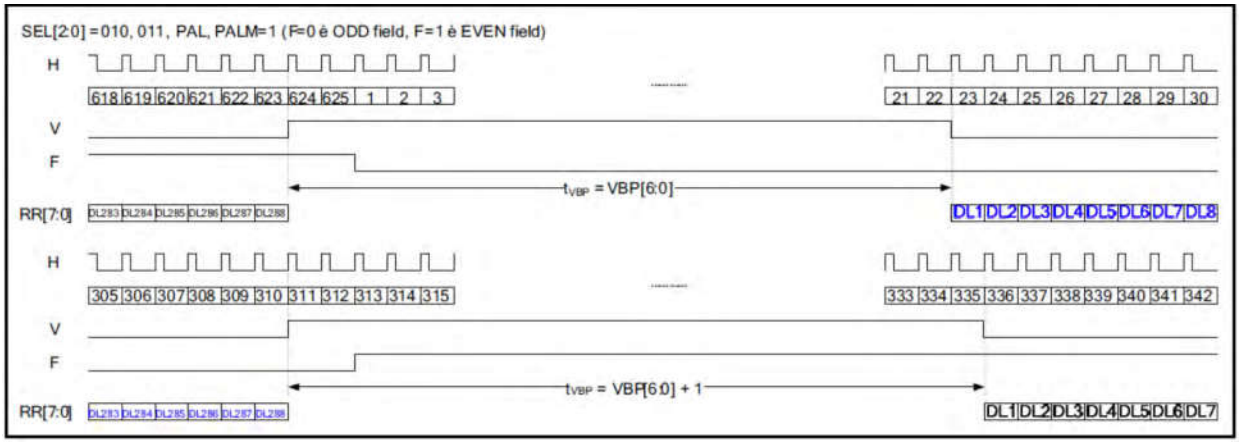


Figure 9. CCIR656 Vertical Timing

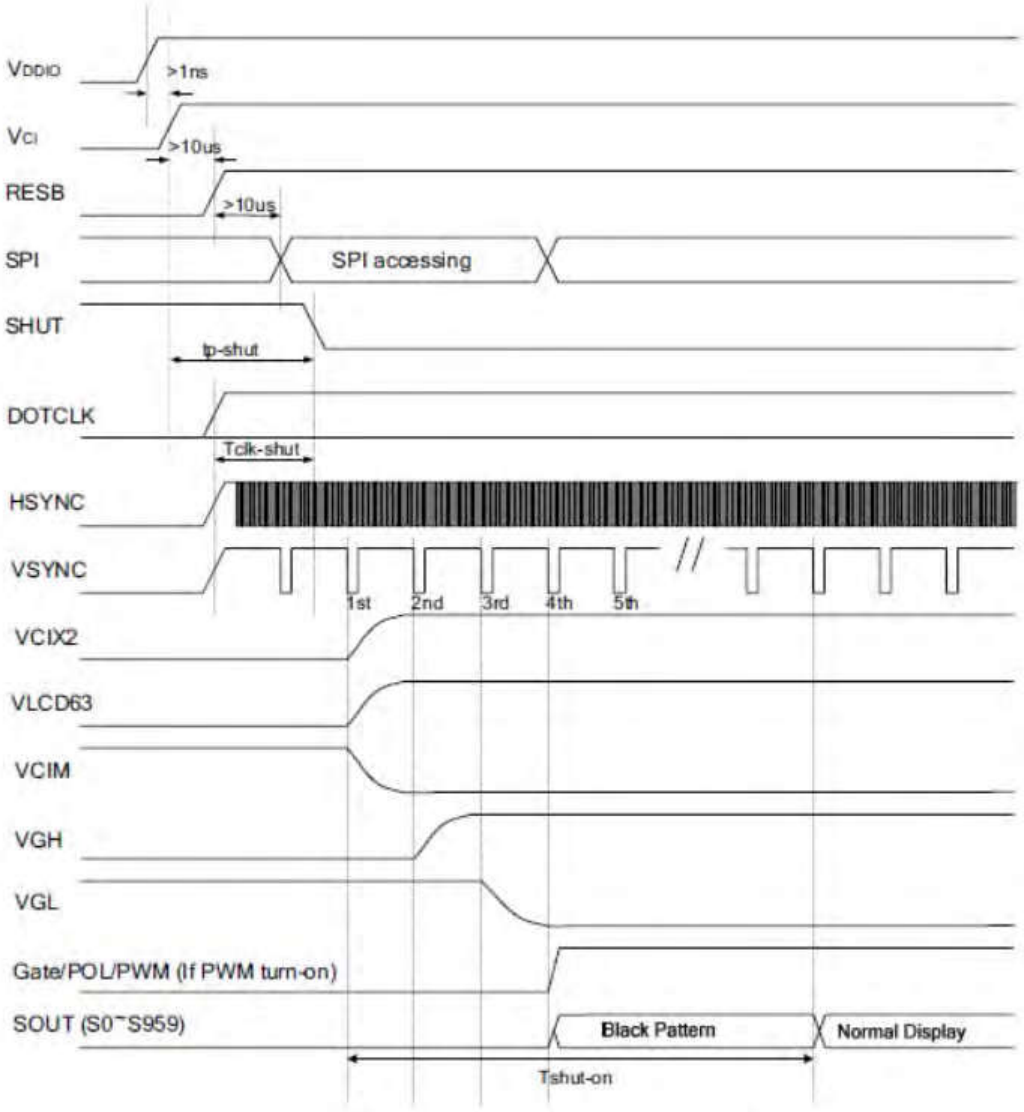


Figure 10. Power Up Sequence

Characteristics	Symbol	Min.	Typ.	Max.	Unit
VDDD / VDDIO on to falling edge of SHUT	tp-shut	1	-	-	us
DOTCLK	tclk-shut	1	-	-	clk
Falling edge of SHUT to display start - 1 line: 408 clk - 1 frame: 262 line -DOTCLK = 6.5MHz	tshut-on	-	-	14	frame
		-	166	232.4	ms

Note: It is necessary to input DOTCLK before the falling edge of SHUT.
Display starts at 10th falling edge of VSTNC after the falling edge of SHUT.

Table 3. Power Up Sequence

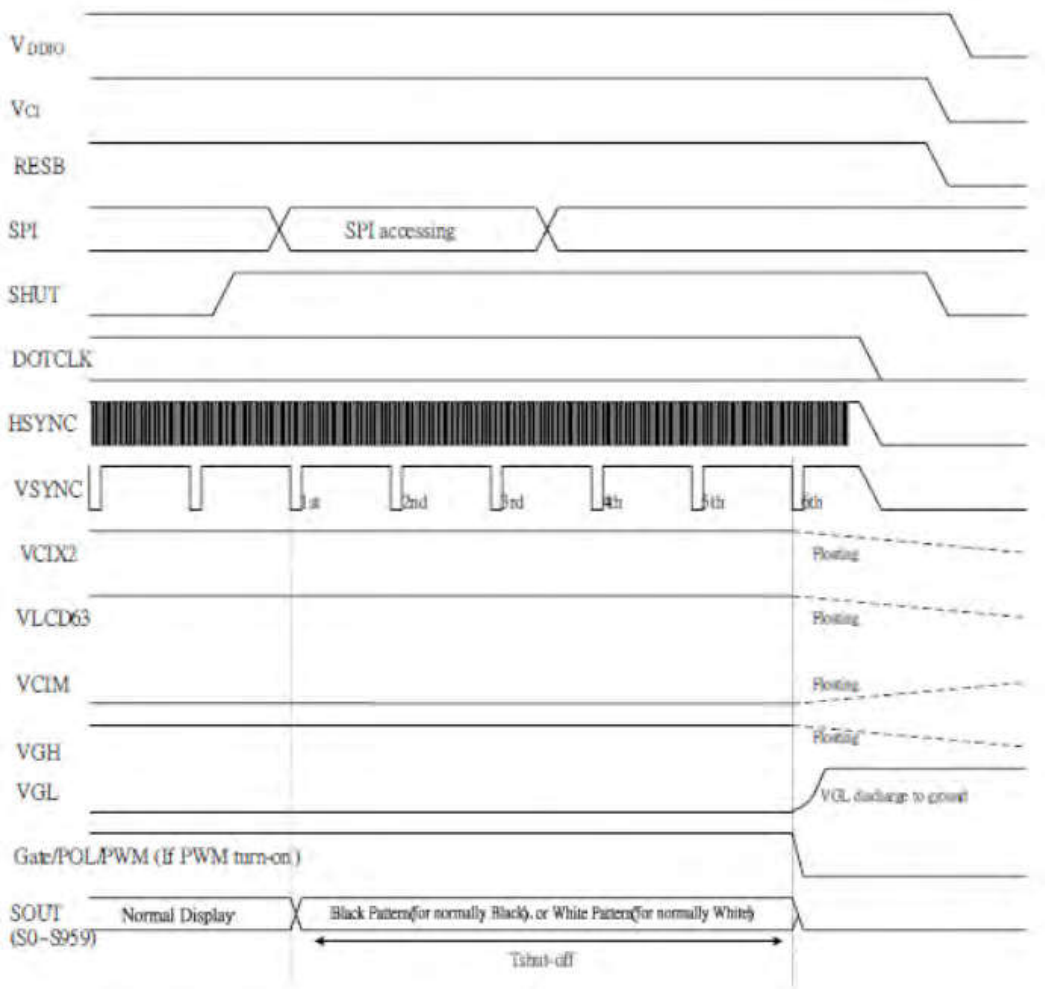


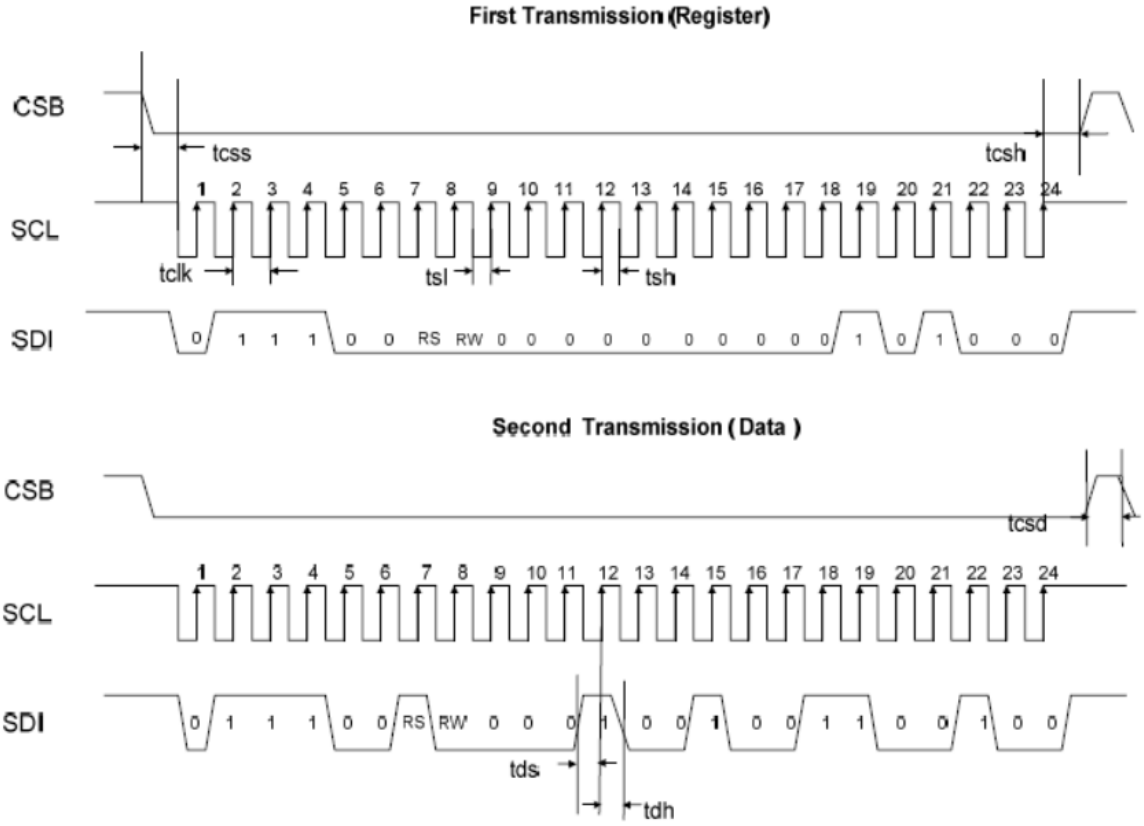
Figure 11. Power Down Sequence

Characteristics	Symbol	Min.	Typ.	Max.	Unit
Rising edge of SHUT to display off - 1 line: 408 clk - 1 frame: 262 line - DOTCLK = 6.5MHz	tshut-off	2	-	-	frame
		33.4	-	-	ms

Note: DOTCLK must be maintained at lease 2 frames after the rising edge of SHUT.
Display become off at the 2nd falling edge of VSTNC after the falling edge of SHUT.
If RESET signal is necessary for power down, provide it after the 2-frames-cycle of the SHUT period.

Table 4. Power Down Sequence

- Write SPI



Note: The example writes "0x1264h" to register R28h.
SPID connected to VSS.

Figure 12. (a) SPI interface Timing Diagram &Write SPI Example

■ CTP SPECIFICATIONS

1. GENERAL SPECIFICATIONS

Item	Specification	Unit
Type	Transparent type projected capacitive touch panel	/
Structure	Cover glass + Sensor glass + FPCA	/
Input Mode	Human's finger	/
Finger	Up to 5	/
Resolution	320 × 240	dots
Cover Viewing Area	70.68(W) × 53.16(H)	mm
Sensor Active Area	71.68 (W) × 54.16(H)	mm
Hardness	7H	Pencil hardness
Driver IC	FT5446-P03	/

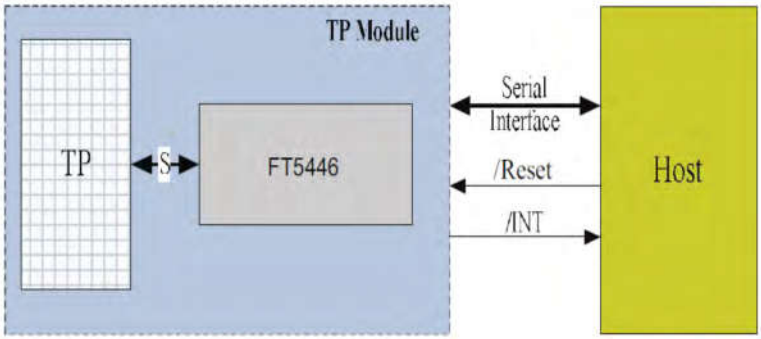
2. ABSOLUTE MAXIMUM RATINS

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Supply Voltage	VCC	2.8	3.3	3.6	V	
Supply Current	ICC	-	TBD	-	mA	
Input Voltage 'H' Level	VIH	0.7VCC	-	VCC	V	
Input Voltage 'L' Level	VIL	0	-	0.3VCC	V	

3. PIN CONNECTIONS

No.	Name	Type	Description
1	VSS	P	Ground.
2	VCC	P	Power supply.
3	SCL	I	I²C clock input.
4	NC	-	No connection.
5	SDA	I/O	I²C data signal.
6	NC	-	No connection.
7	/RST	I	Reset. Active low.
8	NC	-	No connection.
9	/INT	O	Interrupt signal to host from CTP.
10	VSS	P	Ground.

4. BLOCK DIAGRAM



5. CTP TIMING

The I²C is always configured in the Slave mode. The data transfer format is shown in Figure 1-1.

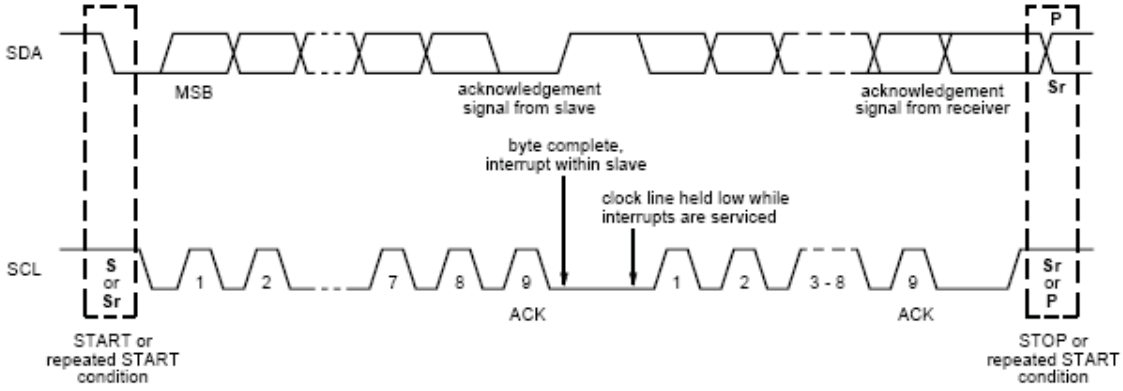
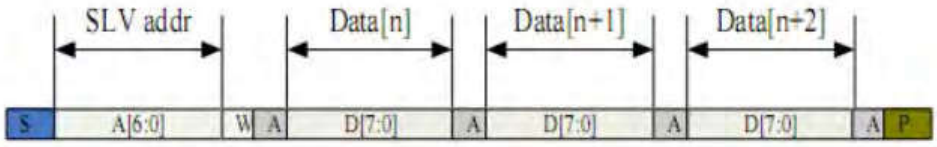
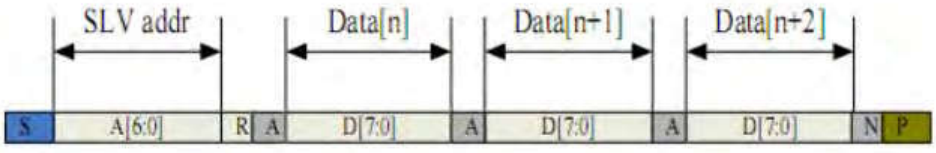


Figure 1-1 I2C serial Data Transfer Format



I2C master write, slave read



I2C master read, slave write

Table 1-1 lists the meanings of the mnemonics used in the above figures.

Table 1-1 Mnemonics Description

Mnemonics	Description
S	I2C Start or I2C Restart
A[6:0]	Slave address A[6:4]: 3'b011 A[3:0]: data bits are identical to those of I2CCON[7:4] register.
W	1'b0: Write
R	1'b1: Read
C	ACK
P	STOP: the indication of the end of a packet (if this bit is missing, S will indicate the end of the current packet and the beginning of the next packet)

I2C Interface Timing Characteristics is shown in Table 1-2.

Table 1-2 I2C Timing Characteristics

Parameter	Unit	Min	Max
SCL frequency	KHz	0	400
Bus free time between a STOP and START condition	us	4.7	\
Hold time (repeated) START condition	us	4.0	\
Data setup time	ns	250	\
Setup time for a repeated START condition	us	4.7	\
Setup Time for STOP condition	us	4.0	\

Note: More information please refer to IC spec..

■ RELIABILITY TEST

No.	Test Item	Test Condition	Remark
1	High Temperature Storage Test	85℃ ± 2℃ / 120Hrs.	IEC60068-2-2 GB2423.2
2	Low Temperature Storage Test	-30℃ ± 2℃ / 120Hrs.	IEC60068-2-1 GB2423.1
3	High Temperature Operating Test	85℃ ± 2℃ / 120Hrs.	IEC60068-2-2 GB2423.2
4	Low Temperature Operating Test	-20℃ ± 2℃ / 120Hrs.	IEC60068-2-1 GB2423.1
5	High Temperature and High Humidity Operation Test	60 ± 5℃, 90%RH 120Hrs.	IEC60068-2-3 GB/T2423.3
6	Thermal Shock Test (Non-operating)	-30±2℃(30Min.)~25±2℃(5Min.)~85±2℃(30Min.) 10Cycles	IEC60068-2-14 GB2423.22
7	Vibration Test (Non-operating)	Frequency: 10~55Hz Amplitude: 1.5mm Sweep Time: 11Mins Test Period: 6 Cycles for Each Direction of X, Y, Z (Packing Condition)	IEC60068-2-6 GB2423.10
8	Shock Test (Non-operating)	100G, 6Ms Direction: ±X, ±Y, ±Z Cycle: 3 Times	IEC60068-2-27 GB/T2423.5
9	Electro Static Discharge Test	R: 330Ω, C:150pF, 5points/panel Air: ±8KV, 5times; Contact: ±4KV, 5times; (Environment: 15℃~35℃, 30%~60%, 86Kpa~106Kpa)	IEC61000-4-2 GB/T17626.2

Note 1: Without water condensation.

Note 2: The function test shall be conducted after 2 hours storage at the room temperature (25℃±2℃) and room humidity (65%±5%) after removed from the test chamber. In the standard conditions, there shall be no functional defects occurred.

ALL SHORE INDUSTRIES

■ INSPECTION CRITERION

OUTGOING QUALITY STANDARD	PAGE 1 OF 4
TITLE: FUNCTIONAL TEST & INSPECTION CRITERIA	

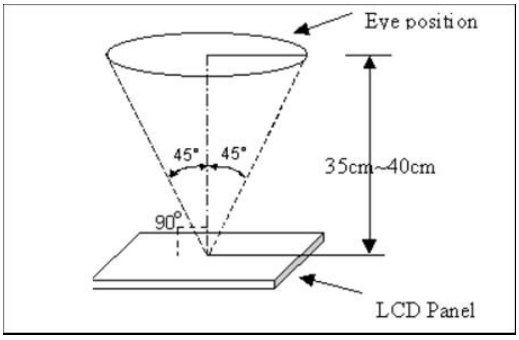
This specification is made to be used as the standard acceptance/rejection criteria for TFT module.

1. Sample Plan

1.1 Lot size: Quantity per shipment lot per model
1.2 Sampling type: Normal inspection, Single sampling
1.3 Inspection level: II
1.4 Sampling table: MIL-STD-105D
1.5 Acceptable quality level (AQL)
Major defect: AQL=0.65
Minor defect: AQL=1.50

2. Inspection Condition

2.1 Ambient conditions
a. Temperature: Room temperature 25±5℃
b. Humidity: (60±10) %RH
c. Illumination: Single fluorescent lamp non-directive (300 to 700 Lux)
2.2 Viewing distance
The distance between the LCD and the inspector's eyes shall be at least 35±5cm.
2.3 Viewing angle
U/D: 45° / 45°, L/R: 45° / 45°



3. Definition of Inspection Item

3.1 Definition of inspection zone in LCD module (LCM)

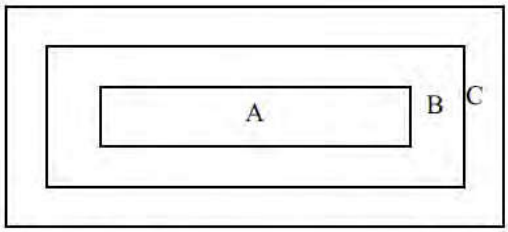


Fig.1 Inspection zones in an LCD

Zone A: Character / Digit area (Active area)
Zone B: Viewing area except Zone A (Zone A + Zone B=minimum viewing area)
Zone C: Outside viewing area (invisible area after assembly in customer's product)

Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble for quality and assembly of customer's product. If any visual defect in Zone C is impermissible, customers need to inform us by written.

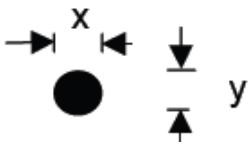
4. Inspection Plan

Defects are classified as major defects and minor defects according to the degree of defectiveness defined herein.

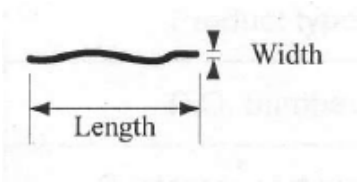
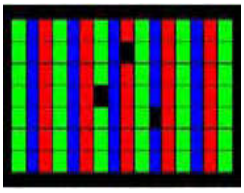
4.1 Major defect

Item No.	Items To Be Inspected	Inspection Standard
4.1.1	All Functional Defects	1) No display 2) Display abnormally 3) Short circuit 4) Line defect 5) Excess power consumption
4.1.2	Missing	Missing function component
4.1.3	Crack	Glass crack

4.2 Minor defect

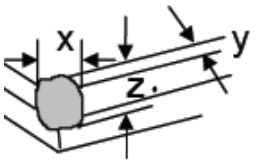
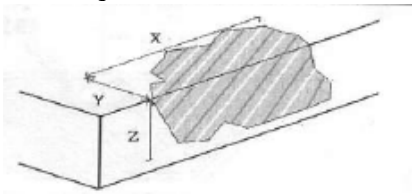
<table>
<tr><th>Item No.</th><th>Items To Be Inspected</th><th colspan="2">Inspection Standard</th></tr>
<tr><td rowspan="5">4.2.1</td><td rowspan="5">Spot Defect
Including
Black spot
White spot
Pinhole
Foreign particle
Polarizer dirt</td><td colspan="2">For dark / white spot is defined
$\varphi = (x+y) / 2$
  </td></tr>
<tr><td>Size φ(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>φ ≤ 0.15
2mm(min) apart</td><td>Ignore</td></tr>
<tr><td>0.15 < φ ≤ 0.25
5mm(min) apart</td><td>3</td></tr>
<tr><td>0.25 < φ</td><td>Not allowed</td></tr>
</table>

OUTGOING QUALITY STANDARD	PAGE 3 OF 4
TITLE: FUNCTIONAL TEST & INSPECTION CRITERIA	

<table>
<tr><td rowspan="5">4.2.2</td><td rowspan="5">Line Defect
Including
Black line
White line
Scratch</td><td colspan="2">Defined
 
</td></tr>
<tr><td>Width (mm)
Length (mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>W ≤ 0.05 and L ≤ 10</td><td>Ignore</td></tr>
<tr><td>0.05 < W ≤ 0.08 and L ≤ 10
3mm(min) apart</td><td>3</td></tr>
<tr><td>0.08 < W ≤ 0.10 and L ≤ 5
3mm(min) apart</td><td>1</td></tr>
<tr><td rowspan="4">4.2.3</td><td rowspan="4">Polarizer
Dent / Bubble</td><td>0.10 < W or 10<L</td><td>Not allowed</td></tr>
<tr><td>Size φ(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>φ ≤ 0.25</td><td>Ignore</td></tr>
<tr><td>Non visible area</td><td>Ignore</td></tr>
<tr><td rowspan="5">4.2.4</td><td rowspan="5">Electrical Dot Defect</td><td>0.25 < φ ≤ 0.50
5mm(min) apart</td><td>3</td></tr>
<tr><td>0.50 < φ</td><td>Not allowed</td></tr>
<tr><td colspan="2">Bright and black dot define:
  and  </td></tr>
<tr><td colspan="2">Inspection pattern: Full white, Full black, Red, Green and Blue screens</td></tr>
<tr><td>Item</td><td>Acceptable Quantity</td></tr>
<tr><td>Black dot defect</td><td>2</td></tr>
<tr><td>Bright dot defect</td><td>0</td></tr>
<tr><td>Total Dot</td><td>2</td></tr>
</table>

ALL SHORE INDUSTRIES

OUTGOING QUALITY STANDARD	PAGE 4 OF 4
TITLE: FUNCTIONAL TEST & INSPECTION CRITERIA	

<table>
<tr><td rowspan="5">4.2.5</td><td rowspan="5">Touch Panel Chips</td><td colspan="2">1. Corner chips:
  </td></tr>
<tr><td>Size (mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>X ≤ 3mm
Y ≤ 3mm
Z ≤ T</td><td>Ignore
T: Glass thickness
X: Length
Y: Width
Z: Thickness</td></tr>
<tr><td colspan="2">2. Side chips:
  </td></tr>
<tr><td>Size (mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>4.2.6</td><td>Touch Panel Newton Ring</td><td colspan="2">Compare with limit sample</td></tr>
</table>

Note: 1. Dot defect is defined as the defective area of the dot area is larger than 50% of the dot area.
2. The distance between black dot defects or black and bright dot defects should be more than 5mm apart. The distance between two bright dot defects should be more than 15mm apart.
3. Polarizer bubble is defined as the bubble appears on active display area. The defect of polarizer bubble shall be ignored if the polarizer bubble appears on the outside of active display area.
4. Mura is checker by 6% ND filter.
5. Foreign particle on the surface of the LCM should be ignore.

■ PRECAUTIONS FOR USING LCD MODULES

◆ Handing Precautions

1. The display panel is made of glass and polarizer. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Dot not subject it to a mechanical shock by dropping it or impact.

2. If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

3. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

4. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.

5. If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents.

- Isopropyl alcohol
- Ethyl alcohol

Do not scrub hard to avoid damaging the display surface.

6. Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.

- Water
- Ketone
- Aromatic solvents

7. Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contacting oil and fats.

8. Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

9. Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.

10. Do not attempt to disassemble or process the LCD module.

11. If the logic circuit power is off, do not apply the input signals.

12. Electro-Static Discharge Control. Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

13. Electro-Static Discharge Control. Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential. Be sure to ground the body when handling the LCD modules.

- Tools required for assembling, such as soldering irons, must be properly grounded. make certain the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.

- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended. As far as possible make the electric potential of your work clothes and that of the work bench the ground potential

- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

- Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

- Do not alter, modify or change the shape of the tab on the metal frame.

- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.

- Do not damage or modify the pattern writing on the printed circuit board.

- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.

- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.

- Do not drop, bend or twist LCM.

◆ **Handing Precaution for LCM**

LCM is easy to be damaged.
Please note below and be careful for handling!

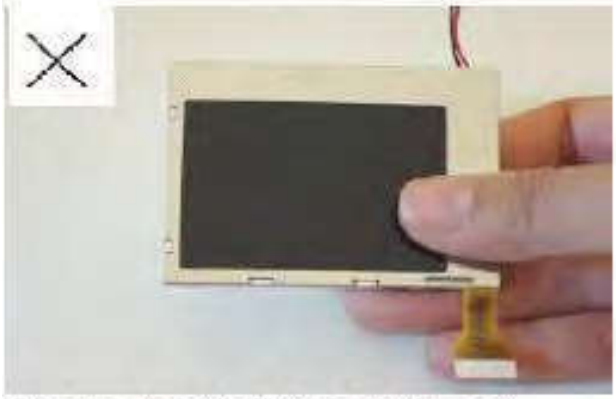
Correct handling:

As above picture, please handle with anti-static gloves around LCM edges.

Incorrect handling:

Please don't touch IC directly.

Please don't stack LCM.



Please don't hold the surface of panel.

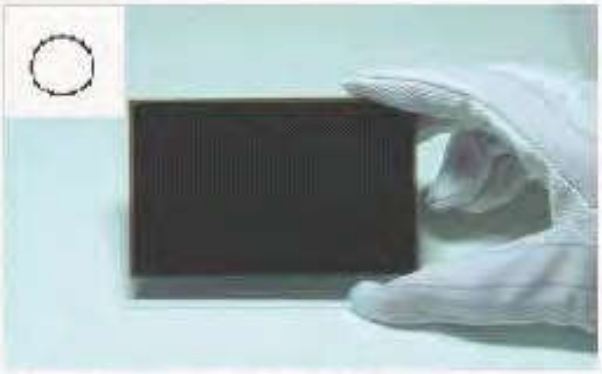
Please don't stretch interface of output, such as FPC cable.

ALL SHORE INDUSTRIES

◆ **Handing Precaution for LCD**

LCD is easy to be damaged.
Please note below and be careful for handling!

Correct handling:



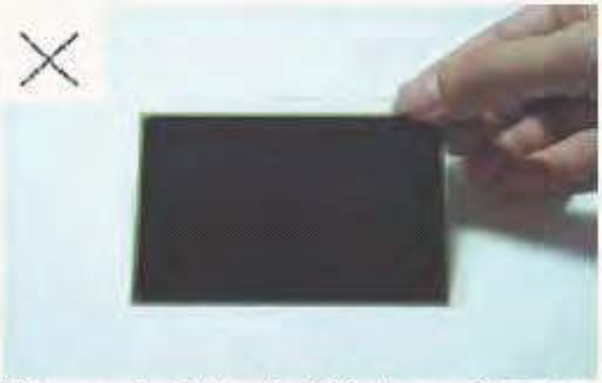
As above photo, please handle with anti-static gloves around LCD edges.

Incorrect handling:

Please don't stack the LCDS.

Please don't hold the surface of LCD.

Please don't operate with sharp stick such as pens.



Please don't touch ITO glass without anti-static gloves.

◆ **Storage Precautions**

When storing the LCD modules, the following precaution is necessary.

1. Store them in a sealed polyethylene bag. If properly sealed, there is no need for the dessicant.
2. Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0℃ and 35℃, and keep the relative humidity between 40%RH and 60%RH.
3. The polarizer surface should not come in contact with any other objects. (We advise you to store them in the anti-static electricity container in which they were shipped.

◆ **Others**

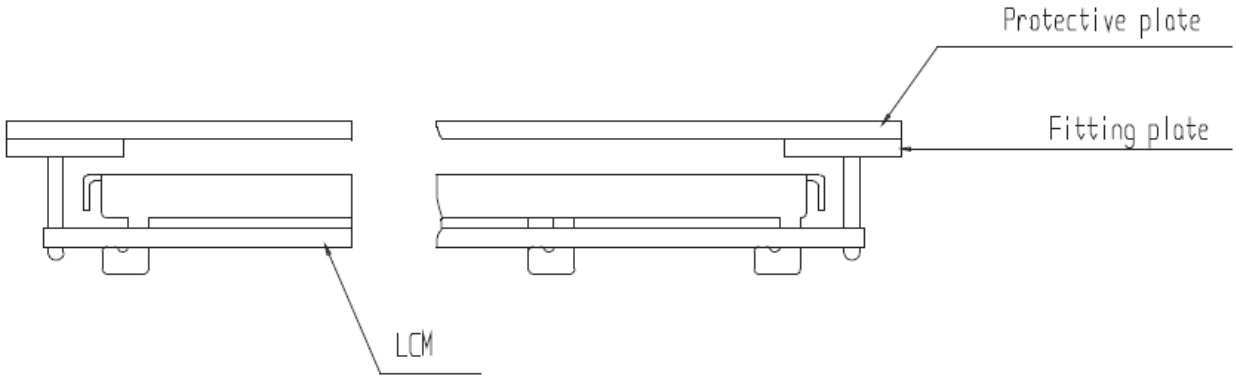
1. Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.
2. If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.
3. To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.
   - Exposed area of the printed circuit board.
   - Terminal electrode sections.

◆ **Using LCD Modules**

1. Installing LCD Modules

1.1 The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to the following items when installing the LCM.

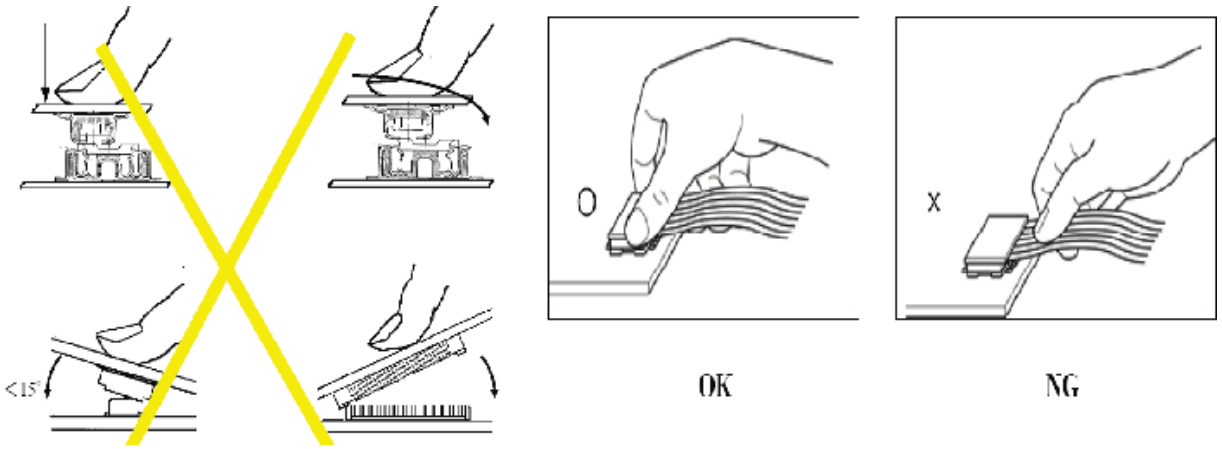
1.1.1 Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



1.1.2 When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ±0.1mm.

2. Precaution For Assemble The Module With BTB Connector

Please note the position of the male and female connector position, don't assemble or assemble like the method which the following picture shows.



◆ **Precaution For Soldering To The LCM**

	Hand Soldering	Machine Drag Soldering	Machine Press Soldering
No ROHS Product	290℃ ~ 350℃. Time: 3~5S.	330℃ ± 350℃. Speed: 4~8mm/s.	300℃ ± 330℃. Time: 3~6S. Press: 0.8~1.2Mpa
ROHS Product	340℃ ~ 370℃. Time: 3~5S.	350℃ ± 370℃. Speed: 4~8mm/s.	330℃ ± 360℃. Time: 3~6S. Press: 0.8~1.2Mpa

1. If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

2. When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.

3. When remove the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

◆ **Precaution For Operation**

1. Viewing angle varies with the change of liquid crystal driving voltage (VLCD). Adjust VLCD to show the best contrast.

2. It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life. An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.

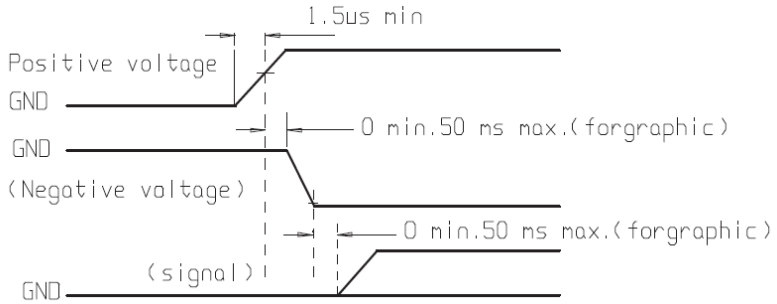
3. Response time will be extremely delayed at lower temperature than the operating temperature range and on the mean malfunction or out of order with LCD's. Which will come back in the specified operating temperature.

4. If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.

5. A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the maximum operating temperature, 50%RH or less is required.

6. Input each signal after the positive/negative voltage becomes stable.

7. Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.



◆ **Safety**

1. It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

2. If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.