

LIQUID CRYSTAL DISPLAY MODULE

Product Specification

CUSTOMER		
PRODUCT NUMBER	DET043QQNCNT0-1A	
CUSTOMER APPROVAL		Date

INTERNAL APPROVALS		
Product Mgr	Doc. Control	Electr. Eng
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Date: 07/07/14	Date: 07/07/14	Date: 07/07/14

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REVISION RECORD

Ver.	Date	Page	Chapt.	Comment
A	07/12/12			First Release
B	15/07/14	6 7 15	3.2.2 4.1 9.1	Backlight Max. current Input voltage for logic AC characteristics

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1 General Description and Features

DET043QQNCNT0-1B is a TM (Transmissive) type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT-LCD module, a driver circuit and a back-light unit. The resolution of a 4.3" contains 480RGBx272 dots and can display up to 16.7 million colors. The following table described the features of DET043QQNCNT0-1B.

1.1 Features

- Transmissive and back-light with 7 LEDs are available.
- TN (Twisted Nematic) mode.
- 8 Bits 8080 system interface
- RoHS compliant

1.2 LCD Module

Item	Specification	Unit
Screen Size	4.3 inches	Diagonal
Display Resolution	480(H) x RGB x 272(V)	Dot
Pixel Pixels	0.198 (H) x 0.198 (V)	mm
Active Area	95.04 (H) x 53.856 (V)	mm
Outline Dimension	105.5 (W) x 67.2 (H) x 4.65 (D)	mm
Display Mode	Normally white/Transmissive	--
Pixel Arrangement	RGB Vertical Stripe	--
Surface Treatment	Anti-glare (AG)	--
Display Color	16.7 Million	--
Viewing Direction	6 o'clock (Gray Inversion)	--
TFT Driver	SSD1963 or equivalent	--
Input Interface	8 Bits i80 system interface.	--

2 Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	-	105.5	-	mm	--
	Vertical (V)	-	67.2	-	mm	(1)
	Thickness (T)	-	4.65	-	mm	(1)
Weight		--	55	--	g	--

Note (1) Not include FPC.

Refer to the Dimensional Outlines for further information.

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3 Electrical Specifications

3.1 Absolute Max. Ratings

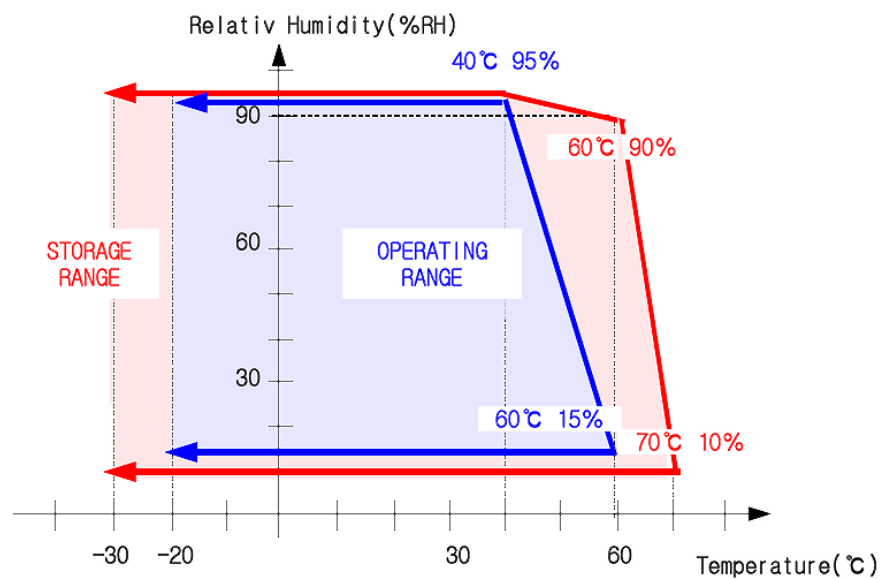
3.1.1 Absolute Ratings of Environment

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

($T_a=25\pm 2^\circ\text{C}$, $V_{SS}=\text{GND}=0$)

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T_{STG}	-30	80	$^\circ\text{C}$	(1)
Operating temperature	T_{OPR}	-20	70	$^\circ\text{C}$	(1,2,3)

Note (1) 95 % RH Max. ($40^\circ\text{C} \geq T_a$). Maximum wet-bulb temperature at 39°C or less. ($T_a > 40^\circ\text{C}$) No condensation.



Note (2) In case of below 0° , the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's character

Note (3) Only operation is guaranteed at operating temperature. Contrast, response time, another display quality are evaluated at $+25^\circ\text{C}$.

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3.2 Electrical Absolute Rating

3.2.1 TFT-LCD Module

(Ta=25±2°C, V_{SS}=GND=0)

Item	Symbol	Value		Unit	Condition
		Min.	Max.		
Logic power supply	VCC	-0.5	4.5	V	--
Current Drain Per Pin Excluding VCC and VSS	I	--	25	mA	--

Note : Temp. ≤ 60°C, 90% RH MAX.

Temp. > 60°C, absolute humidity shall be less than 90% RH at 60°C

3.2.2 Back-Light Unit

(Ta=25±2°C)

Item	Symbol	Min.	Max.	Unit	Note
Current	I _f	--	25	mA	(1)

Note (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded. Functional operation should be restricted to the conditions described under normal operating conditions.

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4 Electrical Characteristics

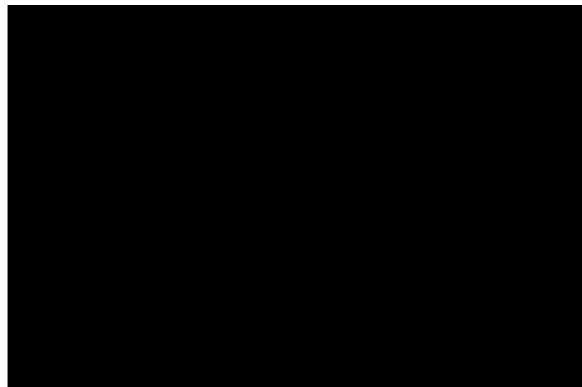
4.1 TFT-LCD Module

(Ta=25±2°C, VSS=0V)

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
Power supply	VCC	3.0	3.3	3.6	V	
Input voltage for logic(H Level)	VIH	0.7Vdd	-	Vdd		
Input voltage for logic(L Level)	VIL	0	-	0.3Vdd		
Digital current	IDD	-	15	18	mA	Note 1

Note 1: The specified power consumption is under the conditions at Vcc=3.3V, Fv=60Hz, whereas a power dissipation check pattern below is displayed.

Black Pattern / 0 Gray



Active Area

4.2 Backlight Unit

The back-light system is an edge-lighting type with 7 white LEDs.

(Ta=25±2°C)

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
LED Voltage	VL	(20.3)	(22.4)	(23.8)	V	
LED Current	If	-	20	25	mA	
Power Consumption	P _{LED}	-	(448)	(595)	mW	
LED Life Time(25°C)	-	(20000)	-	-	hr	

Note (1) 7 LEDs serial 1 parallel type.

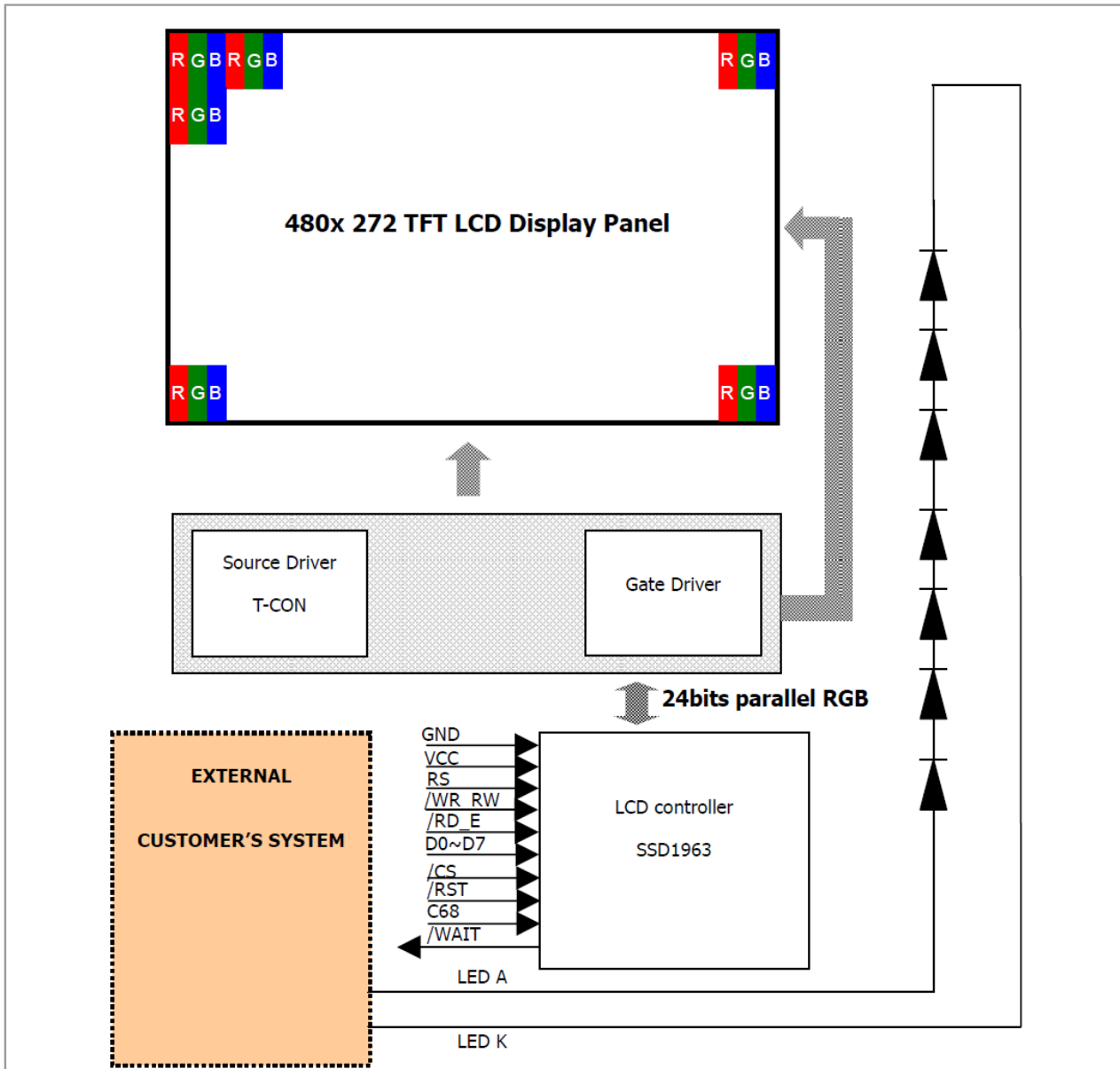
(2) Where If = 20mA, VL=22.4V, P_{LED} = VL × If

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5 Block Diagram

5.1 Interface System Structure with Back Light Unit



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6 Input Terminal Pin Assignment

6.1 Pin Assignment (LCD)

Pin No.	Symbol	I/O	Function
1	VCC	P	Power supply
2	VCC	P	Power supply
3	GND	P	Ground
4	GND	P	Ground
5	/RST	I	Reset signal
6	NC	-	No connection
7	/WAIT	O	Tearing effect
8	C68	I	MPU interface configuration 1: 8080 interface
9	/CS	I	Chip select
10	RS	I	Data / Command select
11	/RD_E	I	8080 mode: RD# (read strobe signal)
12	/WR_RW	I	8080 mode: WR# (write strobe signal)
13	GND	P	Ground
14	DB0	I/O	Data bus 0
15	DB1	I/O	Data bus 1
16	DB2	I/O	Data bus 2
17	DB3	I/O	Data bus 3
18	DB4	I/O	Data bus 4
19	DB5	I/O	Data bus 5
20	DB6	I/O	Data bus 6
21	DB7	I/O	Data bus 7
22	NC	-	No connection
23	NC	-	No connection
24	NC	-	No connection
25	NC	-	No connection
26	NC	-	No connection
27	NC	-	No connection
28	NC	-	No connection

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Pin No.	Symbol	I/O	Function
29	NC	-	No connection
30	GND	P	Ground
31	NC	-	No connection
32	NC	-	No connection
33	GND	P	Ground
34	GND	P	Ground
35	NC	-	No connection
36	NC	-	No connection
37	NC	-	No connection
38	NC	-	No connection
39	LED A	P	Backlight Anode
40	LED K	P	Backlight Cathode

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7 Optical Characteristics

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (1).

Measuring equipment: BM-5A , BM-7

(Ta=25±2°C)

Item	Symbol	Condition	Min	Type	Max	Unit	Note	
Brightness	--	--	(400)	(500)	--	cd/m ²	(1),(2)	
Response time	T _R	θ=0°	--	10	15	ms	(1),(2)	
	T _F		--	15	20	ms		
Contrast ratio	CR	At optimized viewing angle	(250)	(350)	--	--	(1)	
Color Chromaticity	Red	R _X	θ=0° Normal Viewing Angle	(0.57)	(0.62)	(0.67)	--	(1)
		R _Y		(0.29)	(0.34)	(0.39)		
	Green	G _X		(0.29)	(0.34)	(0.39)	--	
		G _Y		(0.52)	(0.57)	(0.62)		
	Blue	B _X		(0.09)	(0.14)	(0.19)	--	
		B _Y		(0.05)	(0.10)	(0.15)		
	White	W _X		(0.27)	(0.32)	(0.37)	--	
		W _Y		(0.29)	(0.34)	(0.39)		
Viewing Angle (6H)	Hor.	θ _R	CR≥10	50	(65)	--	Degree	(1)
		θ _L		50	(65)	--		
	Ver.	φ _U		40	(50)	--		
		φ _D		50	(60)	--		

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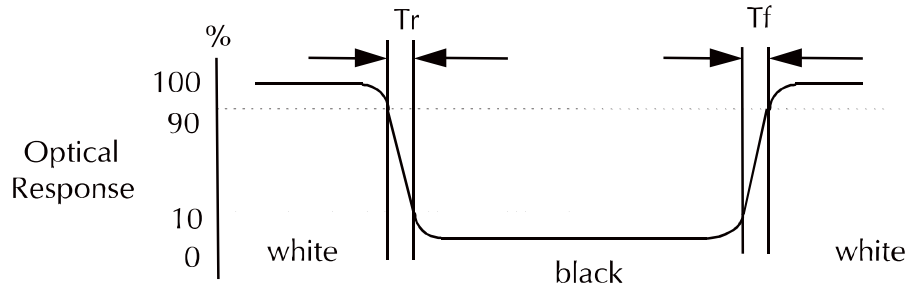
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a. Test equipment setup

After stabilizing and leaving the panel alone shall be warmed up for the stable operation of LCM, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7(fast) with a viewing angle of 2° at a distance of 50cm and normal direction.

b. Definition of response time: Tr and Tf

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



c. Definition of contrast ratio:

Brightness measured when LCD is at “white state”

$$\text{Contrast Ratio (CR)} = \frac{\text{Brightness measured when LCD is at “white state”}}{\text{Brightness measured when LCD is at “black state”}}$$

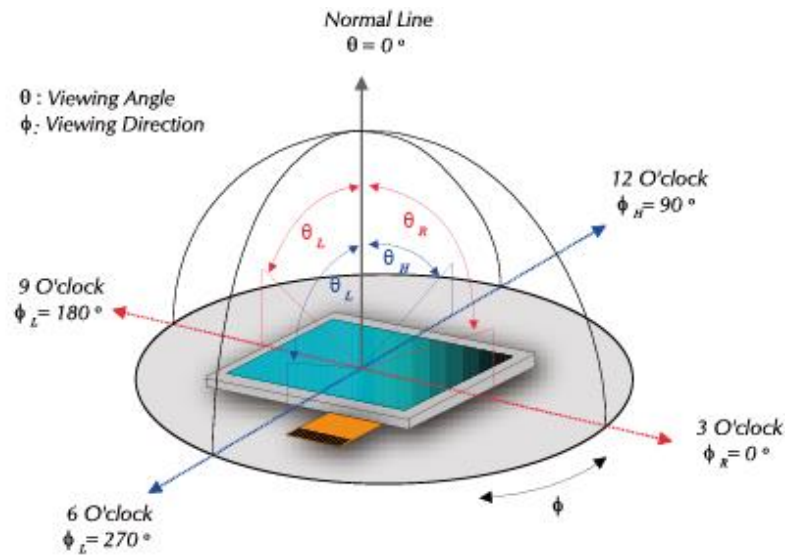
Brightness measured when LCD is at “black state”

d. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

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e. View Angle



f. Definition of Luminance of White: Luminance of white at the center points

Light Source of Back-Light Unit	LED Type
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g. Definition of White Uniformity

Min. luminance of white among 9-points

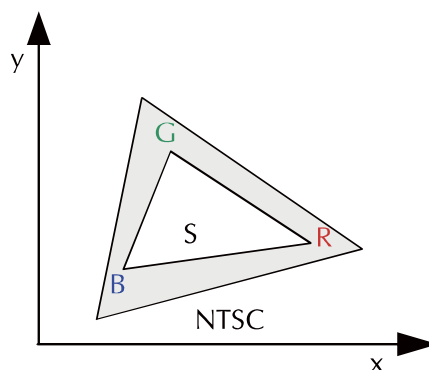
White Uniformity = _____

Max. luminance of white among 9-points

h. The definition of Color Gamut -Color Chromaticity CIE 1931

Color coordinate of white & red, green, blue at center point.

Color Gamut : NTSC(%) = (RGB Triangle Area / NTSC Triangle Area) x 100



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8 Basic Display Color and Gray Scale

Interface	Cycle	D[23]	D[22]	D[21]	D[20]	D[19]	D[18]	D[17]	D[16]	D[15]	D[14]	D[13]	D[12]	D[11]	D[10]	D[9]	D[8]	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]		
8 bits	1 st																		R7	R6	R5	R4	R3	R2	R1	R0	
	2 nd																			G7	G6	G5	G4	G3	G2	G1	G0
	3 rd																			B7	B6	B5	B4	B3	B2	B1	B0

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9 AC CHARACTERISTICS

9.1 Parallel 8080 Timing Characteristics

(Ta=25 ±2°C , VCC=3.3V)

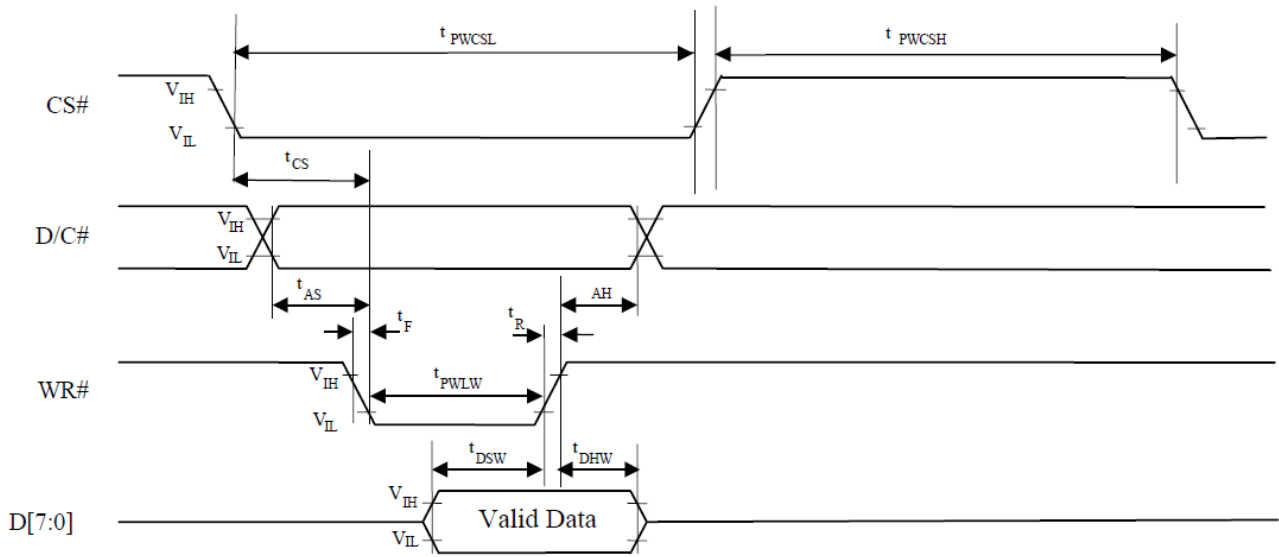
Item	Symbol	Min.	Typ.	Max.	Unit
System clock frequency *	fMCLK	1	-	110	MHz
System clock period	tMCLK	1/fMCLK	-	-	ns
Control pulse high width write	tPWCSH	13	1.5*tMCLK	-	ns
Control pulse high width read		30	3.5*tMCLK	-	ns
Control pulse low width write (next write cycle)	tPWCSL	13	1.5*tMCLK	-	ns
Control pulse low width write (next read cycle)		80	9*tMCLK	-	ns
Control pulse low width read		80	9*tMCLK	-	ns
Address setup time	tAS	1	-	-	ns
Address hold time	tAH	2	-	-	ns
Write data setup time	tDSW	4	-	-	ns
Write data hold time	tDHW	1	-	-	ns
Write low time	tPWLW	12	-	-	ns
Read data hold time	tDHR	1	-	-	ns
Read low time	tPWLR	36	-	-	ns
Data access time	tACC	32	-	-	ns
Rise time	tR	-	-	0.5	ns
Fall time	tF	-	-	0.5	ns
Chip select setup time	tCS	2	-	-	ns
Chip select hold time to read signal	tCSH	3	-	-	ns

* System Clock denotes external input clock (PLL-bypass) or internal generated clock (PLL-enabled)

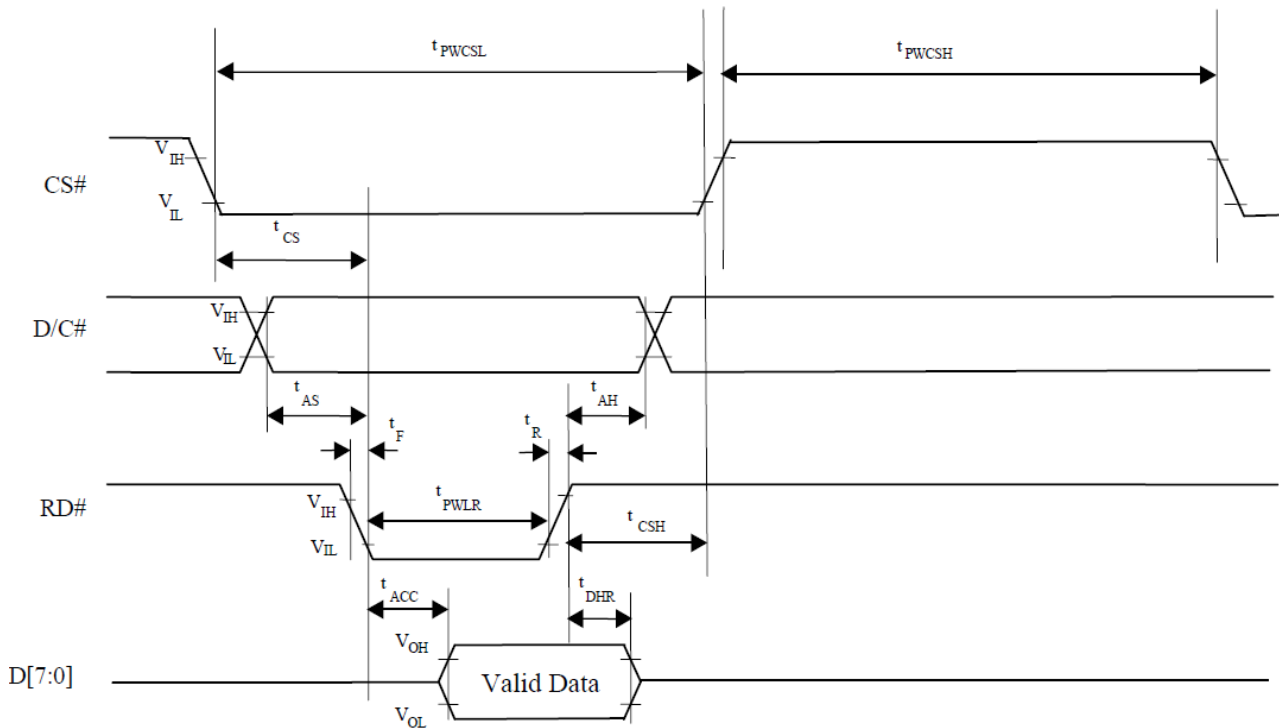
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Parallel 8080-series Interface Timing Diagram (Write Cycle)



Parallel 8080-series Interface Timing Diagram (Read Cycle)



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10 TEST

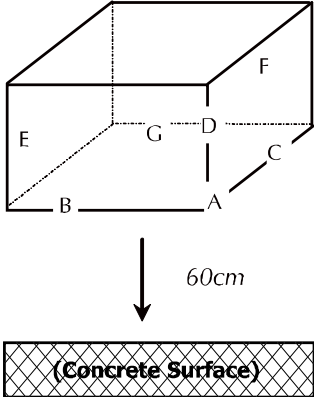
No change on display and in operation under the following test condition.

Condition: Unless otherwise specified, tests will be conducted under the following condition.

Temperature: 20±5°C.

Humidity: 65±5%RH.

Tests will be not conducted under functioning state.

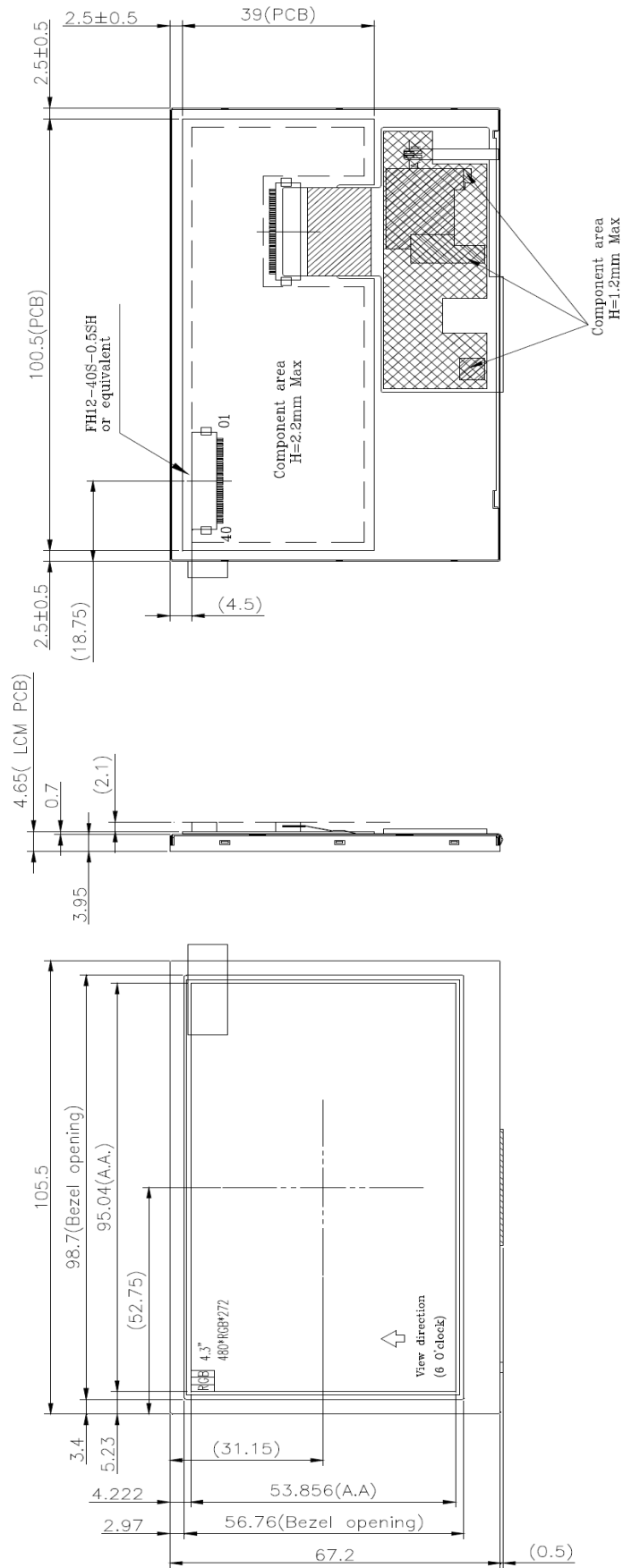
No.	Parameter	Condition	Notes
1	High Operating Temperature	70°C±2°C, 240hrs (Operation state).	
2	Low Operating Temperature	-20°C±2°C, 240hrs (Operation state).	1
3	High Storage Temperature	80°C±2°C, 240hrs.	2
4	Low Storage Temperature	-30°C±2°C, 240hrs.	1,2
5	High Temperature and High Humidity Operation Test	60°C±2°C, 90%, 240hrs	1,2
6	Vibration Test	Total fixed amplitude: 1.5mm. Vibration Frequency: 10~55Hz. One cycle 60 seconds to 3 direction of X, Y, Z each 15 minutes.	3
7.	Drop Test	<p>To be measured after dropping from 60cm high on the concrete surface in packing state.</p>  <p><i>Dropping method corner dropping:</i></p> <p><i>A corner: Once</i> <i>edge dropping.</i></p> <p><i>B, C, D edge: Once</i> <i>face dropping.</i></p> <p><i>E, F, G face: Once.</i></p>	

- Notes:
1. No dew condensation to be observed.
 2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.
 3. Vibration test will be conducted to the product itself without putting I in a container.

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11 Dimensional Outlines



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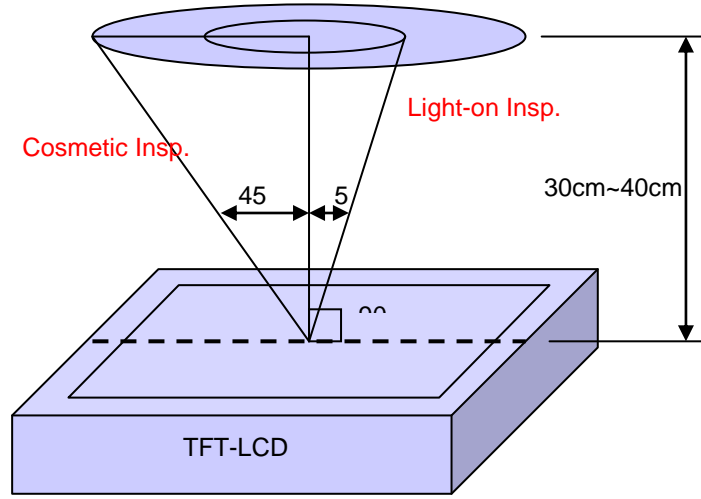
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12 Incoming Inspection Standards

12.1 Inspection and Environment Conditions

12.1.1 Inspection Conditions:

- (1) Inspection Distance: 35 cm±5cm
- (2) View Angle: Light-on Inspection Angle : ±5°
Cosmetic Inspection Angle : ±45°



(Perpendicular to LCD panel surface)

12.1.2 Environment Conditions:

Ambient Temperature		23°C±5°C
Ambient Humidity		55±10%RH
Ambient Illumination	Cosmetic Inspection	more than 600 Lux
	Functional Inspection	300~500 Lux

12.1.3 Sampling Conditions:

- (1) Lot Size: Quantity of shipment lot per model
- (2) Sampling Method:

Sampling Plan		MIL-STD-105E
		Normal Inspection, Single Sampling
		Level II
AQL	Major Defect	1.0%
	Minor Defect	1.5%

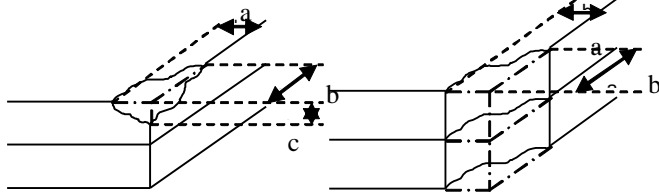
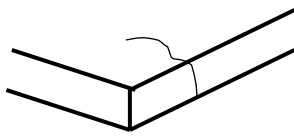
- (3) The classification of Major (MA) and Minor(MI) defects is shown as 3. Inspection Criteria.

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12.1.4 Inspection Criteria

12.1.4.1 Cosmetic Inspection (Panel):

Item	Judgment Criteria	Classification
Chipping on Panel	 <p>$a \leq 3.0\text{mm}$, $b \leq 3.0\text{mm}$, $c \leq t$ (Bottom glass thickness)</p>	MA
Scratch on Panel *Note-2	<p>$W \leq 0.05\text{mm}$ or $L < 5\text{mm}$: Ignored $0.05\text{mm} < W \leq 0.1\text{mm}$ and $L \leq 5\text{mm}$: $N \leq 5$ $W > 0.1\text{mm}$ or $L > 5\text{mm}$: Not allowed</p>	MI
Bubble or Dent on Panel *Note-3	<p>$D \leq 0.2\text{mm}$: Ignored $0.2\text{mm} < D \leq 0.3\text{mm}$: $N \leq 5$ $D > 0.3\text{mm}$: Not allowed</p>	MI
Panel Crack	 <p>Not Allowed crack</p>	MA
Bezel Deformation	Obvious deformation is not allowed.	MI
Bezel Oxidation	Not allowed if it rusts continuously over 1 cm (It is out of warranty with rusted tin plate)	MI
Bezel Scratch	$L \leq 20\text{mm}$, $W \leq 0.2$, $N \leq 3$	MI
Metal Squash Dent /Flange(Front Side)	$D(W) \leq 1, L \leq 3, N \leq 3;$	MI
B/L High Voltage Wire Denudation	Not allowed	MA
Polarizer flaw or leak out resin	Defect is defined as the active area.	MI
Outline Dimension	Must in Spec, refer to related product spec.	MI

12.1.4.2 Functional Inspection:

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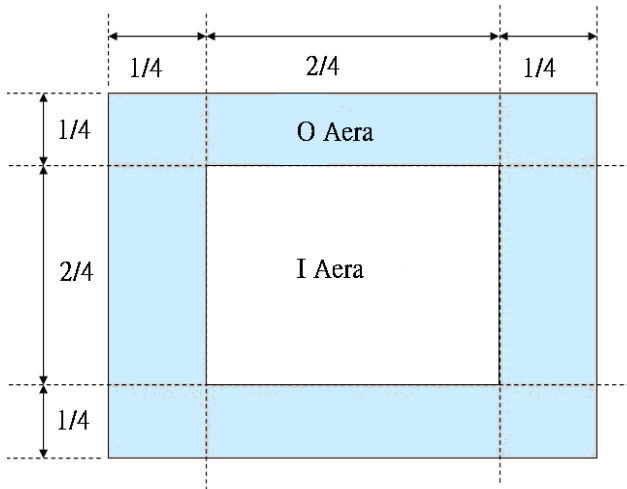
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Item	Judgment Criteria			Classification	
	Area(Note1)	I	O		
Point Defect	Bright dot	Random	2		MI
		2 dots adjacent	0	0	
		3 dots adjacent or more	0	0	
	Dark dot	Random	3		
		2 dots adjacent	0		
		3 dots adjacent or more	0	0	
	Total Dot Defect		5		
	Distance	Distance between Bright and Bright dot	$L \geq 5\text{mm}$		
		Distance between Bright and Dark dot	$L \geq 5\text{mm}$		
		Distance between Dark dot	$L \geq 5\text{mm}$		
(1) It is defined as Point Defect if defect area $> 0.5\text{dot}$ (2) It is ignored if defect area $\leq 0.5\text{dot}$ (3) Weak point defect will be defined as Bright Dot if it can be Observed through ND filter 5%(Full Screen Black Inspection)					
Line Defect	Obvious vertical or horizontal line defect is not allowed.			MA	
Mura	Not allowed if it can be observed through ND Filter 5 %			MI	
Foreign Material in spot shape *Note-3	$D \leq 0.2\text{mm}$: Ignored $0.2\text{mm} < D \leq 0.5\text{mm}$: $N \leq 8$ $D > 0.5\text{mm}$: Not allowed			MI	
Foreign Material in line or spiral shape *Note-4	$W \leq 0.05\text{mm}$ or $L \leq 5\text{mm}$: Ignored $0.05\text{mm} < W \leq 0.2\text{mm}$ and $L 1.0\text{mm} \leq 5\text{mm}$: $N \leq 8$ $W > 0.2\text{mm}$ or $L > 5\text{mm}$: Not allowed			MI	
Display Function Abnormal	No Malfunction can be allowed			MA	

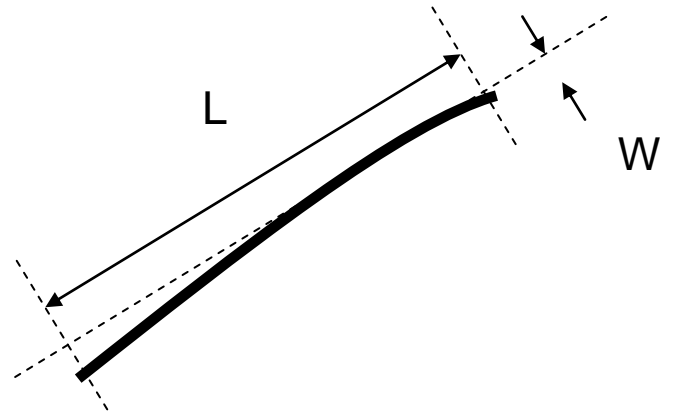
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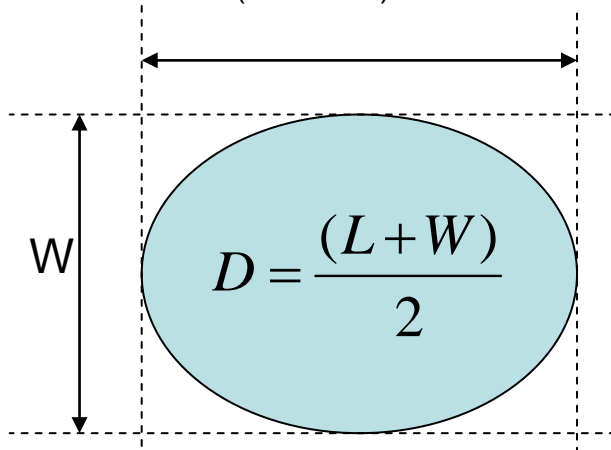
Note-1 : I/O Area Definition



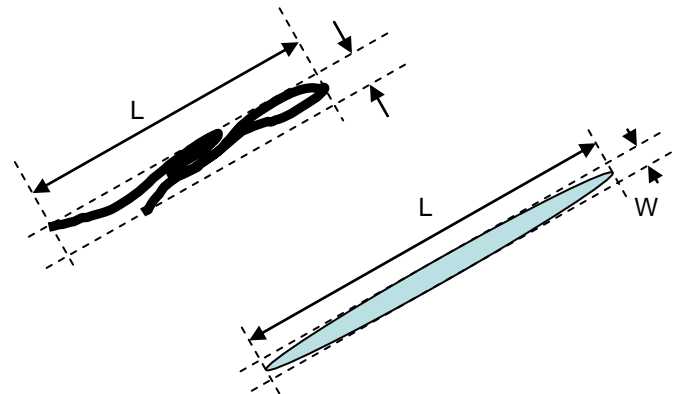
Note-2 : Polarizer Scratch



Note-3 : Spot Foreign Material
($W \geq L / 4$)



Note-4 : Line or Spiral Foreign Material
($W < L / 4$)



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