TFT LCD Approval Specification

MODEL NO.: Q05002-601

Customer : _____

Approved by : _____
Note :

紀錄	工作	審核	角色	投票
2009-06-10	Approval by Dept. Mgr.(QA RA)	Hsiao Chih-Hung	Department Manager (QA RA)	Accept
2009-06-10	Approval by Dept. Mgr.(PD)	Lifen Chou	Department Manager (PD)	Accept
2009-06-10	Approval by Dept. Mgr.(PM)	Jessie Chu	Department Manager (PM)	Accept

Contents

Record of Revision

Version	Date	Page	Section	Description
V1.0	2009/04/21	All	All	New Creation
V2.0	2009/06/10	15	11	Modify ESD condition
		16	12	Modify Outline Drawing
		17	13	Modify Packing Form

1. Summary

Q05002-602 is a transmissive type color active matrix liquid crystal display (LCD) which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT LCD panel, driver ICs, FPC. The following table described the features of Q05002-602.

2. Features

High Resolution: 1152,000 Dots (800 RGB x 480).
Application: Portable Navigation
PMP (Personal Multimedia Player), MP4 application product
DVB-S
GAMING

3. General Specifications

No.	Item	Specification	Unit
1	Screen Size	5.0(Diagonal)	inch
2	Display Resolution	800 RGB x 480	pixel
3	Dot Pitch	0.045(H) x 0.135(V)	mm
4	Pixel Pitch	0.135(H) x 0.135(V)	mm
5	Active Area	108(H) x64.8(V)	mm
6	Outline Dimension	114.8(H) x 73.2 (V) x 1.43(T)	mm
7	Pixel Configuration	RGB-Stripe	--
8	Color Depth	16.7M	colors
9	LCD Type	TN	--
10	Interface Type	TTL	--
11	View direction (Gray inversion)	6 o'clock	--
12	Weight	25.4	g

4. Absolute Maximum Rating

(Ta = 25 ± 2℃)

Item	Symbol	Values		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-30	80	℃	
Operation Temperature	T_{OP}	-20	70	℃	
Power Supply Voltage	VCC	-0.3	+7.0	V	
LED Reverse Voltage	VR	--	5	V	

Note: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above.

5. Electrical Characteristics

5-1. Operating Conditions:

(Ta = 25 ± 2℃)

Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	VCC	2.7	3.3	3.6	V	
Operating Current	I_{DD}	-	110	-	mA	
Frame Frequency	F_{Frame}	-	60	-	Hz	
Still Mode	P_{Still}	-	363	-	mW	
Standby Mode	$P_{Standby}$	-	-	3.6	uW	

6. DC Characteristics

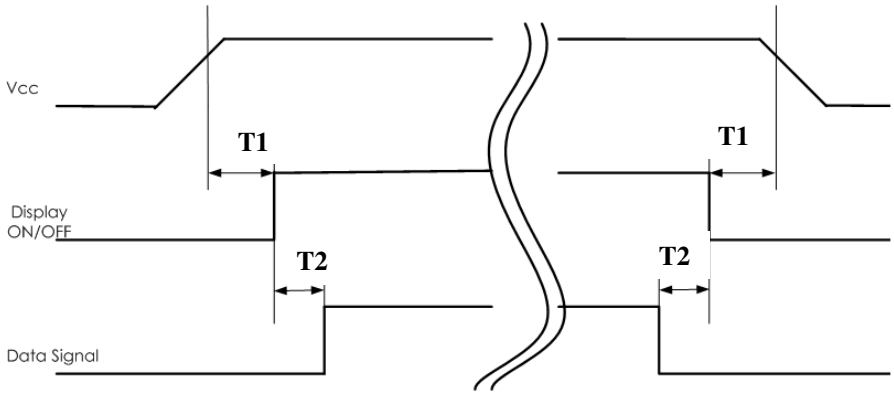
(Ta = 25 ± 2℃)

Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
Hight level input voltage	V_{IH}	0.7* VCC	-	VCC	V	
Low level input voltage	V_{IL}	0	-	0.3* VCC	V	
Hight level output voltage	V_{OH}	0.8*VCC	-	VCC	V	
Low level output voltage	V_{OL}	0	-	0.2*VCC	V	
I/O leakage current	I_{LI}	-1	-	+1	uA	

7. AC Characteristics

7-1. Power On/Off Sequence

The LCD panel power ON/OFF sequence is as below.



Parameter	Spec.			Unit
	Min	Typ	Max	
T1	1	-	-	ms
T2	10	-	-	frame

7-2. RGB Interface Characteristics

.Sync mode

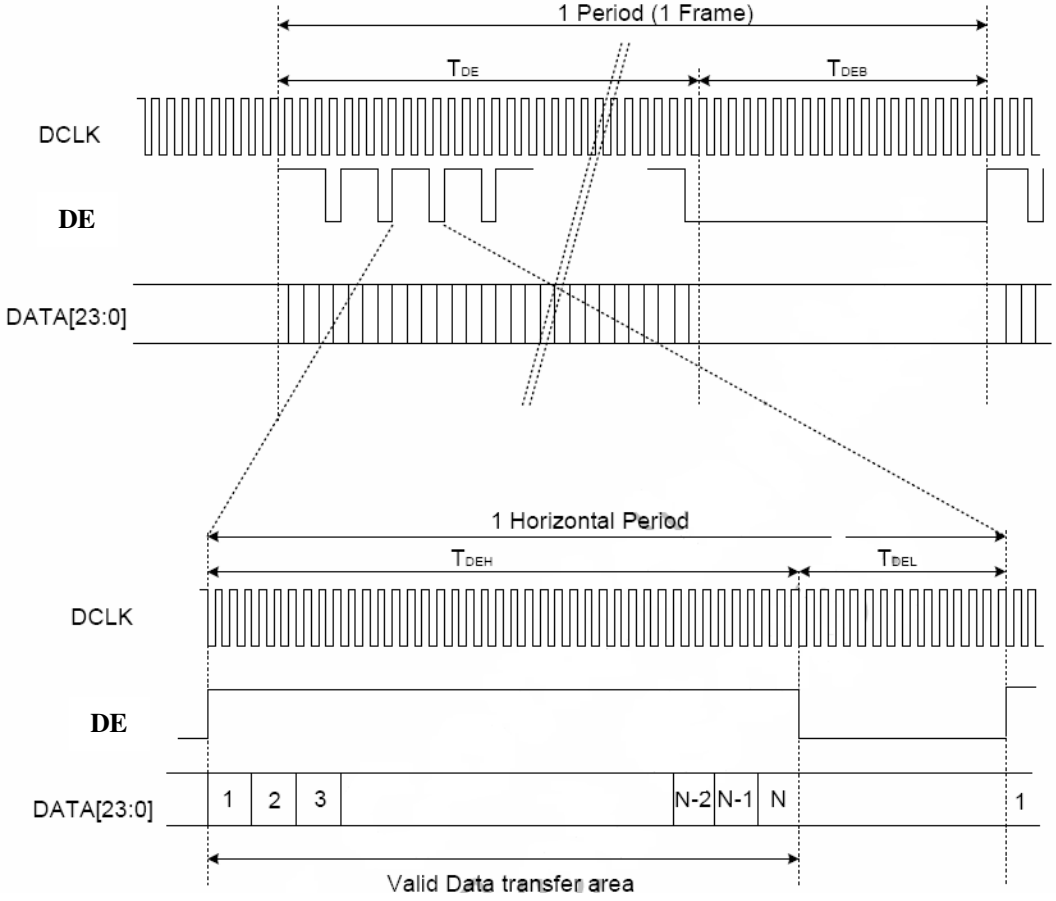
Signal	Item	Symbol	Min	Typ	Max	Unit	Note
DCLK	Frequency	F_{CPH}	-	33.26	-	MHZ	
	Period	T_{CPH}	-	30.06	-	ns	
	Pulse high duty	T_{CWH}	40	50	60	%	
	Pulse low duty	T_{CWL}	40	50	60	%	
Hsync	Period	T_H	-	1056	-	T_{CPH}	
	Pulse width	T_{WH}	1	128	-	T_{CPH}	
	First horizontal data time	T_{HS}	STHD[7:0]+88			T_{CPH}	Note1
	Active Time	T_{HA}	-	800	-	T_{CPH}	
Vsync	Period	T_V	-	525	-	T_H	
	Pulse Width	T_{WV}	1	2	-	T_H	
	DEN time	T_{VS}	STVD[7:0]+8			T_H	Note2
	Active Time	T_{VA}	-	480	-	T_H	
---	Vsync falling to Hsync falling time	T_{HV}	-4	-	4	TCPH	

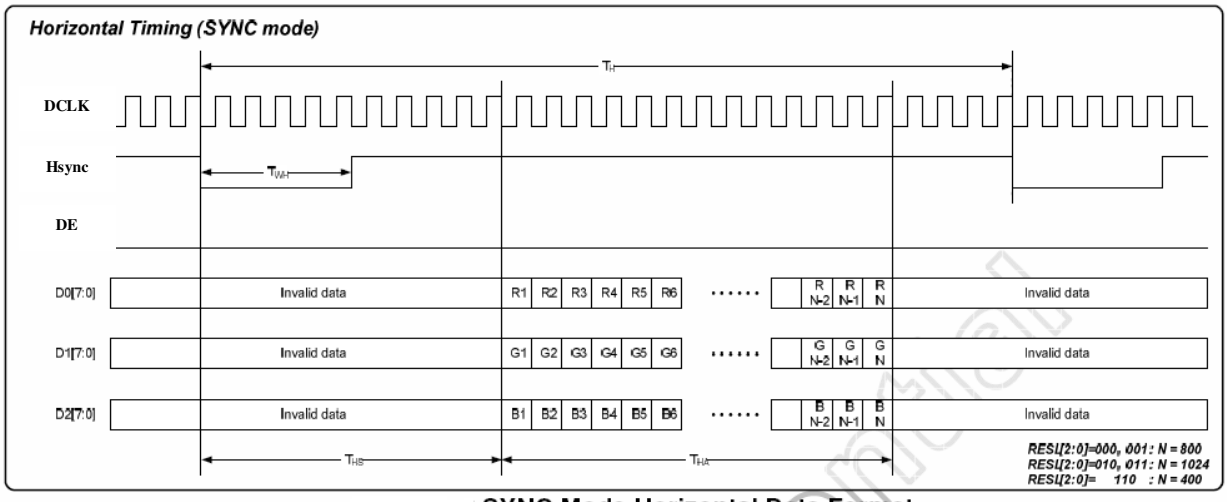
Note1: T_{HS+} $T_{HA<}$ T_H ,STHD[7:0] Default = 128.
Note2: STVD[7:0] Default = 27.

.DE mode

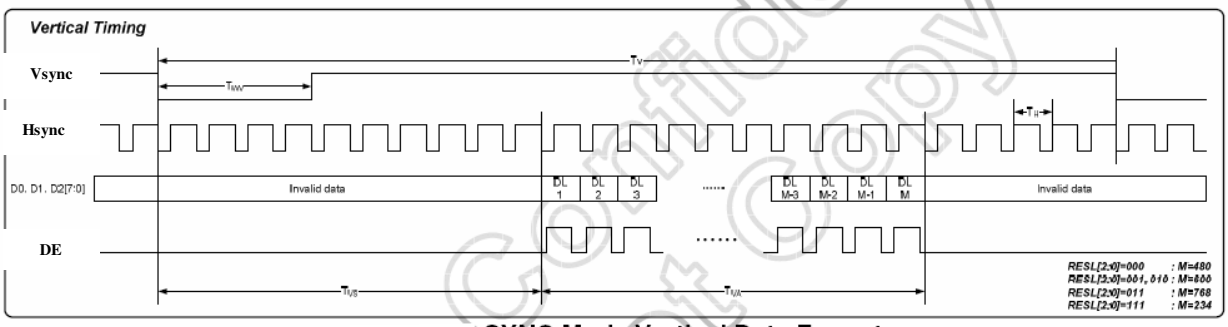
Signal	Item	Symbol	Min	Typ	Max	Unit	Note
DCLK	Frequency	F_{CPH}	-	33.26	-	MHZ	
	Period	T_{CPH}	-	30.06	-	ns	
	Pulse duty	T_{CWH}	40	50	60	%	
DE	Period	$T_{DEH}+T_{DEL}$	1000	1056	1200	T_{CPH}	
	Pulse width	T_{DH}	-	800	-	T_{CPH}	
	Frame blanking	T_{HS}	10	45	110	$T_{DEH}+T_{DEL}$	
	Frame width	T_{EP}	-	480	-	$T_{DEH}+T_{DEL}$	

AC Timing Diagrams

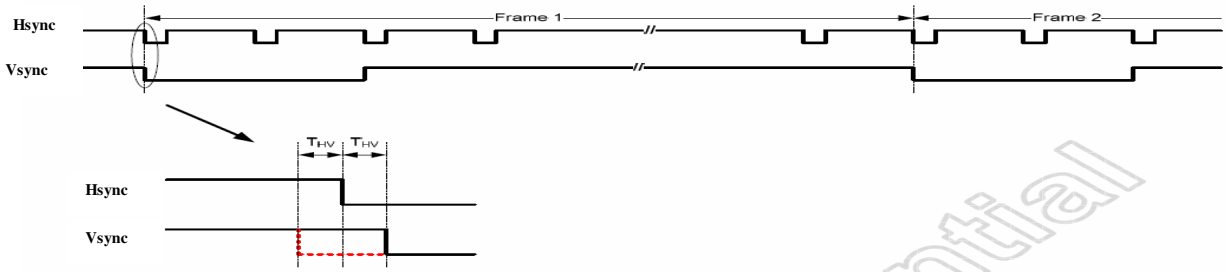


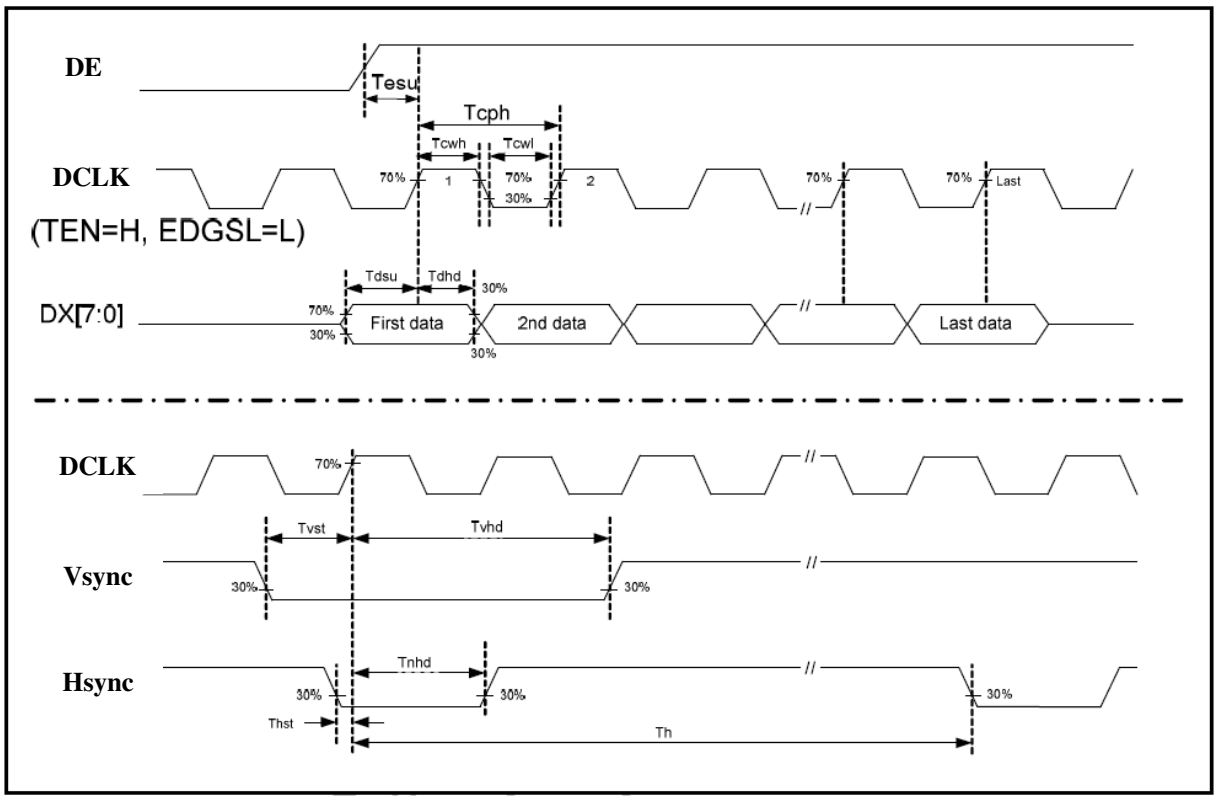


SYNC Mode Horizontal Data Format



SYNC Mode Vertical Data Format




DE
Tesu
Tcph
Tcwh
Tcwl
DCLK
(TEN=H, EDGSL=L)
70%
30%
1
2
Last
Tdsu
Tdhd
DX[7:0]
First data
2nd data
Last data
DCLK
Vsync
Tvst
Tvhd
Hsync
Tnhd
Thst
Th

8. Optical Characteristics (Light Source : CHE Backlight, For reference only)

(Ta = 25 ± 2℃)

Item		Symbol	Conditions	Specifications			Unit	Note
				Min.	Typ.	Max.		
Transmittance		T%	Viewing normal angle θ= 0° Φ= 0° B/L On	-	5	-	%	(1)
Contrast Ratio		CR		350	400	-	--	(3)(5)(6)
Brightness		B		300	350		cd/m^2	
Response time		T_r			15	30	ms	(4)
		T_f			35	50	ms	
Chromaticity	Red	Rx		(0.57)	(0.61)	(0.65)	--	(3)(6)(7)
		Ry		(0.31)	(0.35)	(0.39)	--	
	Green	Gx		(0.29)	(0.33)	(0.37)	--	
		Gy		(0.51)	(0.55)	(0.59)	--	
	Blue	Bx		(0.11)	(0.15)	(0.19)	--	
		By		(0.07)	(0.11)	(0.15)	--	
	White	Wx		(0.26)	(0.31)	(0.36)	--	
		Wy		(0.28)	(0.33)	(0.38)	--	
Viewing Angle	Hor.	θ_L	CR≧10 B/L On	60	70	-	deg.	(2)
		θ_R		60	70	-		
	Ver.	Φ_T		50	60	-		
		Φ_B		60	70	-		
NTSC		--	--	-	50	-	%	

Note:
(1) Transmittance is base on CHE Backlight and normal polarizer.
Brightness =7200nit(min), Wx= 0.30(typ) , Wy=0.32(typ)
(2) Definition of viewing angle range

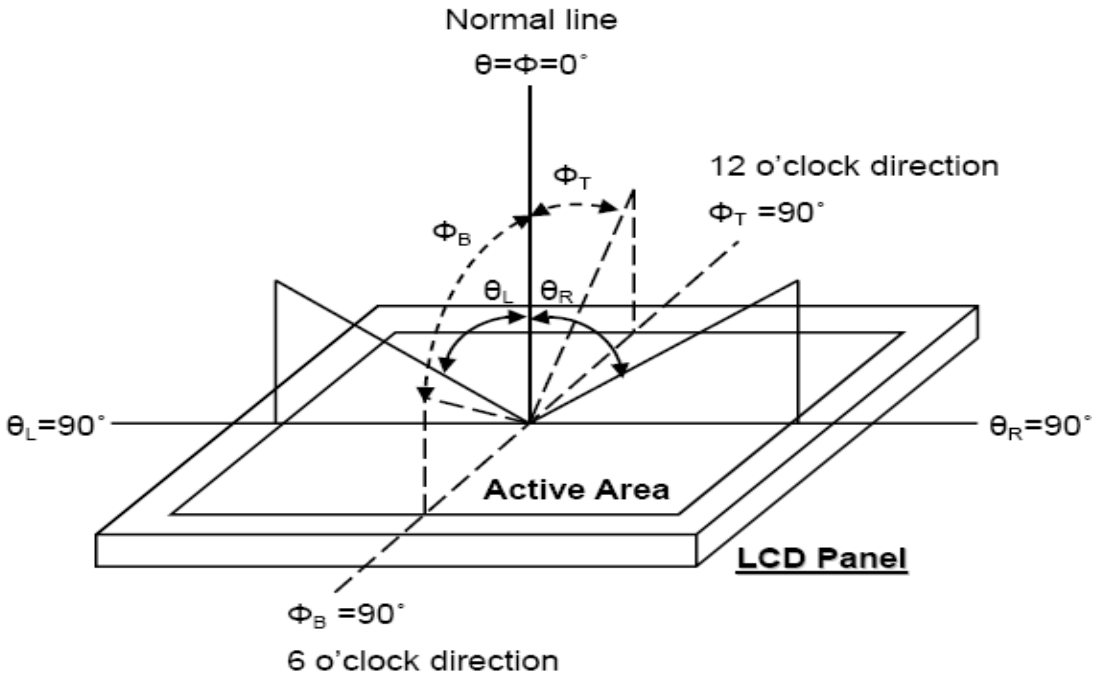


Fig. 8-2 Definition of viewing angle

(3) Test equipment setup:
After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

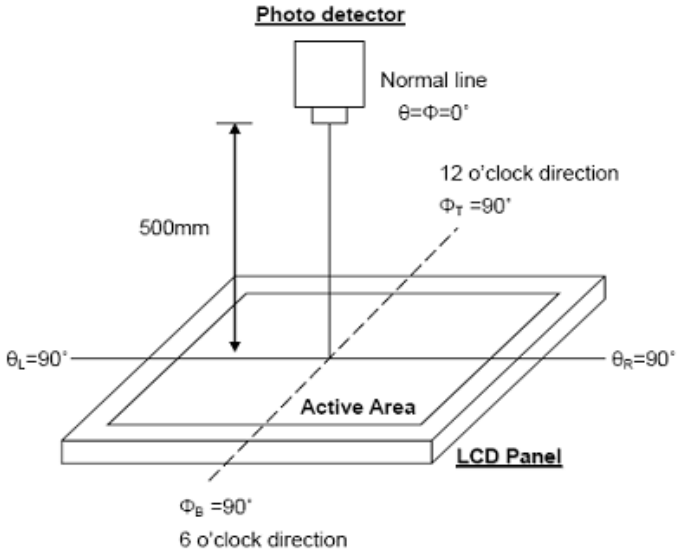


Fig. 8-3 Optical measurement system setup

(4) Definition of Response time:
The response time is defined as the LCD optical switching time interval between "White" state and"Black" state. Rise time, Tr, is the time between photo detector output intensity changed from 90% to 10% . And fall time, Tf, is the time between photo detector output intensity changed from10% to 90% .

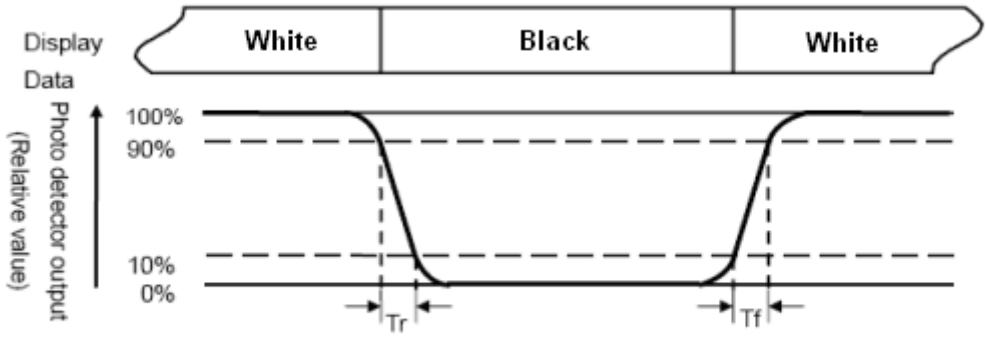


Fig. 8-4 Definition of response time

(5) Definition of contrast ratio:
The contrast ratio is defined as the following expression.

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

(6) Definition of color chromaticity (CIE 1931)
Color coordinates measured at the center point of LCD

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

9. Interface Pin Connection

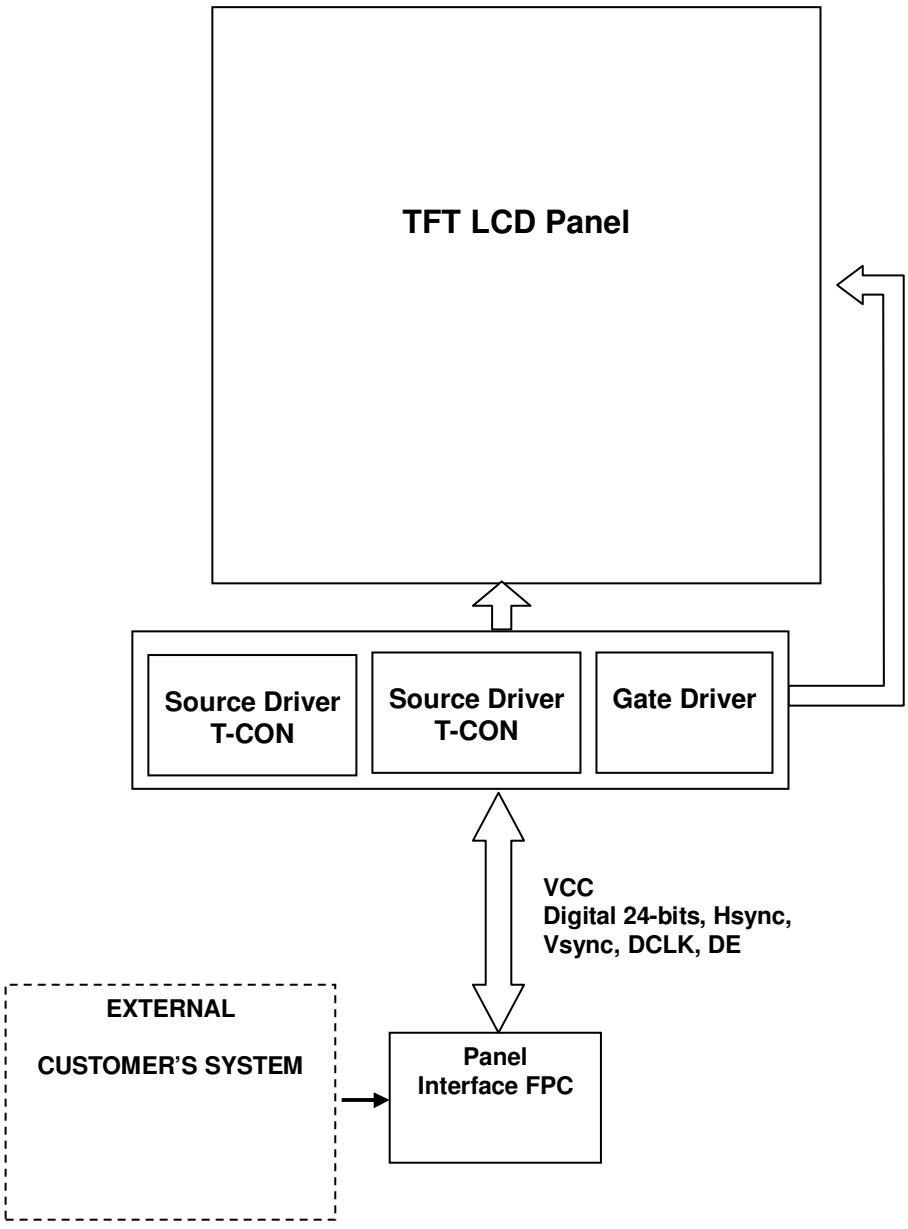
Pin	Symbol	I/O	Function	Note
1	VLED-	I	LED Ground	
2	VLED+	I	LED Power	
3	DGND	I	Digital Ground	
4	VCC	I	Power Supply (+3.3 V)	
5	R0	I	Red Data Bit0	
6	R1	I	Red Data Bit1	
7	R2	I	Red Data Bit2	
8	R3	I	Red Data Bit3	
9	R4	I	Red Data Bit4	
10	R5	I	Red Data Bit5	
11	R6	I	Red Data Bit6	
12	R7	I	Red Data Bit7	
13	G0	I	Green Data Bit0	
14	G1	I	Green Data Bit1	
15	G2	I	Green Data Bit2	
16	G3	I	Green Data Bit3	
17	G4	I	Green Data Bit4	
18	G5	I	Green Data Bit5	
19	G6	I	Green Data Bit6	
20	G7	I	Green Data Bit7	
21	B0	I	Blue Data Bit0	
22	B1	I	Blue Data Bit1	
23	B2	I	Blue Data Bit2	
24	B3	I	Blue Data Bit3	
25	B4	I	Blue Data Bit4	
26	B5	I	Blue Data Bit5	
27	B6	I	Blue Data Bit6	
28	B7	I	Blue Data Bit7	
29	DGND	I	Digital Ground	
30	DCLK	I	Dot Data Clock	
31	STB	I	Standby mode	
32	Hsync	I	Horizontal Sync Input	
33	Vsync	I	Vertical Sync Input	

34	DE	I	Data Enable Control	(1)
35	N.C		N.C	
36	DGND	I	Digital Ground	
37	N.C		N.C	
38	N.C		N.C	
39	N.C		N.C	
40	N.C		N.C	

Note:

(1): DE=" H ": data can be access, DE=" L ": data cannot be access

10. Block Diagram

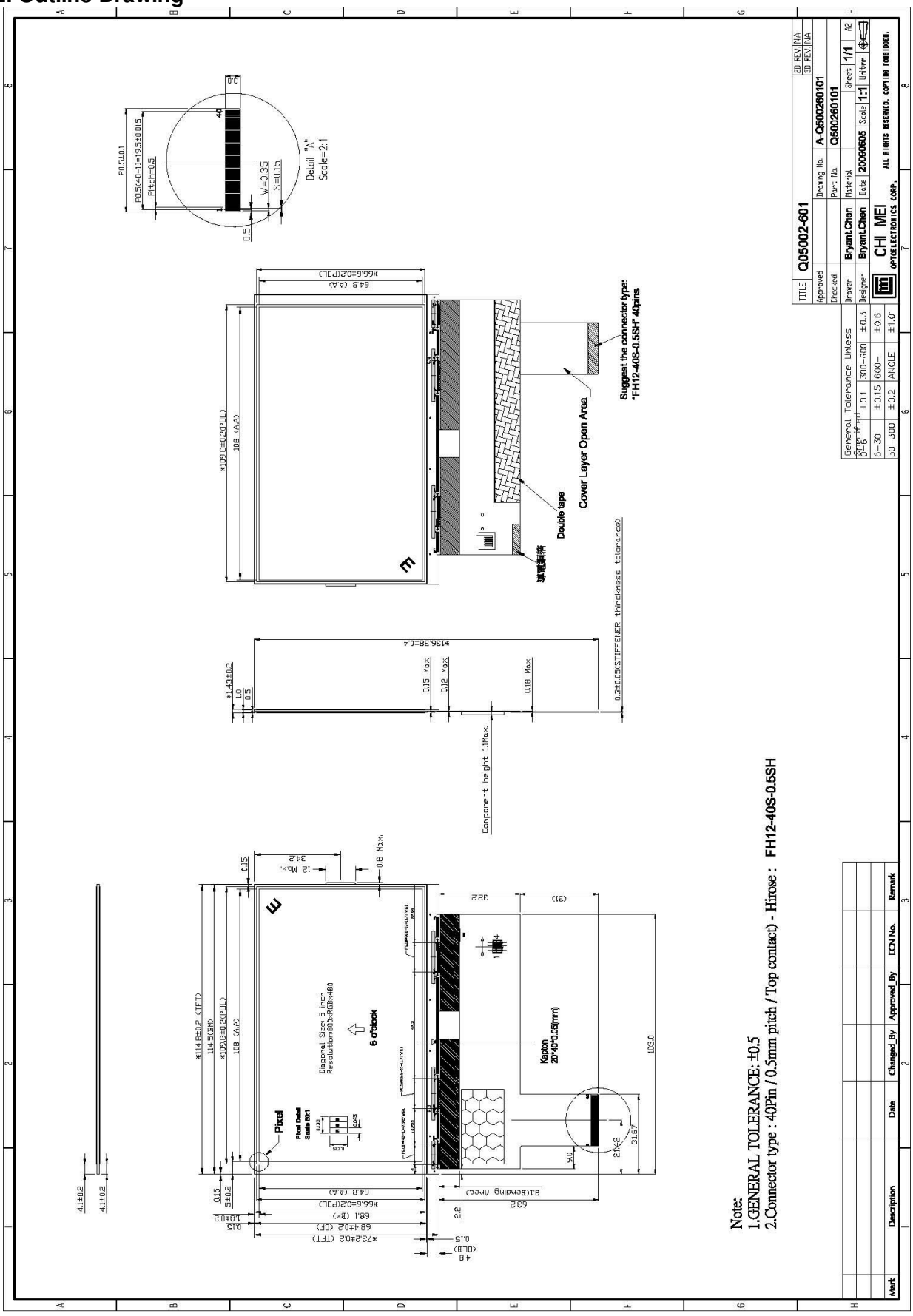


11. Quality Assurance

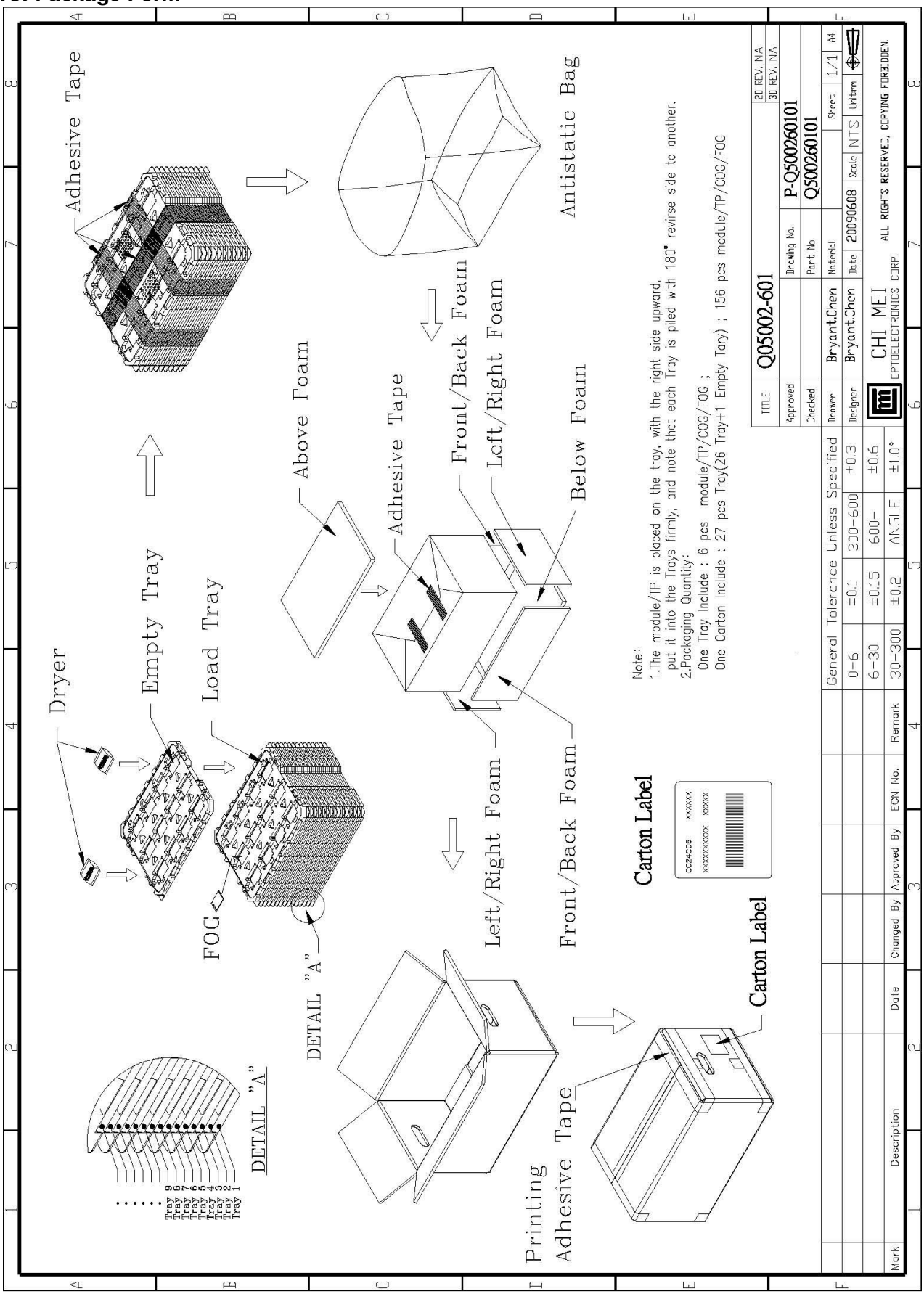
No.	Test Items	Test Condition	Note
1	High Temperature Storage Test	Ta=80℃ Dry 240h	
2	Low Temperature Storage Test	Ta=-30℃ Dry 240h	
3	High Temperature Operation Test	Ta=70℃ Dry 240h	
4	Low Temperature Operation Test	Ta=-20℃ Dry 240h	
5	High Temperature and High Humidity Operation Test	Ta=60℃ 90%RH 240h	
6	Electro Static Discharge Test	FPC Pin 200pF / 0Ω , Continual Contact (Non-operation), ±200V	
9	Thermal Shock Test	-30℃(0.5Hr) ~ +80℃(0.5Hr) for 100 cycles	

Note1: In the standard conditions, there is no display function NG issue occurred.
Note2: All the cosmetic specifications are judged before the reliability stress.

12. Outline Drawing



13. Package Form



14. Precautions

Please pay attention to the following when you use this TFT LCD module.

14-1. Mounting Precautions

(1) You must mount a module using arranged in four corners or four sides.
(2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module.
And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
(3) Please attach a transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to the resist external force.
(4) You should adopt radiation structure to satisfy the temperature specification.
(5) Acetic acid type and chlorine type materials for the cover case are not describe because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
(6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are determined to the polarizer)
(7) When the surface becomes dusty, please wipe gently with adsorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
(8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
(9) Do not open the case because inside circuits do not have sufficient strength.

14-2. Operating Precautions

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage：V=±200mV(Over and under shoot voltage)
(2) Response time depends on the temperature. (In lower temperature, it becomes longer.)
(3) Brightness depends on the temperature. (In lower temperature, it becomes lower)
And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.
(4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
(6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

14-3. Electrostatic Discharge Control

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wristband etc. And don't touch interface pin directly.

14-4. Precautions for Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

14-5. Storage

When storing modules as spares for a long time, the following precautions are necessary.

(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5℃ and 35℃ at normal humidity.

(2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

14-6. Handling Precaution for Protection Film

(1) When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.

(2) The protection film is attached to the polarizer with a small amount of glue. Is apt to remain on the polarizer. Please carefully peel off the protection film without rubbing it against the polarizer.

(3) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.

(4) You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.