DEVETECH ELECTRONICS CO. LTD

TFT-LCD MODULE
CUSTOMER: DACHS ELECTRONICA
P/N: DVD70050LY57-27-RTP2

DESIGNED BY	
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CONTENTS		
Nº	Contents	Page
-	Cover	1
-	Contents	2
-	Document Revision History	3
1	General description	4
2	Outline dimension	4
3	Electrical characteristics	6
4	Block diagram	8
5	TFT-LCM Interface specification	8
6	Description of interface signal	9
7	Optical specifications	13
8	Environment absolute maximum ratings	15
9	Reliability test items	16
10	Package	16
11	Precautions	17
12	Incoming inspection standard	18

Document Revision History				
Change No.	**Date**	**Subject and Reason**	**Version No.**	**Responser**
	2017-3-2	First version	A	

1. General description

DVD70050LY57-27-RTP2 is a transmissive type a-Si TFT-LCD (amorphous silicon thin film transistor liquid crystal display) module, which is composed of a TFT-LCD panel, a driver circuit a backlight unit. The panel size is 7.0 inch and the resolution is 480x800. High image quality a-Si TFT LCD module. Partial-screen display function is available. Sleep and Stand-by modes are available for power saving.

1.1 Features

No	Item	Specification	Remark
1	Display mode	Normally white	
2	Screen size	7.0 inch (diagonal)	
3	Resolution	480xRGBx800	
4	Color number	262K	
5	Color arrangement	TFT active matrix	
6	Driver IC	EK9713B+EK73002A	
7	Backlight	White LED 3*9	
8	Viewing direction	12 o'clock	
9	Interface	TTL	
10	Surface treatment	UV cut	
11	Touch panel	With touch	

1.2. Application

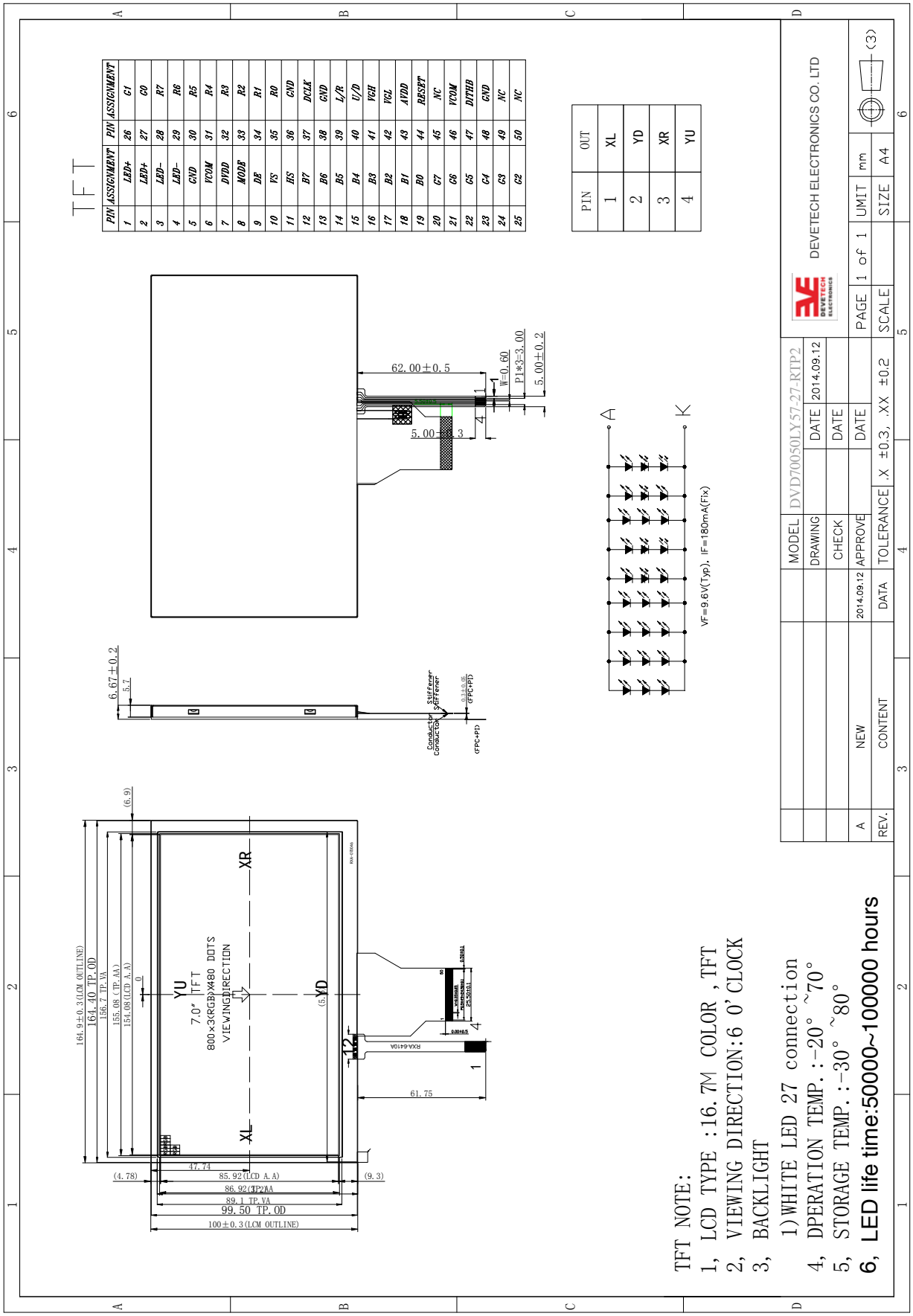
*Car device
*Pad

2. Outline dimension

The mechanical detail is shown in Fig.1 and summarized in Table 1 below.

Parameter	Specifications	Unit
Outline dimensions	164.9(W)x100(H)x6.67(D) (LCD, not include FPC)	mm
Active area	154.08(W)x85.92(H)	mm
Resolution	480(H)RGBx800(V) dots	-
Dot size	0.0642(H)x0.0642(V)	mm

Figure 1: Module specification of the module



3. Electrical characteristics

3.1 TFT-LCD Module

Absolute maximum ratings Ta=25ºC

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Power supply voltage	DVDD	-0.3	5.0	V	
	AVDD	6.5	13.5	V	
	VGH	-0.3	40.0	V	
	VGL	-20.0	0.3	V	
	VGH-VGL	-	40.0	V	
Operation temperature	TOP	-20	70	ºC	
Storage temperature	TST	-30	80	ºC	

Note1: The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum rating exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

Typical operation conditions

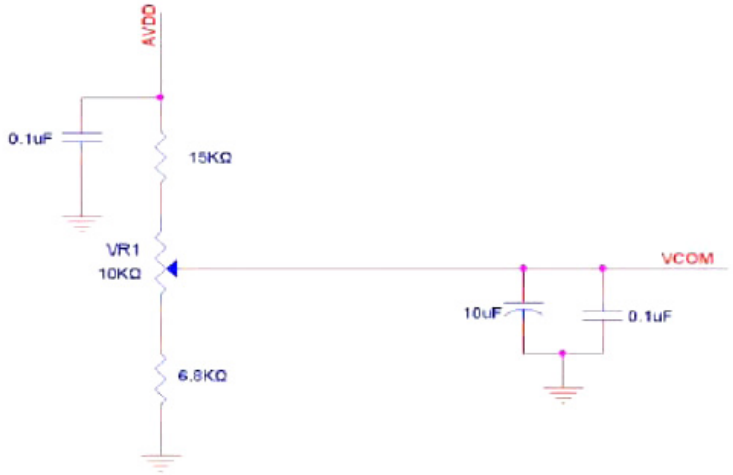
Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max		
Power voltage	DVDD	3.0	3.3	3.6	V	Note2
	AVDD	10.2	10.4	10.6	V	
	VGH	15.3	16.0	16.7	V	
	VGL	-7.7	-7.0	-6.3	V	
Input signal voltage	VCDM	2.8	(3.8)	4.8	V	Note4
Input logic high voltage	VIH	0.7 DVDD	-	DVDD	V	Note3
Input logic low voltage	VIL	0	-	0.3DVDD	V	

Note1: Be sure to apply DVDD and VGL to the LCD first, and then apply VGH.

Note2: DVDD setting should match the signals output voltage (refer to Note3) of customer's system board.

Note3: DCLK, HS, VS, RESET, U/D, L/R, DE, R0~R7, G0~G7, B0~B7, MODE, DITHB.

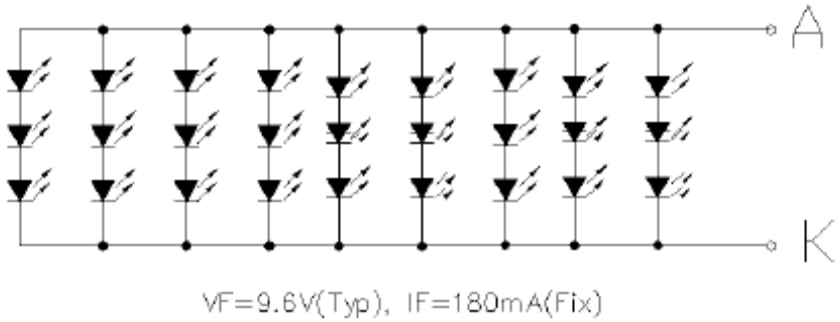
Note4: Typical VCOM is only a reference value. It must be optimized according to each LCM. Please use VR and base on below application circuit.



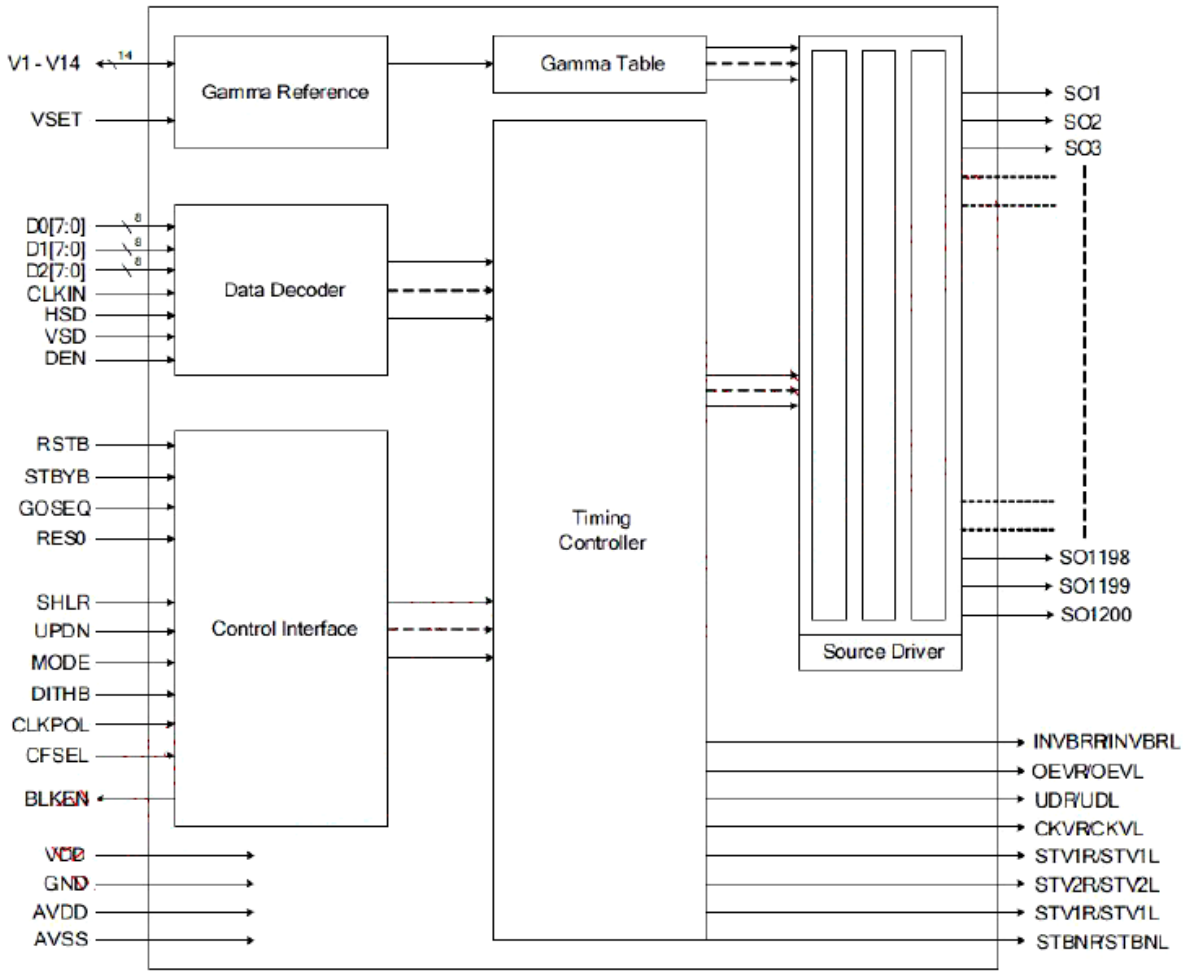
3.2 Back-light unit

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Current	IF	--	20	25	mA	IF=180mA VF=9.6V
Forward voltage	VF	9	9.6	9.9	V	
Chroma	X	0.250		0.30		
	Y	0.250		0.30		
Brightness	L	400			Cd/m2	
Uniformity	UBL	80			%	

*27 LED's used
*The luminous intensity of LED is strongly dependent on the driving current.
*It is recommended the input of backlight to be constant current rather than constant voltage.



4. Block diagram

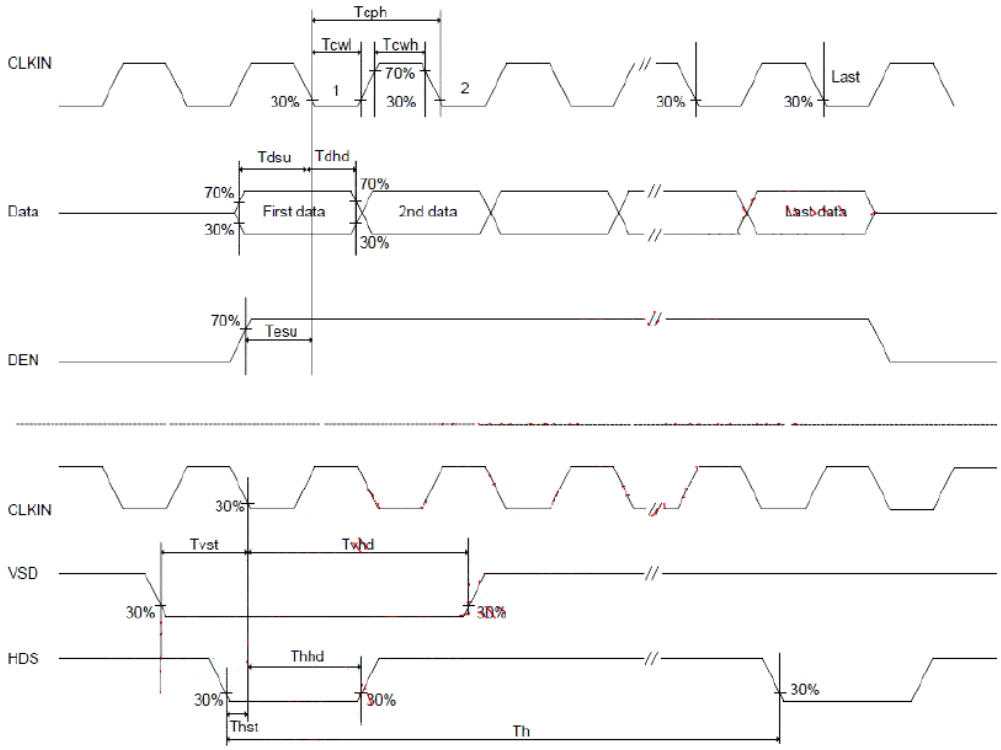


5. TFT-LCM Interface specification

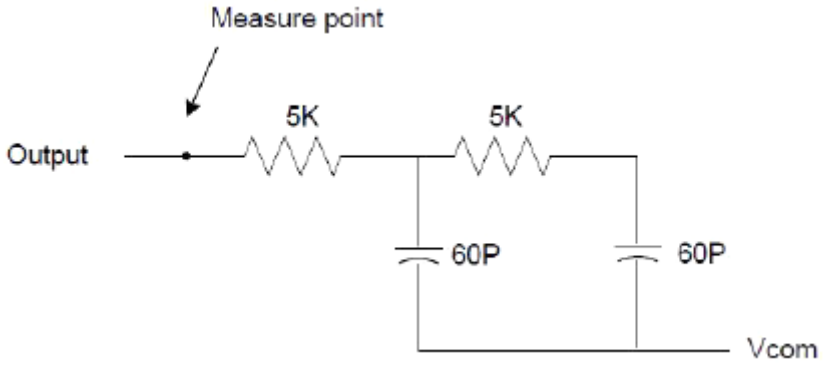
Pin No.	Symbol	Function
1, 2	VLED+	Power for LED backlight (Anode)
3, 4	VLED-	Power for LED backlight (Cathode)
5	GND	Power ground
6	VCOM	Common voltage
7	DVDD	Digital power
8	MODE	DE/SYNC mode select. Normally pull high H: DE mode. L: HSD/VSD mode
9	DE	Data Enable signal
10	VSD	Vertical sync input. Negative polarity
11	HSD	Horizontal sync input. Negative polarity
12-19	B7-R0	Blue data
20-27	G7-G0	Green data
28-35	R7-R0	Red data
36	GND	Ground

37	DCLK	Clock signal
38	GND	Display on/off
39	SHLR	Left or right display control
40	UPND	Up/Down display control
41	VDDG	Positive power for TFT
42	VEEG	Negative power for TFT
43	AVDD	Analog power
44	RSTB	Global reset pin. Active low to enter reset stage. Suggest to connecting with an RC reset circuit for stability. Normally pull high. (R=10KΩ. C=1Mf)
45	NC	Not connect
46	VCOM	Common voltage
47	DITH	Dithering setting DITH=”H” 6bit resolution (last 2 bit of input data truncated) DITH=”L” 8bit resolution (default setting)
48	GND	Power ground
49	NC	Not connect
50	NC	Not connect

6. Description of interface signal



Input clock and data timing diagram



Output load condition

AC Characteristics

(TA=-20 TO 85ºC, VDD=3.0 to 3.6V, AVDD=6.5 to 13.5V, GND=AVSS=OV)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
VDD power on slew rate	TPOR	From 0V to 90%VDD	-	-	20	ms
RSTB pulse width	TRST	CLKIN=40MHz	1	-	-	ms
CLKIN cycle time	Tcph	-	20	-	-	ns
CLKIN pulse duty	Tcwh	-	40	50	60	%
VSD setup time	Tvst	-	8	-	-	ns
VSD hold time	Tvhd	-	8	-	-	ns
HSD setup time	Thst	-	8	-	-	ns
HSD hold time	Thhd	-	8	-	-	ns
Data setup time	Tdsu	D0[7:0],D1[7:0],D2[7:0] to CLKIN	8	-	-	ns
Data hold time	Tdhd	D0[7:0],D1[7:0],D2[7:0] to CLKIN	8	-	-	ns
DEN setup time	Tesu	-	8	-	-	ns
DEN hold time	Tehd	-	8	-	-	ns
Output stable time	Tsst	10% to 90% target voltage. CL=120pF, R=10K ohm	-	-	6	us

Timing table

Parallel 24-bit RGB Mode

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
CLKIN Frequency	Fckl	VDD=3.0V~3.6V	-	33.3	50	MHz
CLKIN cycle time	Tckl	-	20	30	-	ns
CLKIN pulse duty	Tcwh	Tckl=Tcwh+cwl	40	50	60	%
	Tcwl		40	50	-60	%
VSD to STV	Tstv	HV mode	-	24	-	H
DEN to STV	Tstv	DE mode	-	4	-	CLKIN
STV pulse width	Twstv	-	-	0.5	-	H
STV to CKV	Tckv	-	-	18	-	CLKIN
STV to OEV	Toev	-	-	2	-	CLKIN
CKV pulse width	Twckv	-	-	66	-	CLKIN
OEV pulse width	Twoev	-	-	50	-	CLKIN

DC Characteristics

(TA=-20 TO 85ºC, VDD=3.0 to 3.6V, AVDD=6.5 to 13.5V, GND=AVSS=OV)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Low level input voltage	Vil	For the digital circuit	0	-	0.3xVDD	V
High level input voltage	Vih	For the digital circuit	0.7xVDD	-	VDD	V
Input leakage current	li	For the digital circuit	-	-	±1	µA
High level output voltage	Voh	Ioh=-400µA	VDD-0.4	-	-	V
Low level output voltage	Vol	Iol=+400 µA	-	-	GND+0.4	V
Pull low/high resistor	Ri	For the digital input pin @ VDD=3.3V	150K	250K	350K	ohm
Digital operation current	Idd	Fclk=40 MHz FLD=37,88KHz, VDD=3.3V	-	8	10	mA
Digital stand-by current	Ist1	Clock and all functions are stopped	-	10	50	µA
Analog operating current	Idda	No load, Fckl=40 MHz FLD=37,88KHz, @ AVDD=10V, V1=8V, V14=0.4V	-	10	12	mA
Analog stand-by current	Ist2	No load. Clock and all functions are stopped	-	10	50	µA

Input level of V1~V7	Vref1	Gamma correction voltage input	0.4*AVDD	-	AVDD-0.01	V
Input level of V8~V14	Vref2	Gamma correction voltage input	0.1	-	0.06*AVDD	V
Output voltage deviation	Vod1	Vo=AVSS+0.1V~AVSS+0.5V and Vo=AVDD-0.5V~AVDD-0.1V	-	±20	±35	mV
Output voltage deviation	Vod2	Vo=AVSS+0.5V~AVDD-0.5V	-	±15	±20	mV
Output voltage offset between chips	Voc	Vo=AVSS+0.5V~AVDD-0.5V	-	-	±20	mV
Dynamic range of output	Vdr	SO1~SO1200	0.1	-	AVDD-0.1	V
Sinking current of outputs	IOLy	SO1~SO1200; Vo=0.1V v.s1.0V, AVDD=013.5V	80	-	-	uA
Driving current of outputs	IOHy	SO1~SO1200; Vo=13.4V v.s12.5V, AVDD=013.5V	80	-	-	uA
Resistance of Gamma table	Rg	Rn: Internal gamma resistor	0.7*Rn	1.0*Rn	1.3*Rn	ohm

Power On/Off sequence

In order to prevent IC from power on reset fail, the rising time (TPOR) of the digital power supply VDD should be maintained within the given specifications. Refer to "AC characteristics" for more detail on timing.
This is another paragraph of sub-function description.

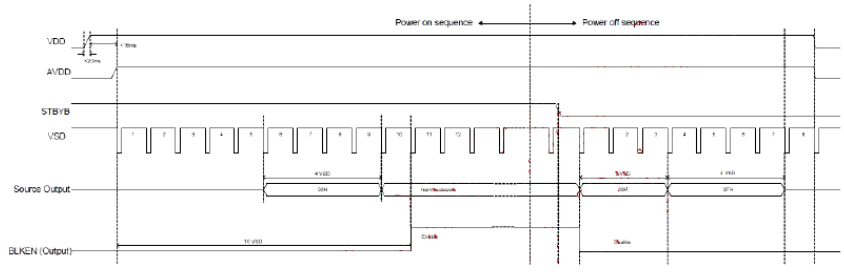


Figure 4. Power-On/Off Timing Sequence

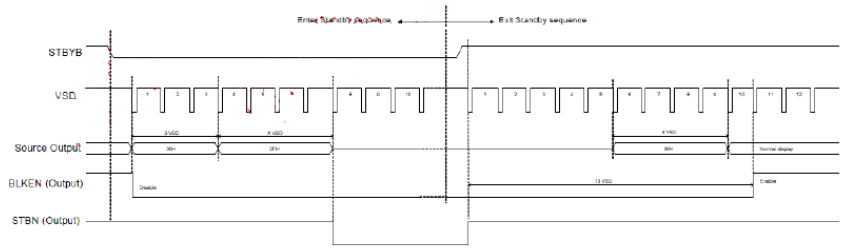


Figure5. Enter and exit standby mode sequence

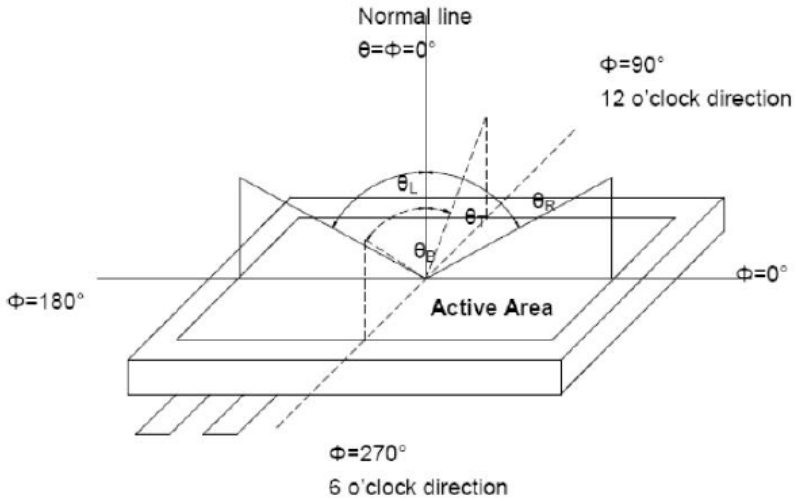
7. Optical specification

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR≥10)	θ_L	Φ=180º(9 o'clock)	60	70	-	Degree	Note1
	θ_R	Φ=0º(3 o'clock)	60	70	-		
	θ_T	Φ=90º(12 o'clock)	40	50	-		
	θ_B	Φ=270º(6 o'clock)	60	70	-		
Response Time	TON	Normal θ = Φ= 0º	-	10	20	msec	Note 3
	TOFF			15	30	msec	Note3
Contrast	CR		400	500	-	-	Note4
Color chromaticity (CF only, Base on C light)	WX		0.278	0.308	0.338	-	Note5
	WY		0.297	0.327	0.357	-	
Transmittance	Tr	-	-	5.11	-	%	

Test conditions:

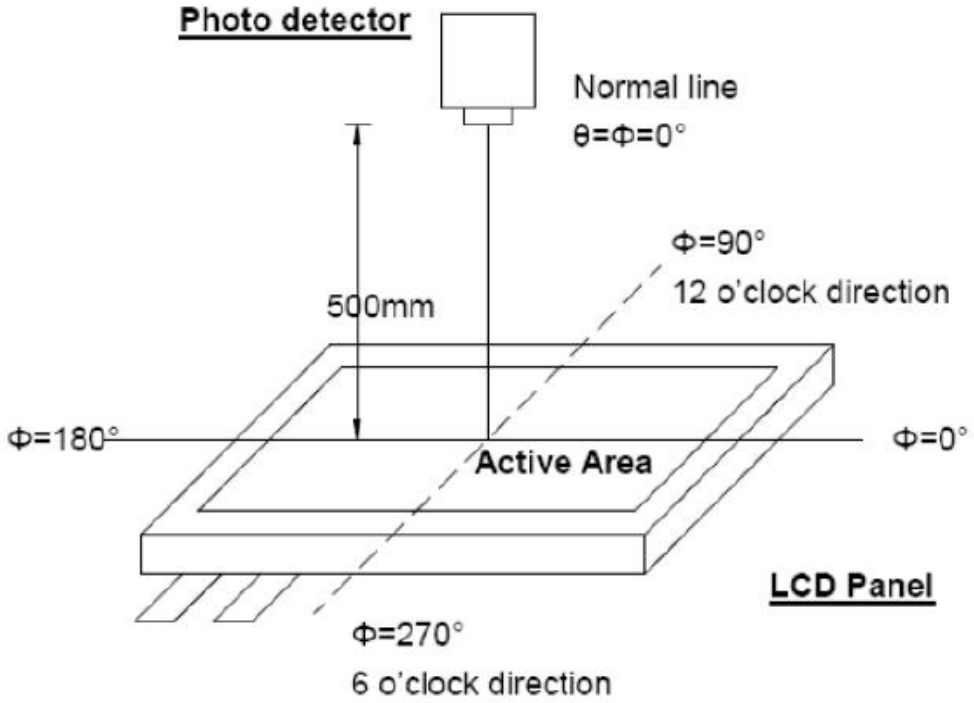
1. DVDD=3.3V, the ambient temperature is 25ºC
2. The test systems refer to Note2.

Note1: Definition of viewing angle range



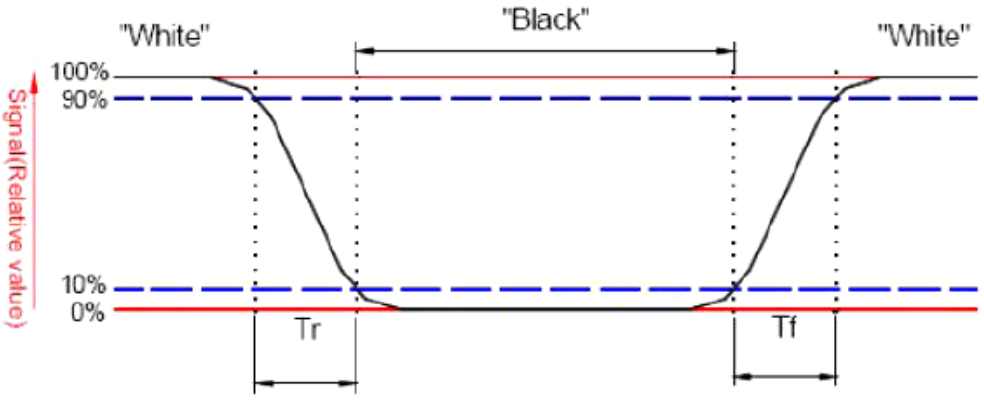
Note2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. The optical properties are measured at the center point of the LCD screen, (Response time is measured by photo detector TRD_100. other items are measured by BM-5A/Field of view: 1°/Height 500mm.)



Note3: Definition of response time:

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (TON) in the time between photo detector output intensity charged from 90% to 10%. And fall time (TOFF) is the time between photo detector output intensity changed from 10% to 90%.



Note4: Definition of Contrast Ratio:
Contrast ratio is calculated by the following formula.

$$CR = \frac{\text{Brightness on the “white” state}}{\text{Brightness on the “black” state}}$$

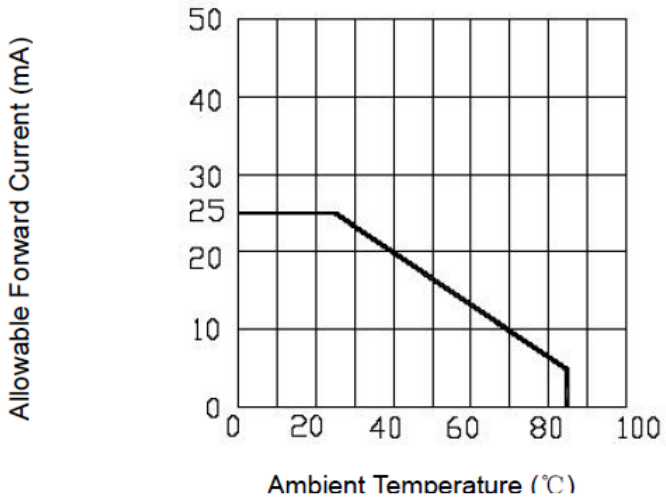
Note5: Definition of color chromaticity (CIE 1931)

Note6: All input terminals LCD panel must be ground while measuring the center area of the panel.

8. Environment absolute maximum ratings

Item	Symbol	Min	Max	Unit	Remark
Operation temperature range	Top	-20	70	ºC	Ambient
Storage temperature range	Tst	-30	80	ºC	Ambient

* Corrosive gas environment is not acceptable.
*TFT-LCD color will change slightly depending on environment temperature. This phenomenon is reversible. Current reduction rate of LED backlight is according to the graph indicated below:

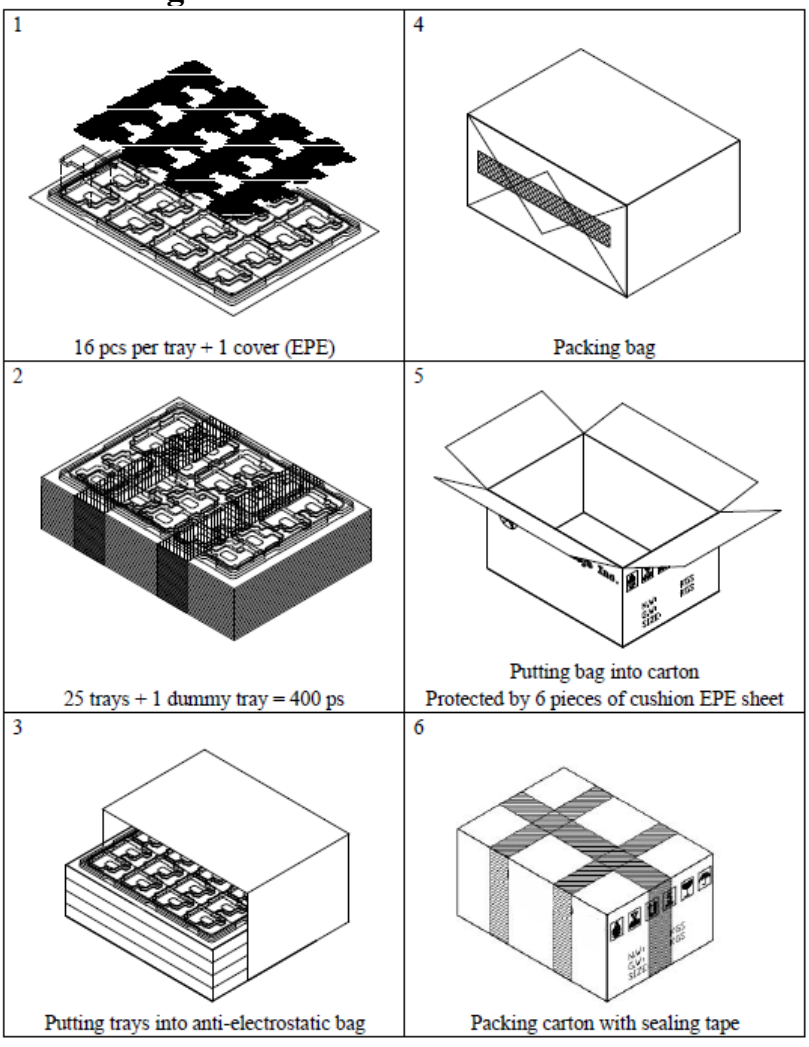


9. Reliability test items

Test	Test condition	Judgment	Remark
High temperature storage test	80ºC, 240 hours	Note1	Note2 Note3 Note4
Low temperature storage test	-30ºC, 240 hours	Note1	
Thermal shock storage test	-30ºC, 0.5hour<->80ºC, 0.5hour, 100cycles, 1 our/cycle	Note1	
High temperature operation test	70ºC, 240 hours	Note1	
Low temperature operation test	-20ºC, 240 hours	Note1	
High temperature & high humidity operation test	60ºC, 90%RH, 240hours	Note1	

Note1: Criteria: Normal display image with no obvious non-uniformity and no line defect.
Note2: All tests above are practiced at module type.
Note3: All the cosmetic specification is judged before the reliability stress. Only a single item of these tests shall be executed on a single panel, not more than one test item shall be executed on a single panel.
Note4: Evaluation should be tested after storage at room temperature for two hours.

10. Package



11. Precautions

Please pay attentions to the followings as using the LCD module.

Handling

*Do not apply strong mechanical stress like drop, shock or any force to LCD module. It may cause improper operation, even damage.
*Because the polarizer is very fragile and easy to be damaged, do not hit, press or rub the display surface with hard materials.
*Do not put heavy or hard material on the display surface, and do not stack LCD modules.
*If the display surface is dirty, please wipe the surface softly with cotton swab or clean cloth.
*Avoid using Ketone type materials (e.g.Acetone), Toluene, Ethyl acid or Methyl chloride to clean the display surface. It might damage the touch panel surface permanently. The recommended solvents are water an Isopropyl alcohol.
*Wipe off water droplets or oil immediately.
*Protect the LCD module from ESD. It will damage the LSI and the electronic circuit.
*Do not touch the output pins directly with bare hands.
*Do not disassemble the LCD module.
*Do not lift the FPC of touch panel.

Storage

*Do not leave the LCD modules in high temperature, especially in high humidity for a long time.
*Do not expose the LCD modules to sunlight directly.
*The liquid crystal is deteriorated by ultraviolet. Do not leave it in strong ultraviolet ray for a long time.
*Avoid condensation of water. It may cause improper operation.
*Please stack only up to the number stated o carton box for storage and transportation. Excessive weight will cause deformation and damage for carton box.

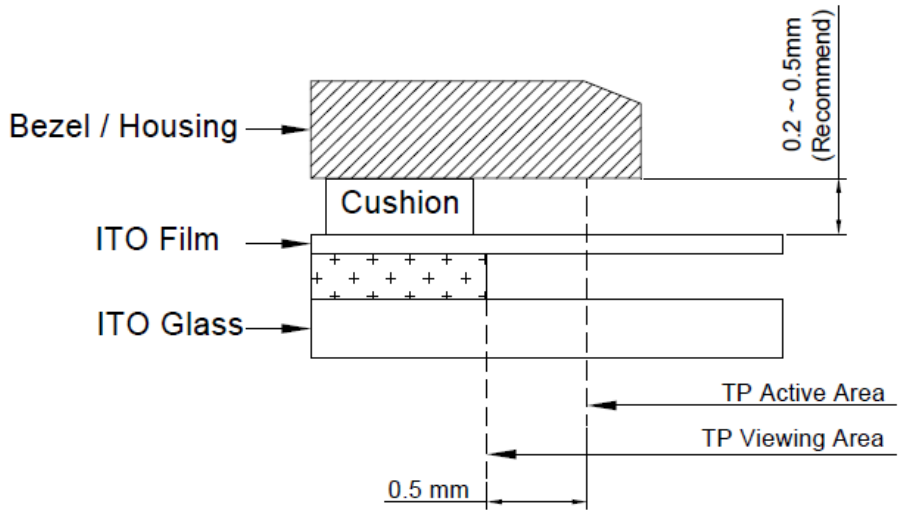
Operation

*When mounting or dismounting the LCD modules, turn the power off.
*Protect the LCD modules from electric shock.
*The driver IC control algorithms stated above should always obeyed to avoid damaging the LSI and electronic circuit.
*Be careful to avoid maxing up the polarity of power supply for backlight.
*Absolute maximum rating specified above has to be always kept in any case. Exceeding it may cause non-recoverable damage of electronic components or, nevertheless, burning.
*When a static image is displayed for a long time, remnant image is likely to occur.
*Be sure to avoid bending the FPC to an acute shape, it might break FPC.
*Most of the touch screens have air vent to equalize the inside air pressure to the outside one. The air vent must be open and liquid contact must be avoided as the liquid may be absorbed if the liquid is accumulated near the air vent.
*For the fragility of ITO film, is should avoid to use too tapering pen as the input material.

Touch panel mounting notes

*If a cushion is used between bezel/housing and film must be choose as free as enough to

absorb the expansion and contraction to avoid the distortion of film.
*The cushion must be placed out of the viewing area.
*Bezel/housing edge must be posited between key area and viewing area. The edge enters the key area may cause unexpected input if the gap is too narrow or foreign particles like dusts exist between bezel/housing and ITO film.
*Mounting example:



The corner part has conductivity. Do not touch any metal part after mounting.

Others

*If the liquid crystal leaks from the panel, it should be kept away from the eyes or mouth.
*For the fragility of polarizer, it is recommended to attach a transparent protective plate over the display surface.
*It is recommended to peel off the protection film o the polarizer slowly so that the electrostatic charge can be minimized.

12. Incoming inspection standard

12.1. Description

These inspection standards shall be applied to 3.5IPS(CMI panel) supplied by Devetech Electronics.

12.2. The environmental condition of inspection

The environmental condition and visual inspection shall be conducted as below:
*Ambient temperature: 15~25ºC
*Humidity: 25~75%RH
*External appearance inspection shall be conducted by using a single 20W fluorescent lamp or equivalent illumination.
Cell visual inspection on the operation condition for cosmetic shall be conducted at the distance 35cm or more between the LCD cell and eyes of inspector. And, the visual inspection viewing angle should be with in the 45º to perpendicular line.
Ambient illumination: 400~600 Lux for external appearance inspection.
Ambient illumination: 100~200 Lux for light on inspection.

12.3. Inspection criteria

Definition of dot defect.

Definition of defect.
a) The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot, and all brightness or dark dot defect must be visible through ND 5% filter.
b) Bright dot: Dots appear bright and unchanged in size in which LCD cell is displaying under black pattern.
c) Dark dot: Dots appear dark and unchanged in size which LCD cell is displaying under pure red, green, blue picture.
d) 2 dot adjacent=1pair=2dots

NOTES