



Version	1.0
Total pages	19
Date	Apr, 07, 2008

Product Specification

6.5" Digital color TFT-LCD module

RoHS Compliant Green Product

(◆) Draft Specification
(.....) Final Specification

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Record of Revision

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A. Physical specifications

NO.	Item	Specification	Remark
1	Display resolution(dot)	400RGB(W)×240(H)	
2	Display Active area(mm)	143.4(W)×79.32(H)	
3	Screen size(inch)	6.5(Diagonal)	
4	Dot pitch(mm)	0.1195(W)×0.3305 (H)	
5	Color configuration	R. G. B. stripe	
6	Overall dimension(mm)	155(W)×90.83(H)×14.58(D)	Note 1
7	Weight(g)	132	
8	Surface treatment	AG with SWV film	
9	Backlight unit	L type CCFL lamp	
10	Surface Hardness	3H	

Note 1: Refer to Fig. 1

B. Electrical specifications

1.Pin assignment (Note1,2,3)

a. TFT-LCD panel driving section (Connector type : PF050-O50B-C20 or compatible)

Pin no	Symbol	I/O	Description	
1	GND	P	Ground	
2	VCOM	I	VCOM voltage	
3	DIO1	I/O	Start pulse signal input/output (Horizontal)	
4	AVDD	P	Analog voltage for source driver	
5	AVSS	P	Analog ground for source driver	
6	GND	P	Digital ground for source driver	
7	VCC (DVDD)	P	Digital voltage for source driver	
8	EDGSL	I	Select raising edge or raising/falling edge	
9	GND	P	Ground	
10	CLK	I	Sample CLK	
11	GND	P	Ground	
12	SHL(R/L)	I	Right or Left display control	
13	R0	I	Red data	
14	R1	I	Red data	
15	R2	I	Red data	
16	R3	I	Red data	
17	R4	I	Red data	
18	R5	I	Red data	
19	G0	I	Green Data	
20	G1	I	Green Data	
21	G2	I	Green Data	
22	G3	I	Green Data	
23	G4	I	Green Data	
24	G5	I	Green Data	
25	V1	I	Reference voltage	
26	V2	I	Reference voltage	
27	V3	I	Reference voltage	
28	V4	I	Reference voltage	
29	V5	I	Reference voltage	
30	V6	I	Reference voltage	
31	V7	I	Reference voltage	
32	V8	I	Reference voltage	
33	V9	I	Reference voltage	
34	V10	I	Reference voltage	
35	B0	I	Blue Data	
36	B1	I	Blue Data	
37	B2	I	Blue Data	
38	B3	I	Blue Data	
39	B4	I	Blue Data	
40	B5	I	Blue Data	
41	GND	P	Ground	
42	LD (OEH)	I	Latch and switch data to output	
43	REV	I	Control data are inverted or not	

44	POL	I	Polarity selection	
45	DIO2	I/O	Start pulse signal input/output (Horizontal)	
46	GND	P	Ground	
47	OEV	I	Output enable	
48	U/D	I	Up or Down display control	
49	CKV	I	CLK (Vertical)	
50	STVR(U)	I/O	Start pulse signal input/output (Vertical)	
51	STVL(D)	I/O	Start pulse signal input/output (Vertical)	
52	VGH	P	TFT high voltage	
53	VGL	P	TFT low voltage	
54	VCC	P	Digital voltage for gate driver	
55	GND	P	Ground for gate drive	

Note 1: Selection of scanning mode (please refer to the following table)

Note 2: I: Input pin; O: Output pin; VI: Voltage Input; VO: Voltage Output; P: Power

Note 3: The mark on FPC of TFT module will follow AUO pin no.

Setting of scan control input		IN/OUT state for start pulse				Scanning direction
U/D	L/R	STVR	STVL	STHR	STHL	
GND	V _{CC}	OUT	IN	OUT	IN	From up to down, and from left to right.
V _{CC}	GND	IN	OUT	IN	OUT	From down to up, and from right to left.
GND	GND	OUT	IN	IN	OUT	From up to down, and from right to left.
V _{CC}	V _{CC}	IN	OUT	OUT	IN	From down to up, and from left to right.

IN: Input; OUT: Output.

Note 2: Definition of scanning direction. Refer to figure as below:

TBD

b. Backlight driving section (Refer to Fig. 1)

No.	Symbol	I/O	Description	Remark
1	HI	I	Power supply for backlight unit (High voltage)	
2	GND	-	Ground for backlight unit	

Note 1: Connector Type: JST-03VS-1 (3pin type), please refer Page 21.

Note 2: Shrouded header: SM03(4.0)B-BHS-1-TB

2. Absolute maximum ratings

Item	Symbol	Condition	Min.	Max.	Unit	Remark
Power voltage	V _{CC}	GND=0	-0.3	5	V	
	AV _{DD}	AV _{SS} =0	-0.3	12	V	
	V _{GH}	GND=0	-0.3	18	V	
	V _{GL}		-15	0.3	V	
	V _{GH} - V _{GL}		-	33	V	
Input signal voltage	V _I		-0.3	V _{CC} +0.3	V	
	V _{ref}		0.4 AV _{DD}	AV _{DD} +0.3	V	Note 1
	V _{COM}		3.5	7	V	

Note 1: V1~V10

3. Environment condition

Item		Condition	Spec.	Remark
Operating temperature	Panel with lighting BLU	Panel surface temperature	-30~ 85℃	Note 1,2,3
Storage temperature	Panel only	Ambient temperature	-40 ~95℃	

Note 1: Under the condition of the operating temperature, the panel would be function normal for the visual display only. For contrast, response time, and other factors related to display quality, determine temperature using the formula $T_a=25^{\circ}\text{C}$

Note 2: Panel surface temperature is defined as the maximum temperature of panel surface. In general, the lamp side temperature is higher than non-lamp side around 10 °C

Note 3: The backlight has been turned on before running about condition.

4. Electrical characteristics

a. Typical operating conditions (GND=AVss=0V, Note 1)

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply	V_{CC}	3	3.3	3.6	V	
	AV_{DD}	8.8	9.8	10.8	V	
	VCOM	4.3	4.8	5.3		
	V_{GH}	14.0	15	16.0	V	
	V_{GL}	-6.5	-7	-7.5	V	
Input reference voltage	V1~V5	0.4 AV_{DD}	-	$AV_{DD}-0.1$	V	
	V6~V10	0.1	-	0.6 AV_{DD}	V	
Input signal voltage	H Level	V_{IH}	0.8 V_{CC}	-	V_{CC}	V
	L Level	V_{IL}	0	-	0.2 V_{CC}	V

Note 1: Be sure to apply GND, V_{CC} and V_{GL} to the LCD first, and then apply V_{GH} .

b. Current consumption (GND=AVss=0V)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Current for driver	I_{GH}	$V_{GH}=15V$	-	100	150	uA	
	I_{GL}	$V_{GL}=-7V$	-	-100	-150	uA	
	I_{CC}	$V_{CC}=3.3V$	-	3.5	5	mA	
	I_{DD}	$AV_{DD}=9.8V$	-	20	30	mA	

c. Backlight driving conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Lamp voltage	V_L	490	540	590	Vrms	
Lamp current	I_L	-	6.5	7.0	mAmps	
Frequency	F_L	-	60	80	kHz	Note 4
Lamp starting voltage	V_S	-	-	1,000	Vrms	Note 1,5
		-	-	1,300	Vrms	Note 2,5
		-	-	1580	Vrms	Note 3,5
Lamp life time		10,000	-	-	Hr	Note 6

Note 1: $T_a = 25^{\circ}\text{C}$.

Note 2: $T_a = 0^{\circ}\text{C}$.

Note 3: $T_a = -30^{\circ}\text{C}$.

Note 4: The lamp frequency should be selected as different as possible from display horizontal synchronous signal to avoid interference.

Note 5: For starting the backlight unit, the output voltage of DC/AC's transformer should be larger than the maximum lamp starting voltage.

Note 6: The" Lamp life time" is defined as the module brightness decrease to 50% original brightness at $T_a=25^{\circ}\text{C}$, $I_L=6.5\text{mA}$.

5. AC Timing

a. Timing conditions(Characteristics : $V_{CC}=3.3\text{V}$, $AV_{DD}=9.8\text{V}$, $AV_{SS}=GND=0\text{V}$, $T_A=25^{\circ}\text{C}$)

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Remark
CLK frequency	Fclk		40	42	MHz	
CLK pulse width	Tcw	8			ns	
Data set-up time	Tsu	4			ns	
Data hold time	Thd	2			ns	
Propagation delay of DIO2/1	Tphl	6	10	15	ns	
Time for the last data to LD	Tld	1			Tcw	
Pulse width of LD	Twld	2			Tcw	
Time for LD to DIO1/2	Tlds	5			Tcw	
POL set-up time	Tpsu	6			ns	
POL hold time	Tphd	6			ns	
CKV pulse width	Tckv	16	28	40	Tcw	
STV setup time	Tsuv	400			ns	
STV hold time	Thdv	400			ns	
Vertical display start	Tsv		3		TDH	
Output stable time	Tst			15	us	

Note 1: The panel is designed to prevent the current leakage for the best display performance. If shorter discharge time is desired when system power off, then extra discharge circuit may be required at customer's side.

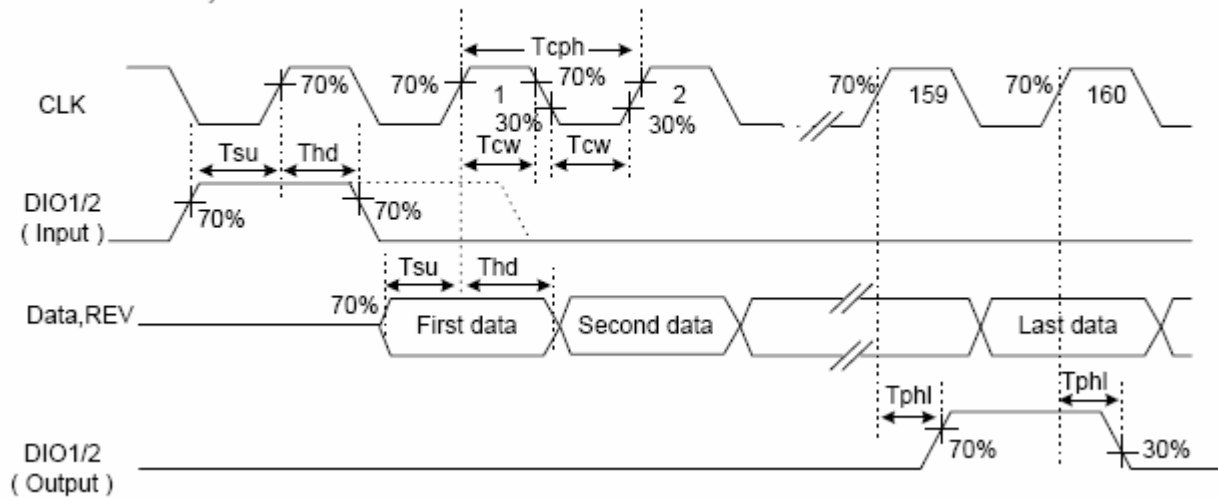
b. Timing diagram

Operation mode 1

Note1 : System integrators need to insert 402RGBx240 data into TFT module, since the source driver ICs are selected 402 channels output as option.

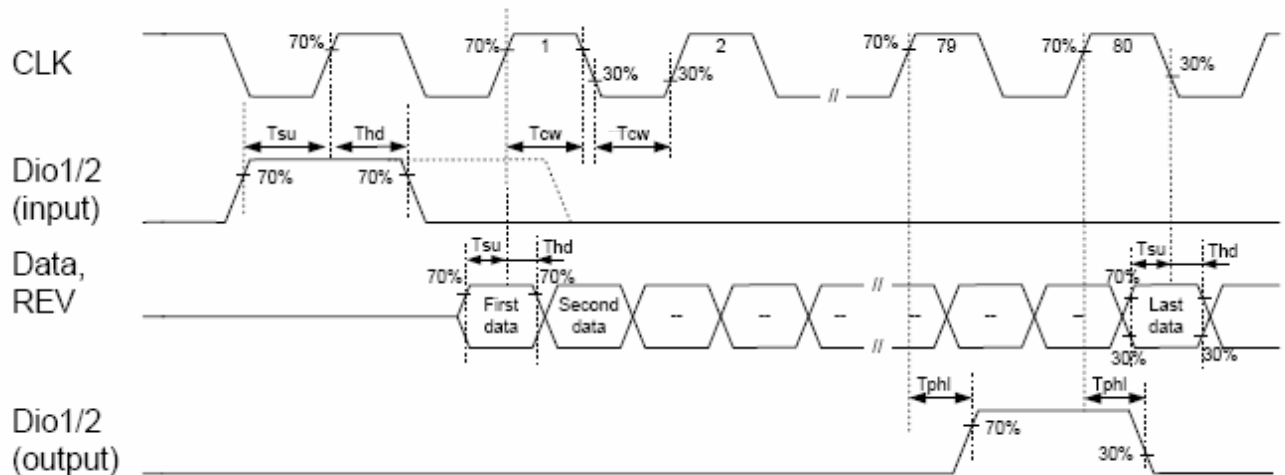
■ Timing Diagram 1 (CHNSL="1" , Default)

<< EDGSL= "0", Default >>

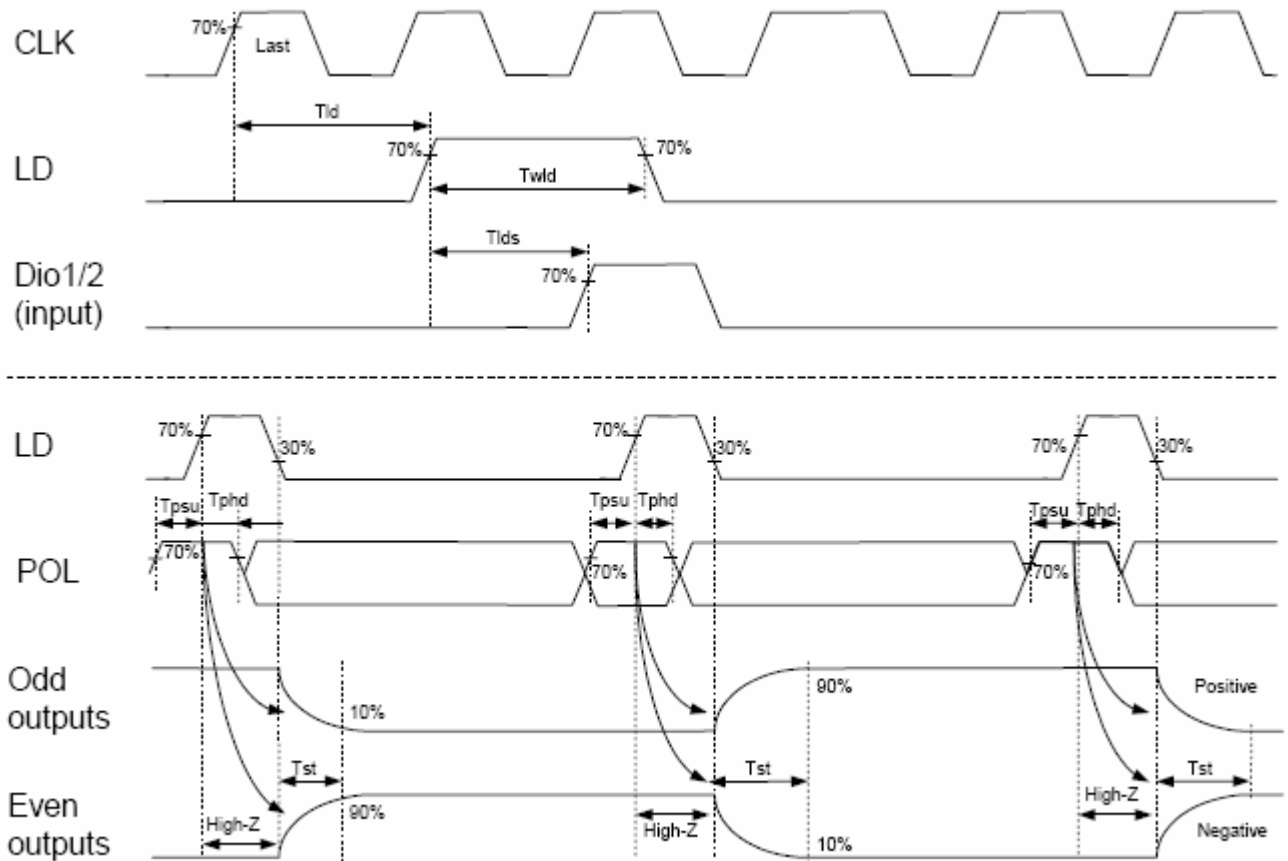


Operation mode 2

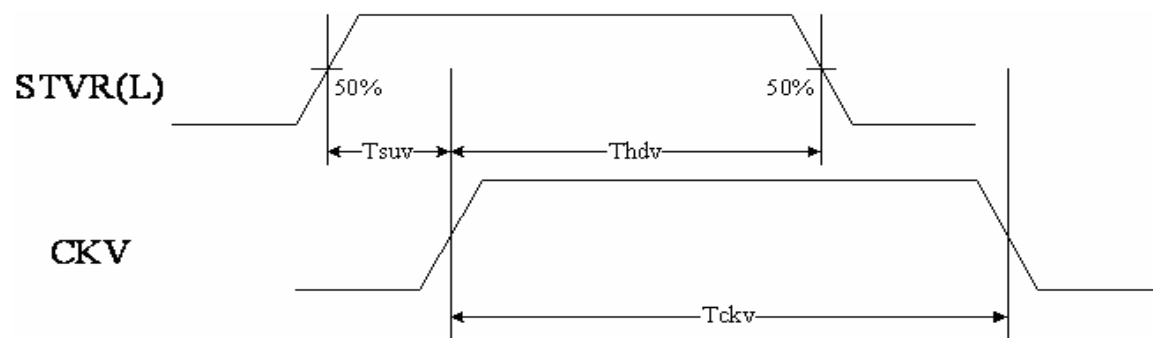
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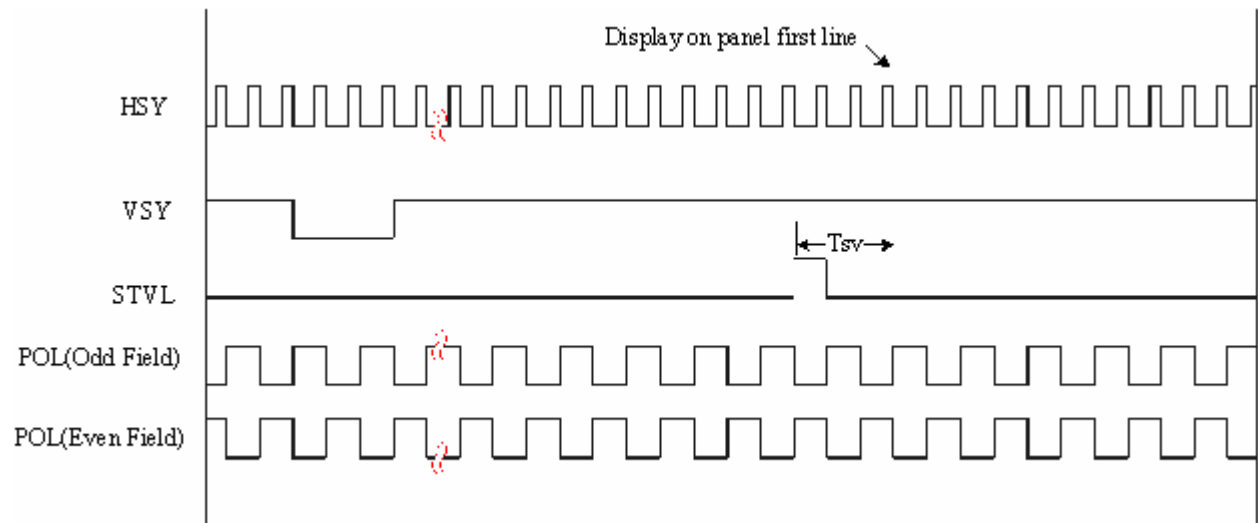
Horizontal Timing



Vertical Shift Clock Timing



Vertical Timing (from up to down)



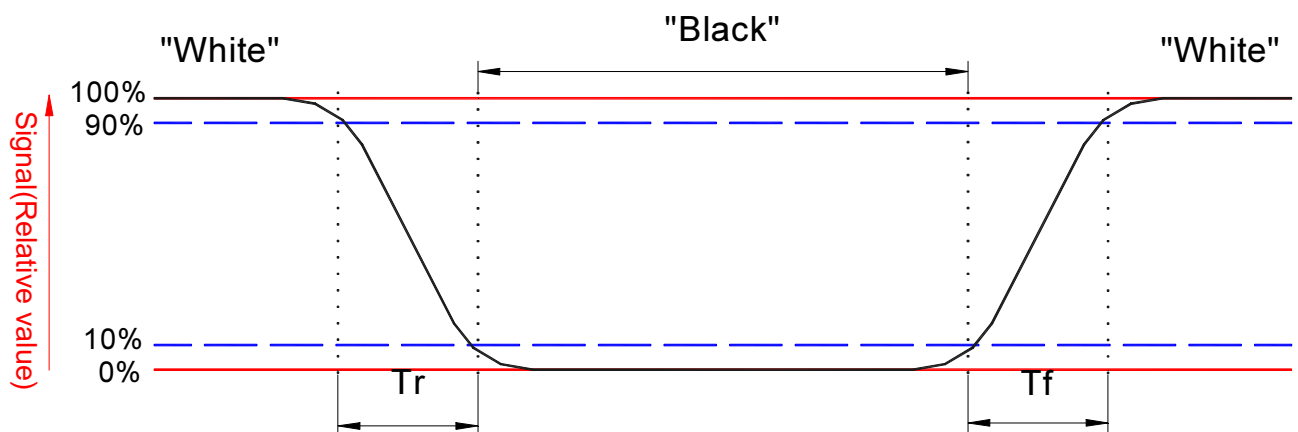
C. Optical specification (Note 1)

Item		Symb	Condition	Min.	Typ.	Max.	Unit	Remark
Response time	Rise	Tr Tf	$\theta = 0^\circ$	-	15	50	ms	Note 1,2,4
	Fall			-	20	60	ms	
Contrast ratio		CR	At optimized Viewing angle	300	400	-		Note 3,4
Viewing angle	Top		$CR \geq 10$	30	45	-	deg.	Note 4,6
	Bottom			50	60	-		
	Left			50	60	-		
	Right			50	60	-		
	Top		$CR \geq 5$	40	50	-	deg.	Note 4,5
	Bottom			60	70	-		
	Left			60	70	-		
	Right			60	70	-		
Brightness		Y_L	$I_L = 6.5\text{mA}$, 25°C	500	550	-	nit	Note 6
Uniformity			$\theta = 0^\circ$			1.3		Note 7
White chromaticity	X		$\theta = 0^\circ$	0.26	0.31	0.36		Note 6
	Y		$\theta = 0^\circ$	0.28	0.33	0.38		

Note 1 : Ambient temperature $\approx 25^\circ\text{C}$. And lamp current $I_L = 6.5 \text{ mArms}$. To be measured in the dark room and to be measured on the center area of panel with a viewing cone of 1° by Topcon luminance meter BM-5, after 10 minutes operation.

Note 2. Definition of response time:

The output signals of photo detector are measured when the input signals are changed from "black" to "white"(falling time) and from "white" to "black"(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



Note 3. Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" state}}{\text{Photo detector output when LCD is at "Black" state}}$$

Note 4. White $V_i = V_{i50} + 1.5V$

Black $V_i = V_{i50} \pm 2.0V$

" \pm " means that the analog input signal swings in phase with V_{COM} signal.

" \mp " means that the analog input signal swings out of phase with V_{COM} signal.

V_{i50} : The analog input voltage when transmission is 50%

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

Note 5. Definition of viewing angle, refer to figure as below.

TBD

Note 6. Measured environment :

(1) Field Aperture : 1°

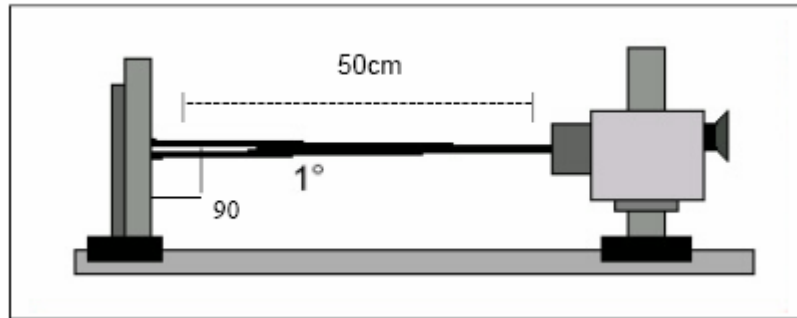
(2) Measuring distance : 50 ± 2.5 cm

(3) Measuring position : The detector should be normal to the center point of the module surface

(4) Measuring environment : Ambient temperature : $25 \pm 2^\circ\text{C}$

Humidity : 25~85 %

Illuminance : < 1 lx



Note 7. Uniformity value = (max. brightness)/(min. brightness), min. 5 points.

D. Reliability test items(Note 2):

No.	Test items	Conditions	Remark
1	High temperature storage	Ta= 95℃ 240Hrs	
2	Low temperature storage	Ta= -40℃ 240Hrs	
3	High temperature operation	Ta= 85℃ 240Hrs	
4	Low temperature operation	Ta= -30℃ 240Hrs	
5	High temperature and high humidity	Ta= 60℃, 90% RH 240Hrs	Operation
6	Heat shock	-40℃~85℃/240 cycles 1Hrs/cycle	Non-operatio
7	Electrostatic discharge	±200V,200pF(0Ω), once for each terminal	Non-operatio
8	Vibration	Frequency range : 8~33.3Hz Stoke : 1.3mm Sweep : 2.9G,33.3~400Hz 2 hours for each direction of X, Z 4 hours for direction of Y	JIS D1601, A-10 condition A Note3
9	Mechanical shock	100G, 6ms, ±X,±Y,±Z 3 times for each direction	JIS C7021, A-7 condition C
10	Vibration (with carton)	Random vibration: 0.015G ² /Hz from 5~200Hz -6dB/octave from 200~500Hz	IEC 68-34
11	Drop (with carton)	Height: 60cm 1 corner, 3 edges, 6 surfaces	JIS Z0202

Note 1: Ta: Ambient temperature.

Note 2: In the standard conditions, there is not display function NG issue occurred. All the cosmetic specification is judged before the reliability stress.

Note 3: Cycle time for vibration is 15 minutes.



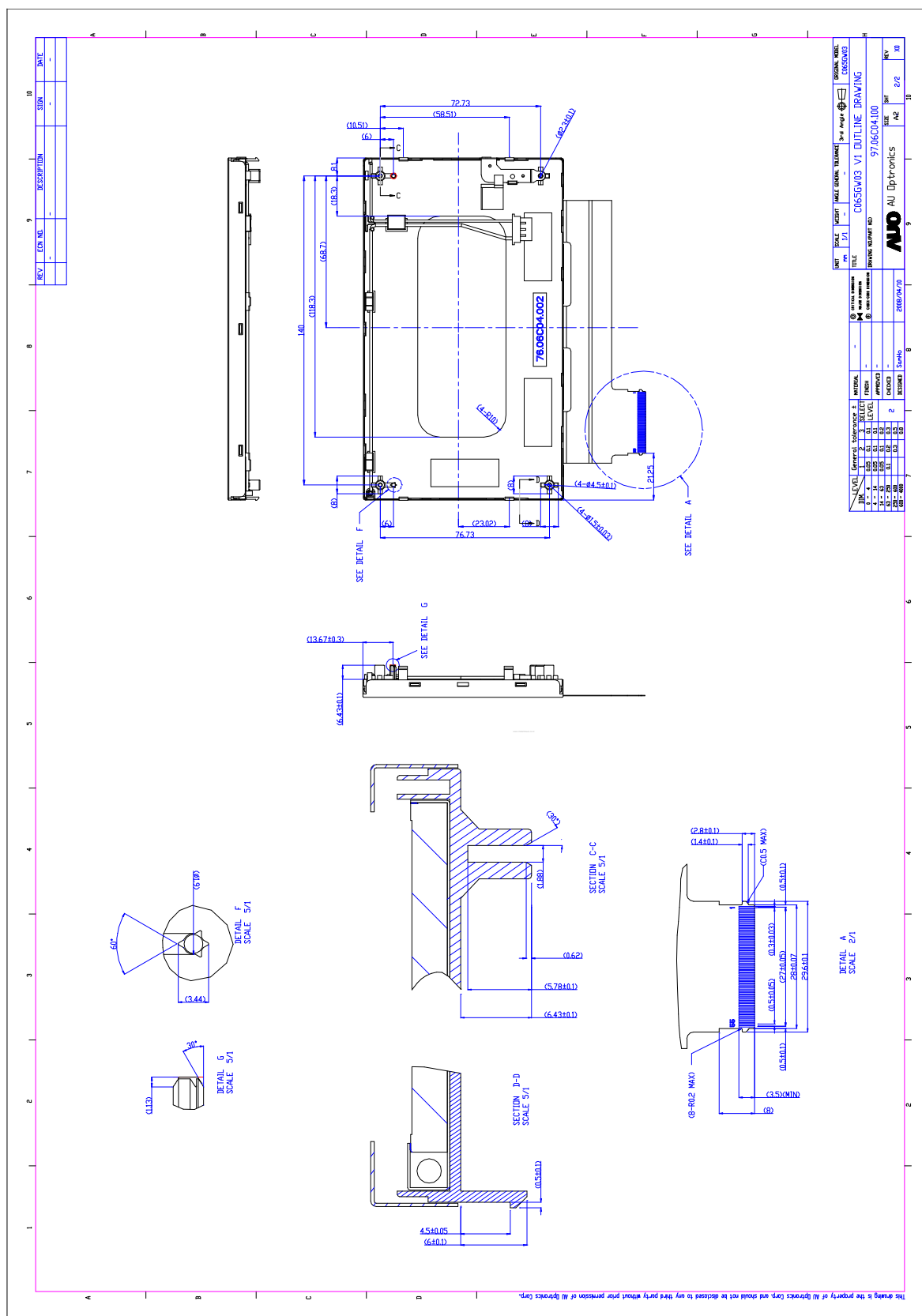
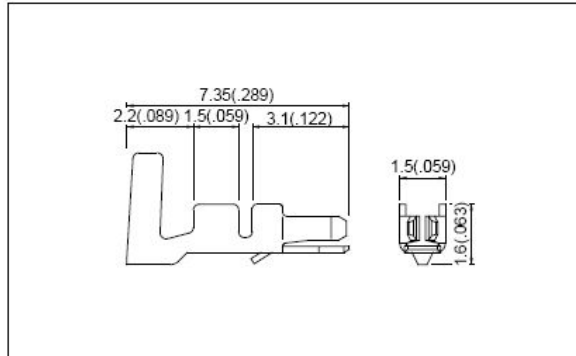


Fig.2 Outline dimension of TFT-LCD module



Appendix 1: CCFL connector – JST BHR(03)VS-1

Contact



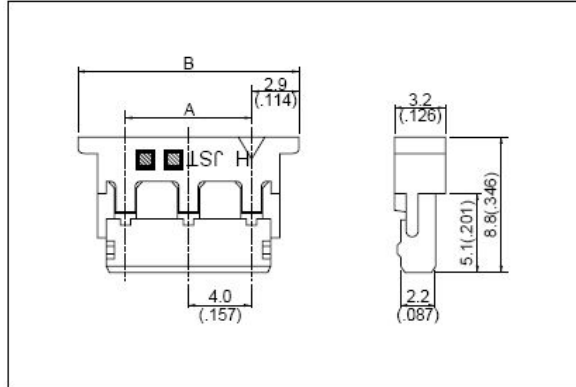
Model No.	Applicable wire			Q'ty / reel
	mm ²	AWG #	Insulation O.D. min(in.)	
SBH-001T-P0.5	0.08 to 0.33	28 to 22	.16 to 2.4(.063 to .094)	4,000

Material and Finish

Phosphor bronze, tin-plated

Note: Wire conductors should be tin-plated annealed copper strands.

Housing



Circuits	Pitch mm(in.)	Model No.	Dimensions mm(in.)		Q'ty / bag
			A	B	
2	4(.157)	BHR-02VS-1	4.0(.157)	9.8(.386)	1,000
	8(.315)	BHR-03VS-1	8.0(.315)	13.8(.543)	1,000
	12(.472)	BHR-04VS-1	12.0(.472)	17.8(.701)	1,000
3	4(.157)	BHR-03VS-1	8.0(.315)	13.8(.543)	1,000
4	4(.157)	BHR-04VS-1	12.0(.472)	17.8(.701)	1,000

Material

Nylon 66, UL94V-0, natural (white)

Appendix 2: Reference Gamma setting

	AVDD	9.80
00H	V1	9.71
10H	V2	8.07
20H	V3	7.43
30H	V4	6.95
3FH	V5	5.9
3FH	V6	4.14
30H	V7	2.92
20H	V8	2.4
10H	V9	1.67
00H	V10	0.1

Note 1 : AVDD and V1~V10 is based on gamma 2.2 setting, only for reference, actual setting depends on customer's requirement.

	AVDD	9.80
00H	V1	9.8
10H	V2	8.1
20H	V3	7.6
30H	V4	7.1
3FH	V5	5.9
3FH	V6	4.15
30H	V7	2.87
20H	V8	2.28
10H	V9	1.66
00H	V10	0.11

Note 2 : AVDD and V1~V10 is based on gamma 2.0 setting, only for reference, actual setting depends on customer's requirement.