深圳市国显科技股份有限公司

Shenzhen K&D Technology Co. Ltd

☐ **Preliminary Specification**

■ **Approval Specification**

SPECIFICATION FOR LCD MODULE

Customer : _____

Product Model: KD070D30-31NB-A21

Sample code: _____

Designed by	Checked by	Approved by
Shichao Lin	Huaxing Li	Juahua Zhang

Final Approval by Customer

☐ LCM Machinery OK **Checked By** _____ ☐ LCM Display OK **Checked By** _____	☐ LCM OK ☐ NG，Problem survey: **Approved By** _____

※ **The specification of "TBD" should refer to the measured value of sample . If there is difference between the design specification and measured value, we naturally shall negotiate and agree to solution with customer.**

Revision History

Version	Contents	Date	Note
A0	Original	2014.08.15	
A1	Update Electrical Characteristics and Optical specifications	2014.08.29	P16
A2	Add HSF Requirements	2015.02.05	P24

Contents

1. Numbering System

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(1) (2) (3) (4) (5) (6) (7) （8）

No	Definition	Specifications
(1)	TFT LCM Productor No.	KD ---- Kingdisplay technologiy Co.,Ltd
(2)	Display monitor opposite angle line size	Unit :mmm (takes three integers)
(3)	Productor Types	D ---- Digital photo frame / DVD G ----GPS M ----MP P ----Mobil-Phone N ----Net Book 。。。
(4)	Productor Development Series No.	By two figures characters expression from 01 to 99
(5)	Interface PIN Number	By two figures characters expression from 01 to 99
(6)	With Touch Panel Or Not	T----With T/P ； N----Without T/P
(7)	LCD Type	A----AUO ； M----CMI ； C----CPT；B----BOE； L----LG；W----Wintek；H----HSD；S----Century T----Tianma ； Y----Hydis ； I----INNOLUX ； U---Samsung； V---- IVO； P---- Panasonic
(8)	Productor Development edition No.	By The English litters : A1~ Z999

2. Scope

This specification applies to the TFT LCD module which is designed and manufactured by LCM Factory of Shenzhen K&D Technology Co. Ltd.

3. Normative Reference

GB/T4619-1996 《 Liquid Crystal Display Test Method》

GB/T2424 《Basic environmental Testing Procedures for Electric and Electronic Products.》

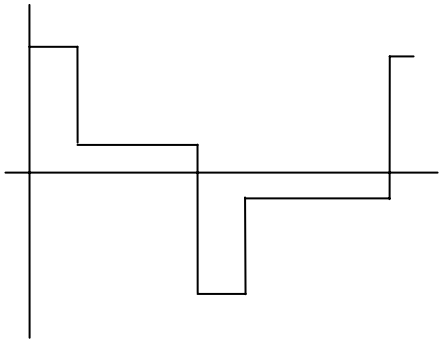
GB/T2423 《Basic Testing Procedures for Electric and Electronic Products》

IEC61747-1 《SIXTH PARTGB2828`2829-87《National Standard of PRC》

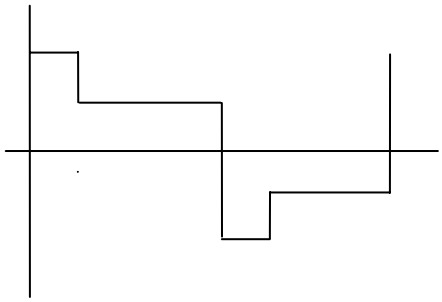
4. Definitions

4.1 Definitions of Vop

The definitions of threshold voltage Vth1, Vth2 the following typical waveforms are applied on liquid crystal by the method of equalized voltage for each duty and bias.



【 selected waveform 】



【 non-selected waveform 】

① Vth1: The voltage which the brightness of segment indicates 50% of saturated value on the conditions of selected waveform

(f_f=80Hz, Φ=10° θ=270° at 25℃)

② Vth2: The voltage which the brightness of segment indicates 50% of saturated value on the conditions of non-selected waveform

(f_f=80Hz, Φ=10° θ=270° at 25℃)

③ Vop: (Vth1(50%)+Vth2(50%))/2 (f_f=80Hz, Φ=10° θ=270° at 25℃)

4.2 Definition of Response Time Tr, Td

①Tr: The time required which the brightness of segment becomes 10% from 100% when waveform is switched to selected one from non-selected one. (f_f=80Hz, Φ=10°θ=270°at 25℃)

②Td: The time required which the brightness of segment becomes 90% from 10% when waveform is switched to selected one from selected one. (f_f=80Hz, Φ=10°θ=270°at 25℃)

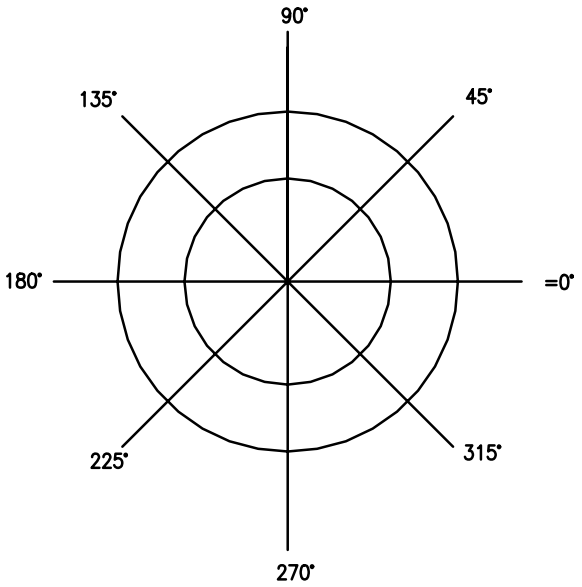
4.3 Definition of Contrast Ratio Cr

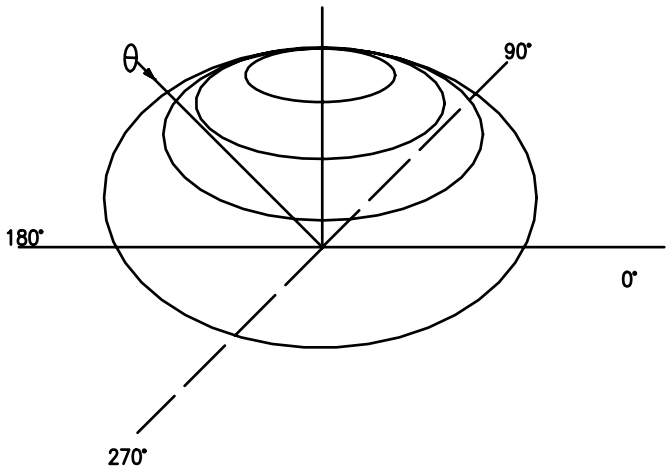
Cr=A/B

① A: Segments brightness in case of non-selected waveform

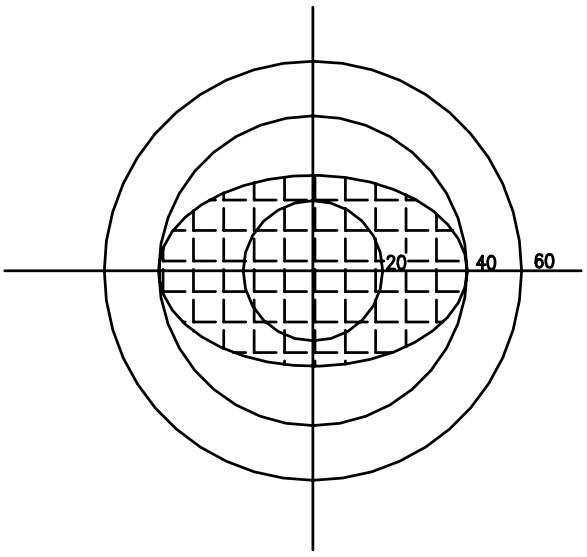
② B: Segments brightness in case of selected waveform

4.4 Definition of Angle and Viewing Range



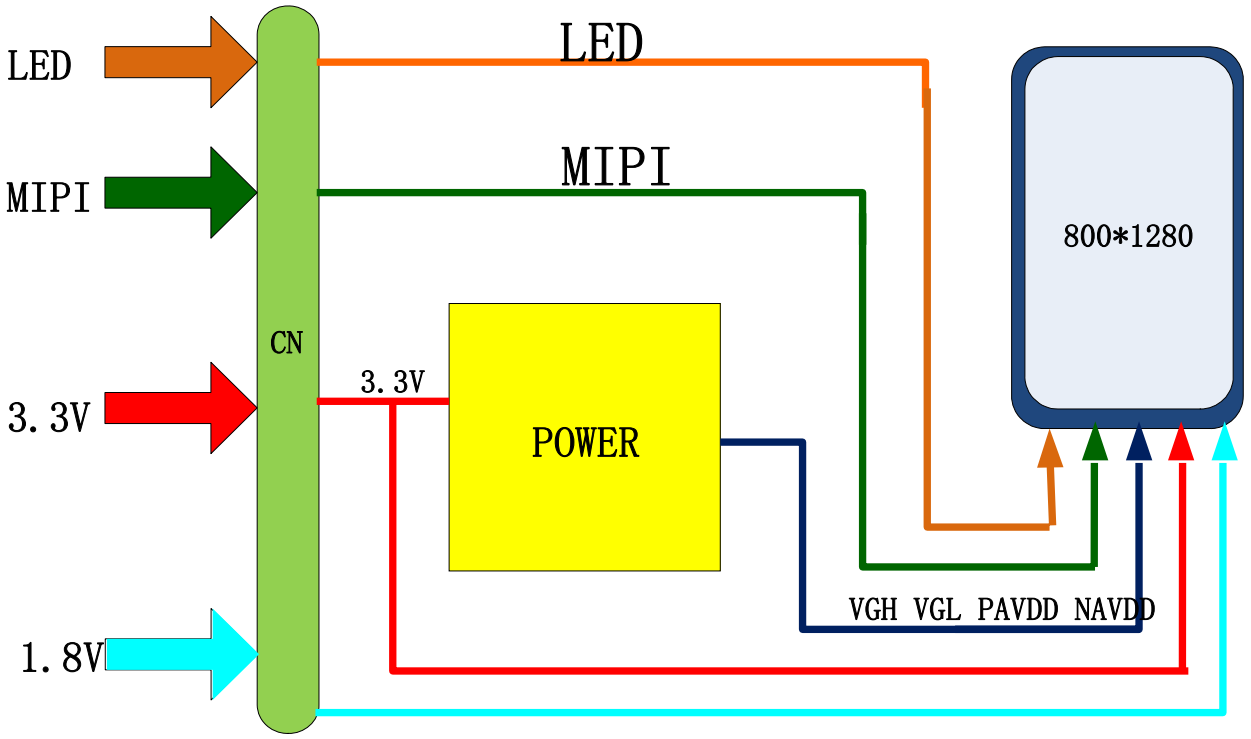


Angular Graph: Constrast Ratio



Such as:
Viewing Angle Range:
80(Cr>2) Horizontal
70(Cr>2) Vertical

5. Block Diagram



6. Technology Specifications

6.1 Feature

This single-display module is suitable for use in in MID products. The LCD adopts one backlight with High brightness 20-lamps white LED.

1) Construction: 7″ a-Si color TFT-LCD ,White LED backlight and FPC.
2) LCD:
   - Amorphous-TFT 7-inch display, transmissive, normally Black type.
   - 800(RGB)×1280 dots Matrix.
   - Narrow-contact ledge technique.
3) Video signal interface: MIPI-vedio mode(4 lanes).

6.2 Mechanical Specifications

Item	Specifications	Unit
LCD Size	7	inch
Dimensional outline	99.90(H) ×161.70(V) ×2.40(T)	mm
Active area	94.20(H) × 150.72(V)	mm
Pixel pitch	0.03925(H) × 0.11775(V)	um
Resolution	800(RGB) ×1280	pixel
Display mode	Normally Black	
Interface	MIPI	
Panel power consumption	0.429	W
Backlight power consumption	1.28	W
Weight	88+/-5	g
Luminance	300(Type)	cd/m2

6.3 Interface Pin Connection

Pin No.	Symbol	I/O	Function	Remark
1	VLED(A)	Power	Power for LED Backlight(Anode)	
2	VLED(A)	Power	Power for LED Backlight(Anode)	
3	VLED(A)	Power	Power for LED Backlight(Anode)	
4	NC	NC	No connection	
5	FB1(K)	Power	Power for LED Backlight(Anode)	
6	FB2(K)	Power	Power for LED Backlight(Cathode)	
7	FB3(K)	Power	Power for LED Backlight(Cathode)	
8	FB4(K)	Power	Power for LED Backlight(Cathode)	
9	GND	Power	Power Ground	
10	GND	Power	Power Ground	
11	MIPI_2P	I	MIPI date lane 2 positive-end input	
12	MIPI_2N	I	MIPI date lane 2 negative-end input	
13	GND	Power	Power Ground	
14	MIPI_1P	I	MIPI date lane 1 positive-end input	
15	MIPI_1N	I	MIPI date lane 1 negative-end input	
16	GND	Power	Power Ground	
17	MIPI_CLKP	I	MIPI clock lane positive-end input	
18	MIPI_CLKN	I	MIPI clock lane negative-end input	
19	GND	Power	Power Ground	
20	MIPI_0P	I	MIPI date lane 0 positive-end input	
21	MIPI_0N	I	MIPI date lane 0 negative-end input	
22	GND	Power	Power Ground	
23	MIPI_3P	I	MIPI date lane 3 positive-end input	
24	MIPI_3N	I	MIPI date lane 3 negative-end input	
25	GND	Power	Power Ground	
26	NC	NC	No connection	
27	RESET	I	Global reset (1.8V)	
28	NC	NC	No connection	
29	VDD1V8	Power	Power Supply for Analog Circuit(1.8V)	
30	VDD3V3	Power	Power Supply for Analog Circuit(3.3V)	
31	VDD3V3	Power	Power Supply for Analog Circuit(3.3V)	

Connector ： BL125-31RL Or Equivalent

6.4 Absolute Max. Rating

Item	Symbol	Values		Unit	Remark
		Min.	Max		
Power voltage	DV_{DD}	-0.5	5.0	V	
	IOVCC	-0.3	3.3	V	
	V_{LED}	-0.9	17.5	V	
Operation temperature	T_{OP}	-10	50	℃	
Storage temperature	T_{ST}	-20	60	℃	

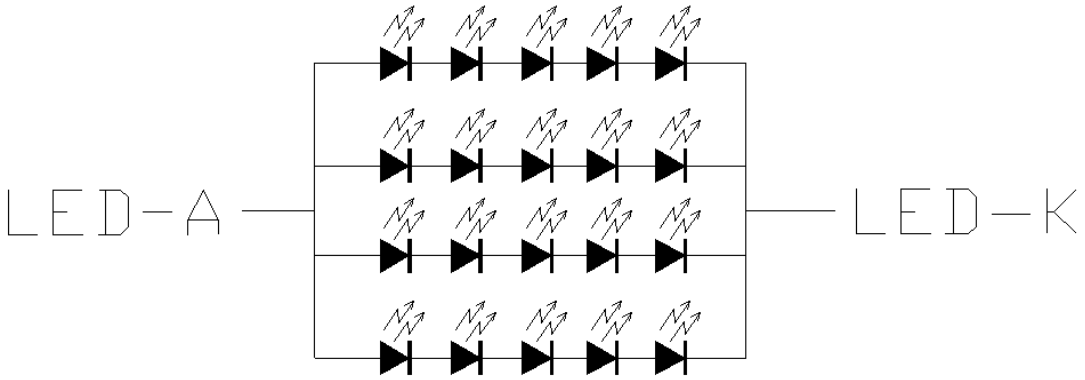
6.5 Typical Operation Conditions

Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
Power Voltage	VDD (VCI)	3.0	3.3	3.6	V	
	IOVCC	1.7	1.8	1.9	V	
Current Consumption	I_{VDD}	-	130	150	mA	
	I_{VDDL}	-	20	25	mA	
	I_{LED}	-	80	100	mA	

6.6 LED Back Light Specification (20 White Chips)

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	Vf	If=80mA	-	16	17.5	V
Uniformity (with L/G)	ΔB_p	If=80mA	70	75	-	%
Luminance for LCM	/	If=80mA	250	300	-	cd/m^2

Note:LED Circuit

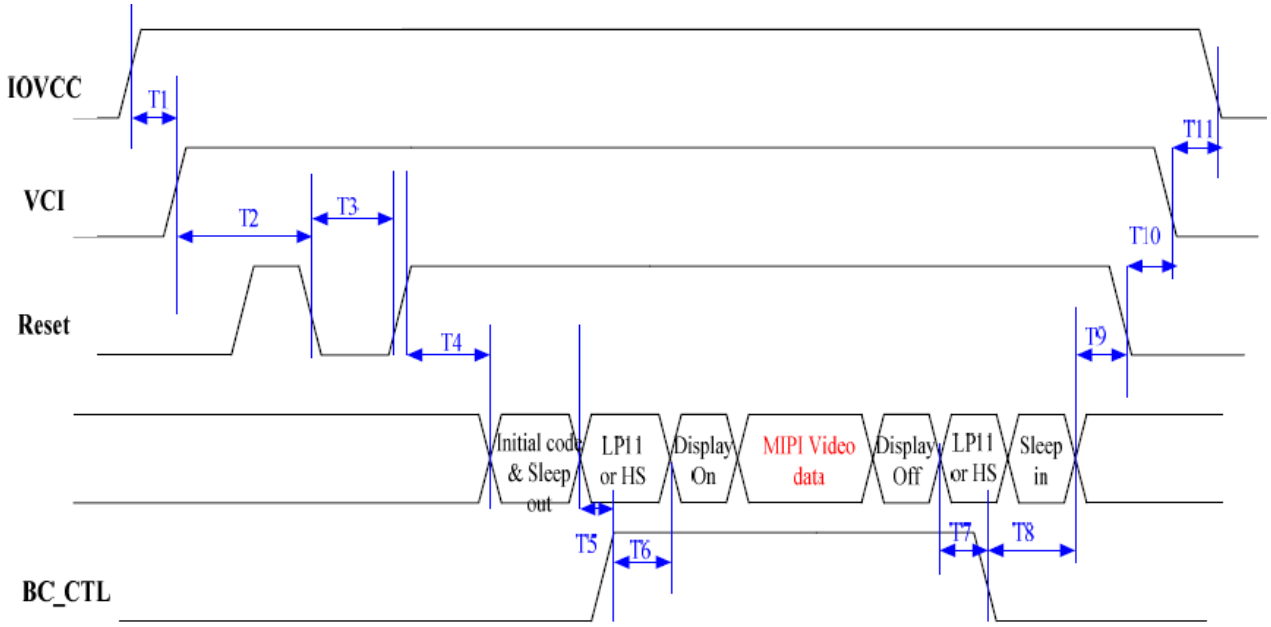


LED CIRCUIT DIAGRAM

Vf=16.0V(If=80mA)

6.7 Power Sequence

To prevent the device damage from latch up, the power on/off sequence shown below must be followed.

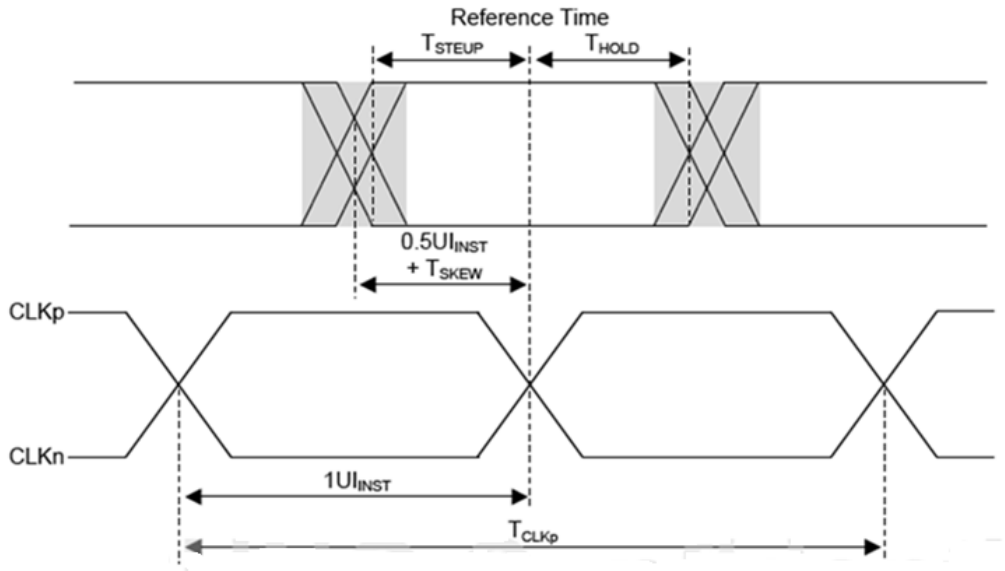


Power ON/OFF Timing			
Parameters	Value		
	min.	max.	Unit
T1	0		ms
T2	1		
T3	1		
T4	50		
T5	120		
T6	50		
T7	50		
T8	50		
T9	10		
T10	1		
T11	1		

6.8 Timing Conditions

6.8.1 MIPI Timing Characteristics

MIPI HIgh-speed Data-clock Timing



Item	Symbol	Min.	Typ.	Max.	Unit	Note
Data to Clock Setup Time[Receiver]	$T_{SETUP[RX]}$	0.15	–	–	UIINST	(2) (3)
Clock to Data Hold Time[Receiver]	$T_{HOLD[RX]}$	0.15	–	–	UIINST	
Data to Clock Skew (Measured at transmitter)	$T_{SKEW[TX]}$	-0.15	–	0.15	–	(1)

NOTE:

1. Total silicon and package delay budget of 0.3 UIINST
2. Total setup and hold window for receiver of 0.3* UI_{INST}
3. $T_{SETUP[Rx]}$ and $T_{HOLD[RX]}$ are only for RX without FPCB and connector and guaranteed by design.

The timing definitions are listed below:

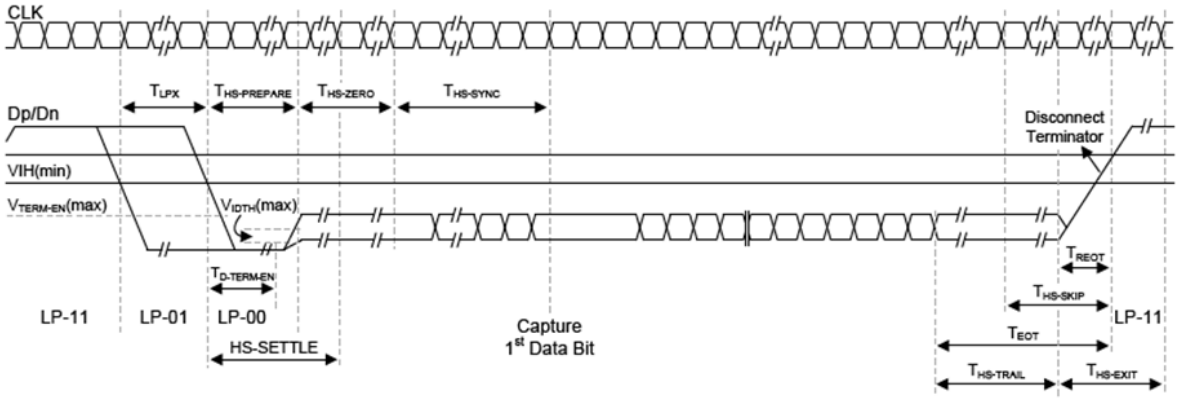
Parameter	Description	Min.	Typ.	Max.	Unit	Note
$T_{CLK-MISS}$	Timeout for receiver to detect absence of Clock transitions and disable the Clock Lane HS-RX	–	–	60	ns	(1) (7)
$T_{CLK-POST}$	Time that the transmitter continues to send HS clock after the last associated data lane has transitioned to LP mode. Interval is defined as the period from the end of $T_{HS-TRAIL}$ to the beginning of $T_{CLK-TRAIL}$	60ns + 52×UI	–	–		(6)
$T_{CLK-PRE}$	Time that the transmitter drives the clock lane LP-00 Line state immediately before the HS-0 line state starting the HS transmission	8	–	–	UI	(2) (6)
$T_{CLK-PREPARE}$	Time to drive LP-00 to prepare for HS clock transmission	38	–	95	ns	(6)
$T_{CLK-SETTLE}$	Time interval during which the HS receiver shall ignore any Clock Lane HS transitions, starting from the beginning of $T_{CLK-PREPARE}$	95	–	300		(7)
$T_{CLK-TERM-EN}$	Time for the clock lane receiver to enable the HS line termination, starting from the time point when Dn crosses $V_{IL,MAX}$	Time for Dn to reach $V_{TERM-EN}$	–	38		
$T_{CLK-TRAIL}$	Time that the transmitter drives the HS-0 state after the last payload clock bit of a HS transmission burst.	60	–	–		(6)
$T_{CLK-PREPARE}$ + $T_{CLK-ZERO}$	$T_{CLK-PREPARE}$ + time that the transmitter drives the HS-0 state prior to starting the Clock.	300	–	–		
$T_{D-TERM-EN}$	Time for the Data Lane receiver to enable the HS line termination, starting from the time point when Dn crosses $V_{IL,MAX}$	Time for Dn to reach $V_{TERM-EN}$	–	35ns + 4 × UI	–	(7)
T_{EOT}	Transmitted time interval from the start of $T_{HS-TRAIL}$ or $T_{CLK-TRAIL}$, to the start of the LP-11 state following a HS burst.	–	–	105ns + n × 12 × UI	–	(4) (6)
$T_{HS-EXIT}$	Time that the transmitter drives LP-11 following a HS burst.	100	–	–	ns	(6)
$T_{HS-PREPARE}$	Time that the transmitter drives the Data Lane LP-00 line state immediately before the hs-0 line state starting the hs transmission	40ns + 4 × UI	–	85ns + 6 × UI		

Parameter	Description	Min.	Typ.	Max.	Unit	Note
$T_{HS-PREPARE}$ + $T_{HS-ZERO}$	$T_{HS-PREPARE}$ + time that the transmitter drives the HS-0 state prior to transmitting the sync sequence.	145ns + 10 × UI	–	–		
$T_{HS-SETTLE}$	Time interval during which the HS receiver shall ignore any data lane HS transitions, starting from the beginning of $T_{HS-PREPARE}$	85ns + 6 × UI	–	145ns + 10 × UI		
$T_{HS-SKIP}$	Time interval during which the HS-RX should ignore any transitions on the data lane, following a HS burst. The end point of the interval is defined as the beginning of the LP-11 state following the HS burst.	40	–	55ns + 4 × UI		(7)
$T_{HS-TRAIL}$	Time that the transmitter drives the flipped differential state after last payload data bit of a HS transmission burst	Max (n × 8 × UI, 60ns + n × 4 × UI)	–	–		(3) (4) (6)
T_{INIT}		–	–	–	–	
T_{LPX}	Transmitted length of any low-power state period	50	–	–	ns	(5) (6)
Ratio T_{LPX}	Ratio of T_{LPX} (MASTER)/T_{LPX} (SLAVE) between master and slave side	2/3	–	3/2	–	
T_{TA-GET}	Time that the new transmitter drives the Bridge state (LP-00) after accepting control during a Link Turnaround.	5× T_{LPX}			ns	(6)
T_{TA-GO}	Time that the transmitter drives the Bridge state (LP-00) before releasing control during a Link Turnaround.	4× T_{LPX}				
$T_{TA-SURE}$	Time that the new transmitter waits after the LP-10 state before transmitting the Bridge state (LP-00) during a Link Turnaround.	T_{LPX}	–	2× TLPX		
T_{WAKEUP}	Time that a transmitter drives a Mark-1 state prior to a Stop state in order to initiate an exit from ULPS.	1	–	–	ms	

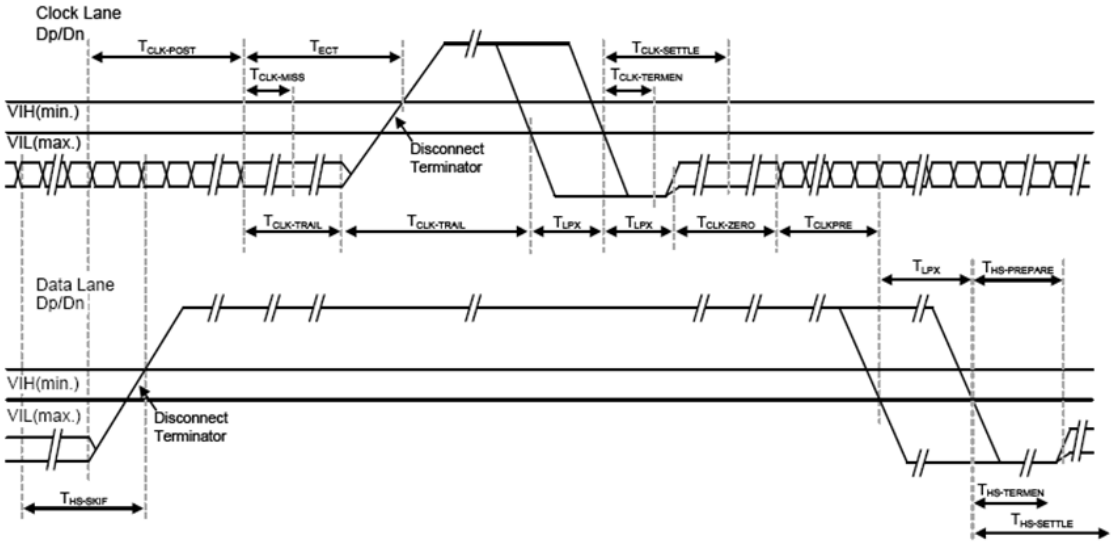
NOTE:

1. The minimum value depends on the bit rate. Implementations should ensure proper operation for the entiresupportedbit rates.
2. UI is the instantaneous unit interval.
3. If a> b then max (a, b) = a otherwise max (a, b) = b
4. n = 1 for forward-direction HS mode and n = 4 for reverse-direction HS mode
5. TLPX is an internal state machine timing reference. Externally measured values may differ slightly from the specified values due to asymmetrical rise and fall times.
6. Transmitter-specific parameter.
7. Receiver-specific parameter.

High-speed Data Transmission in Bursts



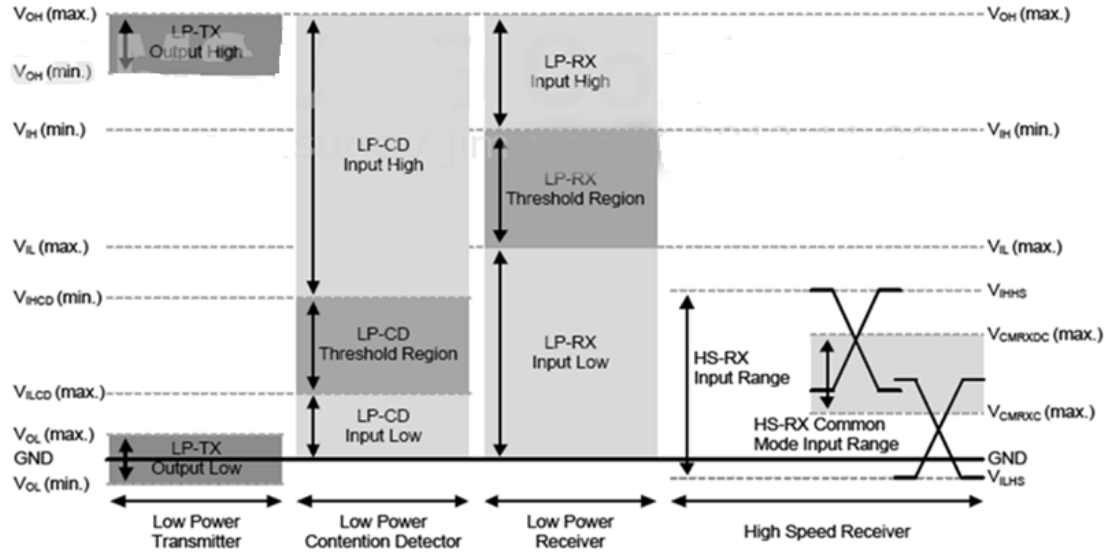
Switching the Clock Lane between Clock Transmission and Low-power Mode



6.8.2 MIPI Interface DC Characteristics

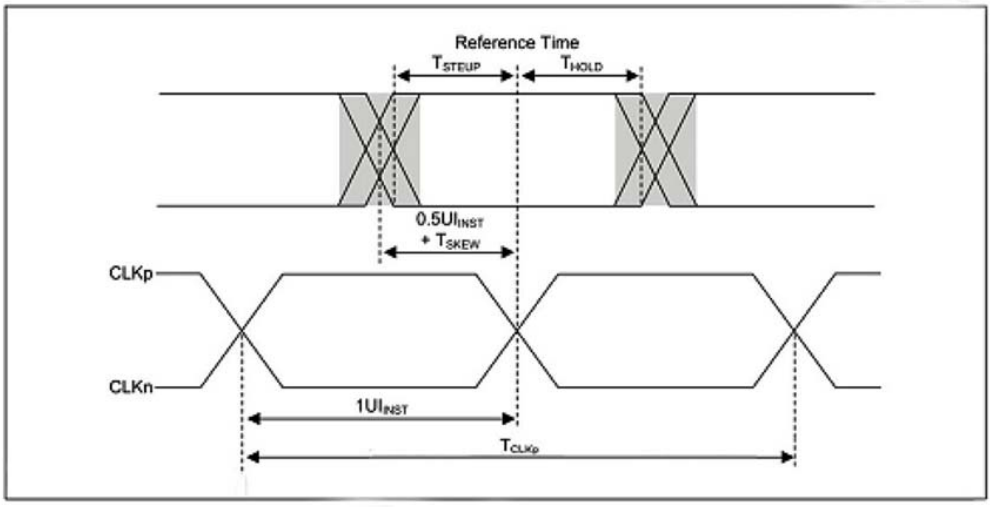
Item		Parameter	Min.	Typ.	Max.	Unit
LP_TX	Thevenin output high level	VOH	1.1	1.2	1.3	V
	Thevenin output low level	VOL	-50		50	mV
	Output impedance of LP transmitter	ZOLP	110	–	–	Ω
HS_RX	Common-mode voltage HS receive mode	VCMRX(DC)	70	–	330	mV
	Differential input high threshold	VIDTH	–	–	70	mV
	Differential input low threshold	VIDTL	-70	–	–	mV
	Single-ended input high voltage	VIHHS	–	–	460	mV
	Single-ended input low voltage	VILHS	-40	–	–	mV
	Single-ended threshold for HS termination enable	VTERM-EN	–	–	450	mV
	Differential input impedance	ZID	80	100	125	Ω
LP_RX	Logic 1 input voltage	VIH	880	–	–	mV
	Logic 0 input voltage, not in ULPState	VIL	–	–	550	mV
	Input hysteresis	VHYST	25	–	–	mV
LP_CD	Logic 1 contention threshold	VIHCD	450	–	–	mV
	Logic 0 contention threshold	VILCD	–	–	200	mV

Line Contention Detection



MIPI High-Speed Data-clock Timing

Host sends a differential clock signal to the IC for data sampling. This signal is a DDR (half-rate) clock and has one transition per data bit time. The timing relationship of the DDR Clock differential signal to the Data differential signal is shown in following figure.



6.9 Data input format

Parameter		Symbol	Min.	Typ.	Max.	Unit
Frame Rate		---	50	60	---	Hz
Clock frequency		1/ T_{Clock}		75		MHz
Vertical Section	Period	T_V	1288	1300	1535	T_{Line}
	Active	T_{VD}		1280		
	Blanking	T_{VB}	8	20	255	
Horizontal Section	Period	T_H	808	960	1055	T_{Clock}
	Active	T_{HD}		800		
	Blanking	T_{HB}	8	160	255	

Horizontal Blanking	Active Field	Front Porch	Frame Time	Vsync Width	Back Porch
160	800	24	960	4	160

Vertical Blanking	20
Active Field	1280
Front Porch	4
Frame Time	1300
Vsync Width	4
Back Porch	14

Pixel Frequency
74.88MHz
Frame rate
60Hz

6.10 Optical specifications

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR≥ 10)	θ_L	Φ=180°(9 o'clock)	80	85	-	degree	Note 1
	θ_R	Φ=0°(3 o'clock)	80	85	-		
	θ_T	Φ=90°(12 o'clock)	80	85	-		
	θ_B	Φ=270°(6 o'clock)	80	85	-		
Response time Rise+Fall	T_{RT}		-	30	35	msec	Note 3
Contrast ratio	CR	Normal θ=Φ=0°	700	850	-	-	Note 4
Color chromaticity	W_X		0.267	0.297	0.327	-	Note 2
	W_Y		0.297	0.327	0.357	-	Note 5 Note 6
Luminance	L		250	300	-	cd/m2	Note 6
Luminance uniformity	Y_U		70	75	-	%	Note 6,7

Note 1: Definition of viewing angle range

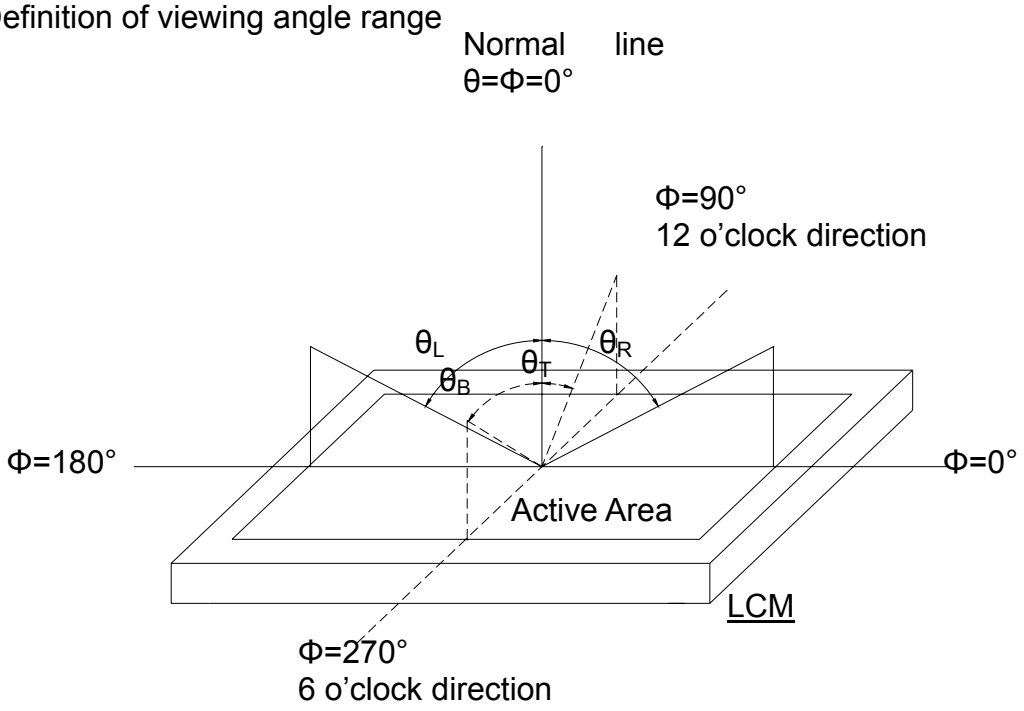


Fig. 4-1 Definition of viewing angle

Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Viewing angle is measured by ELDIM-EZ contrast/Height :1.2mm ,Response time is measured by Photo detector TOPCON BM-5A, other items are measured by BM-7A/Field of view: 1° /Height: 500mm.)

Normal line
θ=Φ=0°

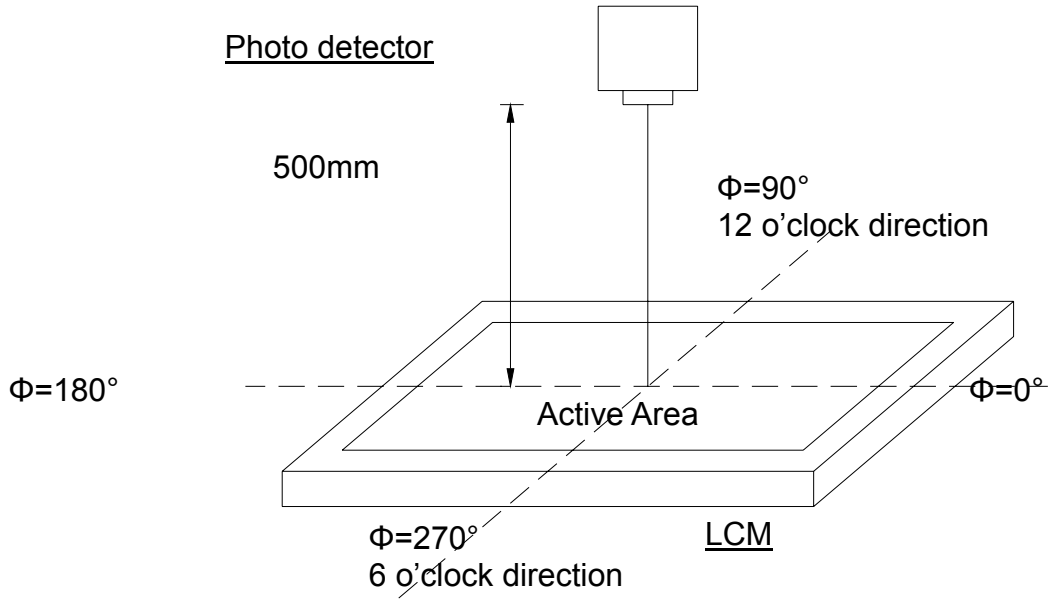


Fig. 4-2 Optical measurement system setup

Note 3: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.

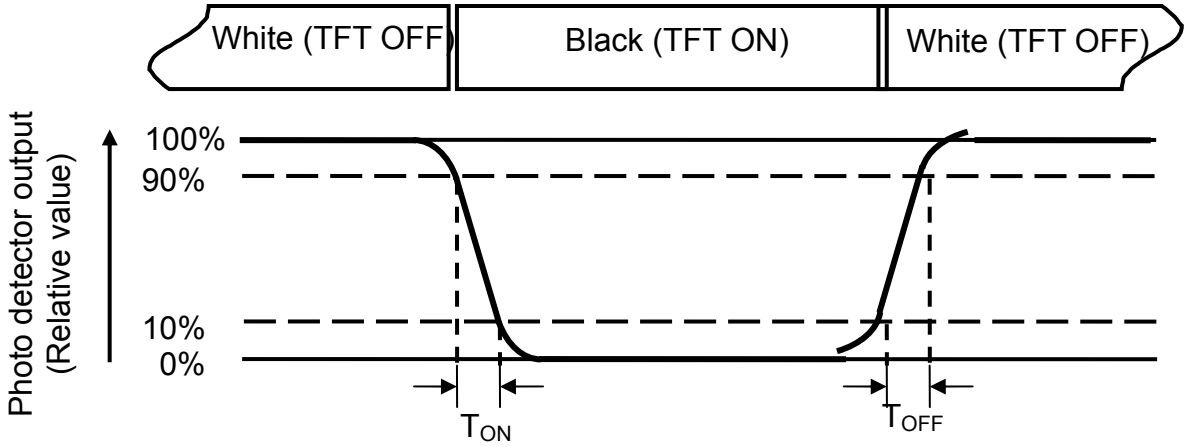


Fig. 4-3 Definition of response time

Note 4: Definition of contrast ratio

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

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is I_{LED}=80mA.

Note 7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer to Fig. 4-4).Every measuring point is placed at the center of each measuring area.

$$Luminance\ \ Uniformity\,(Yu) = \frac{B_{min}}{B_{max}}$$

L-------Active area length W----- Active area width

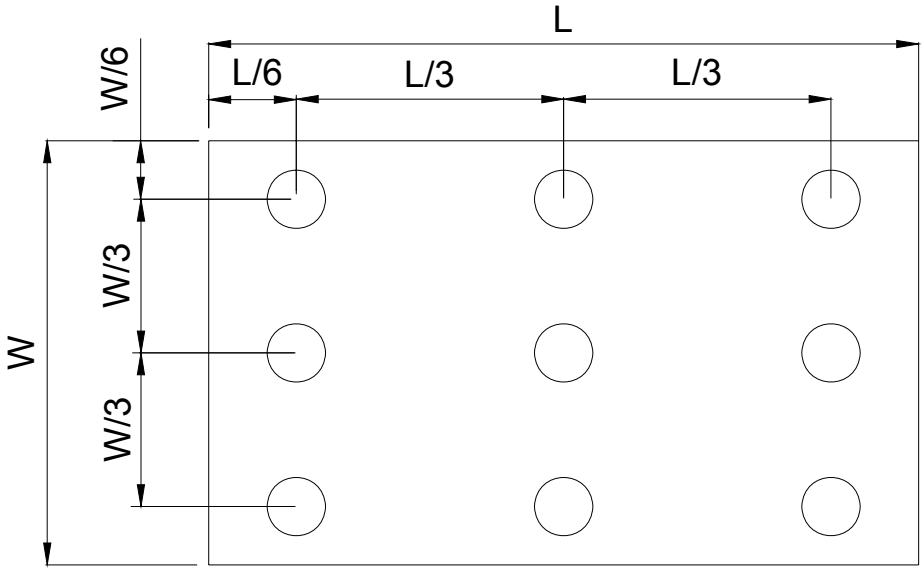


Fig. 4-4 Definition of measuring points

B_{max}: The measured maximum luminance of all measurement position.
B_{min}: The measured minimum luminance of all measurement position.

7. Reliability Test Conditions And Methods

Item	Test Conditions	Remark
High Temperature Storage	Ta = 60℃ 96 hrs	
Low Temperature Storage	Ta = -20℃ 96hrs	
High Temperature Operation	Ts = 50℃ 96hrs	
Low Temperature Operation	Ta = -10℃ 96hrs	
High Temperature and Humidity Storage	50℃, 90%RH max. 96hrs	
Thermal Shock	-20℃~ +60℃ 10 cycles 1Hrs/cycle	Non-operation
Electrostatic Discharge	Contact=±4KV, class B Air=±8KV, class B	

8. Handling Precautions

8.1 Mounting method

The LCD panel of K&D LCD module consists of two thin glass plates with polarizes which easily be damaged. And since the module in so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

8.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent [recommended below] and wipe lightly

- Isopropyl alcohol

- Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated:

- Soldering flux
- Chlorine (Cl) , Salfur (S)

If goods were sent without being sili8con coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happen by miss-handling or using some materials such as Chlorine (Cl), Salfur (S) from customer, Responsibility is on customer.

8.3 Caution against static charge

The LCD module use C-MOS LSI drivers, so we recommended that you:

Connect any unused input terminal to Vdd or Vss, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

8.4 packing

- Module employ LCD elements and must be treated as such.
- Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity

8.5 Caution for operation

- 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.
- Response time will be extremely delayed at lower temperature then the operating temperature range and on the other hand at higher temperature LCD's how dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- 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.

8.6 storage

In the case of storing for a long period of time for instance, for years for the purpose or replacement use, the following ways are recommended.

- Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it . And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.

- Storing with no touch on polarizer surface by the anything else.
  [It is recommended to store them as they have been contained in the inner container at the time of delivery from us

8.7 Safety

- It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water

9. Precaution for use

9.1

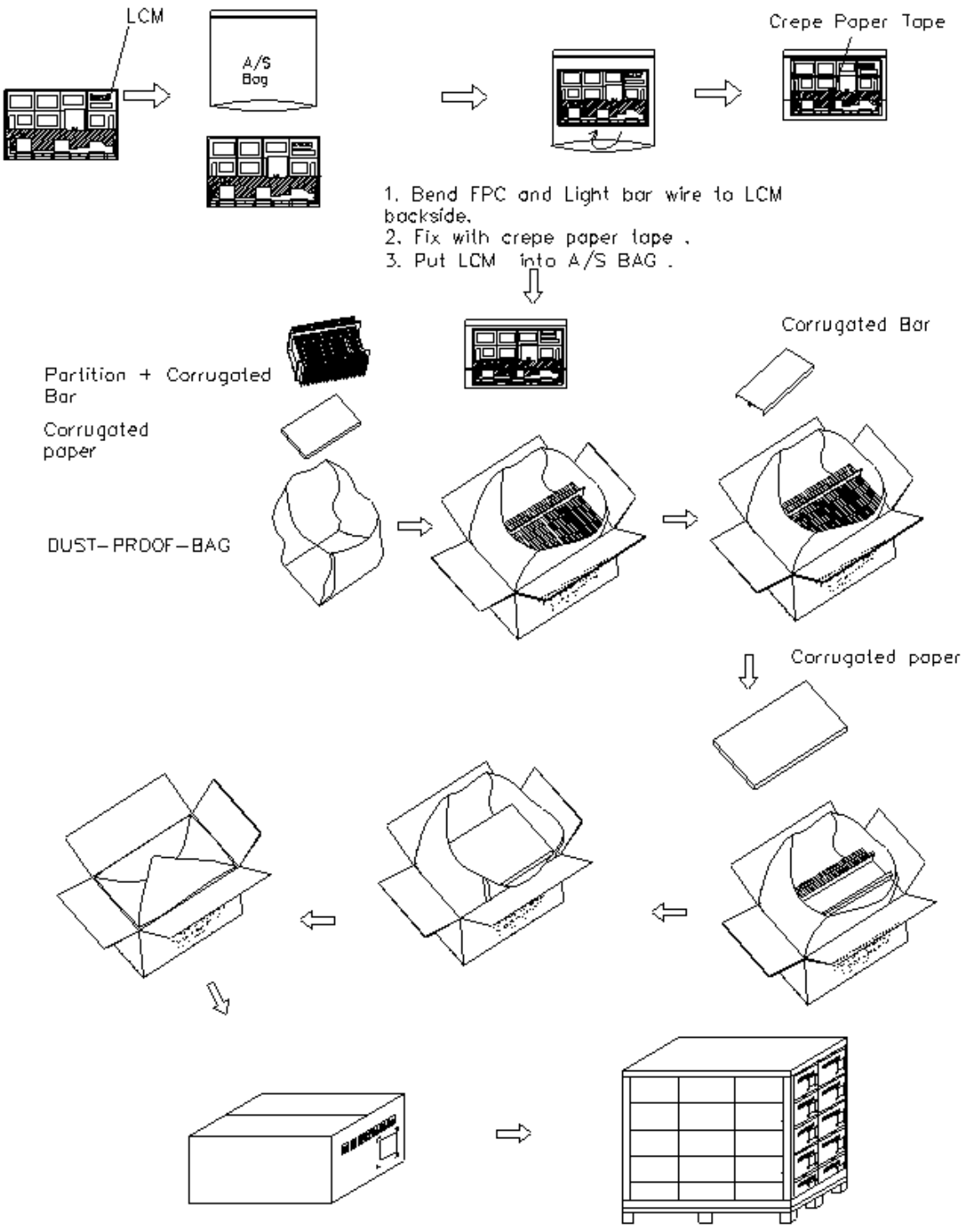
A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

9.2

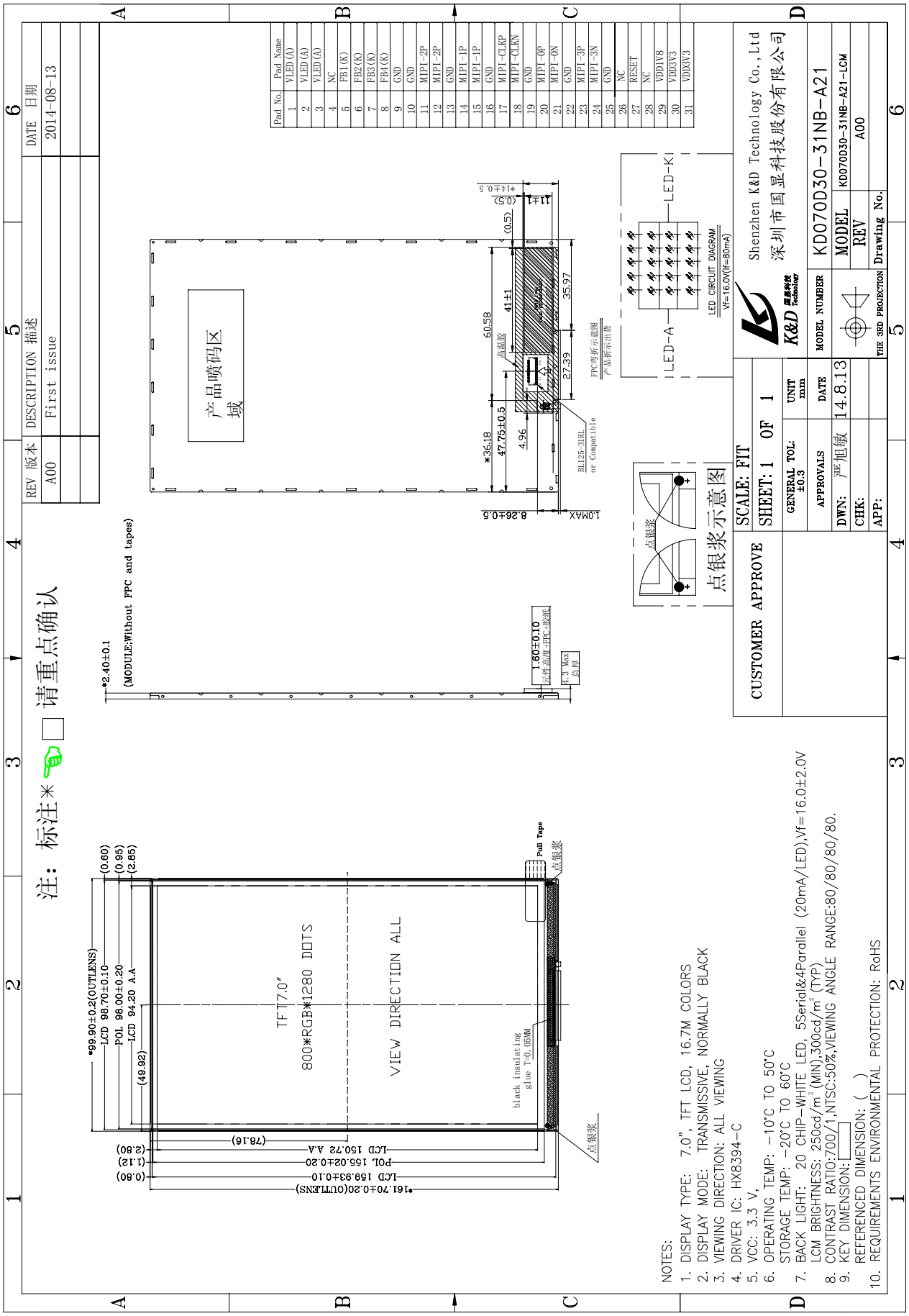
On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- When a question is arisen in this specification
- When a new problem is arisen which is not specified in this specifications
- When an inspection specifications change or operating condition change in customer is reported to K&D , and some problem is arisen in this specification due to the change
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

10. Package Drawing



11. Outline Dimension



12. Bar code label and packing chest label

TBD

13. HSF Requirements

■ RoHS （Restriction of the use of certain Hazardous Substances）

☐ HF（Halogen Free）

☐ REACH（Regulation concerning the Registration, Evaluation, Authorization and Restriction of Chemicals）

☐ Other regulations