深圳市拓普微科技开发有限公司
SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

LMK070DICFWD-APA-2

LCD Module User Manual

Prepared by:	Checked by:	Approved by:
Linli Date: 2017-11-03	Date:	Date:

Rev.	Descriptions	Release Date
0.1	Preliminary	2017-10-18
0.2	Revise Block Diagram	2017-11-03

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1. General Specification

Signal Interface :	LVDS (VESA 24 bits)
Display Mode :	Transmissive with Normally White
Screen Size :	7.0 inch
Outline Dimension :	200.0 x 125 .0x 30.0(mm)(with mounting Bezel) (see outline drawing for details)
Active Area :	154.08x 85.92(mm)
Number of dots :	800x 3 (RGB) x 480
Dot Pitch :	0.1926x 0.179(mm)
Pixel Configuration :	R.G.B. Vertical Stripe
Backlight :	White LED
Viewing Direction :	6 o'clock (Gray scale Inversion) (*1) 12 o'clock (*2)
Operating Temperature :	-20 ~ +70°C
Storage Temperature :	-30 ~ +80°C

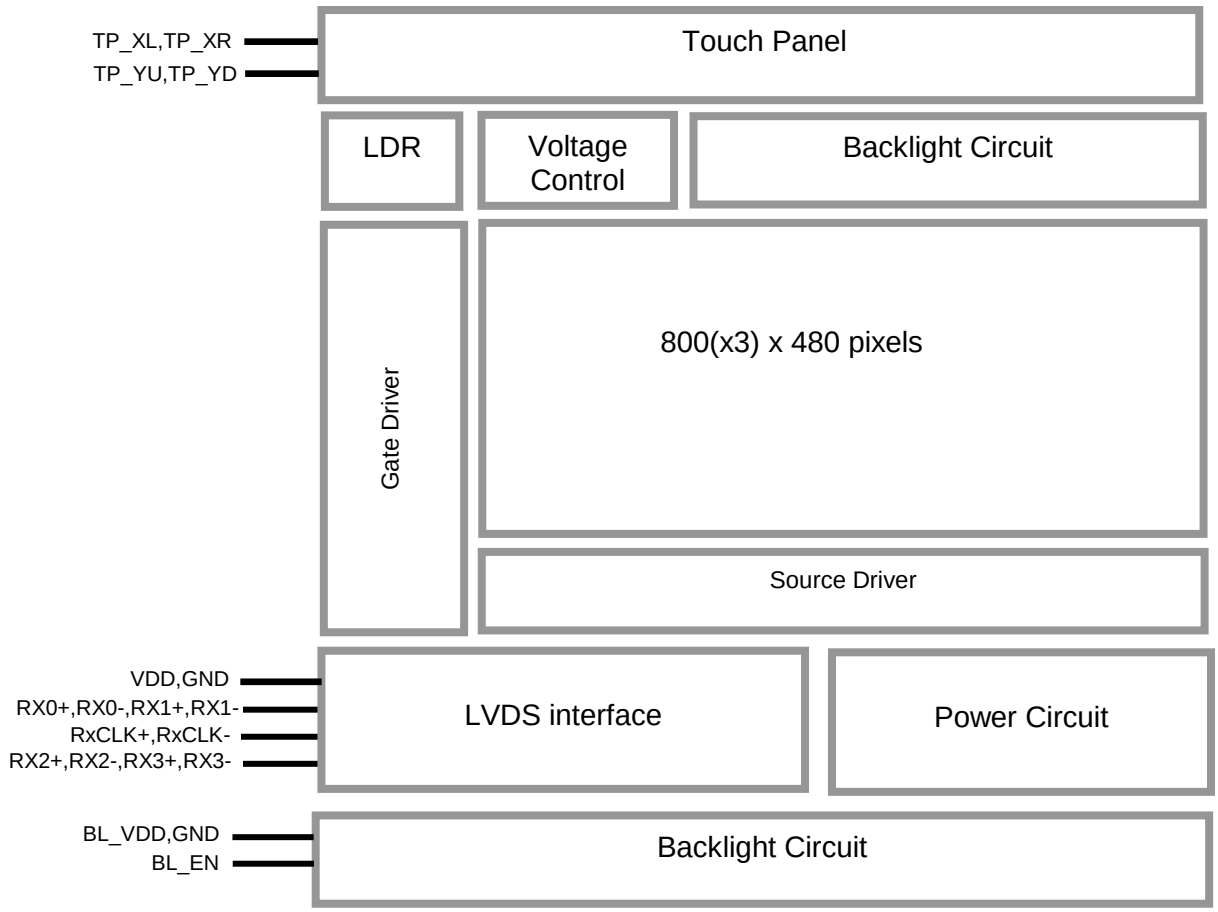
Note:

**1. For saturated color display content (eg. pure-red, pure-green, pure-blue or pure-colors -combinations).*

**2. For "color scales" display content.*

**3. Color tone may slightly change by temperature and driving condition.*

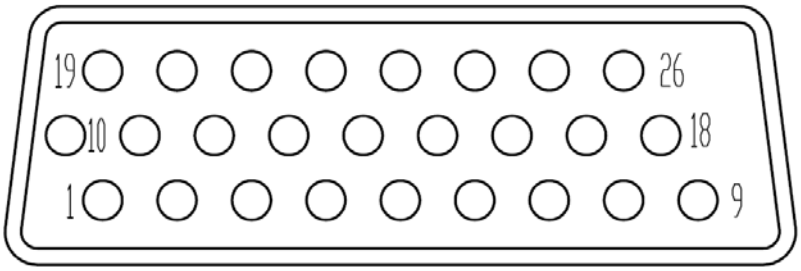
2. Block Diagram



3. Terminal Function

3.1 K1 Terminal (DB26 Right angle connector)

K1 Pin No.	Pin Name	I/O	Descriptions
1	RX3+	Input	LVDS receiver positive signal channel 3
2	RX3-	Input	LVDS receiver negative signal channel 3
3	FRC	I/O	Dithering function(*1)
4	RXCLK+	Input	LVDS receiver positive signal Clock
5	RXCLK-	Input	LVDS receiver negative signal Clock
6	GND	Power	Power Supply GND (0V)
7	RX2+	Input	LVDS receiver positive signal channel 2
8	RX2-	Input	LVDS receiver negative signal channel 2
9	GND	Power	Power Supply GND (0V)
10	RX1+	Input	LVDS receiver positive signal channel 1
11	RX1-	Input	LVDS receiver negative signal channel 1
12	GND	Power	Power Supply GND (0V)
13	RX0+	Input	LVDS receiver positive signal channel 0
14	RX0-	Input	LVDS receiver negative signal channel 0
15	L/R	I/O	Left / right selection(*2)
16	U/D	I/O	Up/ Down selection(*2)
17	VDD	Power	Logic Positive Power Supply
18	VDD		
19	BL_VDD	Power	Backlight Power Supply
20	NC	-	No connection
21	BL_EN	I/O	Backlight Enable control, Active High or keep open
22	GND	Power	Power Supply GND (0V)
23	TP_XR	Passive	Touch Screen XR terminal
24	TP_YU	Passive	Touch Screen YU terminal
25	TP_XL	Passive	Touch Screen XL terminal
26	TP_YD	Passive	Touch Screen YD terminal



Note:

**1: Dithering function enable control.*

When FRC=" 1 " , Disable internal dithering function.

When FRC=" 0 " , Enable internal dithering function. <default>

**2: Selection of scanning mode*

Setting of scan control input		Function Descriptions
L/R	U/D	Scanning direction
VDD	GND	Up to down, left to right <default>
GND	VDD	Down to up, right to left
GND	GND	Up to down, right to left
VDD	VDD	Down to up, left to right

** 3. When JP1 Close, JP2 Open, MODE=" 1 " , select DE mode, VS and HS must pull high. <default>*

When JP2 Close, JP1 Open, MODE =" 0 " , select SYNC mode, DE must pull low.

4. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Power Supply voltage	V_{DD}	-0.3	3.6	V	
Backlight Supply voltage	V_{DD_BL}	-0.3	13.0	V	
Operating Temperature	T_{OP}	-20	70	°C	No Condensation
Storage Temperature	T_{ST}	-30	80	°C	No Condensation

Note:
**1. This rating applies to all parts of the module. And it should not be exceeded.*
**2. The operating temperature only guarantees operation of the circuit. The contrast, response speed, and the other specification related to electro-optical display quality is determined at the room temperature, T_{OP}=25℃*
**3. Any Stresses exceeding the Absolute Maximum Ratings may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.*

5. Electrical Characteristics

5.1 DC Characteristics

VDD=3.3V, GND=0V ,Top=25℃

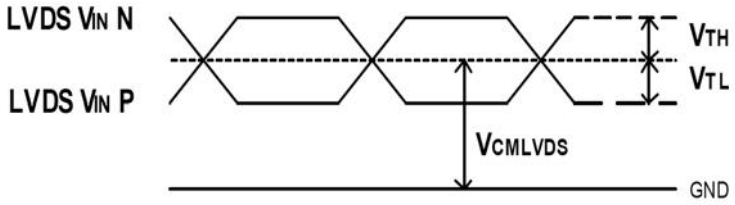
Items	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Supply Voltage	V_{DD}	3.0	3.3	3.6	V	*2
Backlight Supply voltage	V_{DD_BL}	11.5	12.0	12.5		*2, *3
Input logic high voltage	V_{IH}	0.8V_{DD}	-	V_{DD}	V	*2, *3
Input logic low voltage	V_{IL}	0	-	0.2V_{DD}	V	
Logic Supply Current (V_{DD})	I_{VDD}	-	120	250	mA	
Backlight Supply Current (V_{DD_BL})	I_{VDD_BL}	-	175	350	mA	

Note:
**1. Never apply logic signal before the V_{DD} and V_{DD_BL}.*
**2. VDD setting should match the signals voltage*
**3. For all the inputs signals*
**4. Clock Freq=66MHz*

5.2 DC Characteristics(LVDS)

VDD=3.3V,GND=0V,T_a=25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Note
Differential Input High Threshold	V_{TH}	-	-	100	mV	
Differential Input Low Threshold	V_{TL}	-100	-	-	mV	
Input Current	I_{IN}			±10	uA	
Differential Input common Mode voltage	V_{CMLVDS}	1.65	-	2.1	V	

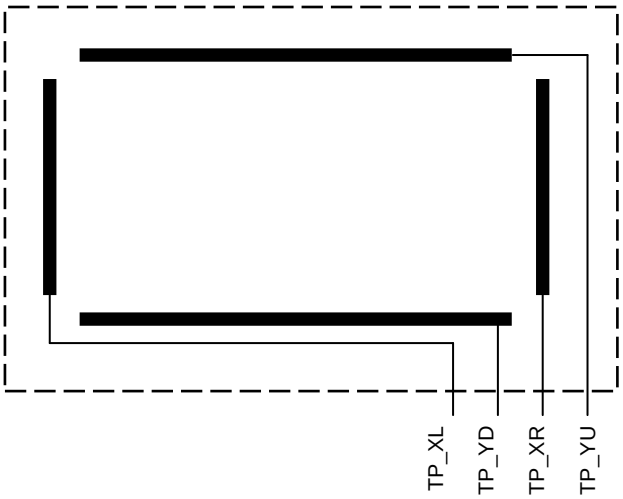


LVDS DC timing diagram

5.3 Touch panel Characteristics

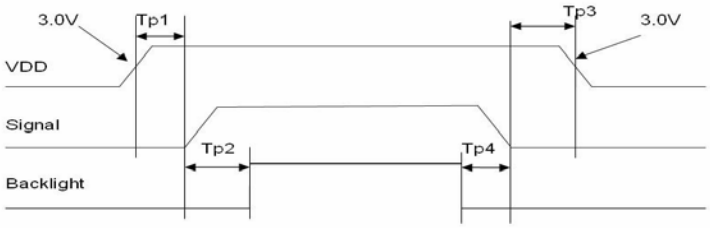
Items	MIN.	TYP.	MAX.	Unit	Applicable Pin
Terminal resistance	100	-	900	Ω	X- terminal
	200	-	1200	Ω	Y- terminal
Operating Voltage	-	-	7	V	-
Response time	-	-	10	ms	-
Life Time	-	1,000,000	-	times	-

Cautions:
Exceeding the recommended Condition could cause substantial damage to the touch panel and shorten its lifetime.



5.4 POWER ON/OFF SEQUENCE

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Note
VDD 3.0V to signal starting	Tp1	0	-	50	ms	
Signal staring to backlight on	Tp2	150	-	-	ms	
Signal off to VDD 3.0V	Tp3	0	-	50	ms	
Backlight off to signal off	Tp4	150	-	-	ms	



Interface Power On/Off Sequence

6. Function Specifications

6.1 Automatic Display Brightness Control

LMK070DICFWD-APA-2 is equipped with a LDR sensing circuit for automatic brightness control. It reduces the brightness to 10% while the environment lighting becomes low. (e.g. night time)

Environment Lighting	Display Brightness
NORMAL	100%
LOW (e.g.night time)	10%

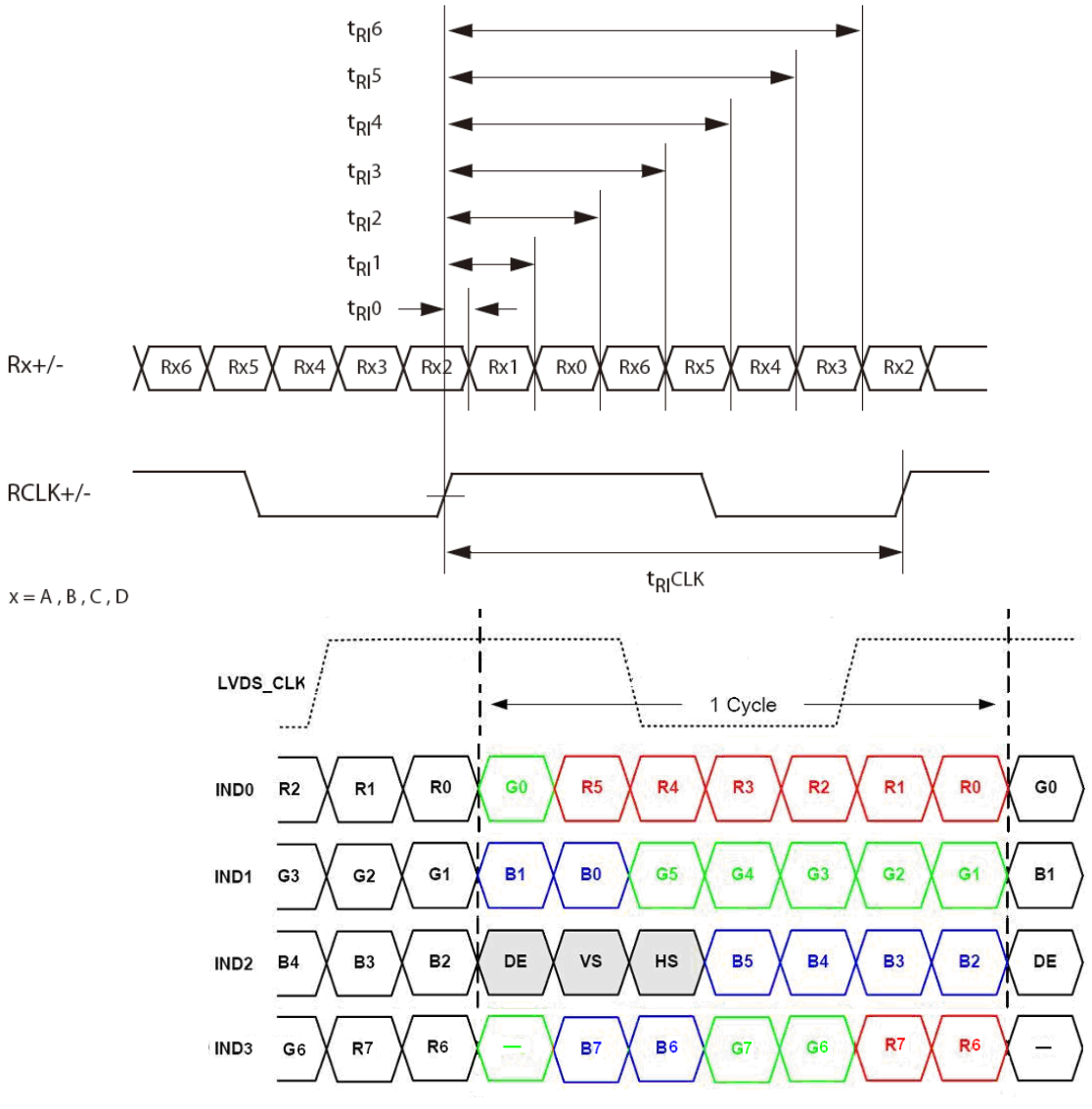
7. AC Characteristics

7.1 AC Characteristics(LVDS)

VDD=3.3V,GND=0V,T_a=25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Input CLK period	tRICLK	8.9	-	50	ns	
Input Data Position 0 (tRICLK = 8.9ns)	tRI0	-0.3	-	+0.3	ns	
Input Data Position 1 (tRICLK = 8.9ns)	tRI1	tRICLK/7-0.3	tRICLK/7	tRICLK/7+0.3	ns	
Input Data Position 2 (tRICLK = 8.9ns)	tRI2	2tRICLK/7-0.3	2tRICLK/7	2tRICLK/7+0.3	ns	
Input Data Position 3 (tRICLK = 8.9ns)	tRI3	3tRICLK/7-0.3	3tRICLK/7	3tRICLK/7+0.3	ns	
Input Data Position 4 (tRICLK = 8.9ns)	tRI4	4tRICLK/7-0.3	4tRICLK/7	4tRICLK/7+0.3	ns	
Input Data Position 5 (tRICLK = 8.9ns)	tRI5	5tRICLK/7-0.3	5tRICLK/7	5tRICLK/7+0.3	ns	
Input Data Position 6 (tRICLK = 8.9ns)	tRI6	6tRICLK/7-0.3	6tRICLK/7	6tRICLK/7+0.3	ns	

Input Clock and Data timing Diagram:

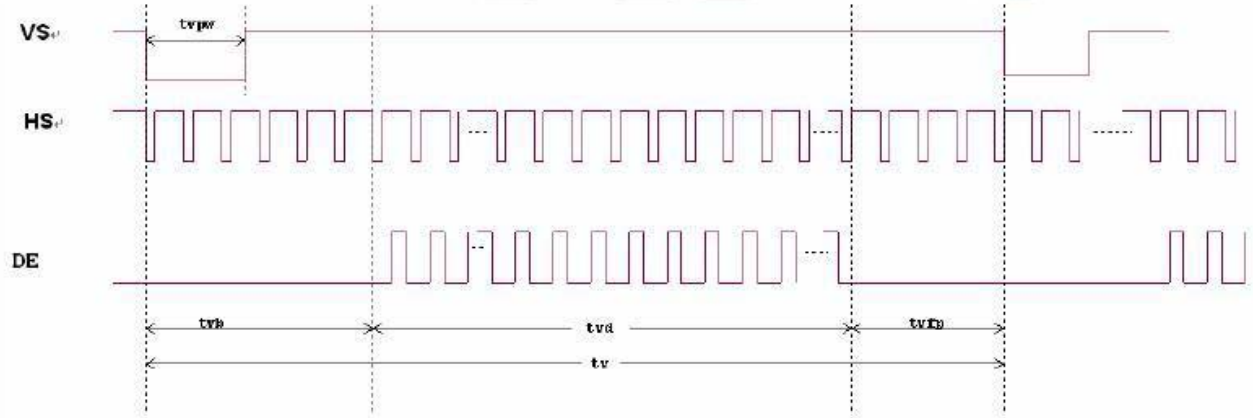


7.2 AC Characteristics(TFT)

Item	Symbol	MIN.	TYP.	MAX.	Unit	Remark
Horizontal Display Area	thd	-	800	-	DCLK	
DCLK Frequency	fclk	26.4	33.3	46.8	MHz	
One Horizontal Line	th	862	1056	1200	DCLK	
HS pulse width	thpw	1	-	40	DCLK	
HS Blanking	thb	46	46	46	DCLK	
HS Front Porch	thfp	16	210	354	DCLK	

Item	Symbol	Values			Unit	Remark
		MIN.	TYP.	MAX.		
Vertical Display Area	tvd	-	480	-	TH	
VS period time	tv	510	525	650	TH	
VS pulse width	tvpw	1	-	20	TH	
VS Blanking	tvb	23	23	23	TH	
VS Front Porch	tvfp	7	22	147	TH	

1 Horizontal input timing diagram.

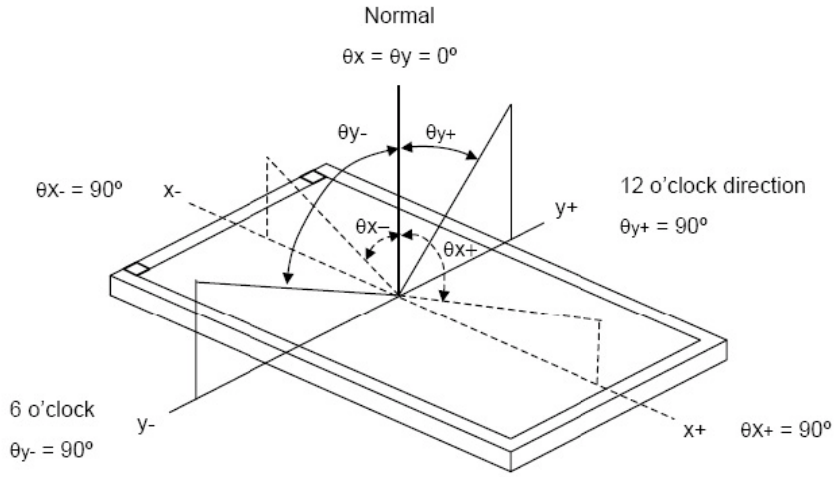


Vertical input timing diagram.

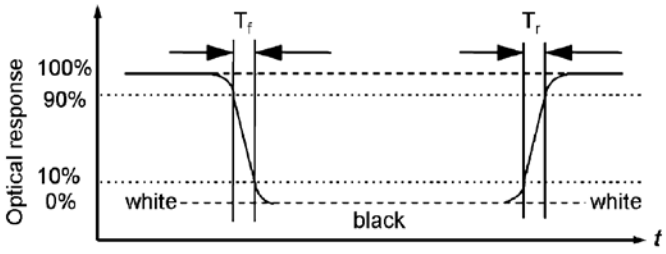
8. Optical Characteristics

Item	Symbol	Condition	MIN.	TYP.	MAX.	UNIT	Note.
Viewing angle (CR≥10)	θ_L	9 o'clock	60	70	-	degree	*2
	θ_R	3 o'clock	60	70	-		
	θ_T	12 o'clock	40	50	-		
	θ_B	6 o'clock	60	70	-		
Response Time	T_f	Normal θ=0°	-	10	20	msec	*3
	T_r		-	15	30	msec	
Contrast ratio	CR		400	500	-	-	*1
Color chromaticlty	W_X		0.26	0.31	0.26	-	
	W_Y		0.28	0.33	0.38	-	
Luminance	L		-	500	-	cd/m^2	*4
Luminance uniformity	Y_U		70	75	-	%	*4

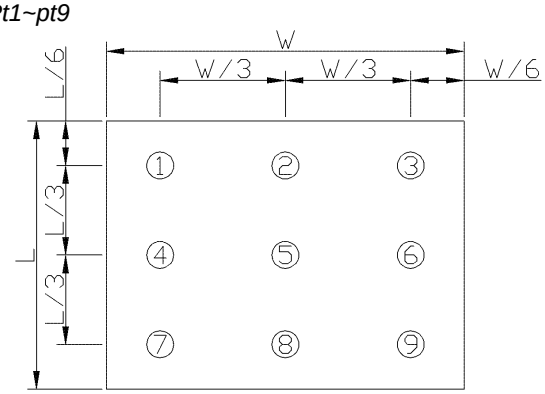
Note:
**1. Definition of Contrast Ratio*
The contrast ratio could be calculate by the following expression:
Contrast Ratio (CR) = Luminanc with all pixels white / Luminance with all pixels black
**2 Definition of Viewing Angle*



**3 Definition of response time*



**4 Definition of Luminance Uniformity*
Luminance uniformity (Lu)=
Min. Luminance form pt1~pt9 / Max Luminance form Pt1~pt9

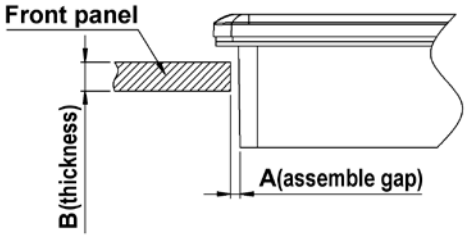


9. Assemble Precaution

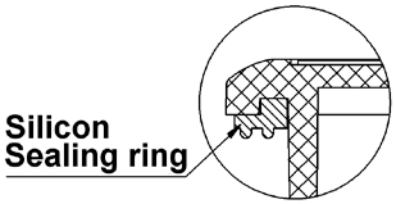
安装注意事项

1. Customer front panel opening and thickness for TOPWAY display module should be fit for its assembling and sealing.
   - The suggested assemble gap(A) should be about 0.3~0.5mm on each side.
   - The suggested front panel thickness(B) should be about 1.5~4.0mm.

   客户面板开窗及厚度应适合 TOPWAY 显示模块的安装及密封.
   - 建议每边安装间隙(A)约为 0.3 ~0.5mm.
   - 建议面板厚度(B) 约为 1.5~4.0mm.



2. A silicon sealing ring ships with TOPWAY display module. It should be in place before assembling to the front panel.
   TOPWAY 显示模块上的硅胶密封圈在安装时确保嵌入到位.



3. It should fix the TOPWAY display module into the front panel with two steps.
   - Pre-fixing: Slightly tighten the screws on beam clamp in sequence as picture on the right side.
   - Final-fixing: Tighten the fixing screws on beam clamp in sequence as well with twist torque about 6~8kg.cm (*1) . and put the beam clamp straight.

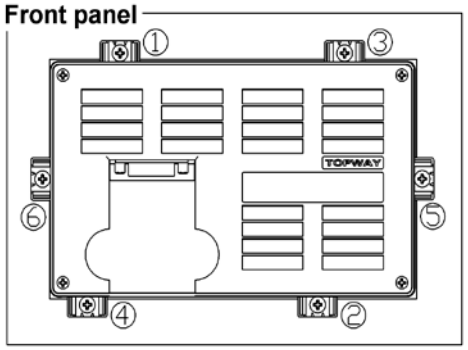
   Note:

   *1. Over tightening might damage the shell and cause bad sealing result.

   应分两步将 TOPWAY 显示模块固定在面板上.
   - 预紧: 将卡扣螺钉按右图所示顺序稍加预紧.
   - 紧定: 再次按顺序用 **6~8kg.cm**扭力拧紧卡扣螺钉(* 1), 并注意卡扣置正无歪斜.

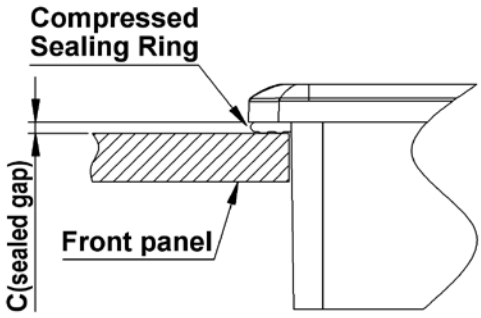
   注:

   *1. 过度拧紧可能会损坏外壳和影响密封效果.



4. It is strongly suggested to check the seal balancing of the four-side of the TOPWAY display module.
   - The suggested after assemble sealed gap(C) should be about 1.0~1.5mm.

   需注意检查 TOPWAY 显示模块四周在安装后保证平衡密封.
   - 建议组装后的密封间隙(C)约为 1.0 ~1.5 mm.



5. Others:
   - Never hot plug the device! Power off the device before connect or disconnect the display module.
   - Don't forget to remove the cover protective film for normal operation.

   其它:
   - 视频线禁止带电插拔！ 在连接或断开显示模块之前先关闭设备电源.
   - 使用前请揭去保护膜.

10. Precautions for Use of LCD Modules

10.1 Handling Precautions

10.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

10.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

10.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

10.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

10.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketone
- Aromatic solvents

10.1.6 Do not attempt to disassemble the LCD Module.

10.1.7 If the logic circuit power is off, do not apply the input signals.

10.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

10.1.8.1 Be sure to ground the body when handling the LCD Modules.

10.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.

10.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

10.8.4 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

10.2 Storage precautions

10.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

10.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:
Temperature : 0℃ ～ 40℃ Relatively humidity: ≤80%

10.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

10.3 Transportation Precautions

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.