




Product Specification				
	Model: GKIPA1MNHA1B0	Rev. No.	Issued Date.	Page.
		A	2017, Jan. 05	1 / 19


Thin-Film-Transistor LCD Module
Model: GKIPA1MNHA1B0

Acceptance

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Product Specification				
	Model: GKIPA1MNHA1B0	Rev. No.	Issued Date.	Page.
		A	2017, Jan. 05	3 / 19

Contents

- 1. General Description and Features 3**
- 1.1 Features 3
- 1.2 LCD Module 3
- 2. Mechanical Information..... 3**
- 3. Electrical Specifications 3**
- 3.1 Absolute Max. Ratings 3
- 4.1 Optical characteristic of the LCD 3
- 5. I/O Terminal..... 3**
- 5.1 Pin Assignment (CN1 connector: Panasonic, AYF334535 or equivalent.) 3
- 5.2 Block Diagram 3
- 6. Displayed Color and Input Data..... 3**
- 6.1 8 bit Input Data 3
- 7. Reliability Condition 3**
- 8. Dimensional Outlines 3**

Product Specification

	Model: GKIPA1MNHA1B0	Rev. No.	Issued Date.	Page.
		A	2017, Jan. 05	4 / 19

1. General Description and Features

GKIPA1MNHA1B0 is a transmissive type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT-LCD module, a receiver circuit, and a back-light unit. Graphics and texts can be displayed on a WUXGA 1920 (W) x 3 x 1200 (H) dots (16:10 aspect ratio) with 16.7M colors by supplying 24 bits data signal (8 bits each color). The following table described the features of GKIPA1MNHA1B0.

1.1 Features

- Transmissive.
- DE (Data Enable) only mode
- 2 channel LVDS Receiver 8 bit Interface.

1.2 LCD Module


Item	Specification	Unit
Screen Size	10.1 inches	Diagonal
Display Resolution	1920 (H) x 1200 (V)	Pixel
Active Area	216.576 (H) x 135.36 (V)	mm
Outline Dimension	229.0(H) x 153.0 (V) x4.5(T)	mm
Display Mode	Normally Black mode/ Transmissive	--
Surface Treatment	HC-LR	--
Pixel Arrangement	R,G,B Vertical Stripe	--
Pixel Size	0.1128 x 0.1128	mm
Display Color	16.7M	--
Viewing Direction	Free	--
Input Interface	LVDS	--

2. Mechanical Information

Item	Min.	Typ.	Max.	Unit	Note	
Module Size	Horizontal (H)	228.7	229.0	229.3	mm	(1)
	Vertical (V)	152.7	153	153.3	mm	
	Thickness (T)	-	4.5	5	mm	
Weight	-	160	200	g		

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Product Specification

	Model: GKIPA1MNHA1B0	Rev. No.	Issued Date.	Page.
		A	2017, Jan. 05	5 / 19

3. Electrical Specifications

3.1 Absolute Max. Ratings

3.1.1 Absolute Ratings of Environment

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.


Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T _{STG}	0	50	°C	(1)
Operating temperature	T _{OPR}	-20	60	°C	(1,2,3)

Note (1) 90 % RH Max. ($40\text{ °C} \geq T_a$). Maximum wet-bulb temperature at 39 °C or less. ($T_a > 40\text{ °C}$) No condensation.

Note (2) In case of below 0 °C , the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's character

Note (3) Only operation is guaranteed at operating temperature. Contrast, response time, another display quality are evaluated at $+25\text{ °C}$.

Product Specification

	Model: GKIPA1MNHA1B0	Rev. No.	Issued Date.	Page.
		A	2017, Jan. 05	6 / 19

3.1.2 Electrical Absolute Maximum Ratings

($V_{SS}=GND=0$)

Parameter	Symbol	Min.	Max.	Unit	Remark
Power supply voltage	VCC	-0.3	4.0	V	(1)
Logic input voltage	V_{IN}	-0.3	3.6	V	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for lamp (Refer to 3.2 for further information).

3.1.3 DC Electrical Characteristics of the TFT LCD


($T_a=25\pm 2^\circ\text{C}$, $GND=0$)

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply Logic Voltage	VCC	3.0	3.3	3.6	V	-
Rush Current	I_{rush}	-	-	3	A	-
Power supply Logic Current	ICC	-	400	600	mA	(2)
Differential Input Voltage for LVDS Receiver Threshold	V_{IH}	-	-	100	mV	-
	V_{IL}	-100	-	-	mV	-

Note (1) The assembly should be always operated within above ranges.

Note (2) The specified power supply current is under the conditions at $VCC = 3.3V$, $T_a = 25 \pm 2^\circ\text{C}$, $f_v = 60\text{ Hz}$, $f_H = 74.1\text{ Hz}$, $f_{CLK} = 154\text{ MHz}$.

Product Specification

	Model: GKIPA1MNHA1B0	Rev. No.	Issued Date.	Page.
		A	2017, Jan. 05	7 / 19

3.1.4 DC Electrical Characteristics of the Back-light Unit


(Ta=25±2°C, GND=0)

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply LED Voltage	VLED	7	12	16	V	
Power supply LED Current	ILED	-	-	900	mA	
LED Power Consumption	P _{LED}	-	4.09		W	
PWM Frequency	PWM	100		1000	Hz	
Duty ratio	Dim	10		100	%	
LED Life Time	L _L	15000	-	-	Hrs	I _F =20mA
		30000	-	-	Hrs	I _F =10mA

Note (1) Maximum LED Driver Input Current at 12V Input Voltage/PWM Duty 100%.

Note (2) Life time means that estimated time to 50% degradation of initial luminous intensity.

Product Specification

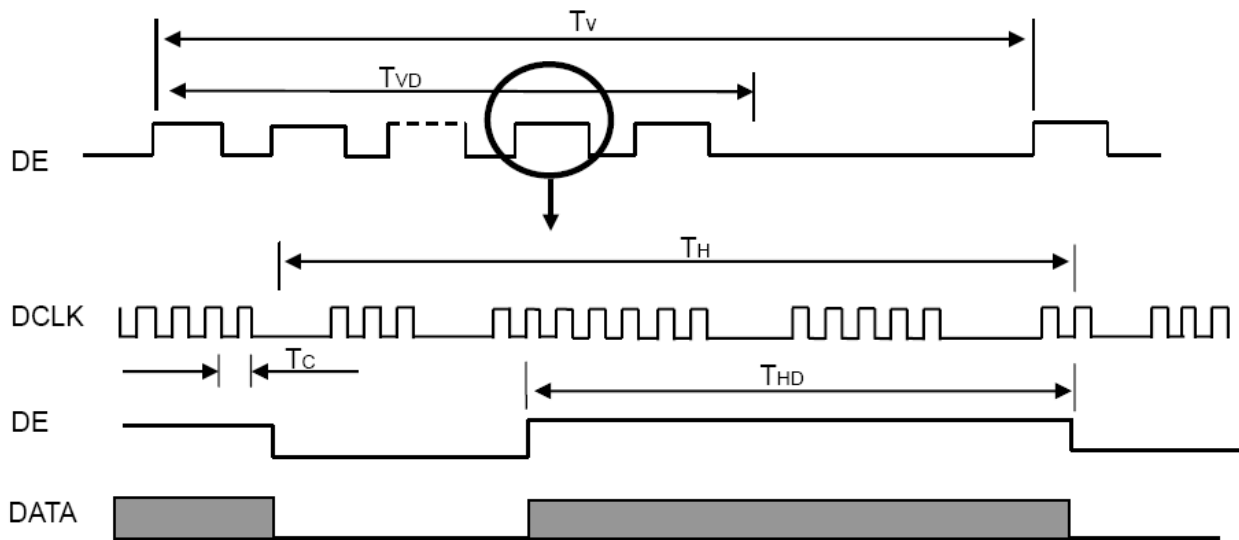
	Model: GKIPA1MNHA1B0	Rev. No.	Issued Date.	Page.
		A	2017, Jan. 05	8 / 19

3.1.5 AC Timing Condition


Signal	Parameter	Symbol	Min.	Typ.	Max.	Unit.	Remark
Frame rate	Frame rate	F	-	60	-	MHz	-
DCLK	CLK frequency	F_c	-	154	-	MHz	-
		T_c	-	6.5	-	ns	-
Horizontal Timing	Total	T_h	-	2080	-	Tc	-
	Display	T_{hd}	-	1920	-	Tc	-
	Blank	T_{hb}	-	160	-	Tc	-
Vertical Timing	Total	T_v	-	1235	-	Th	-
	Display	T_{vd}	-	1200	-	Th	-
	Blank	T_{vb}	-	35	-	Th	-

Note (1) Since this assembly is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this assembly would operate abnormally.

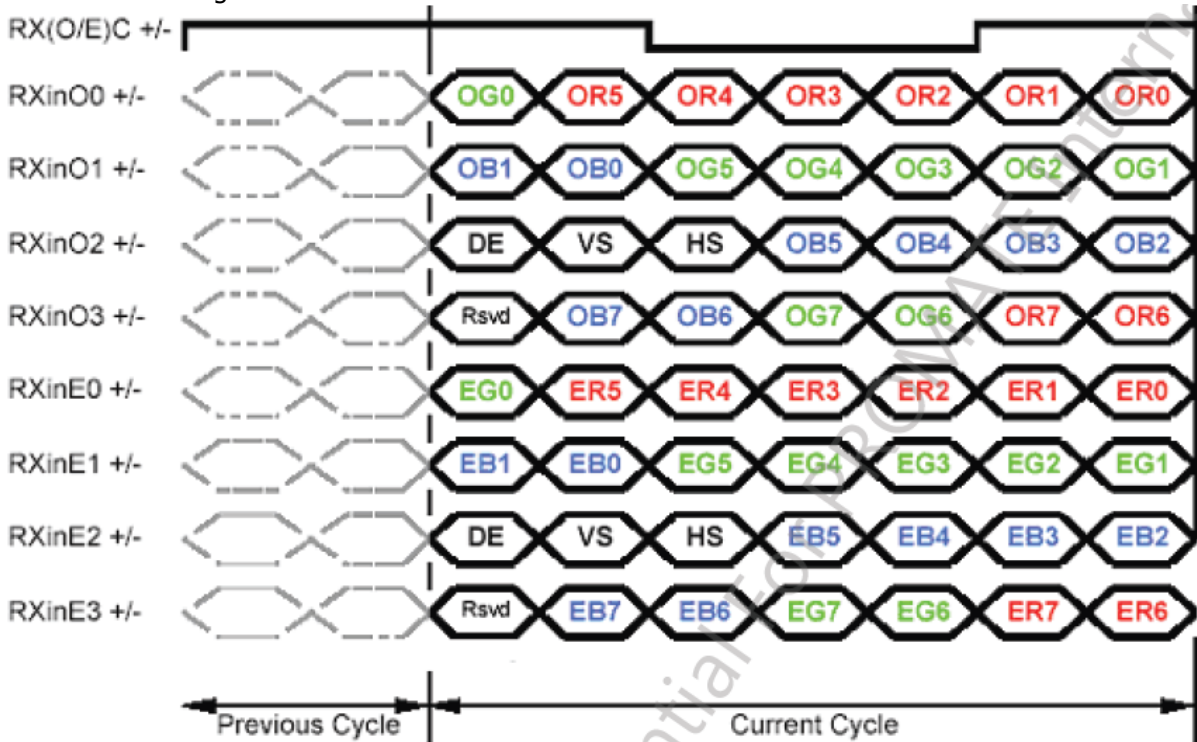
INPUT SIGNAL TIMING DIAGRAM



Product Specification

	Model: GKIPA1MNHA1B0	Rev. No.	Issued Date.	Page.
		A	2017, Jan. 05	9 / 19

3.1.6 Timing Characteristic




Note (1) R/G/B data 7: MSB, R/G/B data 0: LSB

Note (2) please follow PSWG

Signal Name	Description	Remark
R7	Red Data 7(MSB)	Red-pixel Data Each red pixel's brightness data consists of these 8 bits pixel data.
R0	Red Data 0(LSB)	
G7	Green Data 7(MSB)	Green-pixel Data Each green pixel's brightness data consists of these 8 bits pixel data.
G0	Green Data 0(LSB)	
B7	Blue Data 7(MSB)	Blue-pixel Data Each blue pixel's brightness data consists of these 8 bits pixel data.
B0	Blue Data 0(LSB)	
RXCLKIN+ RXCLKIN-	LVDS Clock Input	
DE	Display Enable	
VS	Vertical Sync	
HS	Horizontal Sync	

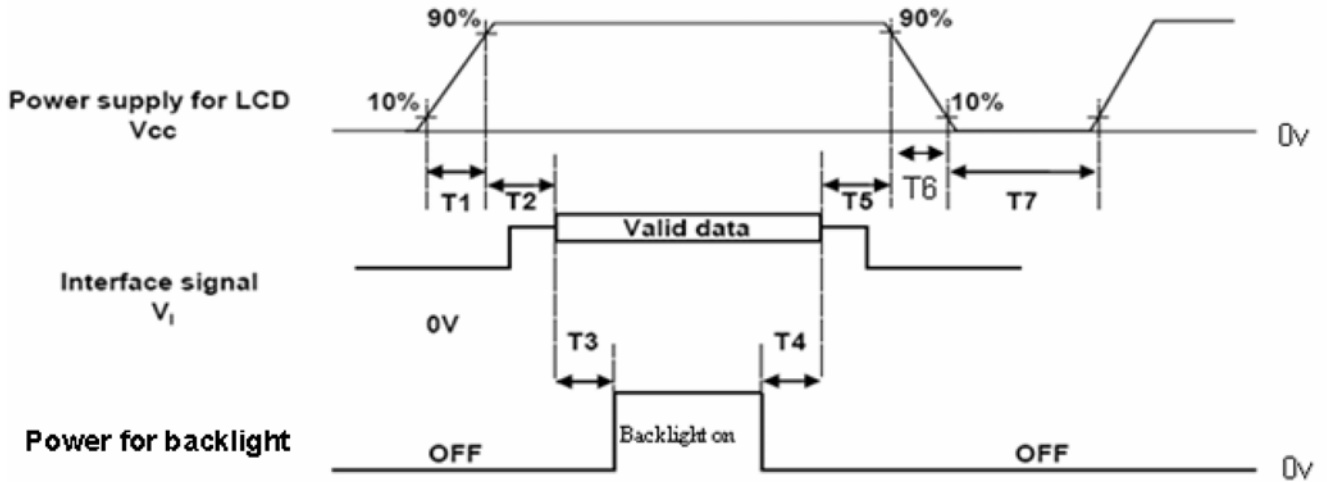
Note (3) Output signals from any system shall be low or Hi-Z state when VCC is off.

Product Specification

	Model: GKIPA1MNHA1B0	Rev. No.	Issued Date.	Page.
		A	2017, Jan. 05	10 / 19

3.1.7 Power On/Off Sequence

To prevent a latch-up or DC operation of LCD assembly, the power on/off sequence should be as the diagram below.




Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid; be sure to pull down the power supply of LCD VCC to 0 V.

Note (3) The Backlight converter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.01	-	50	ms
T2	100	-	150	ms
T3	200	-	-	ms
T4	200	-	-	ms
T5	0.01	-	50	ms
T6	0.01	-	50	ms
T7	500	-	-	ms

Product Specification

	Model: GKIPA1MNHA1B0	Rev. No.	Issued Date.	Page.
		A	2017, Jan. 05	11 / 19

4. Optical Characteristics

4.1 Optical characteristic of the LCD


The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods.

Measuring equipment: BM-7A

Ta=25±2°C ;Ha=50±10%RH

Item	Symbol	Condition	Min	Type	Max	Unit	Note
Brightness	B		(650)	(700)	--	cd/m ²	
Response time	Tr	θ=0°	--	30	40	ms	
	Tf						
Contrast ratio	CR	At optimized viewing angle	600	800	--	--	
Luminance Uniformity	ΔL		70	75		%	
Color Chromaticity (CIE 1931)	White	x	(0.281)	(0.311)	(0.341)	--	BM-7A
		y	(0.327)	(0.357)	(0.387)		
Viewing Angle	Hor.	θ _R	80	89	--	Degree	
		θ _L	80	89	--		
	Ver.	θ _U	80	89	--		
		θ _D	80	89	--		

Product Specification

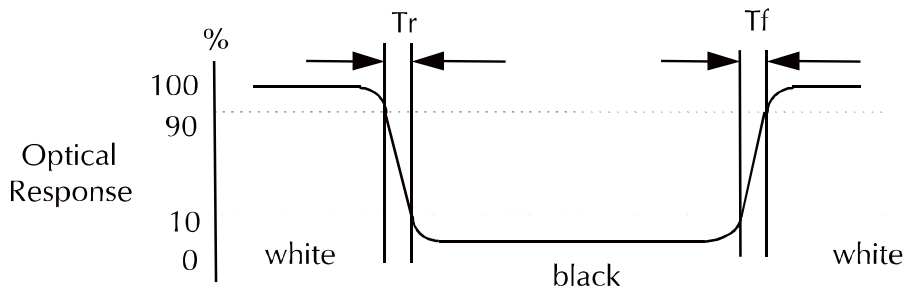
	Model: GKIPA1MNHA1B0	Rev. No.	Issued Date.	Page.
		A	2017, Jan. 05	12 / 19

a. Test equipment setup

After stabilizing and leaving the panel alone shall be warmed up for the stable operation of LCM, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7A(fast) with a viewing angle of 2° at a distance of 50cm and normal direction.

b. Definition of response time: Tr and Tf

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".




c. Definition of contrast ratio:

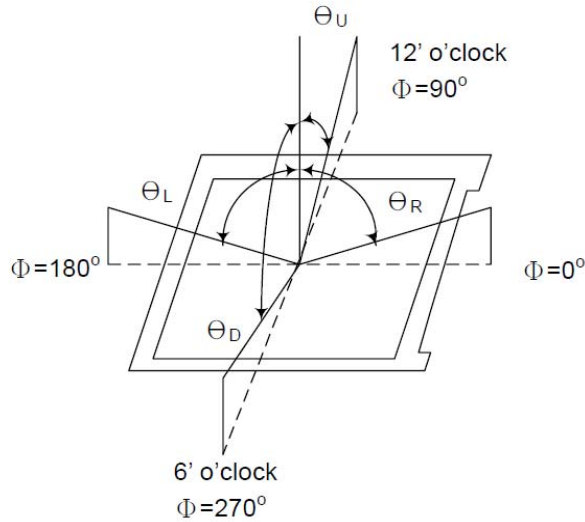
$$\text{Contrast Ratio (CR)} = \frac{\text{Brightness measured when LCD is at "white state"}}{\text{Brightness measured when LCD is at "black state"}}$$

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

Product Specification

	Model: GKIPA1MNHA1B0	Rev. No.	Issued Date.	Page.
		A	2017, Jan. 05	13 / 19

e. View Angle

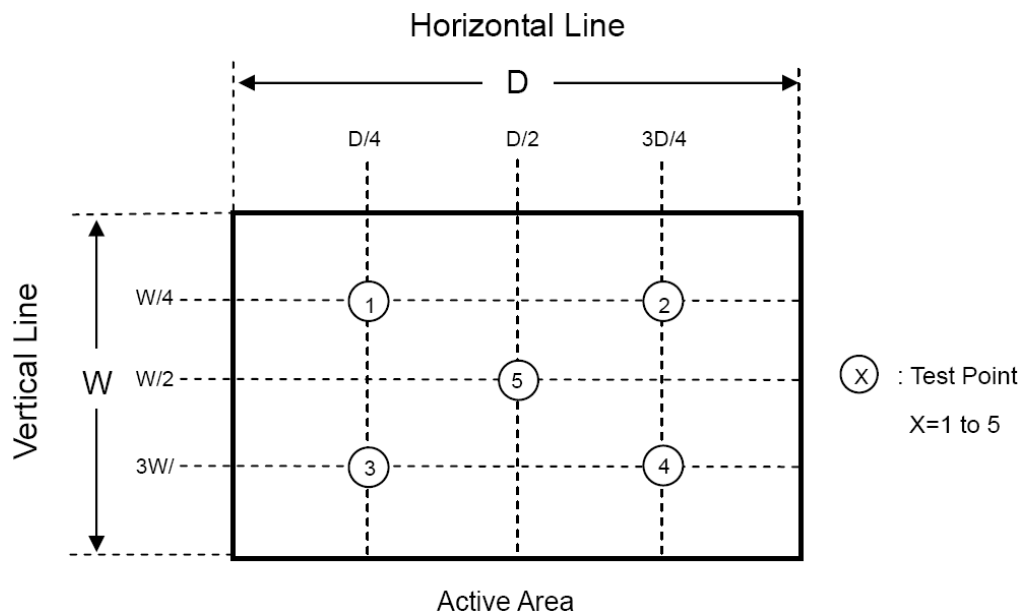


f. Definition of Luminance of White: Luminance of white at the center points


Light Source of Back-Light Unit	LED Type
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g. Definition of White Uniformity

$$\text{White Uniformity} = \frac{\text{Min. luminance of white among 5-points}}{\text{Max. luminance of white among 5-points}} \times 100\%$$



Product Specification

	Model: GKIPA1MNHA1B0	Rev. No.	Issued Date.	Page.
		A	2017, Jan. 05	14 / 19

5. I/O Terminal

5.1 Pin Assignment (CN1 connector: Panasonic, AYP334535 or equivalent.)

Pin No.	Symbol	I/O	Function	Remark
1~4	VDD	P	Power Supply for LCD	
5	NC	-	No connection	
6	RxE3+	I	Positive LVDS differential data input(Even data)	
7	GND	P	Ground	
8	RxE3-	I	Negative LVDS differential data input(Even data)	
9~10	GND	P	Ground	
11	RxO3+	I	Positive LVDS differential data input(Odd data)	
12	RxEC+	I	Positive LVDS differential clock input(Even clock)	
13	RxO3-	I	Negative LVDS differential data input(Odd data)	
14	RxEC-	I	Negative LVDS differential clock input(Even clock)	
15~16	GND	P	Ground	
17	RxOC+	I	Positive LVDS differential clock input(Odd clock)	
18	RxE2+	I	Positive LVDS differential data input(Even data)	
19	RxOC-	I	Negative LVDS differential clock input(Odd clock)	
20	RxE2-	I	Negative LVDS differential data input(Even data)	
21~22	GND	P	Ground	
23	RxO2+	I	Positive LVDS differential data input(Odd data)	
24	RxE1+	I	Positive LVDS differential data input(Even data)	
25	RxO2-	I	Negative LVDS differential data input(Odd data)	
26	RxE1-	I	Negative LVDS differential data input(Even data)	
27~28	GND	P	Ground	
29	RxO1+	I	Positive LVDS differential data input(Odd data)	
30	RxE0+	I	Positive LVDS differential data input(Even data)	
31	RxO1-	I	Negative LVDS differential data input(Odd data)	
32	RxE0-	I	Negative LVDS differential data input(Even data)	
33~34	GND	P	Ground	
35	RxO0+	I	Positive LVDS differential data input(Odd data)	
36	NC	-	No connection	
37	RxO0-	I	Negative LVDS differential data input(Odd data)	
38	LED_EN	I	LED Enable pin	
39	NC	-	No connection	
40	CABC_EN	I	CABC Function Enable pin	
41	LED_PWM	I	Backlight LED Dimming Control	
42~45	VLED	P	LED Power Supply	

I: Input, O: Output, P: Power

Product Specification



Model: GKIPA1MNHA1B0

Rev. No.

Issued Date.

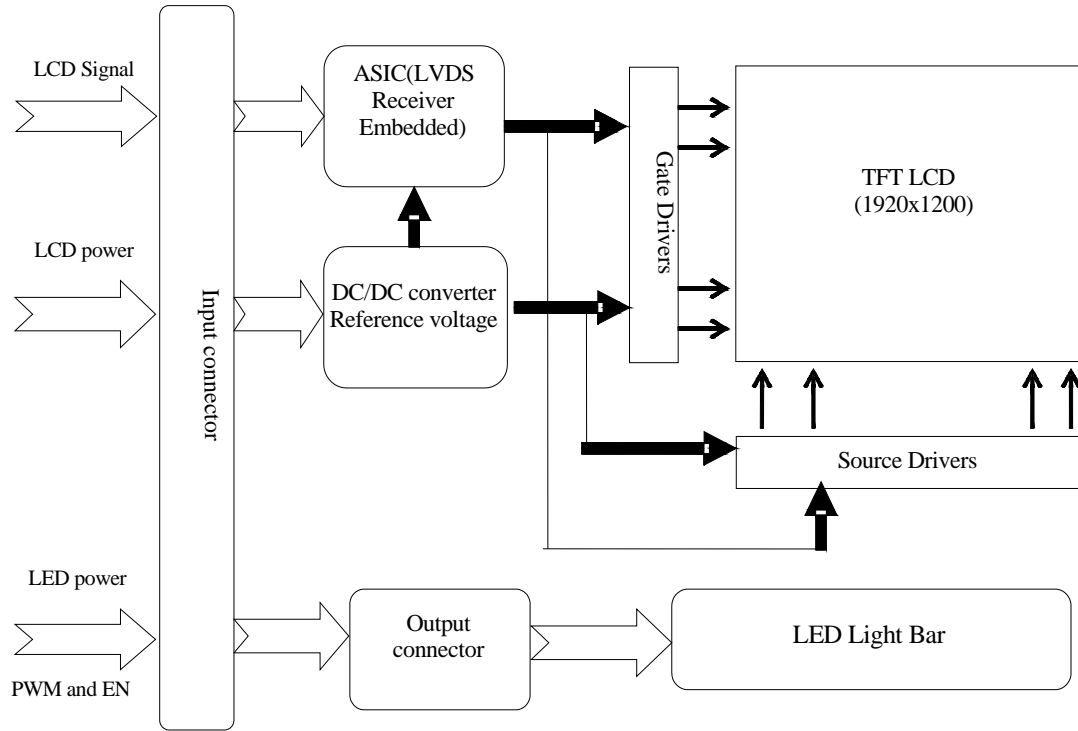
Page.

A


2017, Jan. 05

15 / 19

5.2 Block Diagram



Product Specification

	Model: GKIPA1MNHA1B0	Rev. No.	Issued Date.	Page.
		A	2017, Jan. 05	16 / 19

6. Displayed Color and Input Data


6.1 8 bit Input Data

	Color & Gray Scale	Data Signal																							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(0)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(0)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red(255)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red(254)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(31)	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(1)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(0)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Green(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
	Green(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(31)	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(1)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(0)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(31)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

0 : Low level voltage, 1 :High level voltage

Each basic color can be displayed in 64 gray scales from 6 bit data signals. With the combination of total 18 bit data signals, the 262,144-color display can be achieved on the screen.

Product Specification

	Model: GKIPA1MNHA1B0	Rev. No.	Issued Date.	Page.
		A	2017, Jan. 05	17 / 19

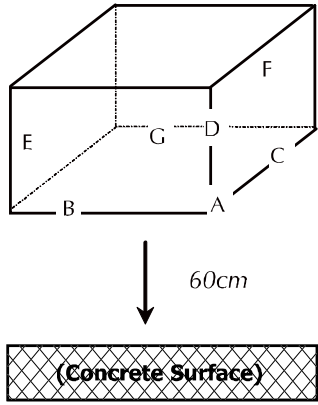
7. Reliability Condition

No change on display and in operation under the following test condition.

Condition: Unless otherwise specified, tests will be conducted under the following condition.

Temperature: 20±5°C. Humidity: 50±10%RH.

Tests will be not conducted under functioning state.

No.	Parameter	Condition	Notes
1	High Temperature Operating	50°C±2°C, 240hrs (Operation state).	1,2
2	Low Temperature Operating	0°C±2°C, 240hrs (Operation state).	
3	High Temperature Storage	60°C±2°C, 240hrs.	
4	Low Temperature Storage	-20°C±2°C, 240hrs.	
5	High Temperature and High Humidity Storage Test	40°C±2°C, 80%, 240hrs.	
6	Thermal Shock Storage Test	-20°C, 0.5 hour ← → 60°C, 0.5 hour; 27 cycles, 1 hour/cycle	
7	ESD Test (Operation)	150pF, 330Ω, 1 sec/cycle Condition 1 : panel contact, ±8 KV Condition 2 : panel non-contact ±15 KV	2
8	Vibration (Non-Operating)	1.5G, 10 ~ 300 Hz sine wave, 10 min/cycle, 3 cycles each X, Y, Z direction	2,3
9	Shock (Non-Operating)	50G, 11ms, half sine wave, 1 time for ±X, ±Y, ±Z direction	2,3
10	Drop Test	To be measured after dropping from 60cm high on the concrete surface in packing state.  <p style="margin-left: 20px;"><i>Dropping method corner dropping:</i></p> <p style="margin-left: 20px;"><i>A corner: Once edge dropping.</i></p> <p style="margin-left: 20px;"><i>B, C, D edge: Once face dropping.</i></p> <p style="margin-left: 20px;"><i>E, F, G face: Once.</i></p>	

- Notes:
1. No condensation of water.
 2. No display malfunction.
 3. At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.
 4. Temperature of panel display surface area should be 60°C Max.

Product Specification



Model: GKIPA1MNHA1B0

Rev. No.

Issued Date.

Page.

A

2017, Jan. 05

18 / 19

8. Dimensional Outlines

