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# Preliminary Specifications

## G070x Interface LED Backlight Rev. 1.03

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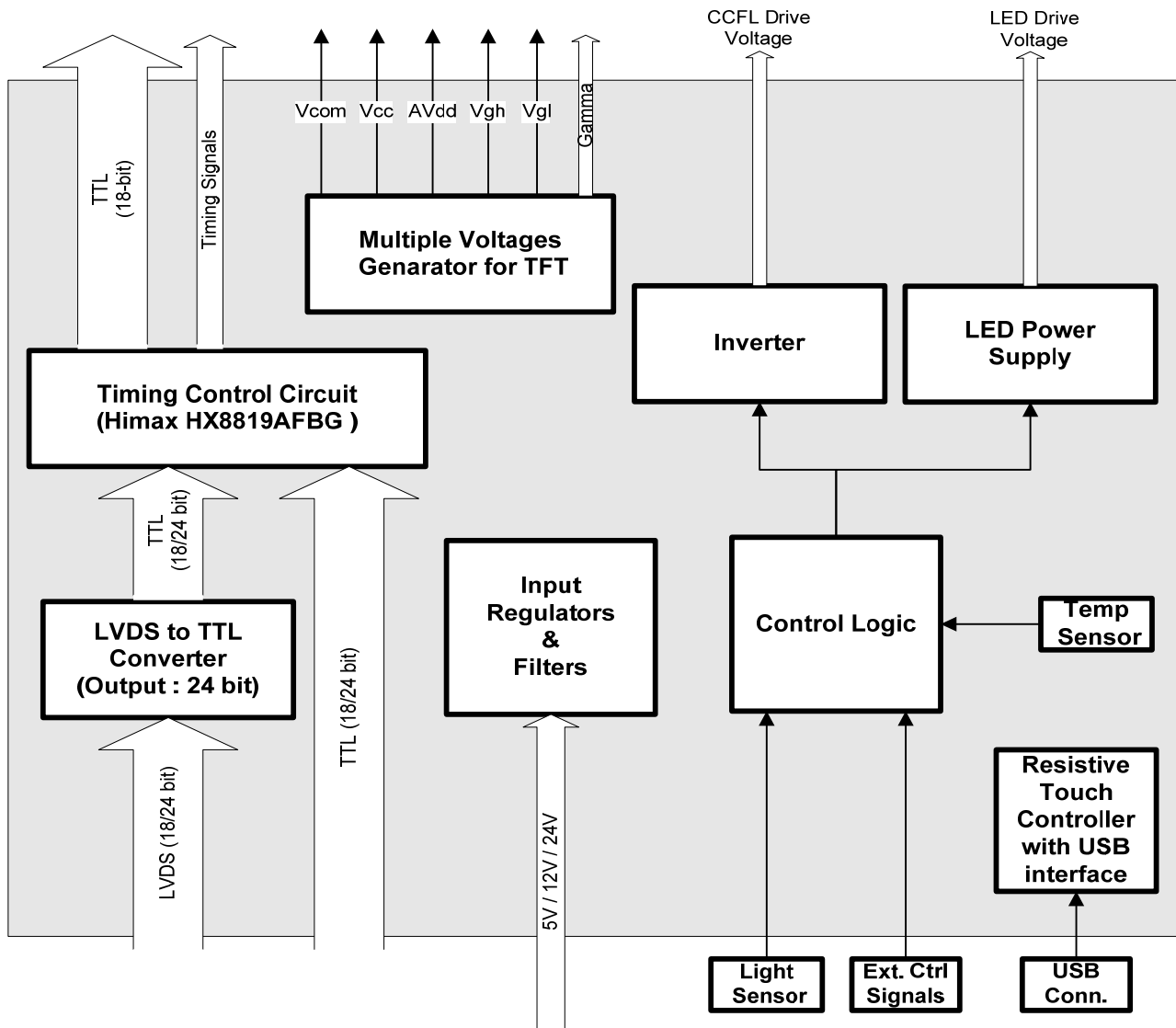
## **1. GENERAL DESCRIPTION:**

The G070x interface is a TFT-LCD timing controller board with integrated dithering function.



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Board provides horizontal and vertical control timing to TFT-LCD source and gate drivers. This controller board performs polarity inverted function to convert 8-bit digital RGB data into 6-bit digital RGB data for TFT-LCD panels. Backlight control with temperature and ambient light intensity, USB interfaced touch panel drivers are also other features.



- Supported display resolution: WVGA 800RGB x 480
- Master display clock frequency: 40 MHz max.
- Supporting 24-bits (8-bits x3) digital parallel RGB input signals
- Supporting both Sync(Hs/Vs) mode and Data enable (DE) mode
- Built-in dithering function.
- Built-in polarity inverted function.
- Provide the control timing of the source drivers and the gate drivers.

This application board is especially designed for the G070x series panels of Chi Mai Corp. (CMO)

### 2. FEATURES:



### 2.1 Hardware Versions:

Currently one version is available for LED backlight driving.

- **Full Version**

- LED backlight driving with dimming capability
- LVDS data input (with conventional / non-conventional selection)
- Ambient Light Sensor control for backlight dimming (with **optional external board**)
- Temperature control for backlight dimming (Selection by jumper)
- External input for backlight dimming control (Selection by jumper)
- 4-wire resistive touch panel support
- 5 - 30V power supply input range
- Resistive Touch Screen Support with USB interface
- Over temperature shutdown

#### Summary:

	TTL Input	LVDS Input	LVDS Con/NonConventional Selection Logic	Touch Control with USB
LED Backlight, Full Version	X	✓	✓	✓

(For power supply requirements please refer "[Electrical Characteristics](#)" section.)

### 2.2 Input Signal Types:

- LVDS  
Conventional (18/24-bit)  
Non-Conventional (24-bit)
- TTL (24 Bit / 18 Bit)

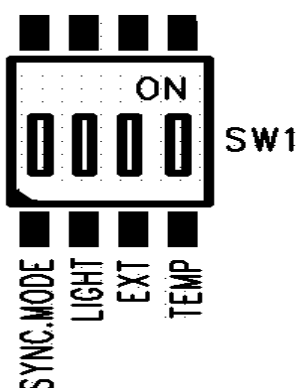
Please refer [section-4](#) for AC electrical details for input signals.

### 2.3 Output Signal Type:

- TTL (16-bit dithered), source and gate control and gamma signals for TFT panel.

### 2.4 Back Light Power Supplies and Controls:

SW1 the switch on the G070x interface select the control signal source for tft backlight. When one switch move the "ON" position (and all others "OFF"), related control algorithm is enabled. These algorithms are:

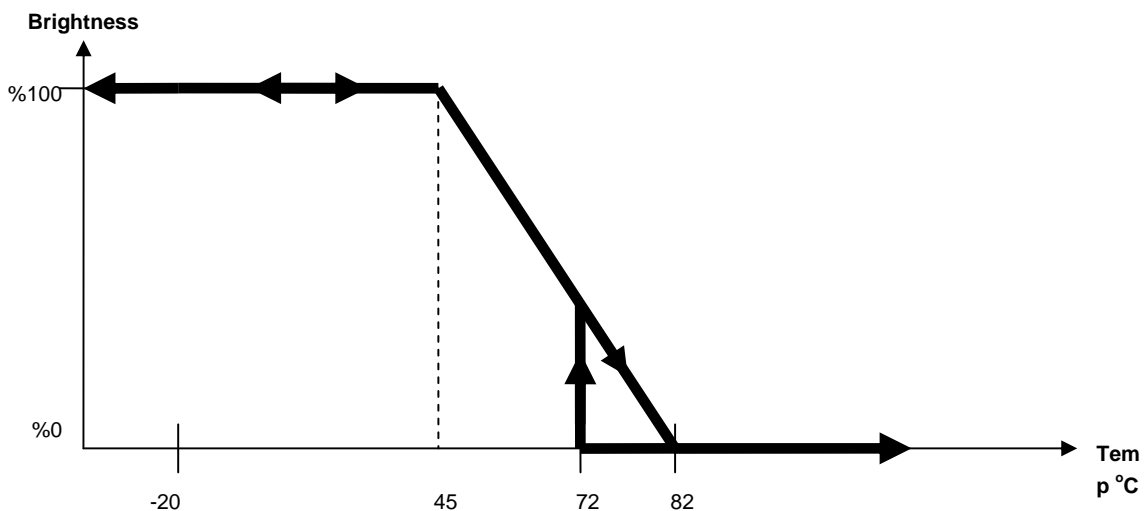




- “**SYNC.MODE**” : Operation mode selection (DE or SYNC)
- “**LIGHT**” :Tft backlight dimming with Light Sensor
- “**EXT**” :Tft backlight dimming with External signal
- “**TEMP**” :Tft backlight dimming with Temperature Sensor

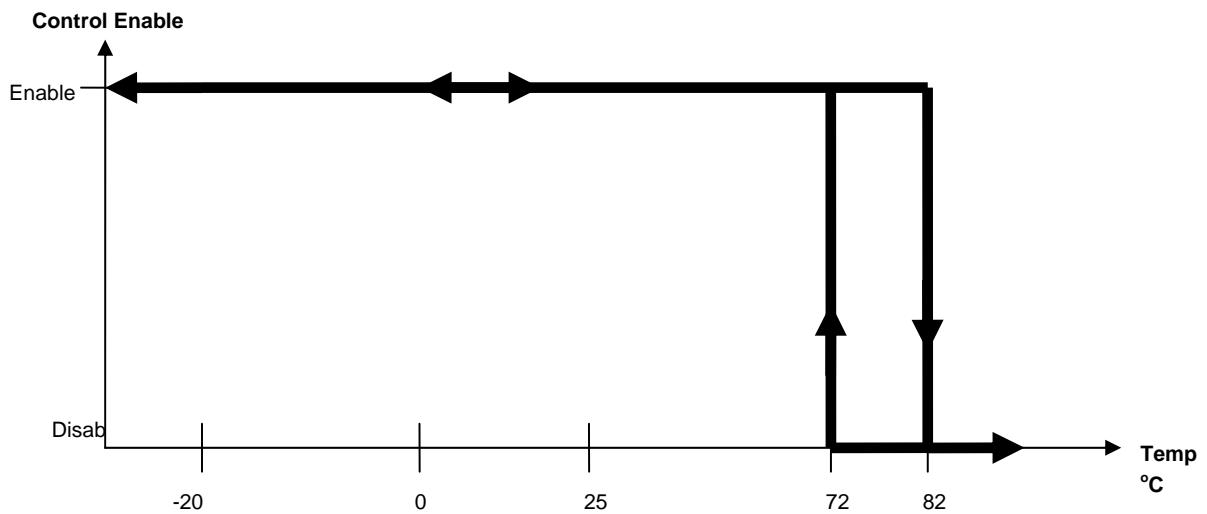
- **Temperature Control with Over Temperature Shut Down:**

The temperature controlled backlight power supply is standard for LED backlight units for the protection of the LED life time over the temperature. The control algorithm of LED brightness and temperature given below:



- **External Control with Over Temperature Shut Down:**

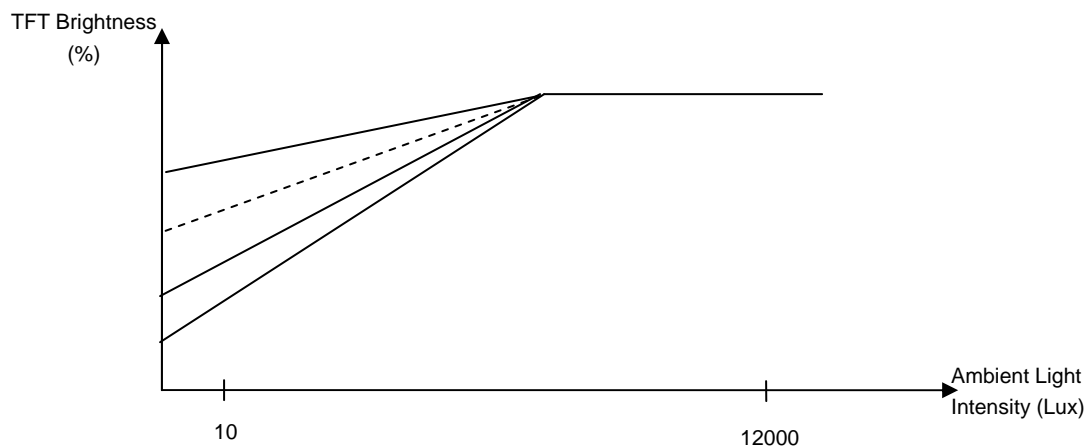
In this kind of control, intensity of LED backlight is left to the user. The CN12 ([connector](#)) is used for controlling the backlight. Electrical values are specified in third section.



As seen from the graph above, after 82°C system shut down the backlight unit since over temperature. Backlight dimming control is enabled for external control again after temperature goes below 72°C.

- **Ambient Light Sensor (Optional control with external board)**

Backlight intensity of TFT panel can be adjusted with ambient light intensity automatically.



Different curves can be created by hardware changes for different applications and specific customer requests.

## 2.5 Touch Control:

4-wire resistive touch controller with USB interface  
Circuit Type: NC41120-0018 Fujitsu  
Drivers can be downloaded from Fujitsu website.



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### 3. Electrical Characteristics:

Parameter		Min.	Typ.	Max.	Unit
Backlight On/Off Control	Input Control Voltage (0V→Bklt.Off , 5V→Bklt.On)	0	-	5	V
Backlight Dimming Control Voltage	Input Control Voltage (0.12V→ Min , 1.5V → Max brightness)	0.12	-	1.5	V
Power Supply	Main Input Voltage " <b>Main VCC</b> " <sup>(1)</sup>	6.5	-	30	V
	TFT supply voltage " <b>TFT Vcc</b> "	3.1	3.3	3.5	V
	Current Consumption (at 12V Input)	110	-	315	mA
	Current Consumption (at 12V Input) (with touch screen)	160	-	375	mA
Operating Temperature		-20	-	+75	°C
Storage Temperature		-40	-	+80	°C
Screen Light Intensity		18	-	480	cd/m <sup>2</sup>
<i>Notes:</i> (1) : Operation at 5V need to remove and assemble some components. This will be simplified in Rev1.1. Details will be TBD.					



#### 4. AC Characteristics:

- SYNC mode input signal characteristics (“SYNC.MODE” : “ON”)

PARAMETER	Symbol	Min.	Typ.	Max.	Unit
Clock Period	tCLK	25.0	30.0	50.0	ns
Clock Frequency	fCLK	20	33.3	40	MHz
Clock Low Level Width	tWCL	8	-	-	ns
Clock High Level Width	tWCH	8	-	-	ns
Clock Rise, Fall Time	tCLKr, tCLKf	-	-	3	ns
HSYNC Period	tHP	888	928	1054	tCLK
HYNC Pulse Width(1)	tHW	1	48	87	tCLK
HYNC Back Porch(1)	tHBP	1	40	87	tCLK
HYNC Width+Back Porch(1)	tHW + tHBP	88	88	88	tCLK
Horizontal Valid Data Width	tHV	800	800	800	tCLK
HYNC Front Porch	tHFP	0	40	166	tCLK
VSYNC Period	tVP	512	525	1056	tHP
VYNC Pulse Width(2)	tVW	1	3	31	tHP
VSYNC Back Porch(2)	tVW	1	29	31	tHP
VYNC Width + Back Porch(2)	tVW + tVW	32	32	32	tHP
Vertical Valid Data Width	tW	480	480	480	tHP
VSYNC Front Porch	tVFP	0	13	544	tHP
Data Setup Time	tDS	5	-	-	ns
Data Hold Time	tDH	10	-	-	ns

**Note:**

- (1) (HYNC Pulse Width+ HYNC Back Porch) must be 88 tCLK.  
 (2) (VYNC Pulse Width+ VYNC Back Porch) must be 32 tHP.

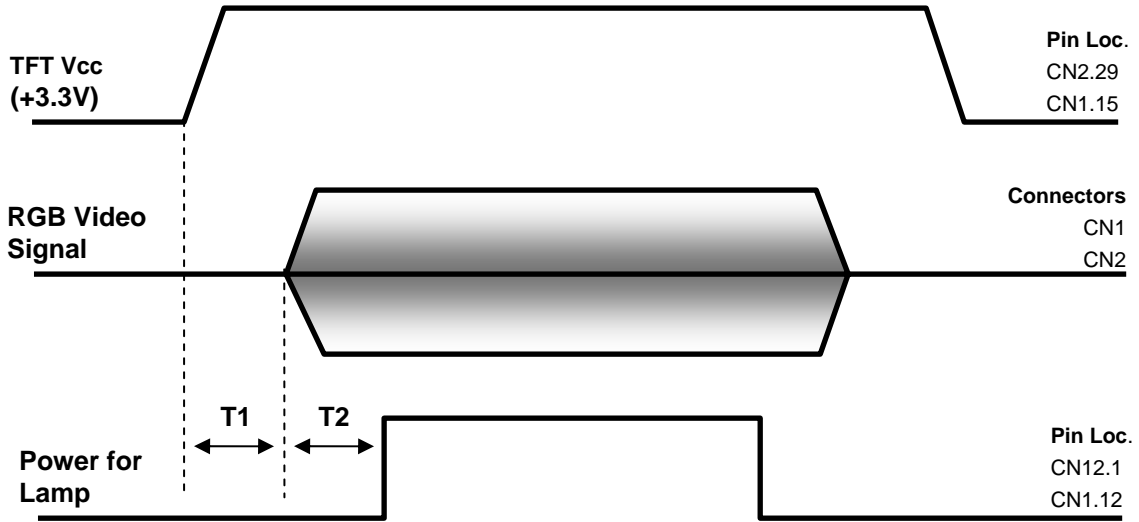
#### 4.1 DE (Data Enable) mode input signal characteristics (“SYNC.MODE” : “OFF”)

	Item	Symbol	Min.	Typ.	Max.	Unit
DCLK	Period	tCLK	25.0	37.0	50.0	ns
	Frequency	fCLK	20.0	27.0	40.0	MHz
	Low Level Width	tWCL	8	-	-	ns
	High Level Width	tWCH	8	-	-	ns
	Rise, Fall Time	tCLKr, tCLKf	-	-	3	ns
	Duty(1)	-	0.45	0.50	0.55	-
DE (Data Enable)	Setup Time	tDES	5	-	-	ns
	Hold Time	tDEH	10	-	-	ns
	Rise, Fall Time	tDEr, tDEf	-	-	16	ns
	Horizontal Period	tHP	832	900	1054	tCLK
	Horizontal Valid	tHV	800	800	800	tCLK
	Horizontal Blank	tHBK	32	100	254	tCLK
	Vertical Period	tVP	481	513	1023	tHP
	Vertical Valid	tW	480	480	480	tHP
Data	Vertical Blank	tVBK	1	33	543	tHP
	Setup Time	tDS	5	-	-	ns
	Hold Time	tDH	10	-	-	ns
	Rise, Fall Time	tDr, tDf	-	-	3	ns

**Note:** (1) tCLKL/ tCLK.



### 4.2 Power On/Off Sequencing



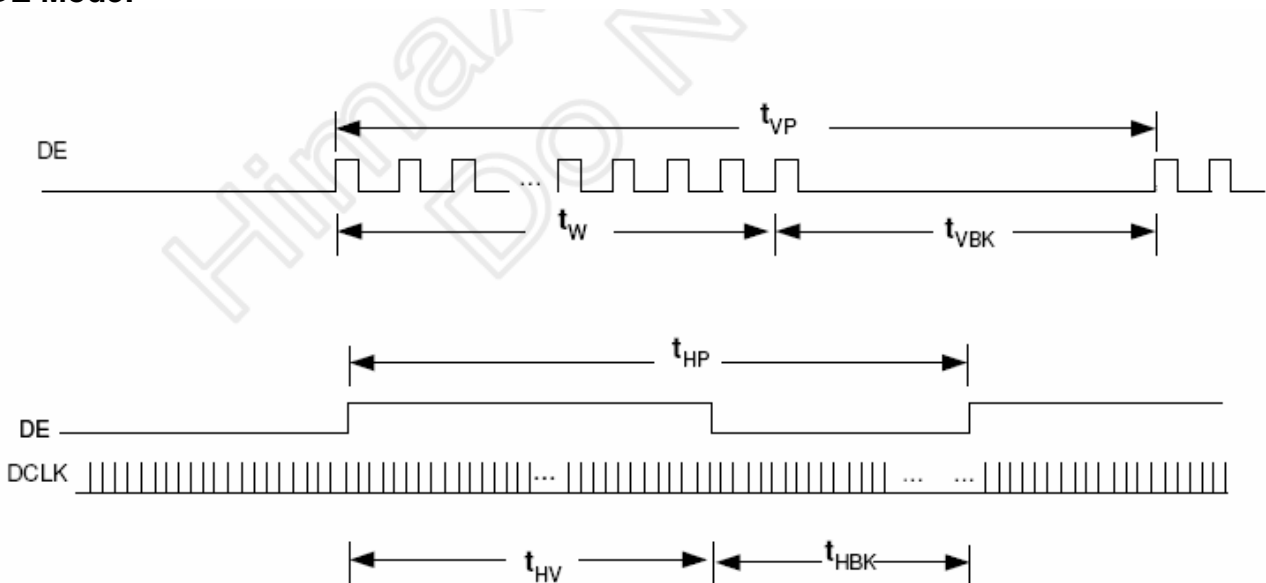
#### Timing Specifications:

- $0 < T1$
- $0 < T2$

Power on/off sequences is very important to use this device properly. Otherwise unexpected colour distortions can be observed.

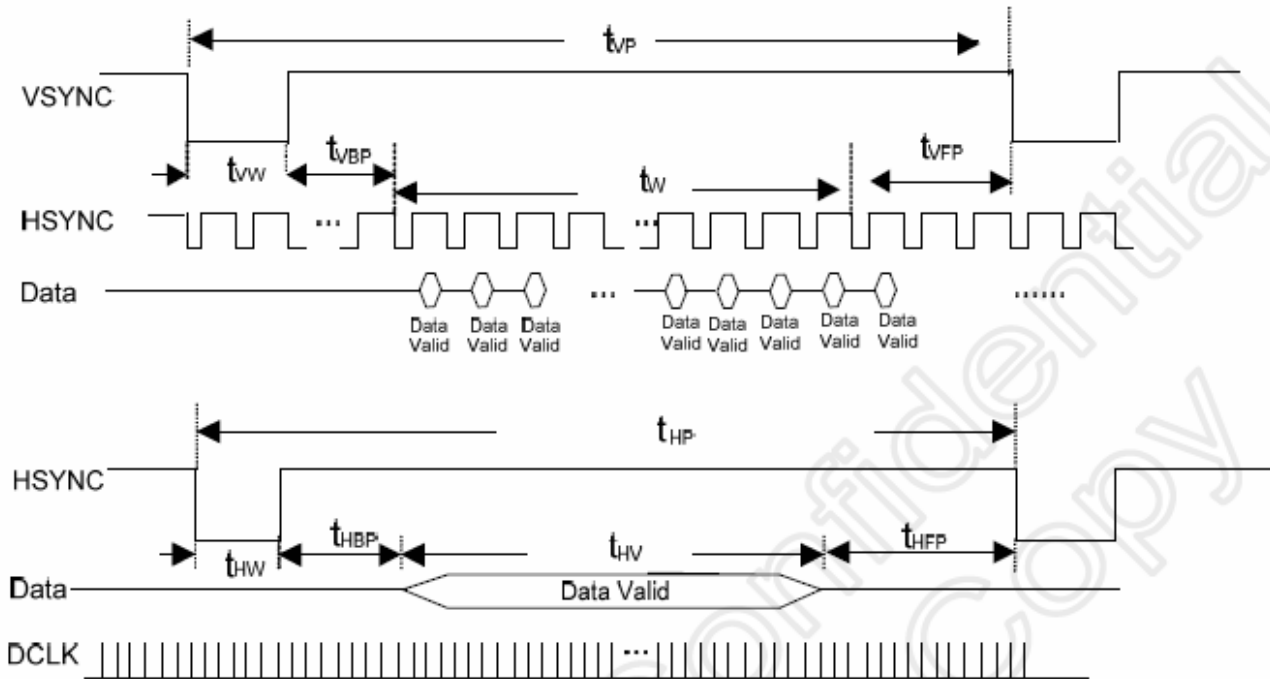
### 4.3 Input Signal Timings

#### DE Mode:





Sync Mode:





**5. Connectors and Pin Outs:**

Conn. No	Manufac.	Ordering Number	Purpose	Assemble
CN1	Hirose	DF14-15P-1.25H(25)	LVDS INPUT	OK
CN2	Hirose	DF14-30P-1.25H	TTL INPUT	OK
CN3*	Molex	0541045031	CCFL PANEL SIGNALS	OK
CN4*	Molex	0512965093	LED PANEL SIGNALS	OK
CN5*	Molex	0528520470	LED BKLT SUPPLY	OK
CN6	Hirose	DF13-10P-1.25H-21	INVERTER SUPPLY	OK
CN7	Nexus	3851HJBR	SMD Mini USB-B Type	OK
CN8	Hirose	DF13-4P-1.25H	LIGHT SENS./BR.CTRL	OK
CN9	Hirose	DF13-2P-1.25H	GND	OK
CN10	Hirose	DF13-5P-1.25V20	TOUCH PANEL INP.	OK
CN12	Hirose	DF13-6P-1.25H (21)	BKLT Control	OK

(\* These connectors are come as plugged with the product. Not open for customer usage.)

CN1 Pin out:	
Pin No	Function
1	LVDS Input Pair 0(-)
2	LVDS Input Pair 0(+)
3	LVDS Input Pair 1(-)
4	LVDS Input Pair 1(+)
5	LVDS Input Pair 2(-)
6	LVDS Input Pair 2(+)
7	LVDS Input Pair 3(-)
8	LVDS Input Pair 3(+)
9	LVDS Input Clock (-)
10	LVDS Input Clock (+)
11	LVDS Type Selection (0:Nonconventional, 1:Conventional)
12	Backlight Enable
13	Brightness Adj. Input
14	GND
15	TFT Vcc (+3.3V)

CN2 Pin out:	
Pin No	Function
1	Red Data In (0)
2	Red Data In (1)
3	Red Data In (2)
4	Red Data In (3)
5	Red Data In (4)
6	Red Data In (5)
7	Red Data In (6)
8	Red Data In (7)
9	Green Data In (0)
10	Green Data In (1)
11	Green Data In (2)
12	Green Data In (3)
13	Green Data In (4)
14	Green Data In (5)
15	Green Data In (6)
16	Green Data In (7)

CN6 Pin out:	
Pin No	Function
1	Inv VCC (+12V) Output
2	GND
3	BKLT Enable Out
4	Brightness Adj. Out
5	+5V Output
6	+5V Output
7	Inv VCC (+12V) Output
8	Inv VCC (+12V) Output
9	GND
10	GND



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17	Blue Data In (0)
18	Blue Data In (1)
19	Blue Data In (2)
20	Blue Data In (3)
21	Blue Data In (4)
22	Blue Data In (5)
23	Blue Data In (6)
24	Blue Data In (7)
25	HSYNC
26	VSYNC
27	DE
28	CLK
29	TFT Vcc (+3.3V)
30	GND

CN8 Pin out:	
Pin No	Function
1	+5V
2	+3.3V
3	GND
4	BRIGHTNESS CTRL. INPUT

CN9 Pin out:	
Pin No	Function
1	GND
2	GND

CN10 Pin out:	
Pin No	Function
1	X Axis (+) Input
2	Y Axis (+) Input
3	X Axis (-) Input
4	Y Axis (-) Input
5	GND

CN11 Pin out:	
Pin No	Function
1	USB VCC
2	D-
3	D+
4	USB GND

CN12 Pin out:	
Pin No	Function
1	Backlight Enable
2	Brightness Adj. Input
3	Main VCC
4	Main VCC
5	GND
6	GND



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