# Version :1.0

# TECHNICAL SPECIFICATION

# MODEL NO.: PD035VL1

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Customer's Confirmation

Customer

Date

By

PVI's Confirmation

my Chang

Confirmed By

JL Prepared By

# **TECHNICAL SPECIFICATION**

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### 1. Application

This data sheet applies to a color TFT LCD module , PD035VL1. PD035VL1 module applies to projector , and other media application which require high quality flat panel display.

#### 2. Features

- . Amorphous silicon TFT LCD panel with LED back-light unit
- . Support the DENB mode, Sync mode (Hsync+Vsync)
- . Pixel in stripe configuration
- . Display Colors : 262,144 colors
- . Backlight lamps are Replaceable
- . +3.3V DC supply voltage for TFT LCD panel driving

#### 3. Mechanical Specifications

Parameter	Specifications	Unit
Screen Size	3.5 (diagonal)	inch
Display Format	640×(R, G, B)×480	dot
Display Colors	262,144	
Active Area	72.00 (H)×52.56 (V)	mm
Pixel Pitch	0.1125 (H)×0.1095 (V)	mm
Pixel Configuration	Stripe	
Outline Dimension	85.2 (W)×66.45(H)×8.45 (D) (Typ.)	mm
Weight	78±5	g
Surface treatment	AG	
Display mode	Normally white	
Gray apple inversion direction	6 o'clock	
Gray scale inversion direction	[ ref to Page 17 viewing angle ]	

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### 4. Mechanical Drawing of TFT-LCD Module

## Outline Drawing : Front View (unit mm)







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### **5.Input Terminals**

5-1) TFT-LCD Panel Driving Connector type: DF19K-20P-1H(56)(HRS)

Pin No.	Symbol	Function	Remark
1	Vcc	+3.3V Power Supply	
2	Vcc	+3.3V Power Supply	
3	GND	Ground	
4	GND	Ground	
5	INO-	LVDS receiver signal channel 0	
6	INO+	LVDS receiver signal channel 0	
7	GND	Ground	
8	IN1-	LVDS receiver signal channel 1	
9	IN1+	LVDS receiver signal channel 1	
10	GND	Ground	
11	IN2-	LVDS receiver signal channel 2	
12	IN2+	LVDS receiver signal channel 2	
13	GND	Ground	
14	CLK-	LVDS receiver signal clock	
15	CLK+	LVDS receiver signal clock	
16	GND	Ground	
17	NC	No connection	
18	NC	No connection	
19	GND	Ground	
20	GND	Ground	

### LVDS Interface Block Diagram



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### Recommended Transmitter (THC63LVDM63A Thine) to PD035VL1 interface Assignment:

Input terminal of THC63LVDM63A Gra			aphic controller output signal	Output signal symbol	To PD035VL1 interface terminal (Symbol)
Symbol	No.	Symbol	Function		
TIN0	44	R0	Red pixel data (LSB)	$\mathbf{i}$	
TIN1	45	R1	Red pixel data		
TIN2	47	R2	Red pixel data	Tout0-	<sup>—</sup> No.5 : IN0-
TIN3	48	R3	Red pixel data		
TIN4	1	R4	Red pixel data	Tout0+	—No.6 : IN0+
TIN5	3	R5	Red pixel data(MSB)		
TIN6	4	G0	Green pixel data (LSB)		
TIN7	6	G1	Green pixel data	$\mathbf{Y}$	
TIN8	7	G2	Green pixel data		
TIN9	9	G3	Green pixel data	Tout1-	—No.8 : IN1-
TIN10	10	G4	Green pixel data		
TIN11	12	G5	Green pixel data(MSB)	Tout1+	—No.9 : IN1+
TIN12	13	B0	Blue pixel data(LSB)		
TIN13	15	B1	Blue pixel data	ノ	
TIN14	16	B2	Blue pixel data	$\mathbf{r}$	
TIN15	18	B3	Blue pixel data		
TIN16	19	B4	Blue pixel data	Tout2-	<sup>—</sup> No.11 : IN2-
TIN17	20	B5	Blue pixel data(MSB)		
TIN18	22	Hsync	Horizontal Synchronous Signal	Tout2+	<sup>—</sup> N0.12 : IN2+
TIN19	23	Vsync	Vertical Synchronous Signal		
TIN20	25	DENB	Compound Synchronization signal	7	
CLK in	26	CLK	Data sampling clock	TCLK out-	No.14 : CLK -
			-	TCLK out+	No.15 : CLK+

DENB input signal.



If customer wanted to off the DENB mode , you must keep the DENB always High or Low.

(tc: the period of sampling clock)

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### 6. Absolute Maximum Ratings :

The followings are maximum values, which if exceeded, may cause faulty operation or damage to the unit.

				GND=0V, Ta=25°C						
Parameters	Symbol	MIN.	MAX.	Unit	Remark					
Supply Voltage	V <sub>CC</sub>	-0.3	+4.0	V						

**7.Electrical Characteristics** 

<b>7-1) Recommended Operating Conditions:</b> $GND = 0V$ ,									
Item	Symbol	Min.	Тур.	Max.	Unit	Remark			
Supply Voltage	Vcc	3.0	3.3	3.6	V				
Current Dissipation	lcc	-	455.4	496.8	mA	Note 7-1			
LVDS Differential input high threshold	Vth	-	-	100	mV				
LVDS Differential input low threshold	Vtl	-100	-	-					
V <sub>com</sub> Voltage	V <sub>com</sub>	-	2.6	-	V				

Note 7-1 : To test the current dissipation of VCC using the "color bars" testing pattern shown as below

1 2 3 4 5 6 7 8
-----------------

White
 Yellow

- 3. Cyan
- 4. Green
- 5. Magenta
- 6. Red
- 7. Blue
- 8. Black

Idd current dissipation testing pattern

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# PRIME VIEW

# PD035VL1

### 7-2) Recommended driving condition for LED backlight

					G	$ND = 0 V$ , $Ta = 25^{\circ}C$
Parameter	Symbol	Min	TYP	MAX	Unit	Remark
Supply voltage of LED backlight	$V_{\text{LED}}$	9	9.6	11.4	V	$I_L = 20 \text{ mA}$
Supply current of LED backlight	I <sub>LED1</sub> I <sub>LED2</sub>	-	20	-	mA	Note 7-3
Backlight Power Consumption	PLED	360	384	456	mW	Note 7-4

Note 7-3: LED B/L applied information, please refer to the appendix at the end.

Note 7-4 :  $P_{LED} = V_{LED} * ILED1 + VLED * ILED2$ .





#### 7-3) Power Consumption

Parameters	Symbol	Тур.	Max.	Unit	Remark
Total Power Consumption	-	1.37	1.65	W	

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### 8. Pixel Arrangement

The LCD module pixel arrangement is the stripe.



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# **O**PRIME VIEW

# PD035VL1

# 9. Display Color and Gray Scale Reference

								In	put	Co	olor	Da	ta						
Co	olor			Re	ed					Gre	een					Bl	ue		
		R5	<b>R4</b>	R3	R2	<b>R1</b>	R0	G5	G4	G3	G2	G1	G0	<b>B5</b>	<b>B4</b>	<b>B</b> 3	<b>B2</b>	<b>B1</b>	<b>B0</b>
	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green (63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Basic	Blue (63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Colors	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
	Red (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (01)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red (02)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker																		
Red	$\downarrow$	Ŷ	$\downarrow$	$\downarrow$	↓	$\downarrow$	Ŷ	Ŷ	$\downarrow$	$\downarrow$	$\downarrow$								
	Brighter																		
	Red (61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red (62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (01)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green (02)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Darker																		
Green	$\downarrow$	$\rightarrow$	$\rightarrow$	$\rightarrow$	$\downarrow$														
	Brighter																		
	Green (61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green (62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green (63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue (01)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue (02)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	Darker																		
Blue	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$								
	Brighter																		
	Blue (61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue (62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue (63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1



### 10. Block Diagram

### 10-1) TFT-module Block Diagram



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# 11. Interface Timing

# 11.1) Timing Parameters

		Symbol	Min.	Тур.	Max.	Unit	Remark
Power su	pply	VCC	3.0	3.3	3.6	V	
CLK	Frequency	1/tc	-	25	-	MHz	
		tc	-	40	-	ns	
HSYNC	Period	Нр	-	32	-	us	
			-	800	-	tc	
	Display period	Hdp	-	640	-	tc	
	Pulse width	Hpw	-	96	-	tc	
	Back-porch	Hbp	-	46	-	tc	
	Front-porch	Hfp	-	18	-	tc	
	Hpw+Hbp	1	-	142	-	tc	
	Hsync-CLK	Hhc	10	-	Tc-10	ns	
	Vsync-Hsync	Hvh	0	0	200	tc	
VSYNC	Period	Vp	-	16.8	-	ms	_
			-	525	-	Нр	
	Display period	Vdp	-	480	-	Нр	
	Pulse width	Vpw	-	2	-	Нр	
	Back-porch	Vbp	-	33	-	Нр	
	Front-porch	Vfp	-	10	-	Нр	
	Vpw+Vbp	1	-	35	-	Нр	
DENB	Horizontal scanning period	T1	-	800	-	tc	
	Horizontal display period	T2	-	640	-	tc	
	Vertical display period	Т3	-	480	-	T1	
	Frame cycling period	T4	520	525	800	T1	
R,G,B	CLK-DATA	Dcd	10	-	-	ns	
	DATA-CLK	Ddc	8	-	-	ns	

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# 11.2) The Timing Diagram

# a. Input signal range



#### a.2 HSYNC timing



### a.3 CLK, HSYNC relationship



# a.4 HSYNC, VSYNC relationship



### a.5 VSYNC timing



### a.6 DENB timing





## 12. Power On Sequence



- 1.  $0 < t1 \le 20ms$
- 2. 0<t2≦50ms
- 3. 0<t3≦1s

### **13. Optical Characteristics**

#### 13-1) Specification:

_								<b>Ta=25</b> ℃
Para	meter	Symbol	Condition	MIN.	TYP.	MAX.	Unit	Remarks
	Horizontal	$\theta$ 21, $\theta$ 22		±45	±50	-	deg	
Viewing Angle	Vartical	$\theta$ 12 (to12o'clock)	CR <u>&gt;</u> 10	10	15	-	deg	Note 13-2
	vertical	$\theta$ 11 (to 6 o'clock)		30	35	-	deg	
Contra	st Ratio	CR	-	200	400	-	-	Note 13-4
Response time	Rise	Tr	$\theta = 0^{\circ}$	-	15	30	ms	Note 13-3
Response time	Fall	Tf	0-0	-	25	50	ms	1010 13-5
Brightness		L	$\theta = 0^{\circ}$	200	250	-	$cd/m^2$	Note 13-1
Uniformity		U	$\theta = 0^{\circ}$	70	75	-	%	Note 13-5
Cross Talk		-	$\theta = 0^{\circ}$	-	-	3.5	%	Note 13-6
White Chrometi	oity	Х	-	0.28	0.31	0.34	-	Note 12 1
winte Chromatio	white Chromaticity		-	0.30	0.330	0.36	-	Note 13-1
LED Life Time	;	-	Ta=25℃	20000	30000	-	hrs	Note 13-7

All the optical measurement shall be executed 30 minute after backlight being turn-on. The optical characteristics shall be measured in dark room (ambient illumination on panel surface less than 1 Lux). The measuring configuration shows as following figure.



Optical characteristics measuring configuration

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Note 13-1: 1.Topcon BM-5A or BM-7 fast luminance meter 1° field of view is used in the testing (after 30 minute operation).





Note 13-3: Definition of Response Time Tr and Tr:



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Note 13-4: The definition of contrast ratio  $CR = \frac{Luminance at gray level 63}{Luminance at gray level 0}$ 

#### Note 13-5 : The uniformity of LCD is defined as

 $U = \frac{\text{The Minimum Brightness of the 9 testing Points}}{\text{The Maximum Brightness of the 9 testing Points}}$ Luminance meter : BM-5A or BM-7 fast (TOPCON)
Measurement distance : 500 mm +/- 50 mm
Ambient illumination : < 1 Lux
Measuring direction : Perpendicular to the surface of module

The test pattern is white (Gray Level 63).





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Note 13-7: The "LED Life time " is defined as the module brightness decrease to 50% original Brightness that the ambient temperature is  $25^{\circ}$ C and  $I_{LED} = 20$ mA.

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### 14. Handling Cautions

- 14-1) Mounting of module
  - a) Please power off the module when you connect the input/output connector.
  - b) Please connect the ground pattern of the inverter circuit surely. If the connection is not perfect, some following problems may happen possibly.
    - 1. The noise from the backlight unit will increase.
    - 2. The output from inverter circuit will be unstable.
    - 3.In some cases a part of module will heat.
  - c) Polarizer which is made of soft material and susceptible to flaw must be handled carefully.
  - d) Protective film (Laminator) is applied on surface to protect it against scratches and dirts. It is recommended to peel off the laminator before use and taking care of static electricity.
- 14-2) Precautions in mounting
  - a) When metal part of the TFT-LCD module (shielding lid and rear case) is soiled, wipe it with soft dry cloth.
  - b) Wipe off water drops or finger grease immediately. Long contact with water may cause discoloration or spots.
  - c) TFT-LCD module uses glass which breaks or cracks easily if dropped or bumped on hard surface. Please handle with care.
  - d) Since CMOS LSI is used in the module. So take care of static electricity and earth yourself when handling.
- 14-3) Adjusting module
  - a) Adjusting volumes on the rear face of the module have been set optimally before shipment.
  - b) Therefore, do not change any adjusted values. If adjusted values are changed, the specifications described may not be satisfied.
- 14-4) Others
  - a) Do not expose the module to direct sunlight or intensive ultraviolet rays for many hours.
  - b) Store the module at a room temperature place.
  - c) The voltage of beginning electric discharge may over the normal voltage because of leakage current from approach conductor by to draw lump read lead line around.
  - d) If LCD panel breaks, it is possibly that the liquid crystal escapes from the panel. Avoid putting it into eyes or mouth. When liquid crystal sticks on hands, clothes or feet. Wash it out immediately with soap.
  - e) Observe all other precautionary requirements in handling general electronic components.
  - f) Please adjust the voltage of common electrode as material of attachment by 1 module.

### 15. Reliability Test

No	Test Item	Test Condition			
1	High Temperature Storage Test	Ta = +80 °C, 240 hrs			
2	Low Temperature Storage Test	Ta = -30 °C, 240 hrs			
3	High Temperature Operation Test	Ta = +70 °C, 240 hrs			
4	Low Temperature Operation Test	Ta = -20 °C, 240 hrs			
5	High Temperature & High Humidity Operation Test	Ta = +60 °C, 90%RH, 240 hrs			
6	Thermal Cycling Test (non-operating)	$\begin{array}{rcl} -25^{\circ}\text{C} & \rightarrow & +70^{\circ}\text{C}, 200 \text{ Cycles} \\ 30 \text{ min} & 30 \text{ min} \end{array}$			
7	Shock Test (non-operating)	100G, 6ms Direction: ±X, ±Y, ±Z Cycle: 3 times			
8	Vibration Test (non-operating)	Frequency : 10 ~ 55 H <sub>z</sub> Amplitude : 1 mm Sweep time: 11 mins Test Period: 6 Cycles for each direction of			
9	Electrostatic Discharge Test (non-operating)	Contact mode: ±8KV,10times/point , 5 points/panel face Air mode: 150pF, 330ΩAir : ±15KV			

Ta: ambient temperature

Note: The protective film must be removed before temperature test.

[Criteria]

In the standard conditions, there is not display function NG issue occurred. (including : line defect ,no image), All the cosmetic specification is judged before the reliability stress.

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### 16. Packing Diagram





		ZONE	REV.	DOCUUMENT NO	D. DESCRIPTION	DATE	REV.BY
	$\searrow$						
	Tape						
	$\checkmark$						
 v							
	$\mathbf{K}$						
			NO	TE:			
			1. Q	'TY: 192 pcs	panel/carton.		
	Таре		2. D 3. W	ımension: 48 'eight: 16.3 k	U*396*405mm ⟨G		
				F.0. 0100101			
			ITEM	DU-0100101 PART NO.	DESCRIPTION	QTY	REMARK
MTL.SPEC. UNSPECIFI			 へ 元大利	科技股份有限小	- - - - - - - - - - - - - -		
ANGLE					e View Internat:	–₁ ion (	Co.,ltd.
APPROVE Frank Shin' 07 00 0	-7 SCALE UNIT S	HEET	DW	G.TITLE			
CHECK E I OLIVOZO	/ 1:1 mm 2	of 2		PD03	5VL1 PACKING	Din	٦
Prank Shini'07.02.0	7 MTL.NO.			DWG.NO.			REV. A
DESIGN Ethan Chen 07.02.0	7						01   size





# **Revision History**

Rev.	Eng.	Issued Date	Revised	Contents
0.1	蔡弘毅	Oct.31 ,2006	Preliminary 0.1ver	
1.0	蔡弘毅	Feb,13,2007	Release version	

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