TFT-LCD MONITOR

Product Information

(Preliminary)

MODEL NO. : T035Q1D1

Date : *2007.05.11 Rev.2*

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This product specification is subject to change without any notice.

Records of Revision

Date	Rev. No.	Summary	Page
2007/02/14	01	First issue of T035Q1D1 specification sheet	1
2007/05/11	02	Change the Power Supply Voltage of LED from +12V to 3.3V	11
		Pin 30/31 revised to +3.3V	12

Contents

1.0 Handling Precaution

1.) Handle with care. Pay attention not to press or scratch the surface of the monitor, especially the polarizer. Do not twist or bend the monitor. It may cause un-recoverable damage .

2.) Do not drop or bump the monitor since this monitor contains fragile glass components. Breakage of this monitor might cause leakage of the liquid crystal sealed inside the monitors. Do not touch the liquid crystal liquid in case of leakage. Flush with massive water immediately in case of contact with your skin with liquid crystal fluid and call for doctor for immediate medical treatment.

3.) Be sure to turn off power supply while plug or un-plug the power input connector.

4.) Clean up the polarizer only with soft solvent if necessary. The desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, toluene, Ethyl acid or Methyl chloride. It will permanently damage the polarizer due to chemical reaction.

5.) Wipe off fluid drop immediately to prevent from possible discoloration or spots on the polarizer.

6.) Do not twist nor bend the monitor structure, even momentarily. Bending or twisting torque may likely damage the internal components of the monitor.

7.) The cold cathode fluorescent lamp in LCD contains small amount of mercury (Hg). Please refer to the design specification for application and the local regulations and environmental laws for disposal purpose.

8.) Protect the monitor from static environment to prevent from damage to the CMOS gate array IC.

2.0 General Description

T035Q1D1 is a 3.5 inch color active matrix TFT LCD monitor with slim outlook and excellent display performance driven by a pure **DIGITAL** CMOS interface. This monitor supports true **QVGA**, 320(H) x RGB x 240(V), stripe screen format and 262,144 full colors (RGB 6 bits data). It uses **LED**s (Light Emitting Diodes) as its luminous source and is able to reach 350 (typ.) nits brightness with very slim body. With its **ALL-IN-ONE** functionality, including a built-in DC-DC power module for LEDs and signal circuitry, T035Q1D1 is a designer friendly and cost effective product.

2.1 General Applications

- Mobile Display Terminal for GPS, Gaming, Video, Industrial and Medical Applications

2.2 Main Features

- Wide Operation Temperature Range
- Very Slim Structure Design
- Good brightness
- Wide Viewing Angle
- Low Power Consumption with LED Backlight
- Pure Digital CMOS Interface
- Built-in DC-DC
- Built-in LED Driver

2.3 General Information

2.3.1 Display Characteristics

Item	Specification	Unit	Note
Display Area	70.08(H) x 52.56(V) (Diagonal)	mm	-
Driver Element	a-Si TFT Active Matrix	-	-
Number of Pixels	320(H) x 240(V)	pixel	QVGA
Pixel Arrangement	RGB Vertical Stripe	-	-
Dot Pitch	0.073x3 (H) x 0.219(V)	mm	Dot
Display Mode	Normally White	-	-
Viewing Angle	130/120	degree	6 o'clock
Signal Interface	digital RGB 18 bits		262k colors

2.3.2 Mechanical Dimensions

Item		Min.	Typ.	Max.	Unit	Note
Dimension	Horizontal	-	78.9	-	mm	±0.5 mm
	Vertical	-	65.7	-		±0.5 mm

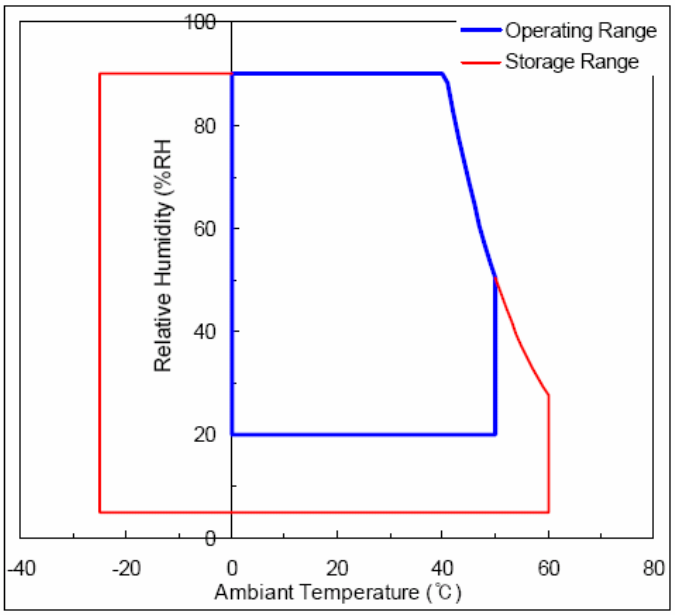
	Depth	-	7.1	-		±0.5 mm
Weight		-	68	-	g	±5g

3.0 Absolute Maximum Ratings

3.1 Absolute Ratings of Environment Requirement

Item	Symbol	Min.	Max.	Unit	Note
Storage Temperature	Tstg	-30	85	ºC	(1)
Operation Temperature (Ambient Temperature)	Topr	-30	85	ºC	(1)

Note (1) Temperature and relative humidity range are shown in the figure below.
95% RH Max. (40º C >Ta)
Maximum wet – bulb temperature at 39ºC or less. (Ta > 40º C) No condensation.



3.2 Electrical Absolute Ratings

3.2.1 TFT-LCD Module

(Ta=25±2ºC), Vgnd=GND=0V)

Item	SYMBOL	Min.	Max.	UNIT	NOTE
Power Supply Voltage for Logic	V_{DD}	-0.3	4.0	V	(1),(2)
Input Voltage	V_{i1}	-0.3	4.0	V	(1),(2),(3)
Power Supply Voltage for LED	V_{LED}	-0.3	4.0	V	(1),(2)

Note (1) Within operating temperature

Note (2) Permanent damage to the device may occur if maximum values are exceeded. Functional operation should be restricted to the conditions described under normal operating conditions.

Note (3) For all pins except power and ground pins

4.0 Optical Characteristics

The following items are measured under stable conditions in a dark room or equivalent state.

* Measuring Equipment: BM-5A, PR-650

(V_{DD}=3.3V, f_V=60Hz, f_H=15.734KHz, Ta=25±2ºC)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	Φ=0 θ=0 Viewing Normal Angle	200	300	-		BM-5A (4)-[1]
Response Time at 25ºC	Rising	T_R		-	15	30	ms	BM-5A (5)
	Falling	T_F		-	20	50		
Luminance		Y_L		-	350	-	Cd/m^2	BM-5A (4)-[2]
Color Chromaticity		W_X		TBD				
		W_Y		TBD				
Viewing Angle	Hor.	θ_L	CR≥10(at center point)		65		Degree	BM-5A (7)
		θ_R			65			
	Ver.	θ_H			45			
		θ_L			65			

Note (1) The optical characteristics is measured with backlight.

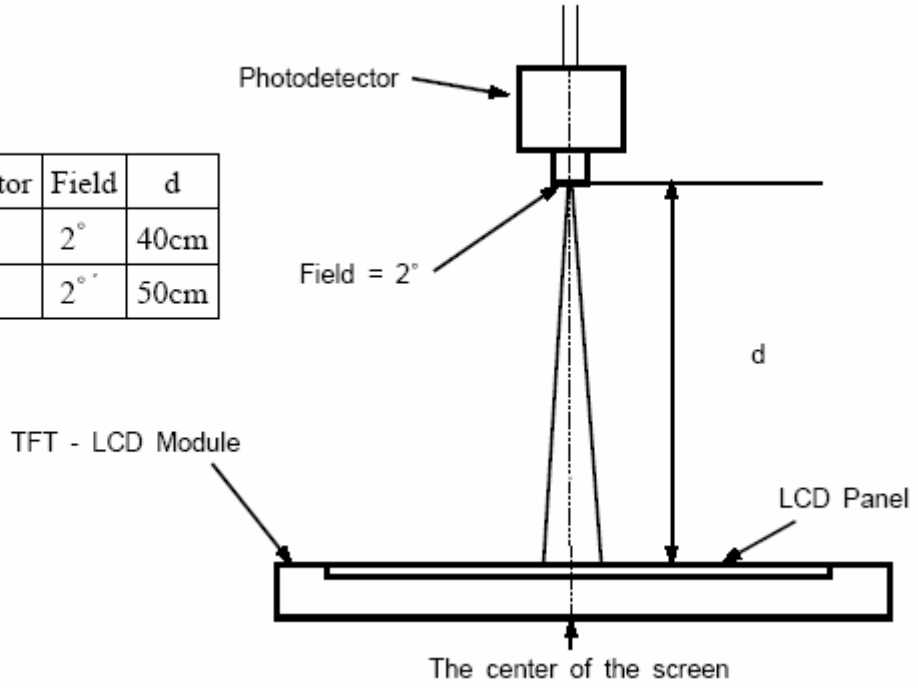
Note (2) If product is exposed to high temperatures for extended time, there is a possibility of the polarizer file damage which could degrade the optical characteristics.

Note (3) Test Equipment Setup

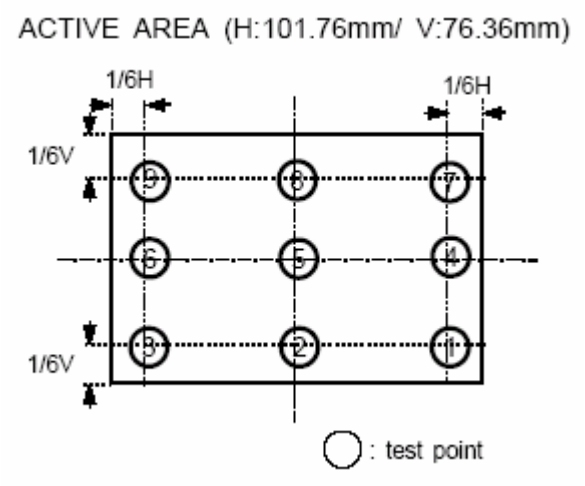
After leaving the panel alone at a given temperature for 30 minutes under a stable condition, the measurement should be executed. Measurement should be executed in a stable, windless and dark room over 30 minutes after the backlight is lighted up. The measuring point should be at the center of screen.

-Environment condition : Ta=25±2ºC

Photodetector	Field	d
BM-5A	2°	40cm
PR-650	2°	50cm



Note (4) Definition of Contrast Ratio, Luminance



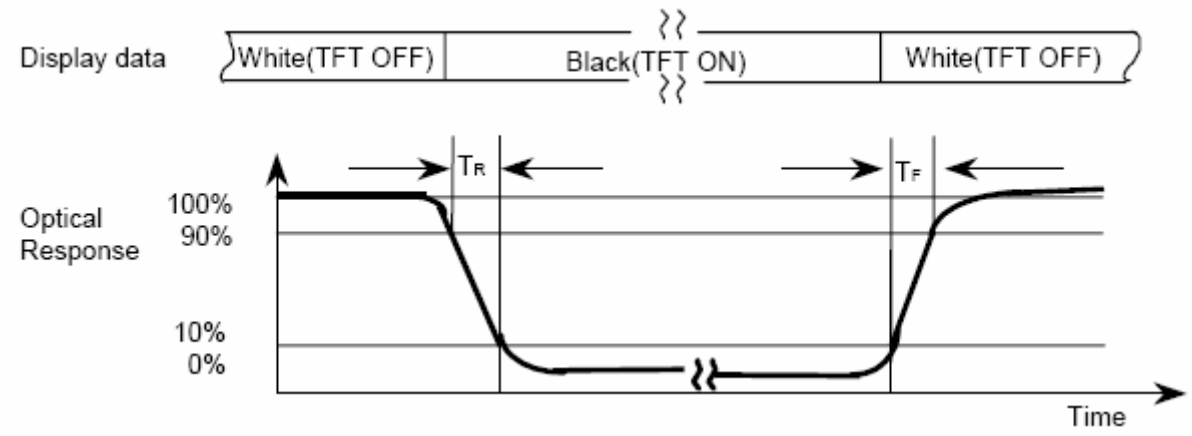
[1] Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax), gray min (Gmax) at 9 points.

$C/R = G_{max}/G_{min}$ G_{max} : Luminance with all pixels white

G_{min} : Luminance with all pixels black

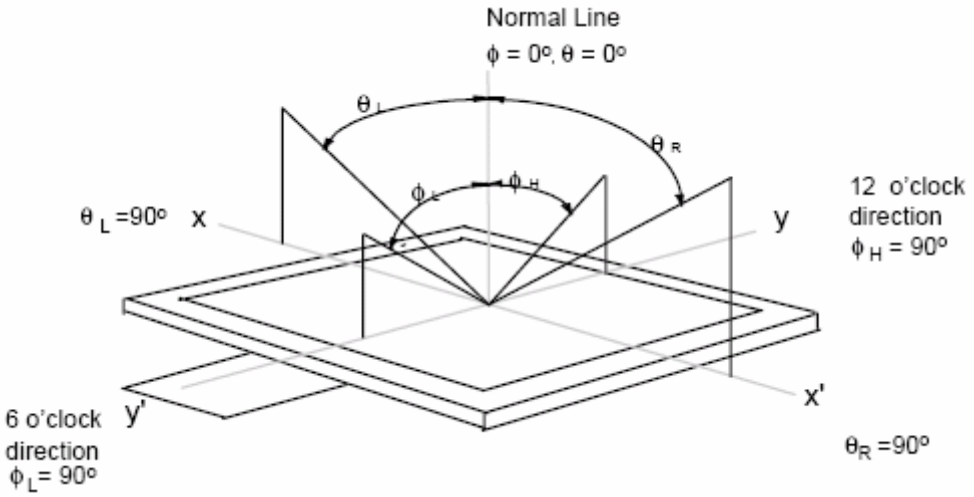
[2] Definition of Luminance : measure the luminance of white at center point and with I_{CCFL}=6.0mA

Note (5) Definition of Response Time : Sum of T_r and T_f.



Note (6) Definition of Color Chromaticity (CIE 1931), (Backlight : ON) :
Color coordinate of white at the center point

Note (7) Definition of Viewing Angle : Viewing angle range (CR≥10)



5.0 Electrical Characteristics

5.1 AC Timing Characteristics

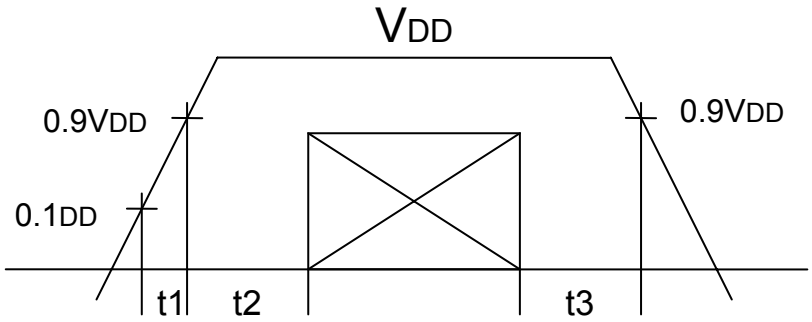
Item	Symbol	Min.	Typ.	Max.	Unit	Note
Clock Frequency	F_{ck}	5.5	6.25	7	MHz	
Clock Duty Ratio	$T_{ch}/ (T_{ch}+T_{cl})$	40	50	60	%	
Hsync Period	T_h	390	392	450	clk	
	τ_h	60	63.5	67	μs	$\tau_h=F_{ck}$ x T_h
Hsync Pulse Width	T_{hw}	2	16	32	clk	
Vsync Period	T_v	258	262	280	T_h	
	τ_v	16.1	16.6	17.1	ms	$\tau_v=\tau_h$ x T_v
Vsync Pulse Width	T_{vw}	2	4	16	T_h	
Hsync/Vsync Phase Shift	T_{vpd}	2	-	-	clk	
Horizontal Display Start	T_{he}	(69)	(69)	(69)	clk	
Vertical Display Start	T_{ve}	(17)	(17)	(17)	T_h	
Hsync Clock Shift	T_{hc}	10	-	-	ns	
Data Setup Time	T_{ds}	5	-	-	ns	
Data Hold Time	T_{dh}	10	-	-	ns	

5.2 DC Characteristics

5.2.1 TFT-LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	V_{DD}	3.0	3.3	3.6	V	(1)
	I_{DD}	-	110	110	mA	(2)(4)
Permissive Input Ripple Voltage	V_{RF}	-	-	100	mV_{P-P}	V_{DD}=+5V
Input Voltage (Low)	V_{IL}	0	-	0.3	V	(3)
Input Voltage (High)	V_{IH}	0.7	-	5.5	V	(3)
Input Current (Low)	I_{IL}	-	-	10	μA	(3)
Input Current (High)	I_{IH}	-	-	10	μA	(3)

Note (1) VDD Power-On condition :



0 < t1 ≤ 20 ms
0 < t2 ≤ 50 ms
t3 ≤ 1 s

Note (2) Conditions for current consumption :
8 Gray Scale Pattern, V_{DD}=3.3V, f_H=15.3K, f_V=58.4Hz, f_{CLK}=6.0MHz

Note (3) CLK, Hsync, Vsync, R0~R5, G0~G5, B0~B5

Note (4) LED current is not included.

5.2.2 DC-DC for LED Backlight

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	V_{LED}	3.0	3.3	3.6	V	
	I_{LED}		145		mA	
Dimming Voltage	V_{dim}	1.4		3.3	V	(1)(2)

Note (1) Brightness Dimming Control Scheme : Linear Analog Voltage Control

Note (2) The “Enable & Dimming Control” of the LED driver shares the same pinning.
The LED backlight will turn on when the input voltage of this pin exceeds +0.6V.
The LED current/brightness will be adjustable by applying an analog voltage between +0.8 ~ +1.3V(Max. Brightness).

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5.3 Input Terminal Pin Assignment

5.3.1 Signal Input Interface

Kyocera Elco Connector : 33 FFC/FPC Type : 08-6210-033-340-800

Pin No	Symbol	Description	Remark
1	GND	Ground	-
2	CLK	Data Clock	-
3	Hsync	Horizontal Sync.	-
4	Vsync	Vertical Sync.	-
5	GND	Ground	-
6	R0	Red Data (LSB)	-
7	R1	Red Data	-
8	R2	Red Data	-
9	R3	Red Data	-
10	R4	Red Data	-
11	R5	Red Data (MSB)	-
12	GND	Ground	-
13	G0	Green Data (LSB)	-
14	G1	Green Data	-
15	G2	Green Data	-
16	G3	Green Data	-
17	G4	Green Data	-
18	G5	Green Data (MSB)	-
19	GND	Ground	-
20	B0	Blue Data (LSB)	-
21	B1	Blue Data	-
22	B2	Blue Data	-
23	B3	Blue Data	-
24	B4	Blue Data	-
25	B5	Blue Data (MSB)	-
26	GND	Ground	-
27	NC	No Connection	-
28	V_{DD}	Power Supply for Logic (+3.3V)	-
29	V_{DD}	Power Supply for Logic (+3.3V)	-
30	V_{LED}	Power Supply for LED Backlight(+3.3V)	-
31	V_{LED}	Power Supply for LED Backlight(+3.3V)	
32	V_{Dim}	Dimming control for LED backlight	
33	GND	Ground	

5.4 Color Data Reference

The below table is about nput signal, Basic display colors and gray scale of each color.

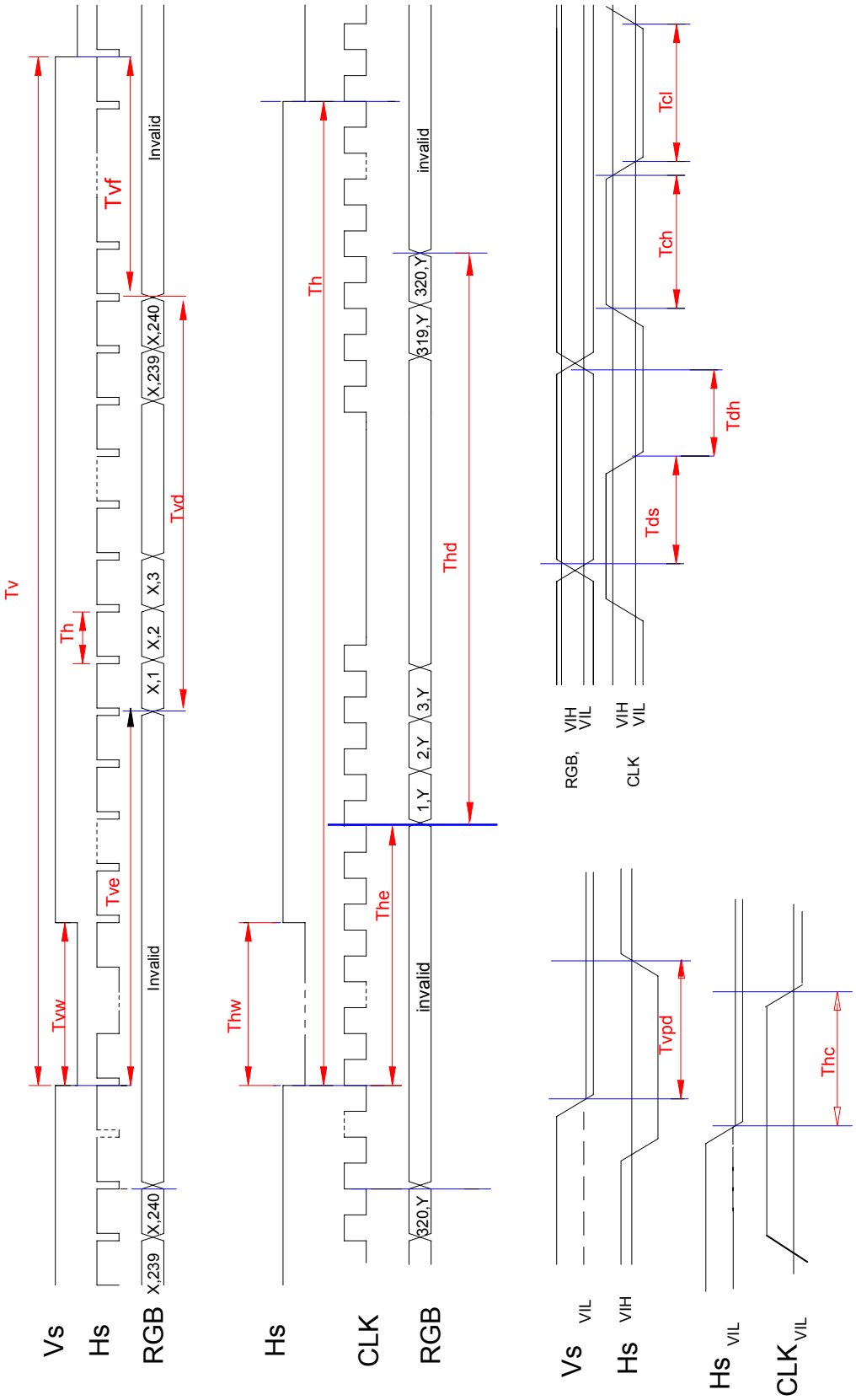
0 : Low Level Voltage 1 : High Level Voltage

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 262k color display can be achieved on the screen.

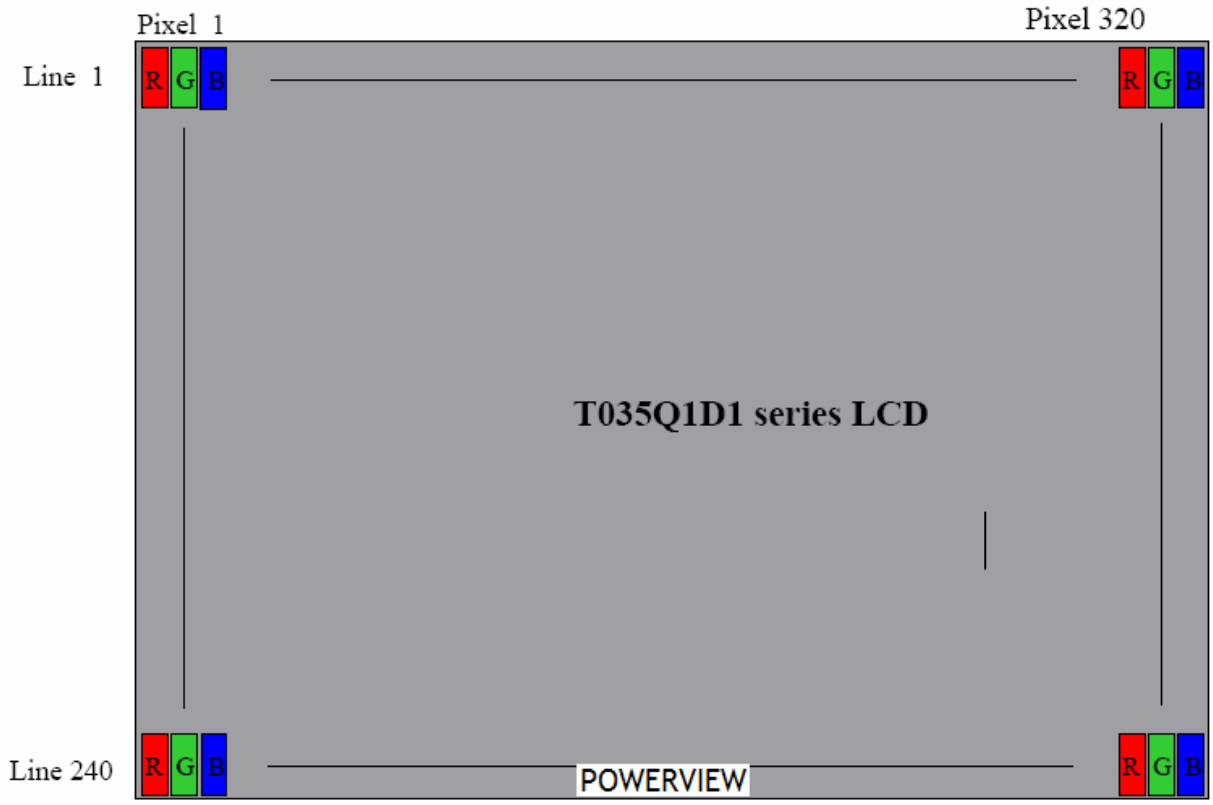
Please see the next page

	Colors & Gray Scale	Data Signal																		
		Gray Scale	R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5
Basic Color	Black	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	-	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Green	-	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Cyan	-	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Red	-	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	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
Gray Scale of Red	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓				↓						↓						↓		
	⇩	↓										↓						↓		
	Brighter	GS61	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS62	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS63	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	⇧	↓				↓														
	⇩	↓				↓														
	Brighter	GS61	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
	⇩	GS62	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
	Green	GS63	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale of Blue	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	⇧	↓																		
	⇩	↓																		
	Brighter	GS61	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
	⇩	GS62	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	Blue	GS63	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

5.5 Input Timing Chart



6.0 Pixel Format



7.0 Outline Dimensions

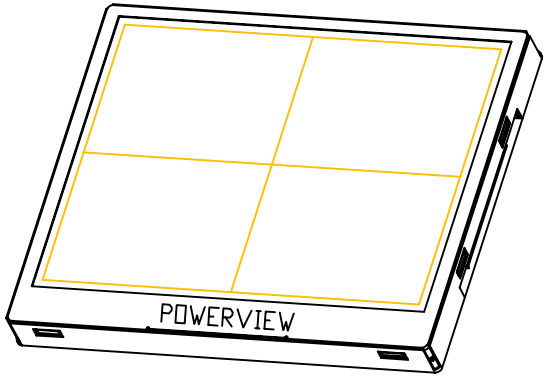
7.1 Monitor Outline Dimensions

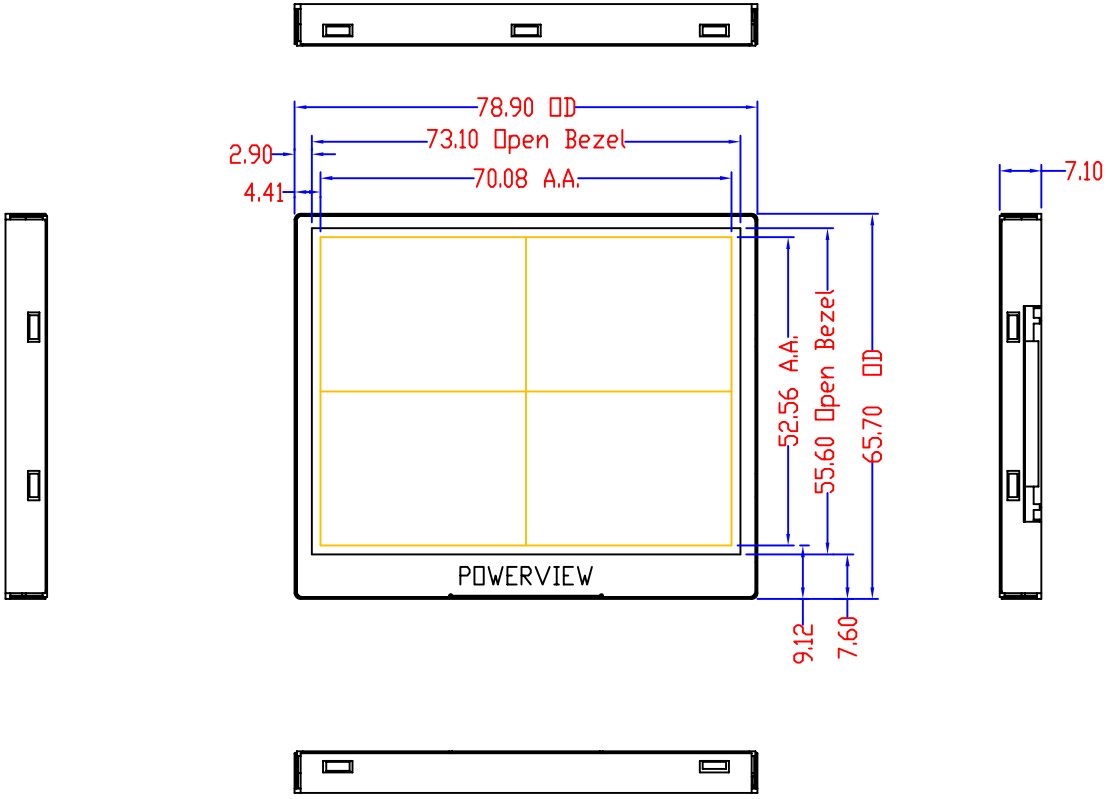
- Please refer to the next page

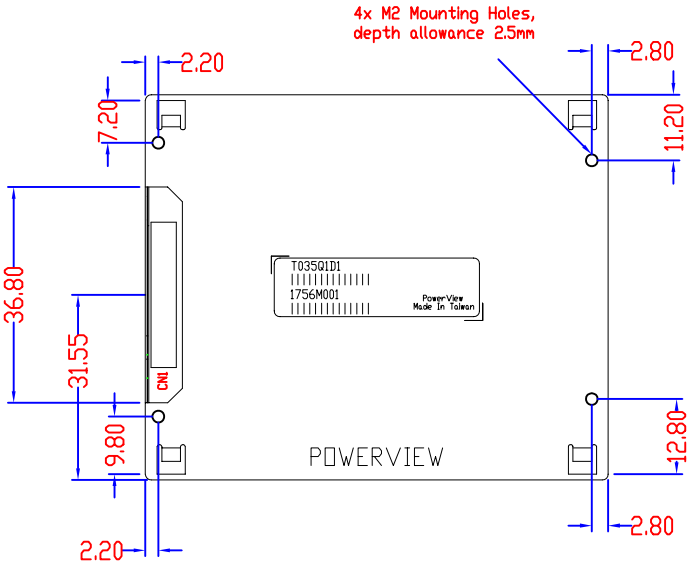
REV	EC NUMBER	DESCRIPTION	DATE
▽	XXXXXXX	XXXXXXXX	2002/02/10

Notes :

1. General Telorance : ± 0.3 mm





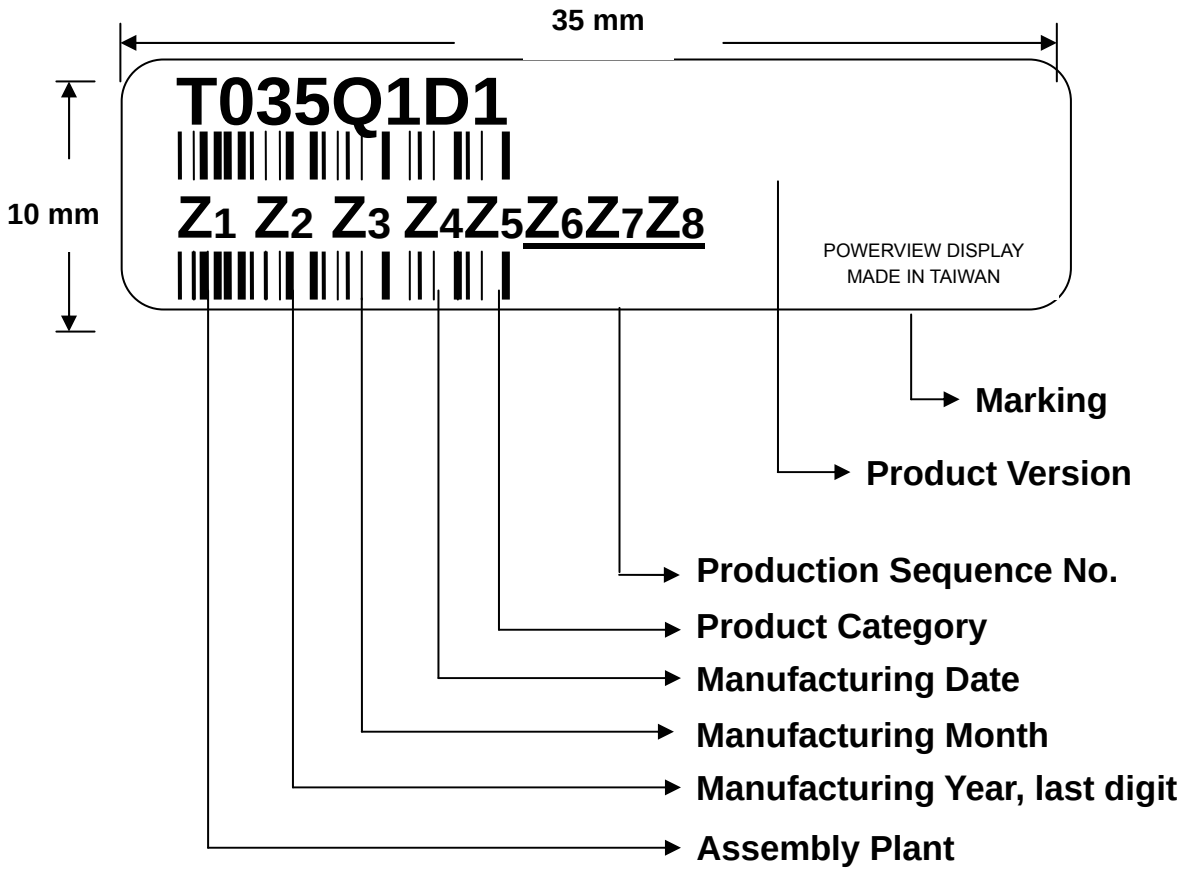


LEVEL / DIMENSION	GENERAL TOLERANCE RANGE 1	2	3	SELECT LEVEL
0 ~ 4	0.1	0.2	0.2	2
4 ~ 14	0.1	0.2	0.2	
14 ~ 63	0.1	0.2	0.4	
63 ~ 250	0.2	0.4	0.6	
250 ~ 630		0.6	1.0	
630 ~ 1000			1.6	

MATERIAL		CRITICAL DIMENSION / SPEC DIMENSION	UNIT: MM; SCALE: 1:1; WEIGHT: ; 3rd ANGLE; MODEL NAME: T035
FINISH	finish		PART NUMBER: T035Q1D1
APPROVED			PART DESCRIPTION: T035Q1D1-1 Outlines
CHECKED			SIZE: A4; SHEET NUMBER: 1-1; REV: A
DESIGNED	Tim	2006/12/18	

8.0 Labeling, Packaging & Others

*** Labeling**



*** Packaging**

- TBD

*** Others**

9.0 General Notice

9.1 Storage

(a) Do not leave the panel in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35°C and relative humidity of less than 70%.

(b) Do not store the TFT-LCD module in direct sunlight.

(c) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the storage.

9.2 Operation

(a) Do not connect, disconnect the module in the "Power On" condition.

(b) Power supply should always be turned on/off by the item 3.2 "Electrical Absolute Ratings"

* Others

(a) The liquid-crystal is deteriorated by ultraviolet rays. Do not leave it in direct sunlight and strong ultraviolet rays for many hours.

(b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(c) Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the panel may be damaged.

(d) If the panel displays the same pattern continuously for a long period of time, it can be the situation when the image "Sticks" to the screen.

(e) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.