Displaytech Ltd.

Website: www.displaytech.com.hk

LCD Module
Product Specification

Product: 4.2'' TFT Display Module (240RGBx432DOTS)

2 March 2009.

1. REVISION RECORD

VERSION	CHANGES	DATE
1.0	Initial revision	2 March 2009

Table of Content

2. Introduction

DT042TFT or *DT042TFT-TS* is a display module that contains a TFT display with a 432 * 240 RGB resolution. The driver used for this project is the Ilitek **ILI9326 or compatible** and can display 262K colors. The driver is mounted on the glass and the interconnection via FPC including components to drive the display module.

3. General Specifications

Item	Specification	Unit
LCD mode	Transmissive	---
Resolution	240(RGB)	Line
	432	Line
Viewing area	49.55	mm
	97.07	mm
Active area	47.952	mm
	95.472	mm
Driver IC	ILI9326	---
Interface type	System parallel / RGB (1)	---
Colours	262K	---
Operation temperature range	-20~70	°C
Storage temperature range	-30~80	°C

Remarks:

(1) Serial interface is available, but not recommendable, as the speed of it is very slow.

(2) Recommended mating connector: Hirose FH19SC-45S-0.5SH, FH12S-45S-0.5SH; or
                Molex 0512964593, 0512964594; or equivalent

(3) Orientation: both Portrait and Landscape mode are available (controlled by software, refer to IC spec)

Component Life Cycle

1) Storage Life: min. 1 Year

2) Operation Life (*1): min. 43 x 10³ h (24h per day x 7 days per week x 52 weeks / year x 5 years)
    (Not include backlight)

3) Storage and Operation Life Times are defined for a temperature of +25°C

Notes:

*1. Operation life ends when one of the listed faults occurs:

- The on/off response-times reach 1.5 times of the max. value specified for a new display
- The contrast is reduced to 0.5 of the original contrast value
- Loss of function
- The number of cosmetic defects exceeds the maximum defined
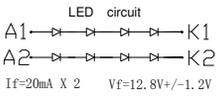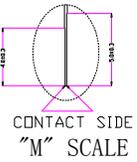
4. Mechanical Drawing

4.1. DT042TFT
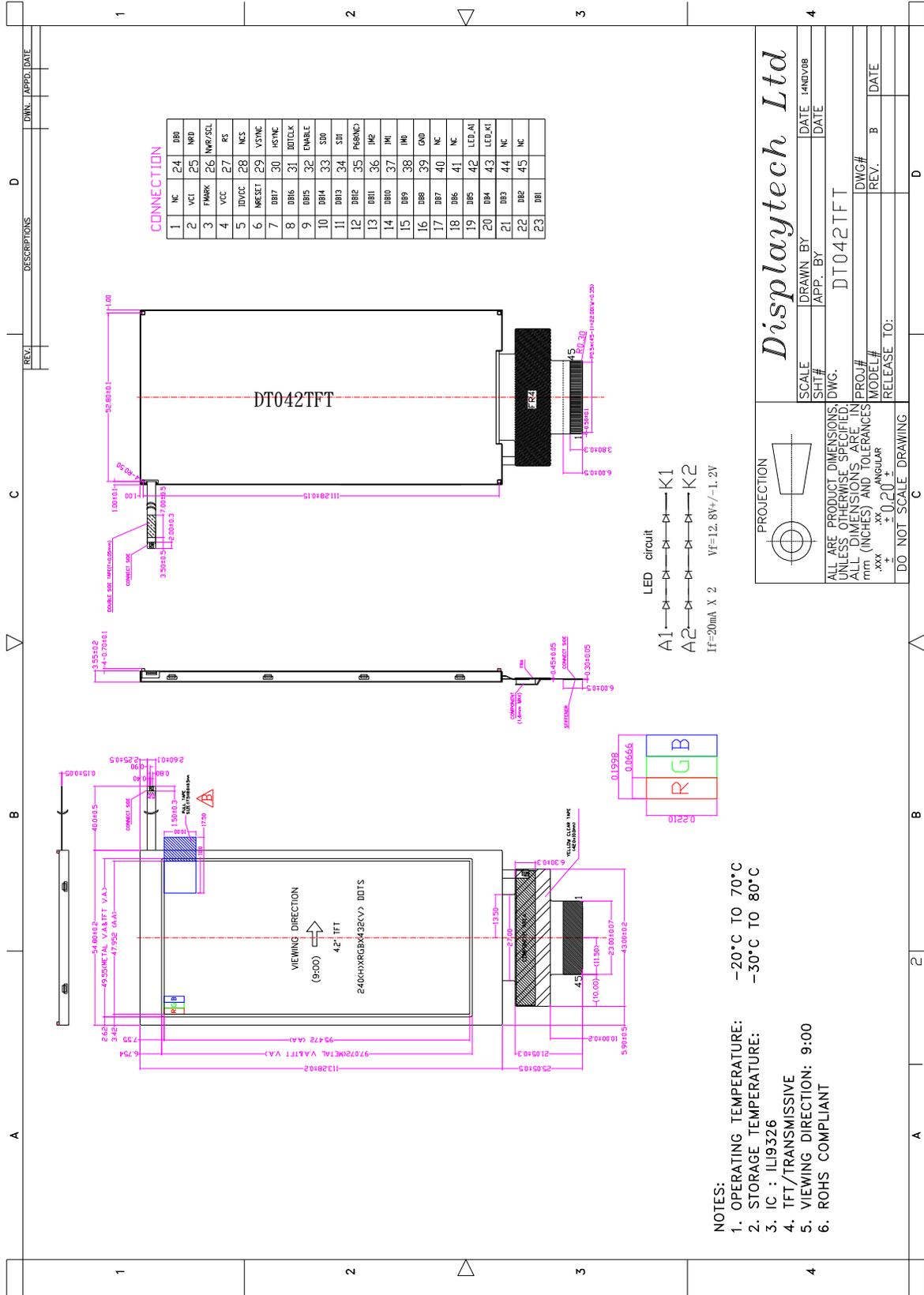
REV.	DESCRIPTIONS	DWN.	APPD.	DATE

CONNECTION

1	NC	24	DB0
2	VCI	25	NRD
3	FMARK	26	NWR/SCL
4	VCC	27	RS
5	IOVCC	28	NCS
6	NRESET	29	VSYNC
7	DB17	30	HSYNC
8	DB16	31	DOTCLK
9	DB15	32	ENABLE
10	DB14	33	SD0
11	DB13	34	SD1
12	DB12	35	P68(NC)
13	DB11	36	IM2
14	DB10	37	IM1
15	DB9	38	IM0
16	DB8	39	GND
17	DB7	40	NC
18	DB6	41	NC
19	DB5	42	LED_A1
20	DB4	43	LED_K1
21	DB3	44	NC
22	DB2	45	NC
23	DB1		

VIEWING DIRECTION
(9:00)
4.2" TFT
240(H)XRGBX432(V) DOTS

XL   XR
YU   YD

DT042TFT-TS
DT042TFT-BL-A1 DATE CODE
DATE-CODE-TR(EX-CODE-NO-)

FR4

M

LED circuit

A1 ▷|—▷|—▷|—◁ K1
A2 ▷|—▷|—▷|—◁ K2

If=20mA X 2   Vf=12.8V+/-1.2V

CONTACT SIDE
"M" SCALE

TOUCH PANEL PIN SYMBOL

1	XL
2	YD
3	XR
4	YU

R G B

NOTES:
1. OPERATING TEMPERATURE: -20 ℃ TO 70 ℃
2. STORAGE TEMPERATURE: -30 ℃ TO 80 ℃
3. IC : ILI9326
4. TFT/TRANSMISSIVE
5. VIEWING DIRECTION: 9:00
6. ROHS COMPLIANT

PROJECTION

Displaytech Ltd

SCALE	DRAWN BY	DATE 14NOV08
SHT#	APP. BY	DATE

DWG.   DT042TFT-TS

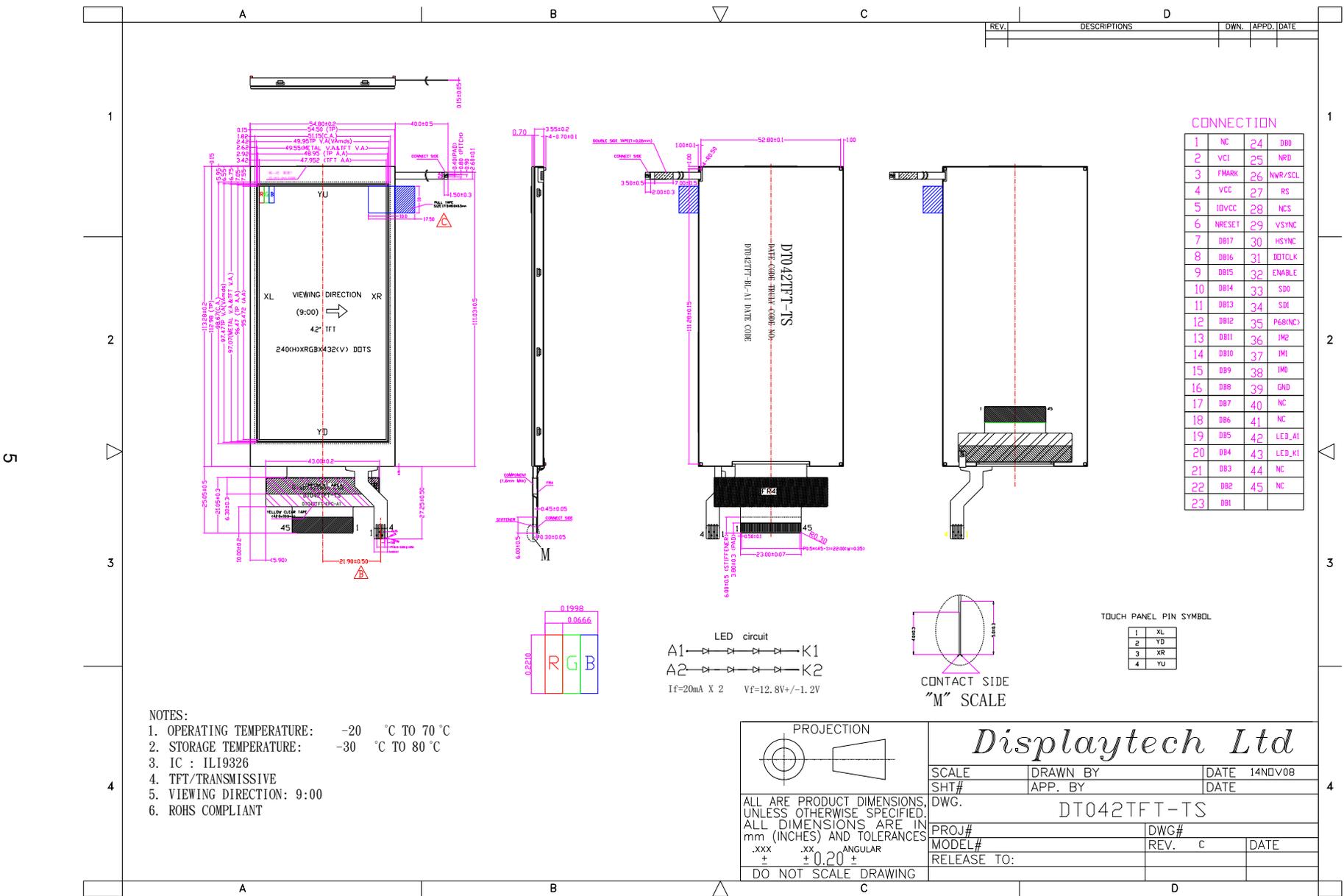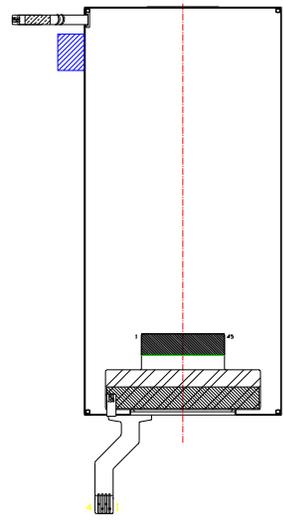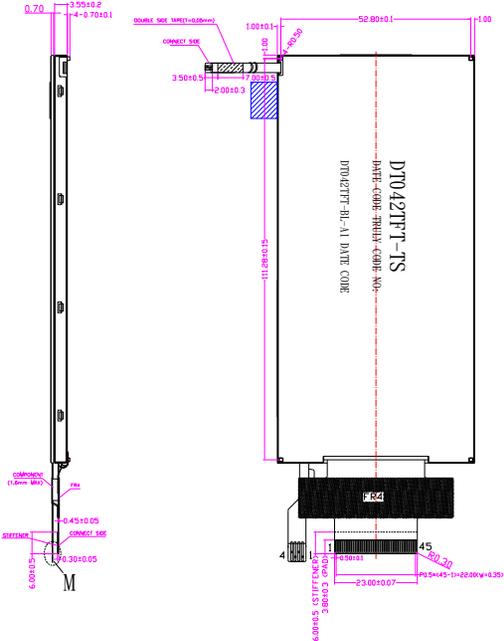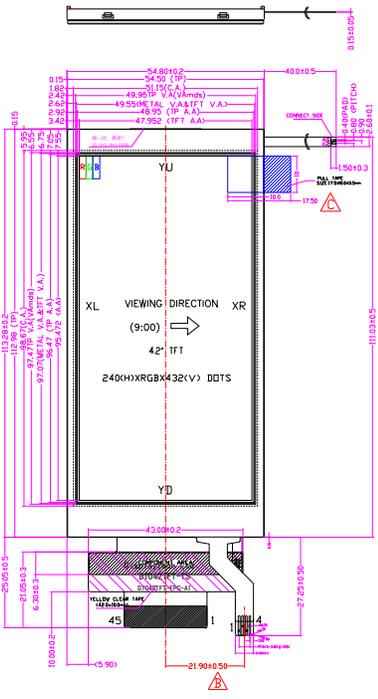| PROJ#		DWG#	
MODEL#		REV. C	DATE
RELEASE TO:			

ALL ARE PRODUCT DIMENSIONS, UNLESS OTHERWISE SPECIFIED.
ALL DIMENSIONS ARE IN mm (INCHES) AND TOLERANCES
.xxx   .xx ANGULAR
±   ±0.20 ±

DO NOT SCALE DRAWING

5. Interface Description

Pin no	Symbol	Level	Description
1	NC	---	No connection
2	VCI	2.5~3.3V	A supply voltage to the analog circuit. Connect to an external power supply of 2.5 ~ 3.3V.
3	FMARK	H/L	Output a frame head pulse signal. The FMARK signal is used when writing RAM data in synchronization with frame. Leave the pin open when not in use.
4	VCC	2.4~3.3V	A supply voltage to the internal logic: Vcc = 2.4~3.3V Vcc ≥ IOVcc1, IOVcc2
5	IOVCC	1.65~3.3V	I/O interface supply voltage
6	NRESET	H/L	A reset pin. Initializes the ILI9326 with a low input. Be sure to execute a power-on reset after supplying power.
7~24	DB17~DB0	H/L	18-bit parallel bi-directional data bus for MPU system interface mode 8-bit I/F: DB[17:10] is used. 9-bit I/F: DB[17:9] is used. 16-bit I/F: DB[17:10] and DB[8:1] is used. 18-bit I/F: DB[17:0] is used. 18-bit parallel bi-directional data bus for RGB interface operation 6-bit RGB I/F: DB[17:12] are used. 16-bit RGB I/F: DB[17:13] and DB[11:1] are used. 18-bit RGB I/F: DB[17:0] are used
25	NRD	H/L	A read strobe signal and enables an operation to read out data when the signal is low. Fix to IOVcc1 level when not in use.
26	NWR/SCL	H/L	A write strobe signal and enables an operation to write data when the signal is low. Fix to either IOVcc1 level when not in use. SPI Mode: Synchronizing clock signal in SPI mode.
27	RS	H/L	A register select signal. Low: select an index or status register High: select a control register Fix to GND level when not in use.
28	NCS	H/L	A chip select signal. Low: the ILI9326 is selected and accessible High: the ILI9326 is not selected and not accessible Fix to the IOVcc1 level when not in use.
29	VSYNC	H/L	Frame synchronizing signal for RGB interface operation. VSPL = "0": Active low. VSPL = "1": Active high. Fix to GND level when not in use.
30	HSYNC	H/L	Line synchronizing signal for RGB interface operation. HSPL = "0": Active low. HSPL = "1": Active high. Fix to GND level when not in use.
31	DOTCLK	H/L	Dot clock signal for RGB interface operation. DPL = "0": Input data on the rising edge of DOTCLK DPL = "1": Input data on the falling edge of DOTCLK Fix to GND level when not in use.
32	ENABLE	H/L	Data ENEABLE signal for RGB interface operation. Low: Select (access enabled) High: Not select (access inhibited) The EPL bit inverts the polarity of the ENABLE signal.
33	SDO	H/L	SPI interface output pin. The data is outputted on the falling edge of the SCL signal. Let SDO as floating when not used

34	SDI	H/L	SPI interface input pin. The data is latched on the rising edge of the SCL signal. Fix to GND level when not in use.
35	P68(NC)	---	No connection
36	IM2		Select the MPU system interface mode
37	IM1	H/L	
38	IM0		When the serial peripheral interface is selected, IM0 pin is used for the device code ID setting.
39	GND	0V	Ground
40	NC	---	No connection
41	NC	---	No connection
42	LED_A1	---	LED Backlight #1 anode
43	LED_K1	---	LED Backlight #1 cathode
44	NC	---	No connection
45	NC	---	No connection

The interface mode table within pins 36-38:

IM2	IM1	IM0	MPU interface	DB Pin in use
0	0	0	i80-system, 18 bit interface	DB[17:0]
0	0	1	i80-system, 9 bit interface	DB[17:9]
0	1	0	i80-system, 16 bit interface	DB[17:10], DB[8:1]
0	1	1	i80-system, 8 bit interface	DB[17:10]
1	0	ID	Serial Peripheral Interface SPI	SDI, SDO
1	1	1	MDDI interface	

LED Backlight #2

Pin no	Symbol	Level	Description
A2	LED_A2	---	LED Backlight #2 anode
K2	LED_K2	---	LED Backlight #2 cathode

Touch Screen FPC (only for DT042TFT-TS)

Pin no	Symbol
1	XL
2	YD
3	XR
4	YU

6. Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply voltage range	V_{CC} / IOV_{CC}	-0.3 to + 4.6	V
Input voltage range	V_{in}	-0.3 to V_{cc} + 0.3	V
Operating Ambient Temperature	T_{OP}	-20 ~ +70	°C
Operating Ambient Humidity	H_{OP}	10 ~ 90 (Max 60°C)	% RH
Storage Temperature	T_{STG}	-30 ~ +80	°C
Storage Humidity	H_{STG}	10 ~ 90 (Max 60°C)	% RH

7. Electrical Characteristics

DC Characteristics

Item	Symbol	Rating	Unit
Power supply	V_{CC}	2.4 to 3.3	V
Input current	I_{DD}	14.9 typ; 29.8 max	mA
Input voltage "H"	V_{IH}	0.8 IOV_{CC} to IOV_{CC}	V
Input voltage "L"	V_{IL}	-0.3 to 0.2 IOV_{CC}	V
Output voltage "H"	V_{OH}	0.8 IOV_{CC} to IOV_{CC}	V
Output voltage "L"	V_{OL}	0 to 0.2 IOV_{CC}	V

8. Display Controller /Power Supply Timing

See Display Controller Specification: **ILITEK ILI9326**

9. Operational EMC Requirements

The operational EMC immunity requirements and emission limits for DISPLAYTECH modules are provided in table 1: EMC specification for operational modules.

Table 1. EMC specification for operational modules

EMC phenomena	REFERENCE standard	Frequency range	Level/ Limit	Test specification	Performance criteria
Electromagnetic field	IEC 61000-4-3	30MHz-1000MHz	3 V/m	1kHz sine, 80% AM	C
EFT/Burst	IEC 61000-4-4	n.a.	10 V	-8us/50us	C
				-10ns/100ns	C
Electrostatic Discharge*	IEC61000-4-2	n.a.	4 kV/ 8 kV	Contact/ Air	C
Conducted RF signals	IEC 61000-4-6	150kHz-30MHz	1 V	1kHz sine, 80% AM	C
Radiated emission	IEC 61000-6-4	30 MHz-1000MHz	47 dBuV	d = 10 m	n.a.

After a charge of 4kV, the display module is allowed to go down for 2 seconds and need to comeback again. With 8kV the display module is allowed to go down and has to comeback after a reset.

10. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response Time		Tr + Tf	θ=0º Ø=0º Ta=25ºC	---	28.4	42.6	ms	Fig 2	4
Contrast ratio		Cr		211	423	---	---		1
Luminance Uniformity		δ White		67	84	---	%		3
Surface Luminance		Lv		149	187	---	cd/m²		2
Viewing Angle range		θ	Ø=90º	70	80	---	deg	Fig 1	6
			Ø=270º	70	80	---			
			Ø=0º	58	68	---			
			Ø=180º	70	80	---			
CIE (x,y) Chromaticity	Red	x	θ=0º Ø=0º Ta=25ºC	0.582	0.632	0.682			5
		y		0.294	0.344	0.394			
	Green	x		0.283	0.333	0.383			
		y		0.543	0.593	0.643			
	Blue	x		0.093	0.143	0.193			
		y		0.009	0.059	0.109			
	White	x		0.243	0.303	0.363			
		y		0.257	0.317	0.377			

Note 1: Contrast Ratio = <u>Average Surface Luminance with all white pixels (P $_1$,P$_2$, P $_3$,P$_4$, P$_5$)</u>
Average Surface Luminance with all black pixels (P$_1$, P$_2$, P $_3$,P$_4$, P$_5$)

Note 2: Surface luminance is the LCD surface from the surface with all pixels displaying white.
Lv = Average Surface Luminance with all white pixels (P$_1$, P$_2$, P $_3$,P$_4$, P$_5$)

Note 3: The uniformity in surface luminance, δ WHITE is determined by measuring luminance at each test position 1 through 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance.
δ WHITE = <u>Minimum Surface Luminance with all white pixels (P$_1$, P$_2$, P $_3$,P$_4$, P$_5$)</u>
Maximum Surface Luminance with all white pixels (P$_1$, P$_2$, P $_3$,P$_4$, P$_5$)

Note 4: Response time is the time required for the display to transition from White to black (Rise Time, Tr) and from black to white (Decay Time, Tf). For additional information see FIG 2.

Note 5: CIE (x, y) chromaticity: The x,y value is determined by measuring luminance at each test position 1 through 5,and then taking average value

Note 6: Viewing angle is the angle at which the contrast ratio is greater than 2. For TFT module the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For additional information see Fig 1.
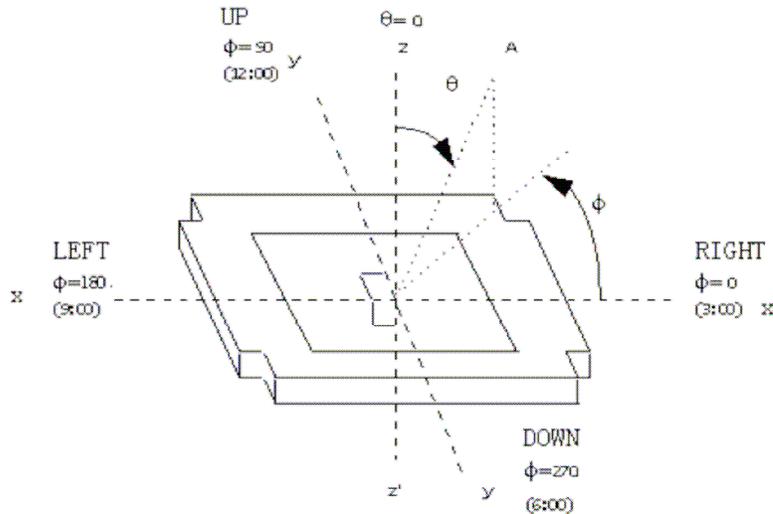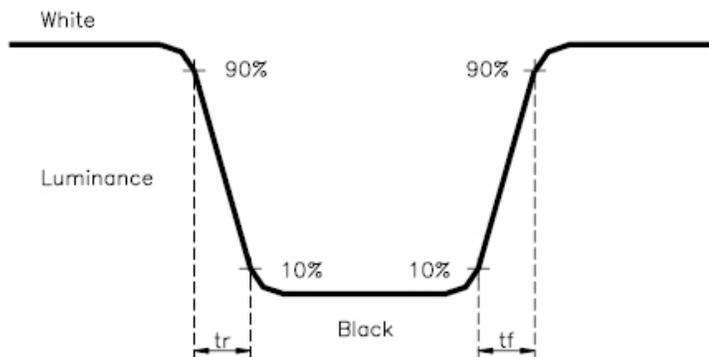
Fig.1 (Definition of Viewing Angle)

Fig. 2 (The response time is defined as the time interval between the 10% and 90% amplitudes. Refer to figure below.)

11.Backlight specification

ITEM	PARAMETER	UNIT
COLOR	WHITE	
AVERAGE LUMINOUS INTENSITY (LV)	4100 to 5100 (IF 20mAx2)	cd/m^2
NO.OF LED SMT	4x2	---
FORWARD VOLTAGE (VF)	11.6x2 to 13.6x2 (IF 20mAx2)	V

12.Safety Precaution

Handling precautions:

- This device is susceptible to Electro-Static Discharge (ESD) damage. Observe Anti-Static   precautions.

Power supply precautions:

- Identify and, at all times, observe absolute maximum ratings for both logic and LC   drivers. Note that there is some variance between models.

- Prevent the application of reverse polarity to VCC and GND, however briefly.

- Use a clean power source free from transients. Power up conditions are occasionally "jolting" and may exceed the maximum ratings of the modules.

- The VCC power of the module should also supply the power to all devices that may access the display. Don't allow the data bus to be driven when the logic supply to the module is turned off.

Operating precautions:

- DO NOT plug or unplug the module when the system is powered up.

- Minimize the cable length between the module and host MPU.

- Operate the module within the limits of the modules temperature specifications.

Mechanical/Environmental precautions:

- Improper soldering is the major cause of module difficulty. Use of flux cleaner is not recommended as they may seep under the elastomeric connection and cause display failure.

- Mount the module so that it is free from torque and mechanical stress.

- Surface of the LCD panel should not be touched or scratched. The display front surface is an easily scratched, plastic polarizer. Avoid contact and clean only when necessary with soft, absorbent cotton dampened with petroleum benzene.

- Always employ anti-static procedure while handling the module.

- Prevent moisture build-up upon the module and observe the environmental constraints for storage temperature and humidity.

- Do not store in direct sunlight

- If leakage of the liquid crystal material should occur, avoid contact with this material, particularly ingestion. If the body or clothing becomes contaminated by the liquid crystal material, wash thoroughly with water and soap