

DLC Display Co., Limited

德爾西顯示器有限公司



MODEL No: DLC0320DUG

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Record of Revision

Date	Revision No.	Summary
2010-01-12	1.0	Rev 1.0 was issued
2012-03-22	1.1	Product Upgrade ---- Update the IC
2014-09-17	2.0	Update the IC
2015-05-28	2.1	Update the IC and outline drawing

1. Scope

This data sheet is to introduce the specification of DLC0320DUG active matrix TFT module. It is composed of a color TFT-LCD panel, driver ICs, FPC and a backlight unit. The 3.2'' display area contains 240(RGB)×320 pixels.

2. Application

Digital equipments which need color display, mobile phone, mobile navigator/video systems.

3. General Information

Item	Contents	Unit
Size	3.2	inch
Resolution	240(RGB) × 320	/
Interface	MPU/SPI + RGB interface	/
Technology type	a-Si TFT	/
Pixel pitch	0.2025 × 0.2025	mm
Outline Dimension (W x H x D)	57.54 × 79.20 × 3.65	mm
Active Area	48.60 × 64.80	mm
Display Mode	TRANSFLECTIVE, Normal white	/
Viewing Direction	12 O'clock	/
Backlight Type	LED	/
Driver IC	ST7789V-G4	/
Weight	29.3	g

4. Outline Drawing

PIN	PIN NAME
1	LED_A
2	LED_K
3	GND
4	VCI
5	IM0
6	IM1
7	IM2
8	IM3
9	FRAME
10	RESET
11	VSYNC
12	HSYNC
13	DOTCLK
14	ENABLE
15	DB17
16	DB16
17	DB15
18	DB14
19	DB13
20	DB12
21	DB11
22	DB10
23	DB9
24	DB8
25	DB7
26	DB6
27	DB5
28	DB4
29	DB3
30	DB2
31	DB1
32	DB0
33	RD
34	WR/SCL
35	DC
36	SD0
37	SD1
38	VDD3
39	CS
40	GND

LED CIRCUIT DIAGRAM

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DRAWN BY:	TITLE: DLC0320DUG
CHECKED BY:	SCALE:
APPROVED BY:	DWG NO:
CONFIRMED BY:	DWG NAME:

SCALE 40 : 1

NOTES:

- DISPLAY TYPE: TFT
- VIEWING DIRECTION: 12:00
- POLARIZER MODE: Transflective
- BACKLIGHT: LED
- OPERATING TEMP: -20°C ~ 70°C
- STORAGE TEMP: -30°C ~ 80°C
- RoHS Compliant

5. Interface signals

No	Symbol	Description	Remark
1	LED_A	LED light anode	OPEN
2	LED_K	LED light cathode	OPEN
3	GND	POWER GROUND	--
4	VCI	Power Supply for Analog, Digital System and Booster Circuit.	--
5~8	IM0	Select the interface mode	--
6	IM1		
7	IM2		
8	IM3		
9	FRAME	Tearing Effect output signal. It can be used as signal to verify NVM write operation depending on register setting.	OPEN
10	RESET	This signal will reset the device and must be applied to properly initialize the chip. Signal is active low.	--
11	VSYNC	Frame synchronous signal. Low active. Connect to IOVCC1 or GND when DPI is not selected. Connect to host processor and input an IOVCC1/GND signal always when DPI is selected.	VDD3/GND
12	HSYNC	Line synchronous signal. Low active. Connect to IOVCC1 or GND when DPI is not selected. Connect to host processor and input an IOVCC1/GND signal always when DPI is selected.	VDD3/GND
13	DOTCLK	Pixel clock signal. The data input timing is set on the rising edge. Connect to IOVCC1 or GND when DPI is not selected. Connect to host processor and input an IOVCC1/GND signal always when DPI is selected.	VDD3/GND
14	ENABLE	Data enable signal in DPI operation. Low: Select (Accessible) High: Not select (Inaccessible) Connect to IOVCC1 or GND when DPI is not selected. Connect to host processor and input	VDD3/GND
15~32	DB[17:0]	18-bit bi-directional data bus in DBI Type B operation. 8-bit interface: Use DB[7:0] 9-bit interface: Use DB[8:0] 16-bit interface: Use DB[15:0] 18-bit interface: Use DB[17:0] Abnormal current (through current) is not conducted when CS is High and the data bus is Hi-z. 18-bit input data bus in DPI operation. 16-bit interface: Use DB[15:0] 18-bit interface: Use DB[17:0]	VDD3/GND
33	RD	Read strobe signal. Data are read when RDX is low.	VDD3

34	WR/SCL	Write strobe signal in DBI Type B operation.Data are written when WR is Low.Synchronous clock signal in DBI Type C operation.	--
35	DC	Command/data select signal Low: Command; High: Data Command/data select signal in DBI Type Coperation	--
36	SDO	This pin is enabled when SDOE=1 and DBI Type C is used. With this setting, SDA can be used as an input pin and SDO pin can be used as an output pin without bidirectional bus to execute serial communication.	OPEN
37	SDI	Serial data input/output pin in DBI Type C operation. Data is input on the rising edge of signal SCL. Data is output on the falling edge of SCL when serial data output pin is selected.	VDD3/GND
38	VDD3	Power supply to interface pins and the logic.	--
39	CS	System bus select signal. Low: Select (Accessible) High: Not select (Inaccessible) Make sure to connect to host processor. Follow AC timing to control the signal.Chip enable signal in DBI Type C operation.	--
40	GND	POWER GROUND	--

Note 1:The recommended connector: XF2M-4015-1A

Note 2: Select the interface mode

IM3	IM2	IM1	IM0	MPU Interface Mode	Data pin
0	0	0	0	80-8bit parallel I/F	DB[7:0]
0	0	0	1	80-16bit parallel I/F	DB[15:0]
0	0	1	0	80-9bit parallel I/F	DB[8:0]
0	0	1	1	80-18bit parallel I/F	DB[17:0],
0	1	0	1	3-line 9bit serial I/F	SDA: in/out
				2 data lane serial I/F	SDA: in/out WRX: in
0	1	1	0	4-line 8bit serial I/F	SDA: in/out
1	0	0	0	80-16bit parallel I/F II	DB[17:10], DB[8:1]
1	0	0	1	80-8bit parallel I/F II	DB[17:10]
1	0	1	0	80-18bit parallel I/F II	DB[17:0],
1	0	1	1	80-9bit parallel I/F II	DB[17:9]
1	1	0	1	3-line 9bit serial I/F II	SDA: in/ SDO: out
1	1	1	0	4-line 8bit serial I/F II	SDA:in/ SDO: out

6. Absolute maximum Ratings

6.1. Electrical Absolute max. ratings

Parameter	Symbol	MIN	MAX	Unit	Remark
Supply voltage for logic	VCI	-0.3	4.60	V	
Supply voltage for IO	VDD3	-0.3	4.60	V	
Input voltage	VIV	-0.3	VDD3+0.5	V	

6.2. Environment Conditions

Item	Symbol	MIN	MAX	Unit	Remark
Operating Temperature	TOPR	-20	70	°C	
Storage Temperature	TSTG	-30	80	°C	

6.3. LED Backlight Absolute max. ratings

Item	Symbol	MIN	MAX	Unit	Remark
LED Forward Current	ILED	--	20	mA	

7. Electrical Specifications

7.1 Electrical characteristics

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Logic Supply Voltage	VCI	2.4	2.8	3.3	V	
Low voltage power supply	VDD3	1.65	2.8	3.3	V	
Input Signal Voltage	VIL	GND	--	0.3VDD3	V	
	VIH	0.7VDD3	--	VDD3		
Output Signal Voltage	VOL	GND	--	0.2VDD3	V	
	VOH	0.8VDD3	--	VDD3	V	
Input Current	Idd	-	6.7	10.1	mA	

7.2 LED Backlight

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	IF	--	15	--	mA	5 LEDs series
Forward Voltage	VF	14	16	17	V	
LED lifetime	--	25,000	--	--	Hr	

8. Optical Specification

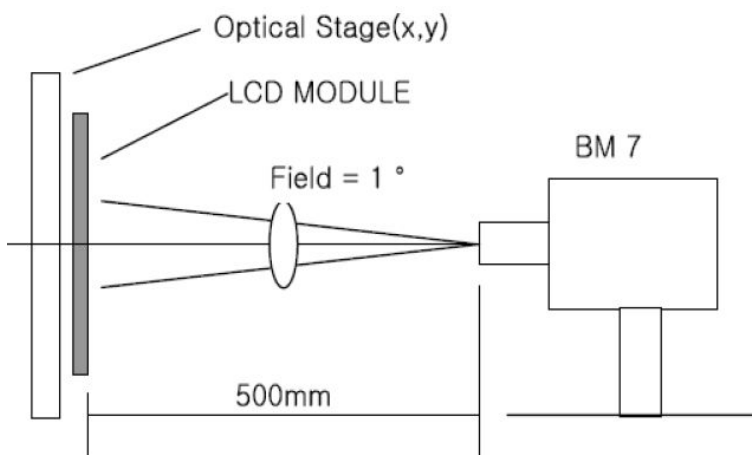
Ta=25°C

Item	Symbol	Condition	Min	Typ.	Max.	Unit	Remark			
Contrast Ratio	CR	$\theta=0^\circ$	46	92	-		Note1 Note2			
Response Time	Ton+ Toff	25°C	-	30	45	ms	Note1 Note3			
View Angles	ΘT	$CR \geq 10$	70	80	-	Degree	Note 4			
	ΘB		20	30	-					
	ΘL		10	25	-					
	ΘR		40	55	-					
Chromaticity	Red	x	Brightness is on	TYP-0.05	TYP+0.05	-	Note5, Note1			
		y								
	Green	x								
		y								
	Blue	x								
		y								
	White	x						0.2296	0.2896	0.3496
		y						0.2446	0.3046	0.3646
Luminance	L		120	160	-	cd/m ²	Note1 Note6			
Uniformity	U		70	-	-	%	Note1 Note7			
NTSC		-		40	-	%				

Note 1: Definition of optical measurement system.

Temperature = 25°C (±3°C)

LED back-light: ON, Environment brightness < 150 lx

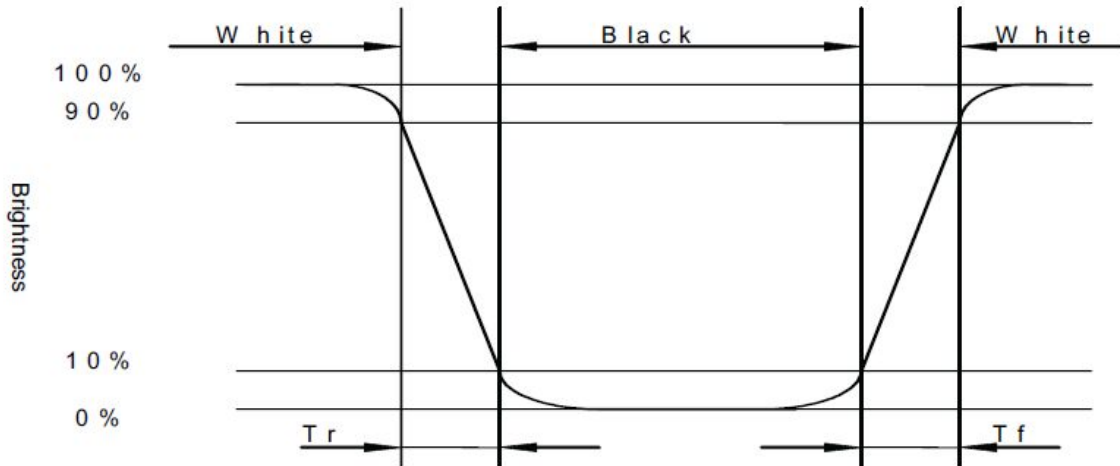


Note 2: Contrast ratio is defined as follow:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

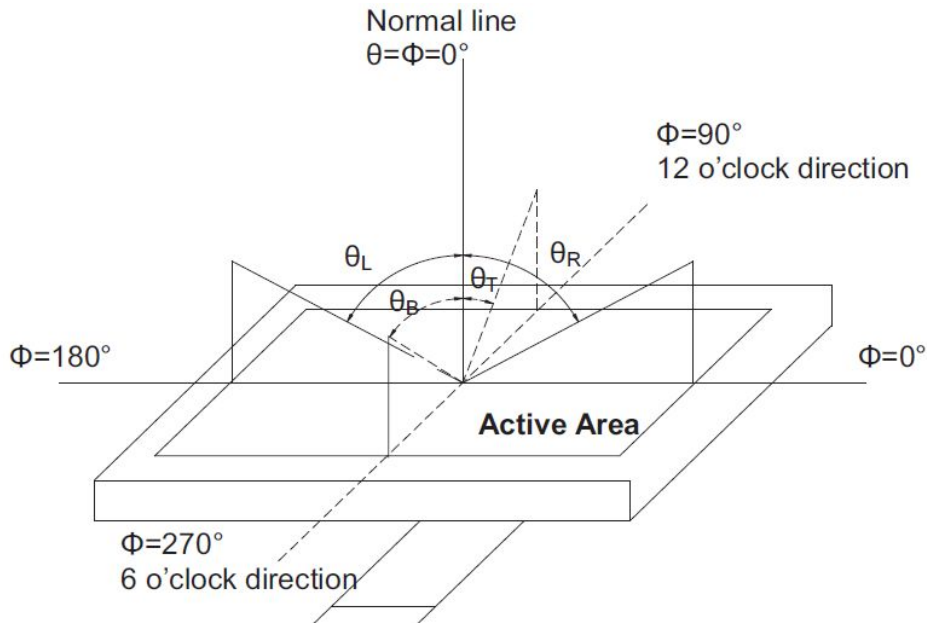
Note 3: Response time is defined as follow:

Response time is the time required for the display to transition from black to white (Rise Time, T_r) and from white to black (Decay Time, T_f).



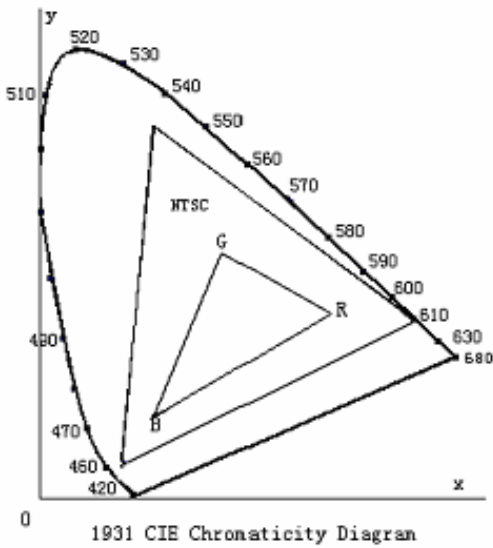
Note 4: Viewing angle range is defined as follow:

Viewing angle is measured at the center point of the LCD.



Note 5: Color chromaticity is defined as follow: (CIE1931)

Color coordinates measured at center point of LCD.



$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

Note 6: Luminance is defined as follow:

Luminance is defined as the brightness of all pixels “White” at the center of display area on optimum contrast.

Note 7: Luminance Uniformity is defined as follow:

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

$$\text{Uniformity (U)} = \frac{\text{Minimum Luminance(brightness) in 9 points}}{\text{Maximum Luminance(brightness) in 9 points}}$$

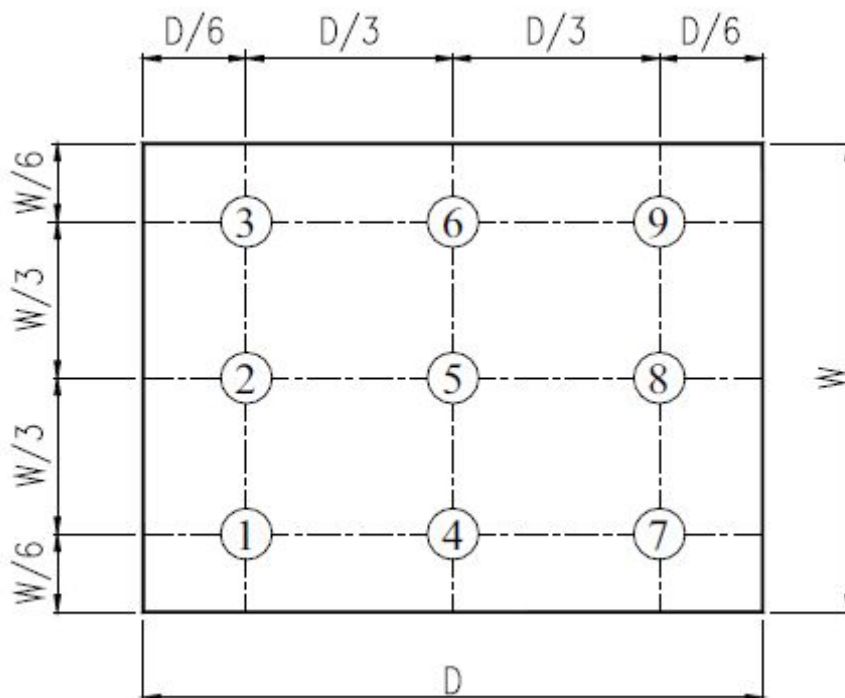


Fig. 2 Definition of uniformity

9. Environmental / Reliability Tests

No	Test Item	Condition	Judgment criteria
1	High Temp Operation	Ts=+70±2°C, 120hrs	Per table in below
2	Low Temp Operation	Ta=-20±2°C, 120hrs	Per table in below
3	High Temp Storage	Ta=+80±2°C, 200hrs	Per table in below
4	Low Temp Storage	Ta=-30±2°C, 200hrs	Per table in below
5	High Temp & High Humidity Storage	Ta=+40±5°C, 90% RH 120 hours	Per table in below (polarizer discoloration is excluded)
6	Temperature Cycle	-20±2°C~25~70±2°C×10cycles (30min.) (5min.) (30min.)	Per table in below
7	ESD (Operation)	Voltage:±8KV R: 330Ω C: 150pF Air discharge, 10time	Per table in below
8	Vibration (Non-operation)	Frequency range: 10Hz~55Hz~10Hz, Amplitude: 1.5mm, X, Y, Z direction for total 3hours (Packing condition)	Per table in below
9	Package Drop Test	Height:100 cm, one time, every side of carton.	Per table in below

INSPECTION	CRITERION(after test)
Appearance	No Crack on the FPC, on the LCD Panel
Alignment of LCD Panel	No Bubbles in the LCD Panel No other Defects of Alignment in Active area
Electrical current	Within device specifications
Function / Display	No Broken Circuit, No Short Circuit or No Black line No Other Defects of Display

10. Precautions for Use of LCD Modules

10.1 Safety

The liquid crystal in the LCD is poisonous. Do not put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

10.2 Handling

- A. The LCD and touch panel is made of plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
- B. Do not handle the product by holding the flexible pattern portion in order to assure the reliability
- C. Transparency is an important factor for the touch panel. Please wear clear finger sacks, gloves and mask to protect the touch panel from finger print or stain and also hold the portion outside the view area when handling the touch panel.
- D. Provide a space so that the panel does not come into contact with other components.
- E. To protect the product from external force, put a covering lens (acrylic board or similar board) and keep an appropriate gap between them.
- F. Transparent electrodes may be disconnected if the panel is used under environmental conditions where dew condensation occurs.
- G. Property of semiconductor devices may be affected when they are exposed to light, possibly resulting in IC malfunctions.
- H. To prevent such IC malfunctions, your design and mounting layout shall be done in the way that the IC is not exposed to light in actual use.

10.3 Static Electricity

- A. Ground soldering iron tips, tools and testers when they are in operation.
- B. Ground your body when handling the products.
- C. Power on the LCD module before applying the voltage to the input terminals.
- D. Do not apply voltage which exceeds the absolute maximum rating.
- E. Store the products in an anti-electrostatic bag or container.

10.4 Storage

- A. Store the products in a dark place at $+25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ with low humidity (40% RH to 60% RH). Don't expose to sunlight or fluorescent light.
- B. Storage in a clean environment, free from dust, active gas, and solvent.

10.5 Cleaning

- A. Do not wipe the touch panel with dry cloth, as it may cause scratch.
- B. Wipe off the stain on the product by using soft cloth moistened with ethanol. Do not allow ethanol to get in between the upper film and the bottom glass. It may cause peeling issue or defective operation. Do not use any organic solvent or detergent other than ethanol.

10.6 Cautions for installing and assembling

Bezel edge must be positioned in the area between the Active area and View area. The bezel may press the touch screen and cause activation if the edge touches the active area. A gap of approximately 0.5mm is needed between the bezel and the top electrode. It may cause unexpected activation if the gap is too narrow. There is a tolerance of 0.2 to 0.3mm for the outside dimensions of the touch panel and tail. A gap must be made to absorb the tolerance in the case and connector.

