

LIQUID CRYSTAL DISPLAY MODULE

Product Specification

PRODUCT NUMBER	LMR5429
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INTERNAL APPROVALS		
Product Manager	Engineering	Document Control

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REVISION RECORD

Rev.	Date	Page	Par.	Comment	ECN no.
A	10/28/08	--	--	New DCA Specification – Combined all LMR5429 Versions	E3905
B	08/06/09	7	--	Corrected wiring diagram.	E4154
C	12/02/09	7	--	LCD wiring diagram added	E4218

1 PRODUCT SPECIFICATION

1.1 AVAILABLE FLUID AND POLARIZER TYPE

LCD TYPE		STN		FSTN	
		Normal Temp.	Wide Temp.	Normal Temp.	Wide Temp.
Transmissive	Negative	✓	✓	✓	✓

1.2 AVAILABLE BACKLIGHT TYPE AND COLOR

BACKLIGHT COLOR	Jade Green	Arctic White	Warm Amber	Midnight Blue	Tangerine Orange	Sunburst Yellow
Edge LED	✓	✓	✓	✓	✓	✓

1.3 GENERAL SPECIFICATIONS

ITEM	CONTENTS	UNIT
Outline Dimension	85.00 ± 0.20 (W) x 34.0 ± 0.20 (H) x 8.0 ± 0.50 (D) (*Note 1) (excluding mounting holes)	mm
Display Format	240 x 64	Dots
Viewing Area	82.0 (W) x 24.0 (H)	mm
Dot Size	0.29 x 0.29	mm
View Angle	12:00	O'clock
Duty Ratio	1/64	Duty
Bias	1/9	Bias
Module Operating Voltage	3.0	V
LCD Operating Voltage	12.0	V
LCD Driver	ST7529	-
RoHS Complaint	Yes	-

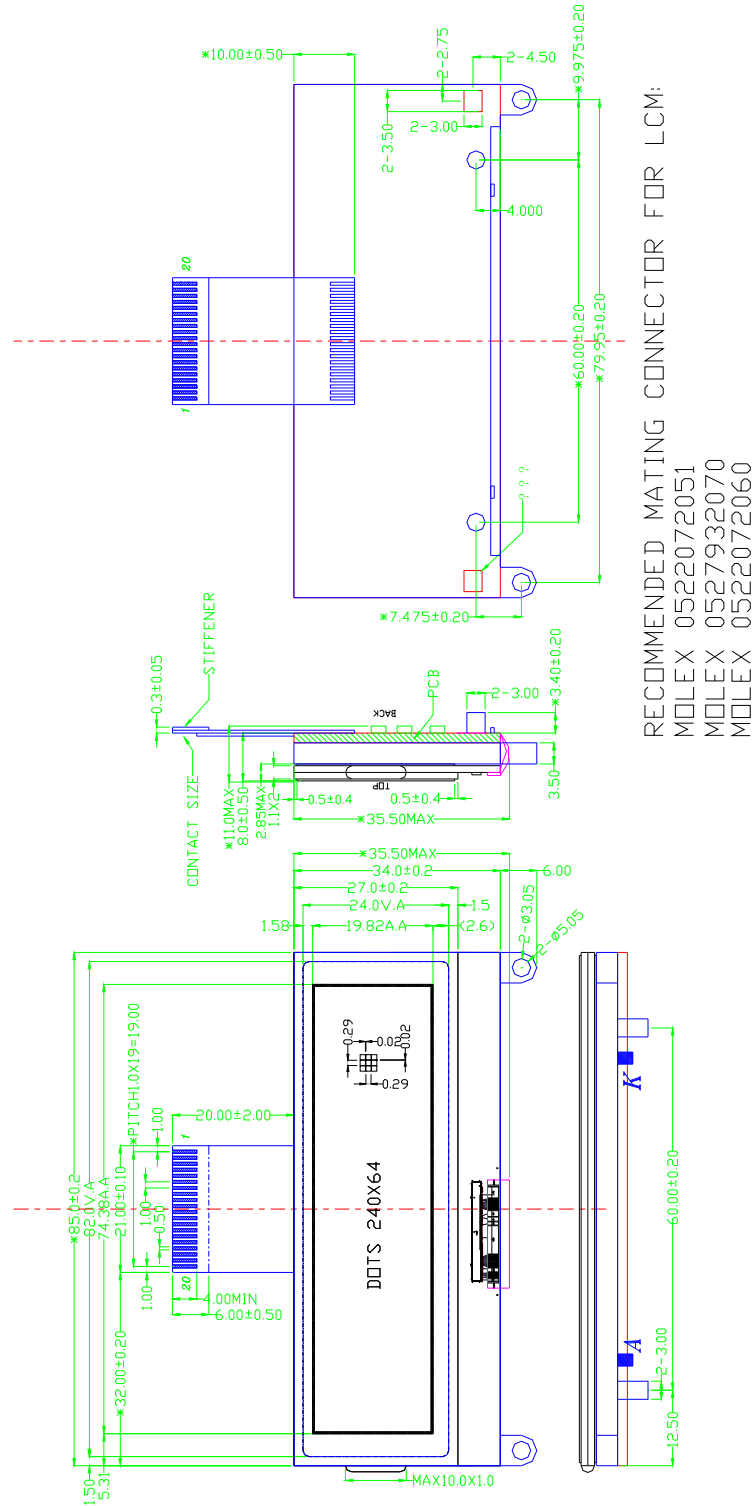
*Note 1: The Depth (D) dimension is 8.50 ± 0.50 (White LED + Yellow Filter) for Sunburst Yellow Backlight.

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2 MECHANICAL DRAWING

2.1 FOR ALL COLORS EXCEPT SUNBURST YELLOW BACKLIGHT

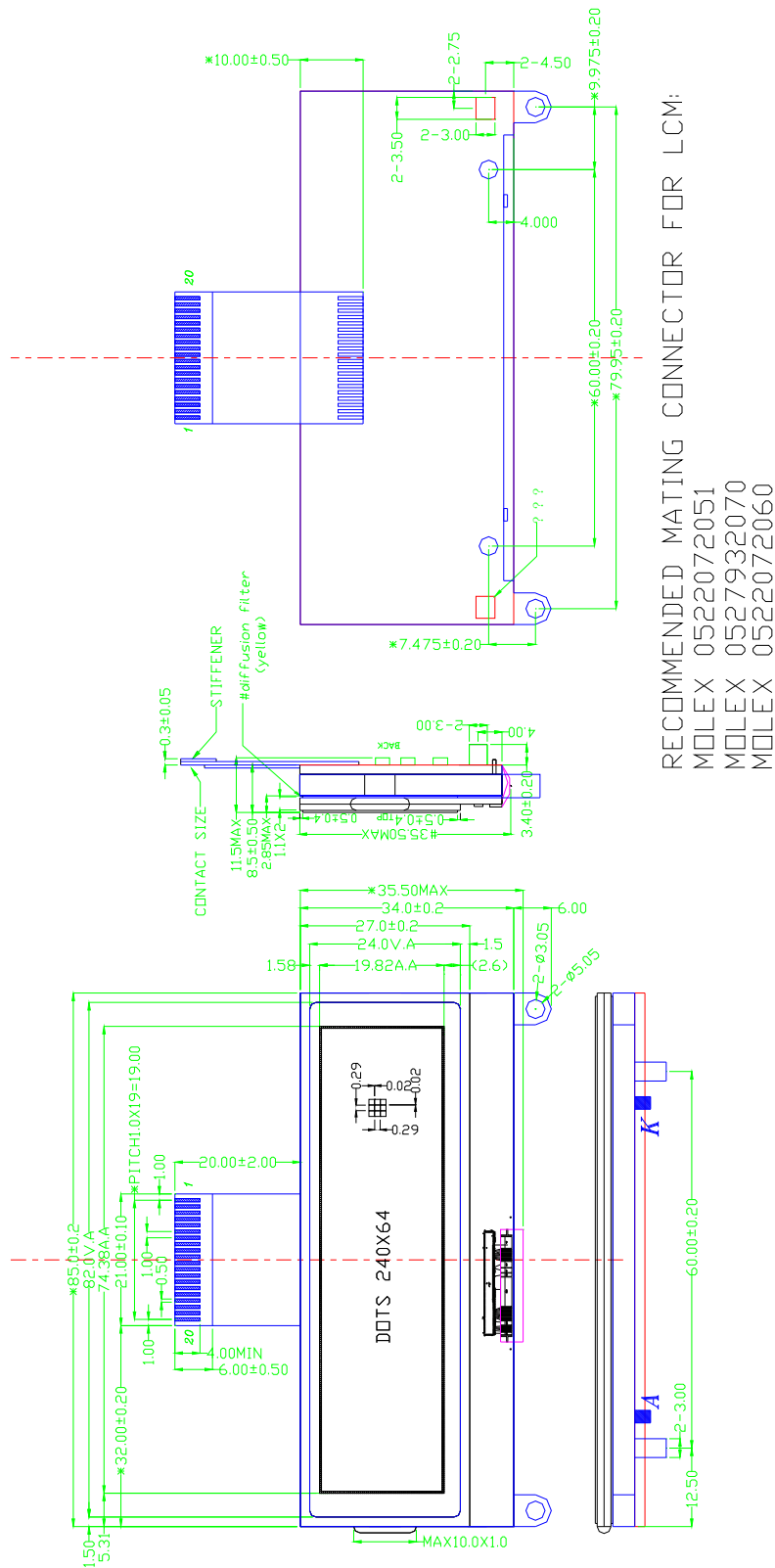


RECOMMENDED MATING CONNECTOR FOR LCM:
 MOLEX 0522072051
 MOLEX 0527932070
 MOLEX 0522072060

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2.2 FOR SUNBURST YELLOW BACKLIGHT



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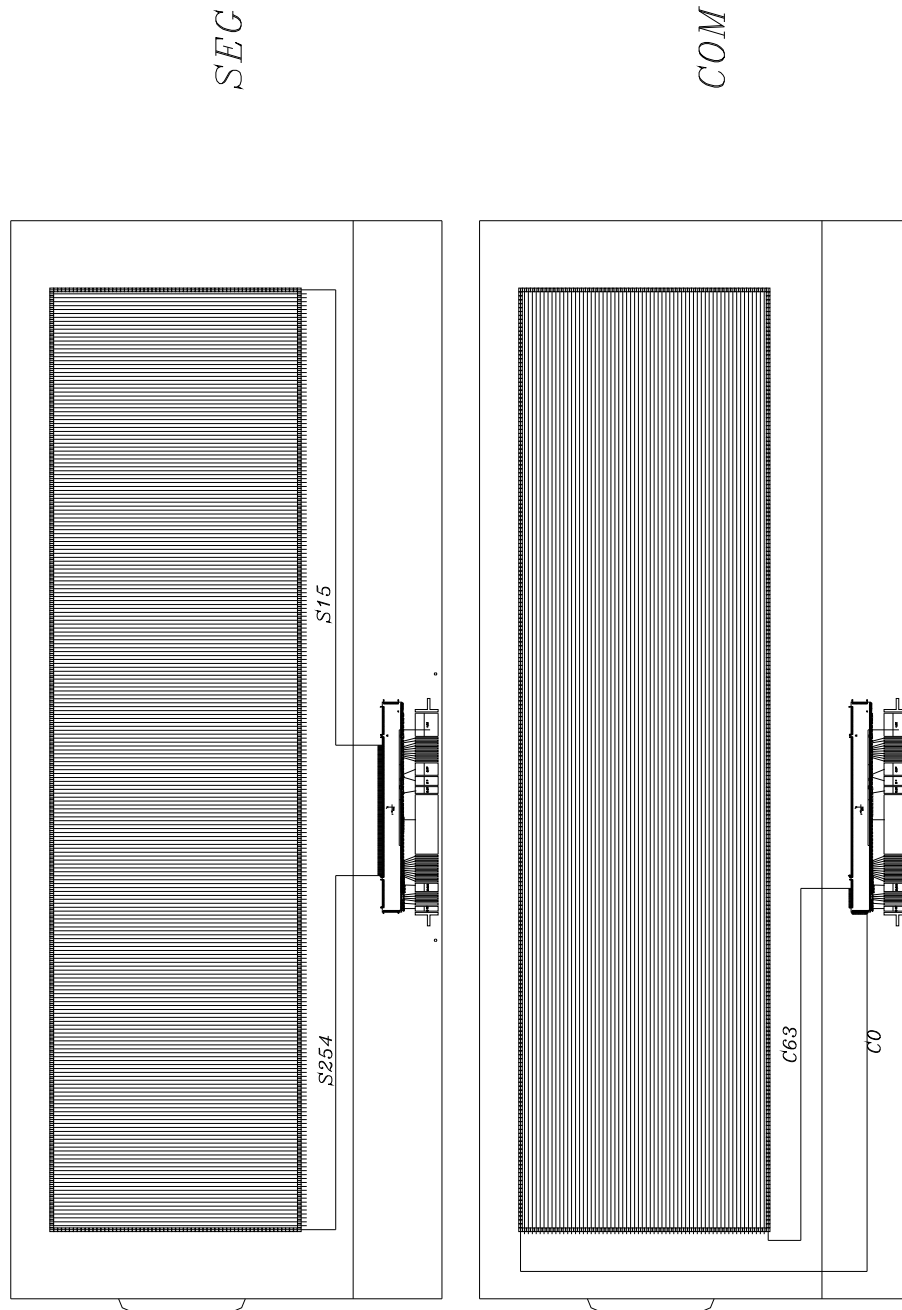
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2.3 LCD WIRING DIAGRAM

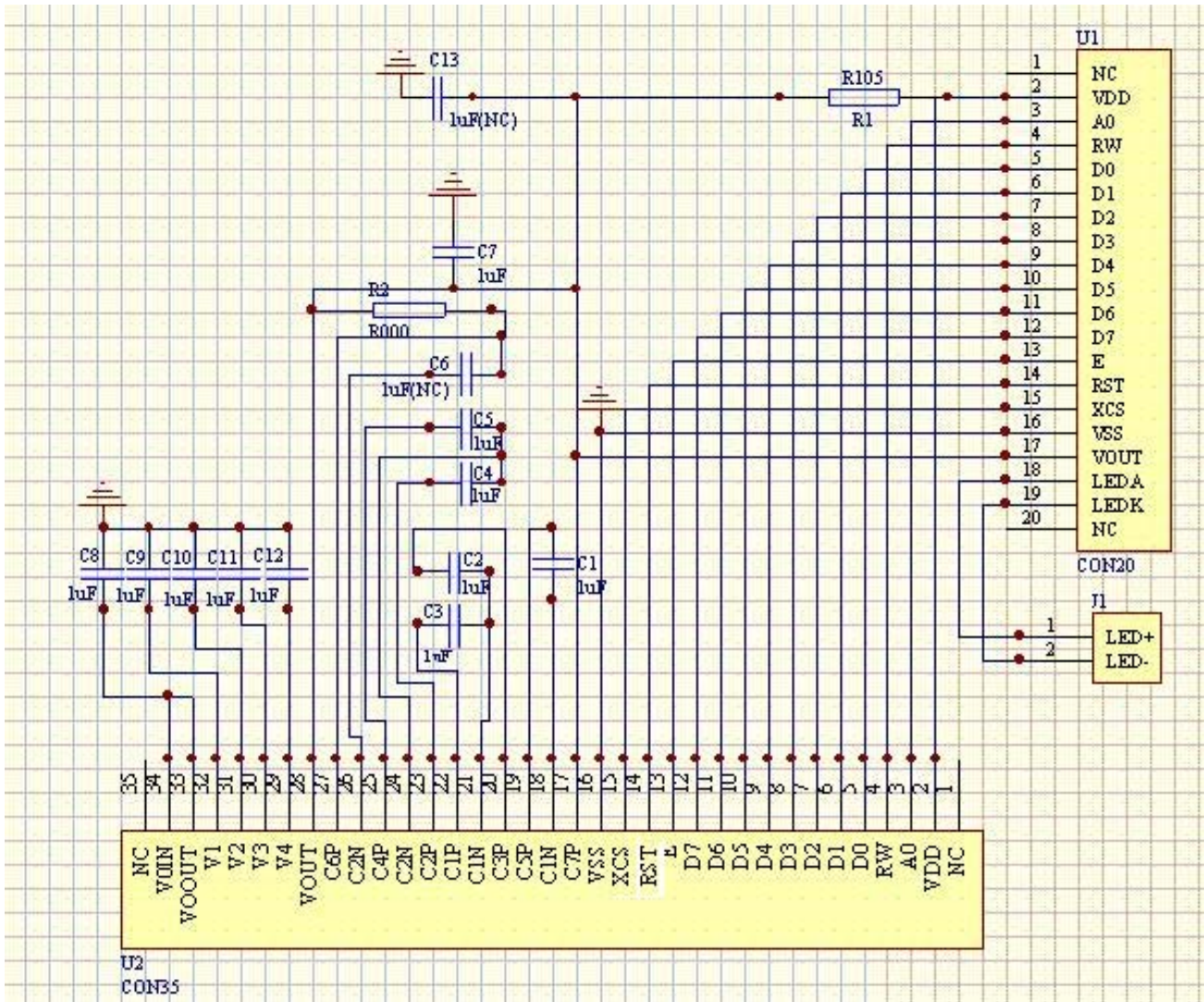
Scan direction:

1.COM: COM0~COM63, COMMON SCAN (BBH)

2. SEG: SEG254~SEG15,, DATA SCAN DIRECTION(BCH)



2.4 PCB WIRING DIAGRAM

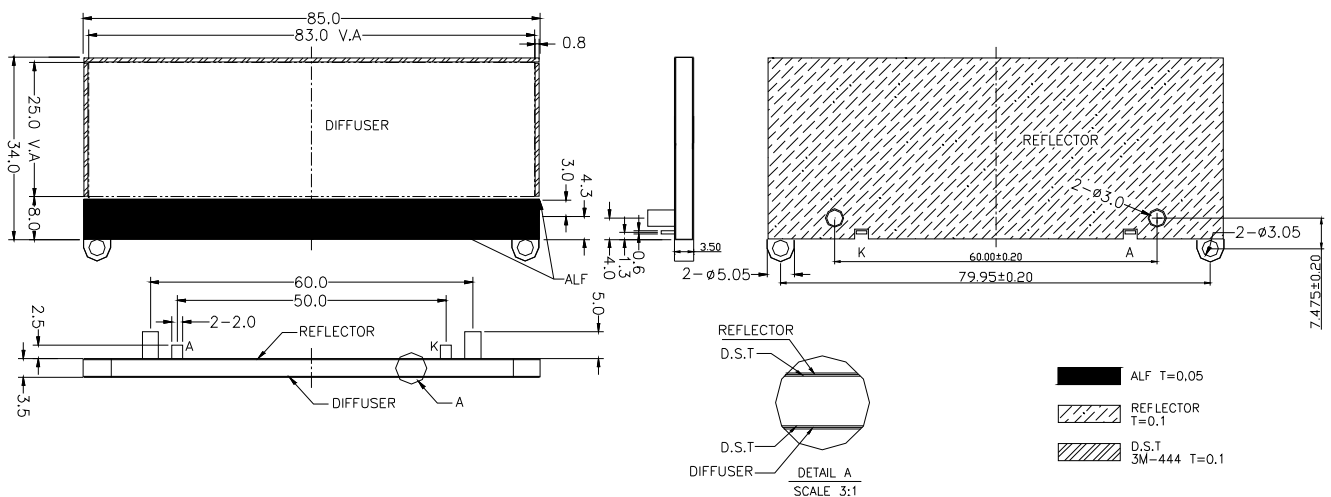


3 PIN CONNECTIONS

Pin No.	Symbol	Function
1	NC	No connection
2	VDD	Chip's power supply pin
3	A0	Register select input pin
4	RW	Read/ write control input pin
5 ~ 12	D0 ~ D7	The 8-bit bi-directional data bus to be connected to the MCU in parallel interface mode
13	E	Read/ write control input pin
14	RST	Reset input pin
15	XCS	Chip select input pin
16	VSS	Ground
17	VOUT	DC-DC voltage converter (No Connection)
18	LEDA	LED backlight power
19	LEDK	LED backlight power
20	NC	No connection

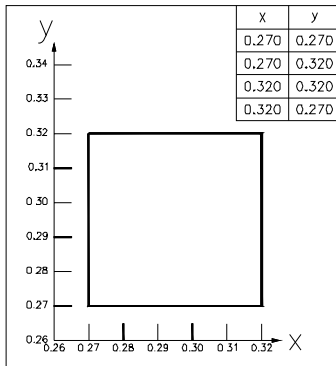
4 THE LED BACKLIGHT

4.1 MECHANICAL OUTLINE



4.2 ELECTRO-OPTICAL CHARACTERISTICS FOR BACKLIGHT

Item	Color(s)	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward Voltage	All	V _f	3.2	3.4	3.6	V	If = 90 mA (Note 1, 2 & 3)
Color Coordinate	Arctic White*	x	0.270	-	0.320	-	
		y	0.270	-	0.320	-	
Uniformity	All	Avg	70	-	-	%	
Luminance	Midnight Blue	L _v	60	-	-	cd/m ²	
	Warm Amber	L _v	120	-	-		
	Jade Green	L _v	60	-	-		
	Tangerine Orange	L _v	120	-	-		
	Sunburst Yellow	L _v	400	-	-		
	Arctic White*	L _v	400	-	-		
Dominant Wave length	Midnight Blue	λ _D	465	468	470	nm	
	Warm Amber	λ _D	584	589	594		
	Jade Green	λ _D	569	572	575		
	Tangerine Orange	λ _D	600	605	610		
Reverse Current (per LED)	Arctic White*, Sunburst Yellow & Midnight Blue	I _r	-	15	20	μA	V _r = 0.8 V
	Tangerine Orange, Warm Amber & Jade Green	I _r	-	-	15	μA	V _r = 3.0 V



(*Coordinates for Arctic White Backlight)

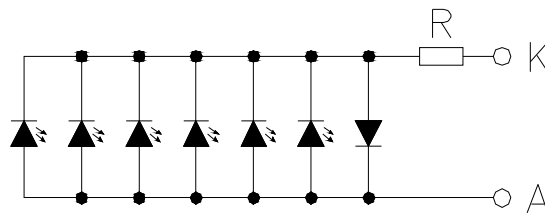
Note 1: LED lifetime for Arctic White and Midnight Blue colors is estimated to be 20000 hrs at 15mA / LED (25°C).

Note 2: LED lifetime for all other available colors is estimated to be 15000 hrs at 15mA (25°C).

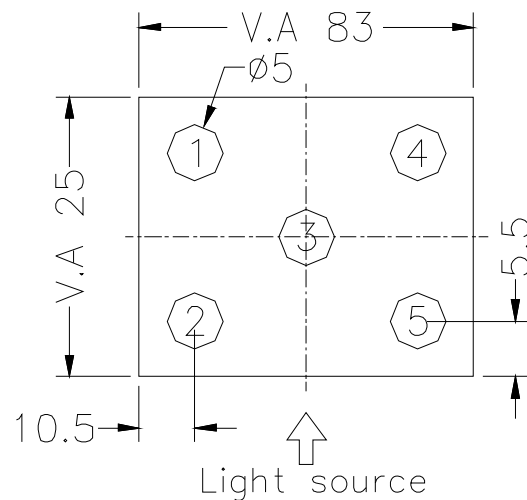
Note 3: Please refer to the PWM White Paper at http://www.densitron.com/displays/lcd_support.aspx for background on extending LED Backlight Lifetimes.

4.3 CIRCUIT DIAGRAM

LED 1 x 6 = 6 SMD, Colors: All

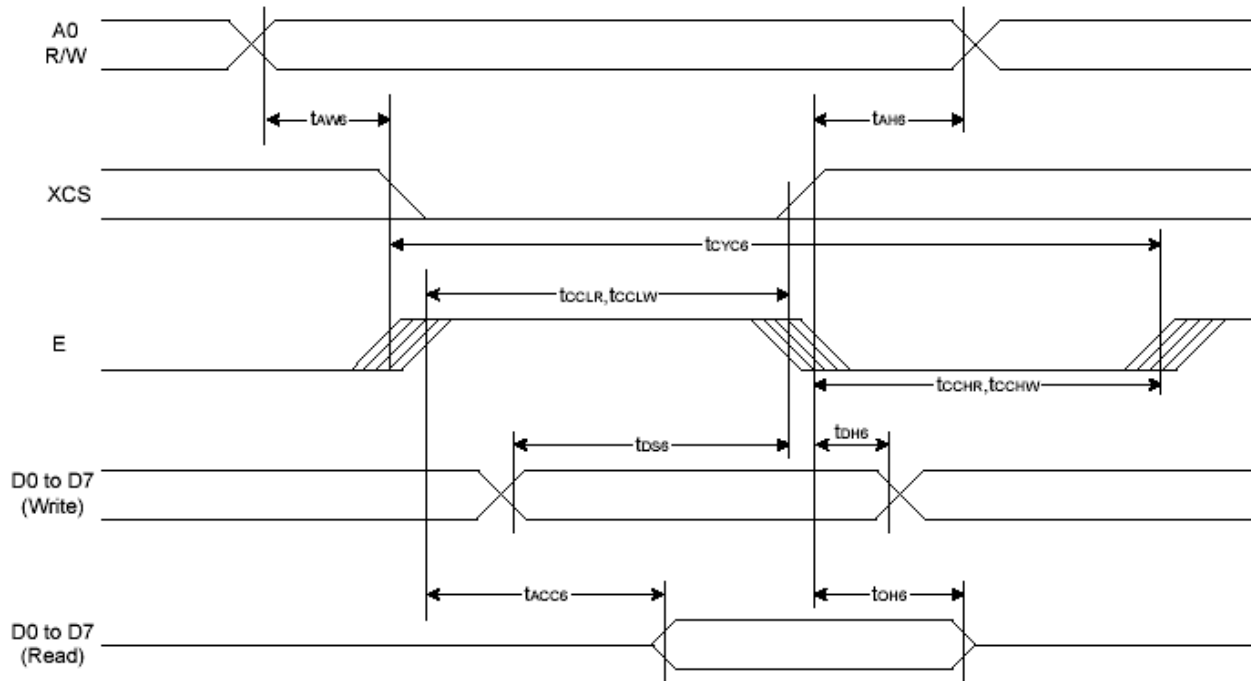


4.4 TEST POINT



5 AC CHARACTERISTICS

System Bus Read/Write Characteristics 1 (For the 6800 Series MPU)



(VDD = 3.3 V , Ta = -30 to 85°C, Die)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	tAH6	-	20	-	ns
Address setup time		tAW6	-	20	-	
System cycle time		tCYC6	-	200	-	
Enable L pulse width (WRITE)	WR	tEWLW	-	100	-	
Enable H pulse width (WRITE)		tEWHW	-	100	-	
Enable L pulse width (READ)	RD	tEWLR	-	100	-	
Enable H pulse width (READ)		tEWHR	-	100	-	
WRITE Data setup time	D0 to D7	tDS6	-	150	-	
WRITE Data hold time		tDH6	-	20	-	
READ access time		tACC6	CL = 100 pF	-	40	
READ Output disable time		tOH6	CL = 100 pF	-	30	

6 ELECTRO-OPTICAL CHARACTERISTICS FOR LCD MODULE

(Temp. = 23 ± 3 °C)

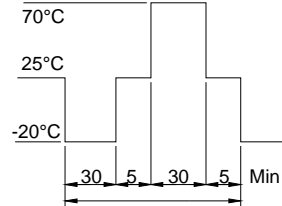
Item		Symbol	Condition	Min	Typ.	Max	Unit	
Supply Voltage (Logic)		$V_{DD} - V_{SS}$	-	2.4	3.0	3.3	V	
Power Requirements		I_{dd}	-	0.63	-	1.59	mA	
LCD Operating Voltage		$V_{DD} - V_O$	Normal Temp.	-10°C	-	12.3	-	V
				25°C	-	12.0	-	
				50°C	-	11.8	-	
			Wide Temp.	-20°C	-	12.4	-	
				25°C	-	12.0	-	
				80°C	-	11.6	-	
Response Time		T_{on}	-	-	64	-	ms	
		T_{off}	-	-	276	-	ms	
Contrast		CR	-	2	-	10.9	-	
Viewing Angle	12H	$\Theta 1$	CR ≥ 2.0	-	58	-	Deg.	
	6H	$\Theta 2$		-	56	-		
	3H	$\Theta 3$		-	53	-		
	9H	$\Theta 4$		-	53	-		
LCD Threshold Voltage		V_{th}	25°C	-	10.1	-	V	

POWER REQUIREMENTS

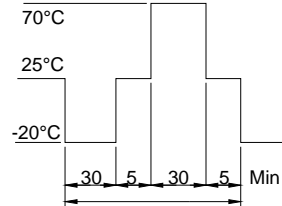
Item	Symbol	Min.	Typ.	Max.	Unit
Module	I_{dd}	0.63	-	1.59	mA
LED	PD	-	306	-	mW

7 RELIABILITY TEST

7.1 NORMAL TEMP.

No.	Items	Test Condition	Equipment	Test Result
1	High Temp. Storage	Temp.: $70 \pm 2^\circ\text{C}$, Time: 96h Restore: 24h	Tenny	Passed
2	Low Temp. Storage	Temp.: $-20 \pm 3^\circ\text{C}$, Time: 96h Restore: 24h	Tenny	Passed
3	High Temp. Operating	Temp.: $50 \pm 2^\circ\text{C}$, Time: 24h Restore: 24h	Tenny	Passed
4	Low Temp. Operating	Temp.: $-10 \pm 2^\circ\text{C}$, Time: 24h Restore: 24h	Tenny	Passed
5	High Temp. / High Humidity Storage	Temp.: $40 \pm 2^\circ\text{C}$, Hum: 95 % RH Time: 96h, Restore: 24h	Tenny	Passed
6	Thermal Shock	Temp.: ($^\circ\text{C}$)  5 Cycles, Restore: 24h	Tenny	Passed

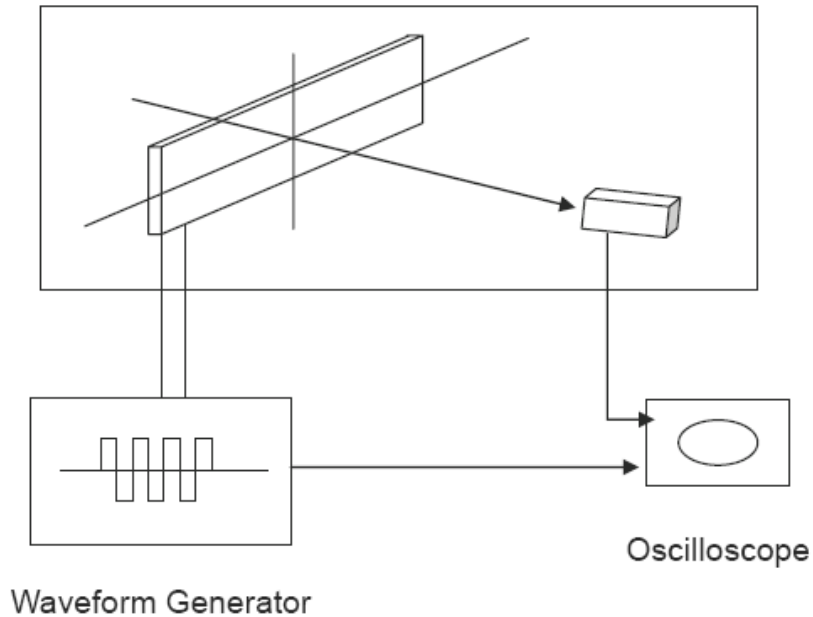
7.2 WIDE TEMP.

No.	Items	Test Condition	Equipment	Test Result
1	High Temp. Storage	Temp.: $80 \pm 2^\circ\text{C}$, Time: 96h Restore: 24h	Tenny	Passed
2	Low Temp. Storage	Temp.: $-30 \pm 3^\circ\text{C}$, Time: 96h Restore: 24h	Tenny	Passed
3	High Temp. Operating	Temp.: $70 \pm 2^\circ\text{C}$, Time: 24h Restore: 24h	Tenny	Passed
4	Low Temp. Operating	Temp.: $-20 \pm 2^\circ\text{C}$, Time: 24h Restore: 24h	Tenny	Passed
5	High Temp. / High Humidity Storage	Temp.: $40 \pm 2^\circ\text{C}$, Hum: 95 % RH Time: 96h, Restore: 24h	Tenny	Passed
6	Thermal Shock	Temp.: ($^\circ\text{C}$)  5 Cycles, Restore: 24h	Tenny	Passed

8 THE LCD MEASURING METHOD AND EQUIPMENT

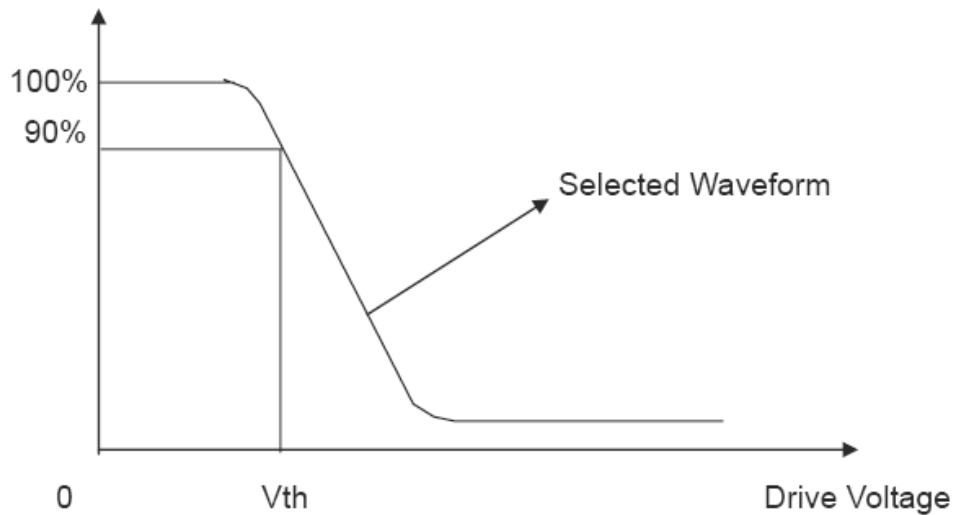
1. Threshold Voltage and Response Time Measuring

(1) Equipment

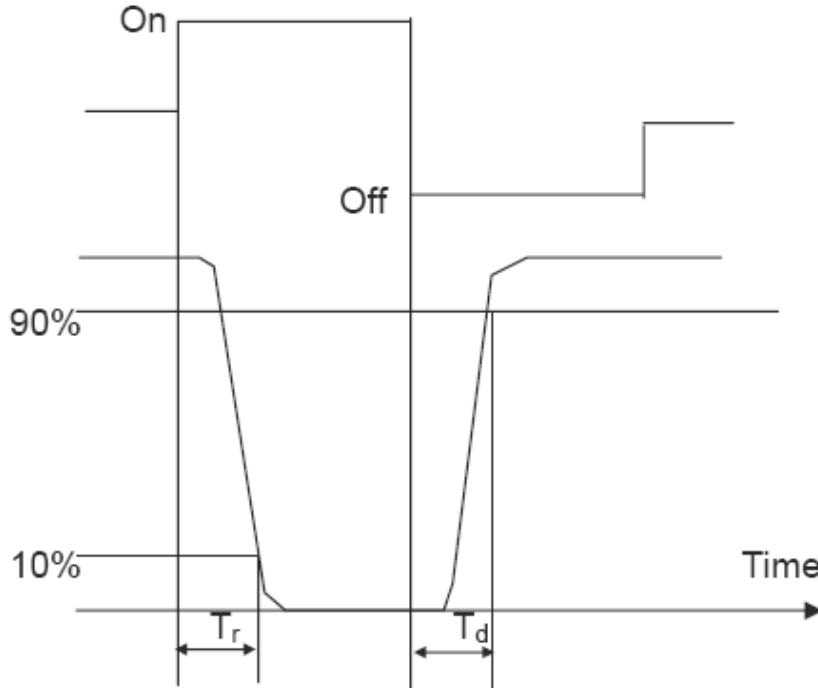


(2) Definition

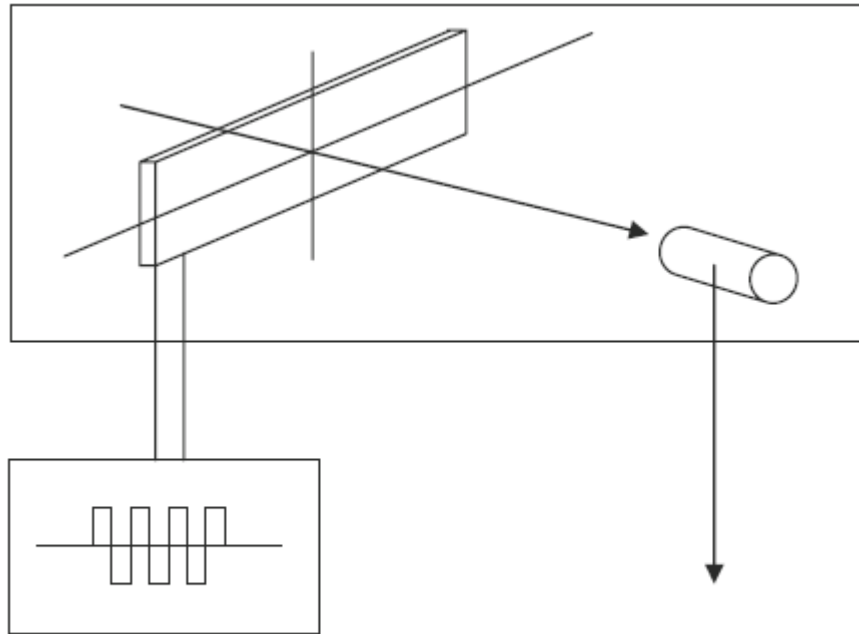
- A. Threshold Voltage (V_{th})
Brightness



B. Response Time



2. Contrast Measuring
(1) Equipment

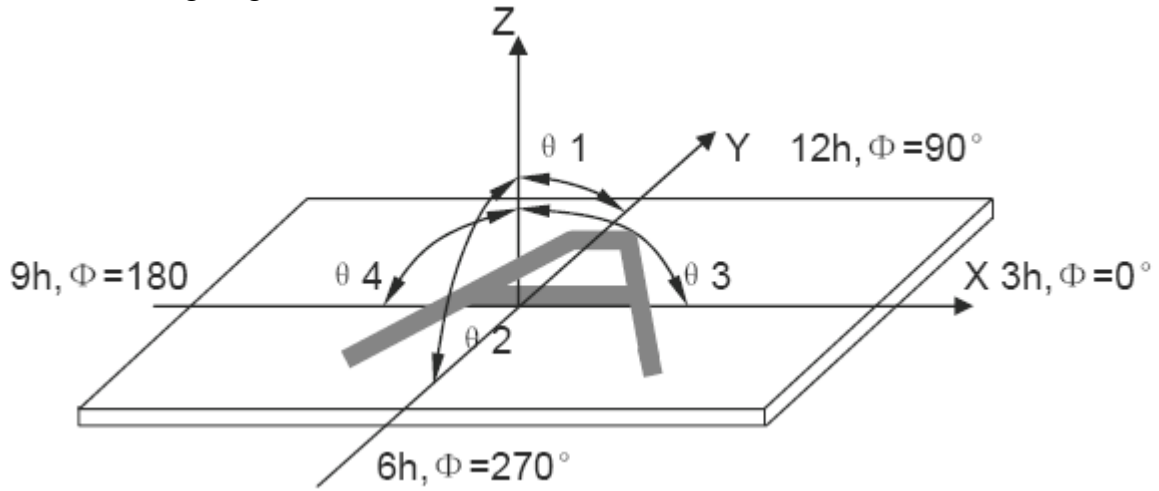


Spectrophotometer

Waveform Generator

(2) Definition:

A. Viewing Angle:



B. Contrast Ratio (Positive)

$$CR = \frac{\text{Brightness of non-selected wave-form}}{\text{Brightness of selected wave-form}}$$

9 SAMPLE CODE

```

#include <reg52.h>
#include <intrins.h>
#include "delay.h"
#include "isp.h"

sbit  rs    =   P2^0;
sbit  rw    =   P2^1;
sbit  e     =   P2^2;
sbit  res   =   P2^3;
sbit  cs    =   P2^4;

sfr   db    =   0x90;

#include "6800.h"
#include "image.h"
#include "lcd_test.h"

void main()
{
    unsigned char i,j;

    delay_us(0);
    delay_ms(0);
    delay_ss(0);
    isp_init();

    while(1)
    {
        res=0;
        delay_ss(1);
        res=1;

        cs=0;

        while(1)
        {
            write_com(0x30); // ext=0
            write_com(0x94); // sleep out
            write_com(0xd1); // osc on
            write_com(0x20); // power control set

```

```

write_dat(0x08); // booster must be on first
delay_ms(2);
write_com(0x20); // power control set
write_dat(0x0b); // booster,regulator follower on
write_com(0x81); // electronic control
write_dat(18); // set vop low: 00~3f vlcd=12.0v
write_dat(0x03); // hige:00~07 0x28, 0x03=13.0
write_com(0xca); // display control
write_dat(0x04); //

write_dat(15); // 1f duty=1/64
write_dat(0x00); //

write_com(0xa6); // normal display

write_com(0xbb); // com scan direction
write_dat(0x00); // 0~79,159~80 64COM:0~63

write_com(0xbc); // data scan direction
write_dat(0x02); //
write_dat(0x01); //
write_dat(0x02); //

write_com(0x75); // line address set
write_dat(0); // start line =0
write_dat(63); // end line =127

write_com(0x15); // column address set
write_dat(0); // start column =0
write_dat(79); // end column =79

write_com(0x31); // ext=1
write_com(0x20); // set gray level

for (i=0;i<16;i++)
{
    write_dat(1);
}

write_com(0x21);

for(i=0;i<16;i++)
{
    write_dat(1);
}

```

```

write_com(0x32); // analog circuit set
write_dat(0x01); // osc frequency=000 (default)
write_dat(0x00); // booster efficiency=01 (default)
write_dat(0x05); // bias=1/9
write_com(0x34); // dithering off
ReadEEPROM(); // read eeprom flow
write_com(0xaf); // display on

```

```

write_com(0x5c); // write data
lcd_full();
delay_ms(200);
lcd_line1();
delay_ms(200);
lcd_line2();
delay_ms(200);
lcd_line3();
delay_ms(200);
lcd_line4();
delay_ms(200);

```

```

lcd_erec1();
delay_ms(200);
lcd_erec2();
delay_ms(200);
lcd_erec3();
delay_ms(200);
lcd_erec4();
delay_ms(200);

```

```

lcd_image(image_yes1);
delay_ss(1);

```

```

    }
}
}

```

10 STANDARD SPECIFICATIONS FOR PRODUCT QUALITY

1. Manner of Test:

1.1. The test must be under 40w fluorescent light, and the distance of view must be at 30 cm.

1.2. The test direction is based on around 15°- 45° of vertical line.

2. Definition of Defects

2.1 Major Defects

A: Non-Display

B: Segment Missing

C: Over Current

D: Segment Short

E: Sealant Disharden

F: Wrong Polarizer Direction

2.2 Minor Defects: The Others.

3. Major defects should be in AQL 0.25, and the minor in AQL 1.00.

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4. Inspection Item and Standards

Item	The standard of quality inspection	Checking Manner	Quality Ratio
1. Frame	Smooth and even surface, no crack, no scratch, no rust, and not be wrenched out of shape. The range between convex and concave is: $d \leq 0.35$ mm and the frame must be connected to the ground.	Check With Eyes And Using Vernier Caliper, Multimeter	100%
2. LCD	1. The major defects would be rejected. 2. No scratch and no dusty on the LCD glass surface. 3. $D \leq 0.15$ mm $n \leq 2$ diameter of bubble: $d \leq 0.5$ $n \leq 2$ damaged size of polarizer: $d \leq 0.15$ mm, $n \leq 2$. 4. No scratch and dusty between the LCD and led.	Check It When Displaying	100%
3. The Relative Position of LCD and Frame	1. The LCD should not be twisted. 2. The LCD graphic should be in the middle position of the frame.	Check With Eyes	100%
4. The Relative Position of PCB Panel and Frame	1. The frame installing direction must be correct. 2. The twisted angle of the pin is from 45° to 60° . 3. The pin is vertical to PCB panel and it should be in the middle position of the installing holes.	Check With Eyes	100%
5. LED	1. The led would be white. 2. The led would be uniform.	Check With Eyes	100%
6. Function Test	1. The major defects must be rejected. 2. Test flow chart (see attached chart) 3. Background changes evenly and no disorderly displaying phenomenon. 4. Display no shortage.	Check It When Displaying	100%

Note: D ~ Diameter N ~ Quantity Unit: mm

11 PART NUMBER DESCRIPTION FOR AVAILABLE OPTIONS

LMR5429①②240G64③④⑤

①

Polarizer Type

E = Transmissive Negative Mode

②

Backlight Color

A = Warm Amber
G = Jade Green
B = Midnight Blue
W = Arctic White
O = Tangerine Orange
Y = Sunburst Yellow

③

Fluid Type and Temperature Range

S = Standard temp. range
W = Wide temp. range

④

Fluid Type and Temperature Compensation

N = STN
F = FSTN

⑤

Background Color

B = Blue mode STN (Ocean Blue)

12 HANDLING PRECAUTIONS

Safety

If the LCD panel breaks, be careful not to get the liquid crystal fluid in your mouth or in your eyes. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

Mounting and Design

Place a transparent plate (e.g. acrylic, polycarbonate or glass) on the display surface to protect the display from external pressure. Leave a small gap between the transparent plate and the display surface. When assembling with a zebra connector, clean the surface of the pads with alcohol and keep the surrounding air very clean. Design the system so that no input signal is given unless the power supply voltage is applied.

Caution during LCD cleaning

Lightly wipe the display surface with a soft cloth soaked with Isopropyl alcohol, Ethyl alcohol or Trichlorotrifluoroethane. Do not wipe the display surface with dry or hard materials that will damage the polariser surface. Do not use aromatic solvents (toluene and xylene), or ketonic solvents (ketone and acetone).

Caution against static charge

As the display uses C-MOS LSI drivers, connect any unused input terminal to VDD or VSS. Do not input any signals before power is turned on. Also, ground your body, work/assembly table and assembly equipment to protect against static electricity.

Packaging

Displays use LCD elements, and must be treated as such. Avoid strong shock and drop from a height. To prevent displays from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity.

Caution during operation

It is indispensable to drive the display within the specified voltage limit since excessive voltage shortens its life. Direct current causes an electrochemical reaction with remarkable deterioration of the display quality. Give careful consideration to prevent direct current during ON/OFF timing and during operation. Response time is extremely delayed at temperatures lower than the operating temperature range while, at high temperatures, displays become dark. However, this phenomenon is reversible and does not mean a malfunction or a display that has been permanently damaged. If the display area is pushed on hard during operation, some graphics will be abnormally displayed but returns to a normal condition after turning off the display once. Even a small amount of condensation on the contact pads (terminals) can cause an electro-chemical reaction which causes missing rows and columns. Give careful attention to avoid condensation.

Storage

Store the display in a dark place where the temperature is 25°C ± 10°C and the humidity below 50%RH. Store the display in a clean environment, free from dust, organic solvents and corrosive gases. Do not crash, shake or jolt the display (including accessories).

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