

LIQUID CRYSTAL DISPLAY MODULE

Product Specification

PRODUCT NUMBER	LMR5436
-----------------------	----------------

INTERNAL APPROVALS		
Product Manager	Engineering	Document Control
Date:	Date:	Date:

Product No.	LMR5436	REV. B
-------------	---------	--------

Page	1 / 27
------	--------

TABLE OF CONTENTS

1	PRODUCT SPECIFICATION	4
1.1	AVAILABLE FLUID AND POLARIZER TYPE	4
1.2	AVAILABLE BACKLIGHT TYPE AND COLOR.....	4
1.3	GENERAL SPECIFICATIONS.....	4
2	MECHANICAL DRAWINGS AND SCHEMATICS.....	5
2.1	FOR ALL COLORS	5
2.2	LCD WIRING DIAGRAM	6
3	PIN CONNECTIONS	7
4	RECOMMENDED CIRCUIT DIAGRAM	8
5	THE LED BACKLIGHT	9
5.1	MECHANICAL OUTLINE	9
5.2	ELECTRO-OPTICAL CHARACTERISTICS FOR BACKLIGHT	10
5.3	TEST POINT.....	11
6	AC CHARACTERISTICS.....	12
7	ELECTRO-OPTICAL CHARACTERISTICS FOR LCD MODULE.....	14
8	RELIABILITY TEST.....	16
8.1	NORMAL TEMP.	16
8.2	WIDE TEMP.	16
9	THE LCD MEASURING METHOD AND EQUIPMENT	17
10	SAMPLE CODE.....	20
11	PART NUMBER DESCRIPTION FOR AVAILABLE OPTIONS.....	22
12	QUALITY ASSURANCE SPECIFICATION.....	23
12.1	CONFORMITY.....	23
12.2	DELIVERY ASSURANCE	23
13	HANDLING PRECAUTIONS.....	27

REVISION RECORD

Rev.	Date	Page	Par.	Comment	ECN no.
A	05/11/12	--	--	New DCA Specification	E4671
B	01/04/12	8	--	Added recommended circuit diagram.	E4745
C	2/12/13	7	--	Pin definition updated.	E4764

1 PRODUCT SPECIFICATION

1.1 AVAILABLE FLUID AND POLARIZER TYPE

LCD TYPE		STN		FSTN		ASTN (Automotive Grade)		ESTN (For Amber and Red Backlight only)	
		Normal Temp.	Wide Temp.	Normal Temp.	Wide Temp.	Normal Temp.	Wide Temp.	Normal Temp.	Wide Temp.
Transmissive	Negative		✓		✓		✓		✓
Transflective	Positive				✓				

1.2 AVAILABLE BACKLIGHT TYPE AND COLOR

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

1.3 GENERAL SPECIFICATIONS

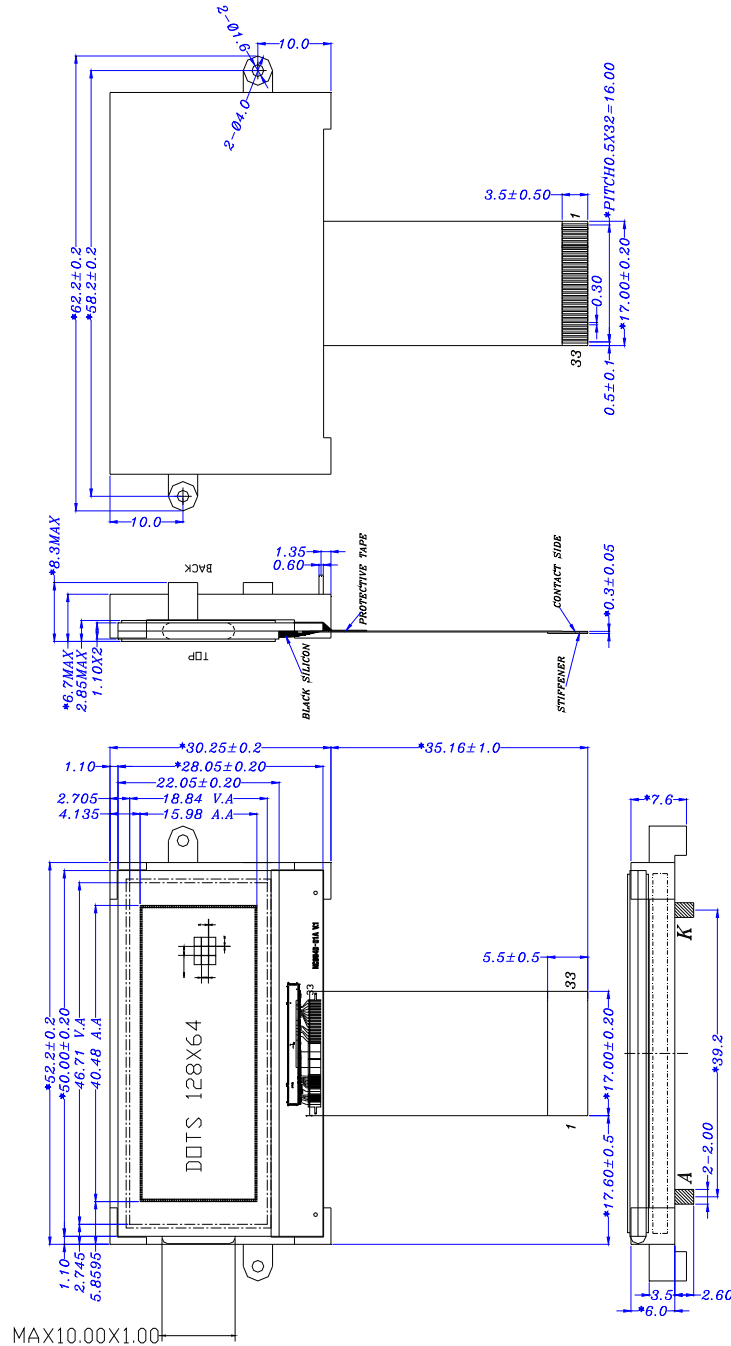
ITEM	CONTENTS	UNIT
Outline Dimension	52.2 ± 0.20 (W) x 30.25 ± 0.20 (H) x 8.3 ± 0.50 (D)	mm
Display Format	128 x 64	Dots
Viewing Area	46.71 (W) x 18.84 (H)	mm
Dot Size	0.3063 x 0.2398	mm
View Angle	12:00	O'clock
Duty Ratio	1/64	Duty
Bias	1/9	Bias
Module Operating Voltage	3.0	V
LCD Operating Voltage	12.5	V
LCD Driver	ST7529	-
Operating/Storage temperature	-20~+70 / -30~80	°C
RoHS Compliant	Yes	-

Product No.	LMR5436	REV. C
-------------	---------	--------

Page	4 / 27
------	--------

2 MECHANICAL DRAWINGS AND SCHEMATICS

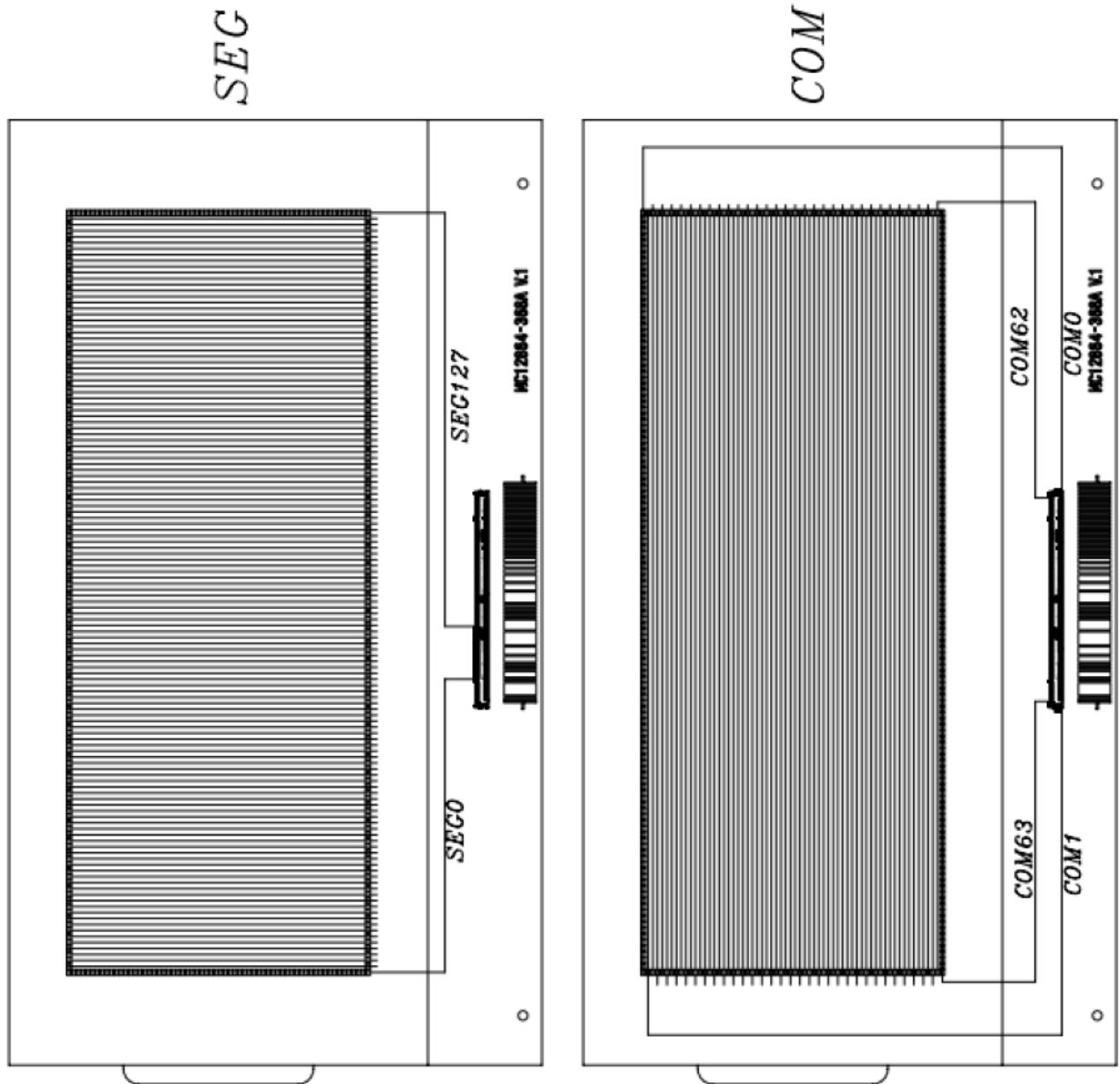
2.1 FOR ALL COLORS



Recommended mating connector for LCM:
Molex 0547043337
Molex 0547323362

Unless Otherwise Specified	Unit	Projection
	mm	$\oplus \ominus$
UNLESS OTHERWISE SPECIFIED TOLERANCE ON DIMENSIONS ARE:		
INTEGERS / FRACTIONS	$\pm / - 1.5$ mm	
DECIMALS (.X)	$\pm / - 0.25$ mm	
DECIMALS (.XX)	$\pm / - 0.12$ mm	
DECIMALS (.XXX)	$\pm / - 0.12$ mm	

2.2 LCD WIRING DIAGRAM

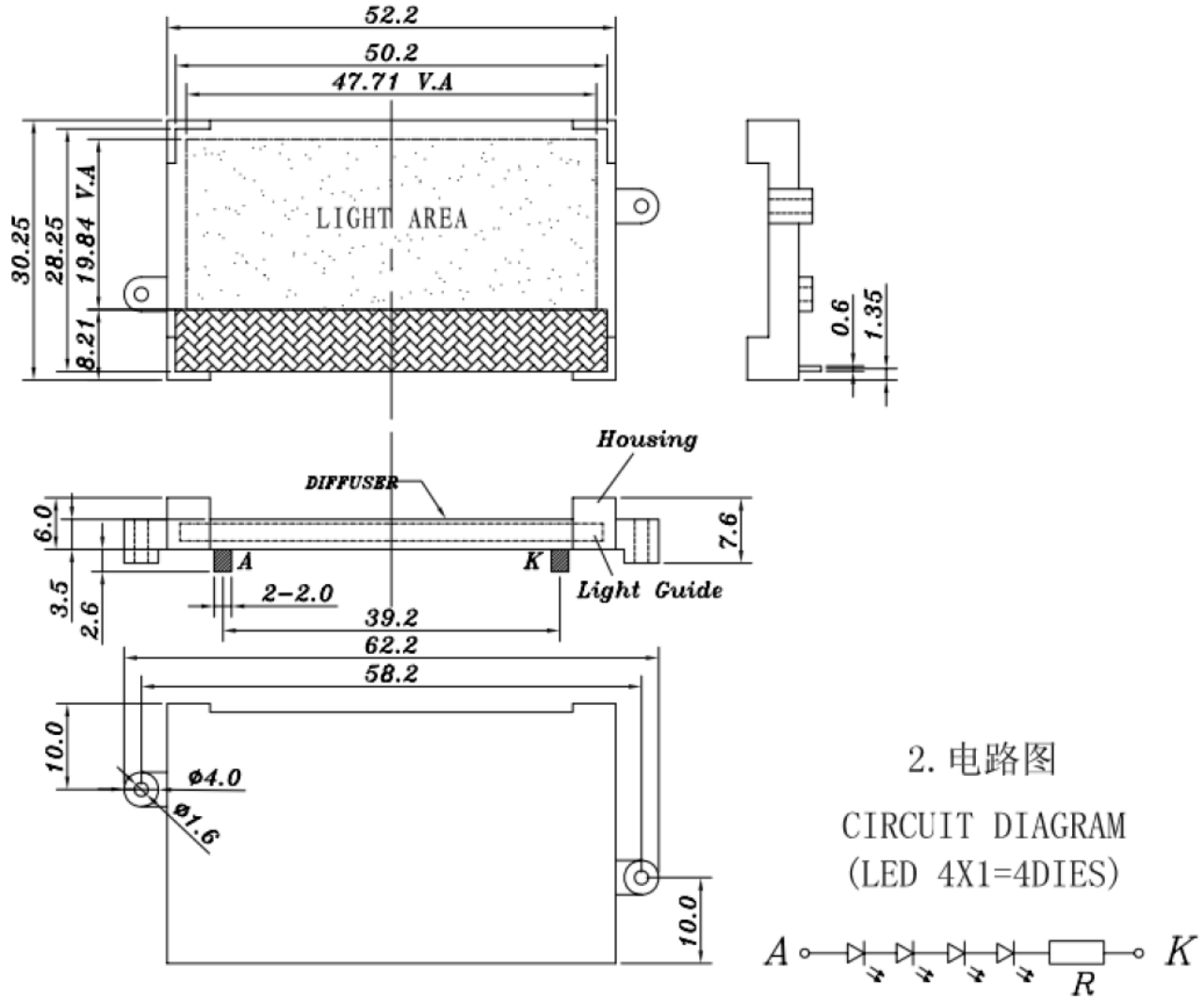


3 PIN CONNECTIONS

Pin No.	Symbol	Function
1	V0IN	LCD driver supply voltages
2	V0OUT	LCD driver supply voltages
3~6	V1-V4	LCD driver supply voltages
7	VLCD	If the internal voltage generator is used, the Vlcdin & Vlcdout must be connected together.
8	C6P	Connection Pin for Voltage Converter
9	C4P	Connection Pin for Voltage Converter
10	C2N	Connection Pin for Voltage Converter
11	C2P	Connection Pin for Voltage Converter
12	C1P	Connection Pin for Voltage Converter
13	C1N	Connection Pin for Voltage Converter
14	C3P	Connection Pin for Voltage Converter
15	C5P	Connection Pin for Voltage Converter
16	C7P	Connection Pin for Voltage Converter
17	VDD	Power Supply
18	VSS	Ground
19	XCS	Chip select input pins
20	IF3	Data input select input: Set Low for 8080 series 8-bit parallel Set High for 6800 series 8-bit parallel
21	IF1	Data input select input: Set High for 8080 series 8-bit parallel Set Low for 6800 series 8-bit parallel
22	RST	Reset input pin
23	E/RD	Read/write execution control pin
24~31	D7-D0	Data bus
32	RW/WR	Read/write execution control pin
33	A0	Register select input pin

5 THE LED BACKLIGHT

5.1 MECHANICAL OUTLINE



5.2 ELECTRO-OPTICAL CHARACTERISTICS FOR BACKLIGHT

Item	Color(s)	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward Voltage	All	V _f	-	14	-	V	If = 20 mA, each chip (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	90	140	220	cd/m ²	
	Fireburst Red	L _v	TBD	-	-		
	Warm Amber	L _v	90	140	-		
	Jade Green	L _v	60	-	-		
	Tangerine Orange	L _v	120	-	-		
	Sunburst Yellow	L _v	TBD	-	-		
Dominant Wave length	Midnight Blue	λ _D	465	468	470	nm	
	Warm Amber	λ _D	585	587	594		
	Jade Green	λ _D	569	572	575		
	Tangerine Orange	λ _D	600	605	610		
	Fireburst Red	λ _D	620	-	630		
	Sunburst Yellow	λ _D	520	-	530		
Reverse Current (per LED)	Arctic White, Midnight Blue	I _r	-	-	10	μA	V _r = 5.0 V each chip

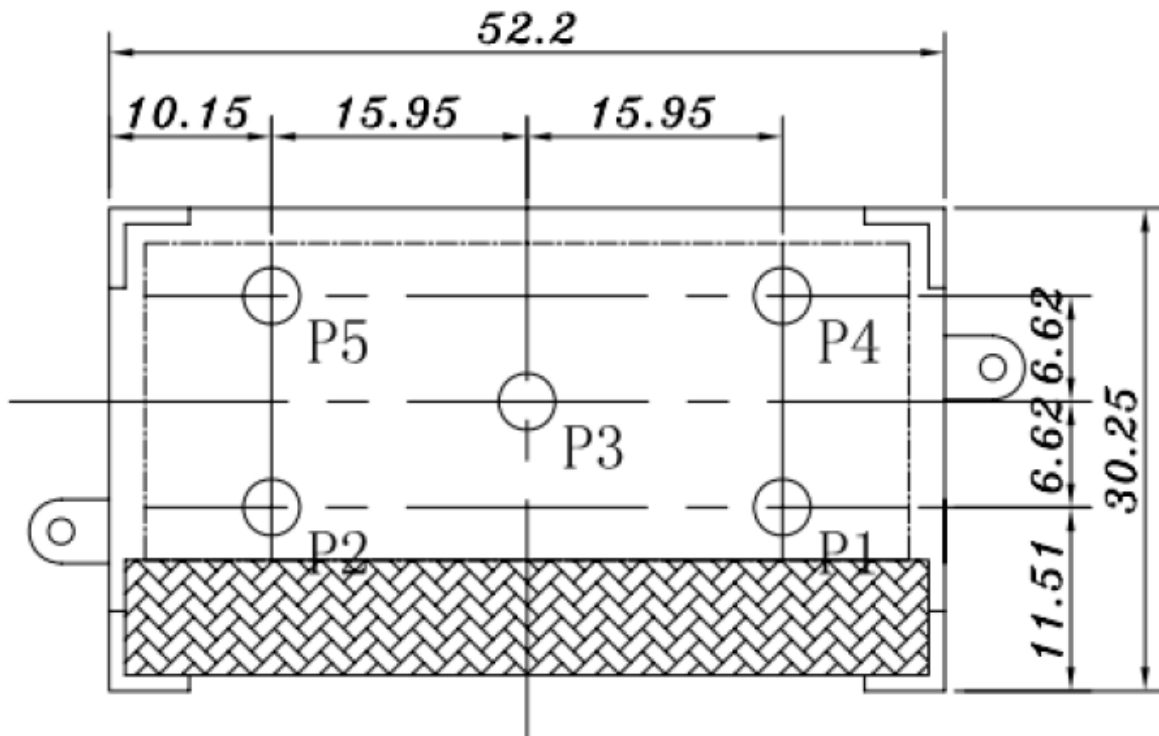
	Tangerine Orange, Warm Amber & Jade Green	Ir	-	-	10	μA	V _r = 5.0 V
--	---	----	---	---	----	----	------------------------

Note 1: LED lifetime for Arctic White and Midnight Blue colour is Estimated to be 20000 hrs at 20mA / LED (25°C).

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

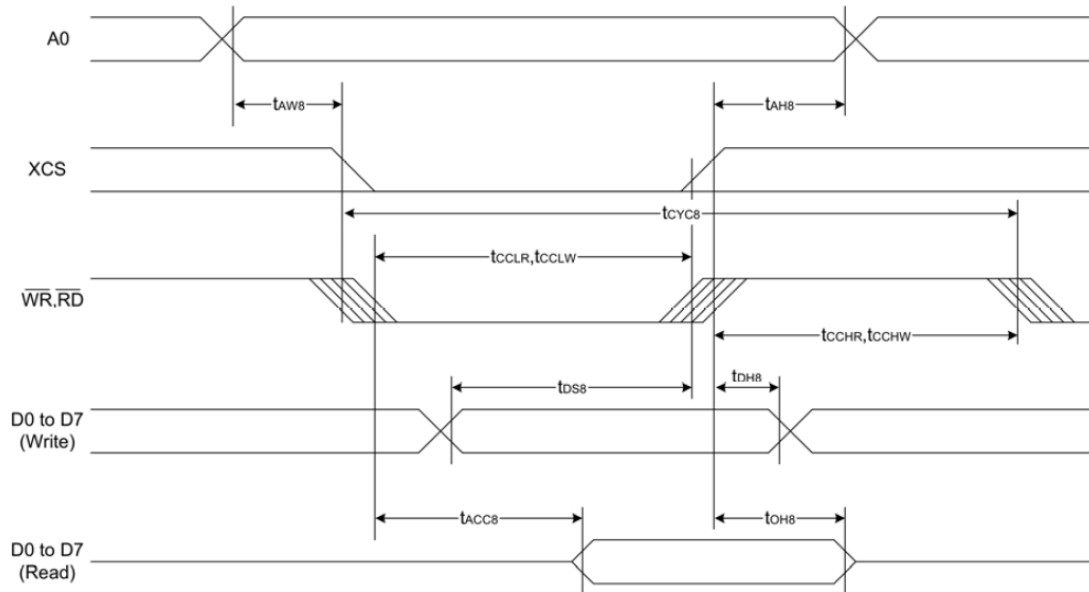
Note 3: Please refer to the PWM White Paper at http://www.densitron.com/displays/lcd_support.aspx for background on extending LED Backlight Lifetimes.

5.3 TEST POINT



6 AC CHARACTERISTICS

System Bus Read/Write Characteristics 1 (For the 8080 Series MPU)



(VDD = 3.3V, Ta = -30 to 85°C, Die)

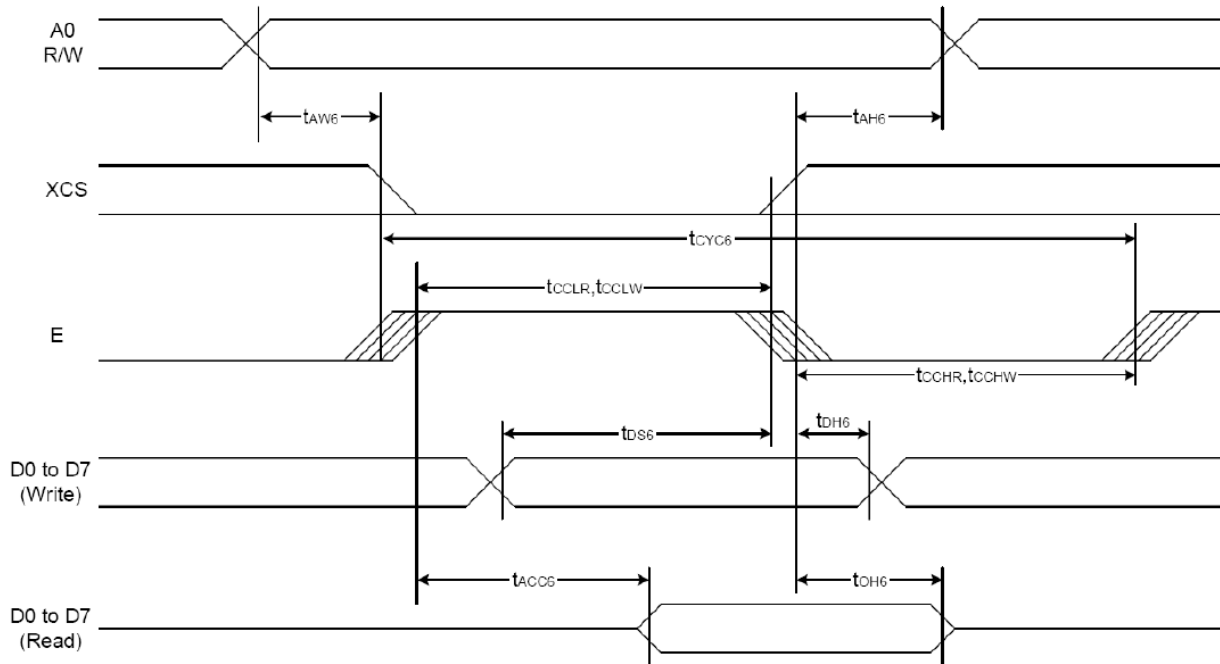
Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	tAH8	-	20	-	ns
Address setup time		tAW8	-	20	-	
System cycle time		tCYC8	-	200	-	
Enable L pulse width (WRITE)	WR	tCCLW	-	100	-	
Enable H pulse width (WRITE)		tCCHW	-	100	-	
Enable L pulse width (READ)	RD	tCCLR	-	100	-	
Enable H pulse width (READ)		tCCHR	-	100	-	
WRITE Data setup time	D0 to D7	tDS8	-	150	-	
WRITE Address hold time		tDH8	-	20	-	
READ access time		tACC8	CL = 100 pF	-	40	
READ Output disable time		tOH8	CL = 100 pF	-	30	

*1 The input signal rise time and fall time (tr, tf) is specified at 15 ns or less. When the system cycle time is extremely fast, (tr + tf) ≤ (tCYC8 - tCCLW - tCCHW) for (tr + tf) ≤ (tCYC8 - tCCLR - tCCHR) are specified.

*2 All timing is specified using 20% and 80% of VDD as the reference.

*3 tCCLW and tCCLR are specified as the overlap between XCS being "L" and WR and RD being at the "L" level.

System Bus Read/Write Characteristics (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	t _{AH6}	-	20	-	ns
Address setup time		t _{AW6}	-	20	-	
System cycle time		t _{CYC6}	-	200	-	
Enable L pulse width (WRITE)	WR	t _{EHLW}	-	100	-	
Enable H pulse width (WRITE)		t _{EHLW}	-	100	-	
Enable L pulse width (READ)	RD	t _{EHLR}	-	100	-	
Enable H pulse width (READ)		t _{EHLR}	-	100	-	
WRITE Data setup time	D0 to D7	t _{DSE}	-	150	-	
WRITE Address hold time		t _{DH6}	-	20	-	
READ access time		t _{ACC6}	CL = 100 pF	-	40	
READ Output disable time		t _{OHW}	CL = 100 pF	-	30	

*1 The input signal rise time and fall time (tr, tf) is specified at 15 ns or less. When the system cycle time is extremely fast, (tr + tf) ≤ (t_{CYC6} - t_{EHLW} - t_{EHLW}) for (tr + tf) ≤ (t_{CYC6} - t_{EHLR} - t_{EHLR}) are specified.

*2 All timing is specified using 20% and 80% of VDD as the reference.

*3 t_{EHLW} and t_{EHLR} are specified as the overlap between XCS being "L" and E.

7 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}	-	-	1.08	-	mA	
LCD Operating Voltage		$V_0 - V_{SS}$	Normal Temp.	-10°C	-	-	V	
				25°C	-	-		
				50°C	-	-		
			Wide Temp.	-20°C	-	12.9		-
				25°C	12.3	12.5		12.7
				80°C	-	12.1		-
Response Time	STN	Ton	-	-	133	230	ms	
		Toff	-	-	138	180		
	FSTN (Positive)	Ton	-	-	177	-		
		Toff	-	-	138	-		
	FSTN (Negative)	Ton	-	-	109	140		
		Toff	-	-	273	320		
	ASTN	Ton	-	-	70	-		
		Toff	-	-	180	-		
	ESTN	Ton	-	-	100	-		
		Toff	-	-	200	-		
Contrast	STN	CR	-	5	8	-	-	
	FSTN (Positive)			4	5	-		
	FSTN (Negative)			60	70	-		
	ASTN			-	100	-		
	ESTN			-	90	-		

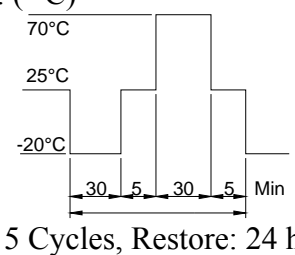
Viewing Angle	STN	12H	θ1	CR ≥ 2	45	55	-	Deg.
		6H	θ2		30	40	-	
		3H	θ3		45	55	-	
		9H	θ4		45	55	-	
	FSTN	12H	θ1		45	50	-	
		6H	θ2		30	35	-	
		3H	θ3		45	55	-	
		9H	θ4		45	55	-	
	ASTN	12H	θ1		-	28	-	
		6H	θ2		-	25	-	
		3H	θ3		-	25	-	
		9H	θ4		-	25	-	
	ESTN	12H	θ1		35	50	-	
		6H	θ2		25	32	-	
		3H	θ3		40	42	-	
		9H	θ4		37	40	-	

POWER REQUIREMENTS

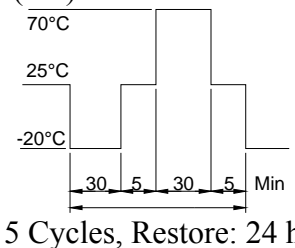
Item	Symbol	Min.	Typ.	Max.	Unit
Module	I _{dd}	-	1.08	-	mA
LED	PD	-	0.21	0.28	W

8 RELIABILITY TEST

8.1 NORMAL TEMP.

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

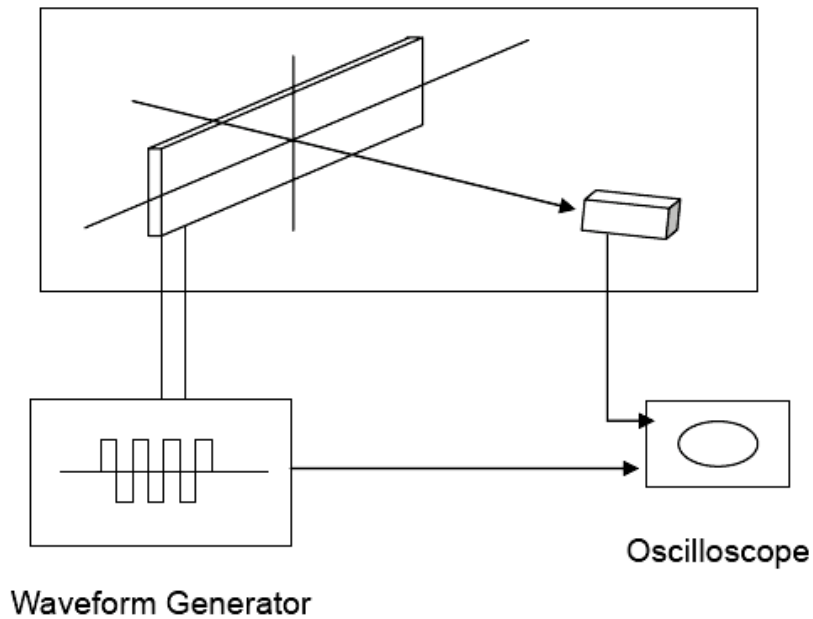
8.2 WIDE TEMP.

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

9 THE LCD MEASURING METHOD AND EQUIPMENT

1. Threshold Voltage and Response Time Measuring.

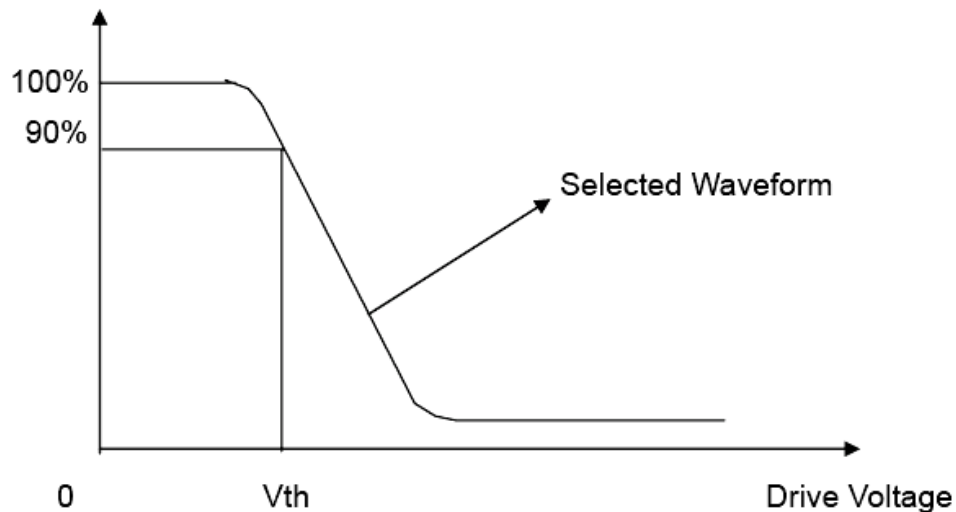
(1) Equipment:



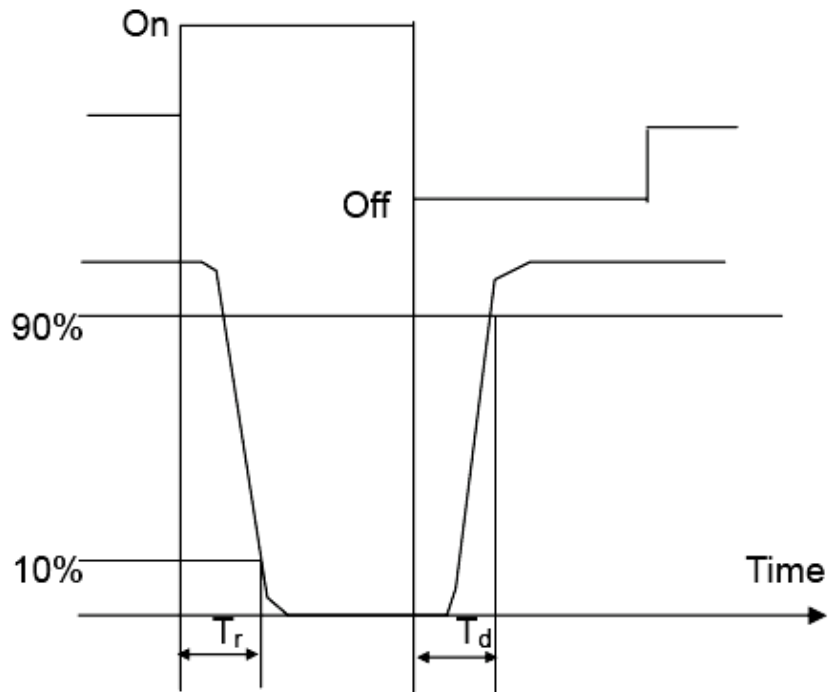
(2) Definition:

A. Threshold Voltage: (V_{th})

Brightness

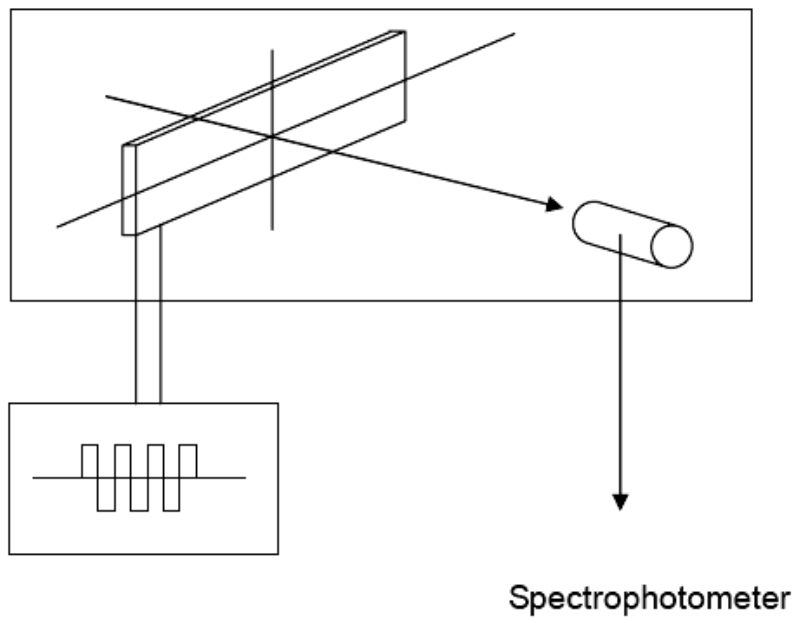


B. Response Time:



2. Contrast Measuring.

(1) Equipment:

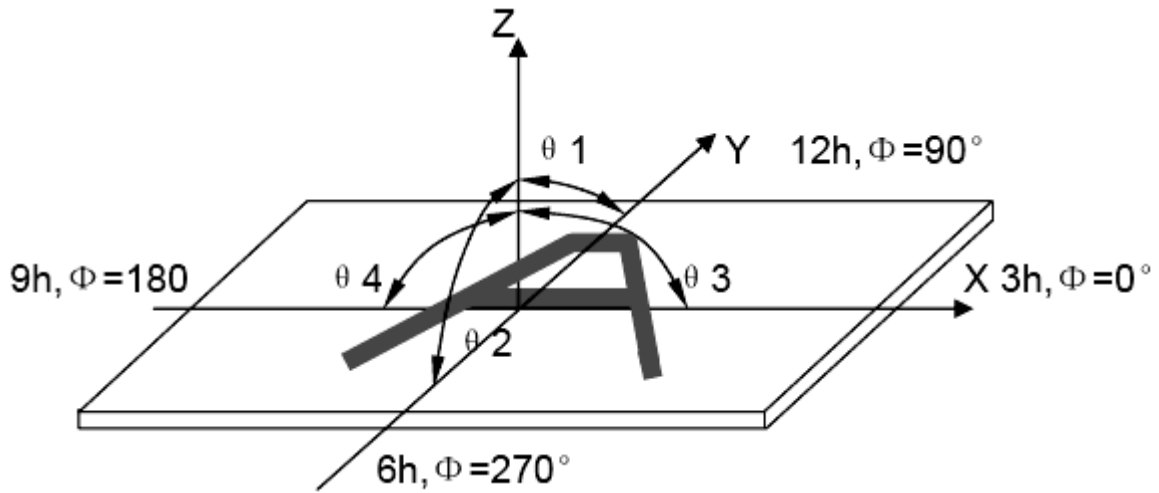


Waveform Generator

Spectrophotometer

(2) Definition:

A. Viewing Angle:



B. Contrast Ratio: (Positive)

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

10 SAMPLE CODE

```

while(1)
{
    res=0;
    delay_ms(200);
    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(15); // set vop low: 00~3f vlcd=12.0v 25
        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); // ;10GOOD;

        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

```

11 PART NUMBER DESCRIPTION FOR AVAILABLE OPTIONS

LMR5436①②128G64③④⑤

①

Polarizer Type

E = Transmissive Negative Mode
B = Transflective Positive Mode

②

Backlight Color

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

③

Fluid Type and Temperature Range

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

④

Fluid Type and Temperature Compensation

N = STN
F = FSTN
A = ASTN (Automotive grade)
E = ESTN (For Amber and Red Backlight only)

⑤

Background Color

B = Blue mode STN (Ocean Blue)

Product No.	LMR5436	REV. C
-------------	---------	--------

Page	22 / 27
------	---------

12 QUALITY ASSURANCE SPECIFICATION

12.1 CONFORMITY

The performance, function and reliability of the shipped products conform to the Product Specification.

12.2 DELIVERY ASSURANCE

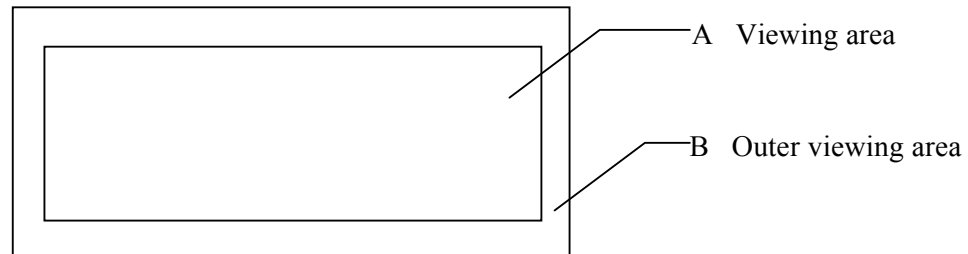
11.2.1 Delivery Inspection Standards

- IPC-AA610, Class 2 Electronic assemblies' standard.

The Quality assurance levels are shown below:

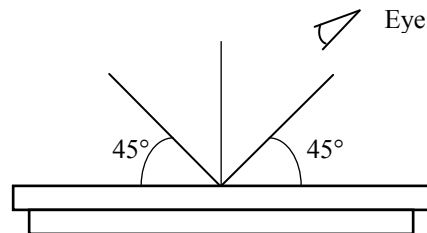
Rank	Item Inspected	Defect type	AQL	Remark		
Major defect	Display	No display	0.25%	Fit/Function defect		
		Over current				
		Missing segment				
		Wrong Viewing direction				
		Incorrect operation				
		No Backlight				
	Flickering Backlight					
	Dimensions	PCB and/or Bezel out of Specifications				
Minor defect	LCD	Black and White spots	1.0%	Appearance defect		
		Black and White lines				
		Polarizer Scratches				
		Bubbles in Polarizer				
		Segment deformations, Pin holes				
		Color Defect				
	COB	Glass Chips				
		Wire Bonding Pad exposed				
		Insufficient covering with Resin (Wire Bonding line exposed)				
	PCB	Bubbles or Dust on COB				
		Dust or Solder balls on PCB				
		Tray			Pad Scratches	
		Particles		Every Tray		
		Total	1.0%			

11.2.2 Zone Definition



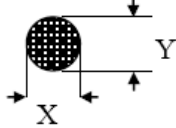
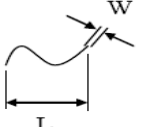
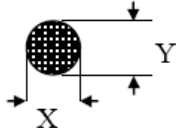
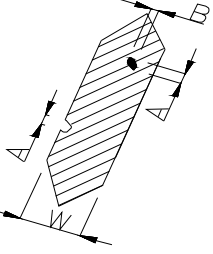
11.2.3 Visual Inspection

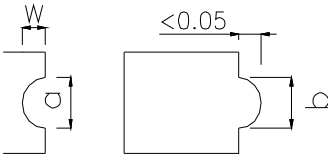
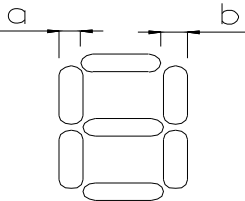
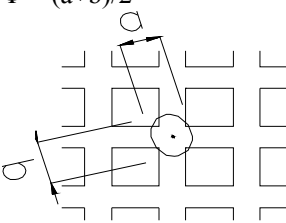
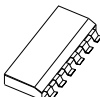
- ❖ Inspect under 2 x 20 W or one 40 W fluorescent lamp (approximately 3000 lux.) leaving 25 to 30 cm between the module and the lamp and 30 cm between the module and the eye. (Measuring position).
- ❖ Appearance is inspected at the best contrast voltage (best contrast is adjusted by considering clarity and crosstalk on the screen).
- ❖ Inspect the module at 45° right and left, top and bottom.
- ❖ Use the optimum viewing angle during the contrast inspection.



11.2.3.1 Standard of Appearance Inspection

Unit: mm

No.	Item	Criteria																															
1	Black spot, White spot, Dust	<p>Round type as shown: $\Phi = (X+Y)/2$</p>  <table border="1" data-bbox="789 438 1281 606"> <thead> <tr> <th colspan="3">Acceptable quantity</th> </tr> <tr> <th>Size</th> <th>Zone A</th> <th>Zone B</th> </tr> </thead> <tbody> <tr> <td>$\Phi < 0.2$</td> <td>Any number</td> <td rowspan="3">Any number</td> </tr> <tr> <td>$0.2 < \Phi < 0.25$</td> <td>2</td> </tr> <tr> <td>$0.25 < \Phi$</td> <td>0</td> </tr> </tbody> </table> <p>Line type as shown:</p>  <table border="1" data-bbox="669 642 1352 810"> <thead> <tr> <th colspan="4">Acceptable quantity</th> </tr> <tr> <th>Length</th> <th>Width</th> <th>Zone A</th> <th>Zone B</th> </tr> </thead> <tbody> <tr> <td>-</td> <td>$W \leq 0.03$</td> <td>Any number</td> <td rowspan="3">Any number</td> </tr> <tr> <td>$L \leq 3$</td> <td>$0.03 < W \leq 0.05$</td> <td>2</td> </tr> <tr> <td>-</td> <td>$0.05 < W$</td> <td>As round type</td> </tr> </tbody> </table> <p>Total acceptable quantity: 5</p>	Acceptable quantity			Size	Zone A	Zone B	$\Phi < 0.2$	Any number	Any number	$0.2 < \Phi < 0.25$	2	$0.25 < \Phi$	0	Acceptable quantity				Length	Width	Zone A	Zone B	-	$W \leq 0.03$	Any number	Any number	$L \leq 3$	$0.03 < W \leq 0.05$	2	-	$0.05 < W$	As round type
Acceptable quantity																																	
Size	Zone A	Zone B																															
$\Phi < 0.2$	Any number	Any number																															
$0.2 < \Phi < 0.25$	2																																
$0.25 < \Phi$	0																																
Acceptable quantity																																	
Length	Width	Zone A	Zone B																														
-	$W \leq 0.03$	Any number	Any number																														
$L \leq 3$	$0.03 < W \leq 0.05$	2																															
-	$0.05 < W$	As round type																															
2	Polarizer Scratch	Scratch on Protective film is permitted. Scratch on Polarizer: Same as 1.																															
3	Polarizer Bubble	<p>$\Phi = (X+Y)/2$</p>  <table border="1" data-bbox="810 1035 1281 1236"> <thead> <tr> <th colspan="3">Acceptable quantity</th> </tr> <tr> <th>Size</th> <th>Zone A</th> <th>Zone B</th> </tr> </thead> <tbody> <tr> <td>$\Phi < 0.2$</td> <td>Any number</td> <td rowspan="4">Any number</td> </tr> <tr> <td>$0.2 < \Phi < 0.5$</td> <td>3</td> </tr> <tr> <td>$0.5 < \Phi < 1.0$</td> <td>1</td> </tr> <tr> <td>$1.0 < \Phi$</td> <td>0</td> </tr> </tbody> </table> <p>Total acceptable quantity: 4</p>	Acceptable quantity			Size	Zone A	Zone B	$\Phi < 0.2$	Any number	Any number	$0.2 < \Phi < 0.5$	3	$0.5 < \Phi < 1.0$	1	$1.0 < \Phi$	0																
Acceptable quantity																																	
Size	Zone A	Zone B																															
$\Phi < 0.2$	Any number	Any number																															
$0.2 < \Phi < 0.5$	3																																
$0.5 < \Phi < 1.0$	1																																
$1.0 < \Phi$	0																																
4	Segment Deformation	<p>I.a. Pin hole on segmented display:</p> <p>W: Segment Width</p> <p>$\Phi = (A+B)/2$</p>  <table border="1" data-bbox="740 1491 1300 1738"> <thead> <tr> <th colspan="2">Acceptable quantity</th> </tr> <tr> <th>Width</th> <th>Φ</th> </tr> </thead> <tbody> <tr> <td>$W \leq 0.4$</td> <td>$\Phi \leq 0.2$ and $\Phi \leq \frac{1}{2}W$</td> </tr> <tr> <td>$W > 0.4$</td> <td>$\Phi \leq 0.25$ and $\Phi \leq (1/3)W$</td> </tr> </tbody> </table> <p>Total acceptable quantity: 1 Defect per segment. Pin holes with Φ under 0.10 mm are acceptable.</p>	Acceptable quantity		Width	Φ	$W \leq 0.4$	$\Phi \leq 0.2$ and $\Phi \leq \frac{1}{2}W$	$W > 0.4$	$\Phi \leq 0.25$ and $\Phi \leq (1/3)W$																							
Acceptable quantity																																	
Width	Φ																																
$W \leq 0.4$	$\Phi \leq 0.2$ and $\Phi \leq \frac{1}{2}W$																																
$W > 0.4$	$\Phi \leq 0.25$ and $\Phi \leq (1/3)W$																																

No.	Item	Criteria																												
4	Segment Deformation	<p>1.b. Pin hole on dot matrix display:</p>  <table border="1" data-bbox="876 325 1307 493"> <thead> <tr> <th colspan="2">Acceptable quantity</th> </tr> </thead> <tbody> <tr> <td>Size</td> <td>-</td> </tr> <tr> <td>$a, b < 0.1$</td> <td>Any number</td> </tr> <tr> <td>$(a+b)/2 \leq 0.1$</td> <td>Any number</td> </tr> <tr> <td>$0.5 < \Phi < 1.0$</td> <td>3</td> </tr> </tbody> </table> <p>Total acceptable quantity: 7</p> <p>2. Segments / dots with different width:</p>  <table border="1" data-bbox="876 703 1307 808"> <thead> <tr> <th colspan="2">Acceptable limits</th> </tr> </thead> <tbody> <tr> <td>$a \geq b$</td> <td>$a/b \leq 4/3$</td> </tr> <tr> <td>$a < b$</td> <td>$a/b > 4/3$</td> </tr> </tbody> </table> <p>3. Alignment layer defect:</p> <p>$\Phi = (a+b)/2$</p>  <table border="1" data-bbox="876 955 1307 1155"> <thead> <tr> <th colspan="2">Acceptable quantity</th> </tr> </thead> <tbody> <tr> <td>Size</td> <td>-</td> </tr> <tr> <td>$\Phi \leq 0.4$</td> <td>Any number</td> </tr> <tr> <td>$0.4 < \Phi \leq 1.0$</td> <td>5</td> </tr> <tr> <td>$1.0 < \Phi \leq 1.5$</td> <td>3</td> </tr> <tr> <td>$1.5 < \Phi \leq 2.0$</td> <td>2</td> </tr> </tbody> </table>	Acceptable quantity		Size	-	$a, b < 0.1$	Any number	$(a+b)/2 \leq 0.1$	Any number	$0.5 < \Phi < 1.0$	3	Acceptable limits		$a \geq b$	$a/b \leq 4/3$	$a < b$	$a/b > 4/3$	Acceptable quantity		Size	-	$\Phi \leq 0.4$	Any number	$0.4 < \Phi \leq 1.0$	5	$1.0 < \Phi \leq 1.5$	3	$1.5 < \Phi \leq 2.0$	2
Acceptable quantity																														
Size	-																													
$a, b < 0.1$	Any number																													
$(a+b)/2 \leq 0.1$	Any number																													
$0.5 < \Phi < 1.0$	3																													
Acceptable limits																														
$a \geq b$	$a/b \leq 4/3$																													
$a < b$	$a/b > 4/3$																													
Acceptable quantity																														
Size	-																													
$\Phi \leq 0.4$	Any number																													
$0.4 < \Phi \leq 1.0$	5																													
$1.0 < \Phi \leq 1.5$	3																													
$1.5 < \Phi \leq 2.0$	2																													
5	Color Uniformity	Level of samples for approval is set as the limit.																												
6	Backlight	The backlight color should correspond to the product specification. Flashing / flickering and / or non-functioning backlight is not allowed. Dust larger than 0.25 mm is not allowed.																												
7	COB	Exposed wire bonding pad is not allowed. Insufficient covering with resin is not allowed. (Exposed Wire bonding line) Dust or bubbles on the resin are not allowed.																												
8	 PCB	Non-melted solder paste should not be present on the PCB. Cold solder joints, missing solder connections, or oxidation is not allowed. Residue or solder balls on the PCB are not allowed. Short circuits on components are not allowed.																												

13 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 polarizer 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 terminals 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 sunlight 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 electrochemical 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).

Product No.	LMR5436	REV. C
-------------	---------	--------

Page	27 / 27
------	---------