

TIANMA MICROELECTRONICS CO., LTD

DEVICE SPECIFICATION FOR LCD MODULE

Model No. TM162GCC7

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Verified by: 周建	Date: 14/12-99
Approved by: 张成	Date: 15/12-99

To: _____

☐ CUSTOMER'S APPROVAL

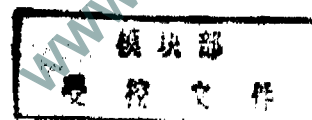
DATE _____

By: _____

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Date	Ref. Page	Revision No.	Revision Items	Check & Approval

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1 Display Specifications

1.1 Display type: STN

1.2 Display color*:

Display color: Blue-Black

Background: WHITE

1.3 Polarizer mode: Transflective/Positive

1.4 Viewing Angle: 6:00

1.5 Driving Duty: 1/16

1.6 Backlight: LED

* Color tone is slightly changed by temperature and driving voltage.

2 Mechanical Specifications

2.1 Outline Dimensions: Refer to outline drawing on page: 2

2.2 Display Format: 16 Characters X 2 Line

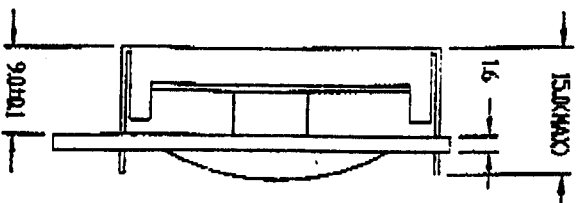
2.3 Display Fonts: 5 X 7 Dots+Cursor

2.4 Character Size: 9.66X4.84(mm)

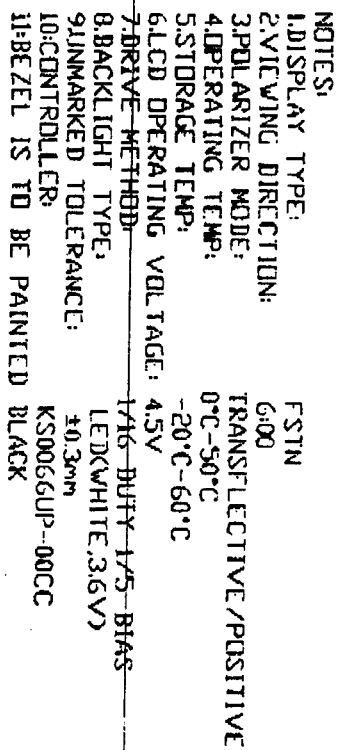
2.4 Dot Size: 0.92X1.1(mm)

2.4 Dot Pitch: 0.98X1.16(mm)

2.5 Weight: 80 g

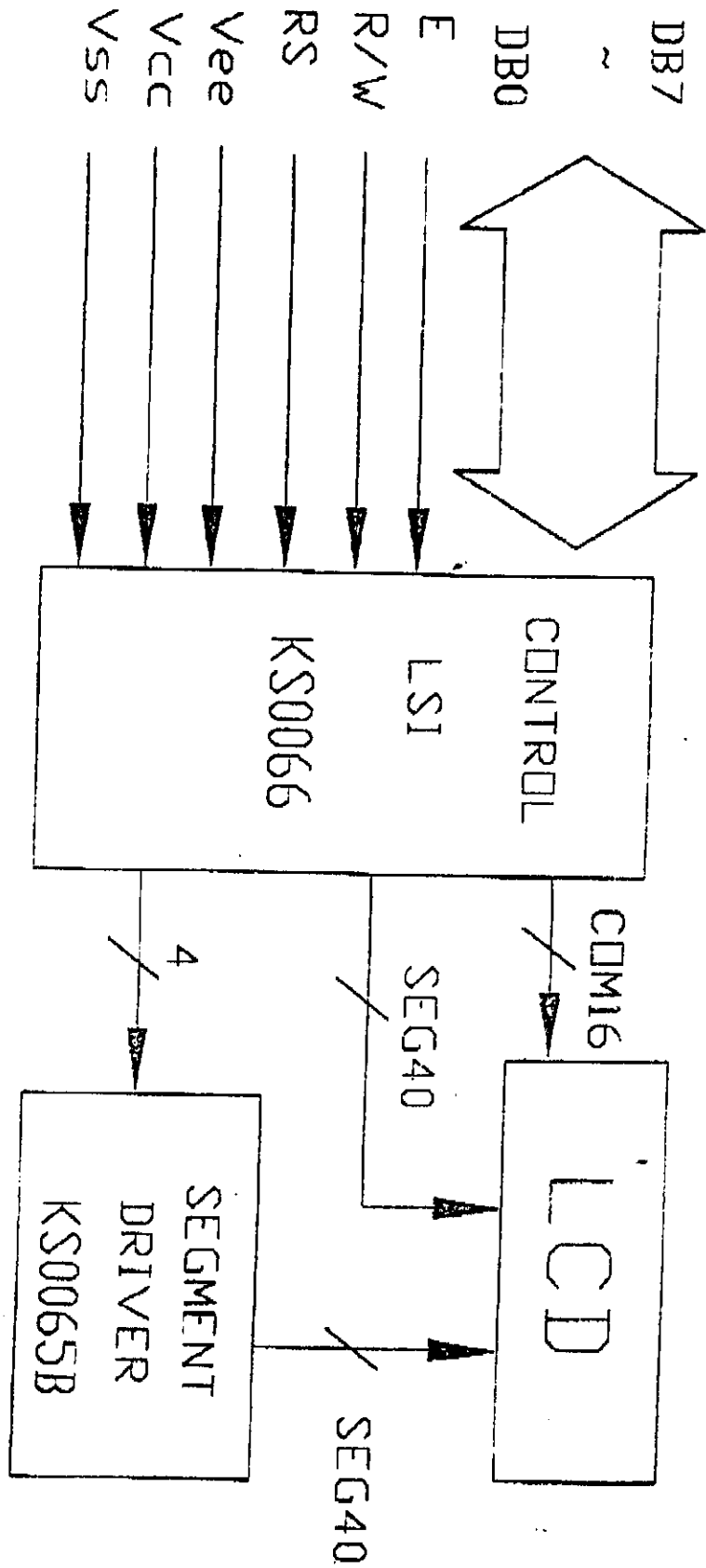


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NOTES:	
1.DISPLAY TYPE:	FSTN
2.VIEWING DIRECTION:	G:00
3.POLARIZER MODE:	TRANSPARENT/POSITIVE
4.OPERATING TEMP:	0°C-50°C
5.STORAGE TEMP:	-20°C-60°C
6.LCD OPERATING VOLTAGE:	4.5V
7.DRIVE METHOD:	1/46 DUTY 1/5 BIAS
8.BACKLIGHT TYPE:	LED(3.6V)
9.UNMARKED TOLERANCE:	±0.3mm
10.CONTROLLER:	KS006GUP-00CC
11.BEZEL IS TO BE PAINTED	BLACK

3 Circuit Block Diagram



4 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	$V_{DD}-V_{SS}$	-0.3	7.0	V	
LCD Driving Voltage	$V_{DD}-V_{EE}$	-0.3	13.0		
Operating Temperature Range	T_{OP}	0	+50	℃	No Condensation
Storage Temperature Range	T_{ST}	-20	+60		

5 Electrical Specifications and Instruction Code

5.1 Electrical characteristics

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Supply Voltage (Logic)		$V_{DD}-V_{SS}$	4.5	5.0	5.5	V	
Supply Voltage (LCD Drive)		$V_{DD}-V_{EE}$	-	4.5	-	V	
Input Signal Voltage	'H'Level	V_{IH}	$0.7V_{DD}$	-	$V_{DD}+0.3$	V	
	'L'Level	V_{IL}	-0.3	-	$0.2 V_{DD}$	V	
Supply current (Logic)		I_{DD}	-	1.3	-	mA	
Supply current (LCD Drive)		I_{EE}	-	0.5	-	mA	
Supply current (LED)		I_{LED}	-	-	25	mA	

5.2 Interface Signals

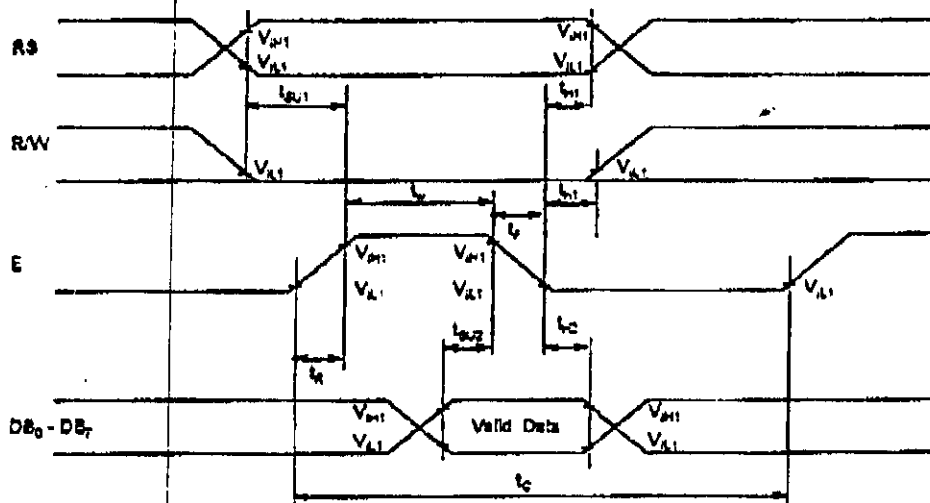
Pin No.	Symbol	Level	Description
1	VSS	0V	Ground
2	VCC	5.0V	Power supply voltage for logic (+5V)
3	VEE	0.5V	Voltage Level for LCD Contrast Adjust
4	RS	H/L	Instruction/Data Selects Registers
5	R/W	H/L	Select Read or Write
6	E	H/L	Enable Input
7	DB0	H/L	Data bit0
8	DB1	H/L	Data bit1
9	DB2	H/L	Data bit2
10	DB3	H/L	Data bit3
11	DB4	H/L	Data bit4
12	DB5	H/L	Data bit5
13	DB6	H/L	Data bit6
14	DB7	H/L	Data bit7
15	LED+	3.6V	Power supply for LED(+)
16	LED-	0V	Power supply for LED(-)

5.3 Interface Timing Chart:

AC Characteristics ($V_{DD}=5V \pm 10\%$, $V_{SS}=0V$, $T=20 \sim +75^\circ C$)

(1) Write mode (Writing data from M30066 to KS0066)

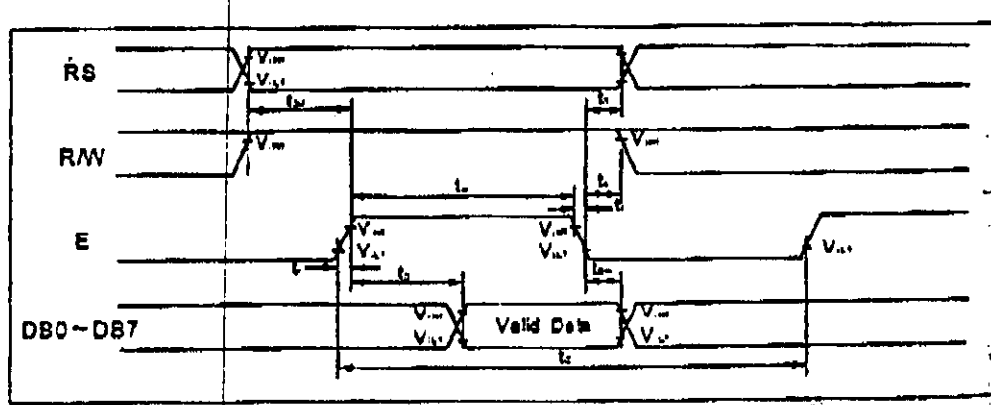
Characteristic	Symbol	Min	Typ	Max	Unit	Test pin
E Cycle Time	t_c	500	-	-	ns	E
E Rise Time	t_r	-	-	25	ns	E
E Fall Time	t_f	-	-	25	ns	E
E Pulse Width (High, Low)	t_w	220	-	-	ns	E
R/W and RS Set-up Time	t_{su1}	40	-	-	ns	R/W, RS
R/W and RS Hold Time	t_h	10	-	-	ns	R/W, RS
Data Set-up Time	t_{su2}	60	-	-	ns	DB ₀ -DB ₇
Data Hold Time	t_h	10	-	-	ns	DB ₀ -DB ₇



(2) Read mode (Reading data from KS0066 to M30066)

Characteristic	Symbol	Min	Typ	Max	Unit	Test pin
E Cycle Time	t_c	600	-	-	ns	E
E Rise Time	t_r	-	-	25	ns	E
E Fall Time	t_f	-	-	25	ns	E
E Pulse Width (High, Low)	t_w	220	-	-	ns	E
R/W and RS Set-up Time	t_{su1}	40	-	-	ns	R/W, RS
R/W and RS Hold Time	t_h	10	-	-	ns	R/W, RS
Data Output Delay Time	t_d	-	-	120	ns	DB ₀ -DB ₇
Data Hold Time	t_{oh}	20	-	-	ns	DB ₀ -DB ₇

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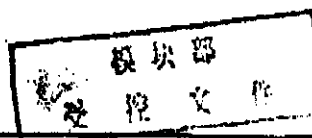
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5.4 Instruction Code

CONTROL and DISPLAY COMMAND

Command	RS	R/W	DS ₇	DS ₆	DS ₅	DS ₄	DS ₃	DS ₂	DS ₁	DS ₀	Execution time (fosc=250KHz)	Remark																		
DISPLAY CLEAR	L	L	L	L	L	L	L	L	L	H	1.84ms																			
RETURN HOME	L	L	L	L	L	L	L	L	L	H	1.84ms	cursor move to first digit																		
ENTRY MODE SET	L	L	L	L	L	L	L	H	LD	SH	40μs	•LD: set cursor move direction <table><tr><td>LD</td><td>H</td><td>Increase</td></tr><tr><td>LD</td><td>L</td><td>Decrease</td></tr></table> •SH: specifies shift of display <table><tr><td>SH</td><td>H</td><td>display is shifted</td></tr><tr><td>SH</td><td>L</td><td>display is not shifted</td></tr></table>	LD	H	Increase	LD	L	Decrease	SH	H	display is shifted	SH	L	display is not shifted						
LD	H	Increase																												
LD	L	Decrease																												
SH	H	display is shifted																												
SH	L	display is not shifted																												
DISPLAY ON/OFF	L	L	L	L	L	L	H	D	C	B	40μs	•Display <table><tr><td>D</td><td>H</td><td>Display on</td></tr><tr><td>D</td><td>L</td><td>Display off</td></tr></table> •Cursor <table><tr><td>C</td><td>H</td><td>Cursor on</td></tr><tr><td>C</td><td>L</td><td>Cursor off</td></tr></table> •Blinking <table><tr><td>B</td><td>H</td><td>Blinking on</td></tr><tr><td>B</td><td>L</td><td>Blinking off</td></tr></table>	D	H	Display on	D	L	Display off	C	H	Cursor on	C	L	Cursor off	B	H	Blinking on	B	L	Blinking off
D	H	Display on																												
D	L	Display off																												
C	H	Cursor on																												
C	L	Cursor off																												
B	H	Blinking on																												
B	L	Blinking off																												
SHIFT	L	L	L	L	L	H	S/C	RL	X	X	40μs	<table><tr><td>SC</td><td>H</td><td>Display shift</td></tr><tr><td>SC</td><td>L</td><td>Cursor move</td></tr></table> <table><tr><td>RL</td><td>H</td><td>Right shift</td></tr><tr><td>RL</td><td>L</td><td>Left shift</td></tr></table>	SC	H	Display shift	SC	L	Cursor move	RL	H	Right shift	RL	L	Left shift						
SC	H	Display shift																												
SC	L	Cursor move																												
RL	H	Right shift																												
RL	L	Left shift																												
SET FUNCTION	L	L	L	L	H	DL	N	F	X	X	40μs	<table><tr><td>DL</td><td>H</td><td>8 bits interface</td></tr><tr><td>DL</td><td>L</td><td>4 bits interface</td></tr></table> <table><tr><td>N</td><td>H</td><td>2 line display</td></tr><tr><td>N</td><td>L</td><td>1 line display</td></tr></table> <table><tr><td>F</td><td>H</td><td>5 x 10 dots</td></tr><tr><td>F</td><td>L</td><td>5 x 7 dots</td></tr></table>	DL	H	8 bits interface	DL	L	4 bits interface	N	H	2 line display	N	L	1 line display	F	H	5 x 10 dots	F	L	5 x 7 dots
DL	H	8 bits interface																												
DL	L	4 bits interface																												
N	H	2 line display																												
N	L	1 line display																												
F	H	5 x 10 dots																												
F	L	5 x 7 dots																												
Command	RS	R/W	DS ₇	DS ₆	DS ₅	DS ₄	DS ₃	DS ₂	DS ₁	DS ₀	Execution time (fosc=250KHz)	Remark																		
SET CG RAM ADDRESS	L	L	L	H	CG RAM address (corresponds to cursor address)						40μs	CG RAM Data is sent and received after this setting																		
SET DD RAM ADDRESS	L	L	H	DD RAM address						40μs	DD RAM Data is sent and received after this setting																			
READ BUSY FLAG & ADDRESS	L	H	BP	Address Counter used for Both DD & CG RAM address						0μs	<table><tr><td>BP</td><td>H</td><td>Busy</td></tr><tr><td>BP</td><td>L</td><td>Ready</td></tr></table> - Reads BP indication internal operating is being performed. - reads address counter contents	BP	H	Busy	BP	L	Ready													
BP	H	Busy																												
BP	L	Ready																												
WRITE DATA	H	L	Write Data								40μs	Write data into DD or CG RAM																		
READ DATA	H	H	Read Data								40μs	Read data from DD or CG RAM																		

X: Don't care

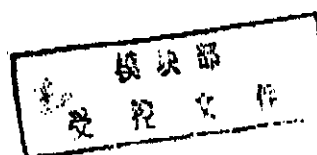


6. Optical Characteristics

6.1 Optical Characteristics

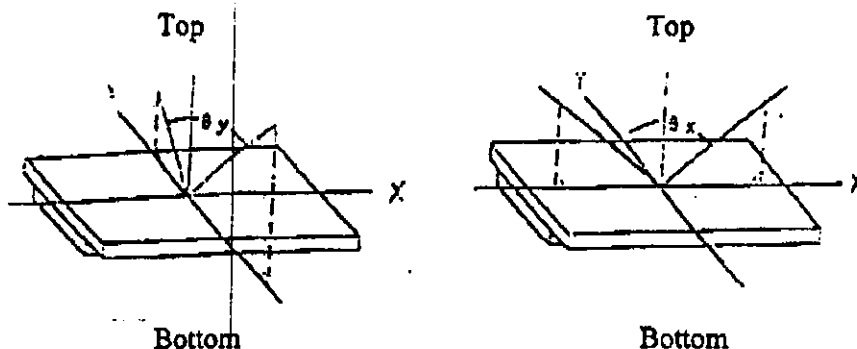
Top=25℃

Item	Symbol	Condition		Min.	Typ.	Max.	Unit	Remark
Viewing Angle	θ_x	Cr>2	$\theta_y=0^\circ$	-30 ~ 30			Deg	
	θ_y		$\theta_x=0^\circ$	-35 ~ 20				
Contrast Ratio	Cr	$\theta_x=0^\circ$ $\theta_y=0^\circ$		4.0				
Response Time	Turn on	Ton	$\theta_x=0^\circ$ $\theta_y=0^\circ$			250	ms	
	Turn off	Toff				250		

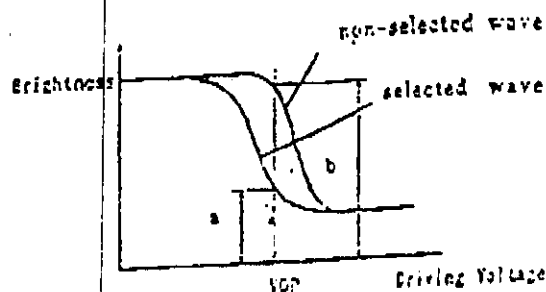


6.2 Definition of optical characteristics

6.2.1 Definition of viewing Angle(see fig. as follow)



6.2.2 Definition of Contrast Ratio(see fig. as follow)

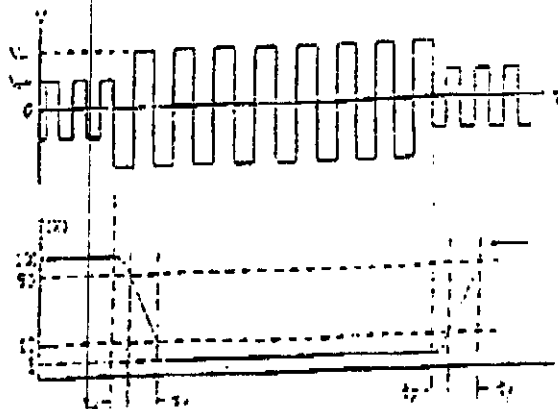


$$\text{Contrast Ratio} = b / a = \frac{\text{non-selected state brightness}}{\text{selected state brightness}}$$

Measuring Conditions:

1) Ambient Temperature: 25°C ; 2) Frame frequency: 64Hz

6.2.3 Definition of Response time(see fig. as follow)



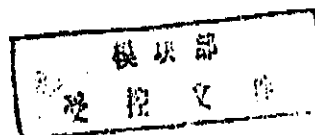
Turn-on time: $t_{on} = t_d + t_r$

Turn-off time: $t_{off} = t_d + t_r$

Measuring Condition:

1) Operating Voltage: 4.5V ;

2) Frame frequency: 64Hz



7. Reliability

7.1 Content of Reliability Test

($T_{OP}=25^{\circ}\text{C}$)

No.	Test Item	Content of Test	Test condition
1	High Temperature Storage	Endurance test applying the high storage temperature for a long time	60°C 96H
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	-20°C 96H
3	High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the thermal stress to the element for a long time	50°C 96H
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time	0°C 96H
5	High Temperature /Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time	40°C 90%RH 96H
6	Temperature Cycle	Endurance test applying the low and high temperature cycle $\begin{array}{ccccccc} -20^{\circ}\text{C} & \longleftrightarrow & 25^{\circ}\text{C} & \longleftrightarrow & 60^{\circ}\text{C} & \longleftrightarrow & -20^{\circ}\text{C} \\ 30\text{min} & & 5\text{min} & & 30\text{min} & & 5\text{min} \end{array}$ ←————— 1 cycle —————→	-20°C/60°C 10 cycles
7	Vibration Test (package state)	Endurance test applying the vibration during transportation	10Hz~150Hz, 50m/s ² , 40min
8	Shock Test (package state)	Endurance test applying the shock during transportation	Half-sinewave, 100m/s ² , 11ms
9	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	40kPa 16H

7.2 Failure Judgment Criterion

Criterion Item	Test Item No.									Failure Judgement Criterion
	1	2	3	4	5	6	7	8	9	
Basic Specification	0	0	0	0	0	0	0	0	0	Out of the basic Specification
Electrical specification	0	0	0	0	0					Out of the electrical specification
Mechanical Specification							0	0		Out of the mechanical specification
Optical Characteristic	0	0	0	0	0	0			0	Out of the optical specification
Remark	Basic specification = Optical specification + Mechanical specification									

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8 Precautions for use of LCD Modules

8.1 Handling Precautions

- 8.1.1** The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- 8.1.2** If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.
- 8.1.3** Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 8.1.4** The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- 8.1.5** If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

—Isopropyl alcohol

— Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

— Water

—Ketone

—Aromatic solvents

- 8.1.6** Do not attempt to disassemble the LCD Module.
- 8.1.7** If the logic circuit power is off, do not apply the input signals.
- 8.1.8** To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - a. Be sure to ground the body when handling the LCD Modules.
 - b. Tools required for assembly, such as soldering irons, must be properly ground.
 - c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
 - d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

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8.2 Storage precautions

8.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

8.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

temperature : $0^{\circ}\text{C} \sim 40^{\circ}\text{C}$

relatively humidity: $\leq 80\%$

8.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

8.3 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.