SPECIFICATION FOR LCD MODULE

Model No.   TM320240ACCWT-1

Prepared by:	Date:
Checked by :	Date:
Verified by :	Date:
Approved by:	Date:

TIANMA MICROELECTRONICS CO., LTD

Rev. 1.0

REVISION RECORD

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

1 General Specifications:

1.1 Display type:　　　　FSTN

1.2 Display color:

　　　Display color*[1]:　Blue-Black

　　　Background*[2]:　　White

1.3 Polarizer mode:　　Transflective/Positive

1.4 Viewing Angle:　　6:00

1.5 Driving Method:　　MLA(Four lines)

1.6 Backlight:　　　　LED(White)

1.7 Drive:　　　　　　COM DRIVER: SSD1882T1R

　　　　　　　　　　SEG DRIVER: SSD1871T2R　2

1.8 Data Transfer:　　4 Bit Parallel

1.9 Operating Temperature:　　-25----+70

　　Storage Temperature:　　-30----+80

1.10 VDD:　　　　　　5.0V

1.11 LCD Operating Voltage: 25.0V

1.12 Outline Dimensions:　Refer to outline drawing on next page

1.13 Dot Matrix:　　　320× 240　Dots

1.14 Dot Size:　　　　0.39× 0.39(mm)

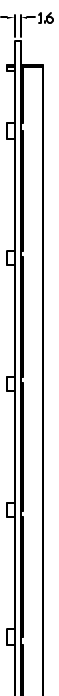1.15 Dot Pitch:　　　0.42× 0.42(mm)

1.16 Weight:　　　　about 250g

　　*[1] Color tone is slightly changed by temperature and driving voltage.
　　*[2] Color tone will be changed by backlight.
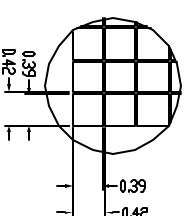
NOTES:

1. DISPLAY TYPE: FSTN MODE
2. VIEWING DIRECTION 6:00
3. POLARIZER MODE: TRANSFLECTIVE/POSITIVE
4. DRIVE METHOD: MLA(FOUR LINES)
5. VDD=5.0V
6. OPERATING TEMP. -25°C~+70°C
7. STORAGE TEMP. -30°C~+80°C
8. COM DRIVER: SSD1882T1R; SEG DRIVER: SSD1871T2R X 2
9. BACKLIGHT: LED(WHITE)
10. ANTI-HUMIDITY, ANTI-MILDEW AND ANTI-SALTFOG PCB
11. BEZEL IS TO BE PAINED WHITE.
12. ALL UNMARKED TOLERANCES: ±0.3mm

320 X 240 DOTS

DETAIL A:

0.39
0.42
0.39
0.42

I/O PORTS

NO.	SYMBOL
1	Vdd
2	Vss
3	/DIFF
4	YD
5	LP
6	XSCL
7	XD0
8	XD1
9	XD2
10	XD3
11	VL
12	VEE
13	LED+
14	LED-

CONNECTOR
Pitch:1.25
14PIN

TIAN-MA MICROELECTRONICS CO.

22/F., HANGU Building, Shennan Road, Central, Shenzhen, China

DRAWN	BY:	TITLE:	TM320240ADCWT-1		
CHECKED	BY:				
APPROVED	BY:	DWG NO:	G-1	SCALE	
CONFIRMED BY:		DWG NAME:	TM320240DCWT-1	SHEET NO. 1 OF 1	UNIT: mm

3 LCD Module Part Numbering System

TM 320240 A C C W T

MODULE TYPE
T:TAB

TEMPERATURE RANGE
W:WIDE TEMPERATURE RANGE

BACKLIGHT TYPE
C:TRANSFLECTIVE
LED BACKLIGHT

LCD TYPE
C:FSTN MODE
POSITIVE

MODULE SERIES

MODULE TYPE
320COLUMNS× 240 ROWS

T: TIANMA
M: MODULE

4　Circuit Block Diagram

Signals: XD0, XD1, XD2, XD3, LP, YD, XSCL, VSS, VDD, DOFF, VL, VEE, LED+, LED-

SSD1730 Power Supply Circuit

Temperature compensation unit

LED BACKLIGHT

VH,VL,VDDY

SSD1882T1R

240COM

V3,-V2,V2,-V3,VDDY
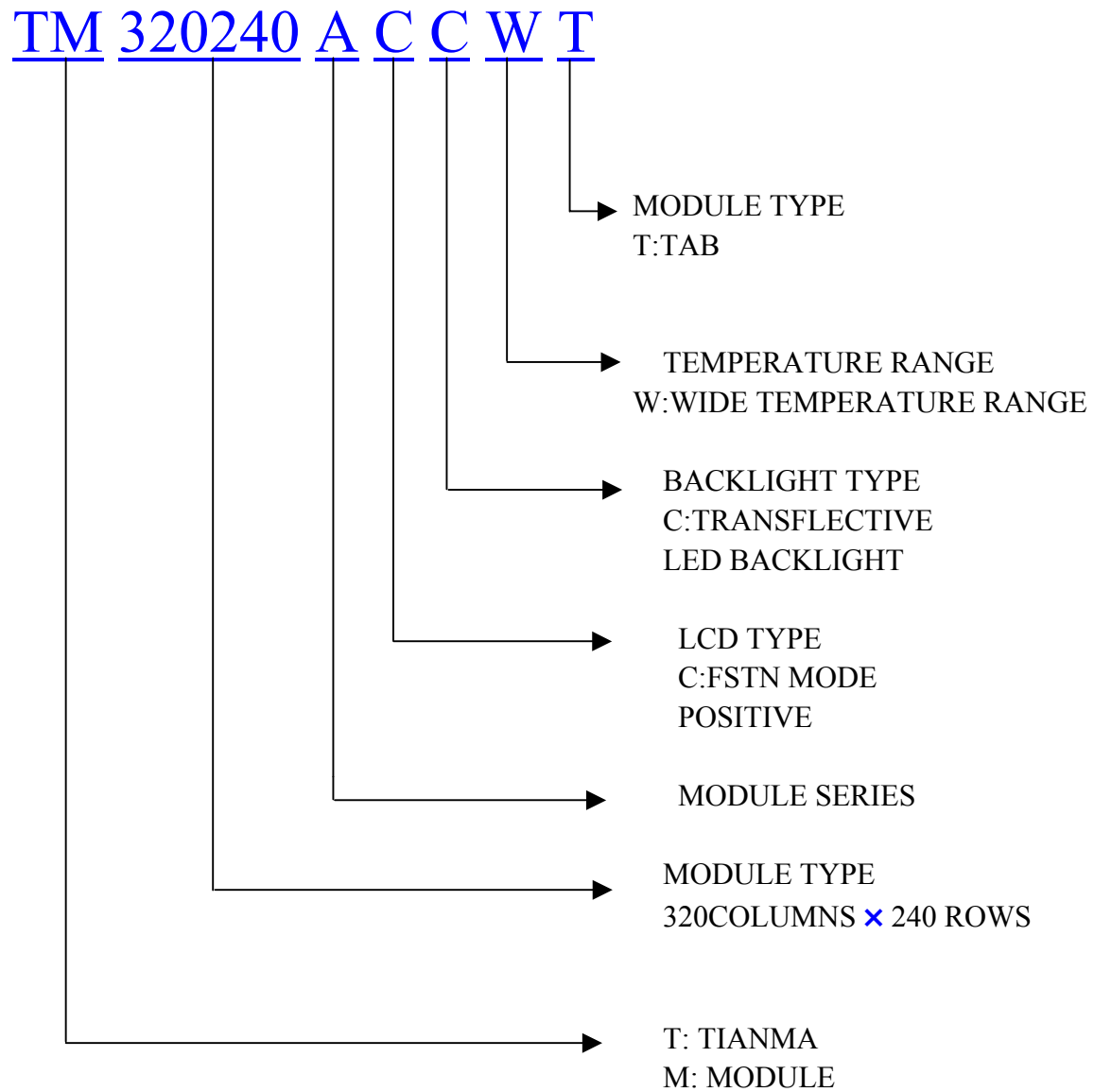
SSD1870T2R　160SEG

SSD1870T2R　160SEG

LCD PANEL 320X240 DOTS

TIAN-MA MICROELECTRONICS CO.
22/F., HANGDU Building, Shennan Road, Central, Shenzhen, China

DRAWN	BY:	TITLE: TM320240AQT		
CHECKED	BY:	DWG NO:	C-1	SCALE:
APPROVED	BY:	DWG NAME: TM320240AQTC-1	SHEET NO:	UNIT: mm
				OF

5 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	V_{DD} V_{SS}	-0.3	6.0	V	
LCD Drive Voltage	V_{LCD}	-	28.0		
Operating Temperature Range	T_{OP}	-25	+70		No Condensation
Storage Temperature Range	T_{ST}	-30	+80		

6 Electrical Specifications and Instruction Code

6.1 Electrical characteristics

Item		Symbol	Min.	Typ.	Max.	Unit
Supply Voltage (Logic)		V_{DD} V_{SS}	4.75	5.0	5.25	V
Supply Voltage (LCD Drive)		V_{LCD}	-	25.0	-	V
Input Signal Voltage	High	V_{IH} V_{DD}=5.0V	$0.8V_{DD}$	-	$V_{DD}+0.3$	V
	Low	V_{IL} V_{DD}=5.0V	0	-	$0.2 V_{DD}$	V
Supply current (Logic)		I_{DD} (V_{DD}- V_{SS}=5.0V)	-		6.0	mA
Supply current (LED Drive)		I_{LED} (V_{LED} =4.2VDC)	-	-	100	mA

6.2 Interface Signals

Pin No.	Symbol	Level	Description
1	VDD	+5.0V	Power supply for the logic system
2	VSS	0V	Ground
3	$\overline{\text{Doff}}$	H/L	Control the display
4	YD	--	A signal to start a frame and to reset the column address for writing
5	LP	--	Generate the charge pump clock and the polarity reverse signal FR and XFR
6	XSCL	--	Serial clock input for segment driver
7	XD0	H/L	Data bit0 for segment input mode
8	XD1	H/L	Data bit1 for segment input mode
9	XD2	H/L	Data bit2 for segment input mode
10	XD3	H/L	Data bit3 for segment input mode
11	VL	--	Row drive negative voltage level power supply voltage terminal
12	VEE	--	Power operation voltage for LCD(-)
13	LED+	+3.3V	Backlight power supply pin +
14	LED-	0V	Backlight power supply pin -

6.3 Power Generater AC Characteristics
(1) Input Timing Characteristics

Voltage Referenced to V_{SS}, V_{DD}=2.4 to 3.6V, T_A=25°C

Symbol	Parameter	Min	Typ	Max	Unit
t_{LPC}	LP Period	50	70	125	us
t_{LPW}	LP Pulse Width	70	1000	2000	ns
t_{LPr}	LP Rise Time	--	--	10	ns
t_{LPf}	LP Fall Time	--	--	10	ns

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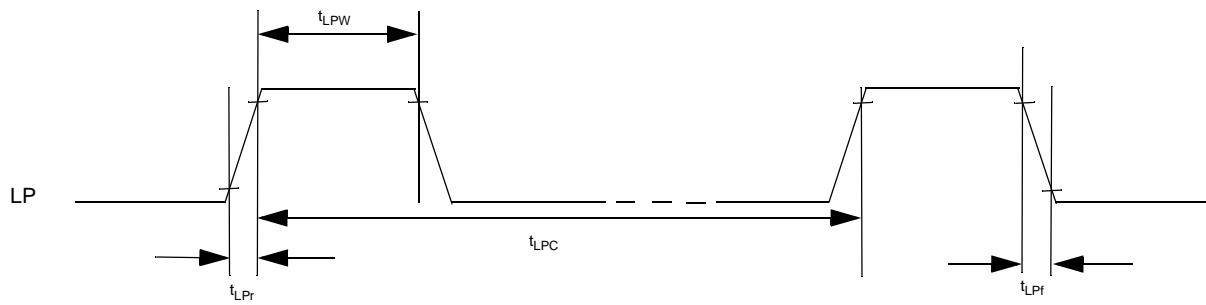
(2) Output Timing Characteristics

LP pulse width = 1us, VL = VEE + 0.6V, 6X step-mode Application

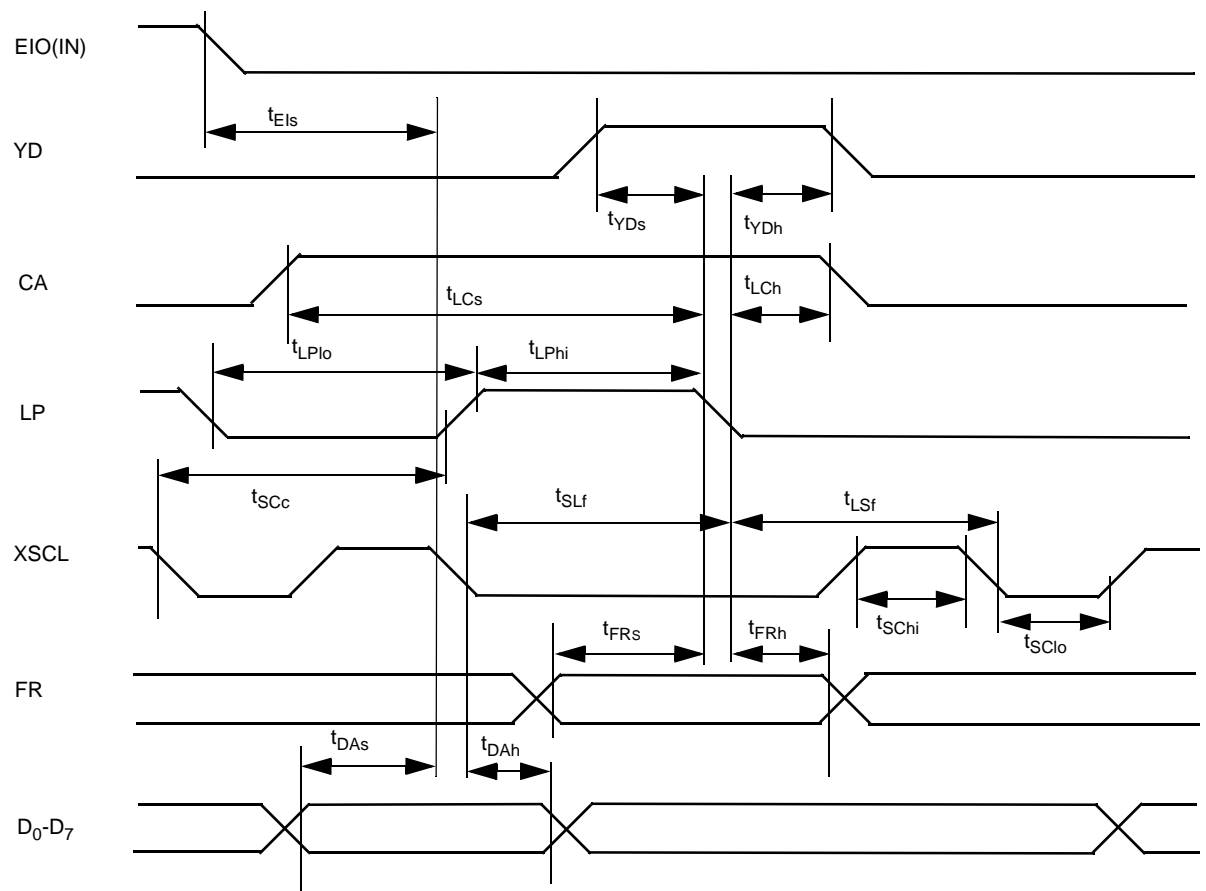| Symbol	Parameter	Min	Typ	Max	Unit
t_{FRr}	FR/XFR Signal Rise Delay Time (with loading = 50pF)	330	--	3300	ns
t_{FRf}	FR/XFR Signal Fall Delay Time (with loading = 50pF)	330	--	3300	ns
t_{ABr}	AB Signal Rise Delay Time	230	--	2000	ns
t_{ABf}	AB Signal Fall Delay Time	180	--	1900	ns
t_{XBBr}	XBB Signal Rise Delay Time	130	--	1100	ns
t_{XBBf}	XBB Signal Fall Delay Time	280	--	3200	ns
t_{OFFr}	Rising Edge Output Phase Differential Time	1000	--	2400	ns
t_{OFFf}	Falling Edge Output Phase Differential Time	1000	--	2200	ns
t_{C7Nr}	C7N Signal Rising Edge Delay Time	270	--	2400	ns
t_{C7Nf}	C7N Signal Falling Edge Delay Time	490	--	3800	ns
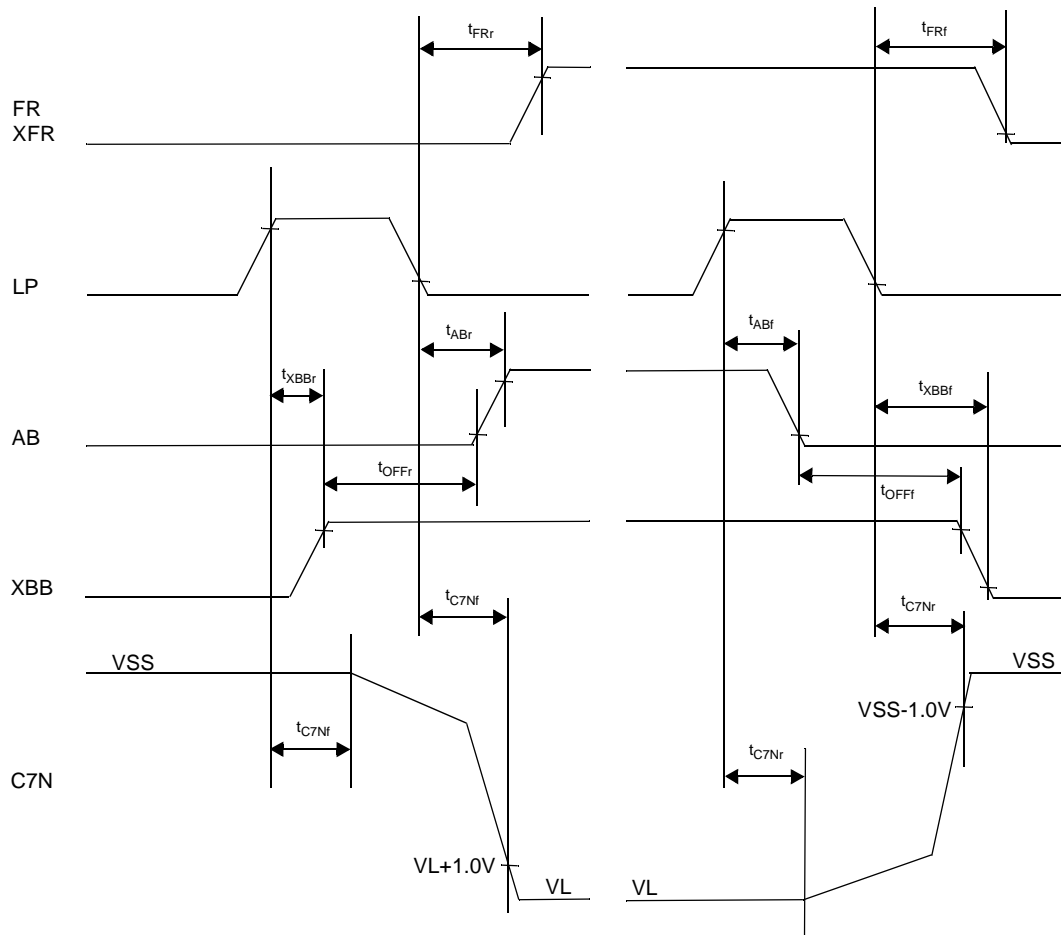
6.4 Segment Driver AC Charactristics
(1) Input Timing Characteristics

VSS = -3.30V, V3 = VDD = 0.00V, V2 = -1.65V, -V2 = -4.95V and -V3 = -6.60V, T_A = 25°C

Symbol	Parameter	Min	Typ	Max	Unit
t_{SCc}	XSCL period	150	---	---	ns
t_{SChi}	XSCL pulse width (High level)	20	---	---	ns
t_{SClo}	XSCL pulse width (Low level)	20	---	---	ns
t_{LPhi}	LP pulse width (High level)	100	---	---	ns
t_{LPlo}	LP pulse width (Low level)	100	---	---	ns
t_{YDs}	YD setup time	50	---	---	ns
t_{YDh}	YD hold time	50	---	---	ns
t_{CAs}	CA setup time	10	---	---	us
t_{CAh}	CA hold time	0	---	200	ns
t_{FRs}	FR setup time	25	---	---	ns
t_{FRh}	FR hold time	10	---	---	ns
t_{EIs}	EIO setup time	30	---	---	ns
t_{SLf}	Fall time between XSCL & LP	10	---	---	ns
t_{LSf}	Fall time between LP & XSCL	150	---	---	ns
t_{DAs}	Data setup time	10	---	---	ns
t_{DAh}	Data hold time	10	---	---	ns

(2) Output Timing Characteristics

VSS = -3.30V, V3 = VDD = 0.00V, V2 = -1.65V, -V2 = -4.95V and -V3 = -6.60V, $T_A = 25^oC$

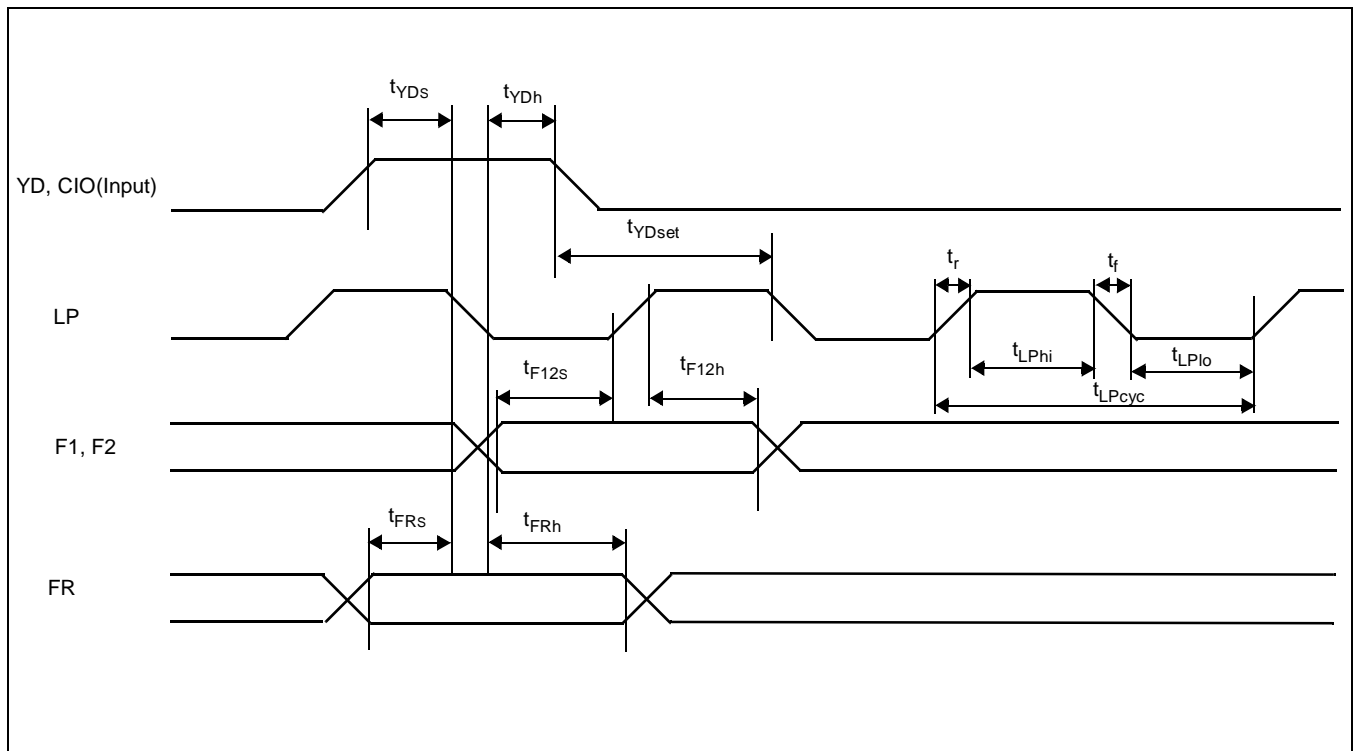| Symbol	Parameter	Min	Typ	Max	Unit
t_{EIre}	EIO reset time	---	---	80	ns
t_{EId}	EIO output delay time	---	---	90	ns
t_{SGd}	Segment output delay time	---	---	400	ns
t_{Fd}	F10 & F20 output delay time	---	---	3000	ns
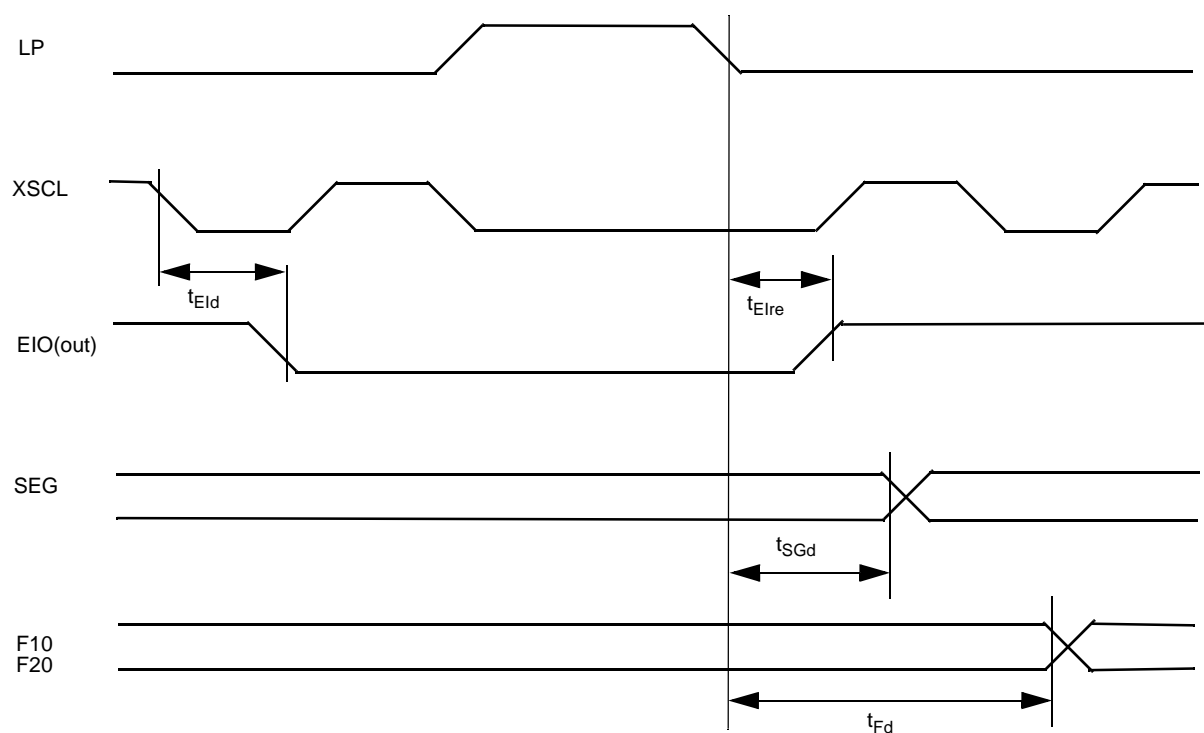
6.5 Common Driver AC Characteristics
(1) Input Timing Characteristics

$-V_1 = 0.0V$, $V_{CC} = 5.0V$, $T_A = 25^{o}C$

Symbol	Parameter	Min	Typ	Max	Unit
t_{LPcyc}	LP period	TBD	TBD	TBD	ns
t_{LPhi}	LP pulse width (High level)	TBD	TBD	TBD	ns
t_{LPlo}	LP pulse width (Low level)	TBD	TBD	TBD	ns
t_{YDs}	YD, CIO setup time	TBD	TBD	TBD	ns
t_{YDh}	YD, CIO hold time	TBD	TBD	TBD	ns
t_{YDset}	YD, CIO setup time	TBD	TBD	TBD	ns
t_{F12s}	F1, F2 setup time	TBD	TBD	TBD	ns
t_{F12h}	F1, F2 hold time	TBD	TBD	TBD	us
t_{FRs}	FR setup time	TBD	TBD	TBD	ns
t_{FRh}	FR hold time	TBD	TBD	TBD	ns
t_r	Input signal rise time	TBD	TBD	TBD	ns
t_f	Input signal fall time	TBD	TBD	TBD	ns

(2) Output Timing Characteristics

-V$_1$ = 0.0V, V$_{CC}$ = 5.0V, T$_A$ = 25°C

Symbol	Parameter	Min	Typ	Max	Unit
t$_{COMd1}$	Delay time from LP to COM	TBD	TBD	TBD	ns
t$_{COMd2}$	Delay time from $\overline{DOFF}$ to COM	TBD	TBD	TBD	ns
t$_{CIOd}$	Delay time from LP to CIO output	TBD	TBD	TBD	ns
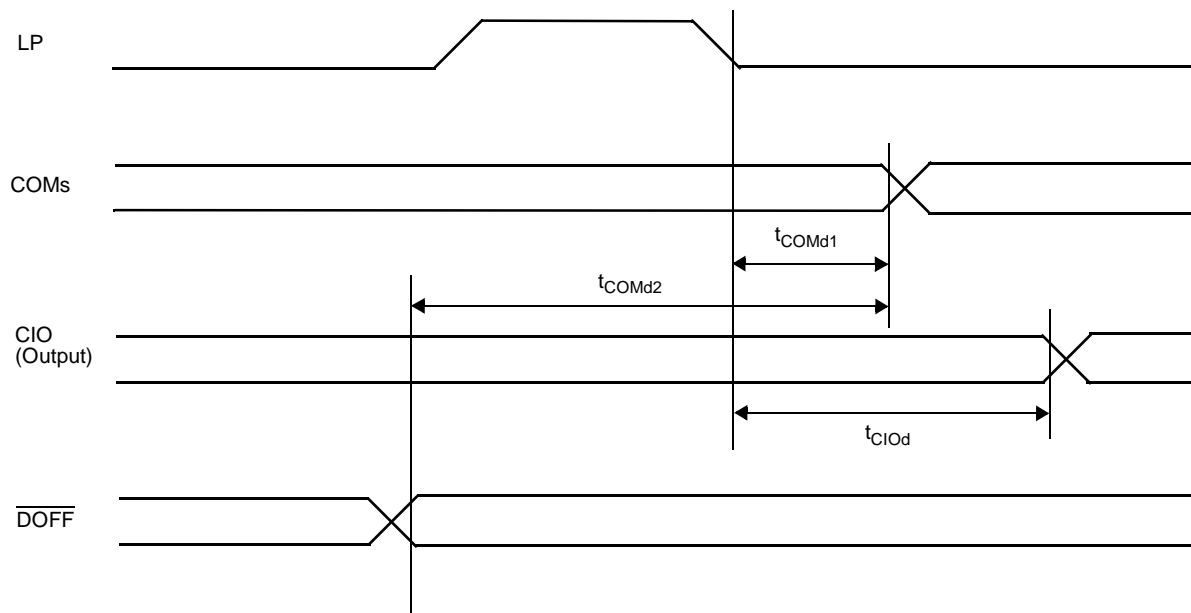
7 Optical Characteristics

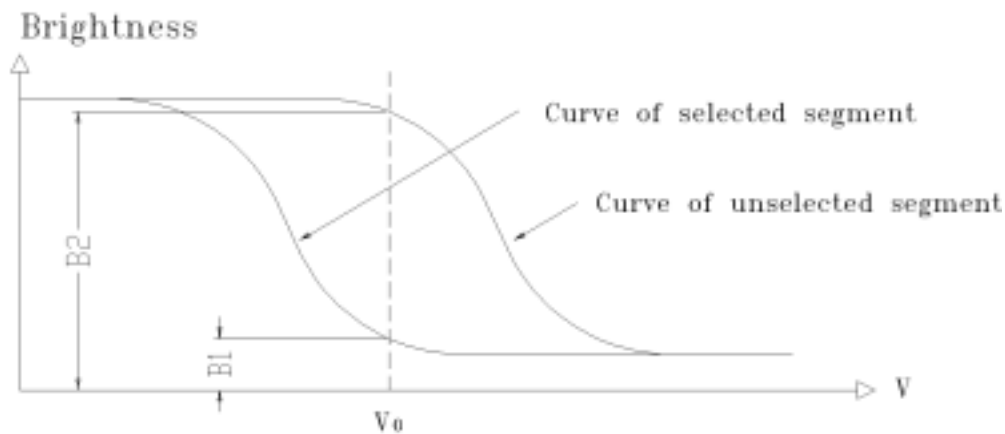## 7.1 Optical Characteristics   Ta=25

Item		Symbol	Condition		Min.	Typ.	Max.	Unit
Viewing Angle		x	Cr≥2	y=0°	-30	--	20	Deg
		y		x=0°	-30	--	30	
Contrast Ratio		Cr	x=0° y=0°		3.0	-	-	
Response Time	Turn on	Ton	x=0° y=0°		-	-	350	ms
	Turn off	Toff			-	-	350	

7.2 Definition of Optical Characteristics
7.2.1 Definition of Viewing Angle

Top   Top

Bottom   Bottom
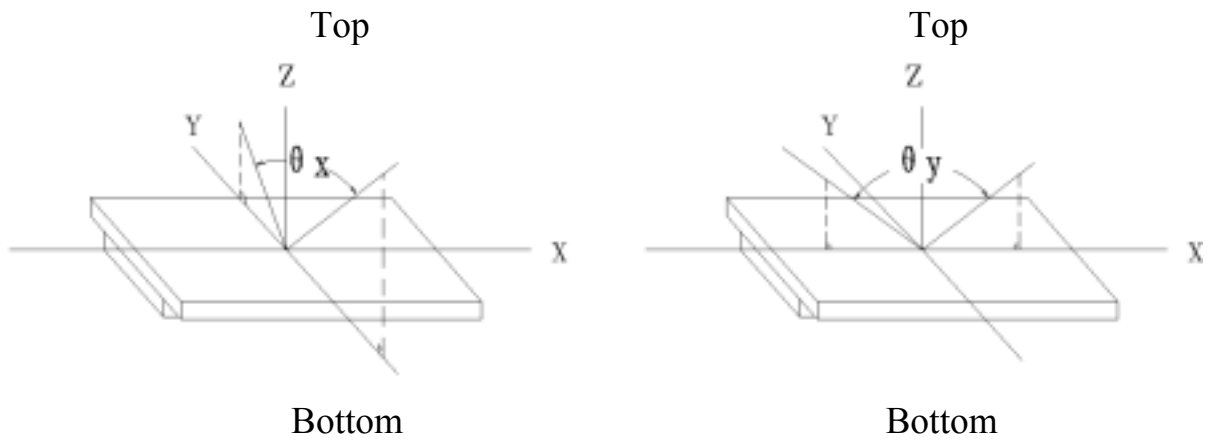
7.2.2 Definition of Contrast Ratio

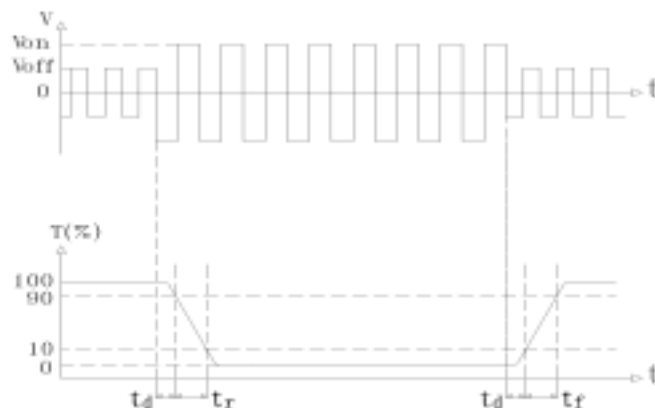
$$\text{Contrast Ratio} = B2/B1 = \frac{\text{unselected state brightness}}{\text{selected state brightness}}$$

Measuring Conditions:

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

7.2.3 Definition of Response time

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

Measuring Condition:

　　1) Operating Voltage:25.0V　2) Frame frequency:64Hz

8 Reliability

8.1 Content of Reliability Test   Ta=25

No.	Test Item	Content of Test	Test condition
1	High Temperature Storage	Endurance test applying the high storage temperature for a long time	80 240H Restore 4H at 25
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	-30 240H Restore 4H at 25
3	High Temperature /Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time	60 90%RH 240H Restore 4H at 25
4	Temperature Cycle	Endurance test applying the low and high temperature cycle -30 25 80 25 30min 5min 30min 5min 1 cycle	-30 /80 10 cycles
5	Vibration Test (package state)	Endurance test applying the vibration during transportation	10Hz~150Hz, 100m/s^2, 120min
6	Shock Test (package state)	Endurance test applying the shock during transportation	Half- sine wave, 300m/s^2, 18ms
7	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	25kPa 16H Restore 2H

8.2 Failure Judgment Criterion

Criterion Item	Test Item No.							Failure Judgement Criterion
	1	2	3	4	5	6	7	
Basic Specification	√	√	√	√	√	√	√	Out of the basic Specification
Electrical specification	√	√	√					Out of the electrical specification
Mechanical Specification					√	√		Out of the mechanical specification
Optical Characteristic	√	√	√	√			√	Out of the optical specification
Note	For test item refer to 8.1							
Remark	Basic specification = Optical specification + Mechanical specification							

9 QUALITY LEVEL

Examination or Test	At T_a=25 (unless otherwise stated)	Inspection				
		Min.	Max.	Unit	IL	AQL
External Visual Inspection	Under normal illumi-nation and eyesight condition, the dis-tance between eyes and LCD is 25cm.	See Appendix A			II	Major 1.0 Minor 2.5
Display Defects	Under normal illumi-nation and eyesight condition, display on inspection.	See Appendix B			II	Major 1.0 Minor 2.5
Note: Major defects: Open segment or common, Short, Serious damages, Leakage Miner defects: Others Sampling standard conforms to GB2828						

10 Precautions for Use of LCD Modules

10.1 Handling Precautions

10.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

10.1.2 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.

10.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

10.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

10.1.5 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

10.1.6 Do not attempt to disassemble the LCD Module.

10.1.7 If the logic circuit power is off, do not apply the input signals.

10.1.8 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.

10.2 Storage precautions

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

10.2.2 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:
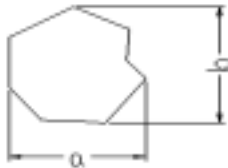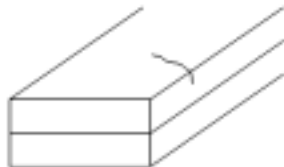
          Temperature :   0   40

          Relatively humidity: 80%

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

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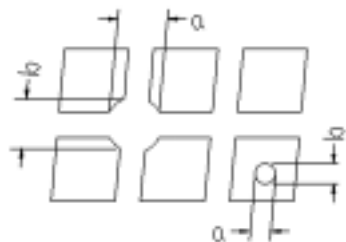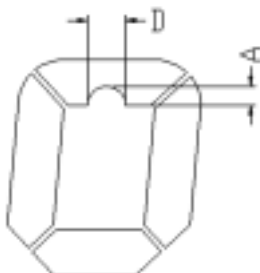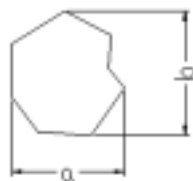
Appendix A

Inspection items and criteria for appearance defects

Items	Contents	Criteria		
Leakage		Not permitted		
Rainbow		According to the limit specimen		
Polarizer	Wrong polarizer attachment	Not permitted		
	Bubble between polarizer and glass	Not counted	Max. 3 defects allowed	
		φ<0.3mm	0.3mm ≦ φ ≦ 0.5mm	
	Scratches of polarizer	According to the limit specimen		
Black spot (in viewing area)		Not counted	Max. 3 spots allowed	Max. 3 spots (lines) allowed
		X<0.2mm	0.2mm ≦ X ≦ 0.5mm	
		X=(a+b)/2		
Black line (in viewing area)		Not counted	Max. 3 lines allowed	
		a<0.02mm	0.02mm ≦ a ≦ 0.05mm b ≦ 2.0mm	
Progressive cracks		Not permitted		
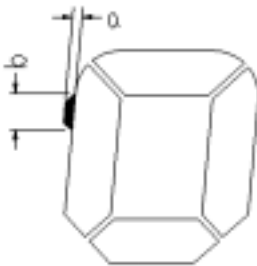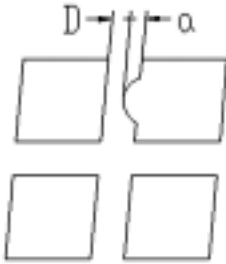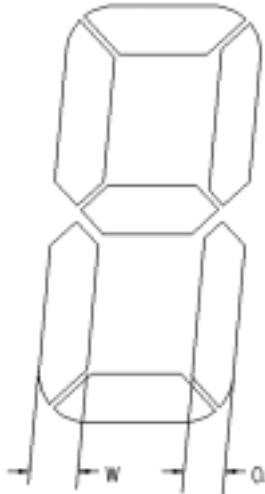
Appendix B

Inspection items and criteria for display defects

Items	Contents	Critera		
Open segment or open common		Not permitted		
Short		Not permitted		
Wrong viewing angle		Not permitted		
Contrast radio uneven		According to the limit specimen		
Crosstalk		According to the limit specimen		
Pin holes and cracks in segment (DOT)		Not counted	Max.3 dots allowed	Max.3 dots allowed
		X<0.1mm	0.1mm X 0.2mm	
		X=(a+b)/2		
		Not counted	Max.2 dots allowed	
		A<0.1mm	0.1mm A 0.2mm D<0.25mm	
Black spot (in viewing area)		Not counted	Max.3 spots allowed	Max.3 spots (lines) allowed
		X<0.1mm	0.1mm X 0.2mm	
		X=(a+b)/2		
Black line (in viewing area)		Not counted	Max.3 lines allowed	
		a<0.02mm	0.02mm a 0.05mm b 0.5mm	

Appendix B

Inspection items and criteria for display defects (continued)

Items	Content	Critera		
Transfor-mation of segment		Not counted	Max. 2 defects allowed	Max.3 defects allowed
		x 0.1mm	0.1mm x 0.2mm	
		$x=(a+b)/2$		
		Not counted	Max. 1 defects allowed	
		a 0.1mm	0.1mm a 0.2mm D>0	
		Max.2 defects allowed 0.8W a 1.2W a=measured value of width W=nominal value of width		