U.R.T.

UNITED RADIANT TECHNOLOGY CORPORATION

R&D SPECIFICATION

LIQUID CRYSTAL DISPLAY MODULE

Model No. UMSH-7306MD-CS

CUSTOMER: U.R.T. R&D Standard Module

TENTATIVE

APPROVED SIGNATURE			
VERSION No: 1.3			

APPROVED BY: _____ **DATE:** _____

United Radiant Technology Corporation

R&D Department

CONTENTS:

1. BASIC Specification

This data sheet defines the specification for a 240x160 dots Color STN delta type Liquid Crystal Display Module with LED backlight. Display size is 35 mm (1.4”).

1.1 Mechanical Specifications:

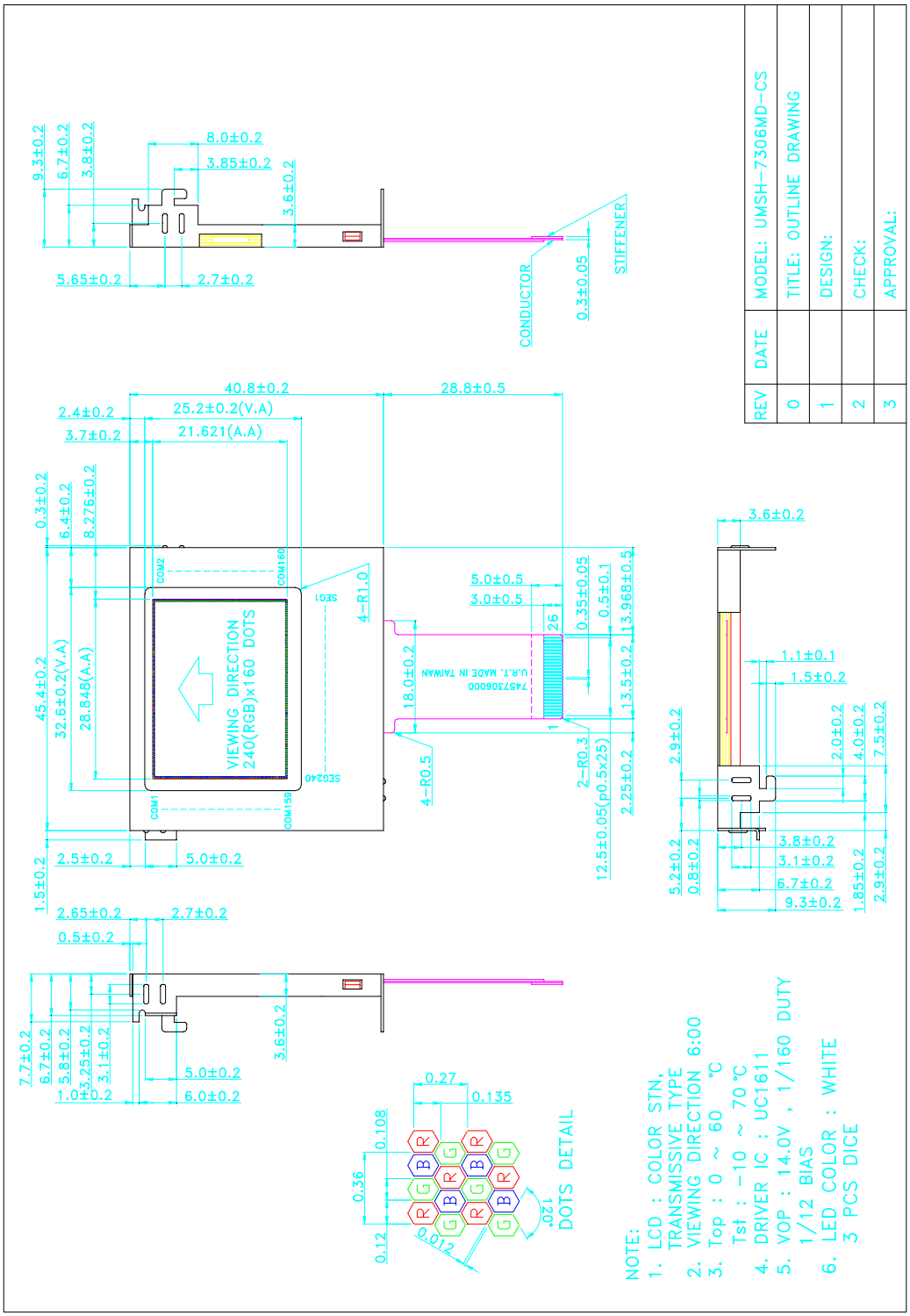
Items	Nominal Dimension	Unit
Dot Matrix	240x160	-
Module Size (W x H x T)	47.2x40.8x9.3	mm.
Display size	35	mm
	1.4	inch
Viewing Area (W x H)	32.6x25.2	mm.
Active Area (W x H)	28.848x21.621	mm.
Dot Size (W x H)	0.108x0.123	mm.
Dot Pitch (W x H)	0.12x0.135	mm.
Driving Method	1/160	Duty
	-	Bias
Driving IC Assembly	COG	-
Weight	TBD	g

** To expose the driver IC under blaze (luminosity over than 1 cd) when using LCM may cause IC operation failure

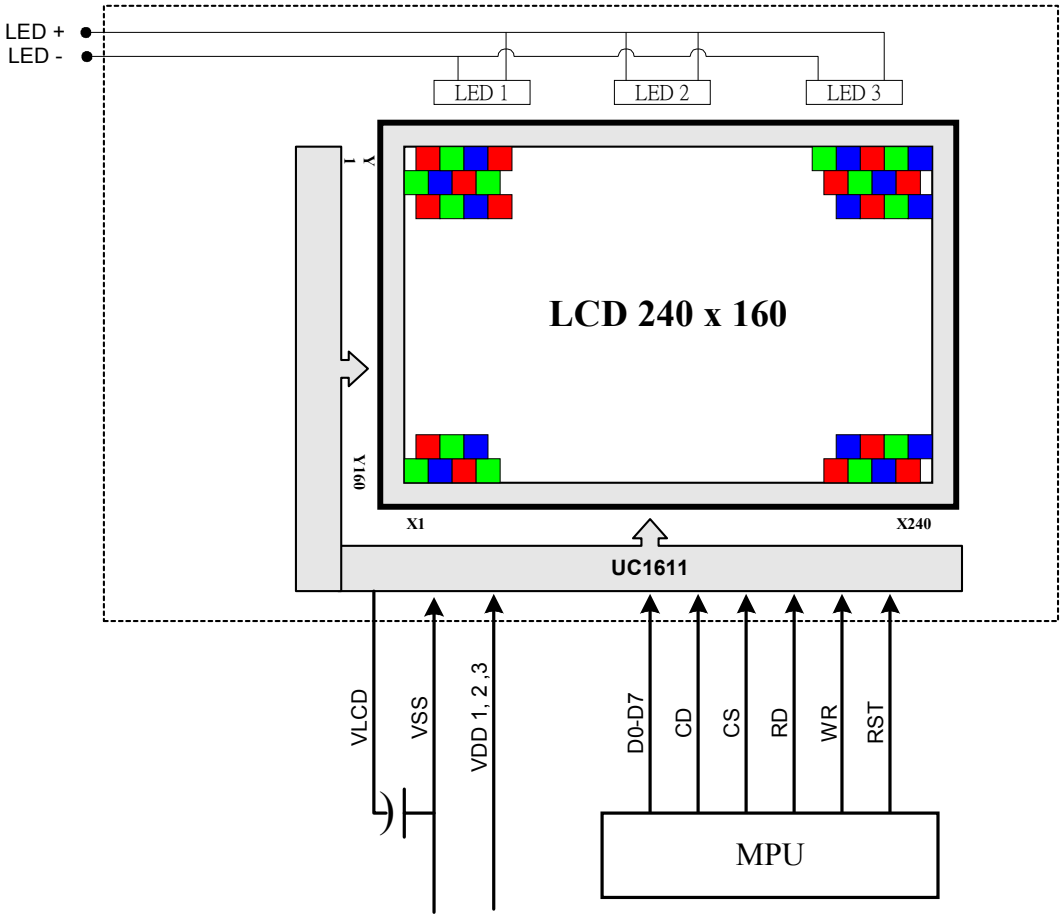
1.2 Display Specification:

Items	Description	Note
LCD Type	Color STN	
LCD Mode	Negative	
Display Type	Transmissive	
Polarizer UV - Cutting	With	
Operation Temperature	0 – 60 °C	
Storage Temperature	-10 – 70°C	
Polarizer Surface	Anti-glare treatment	
Dot Display Color	Red, Green and Blue	
Background Color	Black	
Backlight Type	LEDx3	
Backlight Color	White	
Viewing Direction	6 o'clock	

1.3 Outline Dimension



1.4 Block Diagram



1.5 Example of Power Supply

Recommended Circuit for Contrast Adjustment

1.6 Interface Pin Assignment

■ LCD

PIN No.	SYMBOL	Description	Level
1	VSS	GND	-
2	D7	Display Data	-
3	D6		-
4	D5		-
5	D4		-
6	D3		
7	D2		
8	D1		
9	D0		
10	RST	RESET PIN. When RST = “L”, all control registers are re-initialized by their default states and/or by their pin configuration if applicable. When RST is not used, connect the pin to VDD1.	-
11	CS0	Chip select. The chip is selected when CS0=”H” and CS1 = “L”.	-
12	CS1		
13	CD	Select Control data or Display data for read/write operation. “L” = control data; “H”= Display data	H -> L
14	WR0	WR0 and WR1 control the read/write operation of the host interface. 	H -> L
15	WR1		
16	BT	Bus Type select. “L” = 8080 ; “H” = 6800	H -> L
17	VDD	Power supplies for digital logic, VLCD and VD generator.	V
18	VLCD	VLCD input/output pin.	V

19	VA0-	LCD Bias Voltage. These voltages are always generated internally. Connect capacitors between VAX+/VAX- and VBX+/VBX-.	
20	VA1-		
21	VA1+		
22	VA0+		
23	VB0-		
24	VB1-		
25	VB1+		
26	VB0+		

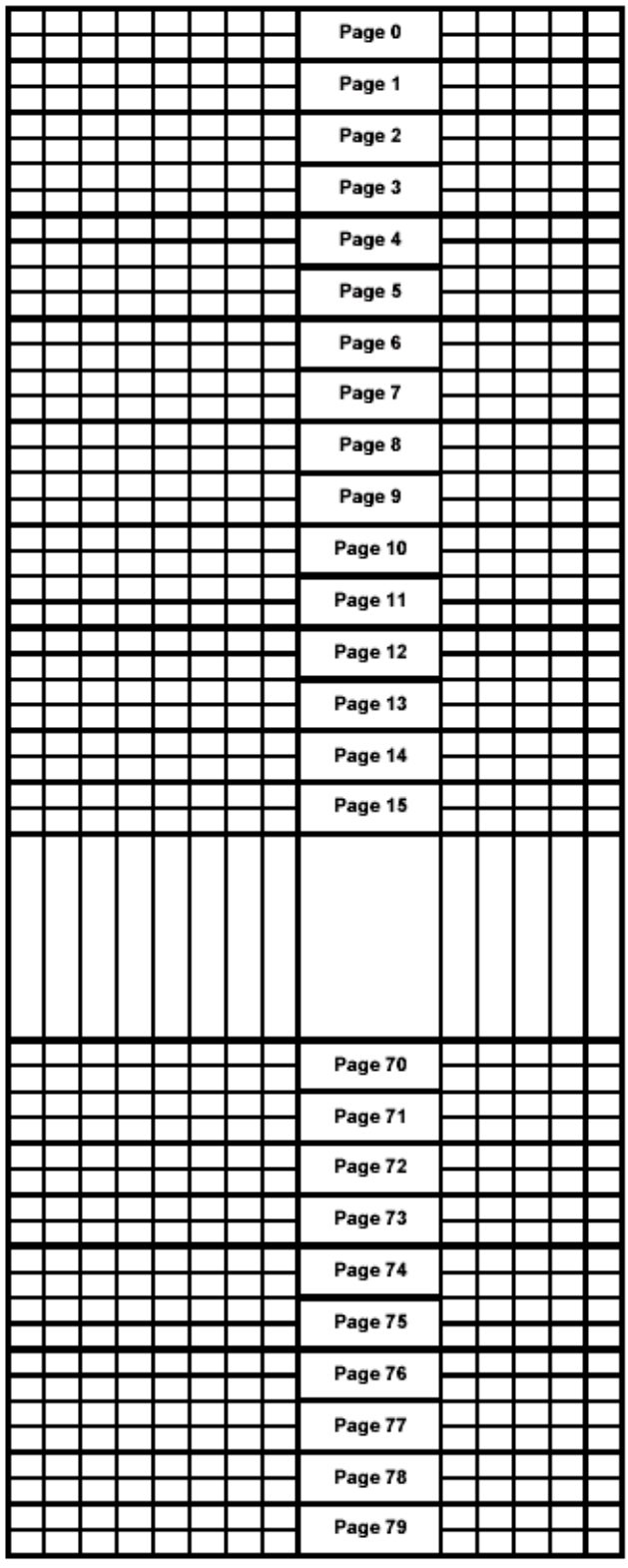
■ LED

PIN No.	SYMBOL	Description	Level
1	LED+	Power Supply for LED	
2	LED -	Power Supply for LED	

1.7 Display Data RAM

MSF 0	MSF 1	Line Adderss
D3/0	D7/4	00H
D7/4	D3/0	01H
D3/0	D7/4	02H
D7/4	D3/0	03H
D3/0	D7/4	04H
D7/4	D3/0	05H
D3/0	D7/4	06H
D7/4	D3/0	07H
D3/0	D7/4	08H
D7/4	D3/0	09H
D3/0	D7/4	0AH
D7/4	D3/0	0BH
D3/0	D7/4	0CH
D7/4	D3/0	0DH
D3/0	D7/4	0EH
D7/4	D3/0	0FH
D3/0	D7/4	10H
D7/4	D3/0	11H
D3/0	D7/4	12H
D7/4	D3/0	13H
D3/0	D7/4	14H
D7/4	D3/0	15H
D3/0	D7/4	16H
D7/4	D3/0	17H
D3/0	D7/4	18H
D7/4	D3/0	19H
D3/0	D7/4	1AH
D7/4	D3/0	1BH
D3/0	D7/4	1CH
D7/4	D3/0	1DH
D3/0	D7/4	1EH
D7/4	D3/0	1FH
D3/0	D7/4	3CH
D7/4	D3/0	3DH
D3/0	D7/4	3EH
D7/4	D3/0	3FH
D3/0	D7/4	40H
D7/4	D3/0	41H
D3/0	D7/4	42H
D7/4	D3/0	43H
D3/0	D7/4	44H
D7/4	D3/0	45H
D3/0	D7/4	46H
D7/4	D3/0	47H
D3/0	D7/4	48H
D7/4	D3/0	49H
D3/0	D7/4	4AH
D7/4	D3/0	4BH
D3/0	D7/4	4CH
D7/4	D3/0	4DH
D3/0	D7/4	4EH
D7/4	D3/0	4FH

RAM



MX															
0	C1	C2	C3	C4	C5	C6	C7	C8		C236	C237	C238	C239	C240
1	C240	C239	C238	C237	C236	C235	C234	C233		C5	C4	C3	C2	C1

MY=0 SL=0	MY=0 SL=16	MY=1 SL=0	MY=1 SL=0	MY=1 SL=16	MY=1 SL=16
R1	R145	R160	R96	R16	R16
R2	R146	R159	R95	R15	R15
R3	R147	R158	R94	R14	R14
R4	R148	R157	R93	R13	R13
R5	R149	R156	R92	R12	R12
R6	R150	R155	R91	R11	R11
R7	R151	R154	R90	R10	R10
R8	R152	R153	R89	R9	R9
R9	R153	R152	R88	R8	R8
R10	R154	R151	R87	R7	R7
R11	R155	R150	R86	R6	R6
R12	R156	R149	R85	R5	R5
R13	R157	R148	R84	R4	R4
R14	R158	R147	R83	R3	R3
R15	R159	R146	R82	R2	R2
R16	R160	R145	R81	R1	R1
R17	R1			R160	R96
R18	R2			R159	R95
R19	R3			R158	R94
R20	R4			R157	R93
R21	R5			R156	R92
R22	R6			R155	R91
R23	R7			R154	R90
R24	R8			R153	R89
R25	R9			R152	R88
R26	R10			R151	R87
R27	R11			R150	R86
R28	R12			R149	R85
R29	R13			R148	R84
R30	R14			R147	R83
R31	R15			R146	R82
R32	R16			R145	R81
R141		R20	---		---
R142		R19	---		---
R143		R18	---		---
R144		R17	---		---
R145		R16	---		---
R146		R15	---		---
R147		R14	---		---
R148		R13	---		---
R149		R12	---		---
R150		R11	---		---
R151		R10	---		---
R152		R9	---		---
R153		R8	---		---
R154		R7	---		---
R155		R6	---		---
R156		R5	---		---
R157	R141	R4	---	R20	---
R158	R142	R3	---	R19	---
R159	R143	R2	---	R18	---
R160	R144	R1	---	R17	---
		160	96	160	96

MUX

2 Electrical Characteristics

2.1 Absolute Maximum Ratings

(V_{SS}= 0 V, at 25°C)

Items	Symbol	Min.	Max.	Unit
Supply voltage for logics	V_{DD}-V_{SS}	-0.3	+4.0	V
Supply voltage for driving LCD	V_{LCD}-V_{SS}	-0.3	+18.0	V
Input voltage	V_{IN}	-0.3	V_{DD}+0.3	V
Operation temperature range	T_{OP}	0	60	°C
Storage temperature range	T_{ST}	-10	70	°C

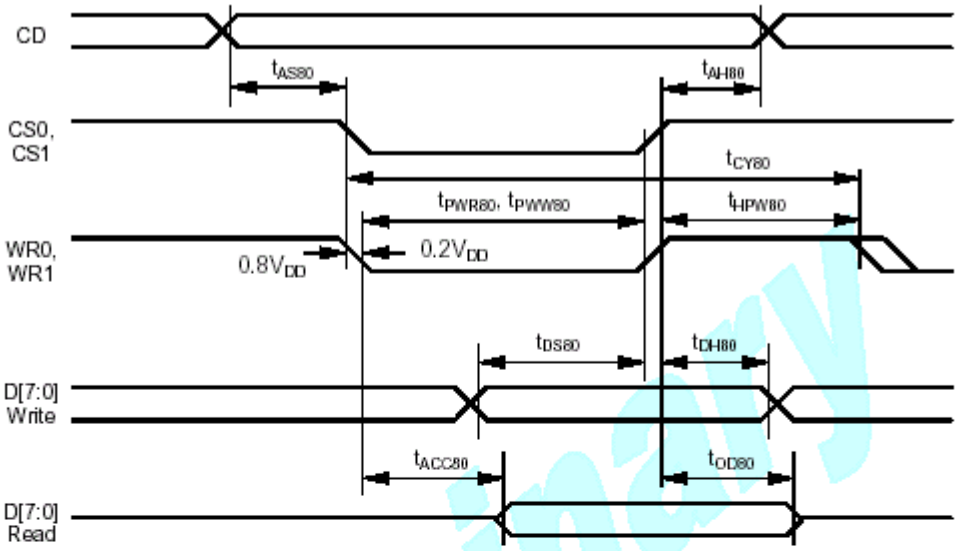
2.2 DC Characteristics

(V_{DD}=3V+/-10%,V_{SS}=0V,at 25°C)

Items	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage (Logic)	V_{DD}-V_{SS}		2.4	3.0	3.3	V
Supply voltage (LCD)	V_{LCD}-V_{SS}	0 °C		-		V
		25 °C		14.0	16.5	V
		40 °C		-		V
Input level voltage	Vin	High, V_{IH}	0.7V_{DD}		V_{DD}	V
		Low, V_{IL}	0		0.3V_{DD}	V
Output level voltage	Vout	High, V_{OH}	V_{DD}-0.4			V
		Low, V_{OL}			0.4	V
Power supply current	I_{DD}	*Note1		-		mA
Power supply for LED	V_{LED+}-V_{LED-}			4.2	5.0	V
LCD power supply current	I_{DD}			-		mA
Power consumption	P_{disp}			-		mW

*Note1:
Measuring Condition:
Temp. = 25 °C
V_{DD}-V_{SS} = 3.0 V
V_{LCD}-V_{SS} = Typical V_{LCD} at 25°C
f_{FR} = 200 Hz
Duty = 1/160 Duty
Display Pattern = Checkered pattern

2.3 AC Characteristics

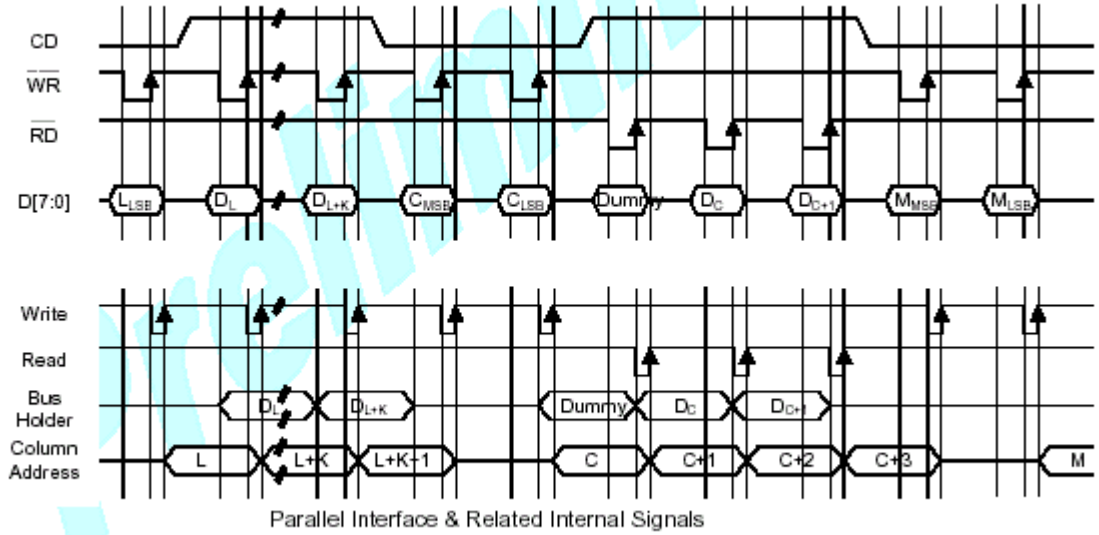


Parallel Bus Timing Characteristics (for 8080 MCU)

(VDD=2.4V to 3.0V, Ta= –30 to +85°C)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{AS80} t_{AH80}	CD	Address setup time Address hold time		20 40	–	ns
t_{CY80}		System cycle time		100	–	ns
t_{PWR80}	WR1	Pulse width (read)		45	–	ns
t_{PWW80}	WR0	Pulse width (write)		45	–	ns
t_{HPW80}	WR0, WR1	High pulse width		40	–	ns
t_{DS80} t_{DH80}	D0~D7	Data setup time Data hold time		30 10	–	ns
t_{ACC80} t_{OD80}		Read access time Output disable time	C_L = 100pF	– 10	50 50	ns

2.4 **Parallel interface and Related internal Signals**



Parallel Interface & Related Internal Signals

2.5 Commands

C/D: 0: Control, 1: Data
W/R: 0: Write Cycle, 1: Read Cycle

\# Useful Data bits
– Don't Care

Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action
Write Data Byte	1	0	#	#	#	#	#	#	#	#	Write 1 byte @ PA/CA
Read Data Byte	1	1	#	#	#	#	#	#	#	#	Read 1 byte @ PA/CA
Get Status	0	1	BZ	MX	DE	RS	WA	GN1	GN0	1	Get Status Summary
Set Column Address LSB	0	0	0	0	0	0	#	#	#	#	Set CA[3:0]=D[3:0]
Set Column Address MSB	0	0	0	0	0	1	#	#	#	#	Set CA[7:4] =D[3:0]
Set Mux rate.	0	0	0	0	1	0	0	0	#	#	Set MR[1:0]=D[1:0]
Set Temp. Compensation.	0	0	0	0	1	0	0	1	#	#	Set TC[1:0]=D[1:0]
Set Panel Loading	0	0	0	0	1	0	1	0	#	#	Set PC[1:0]=D[1:0]
Set Pump Control	0	0	0	0	1	0	1	1	#	#	Set PC[3:2]=D[1:0]
Set Adv. Program Control (double byte command)	0 0	0 0	0 #	0 #	1 #	1 #	0 #	0 #	0 #	R #	Set APC[R][7:0]=D[7:0], where R = 0, or 1
Set Max CA (double byte command)	0 0	0 0	0 #	0 #	1 #	1 #	0 #	0 #	1 #	0 #	Set MC = D[7:0]
Set Start Line LSB	0	0	0	1	0	0	#	#	#	#	Set SL[3:0]=D[3:0]
Set Start Line MSB	0	0	0	1	0	1	#	#	#	#	Set SL[7:4]=D[3:0]
Set Page Address LSB	0	0	0	1	1	0	#	#	#	#	Set PA[3:0]=D[3:0]
Set Page Address MSB	0	0	0	1	1	1	#	#	#	#	Set PA[7:4]=D[3:0]
Set V_{REF} potential meter (double-byte command)	0 0	0 0	1 #	0 #	0 #	0 #	0 #	0 #	0 #	1 #	Set PM[5:0]=D[5:0] Set GN[1:0]=D[7:6]
Set RAM Address Control	0	0	1	0	0	0	1	#	#	#	Set AC[2:0]=D[2:0]
Set Fixed Lines	0	0	1	0	0	1	#	#	#	#	Set FL[3:0]=D[3:0]
Set Frame Rate	0	0	1	0	1	0	0	0	#	#	Set LC[4:3]=D[1:0]
Set All-Pixel-ON	0	0	1	0	1	0	0	1	0	#	Set DC[1]=D0
Set Inverse Display	0	0	1	0	1	0	0	1	1	#	Set DC[0]=D0
Set Display Enable	0	0	1	0	1	0	1	#	#	#	Set DC[4:2]=D[2:0]
Set LCD Control	0	0	1	1	0	0	0	#	#	#	Set LC[2:0]=D[2:0]
Set Gray Scale Mode	0	0	1	1	0	1	0	0	#	#	Set LC[6:5] = D[1:0]
System Reset	0	0	1	1	1	0	0	0	1	0	System Reset sequence
NOP	0	0	1	1	1	0	0	0	1	1	No operation
Set LCD Bias Ratio	0	0	1	1	1	0	1	0	#	#	Set BR[1:0]= D[1:0]
Reset Cursor Update Mode	0	0	1	1	1	0	1	1	1	0	Set AC[3]=0, CA=CR;
Set Cursor Update Mode	0	0	1	1	1	0	1	1	1	1	Set AC[3]=1, CR=CA;
Set Test Control (double byte command)	0 0	0 0	1 #	1 #	1 #	0 #	0 #	1 #	TT #	 #	For testing only. Do not use.

* Other than commands listed above, all other bit patterns result in NOP (No Operation).

Please see the Data sheet of UC-1611 to get more information.

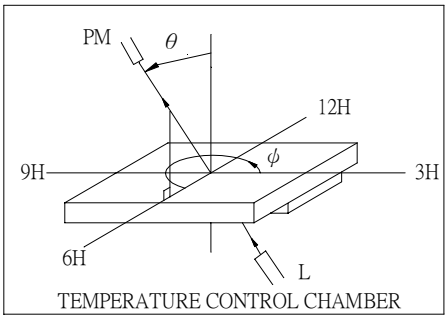
3. Optical Characteristic

Optical Characteristic

Items		Symbol	Condition		Min.	Typ.	Max.	Unit
Response time	Rise	tr	θ = ϕ = 0°			(150)		ms
	Fall	tf	θ = ϕ = 0°			(100)		ms
Viewing Angle (θ)		θ	CR≥2	ϕ=0°			(30)	°
		ϕ		θ=0°			(50)	°
Contrast ratio		CR	θ = ϕ = 0°			5		-
Chromaticity Coordinates	Red	x	θ = ϕ = 0°			(TBD)		-
		y				(TBD)		
	Green	x	θ = ϕ = 0°			(TBD)		
		y				(TBD)		
	Blue	x	θ = ϕ = 0°			(TBD)		
		y				(TBD)		
	White	x	θ = ϕ = 0°			(TBD)		
		y				(TBD)		
	Black	x	θ = ϕ = 0°			(TBD)		
		y				(TBD)		

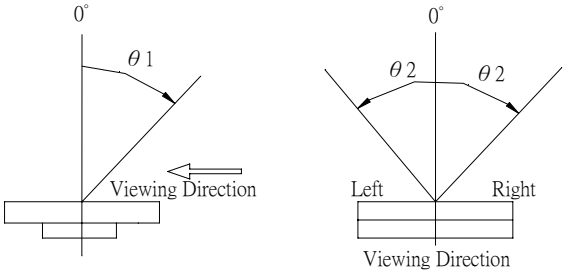
Definition of Optical Characteristics

Measurement Condition
L: LIGHT SOURCE
PM: LIGHT RECEIVING PHOTOMULTIPLIER TUBE

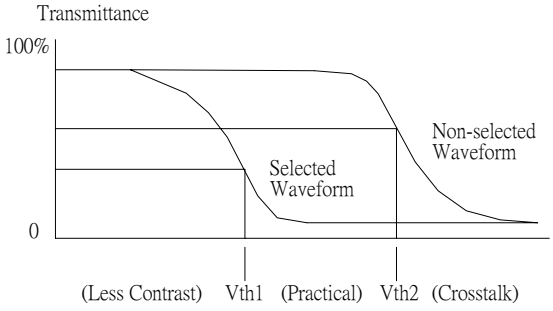


[Note 1] Definition of Viewing Angle

Viewing Direction: ϕ=270°

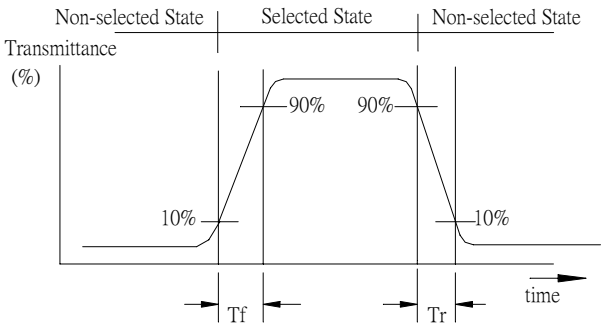


[Note 2] Definition of "Vth"



(a). Vth1: ϕ=270°, θ 1=10°, Selected Waveform 50% Transmittance
(b). Vth1: ϕ=270°, θ 1=40°, Non-selected Waveform 70% Transmittance

[Note 4] Definition of Response Time



Measurement Condition: Viewing Angle: θ 2=0°, θ 1=0°

[Note 3] Definition of Contrast Ratio

(a). Contrast Ratio= $\frac{\text{Transmittance under Non-selected Waveform}}{\text{Transmittance under Selected Waveform}}$

(b). Measurement Condition: Viewing Angle: θ 2=0°, θ 1=10°

4 Reliability

Environmental Test

Item No	Items	Content of Test	Test Condition	Applicable Standard
1	High temperature storage	Endurance test applying the high storage temperature for a long time.	80°C 200 Hrs	
2	Low temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C 200Hrs	
3	High temperature operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time	70°C 200Hrs (*1)	
4	Low temperature operation	Endurance test applying the electric stress under low temperature for a long time.	-20°C 200Hrs (*1)	
5	High temperature / humidity storage	Endurance test applying the high temperature and high humidity storage for a long time.	40°C 90％ RH 200Hrs	
6	Temperature cycle	Endurance test applying the low and high temperature cycles. -30°C ⟷ 80°C (30min.) (30min.) ⟷ 1 Cycle	10 Cycles.	
7	Vibration test	10 →55→ 10 Hz, within 1 minute amplitude 1.5mm .	15 minutes for each direction (X, Y, Z)	
8	Drop test	Packed, 100CM free fall, (6 sides, 1corner, 3edges)		

***1): Driving condition for operation test:**

Power supply voltage for logic system =＋5.0V

Power supply voltage for LCD system = Getting Optimum Contrast at 25°C

5 HANDLING INSTRUCTION

□ PRECAUTION IN USE OF LCD

- Don't contact or scratch the front surface and the contact pads of an LCD panel with hard materials such as metal or glass or with one's nail.
- To clean the surface, wipe it gently with soft cloth dampened alcohol.
- Do not attempt to wiped off the contact pads.
- Keep LCD panels away from direct sunlight, also avoid storing them in a high-temperature & high humidity environment for a long period.
- Do not drive LCD panels by DC voltage.
- Do not expose LCD panels to organic solvent.
- Liquid in LCD is hazardous substance, any contacts with liquid crystal materials, wash it off immediately with soap and water.
- The polarizer is easily damaged and should be handle with special care. Don't press or rub it with hard objects.

□ PRECAUTION FOR HANDLING LCM

- The LCD module contains a C-MOS LSI. To avoid damage to the LSI from static electricity generated while working, Ground your body, work/assembly areas and assembly equipment to protect the module against STATIC ELECTRICITY.
- Do not input any signal before power is turned on.
- Do not take LCM from it's packaging bag until it is assembled.
- Peel off the LCM protective film slowly since static electricity may be generated.
- Pay attention to the humidity of the workshop, 50~60%RH is satisfactory.
- Use a non-leak iron for soldering LCM.
- Do not touch the display surface or connection terminals area with bare hands. Smudges on the display surface reduce the insulation between terminals.
- Cautions for soldering to LCM:
  Conditions for soldering I/O terminals:
  Temperature at iron tip: 280℃±10℃.
  Soldering time: 3~4 sec./ terminal.
  Type of solder: Eutectic solder (rosin flux filled).

□ PRECAUTION FOR STORING LCM

- To avoid degradation of the device, do not store the module under the conditions of direct sunlight, high temperature or high humidity. Keep the module in bags designed to prevent static electricity charging under low temperature / normal humidity conditions(avoid high temperature / high humidity and low temperature below 0 ℃).

□ PRODUCTION NO. DEFINITION