

AZ DISPLAYS, INC.

COMPLETE LCD SOLUTIONS

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

PART NUMBER:
DATE:

AGM1616C SERIES
MAR. 12, 2007

1. General Specifications

1-1.Features

- A. Drive Method:1/160 Duty, 1/13 Bias
- B. The Module Operating Voltage: 3.3V;
- C. The LCD Operating Voltage :20.0V;
- D. Viewing Direction: 6:00
- E. Operating Temperature: 0°C~50°C
- F. Storage Temperature: -20°C~70°C
- G. Display type: FSTN Positive

1-2.Mechanical Data:

- (1) Module Size ----- 75.5 W * 70.5 H mm
- (2) Viewing Area ----- 61.5 W * 61.5 H mm
- (3) Dot Size ----- 0.3345 W * 0.3345 H mm
- (4) Dot Matrix----- 160 * 160
- (5) Outline Dimensions----- See Attached Drawing

1-3. Absolute Maximum Ratings:

Characteristics	Symbol	Ratings
Operating Voltage	VDD	-0.3V to +7.0V
Driver Supply Voltage	V _{LCD}	-0.3V to +30V
Input Voltage Range	V _{IN}	-0.3V to VDD+0.3V

1-4. DC Characteristics:

Segment mode

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition	
Operating Voltage	V _{DD}	2.5	-	5.5	V		
Operating Voltage	V ₀	15	-	30	V		
Input high voltage	V _{IH}	0.8 V _{DD}	-	-	V	D0 - 7, XCK, LP, L/R, FR, MD, S/C, EIO ₁ , EIO ₂ and <u>DISPOFF</u> pins	
Input low voltage	V _{IL}	-	-	0.2 V _{DD}	V		
Output high voltage	V _{OH}	V _{DD} - 0.4	-	-	V	EIO ₁ , EIO ₂ pins, I _{OH} = -0.4mA	
Output low voltage	V _{OL}	-	-	+0.4	V	EIO ₁ , EIO ₂ pins, I _{OL} = +0.4mA	
Input leakage current 1	I _{IH}	-	-	+1	μA	D0 - 7, XCK, LP, L/R, FR, MD, S/C, EIO ₁ , EIO ₂ and <u>DISPOFF</u> pins, V _I = V _{DD}	
Input leakage current 2	I _{IL}	-	-	-1	μA	D0 - 7, XCK, LP, L/R, FR, MD, S/C, EIO ₁ , EIO ₂ and <u>DISPOFF</u> pins, V _I = V _{SS}	
Output resistance	R _{ON}	-	1.0	1.5	kΩ	V ₀ = +30.0V	Y1 - Y160 pins, ΔV _{ON} = 0.5V
		-	1.5	2.0		V ₀ = +20.0V	
Stand-by current	I _{SB}	-	-	5	μA	V _{SS} pin, Note 1	
Consumed current (1) (Deselection)	I _{DD1}	-	-	2.0	mA	V _{DD} pin, Note 2	
Consumed current (2) (Selection)	I _{DD2}	-	-	8.0	mA	V _{DD} pin, Note 3	
Consumed current	I ₀	-	-	1.0	mA	V ₀ pin, Note 4	

Common mode

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition	
Operating Voltage	V _{DD}	2.5	-	5.5	V		
Operating Voltage	V ₀	15	-	30	V		
Input high voltage	V _{IH}	0.8 V _{DD}	-	-	V	D0 - 7, XCK, LP, L/R, FR, MD, S/C, EIO ₁ , EIO ₂ and <u>DISPOFF</u> pins	
Input low voltage	V _{IL}	-	-	0.2 V _{DD}	V		
Output high voltage	V _{OH}	V _{DD} - 0.4	-	-	V	EIO ₁ , EIO ₂ pins, I _{OH} = -0.4mA	
Output low voltage	V _{OL}	-	-	+0.4	V	EIO ₁ , EIO ₂ pins, I _{OL} = +0.4mA	
Input leakage current 1	I _{IH}	-	-	+1	μA	D0 - 7, XCK, LP, L/R, FR, MD, S/C, EIO ₁ , EIO ₂ and <u>DISPOFF</u> pins, V _I = V _{DD}	
Input leakage current 2	I _{IL}	-	-	-1	μA	D0 - 7, XCK, LP, L/R, FR, MD, S/C, EIO ₁ , EIO ₂ and <u>DISPOFF</u> pins, V _I = V _{SS}	
Output resistance	R _{ON}	-	1.0	1.5	kΩ	V ₀ = +30.0V	Y1 - Y160 pins, ΔV _{ON} = 0.5V
		-	1.5	2.0		V ₀ = +20.0V	
Stand-by current	I _{SB}	-	-	5	μA	V _{SS} pin, Note 1	
Consumed current (1) (Deselection)	I _{DD1}	-	-	2.0	mA	V _{DD} pin, Note 2	
Consumed current (2) (Selection)	I _{DD2}	-	-	8.0	mA	V _{DD} pin, Note 3	
Consumed current	I ₀	-	-	1.0	mA	V ₀ pin, Note 4	

1-5. AC Characteristics:

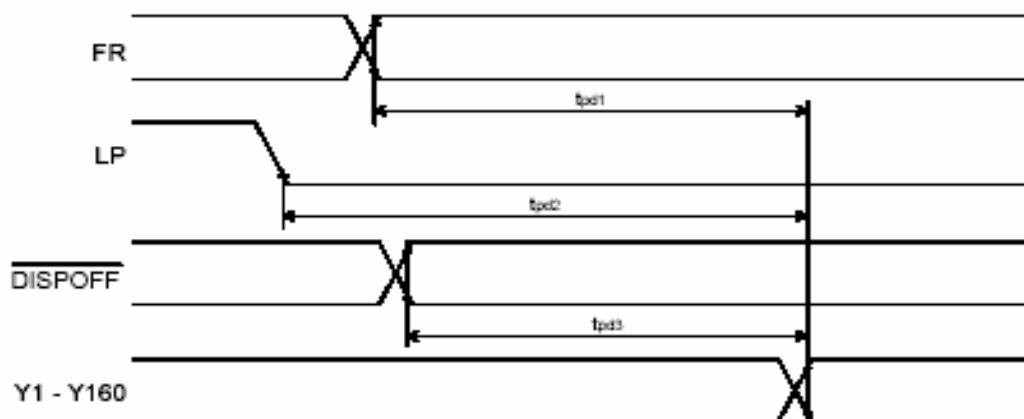
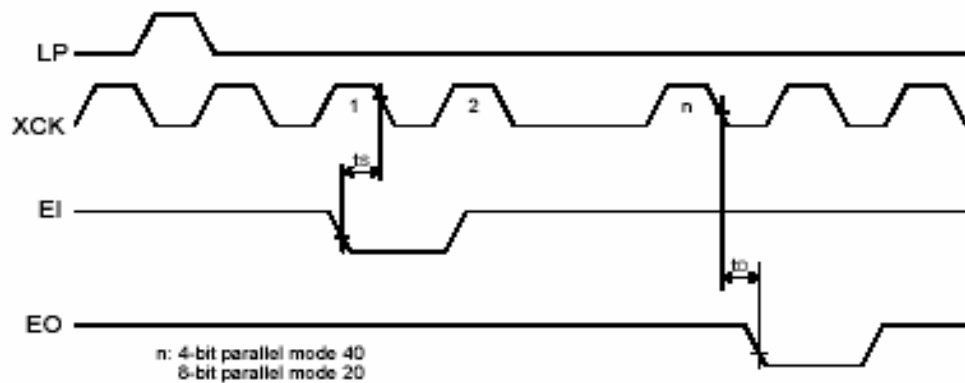
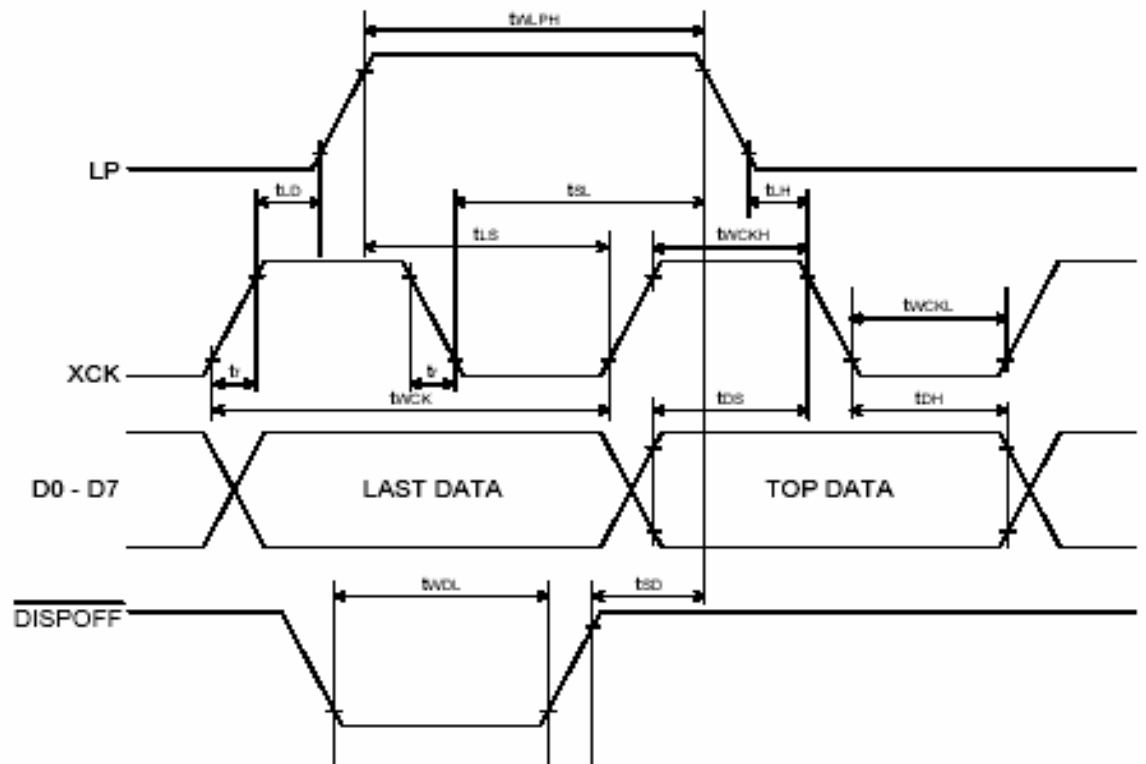
Segment mode

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Shift clock period	twck	125	-		ns	$t_r, t_f \leq 11\text{ns}$, Note 1
Shift clock "H" pulse width	twckH	51	-		ns	
Shift clock "L" pulse width	twckL	51	-		ns	
Data setup time	t _{DS}	30	-		ns	
Data hold time	t _{DH}	40	-		ns	
Latch pulse "H" pulse width	twLPH	51	-		ns	
Shift clock rise to Latch pulse rise time	t _{LD}	0	-		ns	
Shift clock fall to Latch pulse fall time	t _{SL}	51	-		ns	
Latch pulse rise to Shift clock rise time	t _{LS}	51	-		ns	
Latch pulse fall to Shift clock fall time	t _{LH}	51	-		ns	
Input signal rise time	t _r		-	50	ns	Note 2
Input signal fall time	t _f		-	50	ns	Note 2
Enable setup time	t _S	36	-		ns	
$\overline{\text{DISPOFF}}$ Removal time	t _{SD}	100	-		ns	
$\overline{\text{DISPOFF}}$ enable pulse width	twDL	1.2	-		μs	
Output delay time (1)	t _D		-	78	ns	CL = 15pF
Output delay time (2)	t _{pd1} , t _{pd2}		-	1.2	μs	CL = 15pF
Output delay time (3)	t _{pd3}		-	1.2	μs	CL = 15pF

Note

1. Take the cascade connection into consideration.
2. $(t_{CK} - tw_{CKH} - tw_{CKL})/2$ is the maximum in the case of high speed operation.

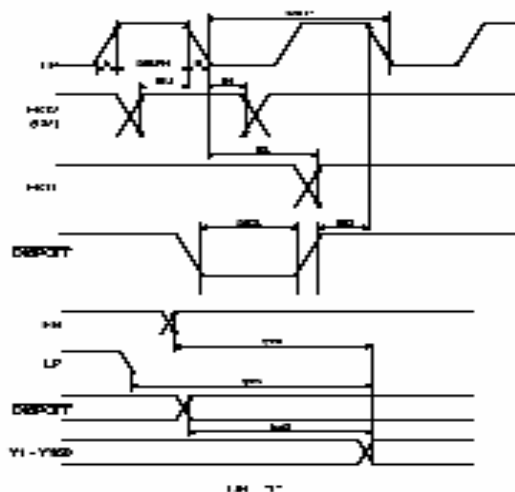
Timing waveform of the Segment Mode



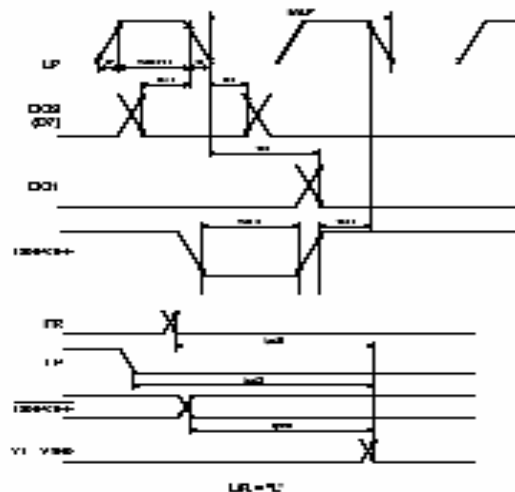
Common mode

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Shift clock period	twLP	250	-	-	ns	$t_r, t_f \leq 20\text{ns}$
Shift clock "H" pulse width	twLPH	15	-	-	ns	$V_{DD} = +5.0\text{V} \pm 10\%$
		30	-	-	ns	$V_{DD} = +2.5 - +4.5\text{V}$
Data setup time	tsu	30	-	-	ns	
Data hold time	th	50	-	-	ns	
Input signal rise time	tr		-	50	ns	
Input signal fall time	tf		-	50	ns	
$\overline{\text{DISPOFF}}$ Removal time	tsD	100	-	-	ns	
$\overline{\text{DISPOFF}}$ enable pulse width	twDL	1.2	-	-	μs	
Output delay time (1)	tDL	-	-	200	ns	$C_L = 15\text{pF}$
Output delay time (2)	tpd1, tpd2	-	-	1.2	μs	$C_L = 15\text{pF}$
Output delay time (3)	tpd3	-	-	1.2	μs	$C_L = 15\text{pF}$

Timing Characteristics of Common Mode



Timing Characteristics of Common Mode



2.The Characteristics and The Reliability Test

1.Electro-Optic Characteristics:

Condition:TEMP=(23. ±3) °C · Hum=(70. ±5)%RH

V_{dd}: 5.0V

NO	Item	Symbol	Min	Typ.	Max	Unit	Condition
1	Supply Voltage(Logic)	Vdd-Vss		3.3		V	
2	LCD Operating Voltage	Vdd-V ₀		20.4		V	-20°C
				20.0		V	25°C
				19.6		V	70°C
3	Response Time	Ton		268		ms	
		Toff		96		ms	
4	Contrast	CR	3				
5	Viewing Angel	12H	θ 1	56		Deg	(CR≥3.0)
		6H	θ 2	64			
		3H	θ 3	60			
		9H	θ 4	60			
6	LCD Threshold Voltage	Vth		18.0		V	25°C

2. Characteristics of backlight

Item	Symbol	Min.	Typ.	Max.	Unit	Condition	
Forward Voltage	VF		5.0		V		
Forward Current	IF		80	120	mA	VF=5.0V	
Reverse Voltage	VR			5.0	V		
Reverse Current	IR		0.04		mA		
Luminous	LV		230		cd/m ²	VF= 5.0V	
Color	WHIT	E					

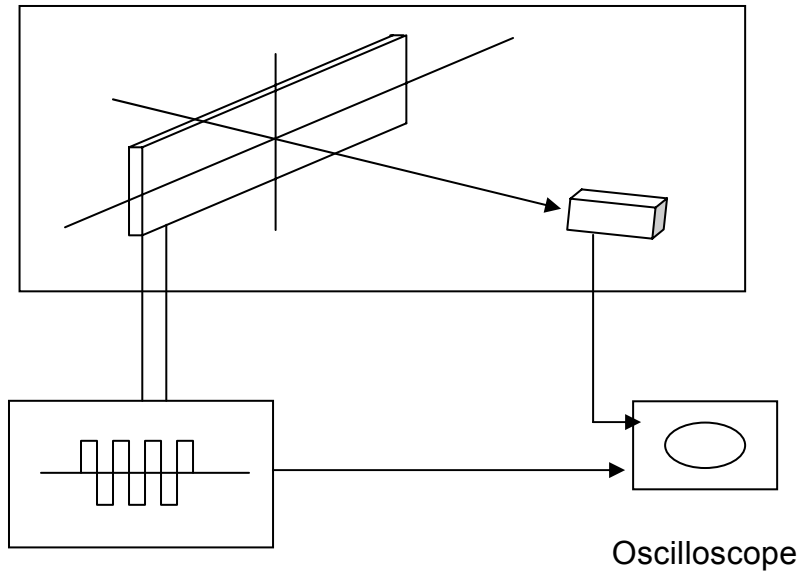
WARNING:

A BACKLIGHT IS A KIND OF CURRENT DEVICE,IT MUST CONNECT A RESISTANCE FOR LIMITING CURRENT ,OR IT WILL BE DAMAGED.

3.The LCD Measuring Method and Equipment

1. Threshold Voltage and Response Time Measuring

(1) Equipment



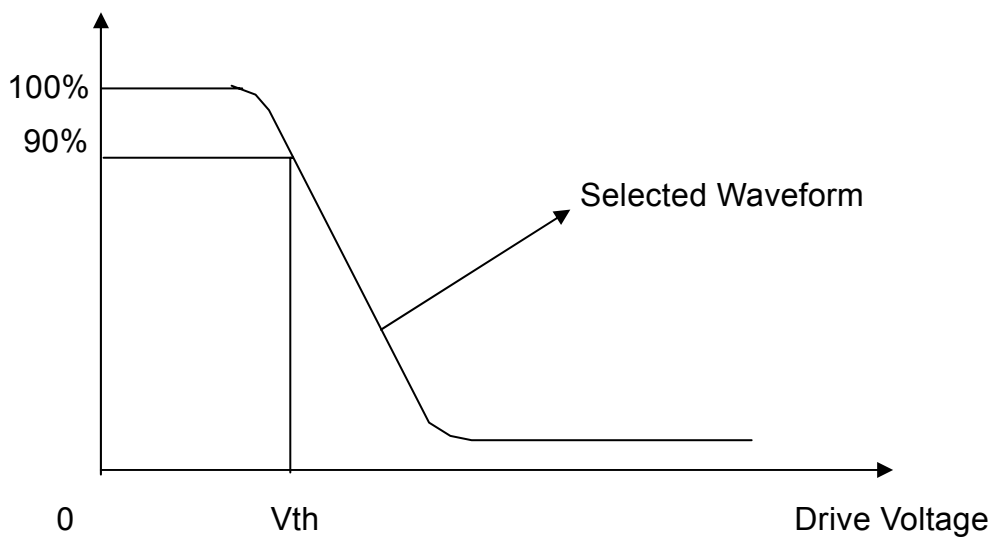
Waveform Generator

Oscilloscope

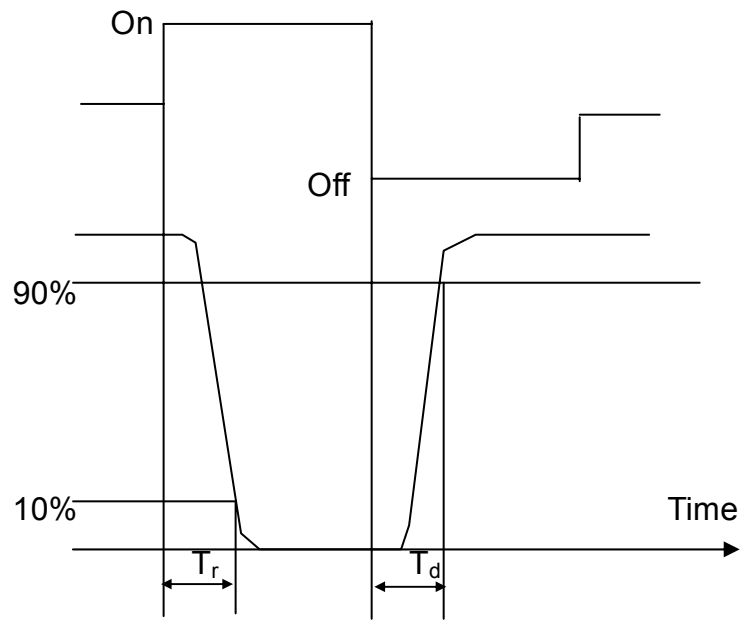
(2) Definition

A. Threshold Voltage (V_{th})

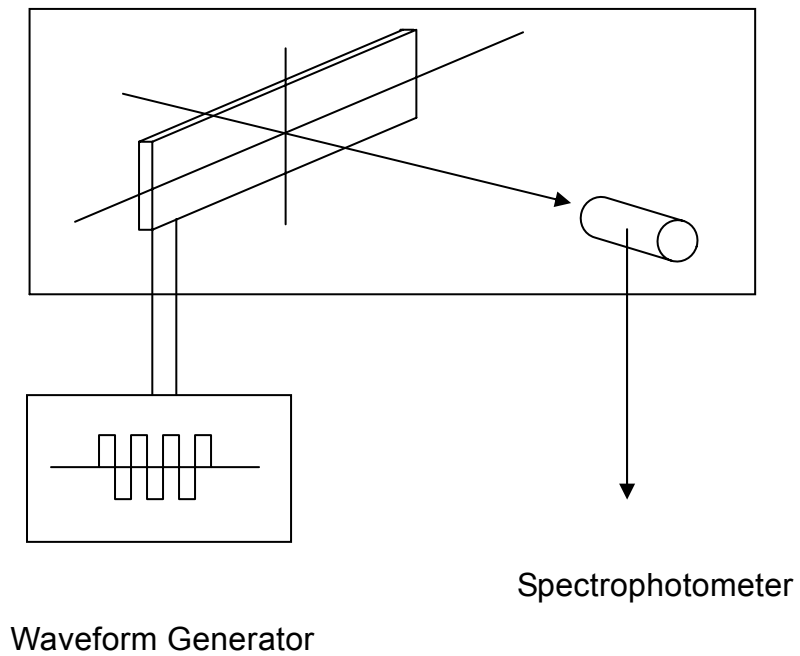
Brightness



B. Response Time

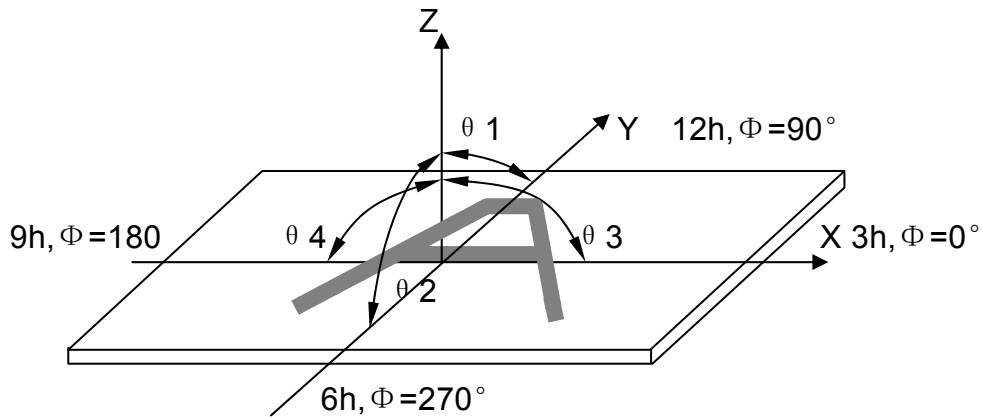


2. Contrast Measuring (1) Equipment



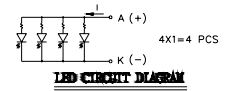
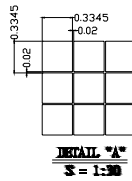
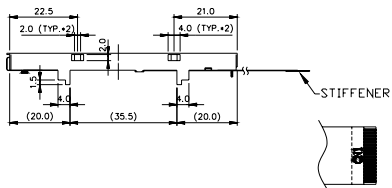
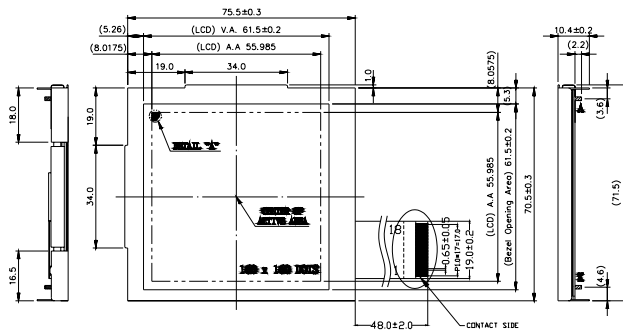
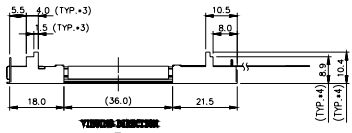
(2)Definition:

A. Viewing Angle:



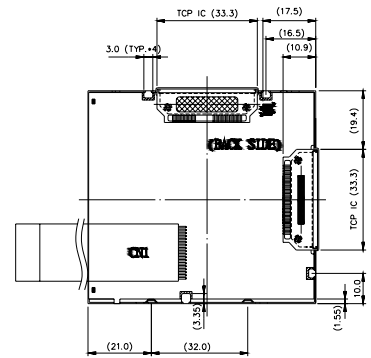
B. Contrast Ratio (Positive)

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



LED Backlight Specification:

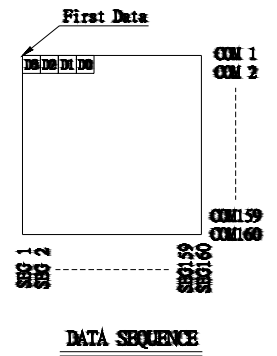
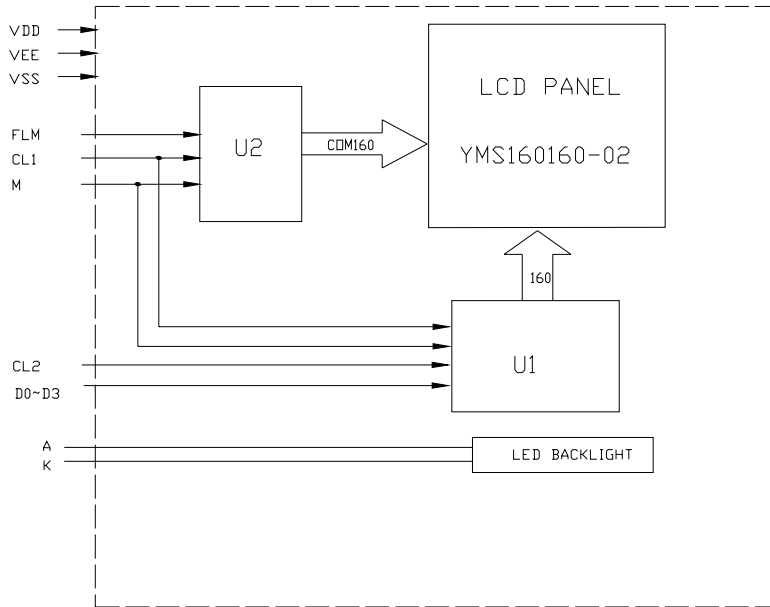
ITEM	Color		WHITE	
	MIN	MAX	TYP	MAX
Avg. I of DR. C.I.E.	0.10	0.31	0.31	0.31
Avg. Y of DR. C.I.E.	Y	0.10	0.21	0.31
Forward Current	I _f	-	-	30 mA
Forward Voltage	V _f	-	3.5	V



Unspecified Tolerance: ± 0.2

Note:

1. Operating Voltage: 3.3V, LCD Drive Voltage: 20.0V
2. Drive method: 1/160 Duty, 1/13 Bias
3. Viewing Direction: 6:00
4. Operating Temp: 0°C ~ 50°C
5. Storage Temp: -20°C ~ 70°C
6. Display type: FSTN, Positive
7. LCD DRIVER: NT7701H-TAB18
8. BACKLIGHT: LED/W
9. Frame Material: Covered With Nickel (0.4mm)



INTERFACE (CU1)

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	VSS	Power Supply (0V)	10	DB	H/L Display Data
2	FLM/FRM0	First Line Mark For Channel Scan	11	DI	
3	CL1(LP)	H → L DMA Latch Pulse	12	DO	
4	CL2(CLK)	Clock Pulse For Segment shift register	13	NC	No Connection
5	MFRQ	H/L Frame Reverse Signal	14	NC	
6	VDD	H/L Supply For Logic (+3.3V)	15	NC	
7	NC	No Connection	16	NC	
8	VEE	Power Supply For LCD	17	A	Power Supply For LED Backlight
9	DB	H/L Display Data	18	K	Power Supply For LED Backlight