Crystal Clear Technology

Product Specification

G2432W34xxxxx

(5.7 inch QVGA)

Without controller

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1.0 Table of Contents

2.0 Record of revision

Rev	Date	Item	Page	Comment	Originator	Checked By
1.0	10/04/10			Initial Release	Khairiah	Azhar

3.0 General specification

Display format: Graphics, 240 (H) x 320 (W)

Pixel size: 0.33 (H) x 0.33 (W) mm

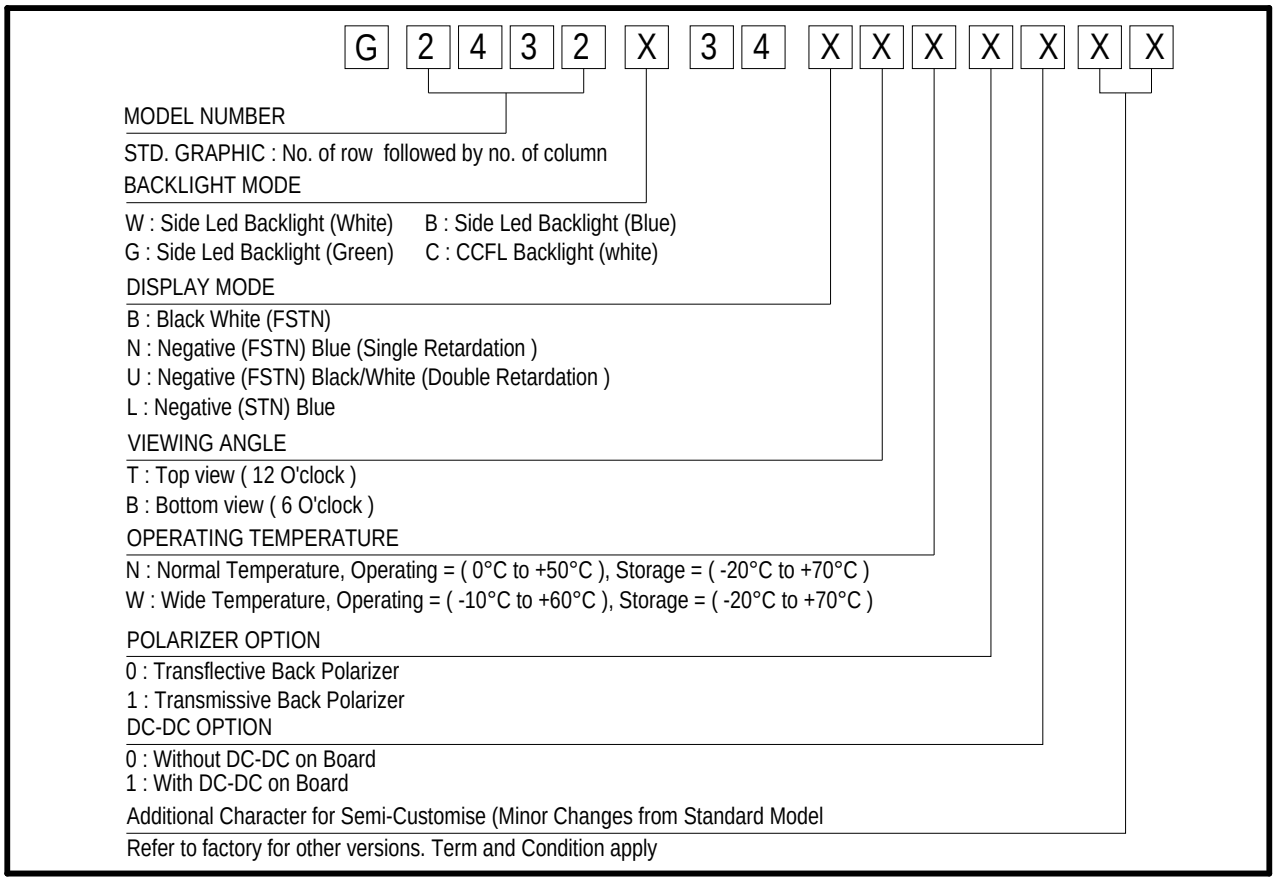
Pixel pitch: 0.36 (H) x 0.36 (W) mm

View area: 92.0 (H) x 122.0 (W) mm

Active area: 86.37 (H) x 115.37 (W) mm

General dimensions: 109.0 (H) x 160.0 (W) x 10.0 max (T) mm

Driver : NT7701 and NT7702 or equivalent



4.0 Absolute maximum rating (at Vss = 0V, ambient temperature = 25°C)

NO	ITEM	SIMBOL	MIN	MAX	UNIT
1.	Power Supply voltage (Logic)	$V_{DD} - V_{SS}$	0	7.0	V
2.	Power Supply voltage (LCD Driver)	$V_{DD} - V_0$	-	23.6	V
3.	Operating Temperature	T_{op}	Refer page 3		°C
4.	Storage Temperature	T_{st}	-20ºC to +70ºC		°C

5.0 Electrical characteristics

NO	ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
1.	Power Supply voltage (Logic)	$V_{DD} - V_{SS}$	-	4.5	5.0	5.5	V
2.	Power Supply voltage (V_{LCD})	V_{DD}-V_0	25°C	22.5±5%			V
3.	Input Voltage	V_{IH}	-	$0.9V_{DD}$	-	V_{DD}	V
		V_{IL}	-	0	-	$0.1V_{DD}$	V
4	Current Supply	I_{DD}	$V_{DD} - V_{SS}$ = 5V $V_{DD} - V_{SS}$= 30V		30.0	50.0	mA

5.1 Backlight Options LED.

NO	COLOR	FORWARD VOLTAGE (V)			FORWARD CURRENT (mA)			MIN BRIGHTNESS (cd/m2) *
		Min	Typ.	Max	Min	Typ.	Max	
1.	White		5.0		-	150	200	400

*Note : 1. Brightness measured at backlight surface.
2. On LCD surface, brightness is only about 10% to 15% of backlight brightness.
3. Lifetime of backlight 20k hrs.

6.0 Environmental requirements

NO	ITEM	CONDITION
1.	Operating Temperature	Refer page 3
2.	Storage Temperature	-20ºC to +70ºC
3.	Operating Humidity	5% to 95%RH
4.	Cycle Test	0°C @ 30 min to 50°C @ 30min for 1 cycle run for 10 cycles
5.	Lifetime	50000 HOURS (excluding backlight)

Note:
1. The background on LCD has the possibility to be changed in different temperature range.

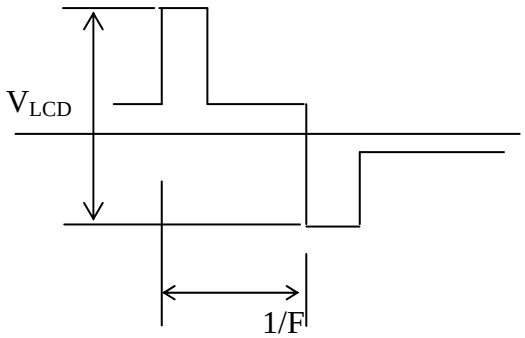
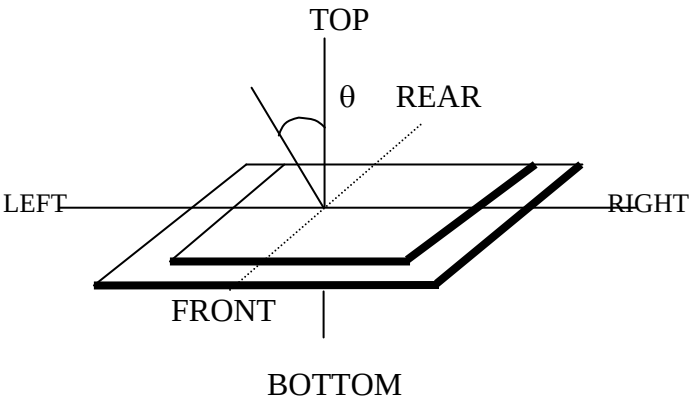
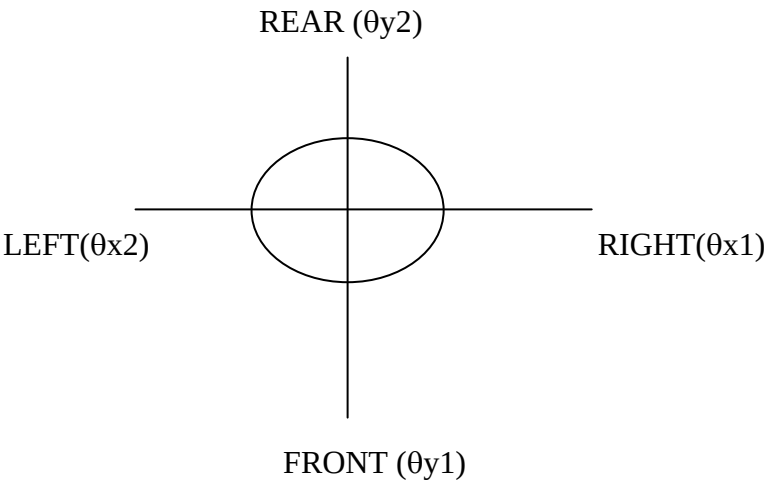
7.0 LCD specification

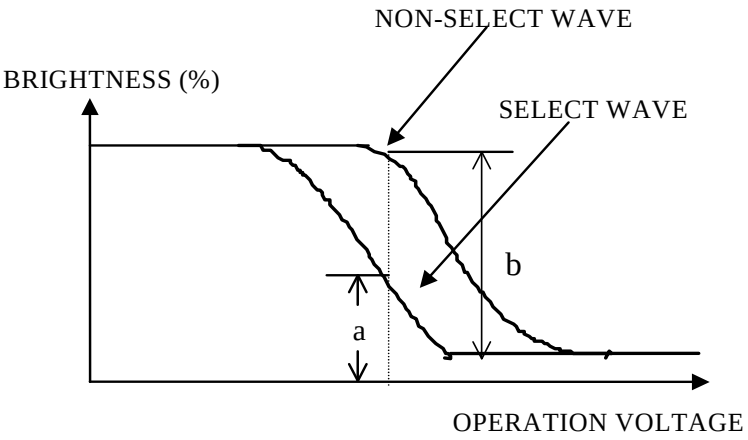
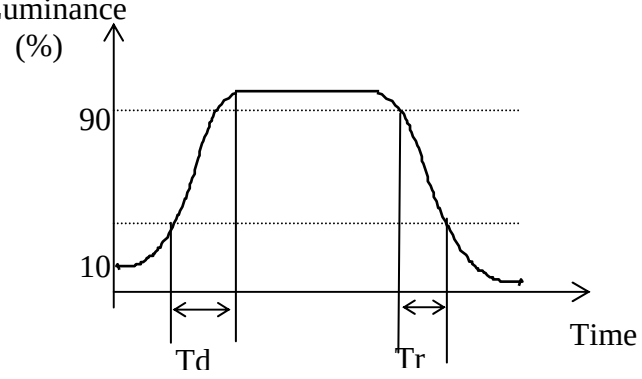
7.1 Electro-optical characteristics (at ambient temperature = 25°C)

NO	ITEM	SYMBOL	CONDITION	LCD TYPE							REF.
				STN YG	STN GREY	STN -VE BLUE/ PURPLE	FSTN +VE B/W	FSTN –VE BLUE	FSTN -VE TRUE B/W	FSTN -VE TRI AXIS	
1	Operating Voltage (Volt)	V_{LCD}	θ = 0 Cr = max	22.5 ± 5%							7.1.1
2	Viewing Angle (Deg)	θ x 1	CR ≥ 2 V_{LCD} = 22.5V	+20	+15	+35	+20	+35	+30	+40	7.1.2
		θ x 2		-20	-15	-35	-20	-35	-35	-40	
		θ y 1		-25	-20	-30	-25	-30	-30	-50	
		θ y 2		+25	+20	+30	+25	+30	+30	+30	
3	Contrast Ratio	CR	θ = 0^0 V_{LCD} =22.5V	2.5	2.0	5.5	2.5	5.5	15	15	7.1.3
4	Response Time (msec)	Rise Time (Tr)	θ = 0^0	400							7.1.4
		Decay Time (Td)	θ = 0^0	400							

Note:

1. Viewing angle data is based on bottom view product by default. Should it be a top view product, values are then swap.
2. Contrast ratio is based on typical data when using white colour as backlight.
3. Equipment Used Eldim; Ez Contrast 120R , Spot Size = 2mm

NO	CHARACTERISTICS	DEFINITIONS
7.1.1	***Definition of Operating Voltage (V_{LCD})***	 V_{LCD} : Operating Voltage F : Frame Frequency
7.1.2	***Definition of Viewing Angle***	 

7.1.3	***Definition of Contrast Ratio***	 Contrast Ratio = Brightness of non-selected state (b) / Brightness of selected state (a) ***Conditions*** (a) Operating Voltage: V_{LCD} (b) Temperature: 25°C (c) Viewing Angle, $\theta = 0^{o}$
7.1.4	*Response Time*	Luminance (%)  Tr: Measured between 10% and 90% of LCD segment maximum response with $V_{ON.}$ Td: With voltage switches to zero and the instant LCD segment reaches 10% of its maximum response.

8.0 Interface

8.1	***Display Controller***	-
8.2	***Display Driver***	NT7701 and NT7702
8.3	***Duty Cycle***	1/240
8.4	***Pin-out Assignments***	

CONNECTOR 2 (CN2) AND CONNECTOR 3 (CN3)			
Pin No	**Symbol**	**Function**	
1	VSS	Ground terminal of module	
2	VCC	Supply terminal of module	
3	D0	4 - Bit parallel mode display data	8 - Bit parallel mode display data
4	D1		
5	D2		
6	D3		
7	D4		
8	D5		
9	D6		
10	D7		
11	XCK	X-driver shift clock. (Data shift)	
12	DISPOFF	Display off signal	
13	LP	Latch pulse for column driver. Shift clock for row driver.	
14	FR	LCD drive output AC Signal	
15	YD	Frame Signal	
16	Vadj	Liquid Crystal Display contrast adjust	
17	VEE	Positive supply for Liquid Crystal Drive	
18	VSS	Ground terminal of module	
19	A	Backlight power supply	
20	K	Backlight ground	

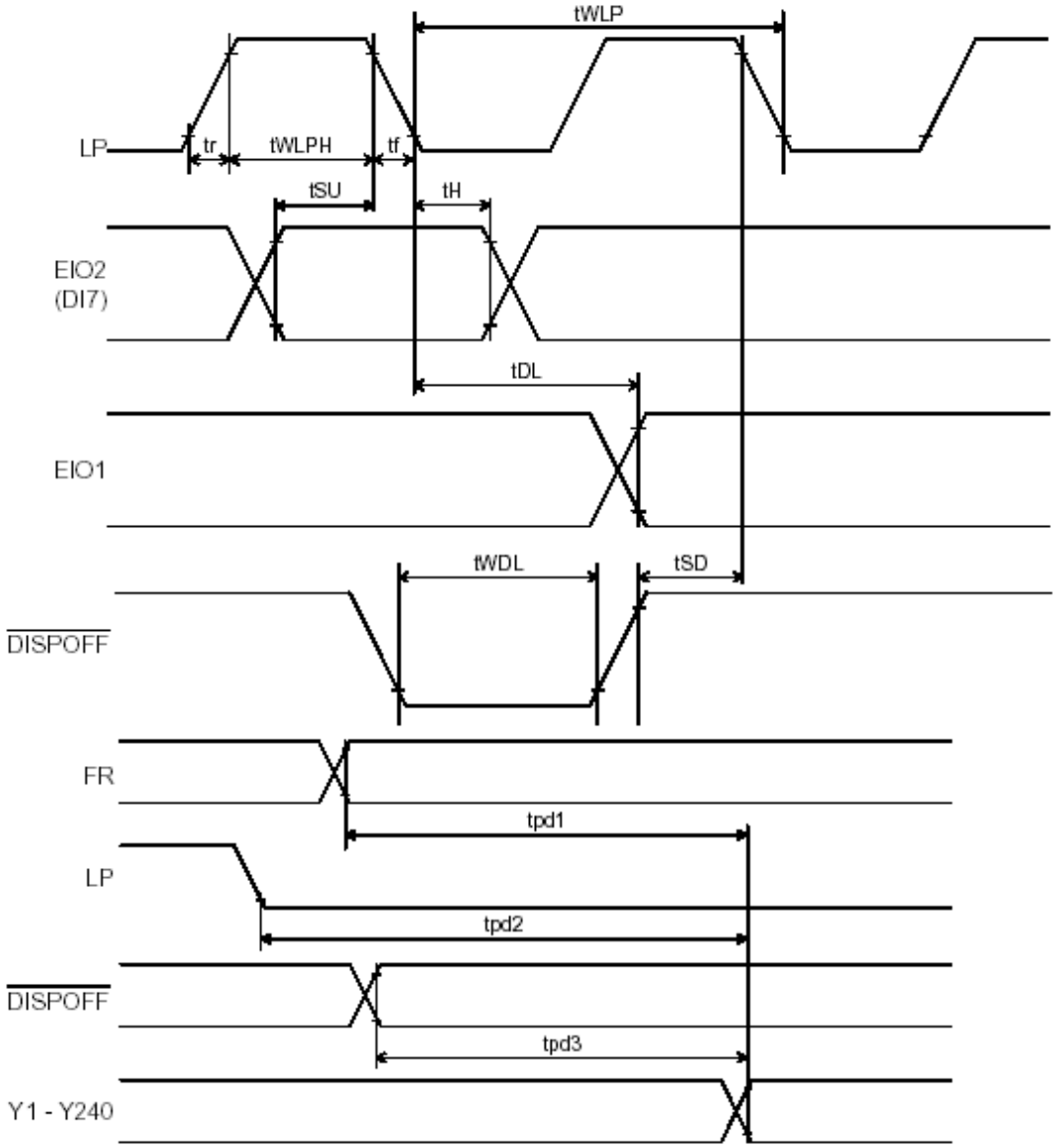
Display Data format selection (only for module without controller):

Segment Mode	R6	R7	R8	R9	R18	R19	Pin Function
4-bit Parallel Mode	Used	Used	Used	Used	Used	NC	Low
8-bit Parallel Mode	NC	NC	NC	NC	NC	Used	High

Note: NC mean not connected

9.0 Timing Diagram For LCD Driver.

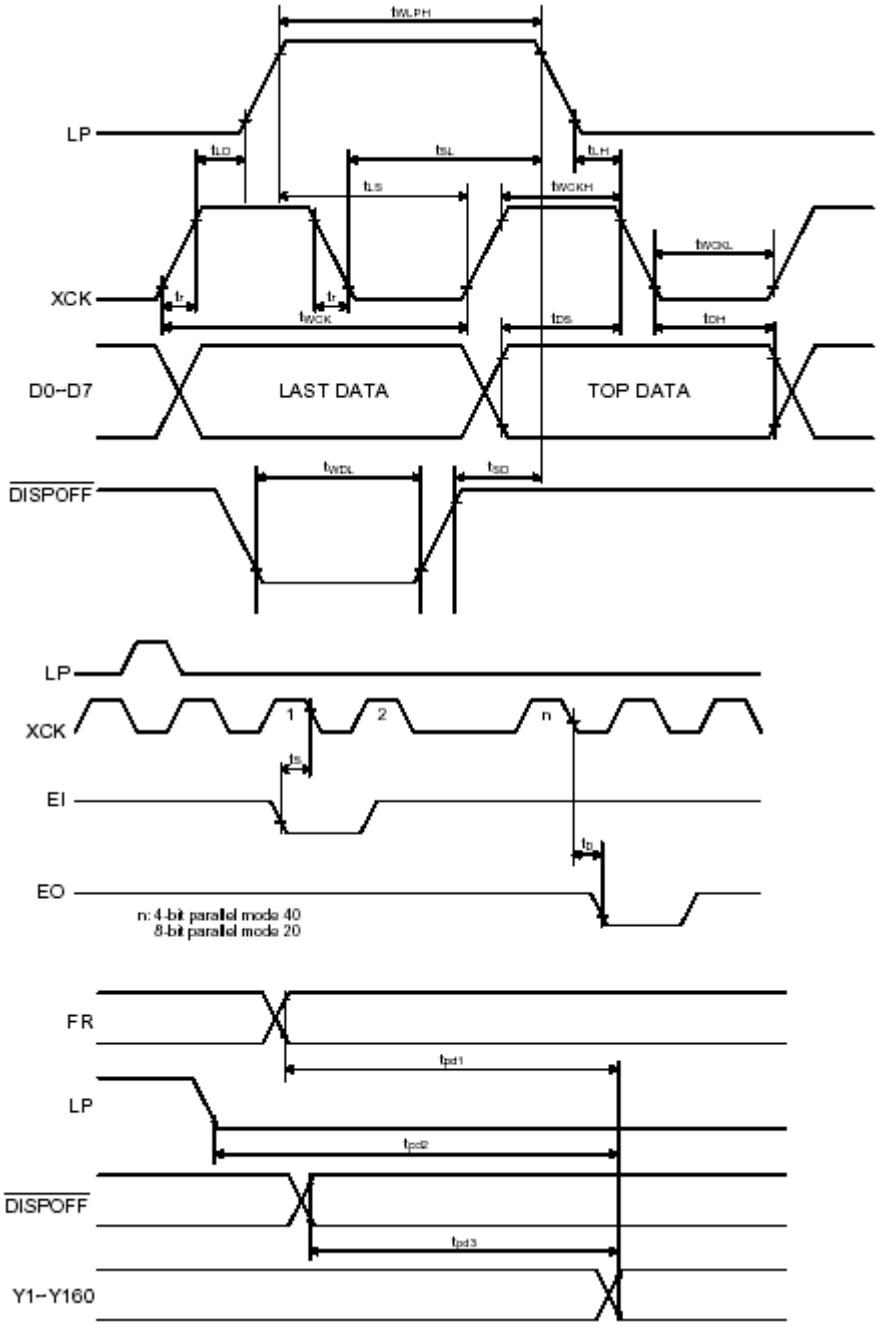
9.1 LCD Driver Timing Characteristics



Timing Characteristic for NT7702

Common Mode (V_{SS} = V_5 = 0V, V_{DD} = 2.5 - 5.5V, V_0 = 15 to 30V and T_A = -30 to +85°C, unless otherwise noted)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Shift clock period	t_{WLP}	250	-	-	ns	t_r, $t_f \leqq$ 20ns
Shift clock "H" pulse width	t_{WLPH}	15	-	-	ns	V_{DD} = +5.0V ± 10%
		30	-	-	ns	V_{DD} = +2.5 - +4.5V
Data setup time	t_{SU}	30	-	-	ns	
Data hole time	t_H	50	-	-	ns	
Input signal rise time	t_r		-	50	ns	
Input signal fall time	t_f		-	50	ns	
$\overline{\text{DISPOFF}}$ Removal time	t_{SD}	100	-	-	ns	
$\overline{\text{DISPOFF}}$ enable pulse width	t_{WDL}	1.2	-	-	µs	
Output delay time (1)	t_{DL}	-	-	200	ns	C_L = 15pF
Output delay time (2)	t_{pd1}, t_{pd2}	-	-	1.2	µs	C_L = 15pF
Output delay time (3)	t_{pd3}	-	-	1.2	µs	C_L = 15pF



Timing Characteristic for NT7701

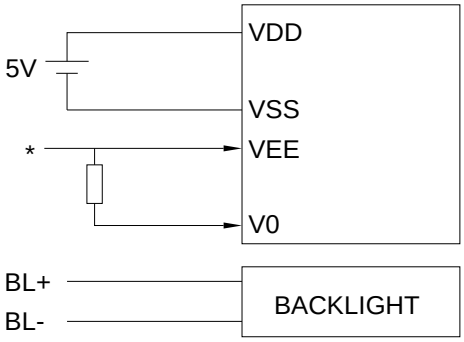
Segment Mode 1 (V_{SS}=0V, V_{DD}= 4.5~5.5V, V_0=15 to 30, and T_A=-20 to +85°C, unless otherwise noted.)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Shift clock period	t_{WCK}	71	-		ns	tr, tf≦10ns, Note 1
Shift clock "H" pulse width	t_{WCKH}	23	-		ns	
Shift clock "L" pulse width	t_{WCKL}	23	-		ns	
Data setup time	t_{DS}	10	-		ns	
Data hole time	t_{DH}	20	-		ns	
Latch pulse "H" pulse width	t_{WLPH}	23	-		ns	
Shift clock rise to Latch pulse rise time	t_{LD}	0	-		ns	
Shift clock fall to Latch pulse fall time	t_{SL}	25	-		ns	
Latch pulse rise to Shift clock rise time	t_{LS}	25	-		ns	
Latch pulse fall to Shift clock rise time	t_{LH}	25	-		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	21	-		ns	
$\overline{DISPOFF}$ Removal time	t_{SD}	100	-		ns	
$\overline{DISPOFF}$ enable pulse width	t_{WDL}	1.2	-		µs	
Output delay time (1)	t_D		-	40	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}-t_{WCKII} -t_{wckI})/2 is maximum in the case of high speed operation.

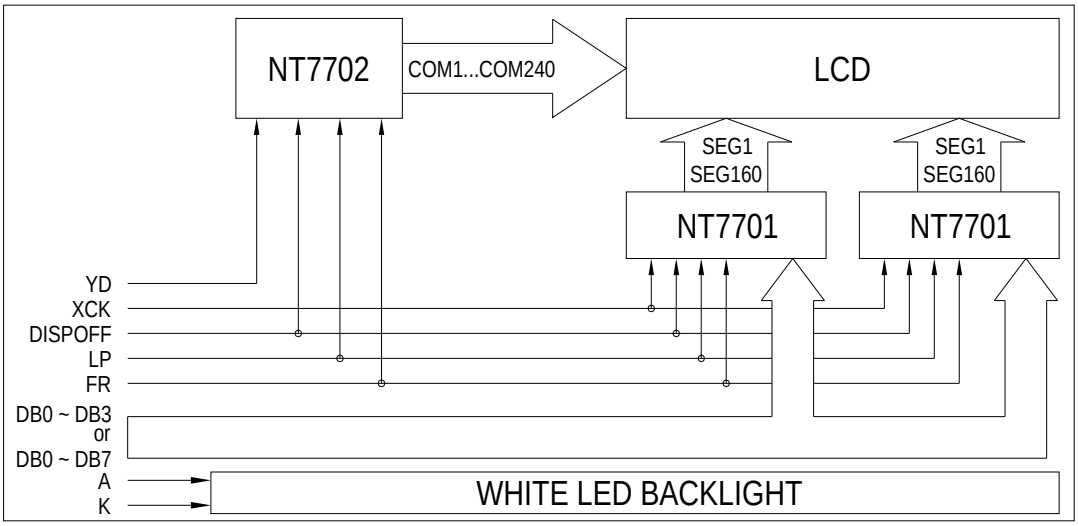
10. Power Supply



*WITH BUILT IN DC-DC
- VEE SUPPLIED BY INTERNAL DC-DC

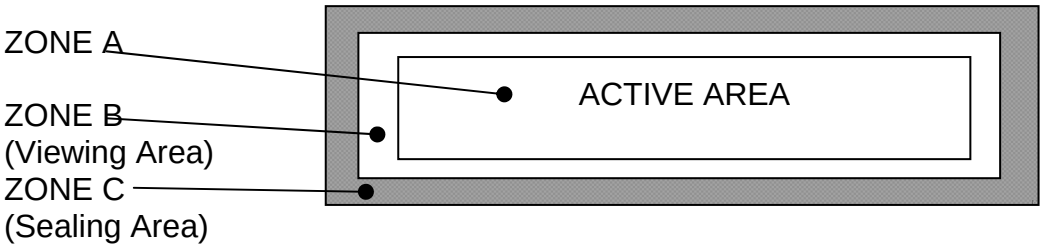
*WITHOUT DC-DC BUILT IN
- CUSTOMER NEED TO SUPPLY EXTERNAL VEE

11. Block Diagram



12. Quality Assurance

1. CRITERIA INVOLVED:



No.	ITEM
1.1	Black Spot, Foreign Materials, White Spot, Polarizer Damage

CRITERIA
Round Shape (solid figure)

Mean diameter = X (Long axis + short axis) /2	Maximum Acceptance Numbers		
	Zone A	Zone B	Zone C
X ≤ 0.10	Disregard	Disregard	Disregard
0.10 < X ≤ 0.15	3	3	
0.15 < X ≤ 0.25	1	2	
0.25 < X ≤ 0.35	1	1	
X > 0.35	0	0	

*The 1/3 or larger parts of individual dot has to be lighted on.The solid figure is that the defect has clear-cut outline at the optimum driving condition In both positive and negative, of which size does not change when the contrast changes.

Mean diameter = X (Long axis + short axis) /2	Maximum Acceptance Numbers		
	Zone A	Zone B	Zone C
X ≤ 0.60	Disregard	Disregard	Disregard
0.60 < X ≤ 0.70	3		
0.70 < X ≤ 0.80	1		
X > 0.80	0		

* The faded figure means that the defects has unclear outline at the optimum driving condition in both positive and negative, of which size seems to change when the contrast changes.

3) Linear (Fibrous)

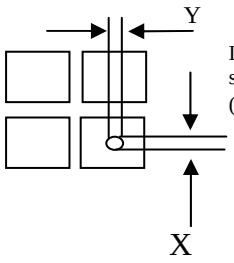
Size		Maximum Acceptable No.		
Length	Width	Zone A	Zone B	ZoneC
Disregard	≤ 0.03mm	Disregard		Disregard
≤ 2mm	≤ 0.05mm	3		
≤ 1mm	≤ 0.10mm			
−−−−−−−	> 0.10mm	Due to (1) round defect		

* Length is the whole length and width the maximum width of foreign material.

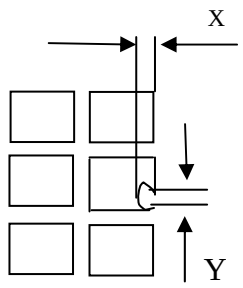
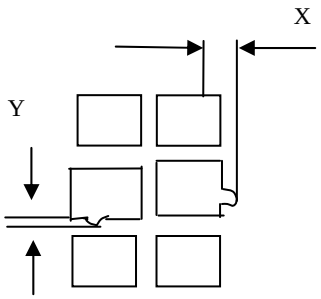
Total amount of spotting defects including round and linear:-
5 are the totally permissible numbers of defects in Zone A & B including above (1), (2), (3). In case of the total permissible, the minimum distance has to be 5mm or larger between every couple of defects.

APPENDIX II

NO	ITEM
1.2	Pin Hole

	Maximum acceptance numbers: 1 per dot 3 per display area (active area)
	Maximum acceptance numbers: 1 per dot 3 per display area (active area) *¾ or larger part of dot area has to be effective for display.*

1.3 Deformed display dot

1) Lacked deformation 	0.15 ≥ X 0.15 ≥ Y
2) Added deformation 	0.02 > X 0.02 > Y

1.4 Polarizer Air Bubbles D= 

Size	Maximum Acceptable No.		
	Zone A	Zone B	Zone C
D ≤ 0.30mm	Disregard	Disregard	Disregard if the polarizer not lifted up pealed off
D ≤ 0.50mm	2		
0.50 < D ≤ 0.60mm	1	2	
D> 0.60mm	0		
Total amount of bubbles	3 are the totally permissible numbers of bubble		

REMARK

All the other items of inspection that are not included herein must be determined by the "Limit Standard"sample, which were occasionally set up with the mutual consent of both parties. In every case of the items setup with the Limit Standard, the Limit Standard always takes precedence over the other means of definition.

13. Precaution for using LCM

1. Liquid Crystal Display (LCD)

LCD is made up of glass, organic sealant, organic fluid and polymer based polarizers. The following precautions should be taken when handling.

b) Keep the temperature within the range of use and storage. Excessive temperature and humidity could cause polarization degredation, polarizer peel off or bubble.

c) Do not contact the exposed polarizer with anything harder than HB pencil lead. To clean dust off the display surface, wipe gently with cotton, chamois or other soft material soaked in petroleum benzin.

d) Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or colour fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.

e) Glass can be easily chipped or cracked from rough handling, especially at corners and edges.

f) Do not drive LCD with DC voltage.

2. Liquid Crystal Display Modules.

2.1 Mechanical Considerations

LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modification. The following should be noted.

a) Do not tamper in any way with the tabs on the metal frame.

b) Do not modify the PCB by drilling extra holes, changing its outline, moving its component or modifying its pattern.

c) Do not touch the elastomer connector, especially insert a backlight panel (for example, EL)

d) When mounting a LCM make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.

a) Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels.

2.2 Static Electricity

LCM contains CMOS LSI's and the same precaution for such devices should apply, namely

a) The operator should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such as the LSI pads, the copper leads on the PCB and the interface terminals with any parts of the human body.

b) The modules should be kept in antistatic bags or other containers to static for storage.

c) Only properly grounded soldering irons should be used.

d) If an electric screwdriver is used, it should be well grounded and shielded from commutator spark.

e) The normal static prevention measures should be observed for work clothes and working benches, the latter conductive (rubber) mat is recommended.

f) Since dry air is inductive to statics, a relative humidity of 50-60% is recommended.

2.3 Soldering

a) Solder only to the I/O terminals.

b) Use only soldering irons with proper grounding and no leakage.

c) Soldering temperature: 280^{o}C

d) Soldering time: 3 to 4 sec

e) Use eutectic solder with resin flux fill.

f) If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed afterwards.

2.4 Operation

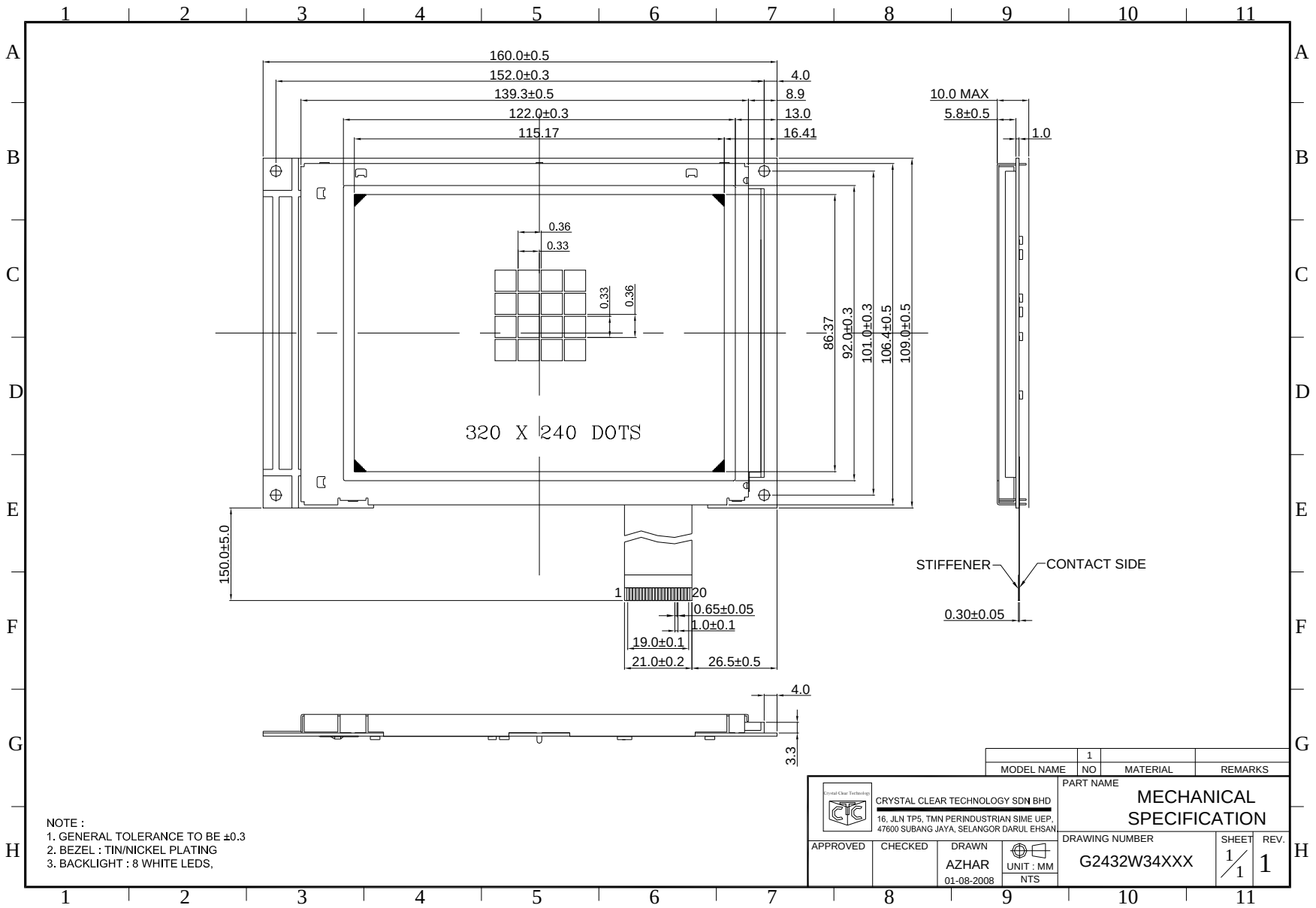
a) The contras can be adjusted by varying the LCD driving voltage V0
b) Driving voltage should be kept within specified range, excess voltage shortens display life.
c) Response time increases with decrease in temperature.
d) Display may turn black or dark blue at temperature above its operational range, this is (however not pressing on the viewing area) may cause the segments to appear “fractured”.
e) Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear “fractured”.

2.5 Storage

If any fluid leaks out of the damage glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.

2.6 Limited Warranty

Unless otherwise agreed between Crystal Clear Technology and customer, Crystal Clear Technology will replace or repair any of its LCD and LCM which is found to be defective electrically and visually when inspected in accordance with Crystal Clear Technology acceptance standards, for a period of one year from date of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of Crystal Clear Technology is limited to repair and/or replacement on the terms set forth above. Crystal Clear Technology will not responsible for any subsequent or consequential events.


160.0±0.5
152.0±0.3
139.3±0.5
122.0±0.3
115.17
4.0
8.9
13.0
16.41
0.36
0.33
0.33
0.36
86.37
92.0±0.3
101.0±0.3
106.4±0.5
109.0±0.5
320 X 240 DOTS
150.0±5.0
1
20
0.65±0.05
1.0±0.1
19.0±0.1
21.0±0.2
26.5±0.5
4.0
3.3
10.0 MAX
5.8±0.5
1.0
STIFFENER
CONTACT SIDE
0.30±0.05
NOTE :
1. GENERAL TOLERANCE TO BE ±0.3
2. BEZEL : TIN/NICKEL PLATING
3. BACKLIGHT : 8 WHITE LEDS,
MODEL NAME
NO
1
MATERIAL
REMARKS
CRYSTAL CLEAR TECHNOLOGY SDN BHD
16, JLN TP5, TMN PERINDUSTRIAN SIME UEP,
47600 SUBANG JAYA, SELANGOR DARUL EHSAN.
PART NAME
MECHANICAL SPECIFICATION
APPROVED
CHECKED
DRAWN
AZHAR
01-08-2008
UNIT : MM
NTS
DRAWING NUMBER
G2432W34XXX
SHEET
1/1
REV.
1

Crystal Clear Technology
16 Jalan TP5—Taman Perindustrian Sime UEP
47600 Subang Jaya—Selangor DE
Malaysia