Crystal Clear Technology

Product Specification

G2432W24xxxxx

(4.7 INCH QVGA SERIES)

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1.0 Table of Contents

2.0 Record of revision

Rev	Date	Item	Page	Comment	Originator	Checked By
1.0	23/07/10			Initial Release	Khairiah	Azhar

3.0 General specification

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

Pixel size: 0.28 (H) x 0.28 (W) mm

Pixel pitch: 0.30 (H) x 0.30 (W) mm

View area: 80.0 (H) x 105.0 (W) mm

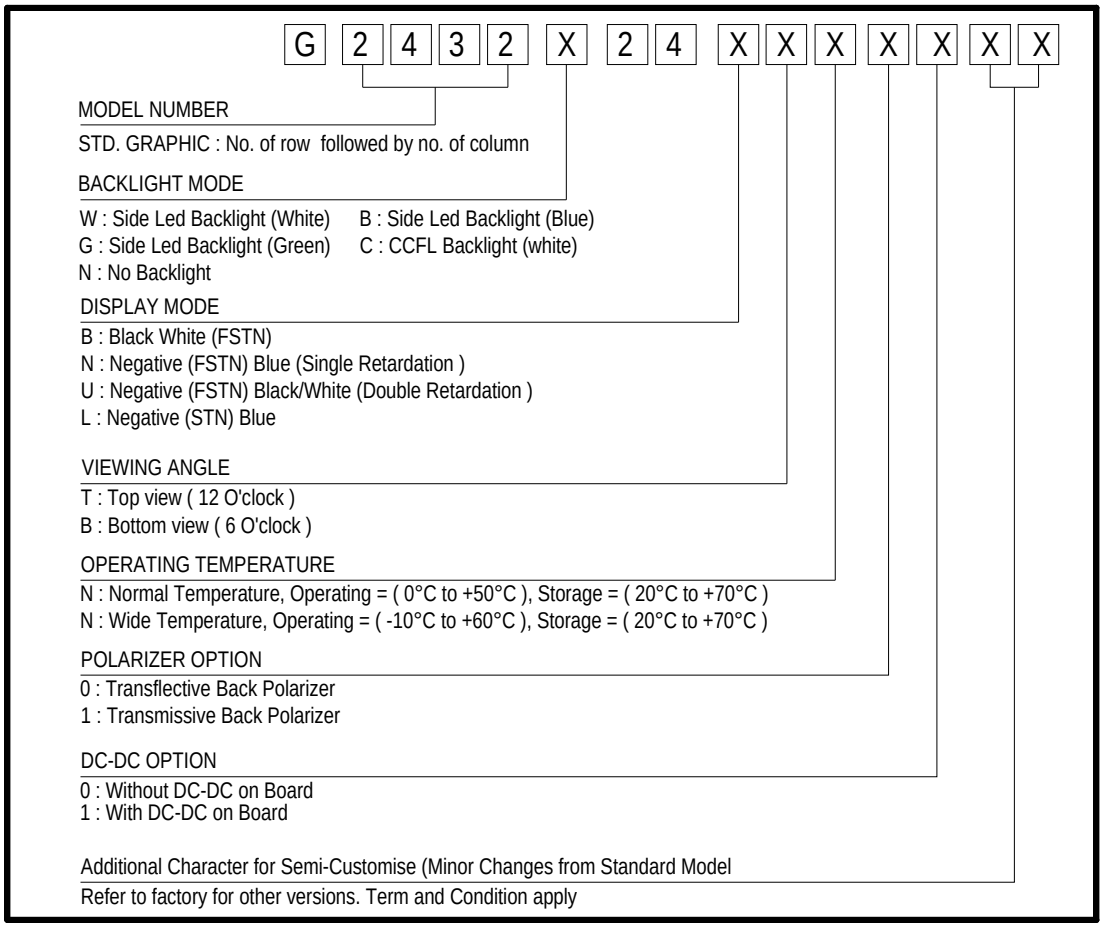
Active area: 71.98 (H) x 95.98 (W) mm

General dimensions: 96.9 (H) x 143.0 (W) x 11.0 max (T) mm

Controller: S1D13700

Driver : NT7701 and NT7702 or equivalent

Interface: Parallel



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)	$V_{DD} - V_0$	-	26.0	V
3.	Operating Temperature	T_{op}	Refer page 3		°C
4.	Storage Temperature	T_{st}	Refer page 3		°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}	-	$0.8V_{DD}$	-	V_{DD}	V
		V_{IL}	-	0	-	$0.3V_{DD}$	V
4.	Current Supply	I_{DD}	$V_{aDJ} - V_{SS} = 22.5V$	-	45	-	mA

5.1 Backlight Options

NO	COLOR	FORWARD VOLTAGE (V)			FORWARD CURRENT (mA)			MIN BRIGHTNESS (cd/m2) *
		Min	Typ.	Max	Min	Typ.	Max	
1.	White	-	5.0	-	-	90	100	300

*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: For Yellow Green = 50K hrs. For White = 20k hrs.

6.0 Environmental requirements

NO	ITEM	CONDITION
1.	Operating Temperature	Refer page 3
2.	Storage Temperature	Refer page 3
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: The background on LCD has the possibility to be changed in different temperature range.

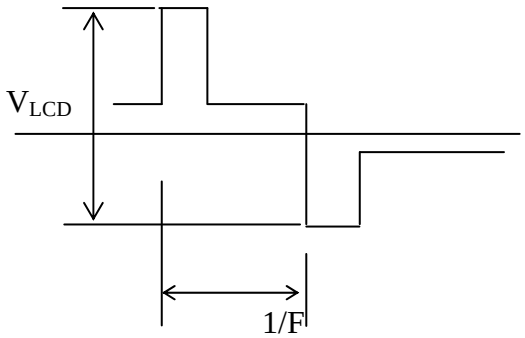
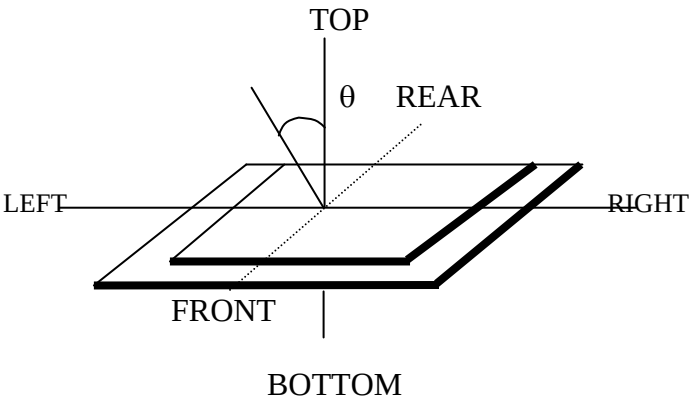
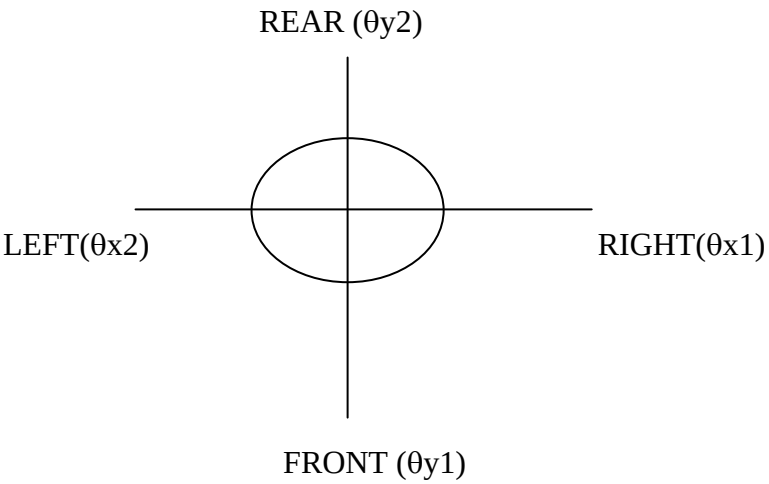
7.0 LCD specification

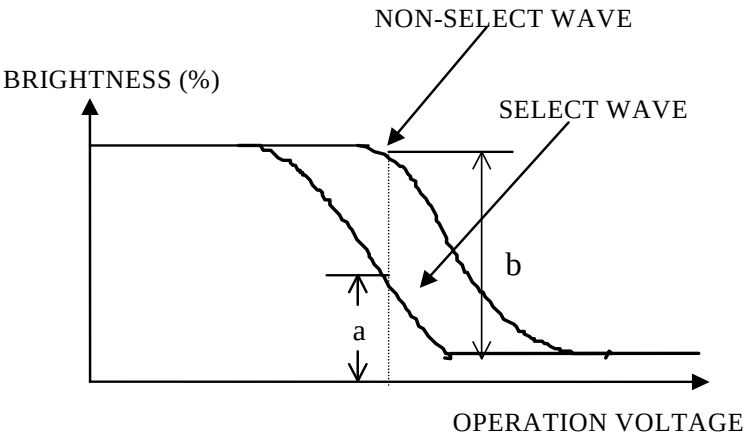
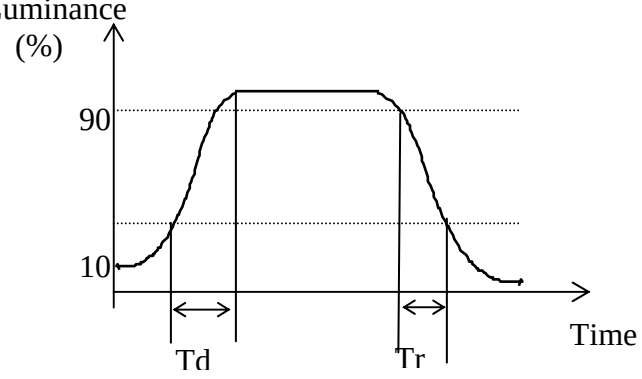
7.1 Electro-optical characteristics (at ambient temperature = 25°C)

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***	SID 13700F00
8.2	***Display Driver***	NT7701 and NT7702 or Equivalent
8.3	***Duty Cycle***	1/240
8.4	***Pin-out Assignments***	
CONNECTOR 1 (CN1)		
Pin No	**Symbol**	**Function**
1	A0	System address pin 0 * Indirect addressing mode – in conjunction with RD# and Write# determine the type of data present in the data bus
2	/CS	Chip select. This active-low input enables the S1D13700F00. It is usually connected to the output of an address decoder device that maps the S1D13700F00 into the memory space of the controlling microprocessor.
3 ~ 10	DB0-DB7	Input /output System data bus.
11	/RD	* When the Generic host bus interface is selected, this pin is the active-LOW read strobe (RD#). The S1D13700F00 data output buffers are enabled when this signal is low. * When the M6800 host bus interface is selected, this pin is the active-high enable clock (E). Data is read from or written to the S1D13700F00 when this clock goes high.
12	/WR	This input pin has multiple functions. • When the Generic host bus interface is selected, this signal is active-low write strobe (WR#). The bus data is latched on the rising edge of this signal. • When the M6800 host bus interface is selected, this signal is the read/write control signal (R/W#). Data is read from the S1D13700F00 if this signal is high, and written to the S1D13700F00 if it is low.
13	/RES	This active-low input performs a hardware reset of the S1D13700F00 which sets all internal registers to their default States and forces all signals to their inactive states.
14	K	Backlight ground
15	A	Backlight power supply
16	VSS	Ground terminal of module
17	VEE	Positive supply for Liquid Crystal Drive
18	VCC	Supply terminal of module
19	Vadj	Liquid Crystal Display contrast adjust
20	*SEL1	Select Host bus interface SEL1 = low, Generic Bus SEL1 = high, M6800 Family Bus

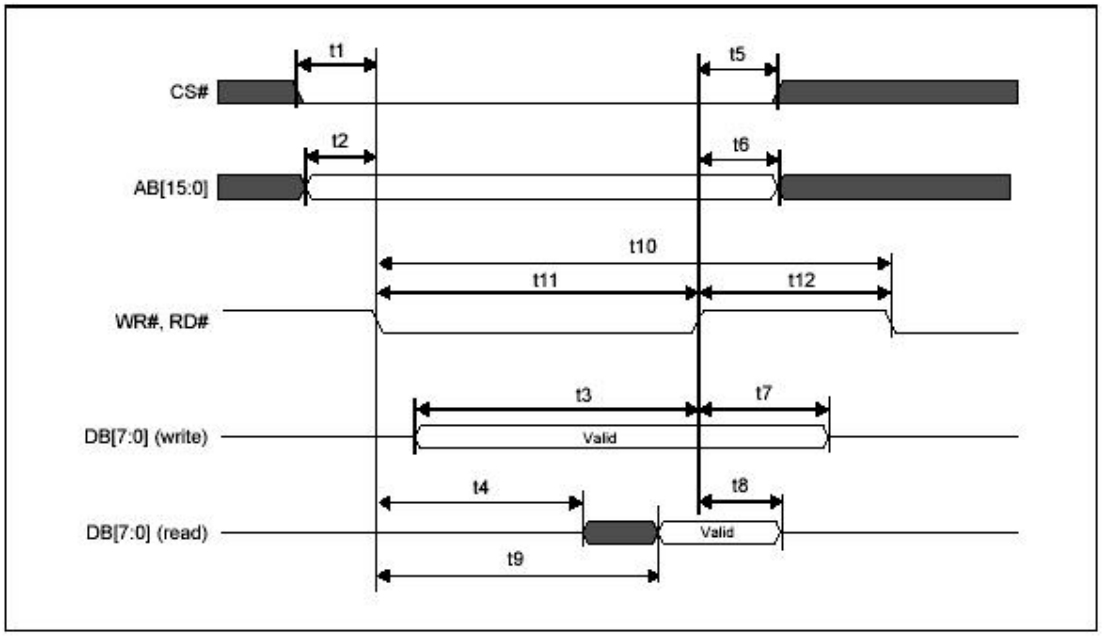
*** Selection can be done by software or hardware. To use hardware option Remove R117 and put 0ohm to R26 (for generic) or to R25 (for M6800)**

9.0 Timing Diagram

Note: This module has been designed for Indirect addressing mode (A15-A1 pins are connected to VSS)

9.1 Timing Characteristic for SID13700

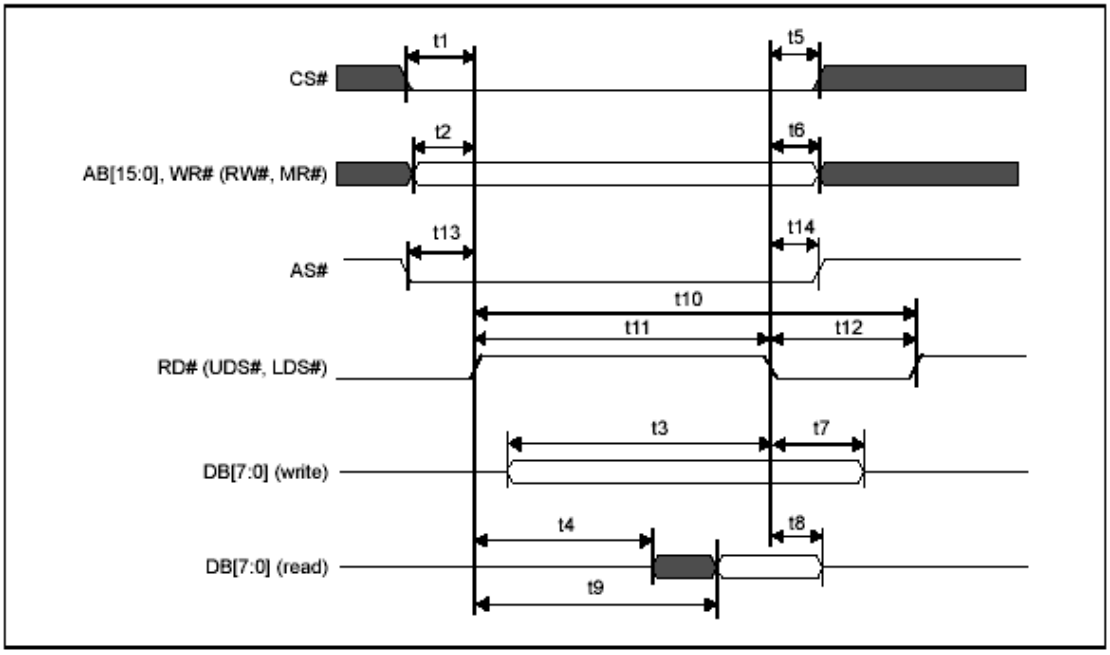
Generic Bus Direct/Indirect Interface without WAIT# Timing



Symbol	Parameter	3.3 Volt		5.0 Volt		Units
		Min	Max	Min	Max	
t1	CS# setup time	5	—	5	—	ns
t2	AB[15:0] setup time	5	—	5	—	ns
t3	DB[7:0] setup time to WR# rising edge (write cycle)	Note 2	—	Note 2	—	ns
t4	RD# falling edge to DB[7:0] driven (read cycle)	3	—	3	—	ns
t5	CS# hold time	7	—	7	—	ns
t6	AB[15:0] hold time	7	—	7	—	ns
t7	DB[7:0] hold time from WR# rising edge (write cycle)	5	—	5	—	ns
t8	DB[7:0] hold time from RD# rising edge (read cycle)	3	14	3	14	ns
t9	RD# falling edge to valid Data (read cycle)	—	Note 3	—	Note 3	ns
t10	RD#, WR# cycle time	Note 4	—	Note 4	—	ns
t11	RD#, WR# pulse active time	5	—	5	—	Ts
t12	RD#, WR# pulse inactive time	Note 5	—	Note 5	—	ns

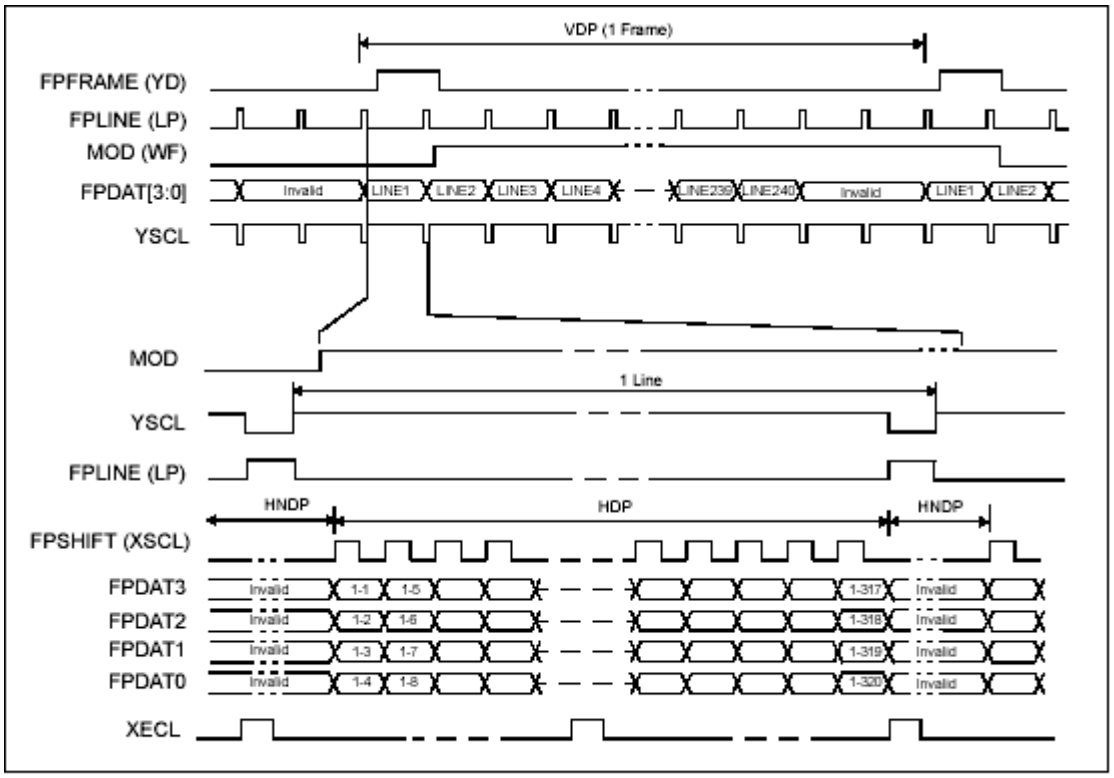
1. Ts = System clock period
2. t3min = 2Ts + 5
3. t9max = 4Ts + 18 (for 3.3V)
   = 4Ts + 20 (for 5.0V)
4. t10min = 6Ts (for a read cycle followed by a read or write cycle)
   = 7Ts + 2 (for a write cycle followed by a write cycle)
   = 10Ts + 2 (for a write cycle followed by a read cycle)
5. t12min = 1Ts (for a read cycle followed by a read or write cycle)
   = 2Ts + 2 (for a write cycle followed by a write cycle)
   = 5Ts + 2 (for a write cycle followed by a read cycle)

M6800 Family Bus Indirect Interface Timing

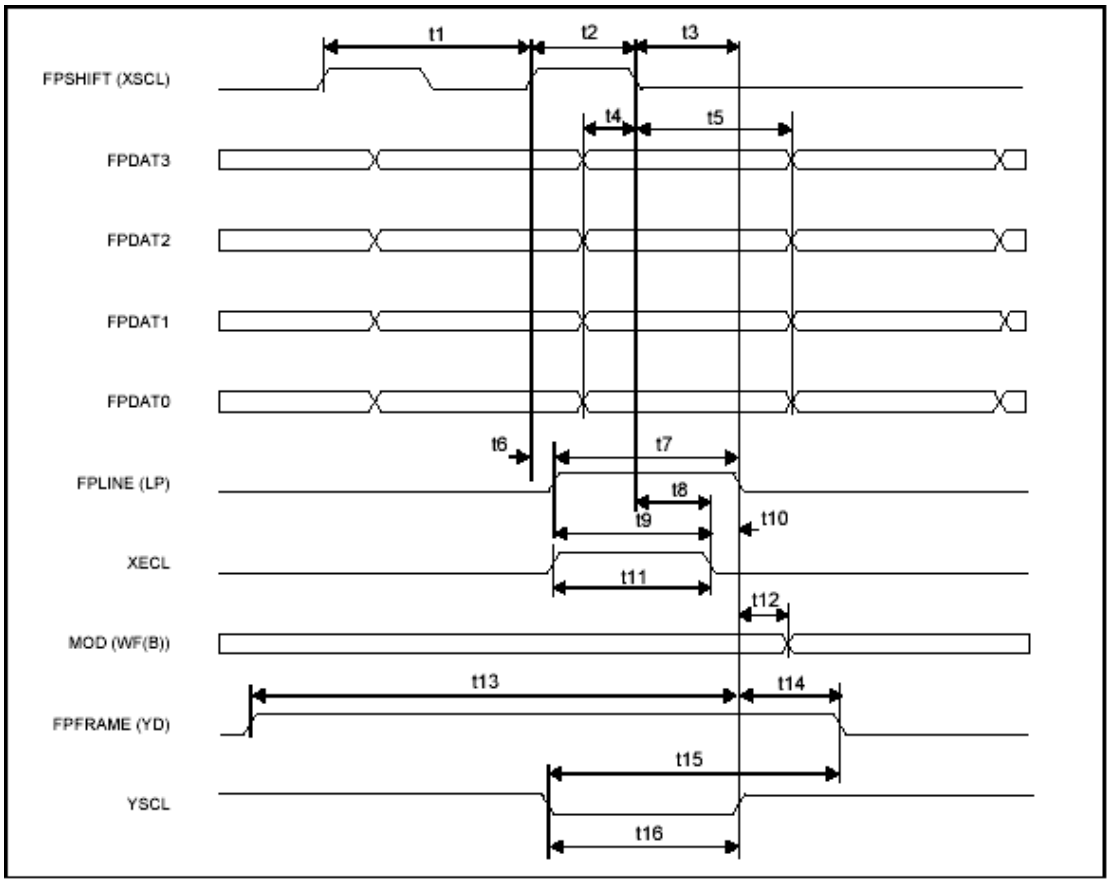


Symbol	Parameter	3.3 Volt		5.0 Volt		Units
		Min	Max	Min	Max	
t1	CS# setup time	5	—	5	—	ns
t2	AB[15:0] setup time	5	—	5	—	ns
t3	DB[7:0] setup time to RD# falling edge (write cycle)	Note 2	—	Note 2	—	ns
t4	RD# rising edge to DB[7:0] driven (read cycle)	3	—	3	—	ns
t5	CS# hold time	7	—	7	—	ns
t6	AB[15:0] hold time	7	—	7	—	ns
t7	DB[7:0] hold time from RD# falling edge (write cycle)	5	—	5	—	ns
t8	DB[7:0] hold time from RD# falling edge (read cycle)	2	55	2	55	ns
t9	RD# rising edge to valid Data	—	Note 3	—	Note 3	ns
t10	RD# cycle time	Note 4	—	Note 4	—	ns
t11	RD# pulse active time	5	—	5	—	Ts
t12	RD# pulse inactive time	Note 5	—	Note 5	—	ns
t13	AS# setup time	0	—	0	—	ns
t14	AS# hold time	0	—	0	—	ns

1. Ts = System clock period
2. t3min = 2Ts + 5
3. t9max = 4Ts + 18 (for 3.3V)
   = 4Ts + 20 (for 5.0V)
4. t13min = 6Ts (for a read cycle followed by a read or write cycle)
   = 7Ts + 2 (for a write cycle followed by a write cycle)
   = 10Ts + 2 (for a write cycle followed by a read cycle)
6. t15min = 1Ts (for a read cycle followed by a read or write cycle)
   = 2Ts + 2 (for a write cycle followed by a write cycle)
   = 5Ts + 2 (for a write cycle followed by a read cycle)



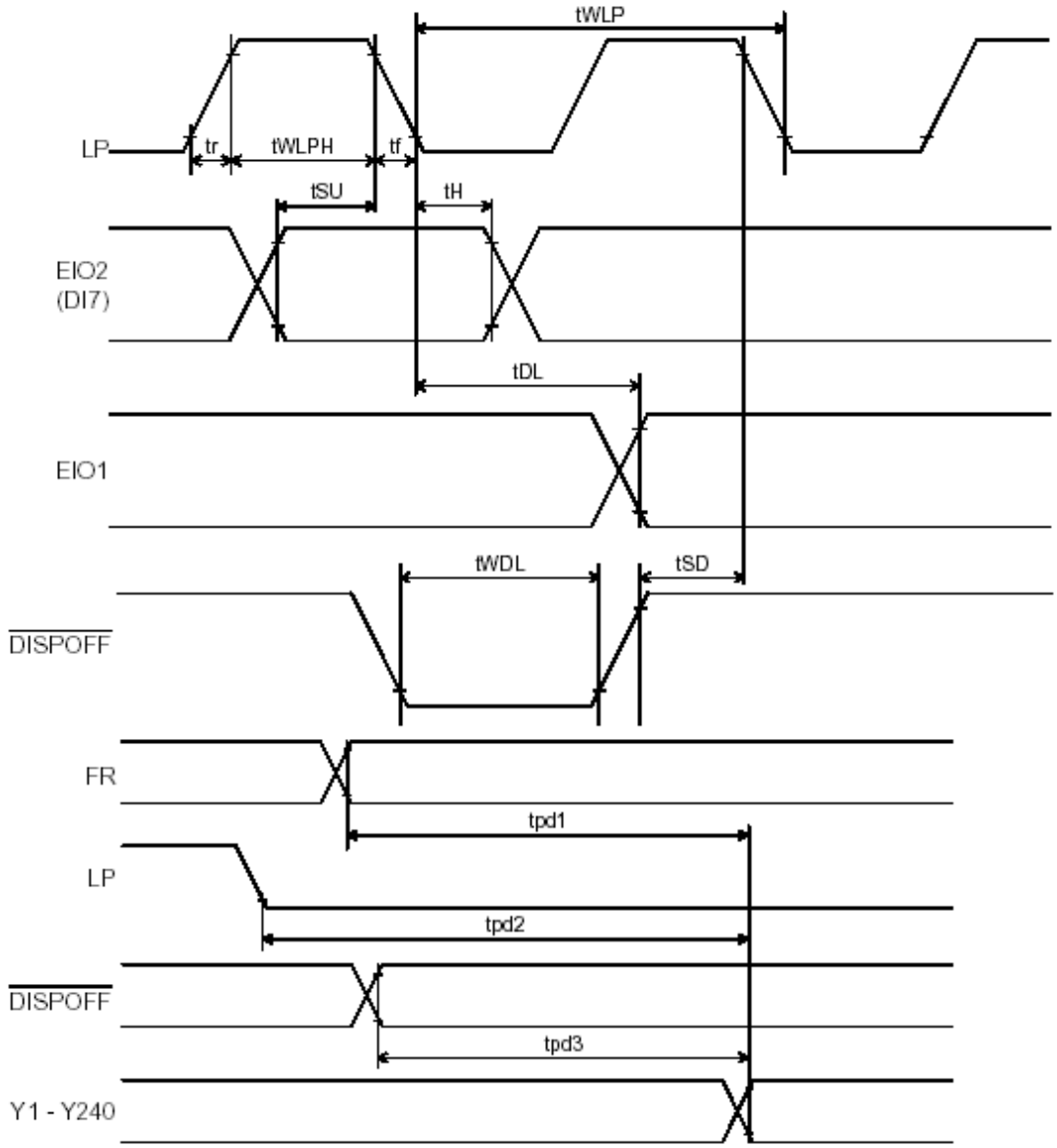
Monochrome 4-Bit Panel Timing



Symbol	Parameter	3.3 Volts		5.0 Volts		Units
		Min	Max	Min	Max	
t1	FPSHIFT cycle time	1	—	1	—	Tc (Note 2)
t2	FPSHIFT pulse width	0.5Tc - 5	—	0.5Tc - 4	—	ns
t3	Latch data setup time from FPSHIFT falling edge	0.5Tc - 5	—	0.5Tc - 4	—	ns
t4	FPDAT[3:0] setup to FPSHIFT falling edge	0.5Tc - 5	—	0.5Tc - 4	—	ns
t5	FPDAT[3:0] hold from FPSHIFT falling edge	0.5Tc - 5	—	0.5Tc - 4	—	ns
t6	FPLINE rising edge delay from FPSHIFT rising edge	0	4	0	4	ns
t7	Latch pulse width	Tc - 5	—	Tc - 4	—	ns
t8	XECL falling edge setup time to FPSHIFT falling edge	0.25Tc -5	—	0.25Tc - 4	—	ns
t9	XECL falling edge setup time from FPLINE rising edge	0.75Tc - 5	—	0.75Tc - 4	—	ns
t10	XECL falling edge hold time to FPLINE falling edge	Tc - 8	—	Tc - 8	—	ns
t11	XECL pulse width	0.75Tc - 5	—	0.75Tc - 4	—	ns
t12	Permitted MOD delay time	—	4	—	4	ns
t13	FPLINE falling edge from FPFRAME rising edge	2Tc - 10	—	2Tc - 10	—	ns
t14	FPLINE falling edge to FPFRAME falling edge	2Tc	—	2Tc	—	ns
t15	FPFRAME falling edge hold time from YSCL falling edge	3Tc - 10	—	3Tc - 10	—	ns
t16	YSCL pulse width	Tc - 5	—	Tc - 4	—	ns

1. Ts = System clock period
2. Tc = FPSHIFT cycle time
   = 4Ts when CNF[1:0] = 00
   = 8Ts when CNF[1:0] = 01
   = 16Ts when CNF[1:0] = 10

9.2 LCD Driver Timing



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	
$\overline{DISPOFF}$ Removal time	t_{SD}	100	-	-	ns	
$\overline{DISPOFF}$ 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.

10.0 Instruction Set and Sample Code

10.1 Indirect addressing Command

Class	Register Address	Command	Register Description	Control Byte Value	No. of Bytes
System Control	8000h - 8007h	SYSTEM SET	Initializes device and display	40h	8
	8008h	POWER SAVE	Enters standby mode	53h	0
Display Control	8009h - 800A	DISP ON/OFF	Enables/disables display and display attributes	58h 59h	1
	800Bh - 8014h	SCROLL	Sets screen block start addresses and sizes	44h	10
	8015h - 8016h	CSRFORM	Sets cursor type	5Dh	2
	8017h	CSRDIR	Sets direction of cursor movement	4Ch - 4Fh	0
	8018h	OVLAY	Sets display overlay format	5Bh	1
	8019h - 801Ah	CGRAM ADR	Sets start address of character generator RAM	5Ch	2
	801Bh	HDOT SCR	Sets horizontal scroll position	5A	1
Drawing Control	801Ch - 801Dh	CSRW	Sets cursor address	46h	2
	801Eh - 801Fh	CSRR	Reads cursor address	47h	2
	8020h	GRAYSCALE	Sets the Grayscale depth (bpp)	60h	1
Memory Control		MEMWRITE	Writes to memory	42h	n/a
		MEMREAD	Reads from memory	43h	

Generic Indirect Addressing Command/Write/Read

A0	$\overline{WR}$	$\overline{RD}$	
1	0	1	Command [C]
1	1	0	Parameter Read [P#]
0	0	1	Parameter Write [P#]

M6800 Indirect Addressing Command/Write/Read

A0	R/$\overline{W}$	E	
1	0	1	Command write
1	1	1	Display data and cursor address read
0	0	1	Display data and parameter write

For more details, please refer to SID13700 datasheet

10.2 Sample code for initialisation

Example of LCD initialisation using Generic Indirect Addressing (8051)

This code is written in assembly language.

```
INIT_LCD:

; System set

        MOV     R3, #40H            ; C = 40H
        LCALL   WRITE_COMM

        MOV     R3, #30H            ; M0 = 0  internal CG ROM
        LCALL   WRITE_PARAM         ; M1 = 0  CG RAM is 32 characters
                                    ; M2 = 0  8 lines per character
                                    ; W/S= 0  single panel drive
                                    ; IV = 1  no top-line compensation
        MOV     R3, #87H            ; FX = 8 pixels (Horizontal Char Size)
        LCALL   WRITE_PARAM         ; WF = 1 two-frame AC Drive

        MOV     R3, #07H            ; FY = 8 pixels (Vertical Char Size)
        LCALL   WRITE_PARAM

        MOV     R3, #27H            ; C/R = 40 characters/bytes per line
        LCALL   WRITE_PARAM

        MOV     R3, #2DH            ; TC/R =  ( Fosc = 40MHz, Ffr = 100Hz )
        LCALL   WRITE_PARAM

        MOV     R3, #0EFH           ; L/F = 240 display lines
        LCALL   WRITE_PARAM

        MOV     R3, #28H            ; AP virtual screen horizontal size is 40 addresses
        LCALL   WRITE_PARAM

        MOV     R3, #00H
        LCALL   WRITE_PARAM

        ; scroll set

        MOV     R3, #44H            ; scroll command C = 44H
        LCALL   WRITE_COMM

        MOV     R3, #00H            ; SAD 1 = 0000H, character/text
        LCALL   WRITE_PARAM

        MOV     R3, #00H
        LCALL   WRITE_PARAM

        MOV     R3, #0F0H           ; SL 1 = 240 display lines
        LCALL   WRITE_PARAM

        MOV     R3, #0B0H           ; SAD 2 =04B0H
        LCALL   WRITE_PARAM

        MOV     R3, #04H
        LCALL   WRITE_PARAM
```

```
MOV         R3, #0F0H           ; SL 2 = 240 display lines
LCALL       WRITE_PARAM


MOV         R3, #00H            ; P7-P10 -XX (don't care)
LCALL       WRITE_PARAM

MOV         R3, #00h
LCALL       WRITE_PARAM

MOV         R3, #00H
LCALL       WRITE_PARAM

MOV         R3, #00H
LCALL       WRITE_PARAM
; cursor form

MOV         R3, #5DH
LCALL       WRITE_COMM
MOV         R3, #04H            ; 4 pixels wide
LCALL       WRITE_PARAM
MOV         R3, #86H            ; 6 pixels high, block
LCALL       WRITE_PARAM

; cursor direction

MOV         R3, #4CH            ; right direction
LCALL       WRITE_COMM

; HDOT SCR

MOV         R3, #5AH
LCALL       WRITE_COMM
MOV         R3, #00H
LCALL       WRITE_PARAM

; OVLAY

MOV         R3, #5BH
LCALL       WRITE_COMM
MOV         R3, #01H            ; XOR,2LAYERS,TEXT AND GRAPHIC
LCALL       WRITE_PARAM

; Display OFF
LCALL  DISP_OFF

; clear TEXT
LCALL  CLEAR_GRPH

; clear graphic
LCALL  CLEAR_GRPH

; Display ON
 LCALL DISP_ON

RET
```

10.3 On chip character code

	Upper 4 bits															
Lower 4 bits	0	1	2	3	4	5	6	7	8	8	A	B	C	D	E	F
0				0	@	P	'	p				ー	タ	三		
1			!	1	A	Q	a	q			。	ア	チ	ム		
2			"	2	B	R	b	r			「	イ	ツ	メ		
3			#	3	C	S	c	s			」	ウ	テ	モ		
4			$	4	D	T	d	t			、	エ	ト	ヤ		
5			%	5	E	U	e	u			・	オ	ナ	ユ		
6			&	6	F	V	f	v			ヲ	カ	ニ	ヨ		
7			'	7	G	W	g	w			ァ	キ	ヌ	ラ		
8			(	8	H	X	h	x			ィ	ク	ネ	リ		
9			)	9	I	Y	i	y			ゥ	ケ	ノ	ル		
A			*	:	J	Z	j	z			ェ	コ	ハ	レ		
B			+	;	K	[	k	{			ォ	サ	ヒ	ロ		
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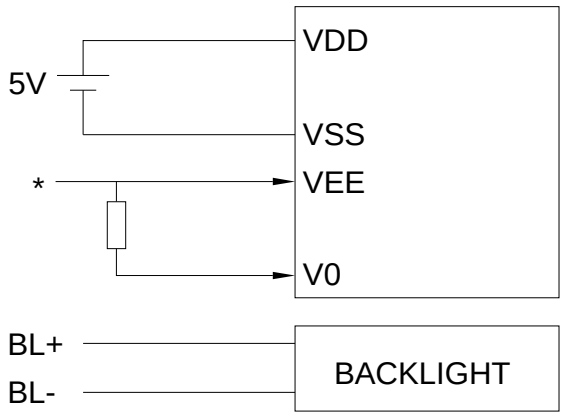
F			/	?	O	_	o	←			ッ	ソ	マ	゜		

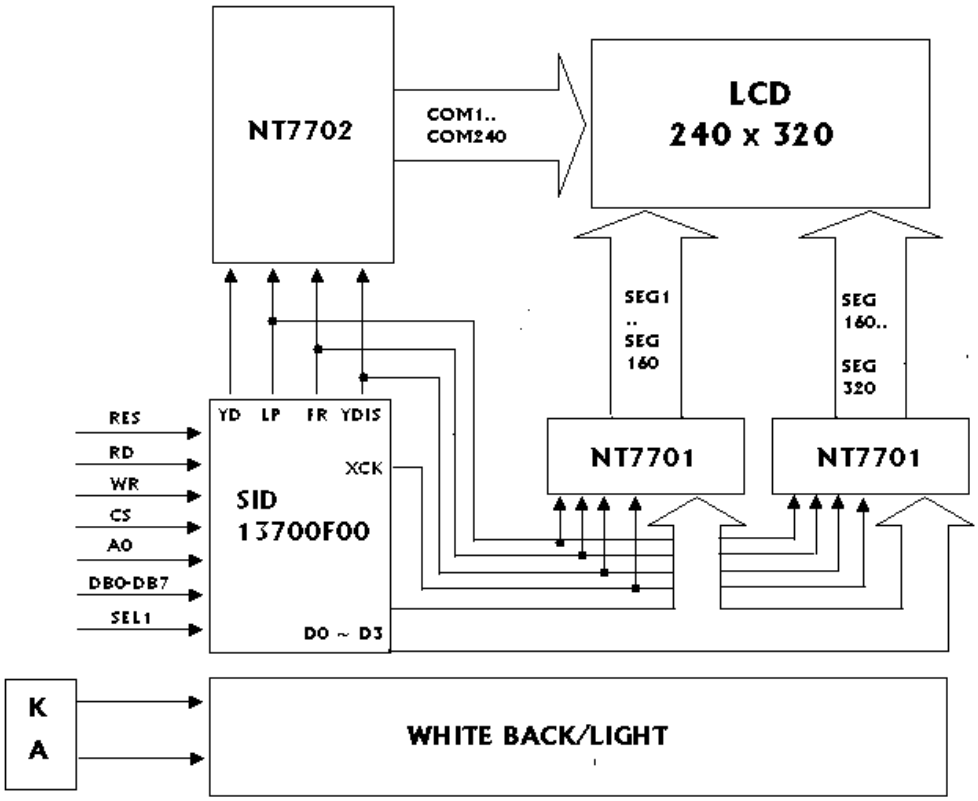
11. Power Supply



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

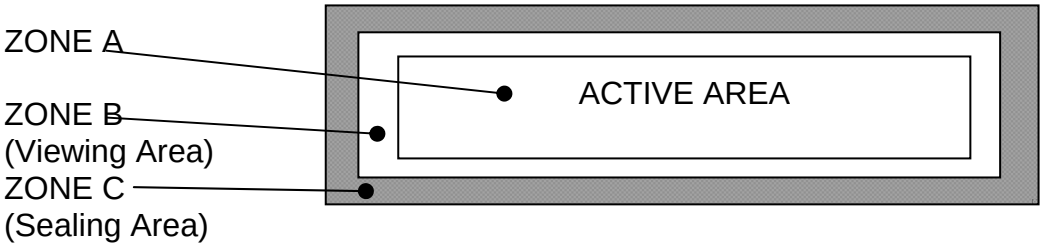
*WITHOUT DC-DC BUILT IN
- CUSTOMER NEED TO SUPPLY EXTERNAL VEE

12. Block Diagram



13. 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)

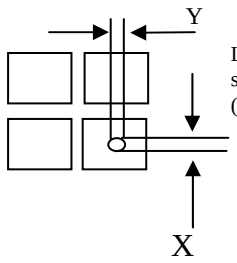
Size		Maximum Acceptable No.		
Length	Width	Zone A	Zone B	ZoneC
Disregard	≤ 0.03mm	Disregard		Disregard
≤ 2mm	≤ 0.05mm	3		
≤ 1mm	≤ 0.10mm			
−−−−−−−	> 0.10mm	Due to (1) round defect		

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

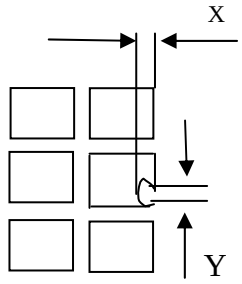
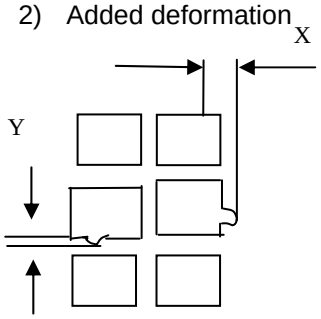
Total amount of spotting defects including round and linear:-
5 are the totally permissible numbers of defects in Zone A & B including above (1), (2), (3). In case of the total permissible, the minimum distance has to be 5mm or larger between every couple of defects.

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.

14. 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

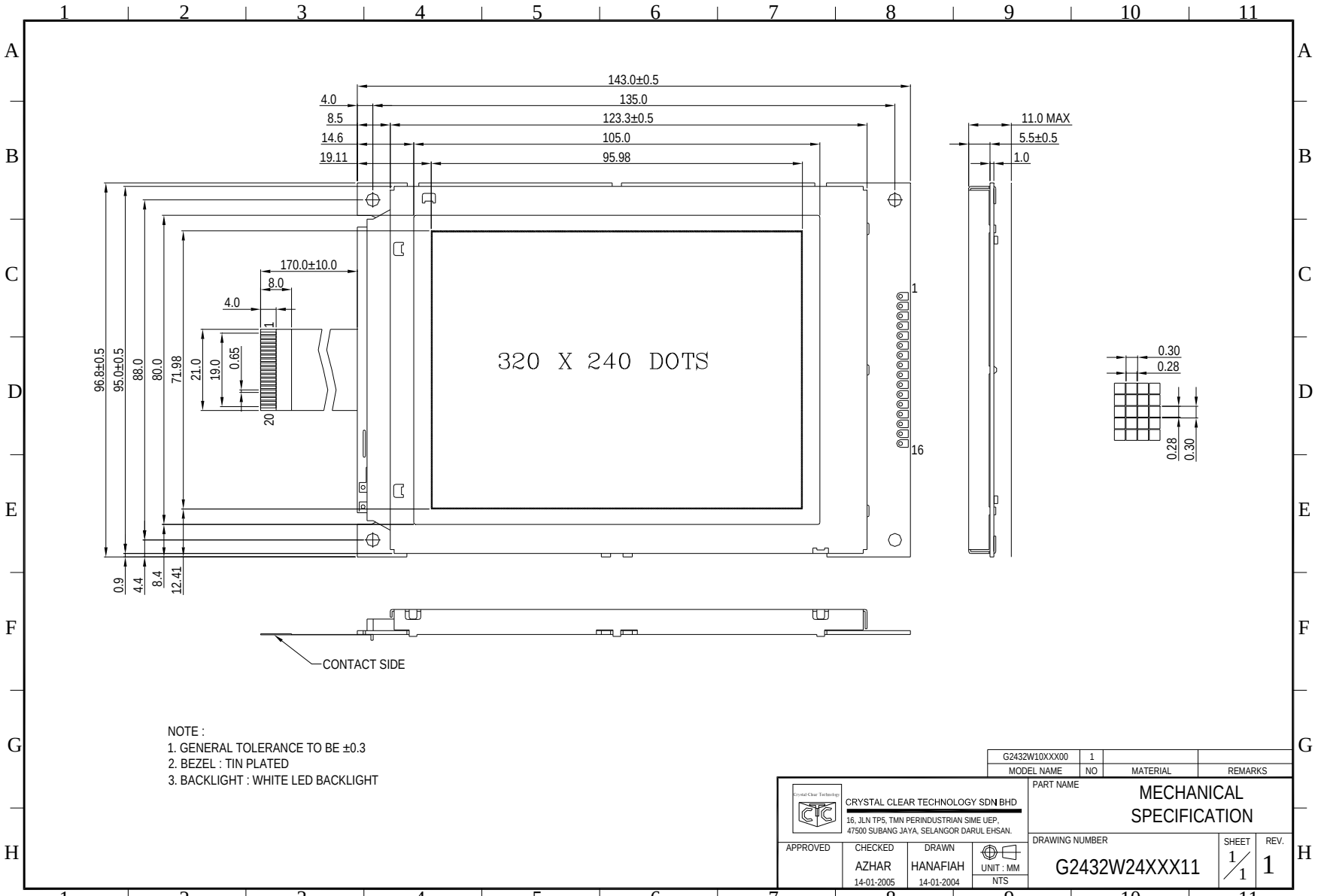
a) The contras can be adjusted by varying the LCD driving voltage V0
b) Driving voltage should be kept within specified range, excess voltage shortens display life.
c) Response time increases with decrease in temperature.
d) Display may turn black or dark blue at temperature above its operational range, 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.



NOTE :
1. GENERAL TOLERANCE TO BE ±0.3
2. BEZEL : TIN PLATED
3. BACKLIGHT : WHITE LED BACKLIGHT

G2432W10XXX00	1		
MODEL NAME	NO	MATERIAL	REMARKS

CRYSTAL CLEAR TECHNOLOGY SDN BHD
16, JLN TP5, TMN PERINDUSTRIAN SIME UEP,
47500 SUBANG JAYA, SELANGOR DARUL EHSAN.

PART NAME: MECHANICAL SPECIFICATION

APPROVED	CHECKED	DRAWN	UNIT : MM	DRAWING NUMBER	SHEET	REV.
	AZHAR 14-01-2005	HANAFIAH 14-01-2004	NTS	G2432W24XXX11	1/1	1

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