



# Microtips Technology Inc.

台北縣汐止市康寧街 169 巷 31 號 12 樓  
12F. No 31. Lane 169. Kang  
Hsi-Chih. Taipei Hsien. Taiwan.

WEB : <http://www.microtips.com.tw>  
E-mail : [bigmail@mail.microtips.com.tw](mailto:bigmail@mail.microtips.com.tw)  
TEL: 886-2-2695-3133 FAX :886-2-2695-8625

## LCD MODULE SPECIFICATION FOR CUSTOMER'S APPROVAL

CUSTOMER : \_\_\_\_\_  
MODULE TYPE : MTG-F32240NRWHS

APPROVED BY: (FOR CUSTOMER USE ONLY)

Approved By	Checked By	Prepared By	MT File No	Date Issued
			MTG-32240N	2002/08/02

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## SPECIFICATION FOR LIQUID CRYSTAL DISPLAY MODULE

MODEL NO. : MTG-F32240NRWHS

View Direction	<input checked="" type="checkbox"/> 6 O'clock		<input type="checkbox"/> 12 O'clock		
LCD Type	<input checked="" type="checkbox"/> FSTN Positive		<input type="checkbox"/> FSTN Negative		
	<input type="checkbox"/> STN Gray	<input type="checkbox"/> STN Yellow Green	<input type="checkbox"/> STN Blue		
Rear Polarizer	<input checked="" type="checkbox"/> Reflective		<input type="checkbox"/> Transflective		<input type="checkbox"/> Transmissive
Backlight Type	<input type="checkbox"/> LED	<input type="checkbox"/> Internal Power	<input type="checkbox"/> EL		<input type="checkbox"/> 4V input
		<input type="checkbox"/> External Power	<input type="checkbox"/> CCFL		<input type="checkbox"/> 12V input
Backlight Color	<input type="checkbox"/> White	<input type="checkbox"/> Amber	<input type="checkbox"/> Blue Green	<input type="checkbox"/> Yellow Green	<input type="checkbox"/> Other
Temperature Range	<input type="checkbox"/> Normal		<input checked="" type="checkbox"/> Wide		<input type="checkbox"/> Super Wide
Touch Screen	<input checked="" type="checkbox"/> Build-in		<input type="checkbox"/> Not Build-in		
Touch Screen Controller IC	<input checked="" type="checkbox"/> Build-in		<input type="checkbox"/> Not Build-in		
Internal DC-to-DC	<input type="checkbox"/> Build-in		<input checked="" type="checkbox"/> Not Build-in		
CCFL Inverter	<input type="checkbox"/> With		<input checked="" type="checkbox"/> Without		

### TO BE VERY CAREFUL !

The LCD driver ICs are made of CMOS process, which is very easy to be damaged by static charge, make sure the user is grounded when handling the LCM.



## GENERAL SPECIFICATION

Item	Content
Display Resolution	320(W)×240(H)
Dimensional Outline(mm)	167.1(W)×109.0(H)×12.4 max(D)
Display mode	Reflective/ positive Type
Circuit	Common-Driver IC, Segment-driver IC,
Interface	Data (D0~D3), CL1, CL2, FRM, V <sub>EE</sub> , F_GND

## ABSOLUTE MAXIMUM RATING

### (1) Electrical Absolute Ratings

Item	Symbol	Min.	Max.	Unit	Note
Power Supply for Logic	V <sub>DD</sub> -V <sub>SS</sub>	-0.3	7.0	Volt	
Power Supply for LCD	V <sub>DD</sub> -V <sub>EE</sub>	0	30.0	Volt	
Input Voltage	V <sub>IN</sub>	-0.3	V <sub>DD</sub>	Volt	

Note: Operator should be grounded during handling LCM.

### (2) Environmental Absolute Maximum Ratings

Item	Normal Temperature				Wide Temperature			
	Operating		Storage		Operating		Storage	
	Max,	Min.	Max,	Min.	Max,	Min.	Max,	Min.
Ambient Temperature	0°C	+50°C	-20°C	+70°C	-20°C	+70°C	-30°C	+80°C
Humidity(without condensation)	Note 2,4		Note 3,5		Note 4,5		Note 4,6	

Note 2 Ta ≤ 50°C : 80% RH max

Ta > 50°C : Absolute humidity must be lower than the humidity of 85%RH at 50°C

Note 3 Ta at -20°C will be <48hrs at 70°C will be <120hrs when humidity is higher than 75%.

Note 4 Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

Note 5 Ta ≤ 70°C : 75RH max

Ta > 70°C : absolute humidity must be lower than the humidity of 75%RH at 70°C

Note 6 Ta at -30°C will be <48hrs, at 80 °C will be <120hrs when humidity is higher than 75%.

## ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	note
Power Supply for Logic	$V_{DD}-V_{SS}$	-	2.7	4.5	5.5	Volt	
Input Voltage	$V_{IL}$	L level	$V_{SS}$	$0.2 V_{DD}$	-	Volt	
	$V_{IH}$	H level	$0.8 V_{DD}$	$V_{DD}$	-	Volt	
LCM Recommend LCD Module Driving Voltage	$V_{DD}-V_O$	Ta = -20°C	-	-	-	Volt	
		Ta = 0°C	-	-	-		
		Ta = 25°C	-	21.2	-		
		Ta = 50°C	-	-	-		
		Ta = 70°C	-	-	-		
Power Supply Current for LCM	$I_{DD}$ (B/L OFF)	$V_{DD}= 4.5V$ $V_{DD}-V_O= 21.2V$ FLM= 64Hz	25	30	35	mA	*1
	$I_{EE}$		-	-	-		
LED Voltage	$V_{LED}$	-	-	-	-	Volt	
LED driving current	$I_{LED}$	-	-	-	-	mA	
CCFL Saturation Time	$t_{SAT}$	-	-	-	-	minut	

Note : \*1: The current consumption including the LCD controller IC and Touch Screen controller.

## OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ	Max.	Unit	note
Viewing angle range	$\Phi f$ (12 o'clock)	When $Cr \geq 2$	-	15	-	Degree	9,10
	$\Phi b$ (6 o'clock)		-	30	-		
	$\Phi l$ (9 o'clock)		-	30	-		
	$\Phi r$ (3 o'clock)		-	30	-		
Rise Time	$T_r$	$V_{DD}-V_O = 21.2V$		239		mS	
Fall Time	$T_f$			140			
Frame frequency	Frm		-	64	-	Hz	8,10
Contrast	Cr	25	-	7.36	-		7

## MECHANICAL SPECIFICATION

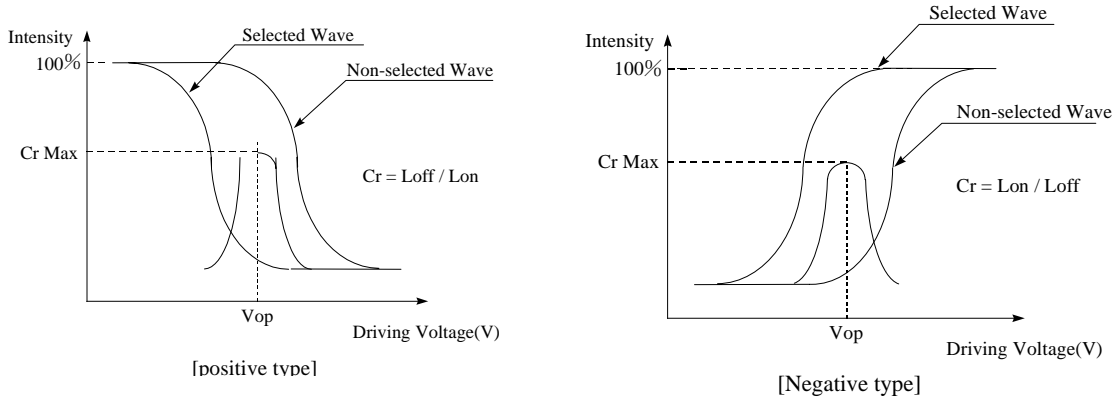
Product No.		MTG-F32240NRWHS
Module Size		167.1(W)mm×109.0(H)mm×12.4(D)mm Max
Dot Size		0.35(W)mm×0.35(H)mm
Dot Pitch		0.36(W)mm×0.36(H)mm
Resolution		320(W)×240(H) Dots Matrix
Duty Ratio		1/240 Duty
LCD Display Mode	STN	<input type="checkbox"/> Gray Mode <input type="checkbox"/> Yellow Mode <input type="checkbox"/> Blue Mode
	FSTN	<input checked="" type="checkbox"/> Black & White(Normally White/Positive Image) <input type="checkbox"/> Black & White(Normally White/Negative Image)
	Front Polarizer	<input type="checkbox"/> Regular <input checked="" type="checkbox"/> Anti-Glare
	Rear Polarizer:	<input checked="" type="checkbox"/> Reflective <input type="checkbox"/> Transflective <input type="checkbox"/> Transmissive
Viewing Direction		<input checked="" type="checkbox"/> 6 O'clock <input type="checkbox"/> 12 O'clock <input type="checkbox"/> 3 O'clock <input type="checkbox"/> 9 O'clock
Backlight		<input checked="" type="checkbox"/> Without <input type="checkbox"/> CCFL <input type="checkbox"/> EL <input type="checkbox"/> LED
LCD Controller		Build-in SED1335
Touch Screen		With
Touch Screen controller		With
DC/DC Controller		Without
CCFL Inverter		Without

## INTERFACE PIN ASSIGNMENT

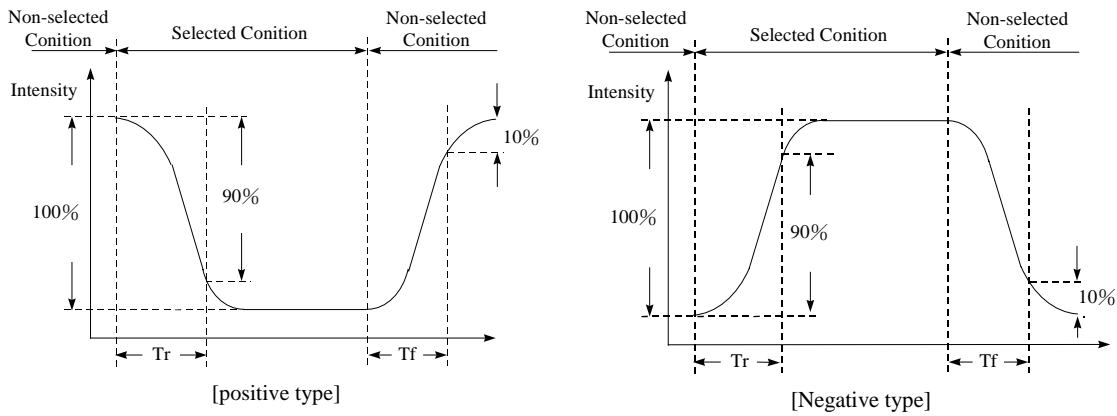
PIN NO.	FUNCTION	FUNCTION DESCRIPTION					
1	V <sub>SS</sub>	Ground					
2	V <sub>DD</sub>	Logic supply voltage					
3	V <sub>O</sub>	Negative Voltage Power supply.					
4	Ao	Data/ Command					
5	WR(R/W)	8080 family : Write signal 6800 family : R/W signal					
6	RD(E)	8080 family : Read signal 6800 family : Enable clock					
7-14	DB0-DB7	3-state I/O Data Bus.					
15	CS	Chip select. This active-LOW input enables the SED1335F. It is usually connected to the output of an address decoder device that maps the SED1335F into the memory space of the controlling microprocessor.					
16	RST	This active-LOW input performs hardware reset on the SED1335F. It is a Schmitt-trigger input for enhanced noise immunity; however, care should be taken to ensure that it is not triggered if the supply voltage is lowered.					
17	V <sub>EE</sub>	Power supply for LCD panel.					
18	SEL1	<b>SEL1</b>	<b>Interface</b>	<b>Ao</b>	<b>RD</b>	<b>WR</b>	<b>CS</b>
		0	8080 family	Ao	RD	WR	CS
		1	6800 family	Ao	E	R/W	CS
19	DCLK	External Clock Input. This clock runs the SAR conversion process and synchronizes serial data I/O.					
20	/CS_T	Chip Select input. Controls conversion timing and enables the serial input/output register.					
21	DIN	Serial Data Input. If CS is LOW, data is latched on rising edge of DCLK.					
22	DOUT	Serial Data Output. Data is shifted on the falling edge of DCLK. This output is high impedance when CS is HIGH.					
23	PEN	Pen interrupt					
24	PEN1	Pen interrupt setting					
25	IN3	Auxiliary Input 1. ADC input Channel 3.					
26	IN4	Auxiliary Input 2. ADC input Channel 4.					

\*: Pin 19~26 are for the Touch Panel controller.

**[Note 7] Definition of Operation Voltage (Vop)**



**[Note 8] Definition of Response Time (Tr, Tf)**



**Conditions:**

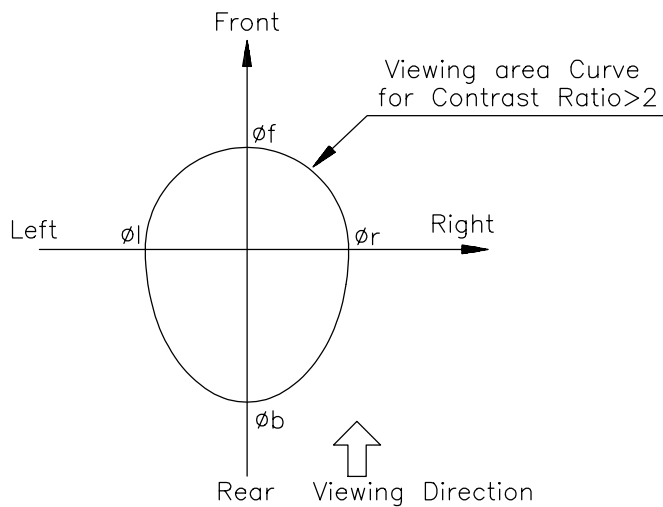
**Operating Voltage : Vop**

**Frame Frequency : 64 Hz**

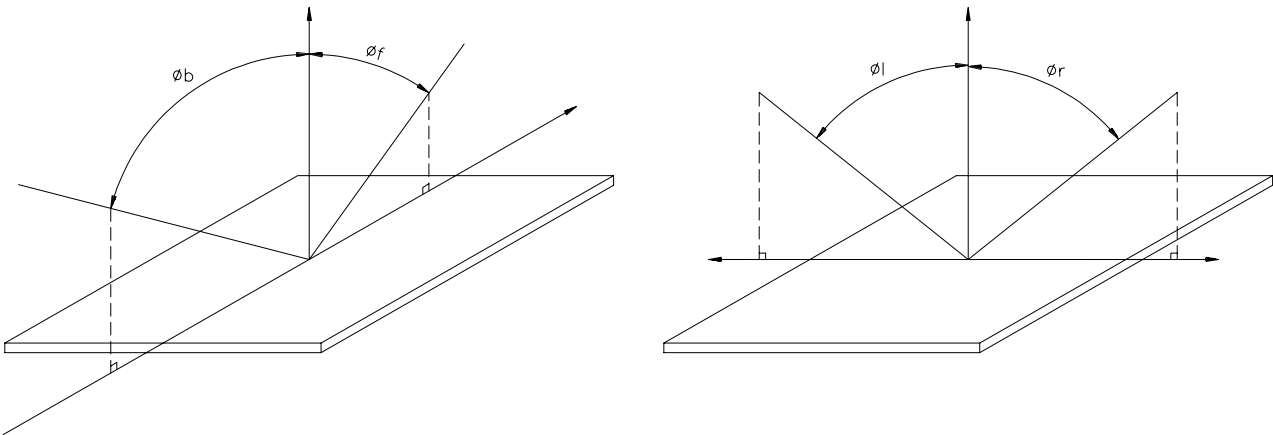
**Viewing Angle ( $\theta, \varphi$ ):  $0^\circ, 0^\circ$**

**Driving Wave form : 1/N duty, 1/a bias**

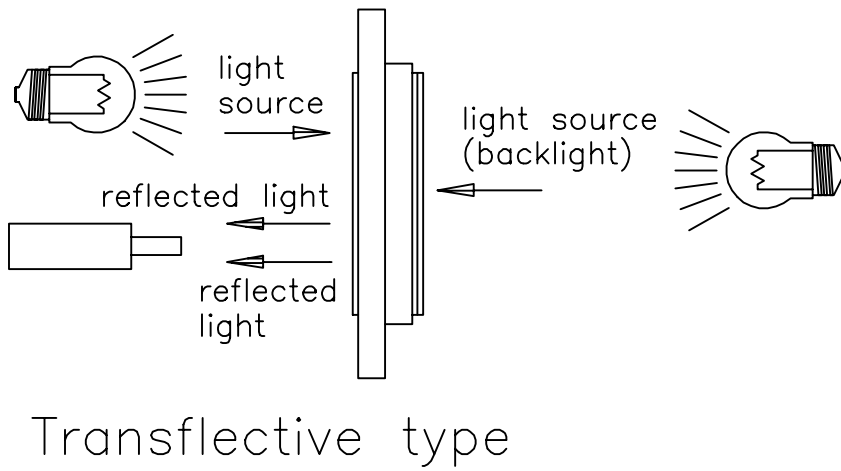
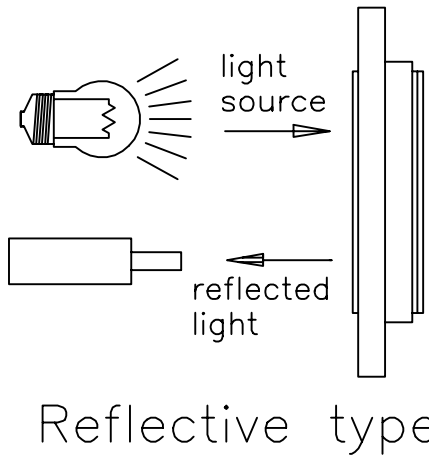
**[Note 9] Definition of Viewing Direction**



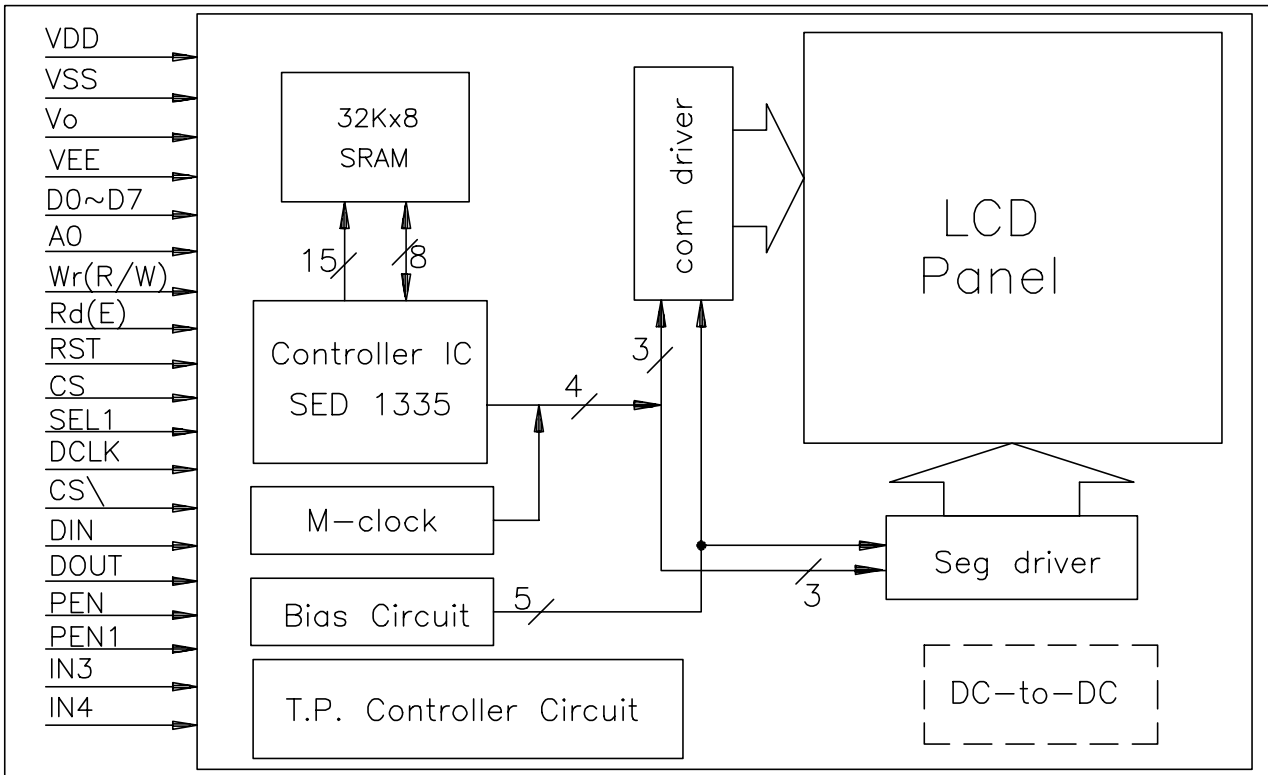
**[Note 10] Definition of viewing angle**



**[Note 11] Description of Measuring Equipment**

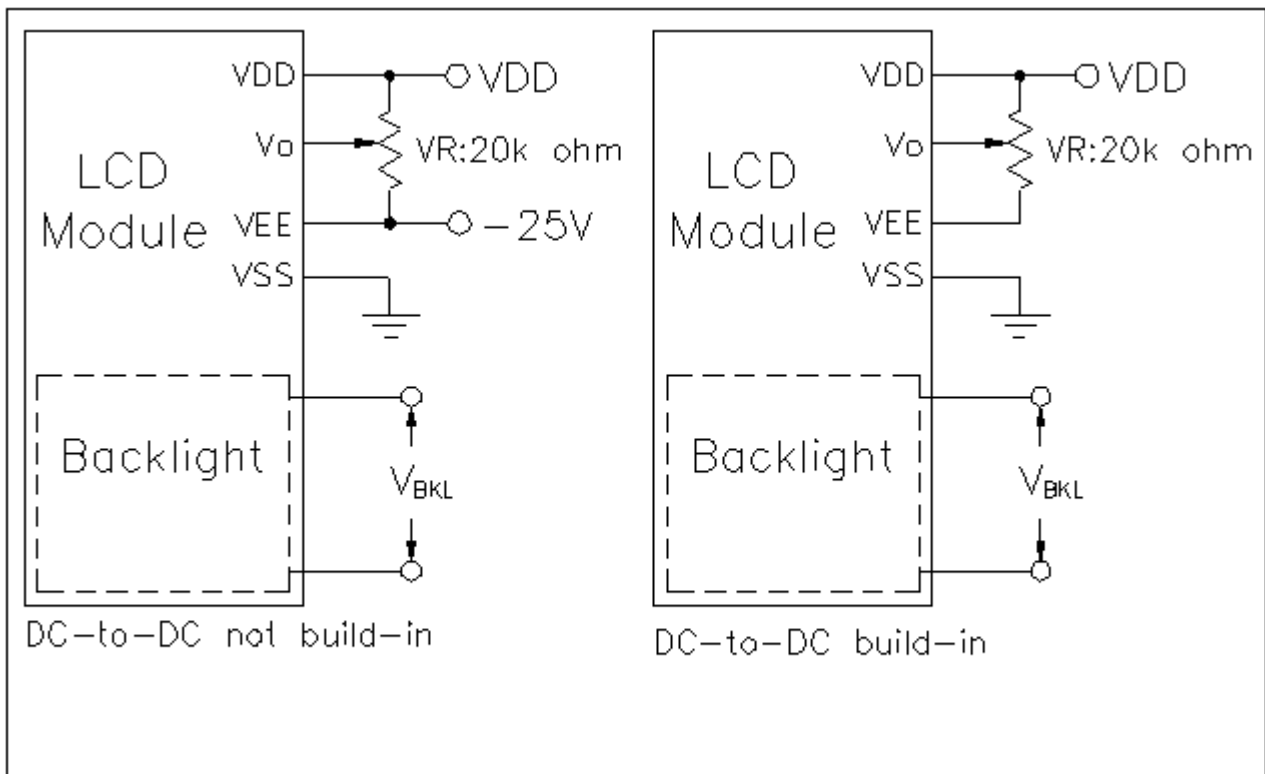


## BLOCK DIAGRAM



- Built-in M-clock generating circuit, User do not have to supplier M-clock.

## POWER SUPPLY



# TIMING CHARACTERISTICS

## 8080 family interface timing

Signal	Symbol	Parameter	Rating		Unit
			Min.	Max.	
Ao, CS	$t_{AH8}$	Address hold time	10	-	ns
	$t_{AW8}$	Address setup time	30	-	
WR, RD	$t_{CYC}$	System cycle time	See note	-	
	$t_{CC}$	Strobe pulse-width	220	-	
D0 to D7	$t_{DS8}$	Data setup time	120	-	
	$t_{DH8}$	Data hold time	10	-	
	$t_{ACC8}$	RD access time	-	120	
	$t_{OH8}$	Output disable time	10	50	

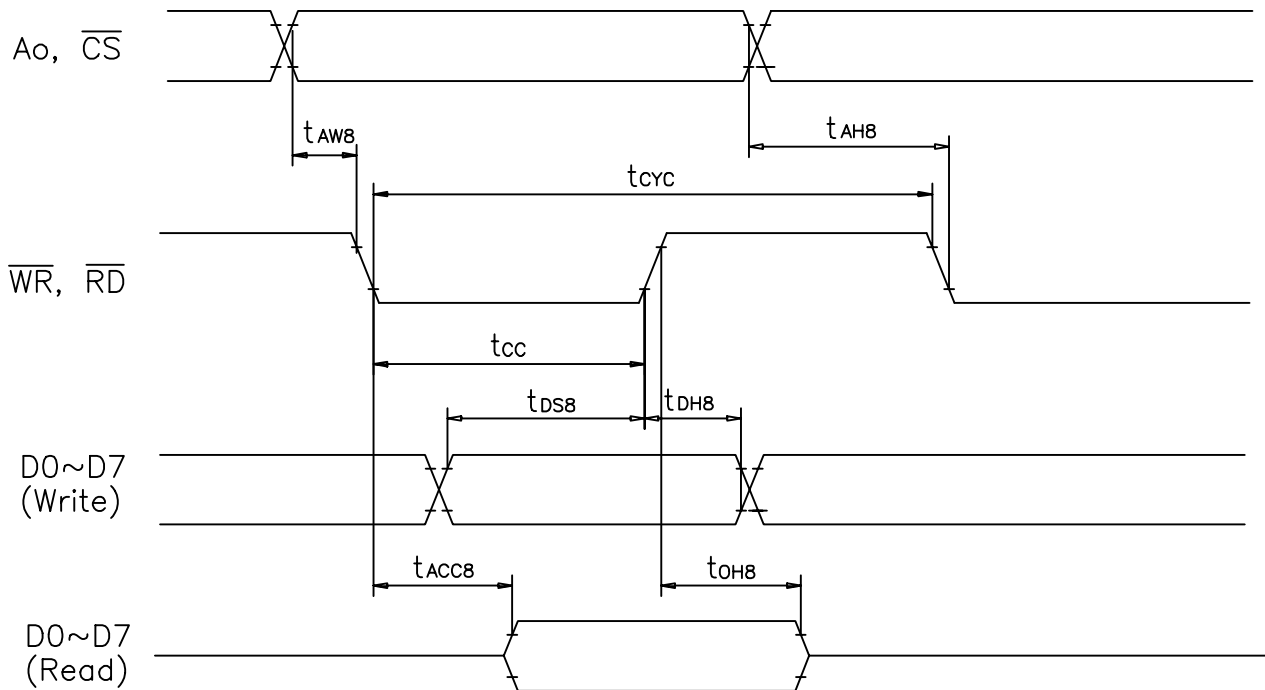
Note:

For memory control and system control command:

$$t_{CYC} = 4t_C + t_{CC} - 45 > 3t_C + 125$$

for all other commands:

$$t_{CYC} = 4t_C + t_{CC} + 30$$



### 6800 family interface timing

Signal	Symbol	Parameter	Rating		Unit
			Min.	Max.	
Ao, CS, R/W	$t_{CYC6}$	System cycle time	See note	-	ns
	$t_{AW6}$	Address setup time	30	-	
	$t_{AH6}$	Address hold time	10	-	
D0 to D7	$t_{DS6}$	Data setup time	120	-	
	$t_{DH6}$	Data hold time	10	-	
	$t_{OH6}$	Output disable time	10	50	
	$t_{ACC6}$	Access time	-	120	
E	$t_{EW}$	Enable pulse-width	220	-	

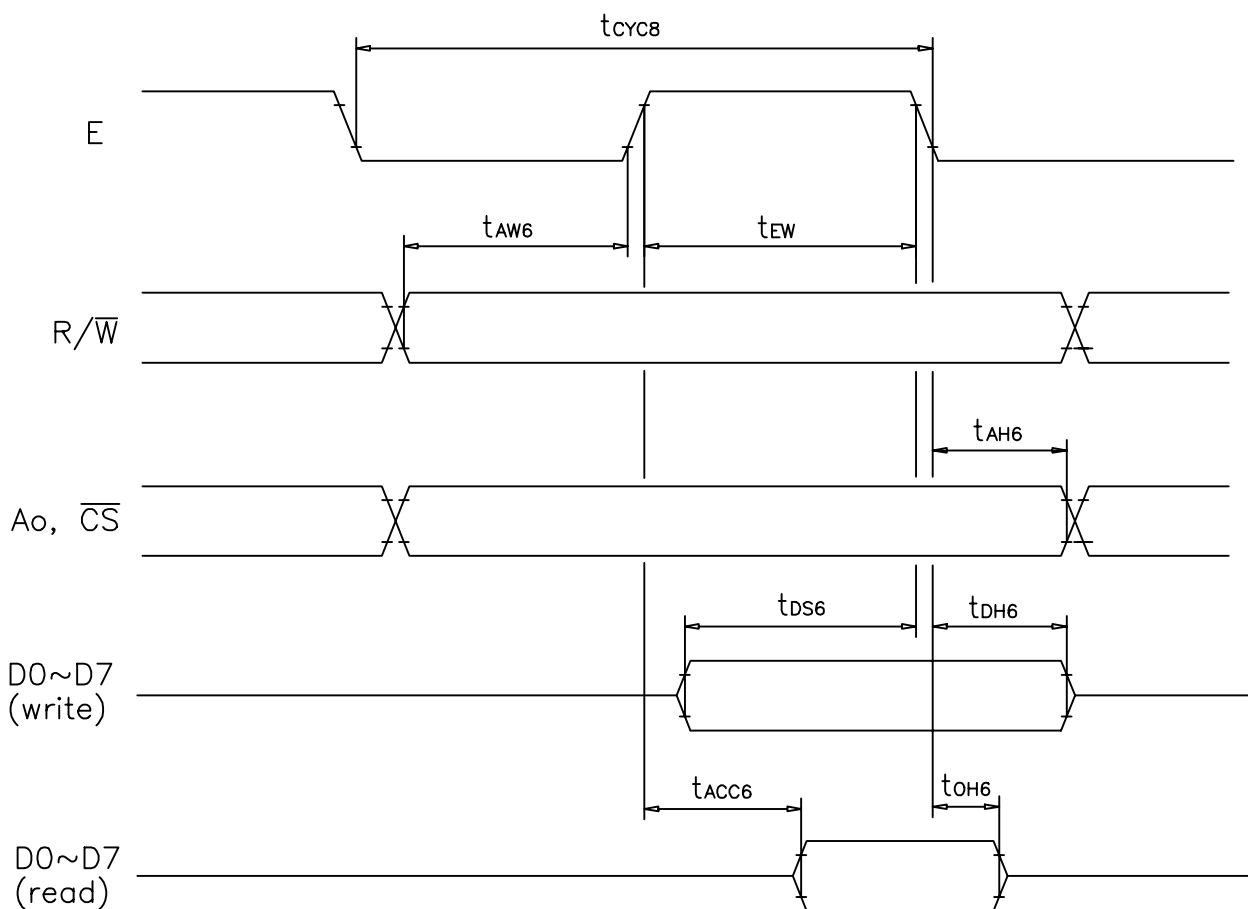
Note:

For memory control and system control command:

$$t_{CYC} = 4t_C + t_{CC} - 45 > 3t_C + 125$$

for all other commands:

$$t_{CYC} = 4t_C + t_{EW} + 30$$



## INSTRUCTION SET (for LCD Controller IC)

Class	Command	Code											Hex	Command Description	Number of bytes
		RD	WR	Ao	D7	D6	D5	D4	D3	D2	D1	D0			
	System set	1	0	1	0	1	0	0	0	0	0	0	40	To initialize device and display	8
	Sleep in	1	0	1	0	1	0	1	0	0	1	1	53	To enter standby mode	0
	Display ON/OFF	1	0	1	0	1	0	1	1	0	0	D	58 59	To enable and disable display and display flashing	1
	Scroll	1	0	1	0	1	0	0	0	1	0	0	44	To set display start address and display regions	10
	CSRFORM	1	0	1	0	1	0	1	1	1	0	1	5D	To set cursor type	2
	CGRAM ADR	1	0	1	0	1	0	1	1	1	0	0	5C	To set the start address of character generator RAM	2
	CSRDIR	1	0	1	0	1	0	0	0	1	1	C0	C1	To set the direction of the cursor movement.	0
	HDOT SCR	1	0	1	0	1	0	1	1	0	1	0	5A	To set horizontal scroll position	1
	OVLAY	1	0	1	0	1	0	1	1	0	1	1	58	To set display overlay format.	1
	CSRW	1	0	1	0	1	0	0	0	1	1	0	46	To set cursor address	2
	CSRR	1	0	1	0	1	0	0	0	1	1	1	47	To read cursor address	2
	MWRITE	1	0	1	0	1	0	0	0	0	1	0	42	Write to display memory	-
	MREAD	1	0	1	0	1	0	0	0	0	1	1	43	To read display memory	-

### Notes:

- In general, the internal registers of the SED1335F are modified as each command parameter is input. However, the microprocessor does not have to set all the parameters of a command and may send a new command before all parameters have been input. The internal registers for the parameters that have been input will have been changed but the remaining parameter registers are unchanged.
  - 2-byte parameters (where two bytes are treated as one data item) are handled as follows:
    - CSRW, CSRR: Each byte is processed individually. The microprocessor may read or write just the low byte of the cursor address.
    - SYSTEM SET, SCROLL, and CG-RAM ADR: Both parameter bytes are processed together. If the command is changed after half of the parameter has been input, the single byte is ignored.
- APL and APH are 2-byte parameters, but are treated as two 1-byte parameters.

**Please see the attached PDF files (SED1335 and ADS7843/ Burr Brown) for the detail description of the commands, the on-chip character table, and memory mapping, etc.**

# DISPLAY PATTERN

	S1	S2	S3	S4	S5	S6	S7	S8		S313	S314	S315	S316	S317	S318	S319	S320
COM1	D7	D6	D5	D4	D3	D2	D1	D0	.....	D7	D6	D5	D4	D3	D2	D1	D0
COM2	D7	D6	D5	D4	D3	D2	D1	D0	.....	D7	D6	D5	D4	D3	D2	D1	D0
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	.....	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
COM239	D7	D6	D5	D4	D3	D2	D1	D0	.....	D7	D6	D5	D4	D3	D2	D1	D0
COM240	D7	D6	D5	D4	D3	D2	D1	D0	.....	D7	D6	D5	D4	D3	D2	D1	D0

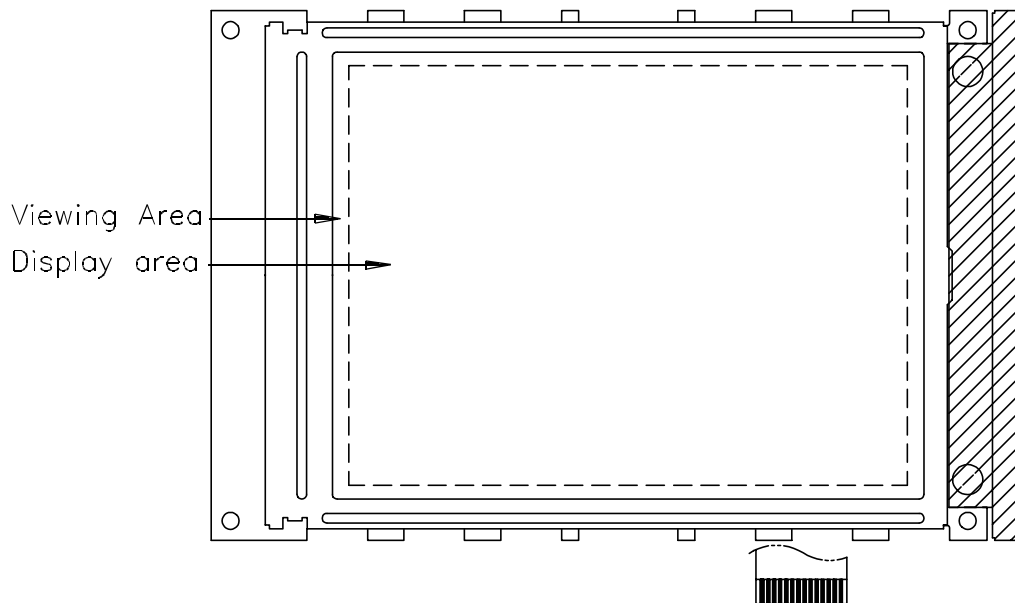
## RELIABILITY TEST

No	Item	Conditions		Note
1	High Temp. Operation	70°C	240 HR	
2	High Temp. Storage	80°C	240 HR	
3	Low Temp. Operation	-20°C	240 HR	
4	Low Temp. Storage	-30°C	240 HR	
5	High Temp./Humid Storage	60°C 90%RH	240 HR	
6	Thermal Shock	-20°C ,30min +60°C ,30min	10 cycles	
7	Vibration Test ( IEC-68-2-6 )	Frequency : 10~55 Hz Duration : 20 times, 6 min/time Amplitude : 0.75 mm	-	
8	Shock ( IEC 68-2-27)	Duration : 11 mS Acceleration : 100g	-	X, Y, Z direction

## APPEARANCE CHECK

CONDIITON OF APPEARANCE CHECK:

- (1) Specimen shall be checked by eyes in distance of 30cm under 40w-fluorescence lamp.
- (2) Checking direction shall be in 45 degree from perpendicular line op specimen surface.



## HANDLING PRECAUTIONS

- (1) Treat polarizer very carefully since it is easy to be damaged.
- (2) When cleaning the display surface, use soft cloth (e.g. gauss) with a solvent (recommended below) and wipe lightly.

- ◆ ethyl alcohol
- ◆ iso-propanol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvents:

- ◆ water
- ◆ ketone
- ◆ aromatics

- (3) Direct current causes electro-chemical reaction with remarkable degradation of the display quality. Give careful consideration to prevent direct current at ON/OFF timing and during operation.
- (4) Avoid strong shock and drop from the height.
- (5) To prevent LCD panels from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity.
- (6) Give careful consideration to avoid electrical static discharge which causes uneven contrast.
- (7) Even a small condensation on the contact pads (terminals) causes electro-chemical reaction which makes missing row and column. Give careful attention to avoid condensation. When assembling with zebra connector, clean the surface of the pads with alcohol and keep the air very clean.



