LCD MODULE SPECIFICATION
FOR CUSTOMER'S APPROVAL

CUSTOMER　　　:　　　Standard

MODULE TYPE :　MTG-S32240PMNHSCW

APPROVED BY: (FOR CUSTOMER USE ONLY)

Approved By	Checked By	Prepared By	MT File No	Date Issued
				2002/4/10

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REVISION HISTORY

Revision Content	Page	Date

SPECIFICATION FOR

LIQUID CRYSTAL DISPLAY MODULE

MODEL NO. :   MTG-S32240PMNHSCW

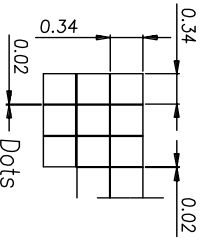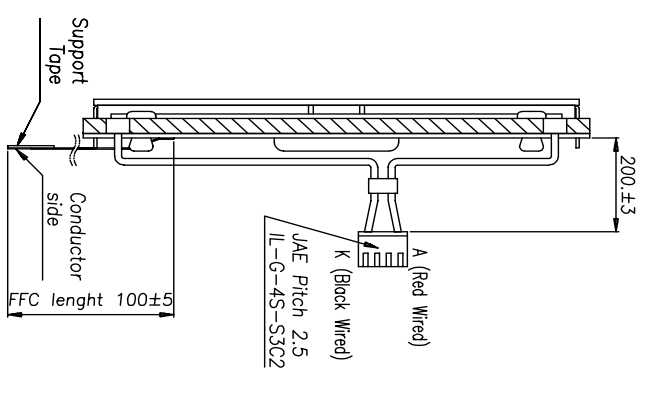| View Direction	☑ 6 O'clock		☐ 12 O'clock	
LCD Type	☐ FSTN Positive		☐ FSTN Negative	
	☐ STN Gray	☐ STN Yellow Green	☑ STN Blue	
Rear Polarizer	☐ Reflective	☐ Transflective	☑ Transmissive	
Backlight Type	☐ LED	☐ Internal Power	☐ EL	☐ 4V input
		☑ External Power	☑ CCFL	☐ 12V input
Backlight Color	☑ White	☐ Amber	☐ Blue Green	☐ Yellow Green ☐ Other
Temperature Range	☐ Normal	☑ Wide	☐ Super Wide	
CCFL Inverter	☐ Build-in	☑ Not Build-in		
EL Driver IC	☐ Build-in	☑ Not Build-in		
Touch Screen	☐ With	☑ 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.

PIN ASSIGNMENT

No.		No.		No.		No.	
1.	VSS	5.	R/W, WR	9.	DB2	13.	DB6	17.	VEE	21.	NC
2.	VDD	6.	E,RD	10.	DB3	14.	DB7	18.	SEL1	22.	NC
3.	V0	7.	DB0	11.	DB4	15.	CS	19.	NC	23.	
4.	A0	8.	DB1	12.	DB5	16.	RST	20.	NC	24.	

54.5±0.3
109±0.5
104.5±0.3
92±0.2
P0.36x240-0.01=86.39
2.25
6.25
2.805
11Max.
1
6.5±0.3
4
11.1
13.9
2.405
4-R1.0
85±0.3
140.8±0.3
152±0.3
122±0.2
P0.36x320-0.01=115.19
P1.25x(22-1)=26.25±0.5
151.75±0.5
70.55±5
35.45±0.5
△18
22
2-φ3.5
101±0.3
109±0.5

(View)

Support Tape
Conductor side
FFC lenght 100±5
0.34
0.34
0.02
0.02
Dots
200±3
JAE Pitch 2.5
IL-G-4S-S3C2
K (Black Wired)
A (Red Wired)

Microtips Technology
Tray He

M-32240D (LED)	
PART NAME	
DRAWN	CHECK	APP'D	Q'TY
Tray He		Chris Luo	

DATE: 03/29/01'
UNIT:MM
SCALE: 1/1
PRODUCT: MTG-32240D
DWG NO.: G32240D
FILE: DWG\MTG320\G32240D
SHEET 1 / 1
MATERIAL
FINISH
F32240DFWHSGW-02
320x240
Rev: X

UNLESS OTHERWISE SPECIFIED
TOLERANCE ON
FRACTIONS DECIMALS ANGLES
0.10 0.5

REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE
△	Add. FFC dim. & modify outline dim.	Tray He		Chris Luo	04/1/01'

GENERAL SPECIFICATION

Item	Content
Display Resolution	320(W)×240(H)
Dimensional Outline(mm)	169.7(W)×109.0(H)×11.0 max(D)
Display mode	Transflective/ Positive Type
Circuit	Controller IC, Common-Driver IC, Segment-driver IC
Interface	DB0~DB7, WR(R/W), RD(E), CS, RES, SEL1

ABSOLUTE MAXIMUN RATING

(1) Electrical Absolute Ratings

Item	Symbol	Min.	Max.	Unit	Note
Power Supply for Logic	V_{DD}-V_{SS}	-0.3	7.0	Volt	
Power Supply for LCD	V_{DD}-V_{EE}	0	30.0	Volt	
Input Voltage	V_{IN}	-0.3	V_{DD}	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℃	+50℃	-20℃	+70℃	-20℃	+70℃	-30℃	+80℃
Humidity(without condensation)	Note 2,4		Note 3,5		Note 4,5		Note 4,6	

Note 2   Ta≦50℃: 80% RH max

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

Note 3   Ta at -20℃ will be<48hrs at 70℃ 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℃: 75RH max

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

Note 6   Ta at -30℃ will be <48hrs, at 80 ℃ 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℃	24.7	25.2	25.7	Volt	
		Ta=0℃	21.7	22.2	22.7		
		Ta=25℃	20.8	21.2	21.6		
		Ta=50℃	20.1	20.6	21.1		
		Ta=70℃	19.5	20.0	20.5		
Power Supply Current for LCM	I_{DD} (B/L OFF)	V_{DD}= 4.5V V_{DD}-V_{O}= 21.2V FLM= 64Hz	-	30	35	mA	
	I_{EE}		-	2.9	4		
LED driving Voltage	V_{BKL}	-	-	4	-	Volt	
LED driving current	I_{LED}	7 Lamp	-	175	210	mA	

OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ	Max.	Unit	note
Viewing angle range	Φf(12 o'clock)	When Cr≧2	-	15	-	Degree	9,10
	Φb(6 o'clock)		-	30	-		
	Φl(9 o'clock)		-	30	-		
	Φr(3 o'clock)		-	30	-		
Rise Time	T_r	V_{DD}-V_{O} = 21.2V		240		mS	
Fall Time	T_f			140			
Frame frequency	Frm		-	64	-	Hz	8,10
Contrast	Cr	25	-	7.36	-		7

MECHANICAL SPECIFICATION

Product No.		MTG-S32240PMNHSCW
Module Size		169.7(W)mm×109.0(H)mm×11.0(D)mm Max
Dot Size		0.34(W)mm×0.34(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	☐Gray Mode ☐Yellow Mode ☑Blue Mode
	FSTN	☐ Black & White(Normally White/Positive Image) ☐ Black & White(Normally White/Negative Image)
	Rear Polarizer:	☐ Reflective ☐ Transflective ☑ Transmissive
Viewing Direction		☑6 O'clock ☐12 O'clock ☐3 O'clock ☐9 O'clock
Backlight		☐Without ☑CCFL ☐EL ☐LED
Controller		SED1335F
DC/DC Converter		Without
Temp Compensation Circuit		Without

INTERFACE PIN ASSIGNMENT

PIN NO.	PIN OUT	FUNCTION DESCRIPTION
1	V_{SS}	Ground
2	V_{DD}	Logic supply voltage
3	Vo	Negative Voltage Power supply. Tuned from V_{DD}-V_{EE}
4	Ao	Data type select
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	DB0	3-state I/O Data Bus.
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
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	RES	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_{EE}	Supply voltage for LCD panel
18	SEL1	'0' for 8080 family MPU, '1' for 6800 family MPU.
19	NC	No Connection
20	NC	No Connection
21	NC	No Connection
22	NC	No Connection

[Note 7] Definition of Operation Voltage (Vop)

Intensity

100%

Selected Wave

Non-selected Wave

Cr Max

$Cr = Loff / Lon$

Vop

Driving Voltage(V)

[positive type]

Intensity

100%

Selected Wave

Non-selected Wave

Cr Max

$Cr = Lon / Loff$

Vop

Driving Voltage(V)

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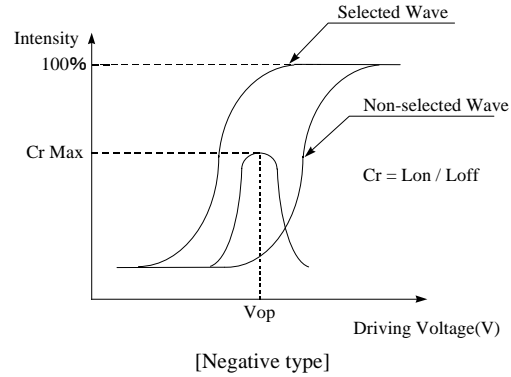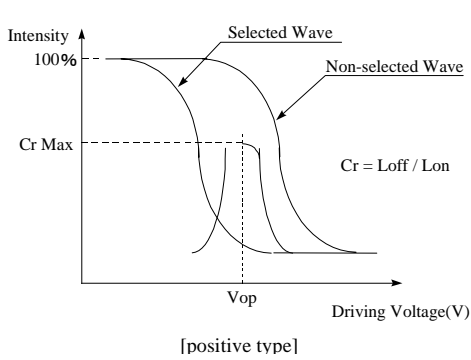
[Note 8] Definition of Response Time (Tr, Tf)

Non-selected Conition | Selected Conition | Non-selected Conition

Intensity

100%

90%

10%

Tr

Tf

[positive type]

Non-selected Conition | Selected Conition | Non-selected Conition
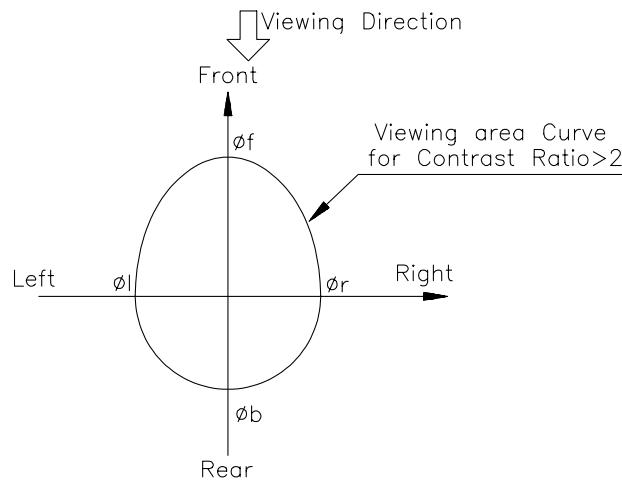
Intensity
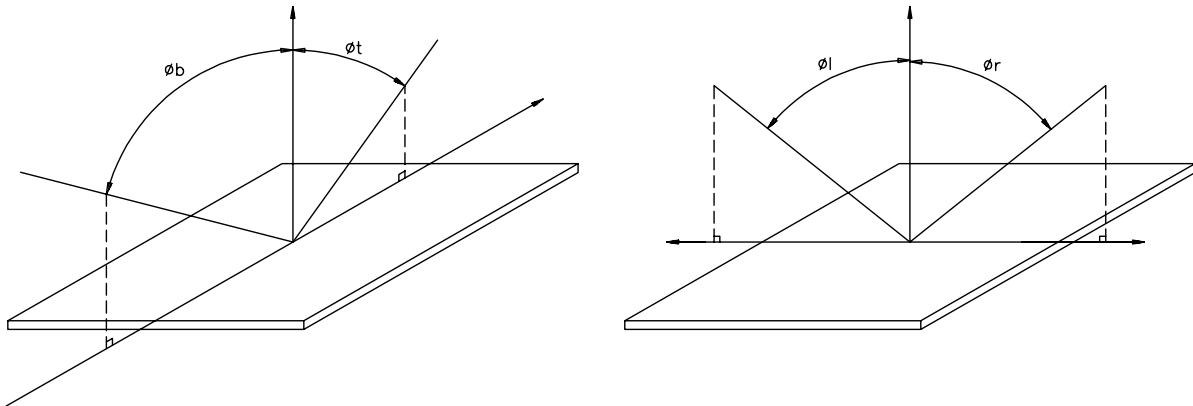
100%

90%

10%

Tr

Tf

[Negative type]
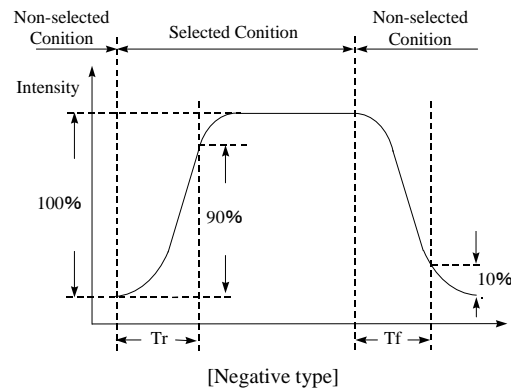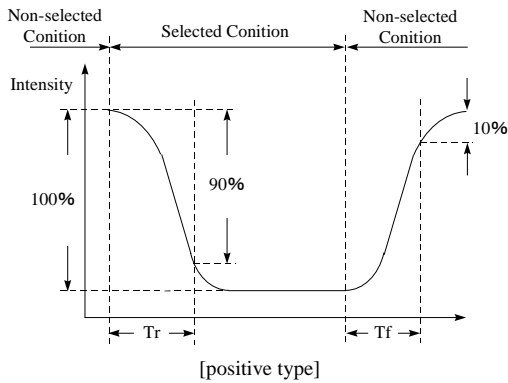
Conditions:

Operating Voltage : Vop

Frame Frequency : 64 Hz

Viewing Angle(θ , φ): 0° , 0°

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

[Note 9] Definition of Viewing Direction

Viewing Direction

Front

ϕf

Viewing area Curve for Contrast Ratio>2

Left

ϕl

ϕr

Right

ϕb

Rear

[Note 10] Definition of viewing angle

[Note 11] Description of Measuring Equipment

Reflective type

Transflective type
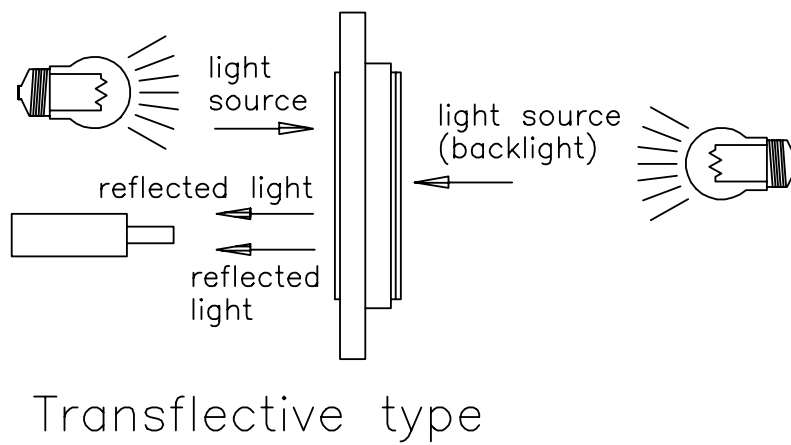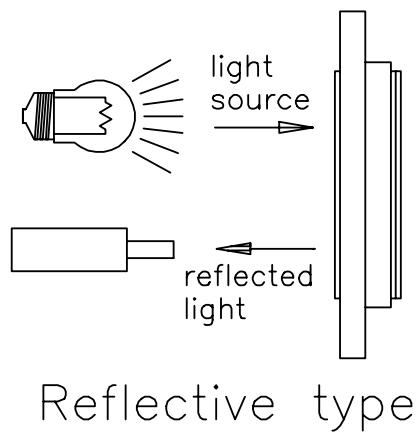
BLOCK DIAGRAM
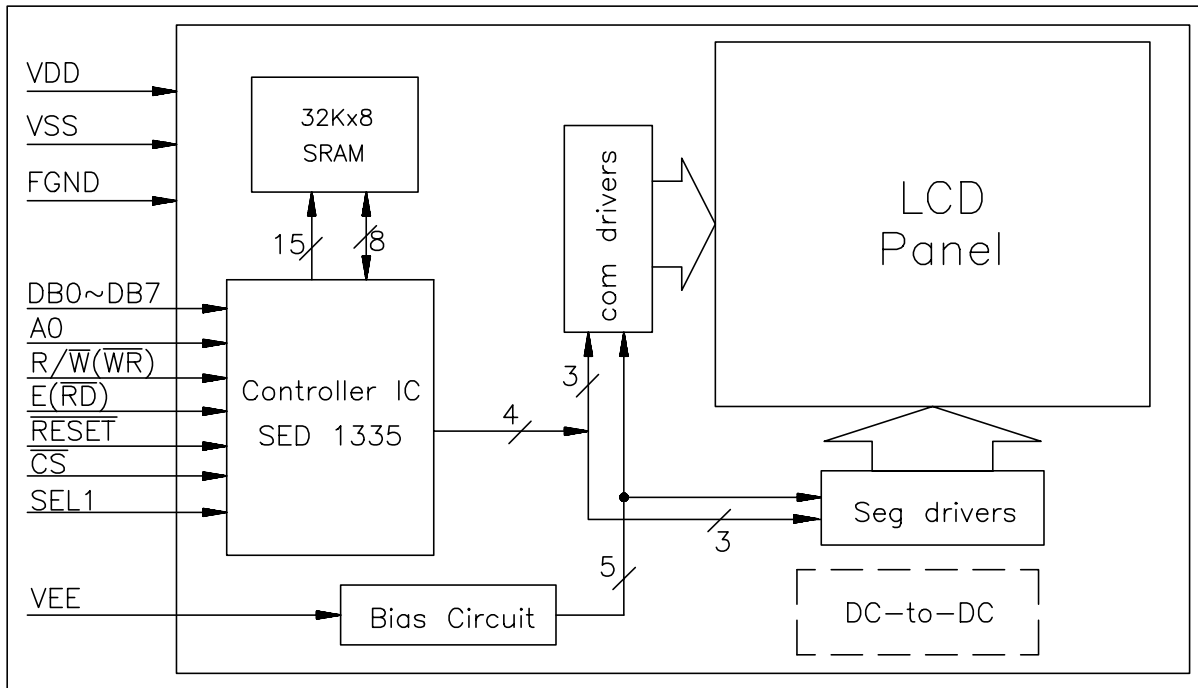
POWER SUPPLY
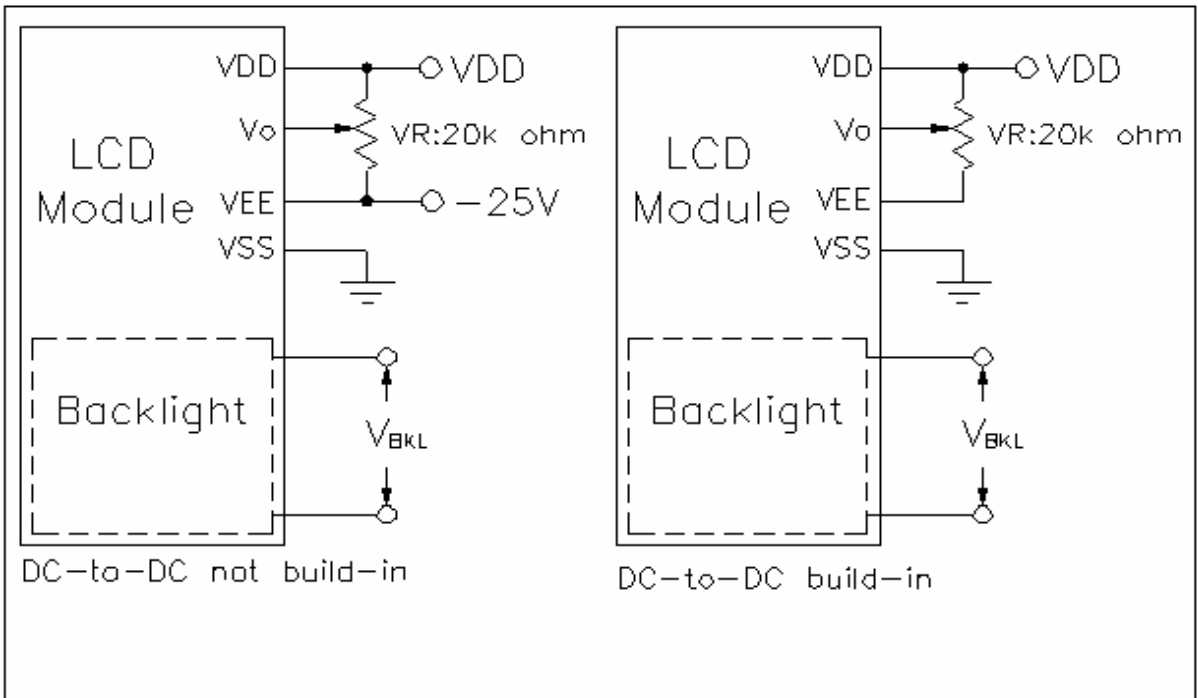
TIMING CHARACTERISTICS

8080 family interface timing

Signal	Symbol	Parameter	Rating Min.	Rating Max.	Unit
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:

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

for all other commands:

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

6800 family interface timing

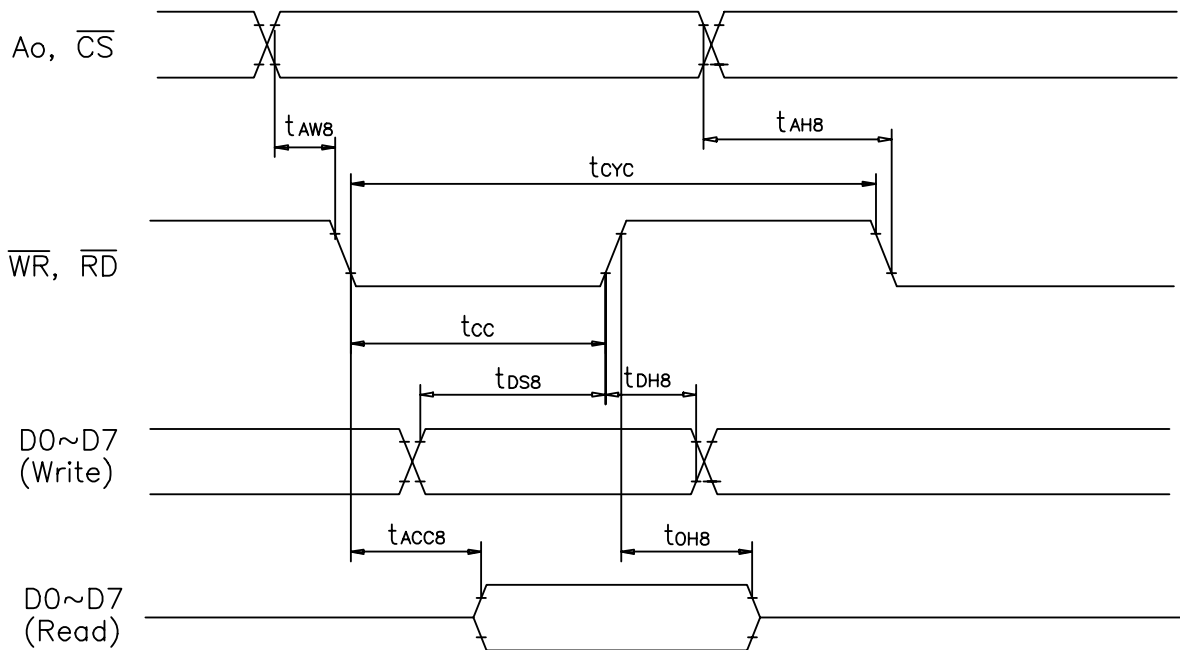| Signal	Symbol	Parameter	Rating		Unit
			Min.	Max.	
Ao, CS, R/W	t_{CYC6}	System cycle time	See note	-	ns
	t_{AW6}	Address setup time	30	-	
	t_{AH6}	Address hold time	10		
D0 to D7	t_{DS6}	Data setup time	120	-	
	t_{DH6}	Data hold time	10	-	
	t_{OH6}	Output disable time	10	50	
	t_{ACC6}	Access time	-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

Note:
For memory control and system control command:
$t_{CYC} = 4t_C + t_{CC} - 45 > 3 t_C + 125$
for all other commands:
$t_{CYC} = 4t_C + t_{EW} + 30$
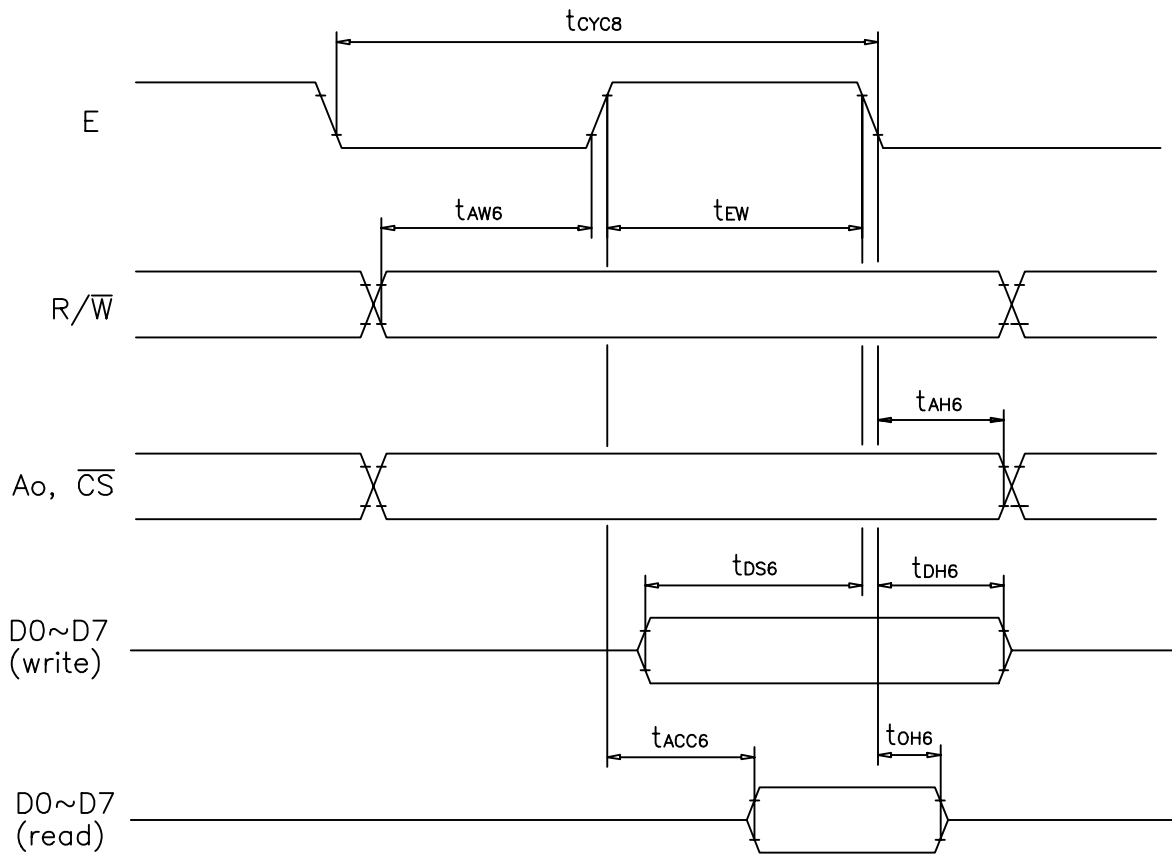
INSTRUCTION SET

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:

1. 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:
   - a. CSRW, CSRR: Each byte is processed individually. The microprocessor may read or write just the low byte of the cursor address.
   - b. 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.

2. APL and APH are 2-byte parameters, but are treated as two 1-byte parameters.

Please see the attached PDF file (SED1335) for the detail description of the commands, the on-chip character table, and memory mapping, etc.

RELIABILITY TEST

No	Item	Conditions		Note
1	High Temp. Operation	70℃	240 HR	
2	High Temp. Storage	80℃	240 HR	
3	Low Temp. Operation	-20℃	240 HR	
4	Low Temp. Storage	-30℃	240 HR	
5	High Temp./Humid Storage	60℃ 90%RH	240 HR	
6	Thermal Shock	-20℃ ,30min +60℃ ,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.
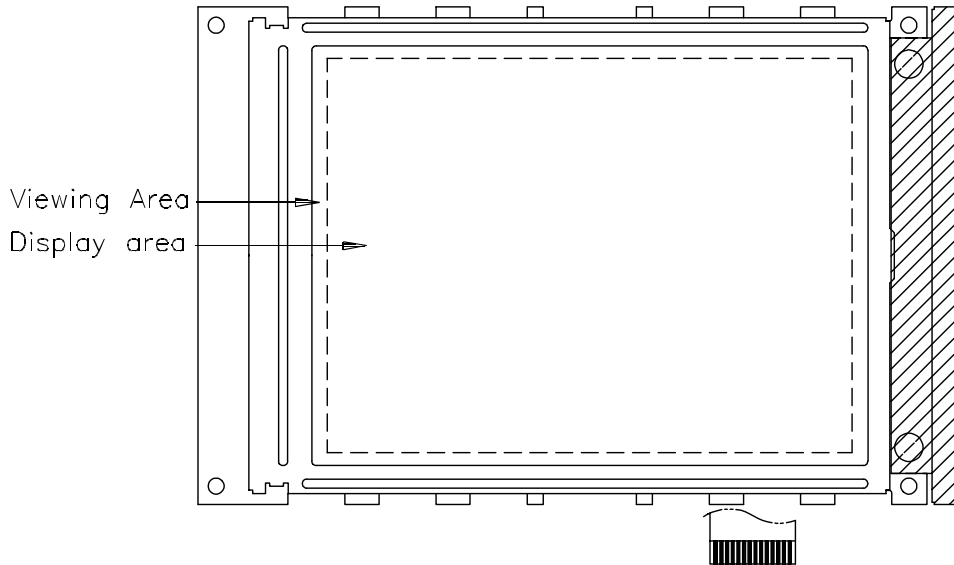
HANDLING PRECAUTIONS

(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-prcolol

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 with 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.

LCD PRODUCT QUALITY STANDARD
DISPLAY APPEARANCE

No	Item	Criteria

1	inclusions (black spot, white spot, dust)	(1)round type
		 diameter mm(a*) no of defect*
		  a≦0.20 neglect
		  0.20＜a≦0.35 5max
		  0.35＜a none
		(2)linear type
		 length mm(l) width mm(W) no. of defect
		  na W≦0.03 neglect
		  l≦3 0.03＜W≦0.08 6
		  3＜l 0.08＜W none

2	scratch	1. scratch on protective film is permitted.
		2. scratch on polarizer shall be as follow:
		 (1)round type
		  diameter mm(a*) no of defect
		   a≦0.15 neglect
		   0.15＜a≦0.20 2 max
		   0.20＜a none
		 (2)linear type
		be judged bye 1.-(2) linear type

3	dent	diameter ＜ 1.5mm
4	bubble	not exceeding 0.5mm average diameter is acceptable between glass and polarizing film
5	pin hole	(a+b)/2 ≦ 0.15mm maximum number: ignored 0.15＜(a+b)/2≦0.20mm maximum number:10
6	dot defect	(a+b)/2≦0.20mm maximum number: ignored 0.20＜(a+b)/2≦0.30mm maximum number:5 x=width
7	contrast irregularity(spot)	diameter spec no of defect a≦0.50mm neglect 0.50＜a≦0.75 5 0.75＜a≦1.00 3 1.00＜a none
8	dot width	design width ±15%
9	color tone and uniformity	obvious uneven color is not permitted