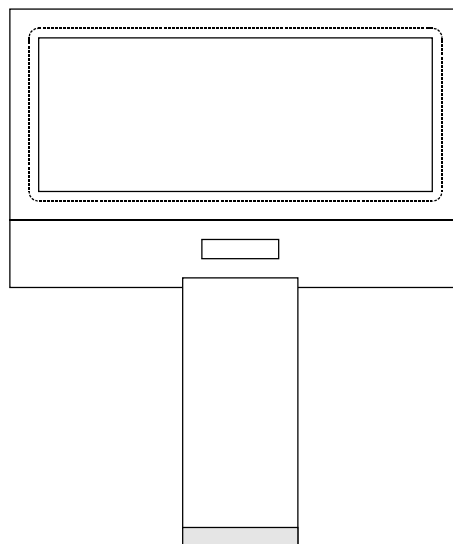




PRODUCT SPECIFICATION

HDG12864F-3

128x64 GRAPHICS
Chip-On-Glass
Parallel Interface
LCD DISPLAY MODULE



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1.MECHANICAL DATA

(1) Product No.	HDG12864F-3
(2) Module Size	71.0 (W)mm x 52.0 (H)mm x 2.8 (D)mm
(3) Dot Size	0.42 (W)mm x 0.51 (H)mm
(4) Dot Pitch	0.46 (W)mm x 0.56 (H)mm
(5) Resolution	128 (W) x 64 (H)
(6) Duty	1/64
(9) LCD Display Mode	FSTN: Normally White / Positive Image
	Rear Polarizer: Reflective
(10) Viewing Direction	6 O'clock
(11) Backlight	Excluded
(12) Weight	22.0 g(Approx.)
(13) Controller	SED1565D0B (S1D15605D00B000)

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2.ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V

	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD-VSS	-0.3	5.5	V	
Input Voltage	VI	-0.3	VDD	V	
Static Electricity	-	-	-	-	Note 1

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	-20	70	-30	80
Humidity(Without Condensation	Note 2,3		Note 2,4	

Note 1 LCM should be grounded during handling LCM.

Note 2 Background color changes slightly depending on ambient temperature.
This phenomenon is reversible.

Note 3 $T_a \leq 70^{\circ}\text{C}$: 75%RH max
 $T_a > 70^{\circ}\text{C}$: Absolute humidity must be lower
than the humidity of 75%RH at 70°C

Note 4 T_a at -30°C will be < 48hrs, at 80°C will be < 120hrs

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3. ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply Voltage	VDD	25℃	2.7	3.3	5.5	V
Input Voltage	VIH	H level	0.7VDD	—	VDD	
	VIO	L level	−0.3	—	0.2VDD	
Recommended LCD Driving Voltage	VDD−VL6 (VLCD)	DUTY= 1/64 Bias= 1/9	−20℃	11.5	11.8	V
			0℃	11.0	11.3	
			25℃	10.5	10.8	
			50℃	10.1	10.4	
			70℃	9.8	10.1	
Power Supply Current	IDD	VDD = +5.0v	—	1.7	2.6	mA

4.OPTICAL CHARACTERISTICS

AT Vop

ITEM MODE		Cr(Contrast Ratio)										θ (Viewing Angle)		ϕ (Viewing Angle)	
		-20°C		0°C		25°C		50°C		70°C		25°C		25°C	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
S	J	5.0	7.0	5.0	7.0	5.5	7.5	4.5	6.5	3.0	4.5	-	73	-	±38
NOTE		NOTE 6										NOTE 5			

NOTE :

S : TRANSFLECTIVE(NORMAL)

J : NORMALLY WHITE 6 O'CLOCK

AT $\phi=0^\circ$ $\theta=0^\circ$

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20°C	2200	2700	3200	ms	NOTE 2
		0°C	450	600	750		
		25°C	150	180	210		
		50°C	65	80	95		
		70°C	40	50	60		
Response Time (fall)	Tf	-20°C	1000	1200	1400	ms	NOTE 2
		0°C	200	250	300		
		25°C	65	80	95		
		50°C	32	40	48		
		70°C	20	25	50		

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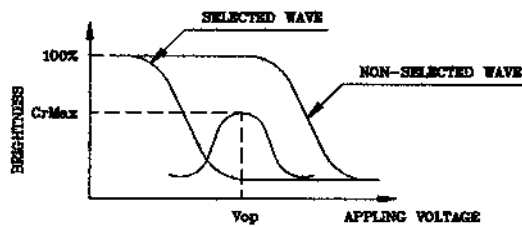
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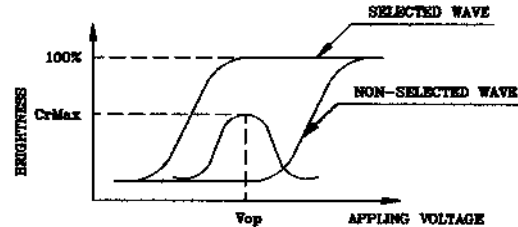
DATE:
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(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



(negative type)

*Conditions

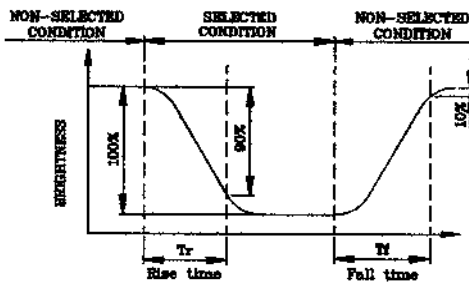
Viewing Angle : 0

Frame Frequency : 70Hz

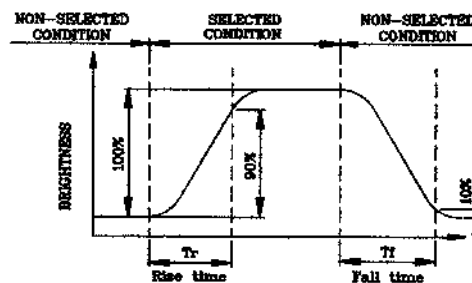
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(T_r , T_f)



(positive type)



(negative type)

*Conditions

Operating Voltage : V_{op}

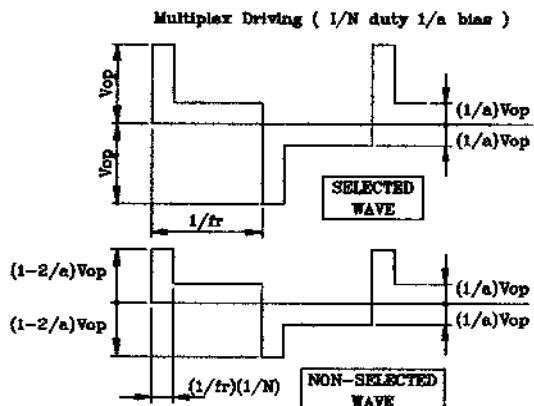
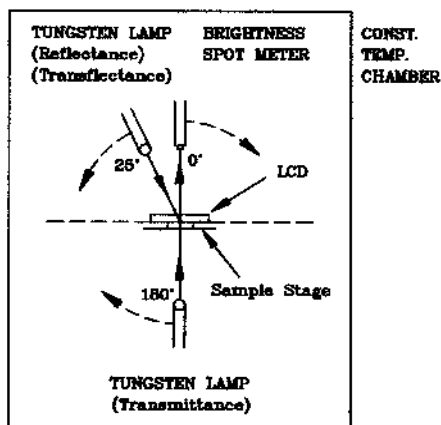
Viewing Angle (θ, ϕ) : (0,0)

Frame Frequency : 70Hz

Applying Waveform : 1/N duty 1/a bias

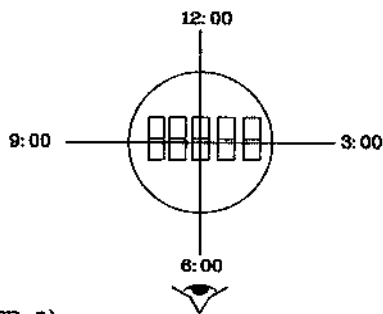
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



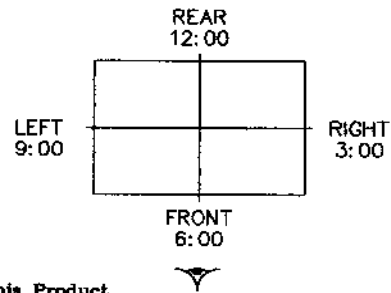
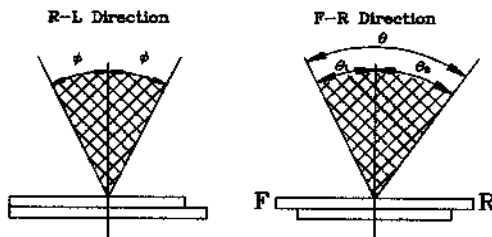
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



*For This Product

The Viewing Direction Is 6 O'clock
So $\theta_1 > \theta_2$

$$\theta = \theta_1 + \theta_2$$

*Conditions

Operating Voltage : Vop

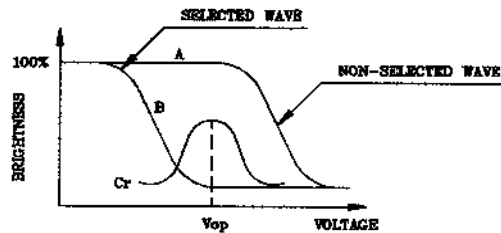
Frame Frequency : 70Hz

Applying Waveform : 1/N duty 1/a bias

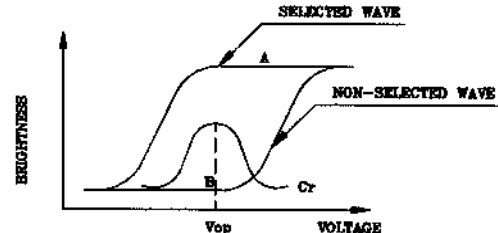
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



(negative type)

$$\text{Contrast Ratio : } Cr = A/B$$

*Conditions

Viewing Angle : 0

Frame Frequency : 70Hz

Applying Waveform : 1/N duty 1/a bias

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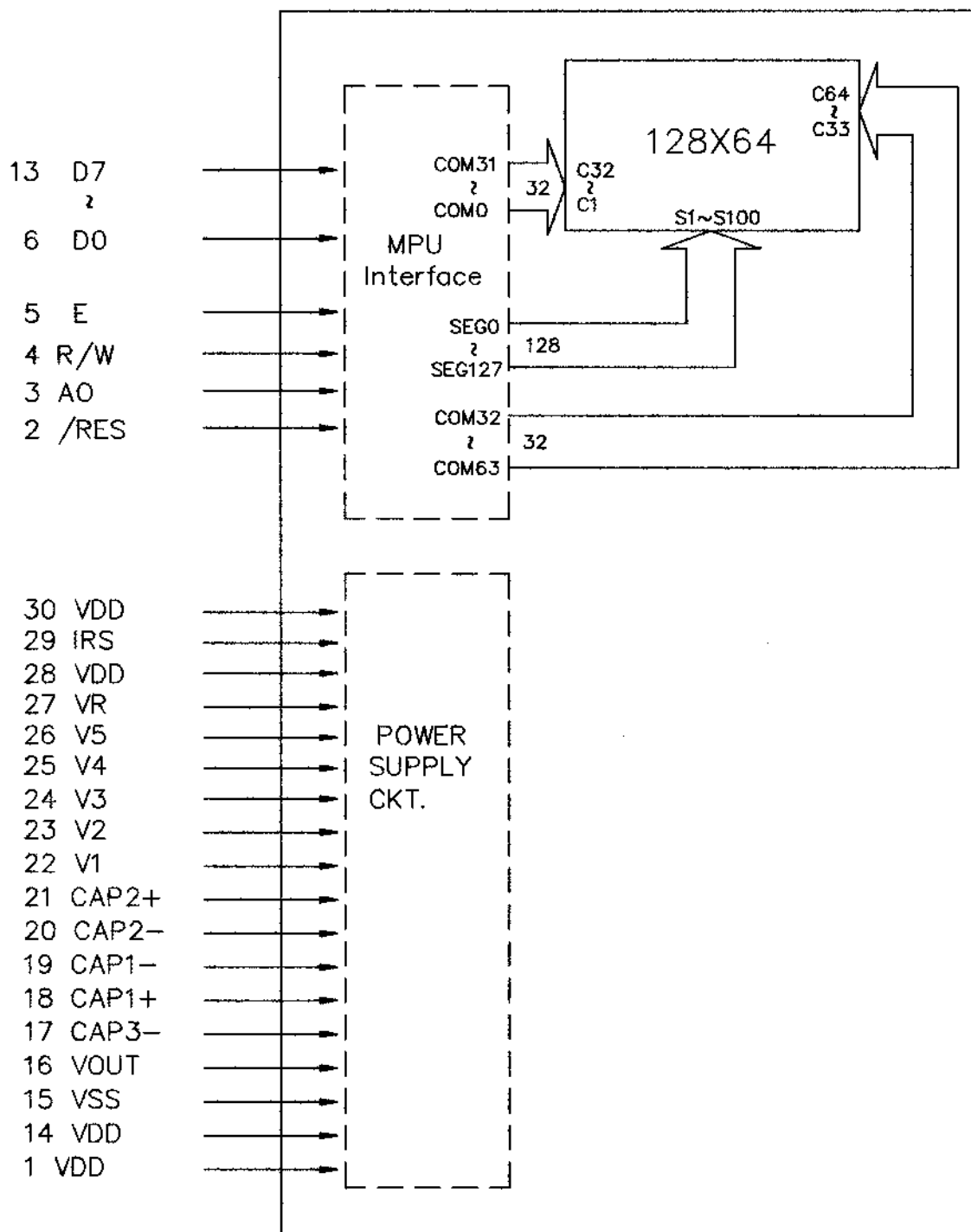
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5. BLOCK DIAGRAM



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6.INTERNAL PIN CONNECTION

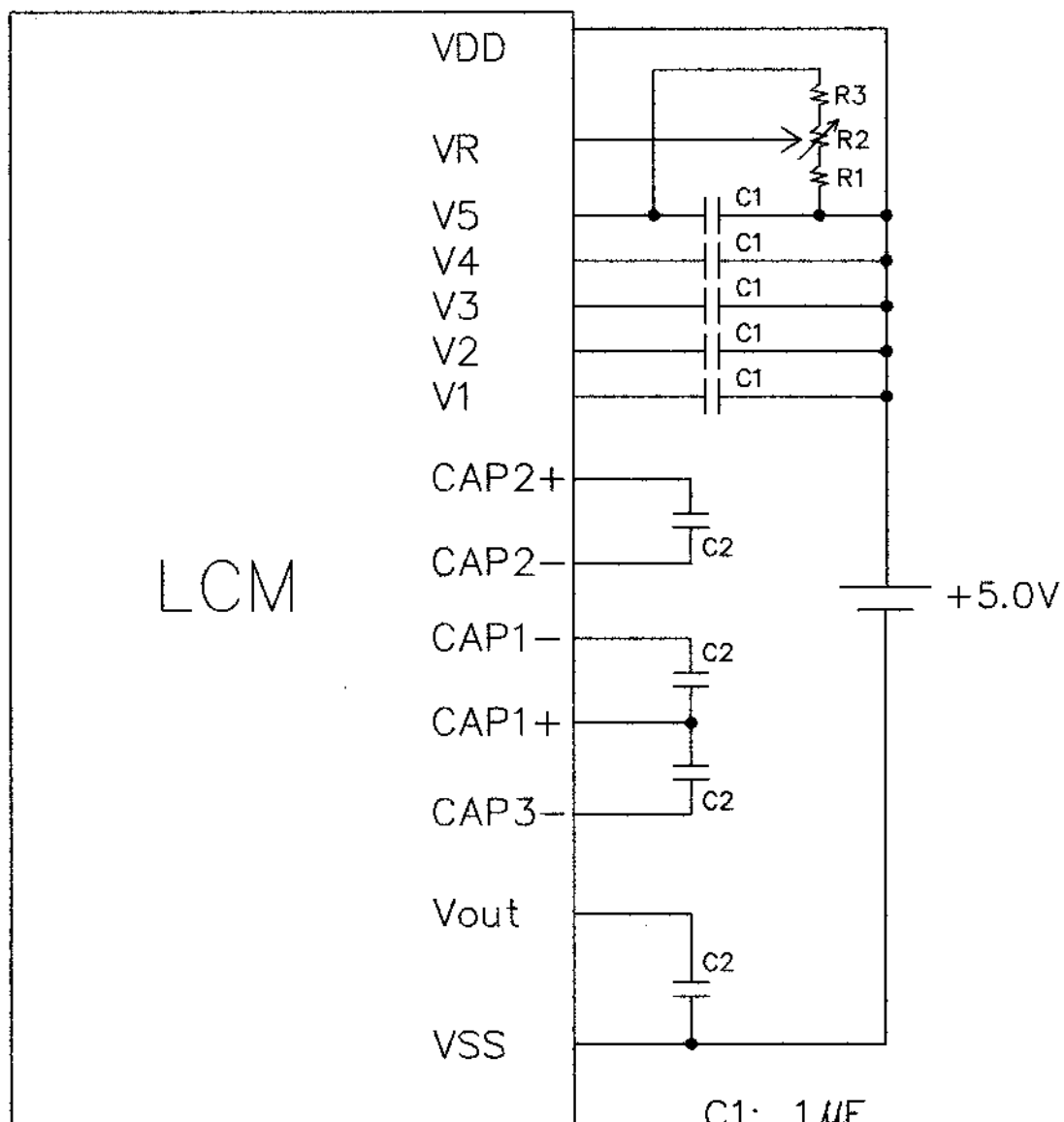
Pin No.	Symbol	Function
1	VDD	Power Supply for Logic
2	$\overline{\text{RES}}$	Reset Signal
3	A0	Control/Data Select Signal
4	R/W	Signal to Select Read and Write
5	E	Enable Clock Input
6	D0	Data Bus
7	D1	
8	D2	
9	D3	
10	D4	
11	D5	
12	D6	
13	D7	
14	VDD	Power Supply for Logic
15	VSS	Ground
16	Vout	DC/DC Converter Output
17	CAP3--	DC/DC Voltage Converter Capacitor 3 Negative Connection
18	CAP1+	DC/DC Voltage Converter Capacitor 1 Positive Connection
19	CAP1--	DC/DC Voltage Converter Capacitor 1 Negative Connection
20	CAP2--	DC/DC Voltage Converter Capacitor 2 Negative Connection
21	CAP2+	DC/DC Voltage Converter Capacitor 2 Positive Connection
22	V1	LCD Driver Supply Voltages
23	V2	
24	V3	
25	V4	
26	V5	
27	VR	Voltage Adjustment Pin.
28	VDD	Power Supply for Logic
29	IRS	"H":Use Internal Resistor ; "L":Not Use Internal Resistor
30	VDD	Power Supply for Logic

Used Cable : FPC , 0.5mm , 30 Pins , thickness 0.3mm.

Mating Connector : Molex 52689-3093 or Compatible.

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7. POWER SUPPLY

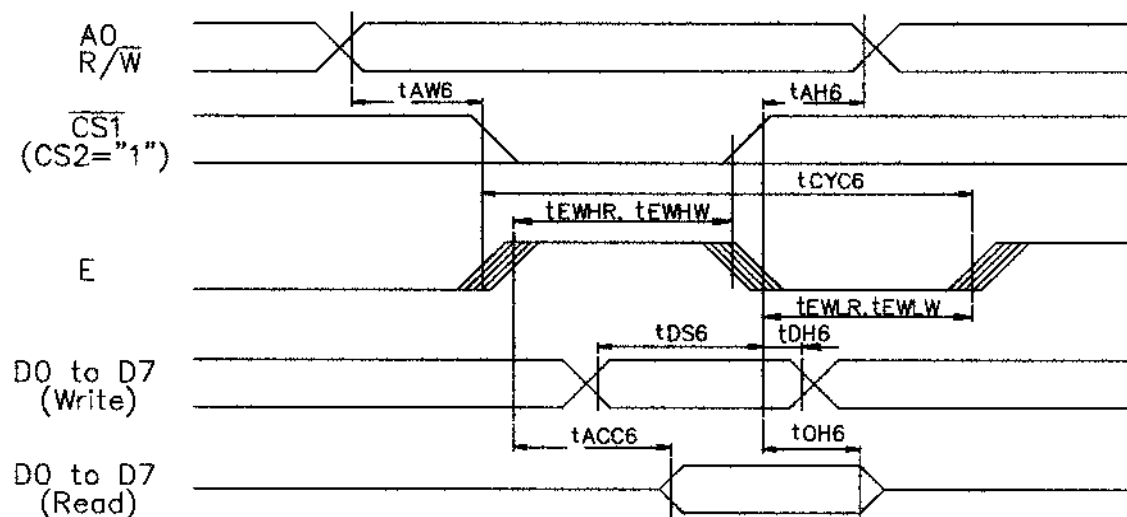


C1: 1 μ F
 C2: 2.2 μ F
 R1: 240K Ω
 R2: 200K Ω
 R3: 1M Ω

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8. TIMING CHARACTERISTICS

8-1 For 6800 Series MPU



VDD=4.5~5.5V, Ta=-40~85°C

Item	Signal	Symbol	Condition	Rating		Unites
				Min	Max	
Address hold time	A0	tAH6		0	—	ns
Address setup time	A0	tAW6		0	—	ns
System cycle time	A0	tCYC6		166	—	ns
Data setup time	D0 to D7	tDS6		30	—	ns
Data hold time		tDH6		10	—	ns
Access time	D0 to D7	tACC6	CL=100pF	—	70	ns
Output disable time		tOH6		10	50	ns
Enable H pulse time	Read	E	tEWHR, tEWHW	70	—	ns
Enable L pulse time	Write			30	—	ns
Enable H pulse time	Read	E	tEWLR, tEWLW	30	—	ns
Enable L pulse time	Write			30	—	ns

VDD=2.7~4.5V, Ta=-40~85°C

Item	Signal	Symbol	Condition	Rating		Unites
				Min	Max	
Address hold time	A0	tAH6		0	—	ns
Address setup time	A0	tAW6		0	—	ns
System cycle time	A0	tCYC6		300	—	ns
Data setup time	D0 to D7	tDS6		40	—	ns
Data hold time		tDH6		15	—	ns
Access time	D0 to D7	tACC6	CL=100pF	—	140	ns
Output disable time		tOH6		10	100	ns
Enable H pulse time	Read	E	tEWHR, tEWHW	120	—	ns
Enable L pulse time	Write			60	—	ns
Enable H pulse time	Read	E	tEWLR, tEWLW	60	—	ns
Enable L pulse time	Write			60	—	ns

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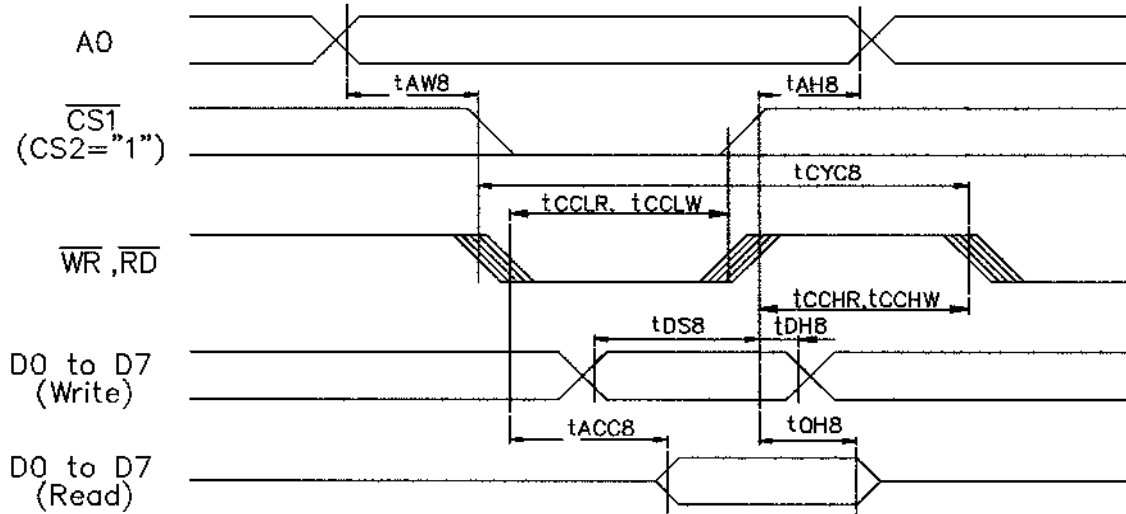
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8-2 For 8080 Series MPU



VDD=4.5~5.5V, Ta=-40~85°C

Item	Signal	Symbol	Condition	Rating		Unites
				Min	Max	
Address hold time	A0	tAH8		0	—	ns
Address setup time	A0	tAW8		0	—	ns
System cycle time	A0	tCYC8		166	—	ns
Control L pulse width	WR	tCCLW		30	—	ns
Control L pulse width	RD	tCCLR		70	—	ns
Control H pulse width	WR	tCCHW		30	—	ns
Control H pulse width	RD	tCCHR		30	—	ns
Data setup time	D0 to D7	tDS8		30	—	ns
Data hold time		tDH8		10	—	ns
RD access time		tACC8	CL=100pF	—	70	ns
Output disable time		tOH8		5	50	ns

VDD=2.7~4.5V, Ta=-40~85°C

Item	Signal	Symbol	Condition	Rating		Unites
				Min	Max	
Address hold time	A0	tAH8		0	—	ns
Address setup time	A0	tAW8		0	—	ns
System cycle time	A0	tCYC8		300	—	ns
Control L pulse width	WR	tCCLW		60	—	ns
Control L pulse width	RD	tCCLR		120	—	ns
Control H pulse width	WR	tCCHW		60	—	ns
Control H pulse width	RD	tCCHR		60	—	ns
Data setup time	D0 to D7	tDS8		40	—	ns
Data hold time		tDH8		15	—	ns
RD access time		tACC8	CL=100pF	—	140	ns
Output disable time		tOH8		10	100	ns

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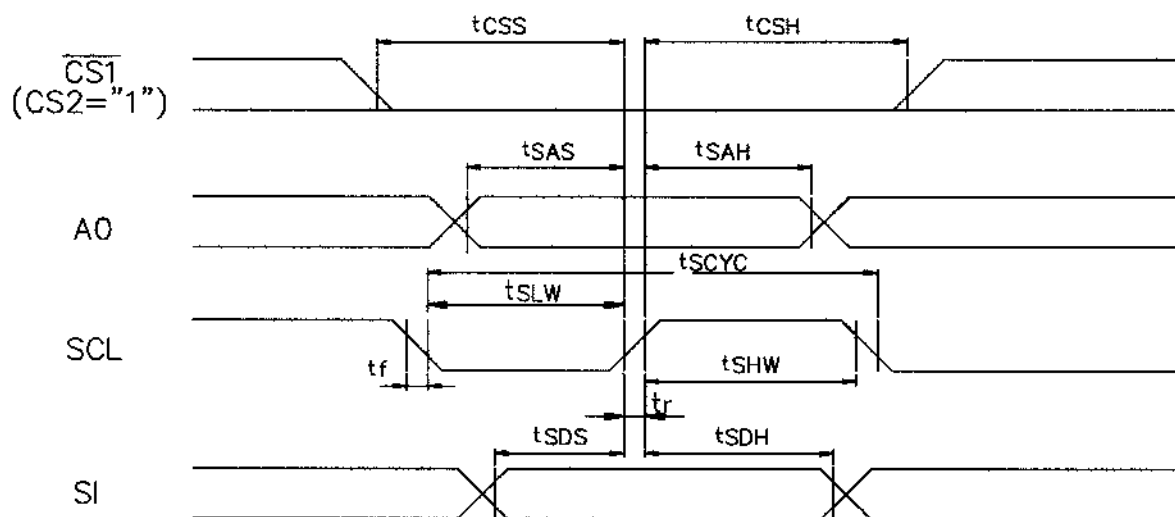
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8-3 For Series Interface



VDD=4.5~5.5V, Ta=-40~85°C

Item	Signal	Symbol	Condition	Rating		Unites
				Min	Max	
Serial Clock Period		tSCYC		200	—	ns
SCL "H" pulse width	SCL	tSHW		75	—	ns
SCL "L" pulse width	SCL	tSLW		75	—	ns
Address setup time	A0	tSAS		50	—	ns
Address hold time	A0	tSAH		100	—	ns
Data setup time	SI	tSDS		50	—	ns
Data hold time	SI	tSDH		50	—	ns
CS-SCL time	CS	tCSS		100	—	ns
		tCSH		100	—	ns

VDD=2.7~4.5V, Ta=-40~85°C

Item	Signal	Symbol	Condition	Rating		Unites
				Min	Max	
Serial Clock Period		tSCYC		250	—	ns
SCL "H" pulse width	SCL	tSHW		100	—	ns
SCL "L" pulse width	SCL	tSLW		100	—	ns
Address setup time	A0	tSAS		150	—	ns
Address hold time	A0	tSAH		150	—	ns
Data setup time	SI	tSDS		100	—	ns
Data hold time	SI	tSDH		100	—	ns
CS-SCL time	CS	tCSS		150	—	ns
		tCSH		150	—	ns

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8-4 SED1565 Series Commands

Command	Command Code											Function
	AD	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	
(1)Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0	LCD display ON/OFF 0: OFF,1: ON
(2)Display start line set	0	1	0	0	1	Display start address					Sets the display RAM display start line address	
(3)Page address set	0	1	0	1	0	1	1	Page address				Sets the display RAM page address
(4)Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address.
Column address set lower bit	0	1	0	0	0	0	0	Least significant column address				Sets the least significant 4 bits of the display RAM column address.
(5)Status read	0	0	1	Status				0	0	0	0	Reads the status data
(6)Display data write	1	1	0	Write data							Writes to the display RAM	
(7)Display data read	1	0	1	Read data							Reads from the display RAM	
(8)ADC select	0	1	0	1	0	1	0	0	0	0	0	Sets the display RAM address SEG output correspondence 0:normal,1:reverse
(9)Display normal/reverse	0	1	0	1	0	1	0	0	1	1	0	Sets the LCD display normal/reverse 0:normal,1:reverse
(10)Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0	Display all points 0:normal display 1:all point ON
(11)LCD bias set	0	1	0	1	0	1	0	0	0	1	0	Sets the LCD drive voltage bias ratio SED1565***.....0:1/9,1:1/7 SED1566***.....0:1/8,1:1/6 SED1567***.....0:1/6,1:1/5
(12)Read/modify/write	0	1	0	1	1	1	0	0	0	0	0	Column address increment At write:+1 At read:0
(13)End	0	1	0	1	1	1	0	1	1	1	0	Clear read/modify/write
(14)Reset	0	1	0	1	1	1	0	0	0	1	0	Internal reset
(15)Common output mode select	0	1	0	1	1	0	0	0	*	*	*	Select COM output scan direction 0:normal direction, 1:reverse direction
(16)Power control set	0	1	0	0	0	1	0	1	Operating mode		Select internal power supply operating mode	
(17)V5 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio		Select internal resistor ratio (Rb/Ra) mode	
(18)Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	1	Set the V5 output voltage electronic volume register
Electronic volume register set	0	1	0	*	*	Electronic volume value						
(19)Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0	0: OFF,1: ON
Static indicator register set	0	1	0	*	*	*	*	*	*	*	mode	Set the flashing mode
(20)Power saver												Display OFF and display all points ON compound command
(21)NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
(22)Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command
(23)Test mode reset	0	1	0	1	1	1	1	0	0	0	0	Enter during the refresh sequence.

(Note)*: disabled data

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9. RELIABILITY TEST

NO	ITEM	CONDITION			STANDARD	NOTE
1	High Temp. Storage	70°C	120HR		Appearance without defect	
2	Low Temp. Storage	-20°C	120HR		Appearance without defect	
3	High Temp. & High Humi. Storage	40°C 90%RH	120HR		Appearance without defect	
4	Thermal Shock	-20°C, 30min → 25°C.5min → 70°C, 30min → 25°C.5min (1cycle)			Appearance without defect	5 cycles

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NOTE:

- SAFETY

- 1.If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
- 2.If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

- HANDLING

- 1.Avoid static electricity which can damage the CMOS LSI.
- 2.Do not remove the panel or frame from the module.
- 3.The polarizing plate of the display is very fragile. So, please handle it very carefully.
- 4.Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
- 5.Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.

- STORAGE

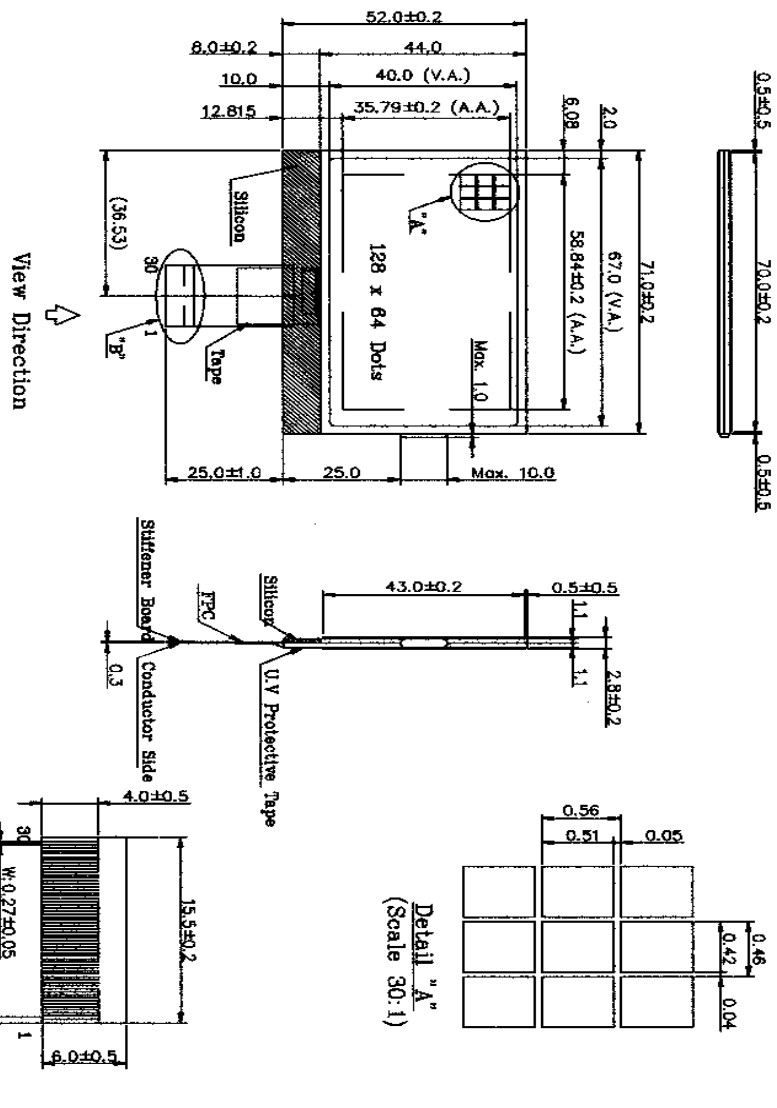
- 1.Store the panel or module in a dark place where the temperature is $25^{\circ}\text{C}\pm 5^{\circ}\text{C}$ and the humidity is below 65% RH.
- 2.Do not place the module near organics solvents or corrosive gases.
- 3.Do not crush, shake, or jolt the module.

- TERMS OF WARRANT

- 1.Acceptance inspection period
The period is within one month after the arrival of contracted commodity at the buyer's factory site.
- 2.Applicable warrant period
The period is within twelve months since the date of shipping out under normal using and storage conditions.
- 3.Strengthen Q.C inspection on the light guide, especially the hooks & pinholes.

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Pin No./Symbol	Function
1 VDD	Power Supply for Logic
2 RES	Reset Signal
3 A0	Control/Data Select Signal
4 R/W	Signal to Select Read and Write
5 E	Enable Clock Input
6 D0	Data Bus
7 D1	
8 D2	
9 D3	
10 D4	
11 D5	
12 D6	
13 D7	
14 VDD	Power Supply for Logic
15 VSS	Ground
16 Vout	DC/DC Converter Output
17 CAP3	DC/DC Converter Capacitor 3 Negative Connection
18 CAP1	DC/DC Converter Capacitor 1 Positive Connection
19 CAP1	DC/DC Converter Capacitor 1 Negative Connection
20 CAP2	DC/DC Converter Capacitor 2 Negative Connection
21 CAP2	DC/DC Converter Capacitor 2 Positive Connection
22 V1	LCD Driver Supply Voltages
23 V2	
24 V3	
25 V4	
26 V5	Voltage Adjustment Pin
27 VR	
28 VDD	Power Supply for Logic
29 ICS	IC Thermal Pad: T: 144 Use Thermal Pad: 144
30 VDD	Power Supply for Logic



DIMENSION	TOLERANCE
L ≤ 6	±0.25 (mm)
6 < L ≤ 18	±0.3 (mm)
18 < L ≤ 50	±0.4 (mm)
50 < L ≤ 125	±0.5 (mm)
125 < L	±0.6 (mm)
ANGLE	±1° (DEG)

- Notes :
- Resolution : 128 x 64 Dots
 - Controller IC : "EPSON" SED 1565D0B
 - Thickness of Glass : 1.1mm

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