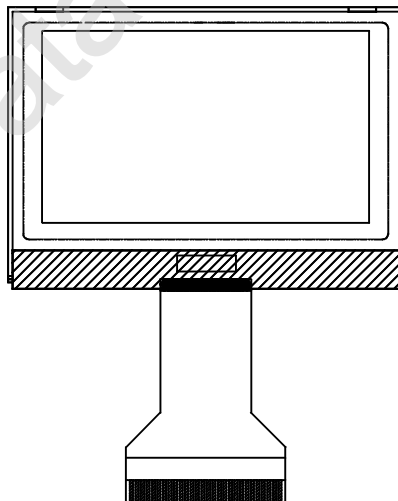


HANTRONIX

PRODUCT SPECIFICATION

HDG12864L-6

128x64 GRAPHICS
Chip-On-Glass
LCD DISPLAY MODULE
with LED Backlight



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1.MECHANICAL DATA

(1) Product No.	HDG12864L-6
(2) Module Size	72.0 (W)mm x 50.4 (H)mm x 6.2 (D)mm (LED B.L.)
(3) Dot Size	0.45 (W)mm x 0.53 (H)mm
(4) Dot Pitch	0.465(W)mm x 0.545 (H)mm
(5) Number of Characters	128 (W) x 64 (H)
(6) Duty	1/64
(9) LCD Display Mode	STN: Gray Mode
	Rear Polarizer: Transflective
(10) Viewing Direction	6 O'clock
(11) Backlight	LED B/L
(12) Weight	25.7g(approx)
(13) Controller (COG)	SED1565D0B OR Compatible

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	SED1565D0B
Input Voltage	VDD	-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
	Note 3,4		Note 4,6	
Humidity (Without Condensation)	Note 2		Note 5	

Note 1 LCM should be grounded during handling LCM.

Note 2 Ta ≤ 50°C : 85%RH max

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

Note 3 Ta at -20°C will be < 48 hrs, at 70°C will be < 120 hrs

Note 4 Background color will change slightly depending on ambient temperature.
That phenomenon is reversible.

Note 5 Ta ≤ 70°C : 75%RH max

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

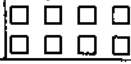
Note 6 Ta at -30°C will be < 48 hrs, at 70°C will be < 120 hrs

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3. ELECTRICAL CHARACTERISTICS

3-1. ELECTRICAL CHARACTERISTICS OF LCM

(VDD = 3.3V ± 10%)

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Input Voltage		VIH	H level	0.8VDD	—	VDD	V
		VIL	L level	0	—	0.2VDD	V
Recommended LCD Driving Voltage (WIDE TEMP. LCM)		Vop (VDD-V5)	DUTY = 1/64 Bias = 1/9	-20°C	9.2	9.5	V
				0°C	8.9	9.2	
				25°C	8.3	8.6	
				50°C	8.1	8.4	
				70°C	7.8	8.1	
Power Supply Current		IDD	VDD = 3.3V 	—	0.4	0.6	mA
LCM	Surface Luminance	L	VAK = 3.2V (RBL = 10Ω)	PATTERN: (Dots All On) 	—	0.59	cd/m ²
				PATTERN: (Dots All Off) 	—	1.26	

3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used LED Rating

Temp.=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Peak forward current	I _P	—	—	150	mA	—
Maximum reverse voltage	V _R	—	—	4	V	—
Applied forward current	I _F	—	90	120	mA	at V _F = 3.2V
Applied forward voltage	V _F	—	3.2	3.5	V	at I _F = 90 mA
LED power consumption	P _F	—	0.288	0.525	W	—
LED life time	L _L	—	40000	—	hrs	at I _F = 90 mA (*1)

(*1) LED life time is defined as follows : The final brightness is at 50% of original brightness .

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4. OPTICAL CHARACTERISTICS

(For Wide Temperature Mode LCM)

AT Vop

ITEM MODE		Cr(Contrast Ratio)										θ(Viewing Angle)		φ(Viewing Angle)	
		-20℃		0℃		25℃		50℃		70℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
H	A	3.5	4.0	4.0	4.5	4.5	5.0	4.0	4.5	3.0	3.5	—	60	—	(L)25 (R)30
NOTE		NOTE 6										NOTE 5			

NOTE :
 H : Transflective (High Transflective)
 A : Gray , 6 O'CLOCK

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	3600	4500	6700	ms	NOTE 2
		0℃	680	850	1200		
		25℃	200	250	370		
		50℃	70	95	140		
		70℃	45	60	90		
Response Time (fall)	Tf	-20℃	1900	2400	3600	ms	NOTE 2
		0℃	370	470	700		
		25℃	120	150	225		
		50℃	45	60	90		
		70℃	30	45	65		

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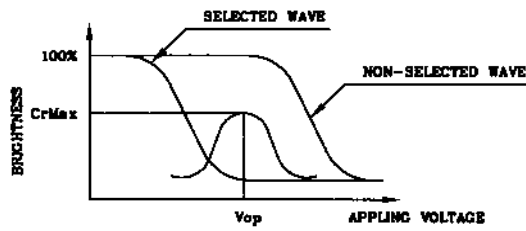
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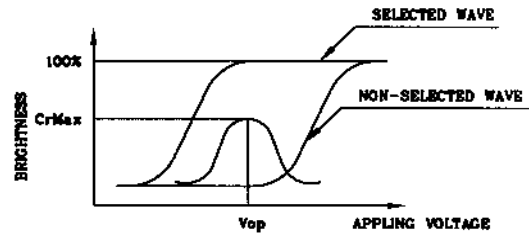
DATE:
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(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



(negative type)

*Conditions

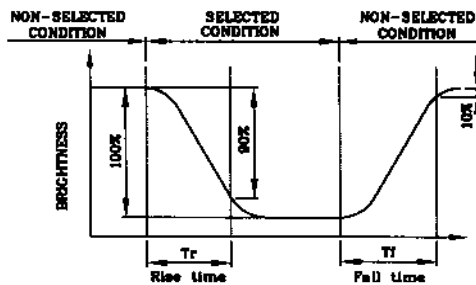
Viewing Angle : 0

Frame Frequency : 70Hz

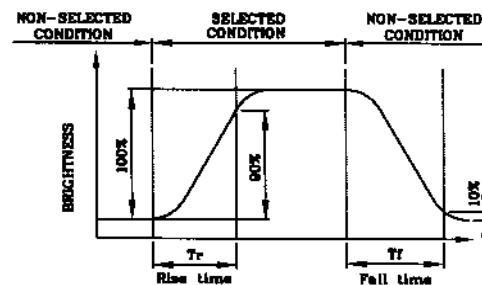
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



(negative type)

*Conditions

Operating Voltage : Vop

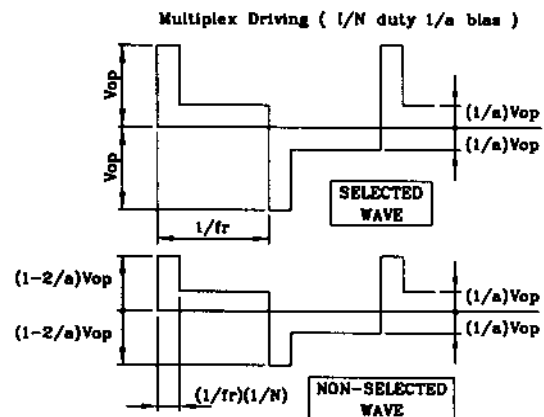
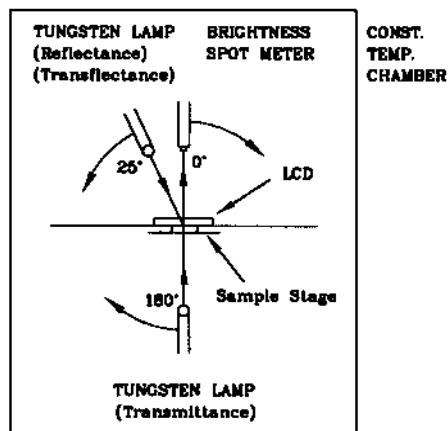
Viewing Angle (°): (0,0)

Frame Frequency : 70Hz

Applying Waveform : 1/N duty 1/a bias

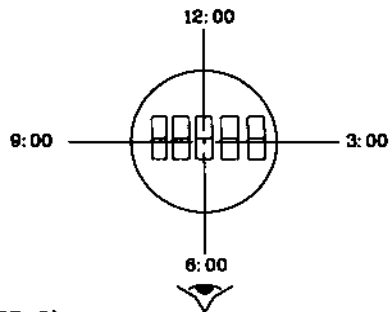
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



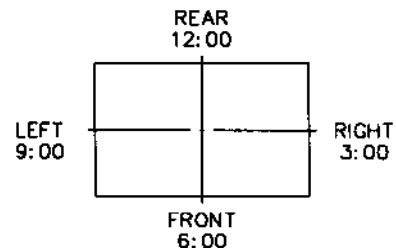
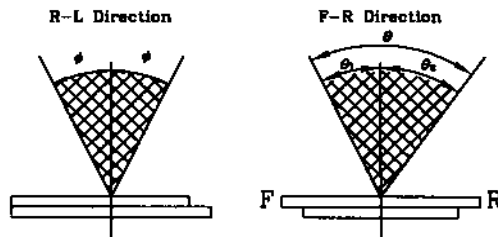
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



*For This Product

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

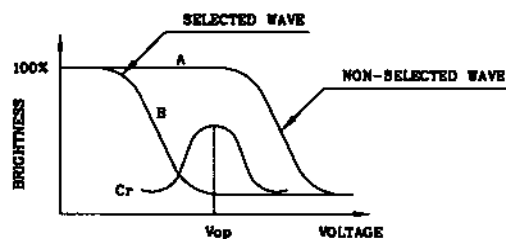
$$\theta = \theta_1 + \theta_2$$

*Conditions

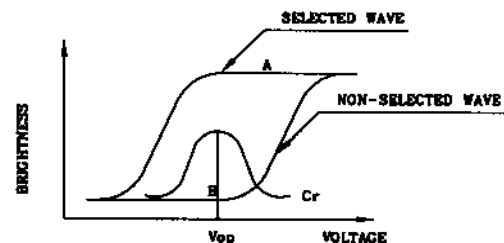
Operating Voltage : V_{op}
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(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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5.INTERNAL PIN CONNECTION

CN1: FPC CONNECTOR (PITCH 1.0)

PIN NO	SED1565008	FUNCTION
1	P/S	Select Parallel / Serial mode
2	C86	"H" : 6800 Series MPU ; "L": 8080 MPU
3	V5	This is a multi-level power supply for the liquid crystal drive
4	V4	
5	V3	
6	V2	
7	V1	
8	CAP2+	DC/DC Voltage converter
9	CAP2-	
10	CAP1-	
11	CAP1+	
12	CAP3-	
13	Vout	
14	Vss	This is a 0V terminal connected to the system GND
15	VDD	Shared with the MPU power supply terminal VCC
16	D7(SI)	Serial data input
17	D6(SCL)	Serial clock input
18	D5	Parallel data input
19	D4	
20	D3	
21	D2	
22	D1	
23	D0	
24	RD(E)	Fixed to either "H" or to "L"
25	WR(R/W)	Fixed to either "H" or to "L"
26	A0	"H" = Display data , "L" = Control data
27	/RES	Reset signal
28	/CS1	Chip select signal

Mating Connector Molex 52271-2890

CN2:

PIN NO	SYMBOL	FUNCTION
1	A	Power Supply Voltage LED Backlight (2.1V)
2	K	GND

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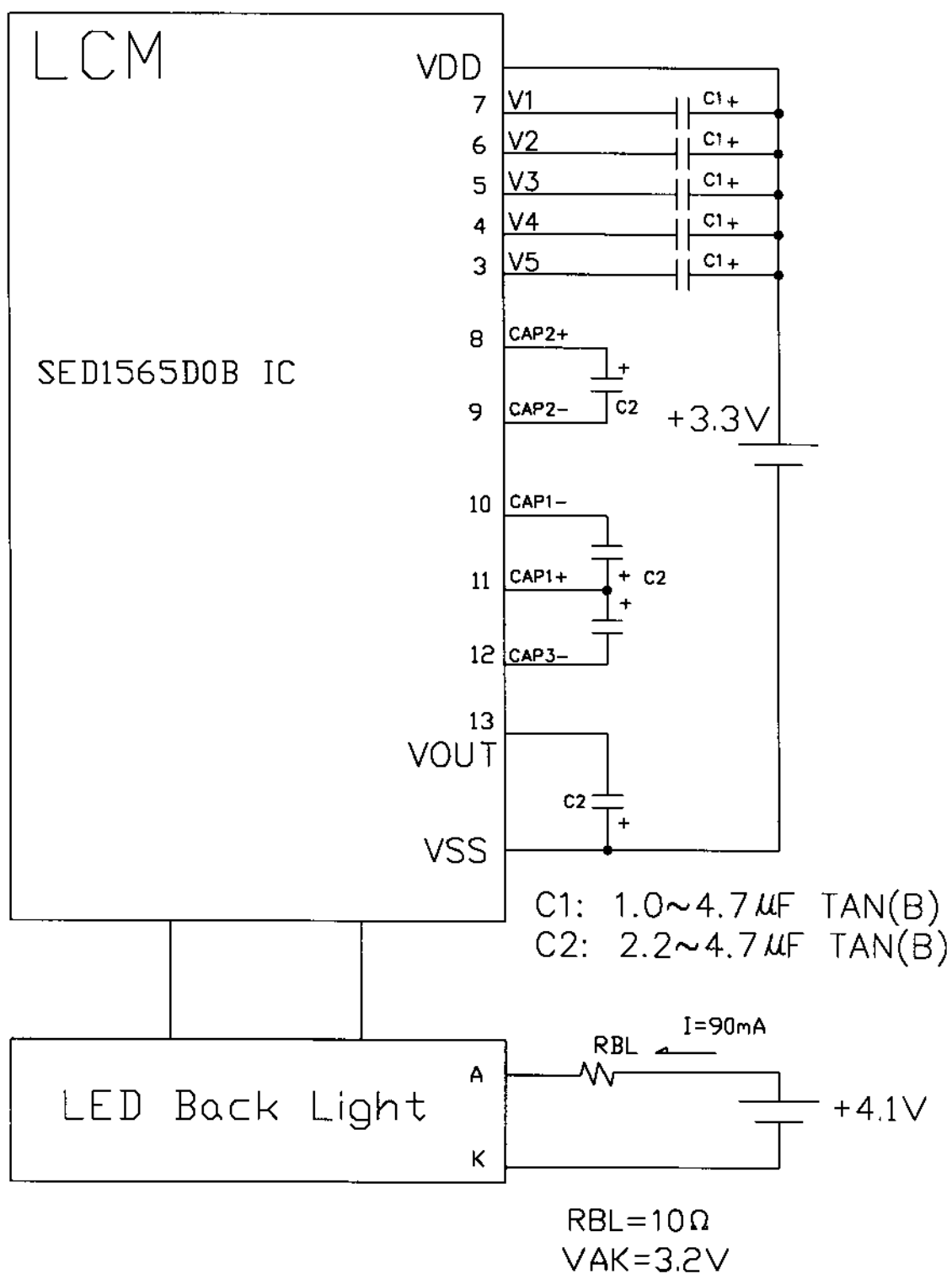
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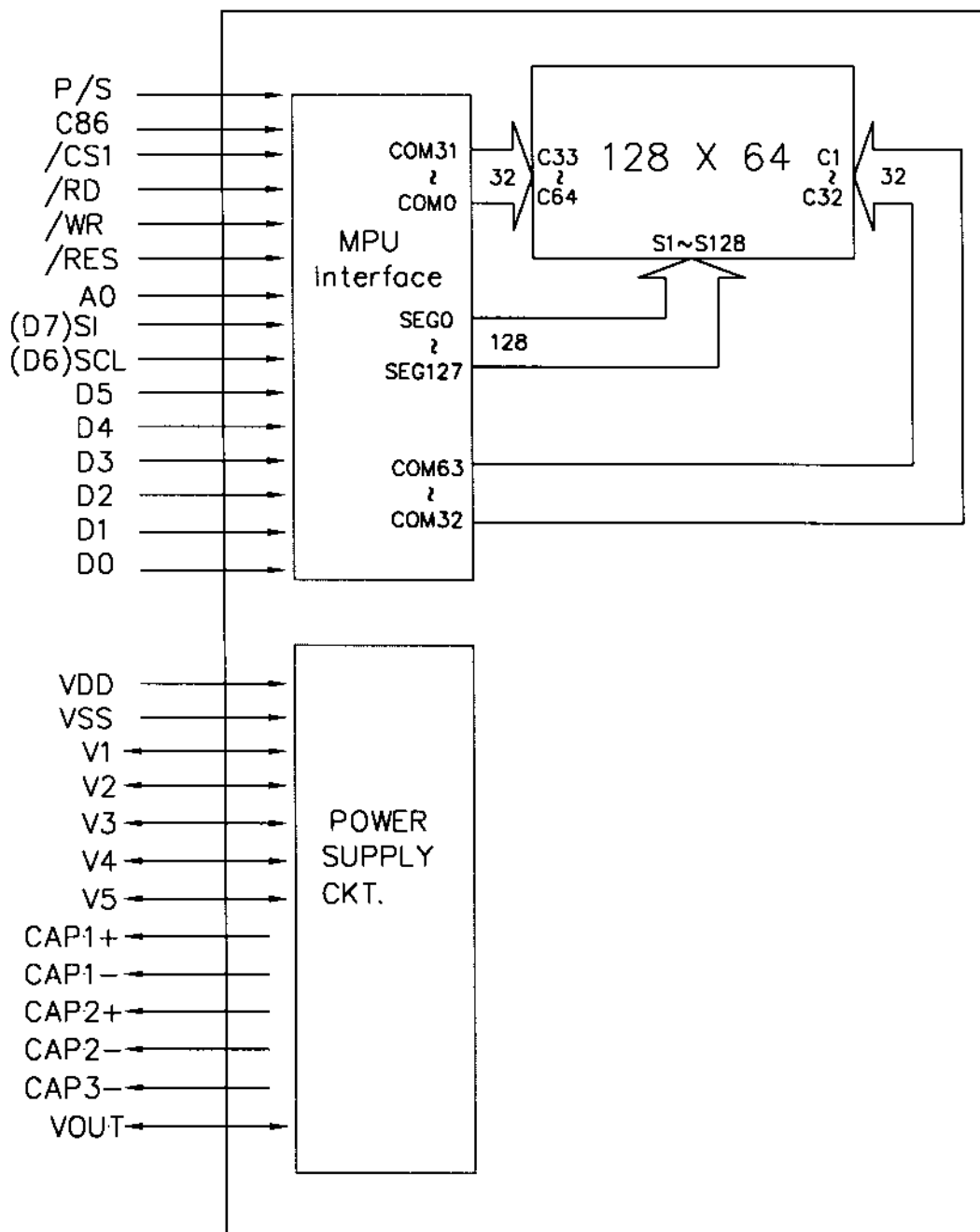
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6. POWER SUPPLY/BOOSTER CAPACITANCE



7. MPU INTERFACE/BLOCK DIAGRAM



8-1.SED1565 Series Commands

Command	Command Code											Function
	A0	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.

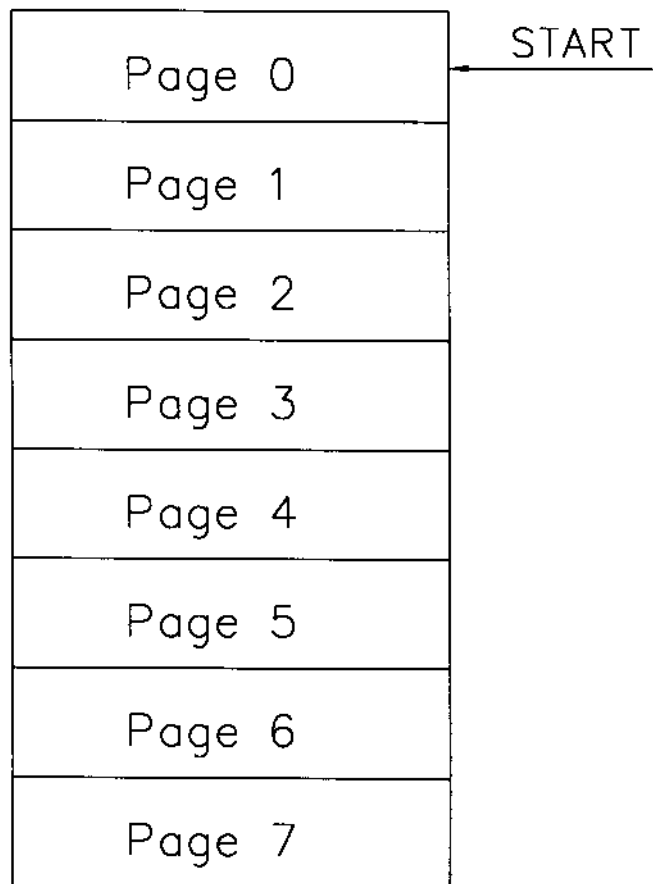
(Note)*: disabled data

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8-2.DISPLAY DATA RAM and ADDRESSES

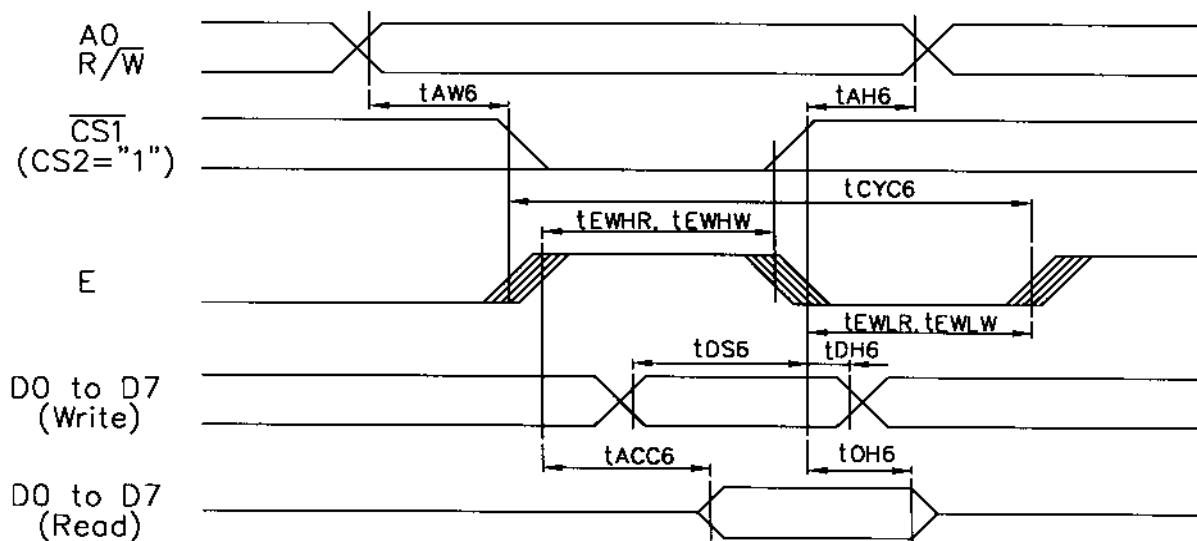
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8-3.DISPLAY PATTRN



9-1. TIMING CHARACTERISTICS

(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			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			tACC6	CL=100pF	—	70	ns
Output disable time			tOH6		10	50	ns
Enable H pulse time	Read	E	tEWHR		70	—	ns
	Write		tEWHW		30	—	ns
Enable L pulse time	Read	E	tEWLR		30	—	ns
	Write		tEWLW		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			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			tACC6	CL=100pF	—	140	ns
Output disable time			tOH6		10	100	ns
Enable H pulse time	Read	E	tEWHR		120	—	ns
	Write		tEWHW		60	—	ns
Enable L pulse time	Read	E	tEWLR		60	—	ns
	Write		tEWLW		60	—	ns

HANTRONIX, INC.
10080 BUBB RD.
CUPERTINO, CA 95014

Q.A.:

JK

REV.:

1.0

HDG12864L-6

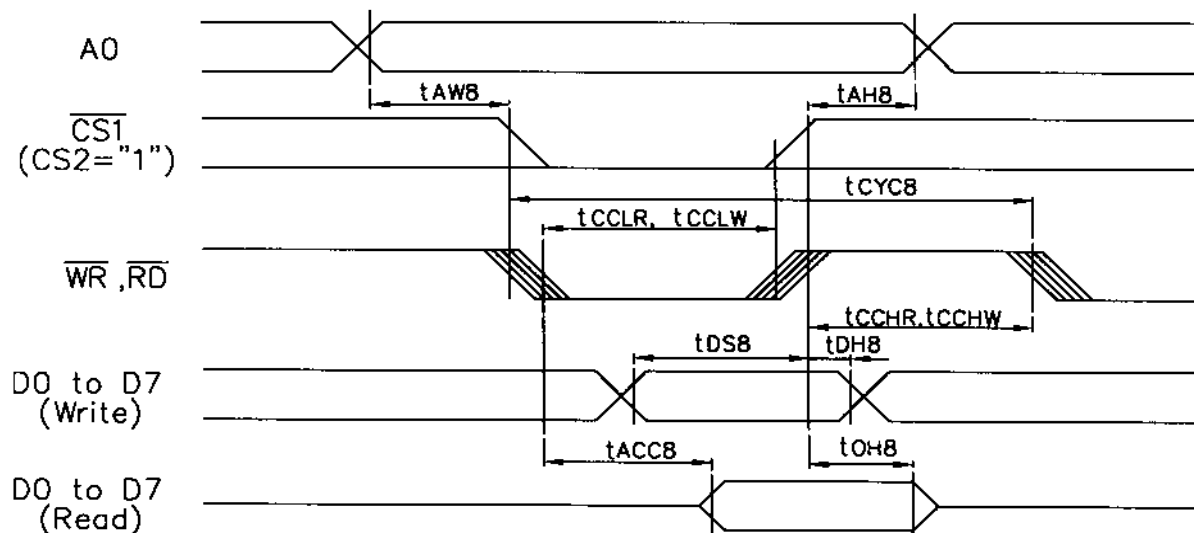
SHEET 15 OF 21

DATE:

7/23/03

9-2. TIMING CHARACTERISTICS

(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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10080 BUBB RD.
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Q.A.:

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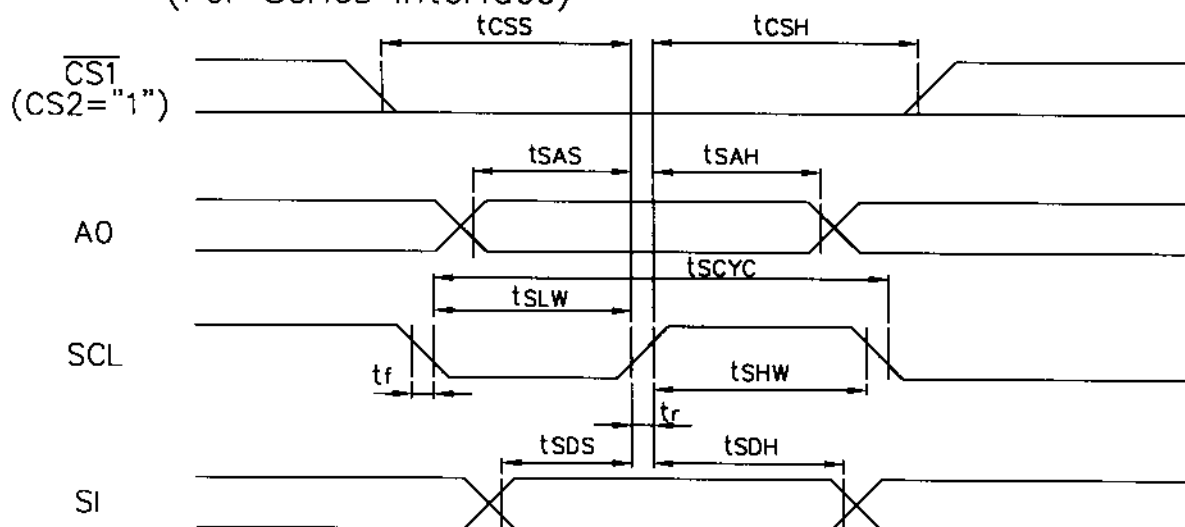
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9-3. TIMING CHARACTERISTICS

(For Series Interface)



VDD=4.5~5.5V, Ta=-40~85°C

Item	Signal	Symbol	Condition	Rating		Units
				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		Units
				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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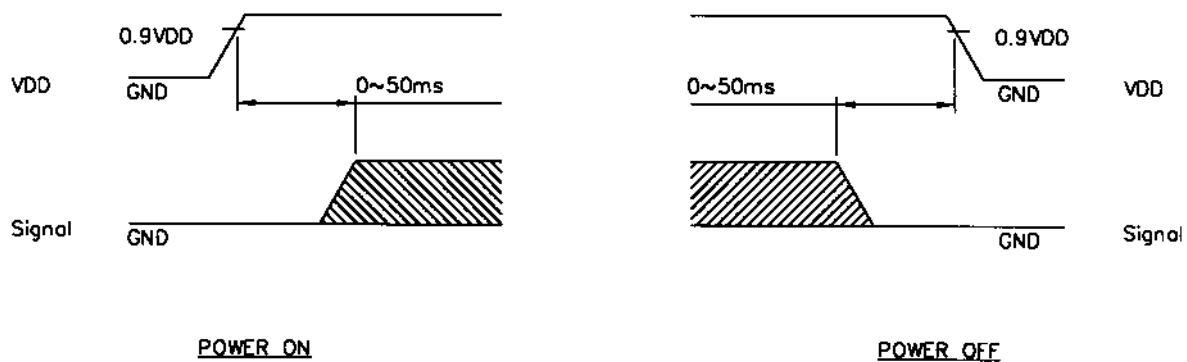
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9-4. POWER ON/OFF TIMING



The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

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10.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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NOTICE:

- **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.

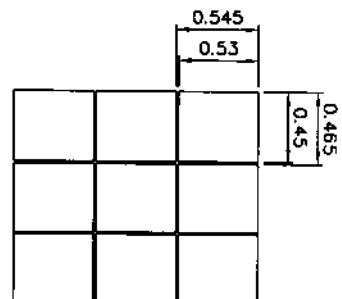
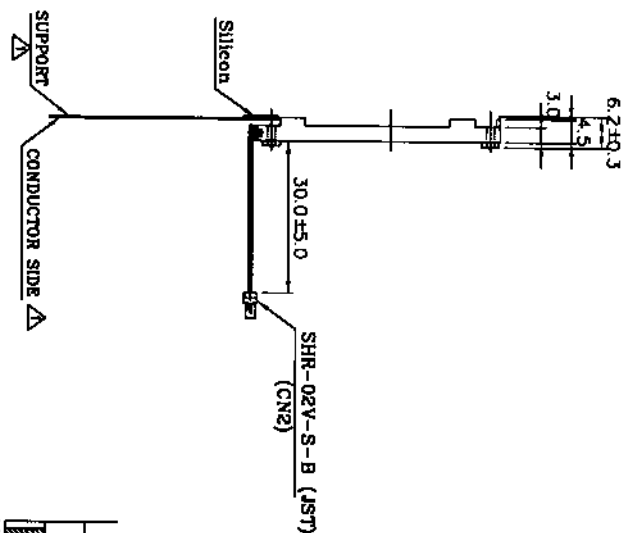
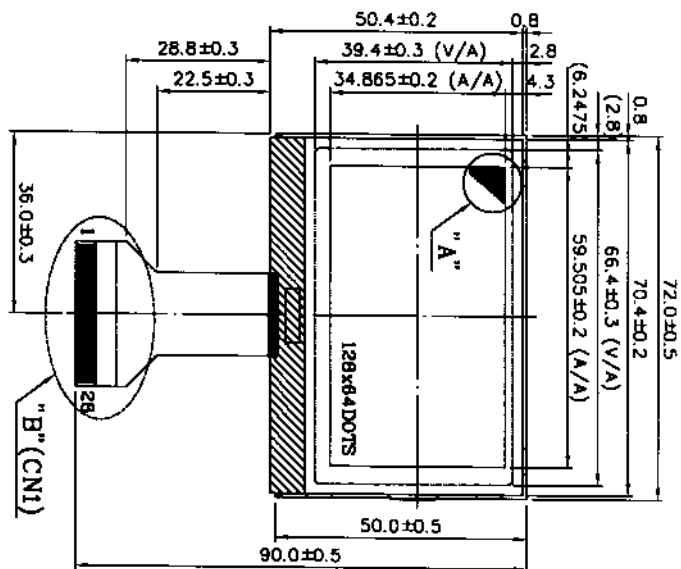
- **STORAGE**

- 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.

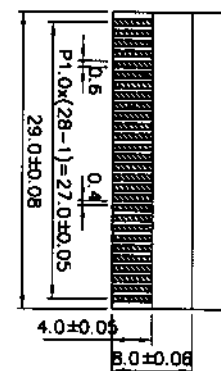
- **TERMS OF WARRANT**

- 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.

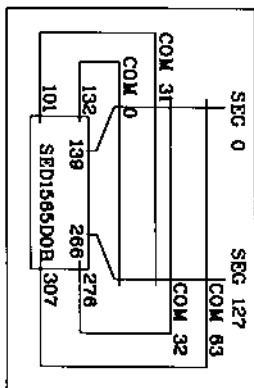
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				DATE: 7/23/03



"A" DETAIL
S=30:1



"B" DETAIL
S=2:1



Layout Diagram

- NOTES :
1. RESOLUTION : 128 x 64 DOTS
 2. COG IC : SED1565DOB or COMPATIBLE
 3. GLASS THICKNESS : 0.7 mm
 4. BACKLIGHT : LED (BLUE)

HANTRONIX, INC.
10080 BUBB RD.
CUPERTINO, CA 95014

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