

SPECIFICATIONS

TITLE : 10,4" TFT COLOR MODULE

NUMBER : HLD 1027-HIBRITE REV.A PAGE 1

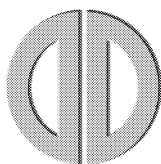
DATA DISPLAY AG

HLD 1027 HIBRITE

10.4 INCH

**ACTIVE MATRIX COLOR
HIGH BRIGHTNESS TFT DISPLAY**

640 x 480 DOTS



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REVISION OVERVIEW

INITIAL REVISION

HLD 1027- 010000 REV.A

CHANGED MAY 99

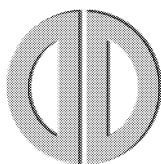
HLD 1027- 010100 REV.A

Added mechanical tolerances for drawings

New halfbrightness time for CCFL tubes

CHANGED SEP. 00

Improved Top and T_{St}



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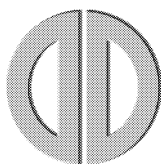
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1. OUTLINE

1-1 Scope

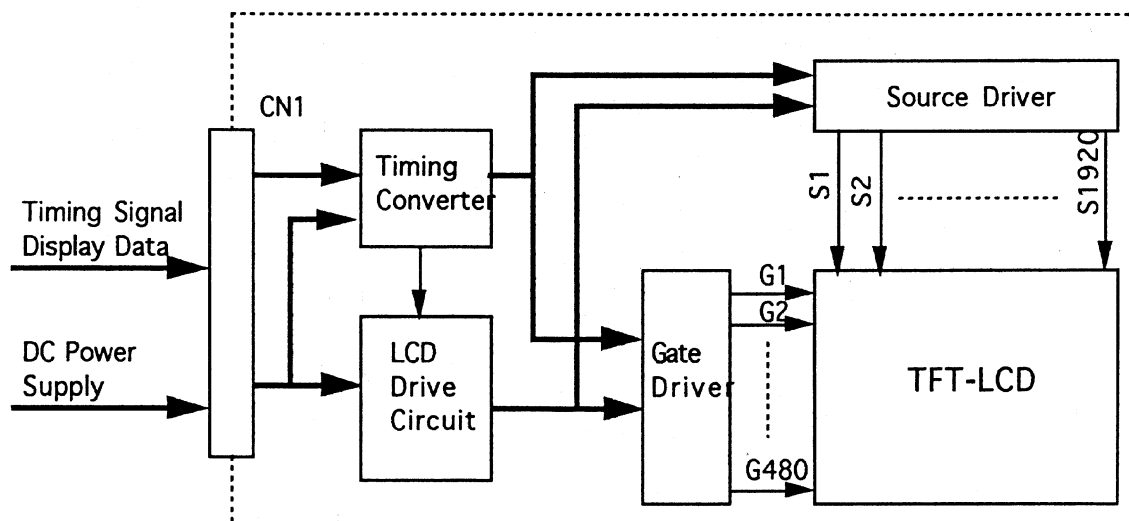
This specification shall be applied to Data Displays Color Active Dot Matrix Liquid Crystal Display (ALCD) with CCFL backlight

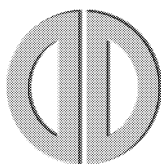
1-2 Features

Display Mode	Transmissive type normally white mode
Display Format	640 (x3) x 480 Dots
Screen Area	216,2 x 163,4 mm (264,2 mm diagonal)
Display Outline	246,5 x 179,4 x 8,0 mm (typ.)
Contrast Ratio	150:1 (typ.)
Brightness	250 cd/m ² (typ) / If = 5 mA
Response Time	Tr = 30ms (typ) / Tf = 50 ms (typ)
Color Pixel Arrangement	RGB vertical stripes
Display Surface	Low reflection type, antiglare with hard coating
Number of Colors	262.144 colors (6 bits for each RGB subpixel)
Contrast Setting	Maximum setting
Viewing Direction	6:00 o' clock (Maximum contrast direction)
Interface	3,3V CMOS logic
Backlight	CCFL top edgelight system

1-3 Block Diagram

1-3-1 Display



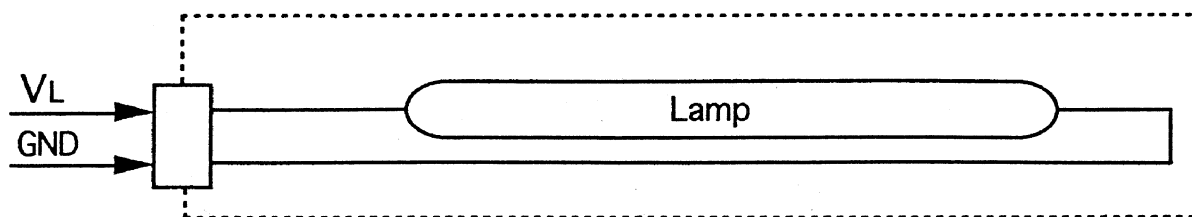


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1-3-2 Backlight Unit



2. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Specification	Unit	Remark
Storage Temperature	T _{st}	-25 ... +70	°C	
Humidity *	RH	95 max	%	≤ 40°C
Operating Temperature	T _{op}	0 ... 60 ^{**}	°C	
Humidity *	RH	95 max	%	≤ 40°C
Supply Voltage	V _{DD}	3.0 ... +3.6		T _a =25°C
Input Voltage	V _I	0V ... V _{DD}	V	

* Notes :

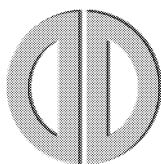
The relative humidity must not exceed 95% non-condensing at temperatures of 40°C or less

At temperatures higher than 40°C the wet bulb temperature must not exceed 39°C

The unit should not be exposed to corrosive chemicals

See section "5 Reliability" for other conditions

^{**}Optical values (contrast, response time, brightness, viewing angle) maybe influenced in lower and upper T_{op}



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3. DISPLAY CHARACTERISTICS

3-1 Physical Dimensions

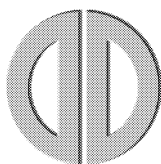
Item	Standard Value	Unit
Display Pixels	640 (x3RGB) x 480	dots
Pixel Pitch	0,33 (0,11x3) x 0,33	mm
Screen Area	216,2 x 163,4	mm
Active Area	211,2 x 158,4 (10,4" diagonal)	mm
Display Outline	246,5 x 179,4 x 8,0	mm
Weight	410	grams

3-2 Electro-Optical Characteristics

Item	Condition	Symbol	Min	Typ	Max	Unit
Contrast Ratio	$\theta=0^\circ, \phi=0^\circ$	CR	100	150	-	-
Viewing Angle STANDARD TYPE	X axis right	CR > 5	-	50	-	degree
	X axis left	CR > 5	-	50	-	degree
	Y axis up	CR > 5	-	15	-	degree
	Y axis down	CR > 5	-	35	-	degree
Viewing Angle WIDE (W) TYPE	X axis right	CR > 5	-	70	-	degree
	X axis left	CR > 5	-	70	-	degree
	Y axis up	CR > 5	-	45	-	degree
	Y axis down	CR > 5	-	50	-	degree
Response Time	Rise	$25^\circ\text{C} \pm 2,5^\circ\text{C}$	T_r	30	-	ms
	Fall	$\theta=0^\circ, \phi=0^\circ$	T_f	50	-	ms
Brightness (5 point average)	see 3-3-2 (typ)		250	-		cd/m^2
Brightness Variation	see note d)		-		1.45	
Chromaticity (CIE 1931)	White x	x	0.292	0.322	0.352	
	White y	y	0.309	0.339	0.369	
	Red x	y	0.513	0.543	0.573	
	Red y	x	0.304	0.334	0.364	
	Green x	y	0.287	0.317	0.347	
	Green y	x	0.470	0.500	0.530	
	Blue x	y	0.126	0.156	0.186	
	Blue y	x	0.121	0.151	0.181	

Recomended Inverter: ZU 01 027C ->280 cd/m^2 , CXA-L05XX-NJL-> 250 cd/m^2

See notes on next page



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Note : Measurements made after 30 min in a dark environment at RT

RT means Room Temperature ($25^{\circ}\text{C} \pm 5^{\circ}\text{C}$)

a) If not specially mentioned, CCFL supply current (I_f) shall be referred to section 3-3-2

b) Refer to section 4 for definitions and other information

c) If not specially mentioned, condition of temperature is RT ($20^{\circ}\text{C} \dots 30^{\circ}\text{C}$)

d) The variation in surface brightness is determined by measuring B_{ON} at each test position 0...9 and then dividing the maximum B_{ON} of 9 points luminance by the minimum B_{ON} of 9 points luminance.

3-3 Electrical Characteristics

3-3-1 Display

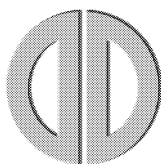
Item	Symbol	Min	Typ	Max	Unit	Remark
Supply Voltage	V_{DD}	3,0	3,3	3,6	V	$V_{DD} \pm 5\%$
Supply Power	P_{DD}	-	0,56	0,75	W	$V_{DD}=3.3V, VS=60Hz$
"High" Input Voltage	V_{ih}	2.0	-	V_{DD}	V	INPUT SIGNALS : DE,VS,HS,DCLK R0...R5 / G0...G5 B0...B5
"Low" Input Voltage	V_{il}	V_{SS}	-	0.8	V	
Input Leakage Current	I_{CL}, I_{CH}	-20	-	20	μA	
Input Capacitance	C_i			120	pF	
Supply Current	I_{DD}	-	170	227	mA	$V_{DD}=3.3V, VS=60Hz$ HS=31kHz DCLK=25 MHz

3-3-2 CCFL Backlight

Item	Symbol	Min	Typ	Max	Unit	Remark
Lamp Current	I_f	2.0	5.0	6.0	mA	
Lamp Voltage	V_L	490	515	630	V_{rms}	
Power Consumption	P_L	1.8	2.6	2.9	W_{rms}	
Starting Voltage		845 1015			V_{rms}	$25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ $0^{\circ}\text{C} \pm 2^{\circ}\text{C}$
Driving Frequency		40	60	80	kHz	*1
Life (half brightness time)		25.000	40.000		h	@ 5mA / 25°C

Note :

*1 : Lamp frequency may produce interference with horizontal sync frequency and may cause beat on the display. Therefore lamp frequency shall be detached from the HSYNC and from the harmonics of HSYNC to avoid interference.



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3-3-3 Interface Description Display

Connector (CN1) for display

Manufacturer : HIROSE ELECTRIC CO., LTD

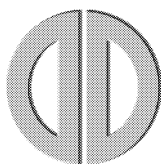
Part Number : DF9B-31P-1V

Matching Connector : DF9B-31S-1V

Pin No.	Signal Name	Function
1	GND	Ground
2	DCLK	Dot Clock
3	HS	Horizontal Sync
4	VS	Vertical Sync
5	GND	Ground
6	R0 (LSB)	Red Data 0
7	R1	Red Data 1
8	R2	Red Data 2
9	R3	Red Data 3
10	R4	Red Data 4
11	R5 (MSB)	Red Data 5
12	GND	Ground
13	G0 (LSB)	Green Data 0
14	G1	Green Data 1
15	G2	Green Data 2
16	G3	Green Data 3
17	G4	Green Data 4
18	G5 (MSB)	Green Data 5
19	GND	Ground
20	B0 (LSB)	Blue Data 0
21	B1	Blue Data 1
22	B2	Blue Data 2
23	B3	Blue Data 3
24	B4	Blue Data 4
25	B5 (MSB)	Blue Data 5
26	GND	Ground
27	DTMG	Data Timing Signal
28	V _{DD}	Power Supply
29	V _{DD}	Power Supply
30	NC	No Connection (leave open)
31	NC	No Connection (leave open)

Available Interfaces :

IF 242	31 pin HIROSE to 30 pin FFC
IF 243	31 pin HIROSE to 18 pin FFC (HLD0912 compatible)
IF 244	LVDS interface (15 pin HIROSE connector)
IF 247	31 pin HIROSE to 30 pin FFC with integrated 3,3/5V-regulator



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3-3-4 Interface Description Backlight

Connector (CN2) for backlight

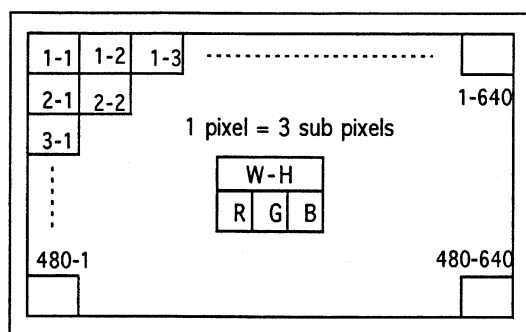
Manufacturer : JAPAN SOLDERLESS TERMINAL MFG. CO. LTD (JST)

Part Number : BHR-03VS-1

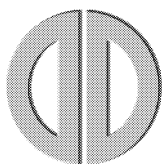
Pin No.	Signal Name	Function
1	VL	Power Supply
2	NC	No Connection
3	GND	Ground (0V)

3-3-5 Data Input Format

Display Position of Input Data (W-H)



3-3-6 Power ON/OFF Sequential Timing



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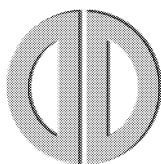
3-3-7 Data Signal, Basic Color and Gray Scale of Each Color

Basic Color	Data Signal																	
	R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Gray Scale of Red / Green / Blue	Data Signal						Gray Level (decimal)
	RGB	RGB	RGB	RGB	RGB	RGB	
Black	5	4	3	2	1	0	= 0
Darker	0	0	0	0	0	1	= 1
↑	0	0	0	0	1	0	= 2
:	0	0	0	0	1	1	= 3
:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:
↓	1	1	1	1	0	1	= 61
Brighter	1	1	1	1	1	0	= 62
Red / Green / Blue	1	1	1	1	1	1	= 63

0 = Low Level Voltage

1 = High Level Voltage



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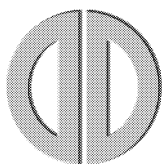
3-3-8 Interface Timing Specification

Parameter		Symbol	Mode	Min	Typ	Max	Unit
DCLK	Frequency	f _{CLK}	All	-	25	32	MHz
	Width Low	tw _{CL}	All	7	-	-	ns
	Width High	tw _{CH}	All	7	-	-	
	Rise Time	t _{rCLK}	All	-	-	20	
	Fall Time	t _{fCLK}	All	-	-	20	
	Duty (D=t _{CLKL} /t _{CLK})	D	All	0.45	0.50	0.55	
HS	Set up time	t _{SH}	All	0	-	-	ns
	Hold time	t _{HH}	All	15	-	-	
	Period	t _{HP}	All	770	800	900	t _{CLK}
	Width Active	tw _H	All	9	-	128	
	Rise / Fall time	t _{Hr} / t _{Hf}	All	-	-	30	ns
VS	Setup time	t _{SV}	All	0	-	-	t _{CLK}
	Hold time	t _{HV}	All	15	-	-	
	Period	t _{VP}		480	515	525	t _{HP}
				400	445	449	
				350	447	449	
	Width Active	tw _V	All	1	-	15	
	Rise / Fall time	t _{Vr} / t _{Vf}	All	-	-	50	line
DTMG	Set up time (for DCLK)	t _{SI}	All	0	-	-	ns
	Hold time (for DCLK)	t _{HI}	All	15	-	-	
	Horizontal Backporch	t _{HBP}	All	10	-	-	t _{CLK}
	Horizontal Frontporch	t _{HFP}	All	10	-	-	
	Vertical Backporch	t _{HBP}		480	34	-	t _{HP}
				400	34	-	
				350	61	-	
	Vertical Frontporch	t _{HFP}		480	1	-	
				400	11	-	
				350	36	-	
	Rise / Fall time	t _{Ir} / t _{If}	All	-	-	30	ns
	Set up time (for DCLK)	t _{SD}	All	0	-	-	
	Hold time (for DCLK)	t _{HD}	All	15	-	-	
DATA	Rise / Fall time	t _{Dr} / t _{Df}	All	-	-	20	

Note : Vertical display position

The vertical display position is automatically centered in the active area at each mode of VGA 480, 400 and 350 line mode. Each mode is selected depending on the polarity of the synchronous signal. In 400 and 350 line mode the data in the vertical invalid period is also displayed so it is recommended to input "0" during this period.

Modes :	480 lines	400 lines	350 lines
HSYNC	negative	negative	positive
VSNC	negative	positive	negative

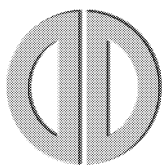


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3-3-9 Signal Timing Waveform (480 Line Mode)

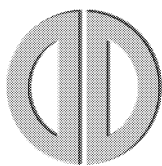


SPECIFICATIONS

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3-3-10 Signal Timing Waveform (400 Line Mode)

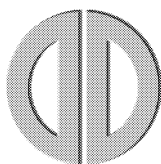


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3-3-11 Signal Timing Waveform (350 Line Mode)



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4. DEFINITION AND MEASURING METHOD

- Note 1) Viewing Angle, Contrast Ratio, Response Time, Reflectance and Chromaticity are measured in a dark room at panel center.
- 2) Brightness and Brightness Uniformity are measured at 5 points as described in Fig. 4
- 3) Backlight is warmed up for more than 15 minutes to make its condition stable.

4-1 Viewing Angle

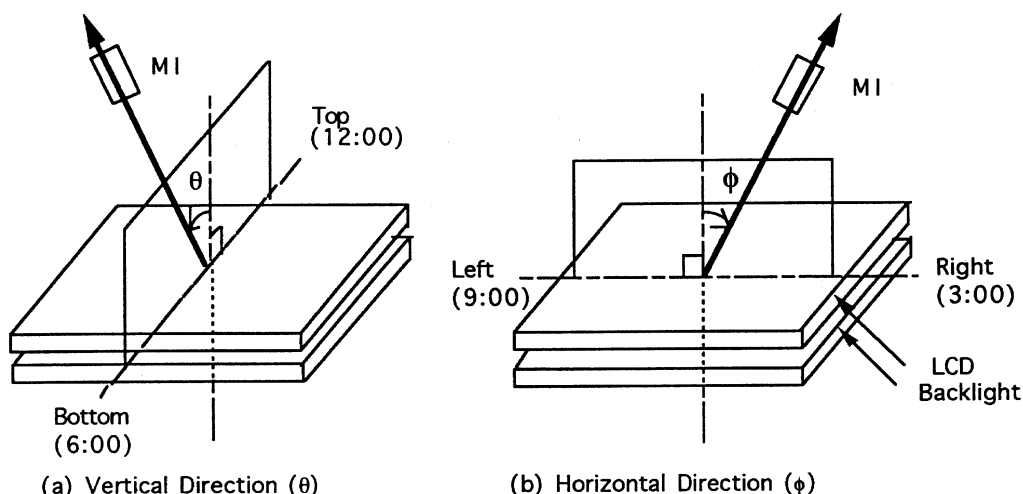


Figure 1

4-2 Optical Measurement

4-2-1 Measurement Instrument (MI)

Luminance & Chromaticity : PHOTORESEARCH / PRITCHARD 1980B/SS or
TOPCON / Color Luminance Meter BM5(A)

Response Time : PRITCHARD 1980/SS or photomultiplier

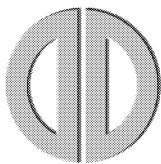
Measurement Diameter : 5 ... 10 mm

4-2-2 Module Driving Conditions

Frame Frequency : 60 Hz

Supply Voltage : Refer to Section 3-3-1

Backlight Supply Current : Refer to Section 3-3-2



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4-3 Contrast Ratio (CR)

Definition Contrast Ratio = $\frac{\text{Luminance in White Level (Gray Level 63)}}{\text{Luminance in Black Level (Gray Level 0)}}$

4-4 Definition of Response Time (T_r , T_f)

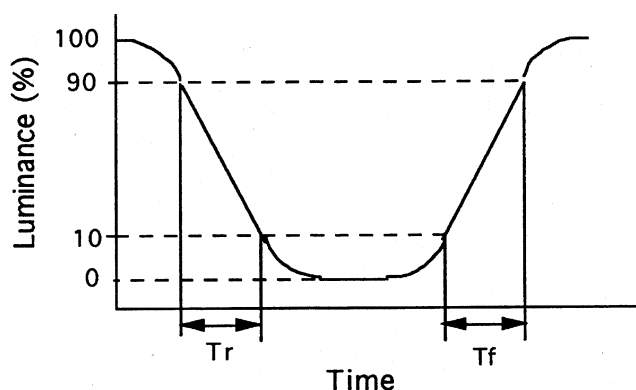


Figure 2

4-5 Definition of Reflectance

Reflectance : $R = R_s / R_{ref} \times 100\%$
 R_s : Brightness of LCD reflectance
 R_{ref} : Brightness of calibrated front surface mirror reflectance

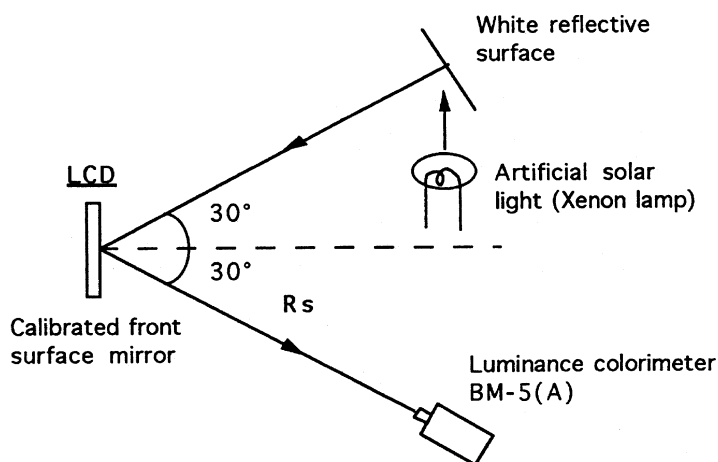
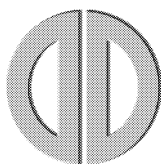


Figure 3



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4-6 Definition of Brightness and Brightness Uniformity

Brightness : Average value of 5 points shown in Figure 4

Brightness Uniformity :
$$\frac{\text{Max (Min) - Average}}{\text{Average}} \times 100 \%$$

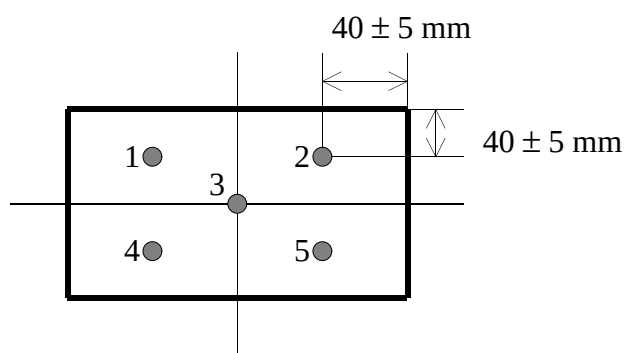


Figure 4

Condition : Display Pattern : Gray Level 63 (white)

4-7 Supply Current (Display without Backlight)

Maximum Current Display Pattern : Line by line vertical stripes with Gray level 0 and 63

Typical Current Display Pattern : 64 vertical gray shades

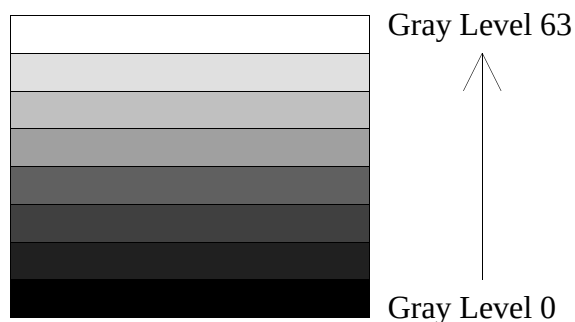
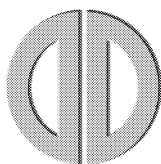


Figure 5



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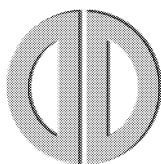
5. ENVIRONMENTAL AND RELIABILITY DATA

5-1 Environmental

Altitude : Operating 0 ... 10000 feet (3048 m)
 Storage / Shipping 0 ... 40000 feet (12192 m)

5-2 Reliability Test Item and Condition

Test Item		Condition	
1	Low Temperature Storage	- 25°C x 200 h	Non-operating
2	High Temperature Storage	+ 70°C x 200 h	Non-operating
3	Low Temperature Operating	0°C x 240 h	Operating
4	High Temperature Operating	60°C x 200 h	Operating
5	High Temp. & High Humidity	40°C , 95% RH x 240h (no condensation)	Operating
6	Vibration (3 axis)	Sine Wave : 10 to 500 Hz, 1.5G, 0.5 oct/min, Random Truck : 6-12-18-42-80-200 Hz, 0.5Grms, 30 min Random Air : 6-18-200-500 Hz, 2.1 Grms, 30 min	Non-operating
7	Shock	Half Sine Wave, 6 faces, 180G, 2ms	Non-operating



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6. APPLICABLE OTHER DOCUMENTS

Outline Drawing : Attached
Shipping Container : 10 pcs per packaging unit

7. CAUTION AND HANDLING PRECAUTION

7-1 Handling

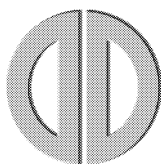
1. Do not disassemble the module
2. Since the LCD cell is made of glass, do not apply strong mechanical impact or static load onto it. Handle with care, and do not twist or bend the LCD module.
3. In case the LCD cell is broken, do not sip or drink leaked liquid crystal material. If the liquid crystal material touched your skin, wash it out with soap immediately.
4. Do not drop water or any chemicals onto the display surface.
5. Handle the polarizers with care as it may be easily scratched. Do not press or rub them with any hard object.
6. Do not apply high electrostatic voltage to the LCD module. It may damage CMOS / LSI circuit in the LCD module. Ground yourself when you touch the LCD module directly.
7. When you handle the LCD module for incoming inspection or assembly, use soft fingerstalls or gloves in order to keep the display quality.
8. Do not pull or fold the CCFL cable

7-2 Storage

1. Store the LCD module within the ratings in order to keep the performance and prevent from any damages. Never store the LCD module under abnormal conditions of high temperature and high humidity. It is recommended that the LCD module shall be stored under the condition of temperature between 0°C and 35°C and humidity less than 60%.
2. Never store LCD module with exposure to direct sunlight

7-3 Operation

1. Do not connect or disconnect the LCD module to or from the system when power is on.
2. Use the LCD module within the ratings in order to keep the performance and prevent from any damages. Never use the LCD module under abnormal conditions of high temperature and high humidity.
3. Long term operation with same image pattern may cause remanent image. (May be avoided with screen saver). Remanent image will disappear after certain time.



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7-4 Others

Avoid any condensation of water during storage or operation as it may cause misoperation or disconnection of electrodes.

8. WARRANTY

8-1 Incoming Inspection

Incoming inspection by the customer shall be performed within thirty (30) days from the shipping date.

8-2 Warranty Period

The warranty period for the LCD modules is 6 months from the shipping date when stored or used under normal conditions.

9. OTHERS

Any and all questions or disputes arising out of or related to this specification shall be settled by a consultation between the customer and HOSIDEN and PHILIPS or its representatives.

10. DRAWING

See following page.

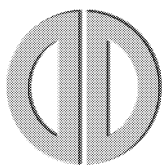
If a more detailed drawing is necessary please contact DATA DISPLAY AG or its representatives.

The information given in this document is carefully checked and believed to be reliable.

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Mechanical Tolerances : 0.5 mm (unless otherwise specified)