POWERTIP CORPORATION

SPECIFICATIONS (DRAWING)

CUSTOMER	:	Gemini
SAMPLE CODE	:	S-GFC00085B-4
MASS PRODUCTION CODE	:	D-GFC00085B-4
DRAWING NO	:	MD00085B6

Customer Approved

Date:

Approved	Checked	Organizer
開發 92.10.16 賴哲奮	林源杰 10/16'03	李厚憲 10/16'03

Powertip Corporation

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POWERTIP DISPLAY CORP. 設計 OCT 16. 2003

History of Version

Version	Contents	Page	Date	Note
	NEW Version		10/16/2003	SPEC

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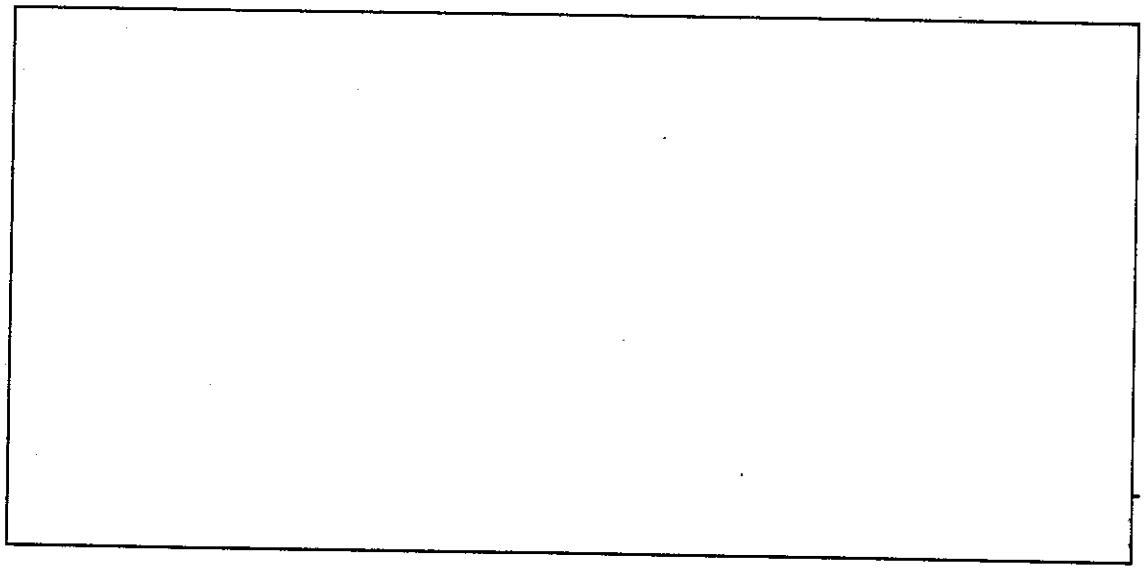
1. Mechanical Specification & Diagram

1.1 Mechanical Specification

ITEM	STANDARD VALUE	UNIT
NUMBER OF CHARACTERS	128 × 64 DOTS	–
MODULE DIMENSION	45.0 (W) × 51.5 (H) × 2.2(T)	mm
EFFECTIVE DISPLAY AREA	31.0 (W) × 16.5 (H)	mm
DOT SIZE	0.2 (W) × 0.2 (H)	mm
DOT PITCH	0.22 (W) × 0.22 (H)	mm
APPROX. WEIGHT	TBD	g
LCD TYPE	FSTN (Positive / Transflective)	
DRIVER METHOD	Duty : 1/65 Bias : 1/9	
VIEWING DIRECTION	6 O'clock	
BACK LIGHT	EL(BLUE)	
DRIVER IC	SSD1815BZ	

1.2 Remark



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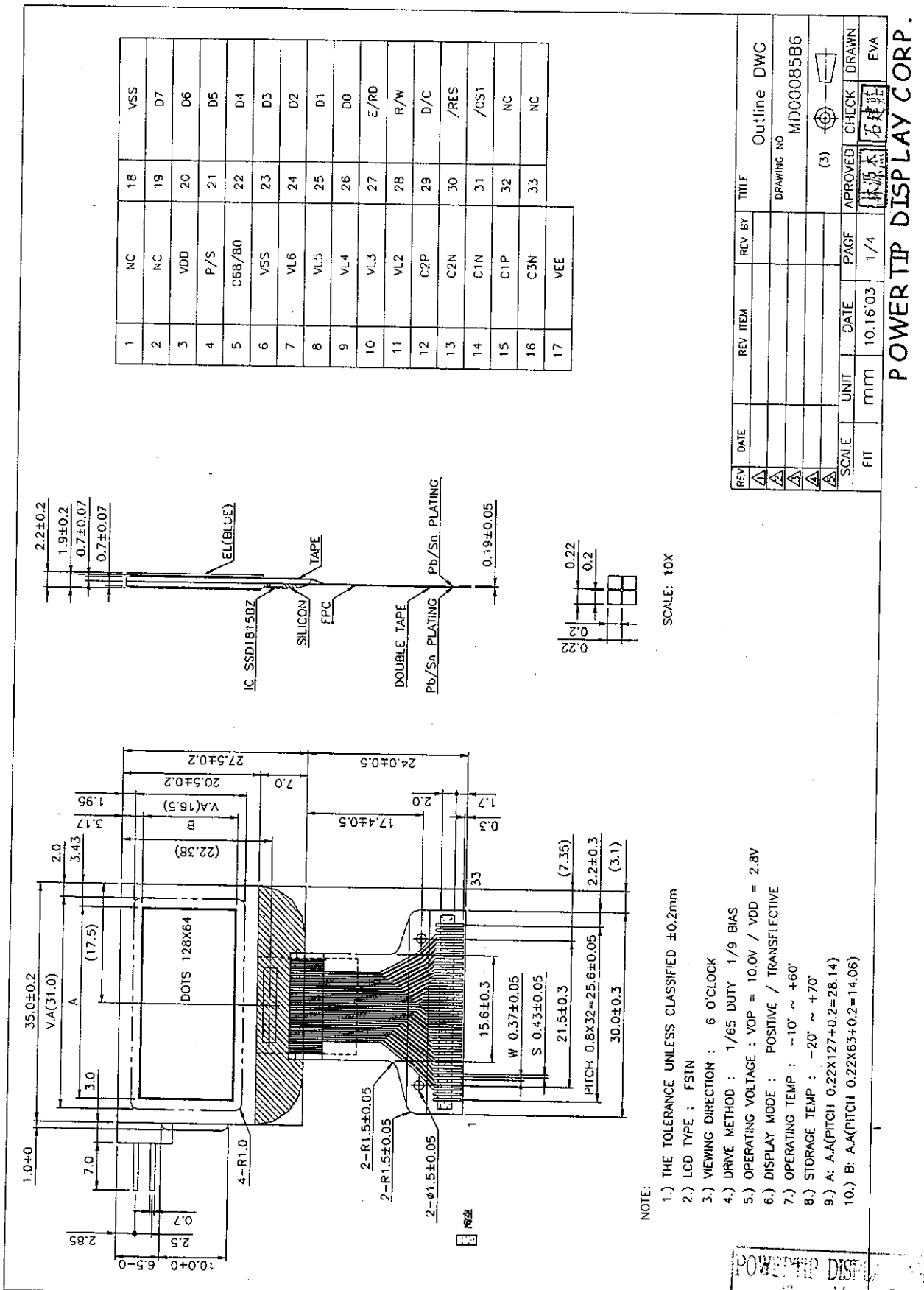
1.3 Mechanical Diagram



1	NC	18 VSS
2	NC	19 D7
3	VDD	20 D6
4	P/S	21 D5
5	C68/80	22 D4
6	VSS	23 D3
7	VL6	24 D2
8	VL5	25 D1
9	VL4	26 D0
10	VL3	27 E/RD
11	VL2	28 R/W
12	C2P	29 D/C
13	C2N	30 /RES
14	C1N	31 /CS1
15	C1P	32 NC
16	C3N	33 NC
17	VEE	

2. Absolute Maximum Rating

ITEM	SYMBOL	MIN	TYP	MAX	UNIT
OPERATING TEMPEATURE	T_{OP}	-10	-	+60	℃
STORAGE TEMPERATURE	T_{ST}	-20	-	+70	℃
INPUT VOLTAGE	V_I	Vss-0.3	-	V_{DD}+0.3	V
SUPPLY VOLTAGE FOR LOGIC	V_{DD}-V_{SS}	-0.3	-	+4.0	V
SUPPLY VOLTAGE FOR LCD	V_{DD}-V_{L6}	-12.0	-	-1.8	V
SUPPLY VOLTAGE	Be sure that you are grounded when handing LCM.				
STATIC ELECTRICITY					

3. Electrical Characteristics

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
SUPPLY VOLTAGE FOR LOGIC	V_{DD}-V_{SS}	Ta=25℃	-	2.8	-	V
SUPPLY VOLTAGE FOR LCD	V_{DD}-V_5 (VOP)	Ta=25℃	-	10	-	V
INPUT HIGH VOL.	V_{IH}	Ta=25℃	0.8VDD	-	V_{DD}	V
INPUT LOW VOL.	V_{IL}	Ta=25℃	0	-	0.2VDD	V
OUTPUT HIGH VOL.	V_{OH}	Ta=25℃	0.9VDD	-	VDD	V
OUTPUT LOW VOL.	V_{OL}	Ta=25℃	0	-	0.1VDD	V
SUPPLY CURRENT	I_{DD}	V_{DD}= 2.8V	-	TBD	-	mA

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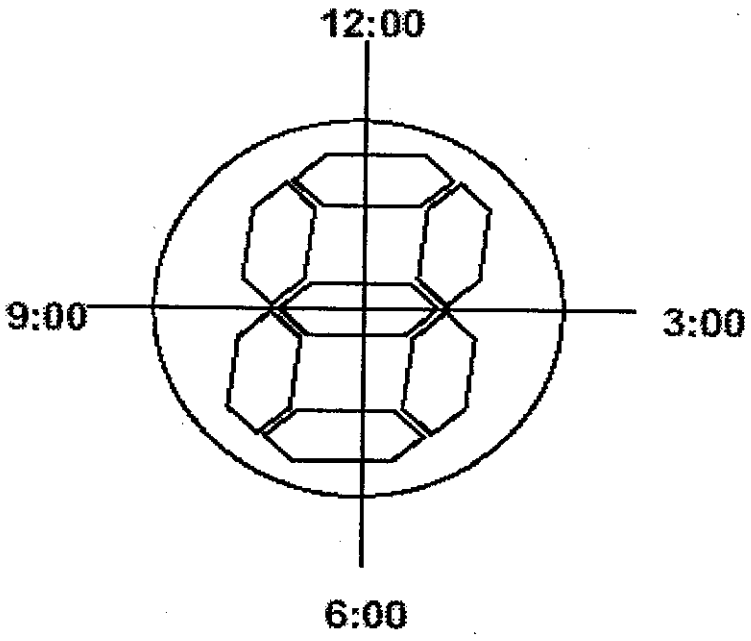
4. Optical Characteristics

FSTN

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
VIEW ANGLE (V)	θ	CR ≧ 2	-40	-	+40	Deg.
VIEW ANGLE (H)	Φ	CR ≧ 2	-40	-	+40	Deg.
CONTRAST RATIO	CR	Ta=25℃	-	5	-	-
RESPONSE TIME	Tr	Ta=25℃	-	200	400	ms
RESPONSE TIME	Td	Ta=25℃	-	200	400	ms

5. Optical Definitions



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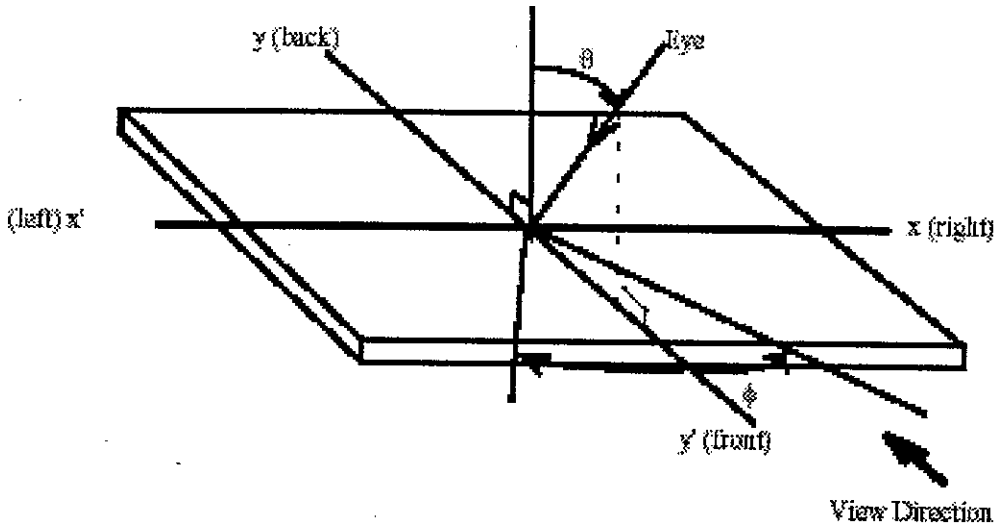
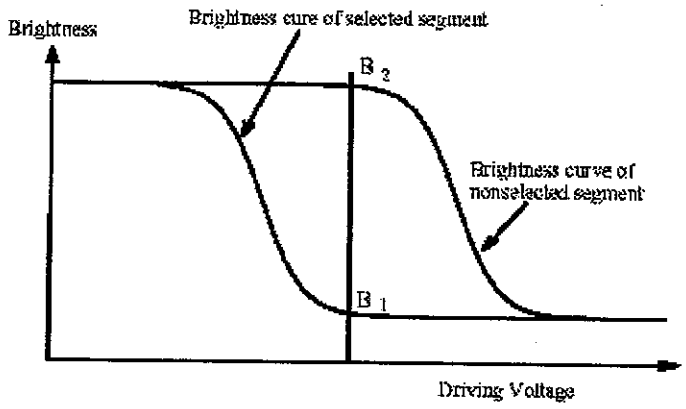
$\theta = 0°$



View Angle



Perpendicular line $\theta = 0°$

$$\text{Contrast ratio} = \frac{\text{Brightness at nonselected segment (B2)}}{\text{Brightness at selected segment (B1)}}$$

Contrast ratio (CR)

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6. Interface Pin Function

NO	SYMBOL	FUNCTION
1	NC	NULL
2	NC	NULL
3	VDD	Chip's Power Supply pin. This is also the reference for the DC-DC Converter output and LCD driving voltages.
4	P/S	This pin is serial/parallel interface selection input. When this pin is pulled high, parallel interface mode is selected. When it is pulled low, serial interface will be selected.
5	C68/80	This pin is MCU parallel interface selection input. When the pin is pulled high, 6800 series interface is selected and when the pin is pulled low, 8080 series interface is selected.
6	VSS	Ground. A reference for the logic pins.
7	VL6	This pin is the most negative LCD driving voltage. It can be supplied externally or generated by turning on the **internal regulator** option in the **Set Power Control Register** command.
8	VL5	These are the LCD driving voltage levels. All these levels are referenced to V_{DD}. They can be supplied externally or generated by the internal bias divider, by turning on the **output op-amp buffers** option in the **Set Power Control Register** command. The potential relation of these pins are given as: $V_{DD} > V_{L2} > V_{L3} > V_{L4} > V_{L5} > V_{L6}$ and with bias factor, a, $V_{L2} - V_{DD} = 1/a * (V_{L6} - V_{DD})$ $V_{L3} - V_{DD} = 2/a * (V_{L6} - V_{DD})$ $V_{L4} - V_{DD} = (a-2)/a * (V_{L6} - V_{DD})$ $V_{L5} - V_{DD} = (a-1)/a * (V_{L6} - V_{DD})$
9	VL4	
10	VL3	
11	VL2	
12	C2P	When internal DC-DC voltage converter is used, external capacitor(s) is/are connected between these pins. Different connection will result in different DC-DC converter multiple factor, 2X, 3X or 4X. Detail connections please refer to voltage converter section in the functional block description.
13	C2N	
14	C1N	
15	C1P	
16	C3N	

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NO	SYMBOL	FUNCTION
17	VEE	This is the most negative voltage supply pin of the chip. It can be supplied externally or generated by the internal DC-DC converter, by turning on the **internal voltage booster** option in the **Set Power Control Register** command. When using internal DC-DC converter as generator, voltage at this pin is for internal reference only. It CANNOT be used for driving external circuitries.
18	VSS	Ground. A reference for the logic pins.
19	D7	These pins are the 8-bit bi-directional data bus to be connected to the MCU in parallel interface mode. D_7 is the MSB while D_0 is the LSB.
20	D6	
21	D5	
22	D4	
23	D3	
24	D2	
25	D1	
26	D0	
27	E/RD	This pin is MCU interface input. When interfacing to an 6800-series microprocessor, this pin will be used as the Enable (E) signal. Read/write operation is initiated when this pin is pulled high when the chip is selected. When connecting to an 8080-microprocessor, this pin receives the Read ($\overline{RD}$) signal. Data read operation is initiated when this pin is pulled low when the chip is selected.
28	R/W	This pin is MCU interface input. When interfacing to an 6800-series microprocessor, this pin will be used as Read/Write (R/$\overline{W}$) selection input. Read mode will be carried out when this pin is pulled high and write mode when low. When interfacing to an 8080-microprocessor, this pin will be the Write ($\overline{WR}$) input. Data write operation is initiated when this pin is pulled low when the chip is selected.

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NO	SYMBOL	FUNCTION
29	D/C	This pin is Data/Command control pin. When the pin is pulled high, the data at D_7-D_0 is treated as display data. When the pin is pulled low, the data at D_7-D_0 will be transferred to the command register. Details relationship with other MCU interface signals, please refer to the Timing Characteristics Diagrams.
30	/RES	This pin is reset signal input. Initialization of the chip is started once this pin is pulled low. Minimum pulse width for completing the reset procedure is 1us.
31	/CS1	These pins are the chip select inputs. The chip is enabled for MCU communication only when both $\overline{CS1}$ is pulled low and CS2 is pulled high.
32	NC	NULL
33	NC	NULL

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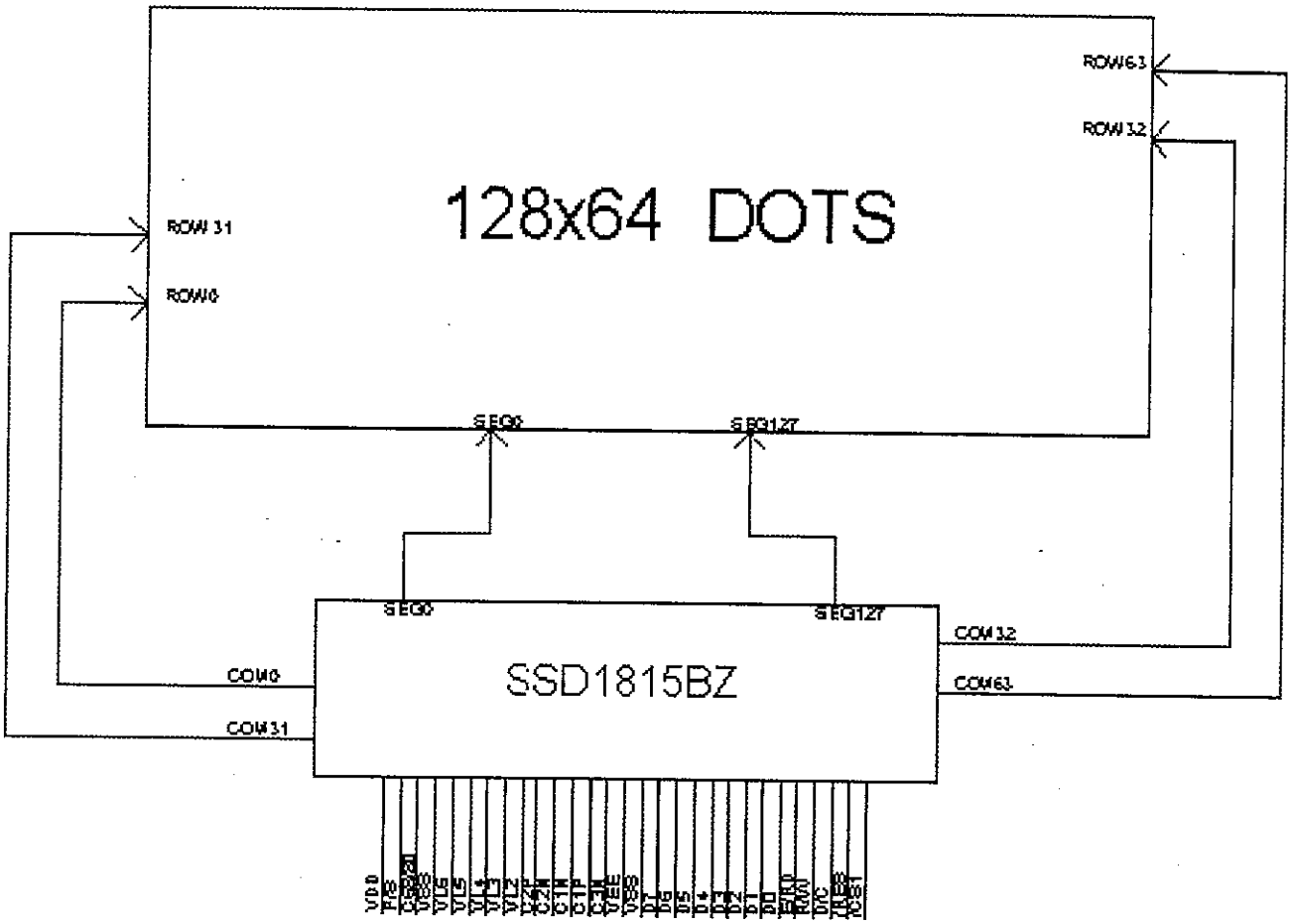
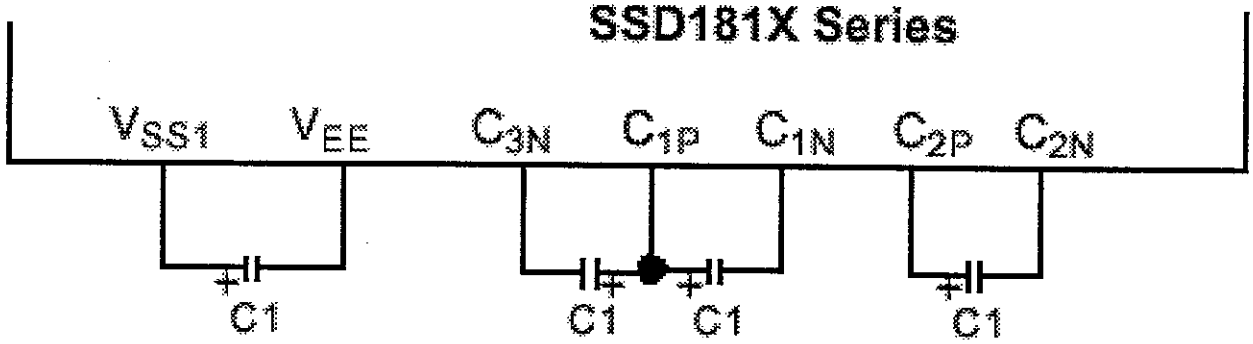
7. Block Diagram



8. Power supply for LCD module



4X Boosting Configuration

Remarks:

1. C1 = 0.47 ~ 1.0uF
2. Boosting input from V_{SS1}.
3. V_{SS1} should be lower potential than or equal to V_{SS}
4. All voltages are referenced to V_{DD}

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9. Backlight Characteristics

LCD Module with EL Backlight

Maximum Ratings:

Item	Symbol	Conditions	Rating	Unit
Supply Voltage	V_{max}	Ta =25°C	120	Vrms
Supply Frequency	F_{max}	Ta =25°C	1000	Hz
Storage Humidity	H_{stg}	Ta =25°C	70	%RH
Operating Temperature	T_{opr}	-	-35 ~ +50	°C
Storage Temperature	T_{stg}	-	-40 ~ +60	°C

Electrical Ratings:

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Luminous Intensity	IV	V_E = 100 Vrms F_E = 400 Hz Ta =25°C	21	28	-	cd/m^2
CIE Color Coordinate	X		0.13	0.16	0.19	—
	Y		0.18	0.22	0.26	—
Color	Blue					

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10. Specification of Quality Assurance

1. Purpose

This standard for Quality Assurance should affirm the quality of LCD module products to supply to purchaser by POWERTIP DISPLAY CORPORATION (Supplier).

2. Standard for Quality Test

2.1 Inspection:

Before delivering, the supplier should take the following tests, and affirm the quality of product.

2.2 Electro-Optical Characteristics:

According to the individual specification to test the product.

2.3 Test of Appearance Characteristics:

According to the individual specification to test the product.

2.4 Test of Reliability Characteristics:

According to the definition of reliability on the specification for testing products.

2.5 Delivery Test:

Before delivering, the supplier should take the delivery test.

2.5.1 Test method: According to MIL-STD-105E, General Inspection Level Ⅱ take a single time.

2.5.2 The defects classify of AQL as following:

Major defect: AQL=0.65
Minor defect: AQL=2.5
Total defects: AQL=2.5

3. Nonconforming Analysis & Deal With Manners

3.1 Nonconforming analysis:

3.1.1 Purchaser should supply the detail data of non-conforming sample and the non-suitable state.

3.1.2 After accepting the detail data from purchaser, the analysis of nonconforming should be finished in two weeks.

3.1.3 If supplier can not finish analysis on time, must announce purchaser before two weeks.

3.2 Disposition of nonconforming:

3.2.1 If find any product defect of supplier during assembly time, supplier must chance the good product for every defect after recognition.

3.2.2 Both supplier and customer should analyze the reason and discuss the disposition of nonconforming when the reason of nonconforming is not sure.

4. Agreement items

Both sides should discuss together when the following problems happen.

4.1 There is any problem of standard of quality assurance, and both sides think that must be modifier.

4.2 There is any argument item which does not record in the standard of quality assurance.

4.3 Any other special problem.

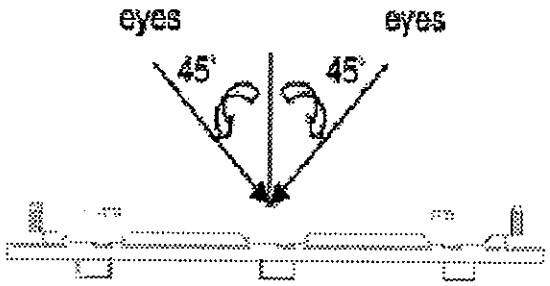
5. Standard of The Product Appearance Test

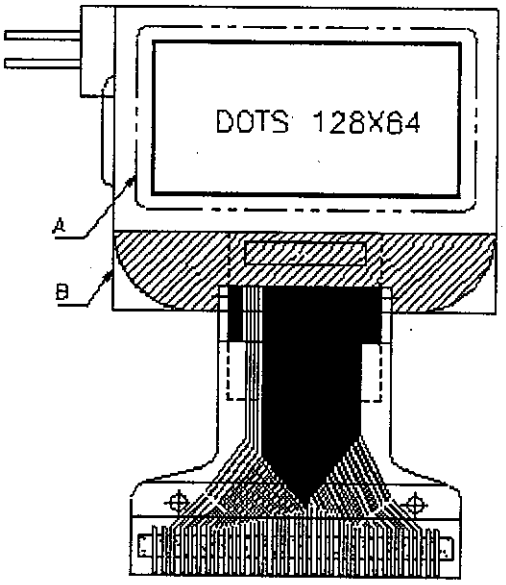
5.1 Manner of appearance test:

5.1.1 The test must be under 20W × 2 or 40W fluorescent light, and the distance of view must be at 30 cm.

5.1.2 When test the model of Tran missive product must add the reflective plate.

5.1.3 The test direction is base on about around 45° of vertical line.





5.1.4 Definition of area:

A Area : Viewing area.

B Area : Out of viewing area.

(Outside viewing area)

5.2 Basic principle:

5.2.1 It will accord to the AQL when the standard can not be described.

5.2.2 The sample of the lowest acceptable quality level must be discussed by both suppiler and customer when any dispute happened.

5.2.3 Must add new item on time when it is necessary.

5.3 Standard of inspection:(Unit: mm)

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11. Standard Specification for Reliability

1.Standard Specification for Reliability of Wide-Temperature COG

NO	Item	Description
1.	High temperature operation	The sample should be allowed to stand at 60 ± 3℃ for 240(-0,+48) hours under driving condition.
2.	Low temperature operation	The sample should be allowed to stand at -10 ± 3℃ for 240(-0,+48) hours under driving condition.
3.	High temperature resistance	The sample should be allowed to stand at 70 ± 3℃ for 240(-0,+48) hours under no-load condition, and then returning it to normal temperature condition, and allowing it stand for 30 minutes.
4.	Low temperature resistance	The sample should be allowed to stand at -20 ± 3℃ for 240(-0,+48) hours under no-load condition, then returning it to normal temperature condition, and allowing it stand for 24 hours.
5.	Moisture resistance	The sample should be allowed to stand at 40 ± 3℃, 90%RH MAX for 240(-0,+48) hours under no-load condition excluding the polarize, then taking it out and drying it at normal temperature.
6.	Thermal shock resistance	The sample should be allowed to stand the following 10 Cycles of operation : 0℃ for 30 minutes→normal temperature for 5 minutes →+70℃ for 30 minutes→normal temperature for 5 minutes, as one cycle.
7.	ESD (Electrostatic Discharge)	Human Body Model : 2000 volt electrical discharge from a 100 pF capacitor to the tested device in series with a 1500 ohm resistor. Apply VDD & VSS to LCD module unit. Test for functionality no missing lines after the discharge, but LCD module may reset. Machine model : 200 volt electrical discharge from a 200 pF capacitor to the tested device with no series resistance. Apply to VDD & VSS to LCD module unit without including hand phone. Test for functionality no any missing lines after the discharge, but LCD module can be reset if display off.

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2.Testing Conditions and Inspection Criteria

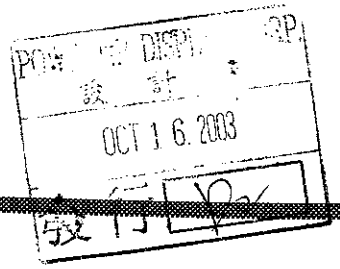
In order to do the final test the testing sample must be in room temperature for 24hours, to ensure stability.

NO	Item	Test Model	Inspection Criteria
1.	**Current Consumption**	Refer To Specification	The current must be under three times of initiated test.
2.	**Contrast**	Refer To Specification	The contrast must be large than half of initiated test.
3.	**Appearance**	Visual inspection	Defect free.

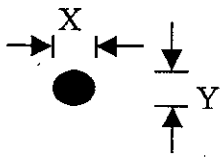
3.Life Time

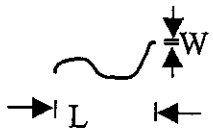
NO	Item	Description
1.	**Life time**	Functions, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (25± 10℃), normal humidity (45± 20% RH), and in area not exposed to direct sun light.
2.	**Life time**	Functions, performance, appearance, etc. shall be free from remarkable deterioration within 5,000 hours under ordinary operating and storage conditions high temperature 70℃, normal humidity(45± 20%RH), and in area not exposed to direct sun light.

Note : From our experience the life time of high humidity operation and high temperature operation as above mentioned could be achieved.



Standard of inspection:(Unit: mm)

<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>AQL</th></tr>
<tr><td>1.</td><td>Electrical Testing</td><td>1.1 Missing vertical, horizontal segment, segment contrast defect.
1.2 Missing character , dot or icon.
1.3 Display malfunction.
1.4 No function or no display.
1.5 Current consumption exceeds product specifications.
1.6 LCD viewing angle defect.
1.7 Mixed product types.
1.8 Contrast defect.</td><td>0.65</td></tr>
<tr><td rowspan="2">2.</td><td rowspan="2">LCD black spots, white spots, contamination</td><td>2.1 Round type : As following drawing
$\phi = (x + y) / 2$
 

<table>
<tr><th>SIZE</th><th>Acceptable Q'TY</th></tr>
<tr><td>$\phi \leqq 0.10$</td><td>Accept no dense</td></tr>
<tr><td>$0.10 < \phi \leqq 0.20$</td><td>2</td></tr>
<tr><td>$0.20 < \phi \leqq 0.25$</td><td>1</td></tr>
<tr><td>$0.25 < \phi$</td><td>0</td></tr>
</table></td><td>2.5</td></tr>
<tr><td>2.2 Line type : (As following drawing)
 

<table>
<tr><th>Length</th><th>Width</th><th>Acceptable Q'TY</th></tr>
<tr><td>-----</td><td>W≦0.02</td><td>Accept no dense</td></tr>
<tr><td>L≦3.0</td><td>0.02＜W≦0.03</td><td rowspan="2">3</td></tr>
<tr><td>L≦2.5</td><td>0.03＜W≦0.05</td></tr>
<tr><td>----</td><td>0.05＜W</td><td>As round type</td></tr>
</table></td><td>2.5</td></tr>
</table>

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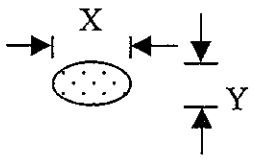
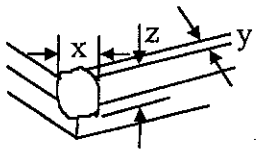
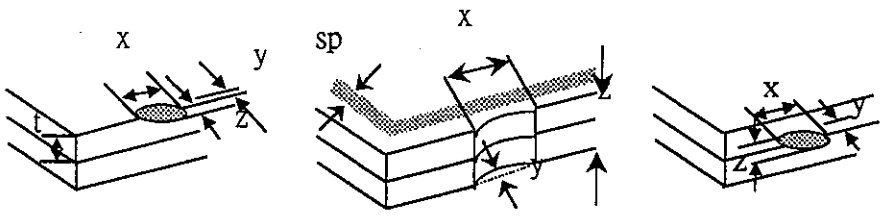
<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>AQL</th></tr>
<tr><td>3.</td><td>Polarize bubbles</td><td>$\phi = (x + y) / 2$
 
<table>
<tr><th>Size ϕ</th><th>Acceptable Q'TY</th></tr>
<tr><td>$\phi \leqq 0.20$</td><td>Accept no dense</td></tr>
<tr><td>$0.20 < \phi \leqq 0.50$</td><td>3</td></tr>
<tr><td>$0.50 < \phi \leqq 1.00$</td><td>2</td></tr>
<tr><td>$1.00 < \phi$</td><td>0</td></tr>
<tr><td>Total Q'TY</td><td>3</td></tr>
</table></td><td>2.5</td></tr>
<tr><td>4.</td><td>Scratches</td><td>Follow NO.2 LCD black spots, white spots, contamination</td><td></td></tr>
<tr><td rowspan="4">5.</td><td rowspan="4">Glass Crack</td><td>Symbols :
x : Chip length y : Chip width z : Chip thickness
t : Glass thickness a : LCD side length
L : Electrode pad length</td><td></td></tr>
<tr><td>5.1 General glass crack :
5.1.1 Corner crack :
 
</td><td>2.5</td></tr>
<tr><td><table>
<tr><th>z :</th><th>y</th><th>x</th></tr>
<tr><td>Z≦1/2t</td><td>Not over viewing area</td><td>x≦1/8a</td></tr>
<tr><td>1/2t<Z≦2t</td><td>Not exceed 1/2 SP width</td><td>x≦1/8a</td></tr>
</table>
⊙If there are 2 or more chips, x is the total length of each chip.</td><td rowspan="2">2.5</td></tr>
<tr><td>5.1.2 Crack on panel surface and crack between panels :
 
<table>
<tr><th>z</th><th>y</th><th>x</th></tr>
<tr><td>Z≦1/2t</td><td>Not over viewing area</td><td>x≦1/8a</td></tr>
<tr><td>1/2t<Z≦2t</td><td>Not exceed 1/2 SP width</td><td>x≦1/8a</td></tr>
</table></td></tr>
</table>

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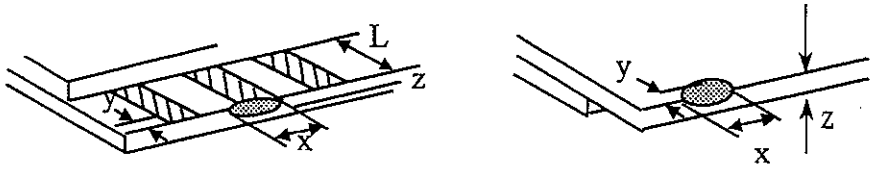
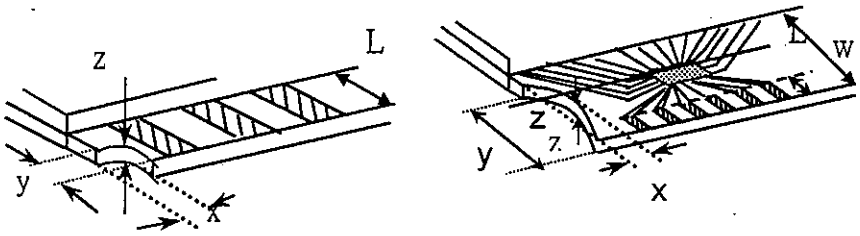
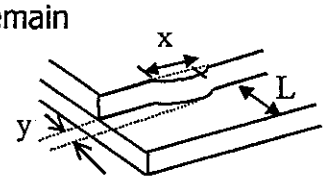
<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>AQL</th></tr>
<tr><td rowspan="3">5.</td><td rowspan="3">Glass Crack</td><td>5.2 Protrusion over terminal :
5.2.1 Crack on electrode pad :
※Top of the glass : ※ Bottom of the glass :
 

<table><tr><th></th><th>y</th><th>x</th><th>z</th></tr><tr><td>top of the glass</td><td>y≦0.5 mm</td><td>x≦1/8a</td><td>0 < z ≦t</td></tr><tr><td>back of the glass</td><td>Not over viewing area</td><td>x≦1/8a</td><td>0 < z ≦t</td></tr></table></td><td>2.5</td></tr>
<tr><td>5.2.2 Non-conductive portion :
 

<table><tr><th>KIND</th><th>y</th><th>x</th><th>z</th></tr><tr><td>General</td><td>y≦L</td><td>x≦1/8a</td><td>z ≦t</td></tr><tr><td>COG</td><td>y≦w</td><td>Not touch the ITO terminal</td><td>z ≦t</td></tr></table>※ the alignment mark must not be damaged.</td><td>2.5</td></tr>
<tr><td>5.2.3 Glass chip remain
 

<table><tr><th>y : width</th><th>x : length</th></tr><tr><td>y≦ 1/3L</td><td>x ≦ a</td></tr></table></td><td>2.5</td></tr>
<tr><td>6.</td><td>Backlight elements</td><td>6.1 Illumination source flickers when lit.
6.2 Spots or scratches that appear when lit must be judged . using LCD spot, lines and contamination standards.
6.3 Backlight doesn't light or color is wrong.</td><td>0.65
2.5
0.65</td></tr>
</table>

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NO	Item	Criterion	AQL
7.	General appearance	7.1 No oxidation, contamination, curves or, bends on interface pin (OLB) of TCP.	2.5
		7.2 No cracks on interface pin (OLB) of TCP.	0.65
		7.3 No contamination, solder residue or solder balls on product.	2.5
		7.4 The IC on the TCP may not be damaged.	2.5
		7.5 The uppermost edge of the protective strip on the interface pin must be present or look as if it cause the interface pin to sever.	2.5
		7.6 The residual rosin or tin oil of soldering (component or chip component) is not burned into brown or black color.	2.5
		7.7 Sealant on top of the ITO circuit has not hardened	2.5
		7.8 Pin type must match type in specification sheet.	0.65
		7.9 LCD pin loose or missing pins.	0.65
		7.10 Product packaging must the same as specified on packaging specification sheet.	0.65
		7.11 Product dimension and structure must conform to product specification sheet .	0.65

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