

PRODUCT : COLOR STN MODULE
MODEL NO. : TSE8215UCTDFW-P-P1-G-F-LED-E
SUPPLIER : TRULY SEMICONDUCTORS LTD.
DATE : December 30, 2005



CERT. No. 946535
(ISO9001)

CERT. No. H002005
(ISO14001)

SPECIFICATION

REVISION: 1.3

TSE8215UCTDFW-P-P1-G-F-LED-E

If there is no special request from customer, TRULY SEMICONDUCTORS Co., Ltd will not reserve the tooling of the product under the following conditions:

1. There is no response from customer in two years after TRULY SEMICONDUCTORS Co., Ltd submit the samples;
2. There is no order in two years after the latest mass production.

TRULY SEMICONDUCTORS LTD:

CUSTOMER :

Quality Assurance Department:
Approved by:

Technical Department:

Approved by:

PRODUCT SPECIFICATION

- CLASSIFICATION OF MODULE
- PHYSICAL DATA
- EXTERNAL DIMENSIONS
- ABSOLUTE MAXIMUM RATINGS
- ELECTRICAL CHARACTERISTICS
- BACKLIGHT CHARACTERISTICS
- ELECTRO-OPTICAL CHARACTERISTICS
- INTERFACE DESCRIPTION
- CIRCUIT BLOCK DIAGRAM
- OPERATING PRINCIPLES & METHODS
- DATE CODE
- RELIABILITY
- INSPECTION CRITERIA
- PRECAUTIONS FOR USING LCD MODULES
- USING LCD MODULES
- PRIOR CONSULT MATTER
- FACTORY

WRITTEN BY	CHECKED BY	APPROVED BY
ZY ZHOU	XIE.X.C	K.K.HO

■ CLASSIFICATION OF MODULE

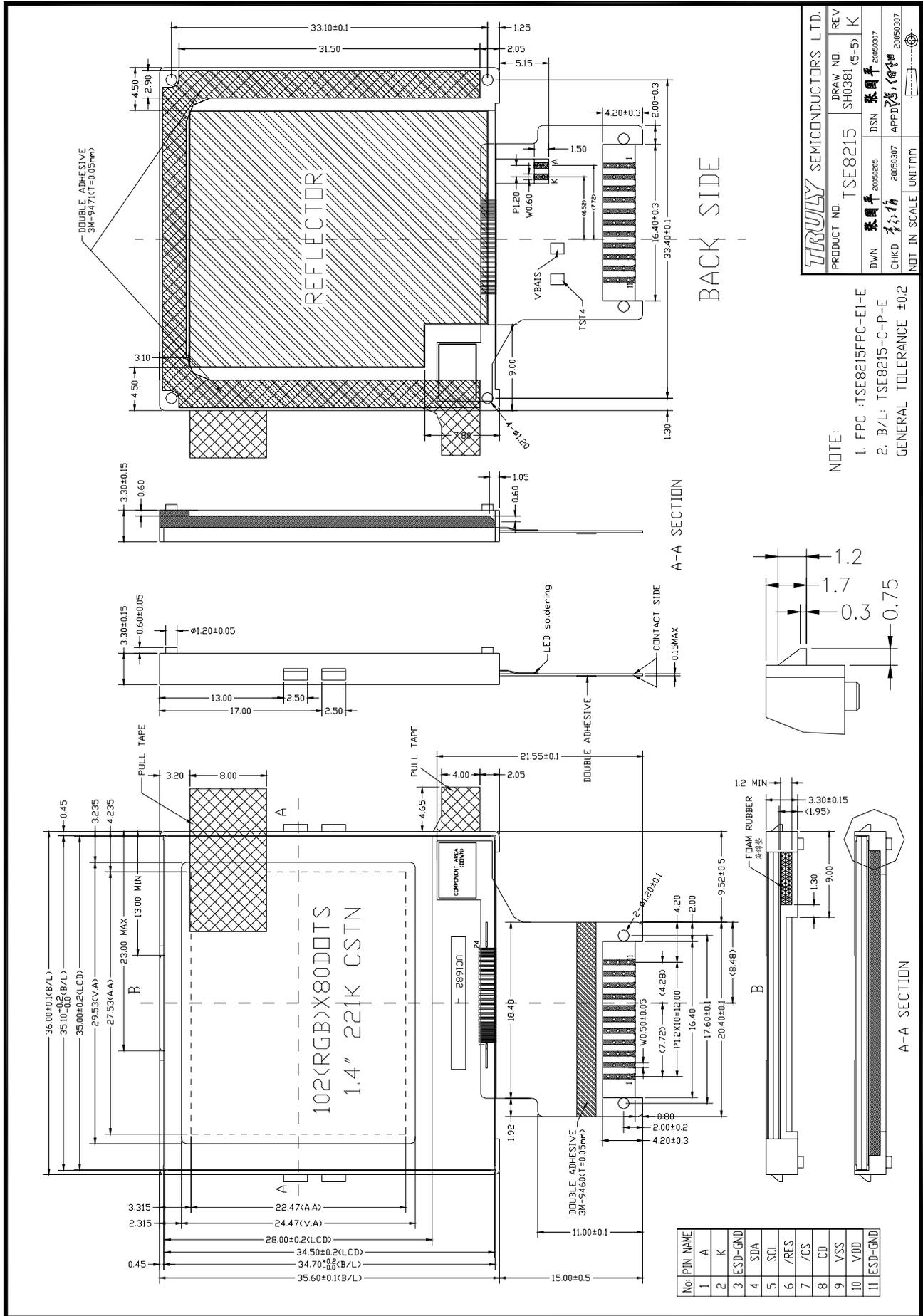
T S E 8215 U C T D F W -P -P1 -G -F -LED -E
 (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15) (16)

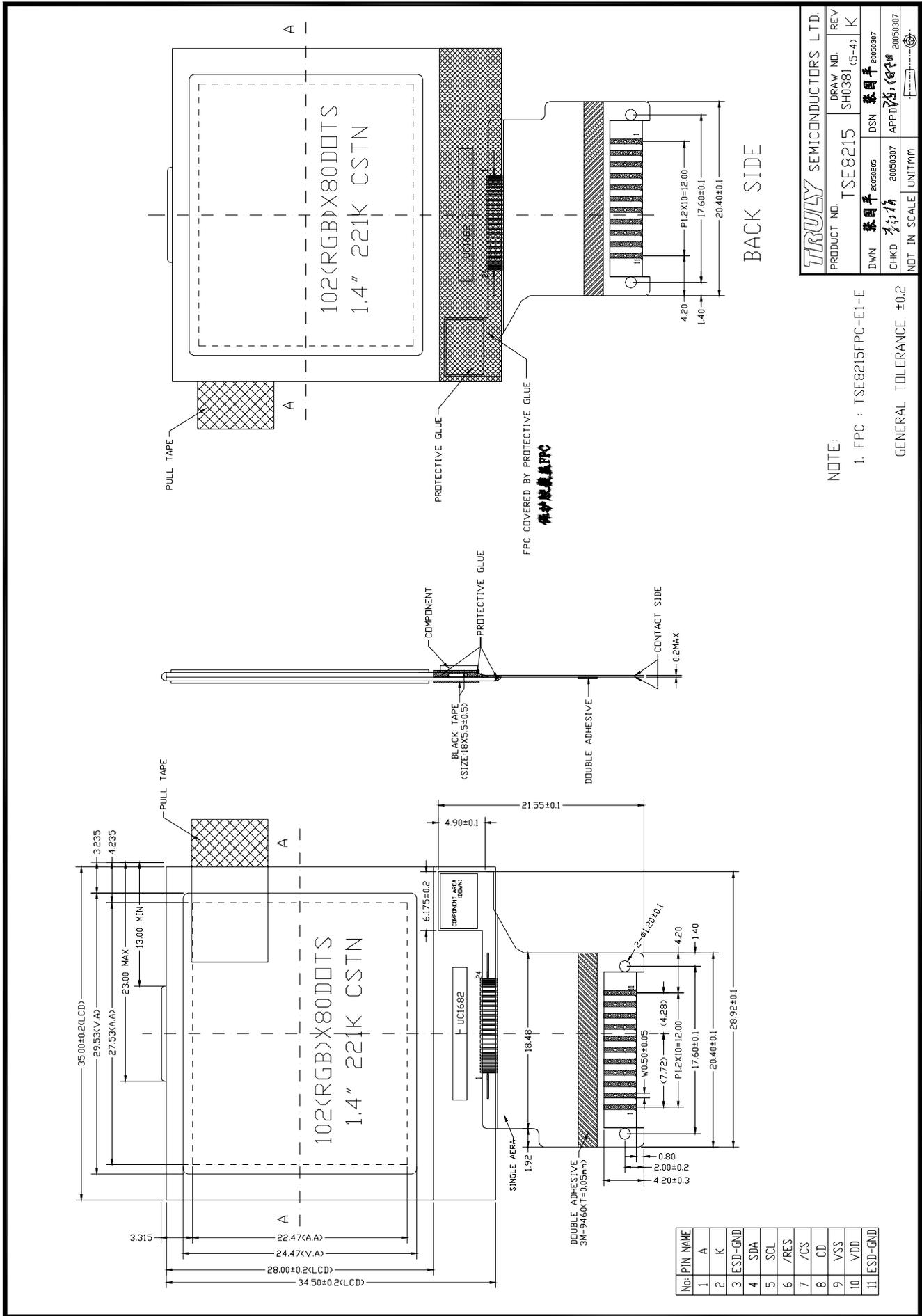
- (1) T : TRULY
 (2) PRODUCT TYPE: S - S T N product
 (3) DUTY: E: $\leq 1/128$
 (4) 8215: Successive Number
 (5) Viewing Angle: U-12:00
 (6) Display Mode: C-Color
 (7) Rear Polarizer Type: T-Transmissive
 (8) Polarizer Method: D-Two Side Adhesive
 (9) Connector: F-FPC
 (10) Temp. Grade: W-Wide temperature
 (11) POLISHED AND CHAMFER AND SPECIAL PIN: P-Side polished
 (12) POLISHED AND CHAMFER AND SPECIAL PIN: P1-Chamfer
 (13) SPECIAL REMARK: G-COG TYPE WITH IC
 (14) SPECIAL REMARK: F-HAVING FPC
 (15) SPECIAL REMARK: LED-HAVING LED
 (16) PRODUCTOR FOR ROHS: E-HAVING ROHS REQUIREMENT

■ PHYSICAL DATA

Item	Contents	Unit
LCD type	CSTN TRANSMISSIVE	---
LCD duty	1/ 80	---
LCD bias	1/ 9	---
Viewing direction	12:00	O' Clock
Grass area (W×H)	35.00 × 34.50	mm ²
Viewing area (W×H)	29.53 × 24.47	mm ²
Active area (W×H)	27.53 × 22.47	mm ²
Number of dots	102 (RGB) × 80	---
Dot size (W×H)	0.08 × 0.271	mm ²
Dot pitch (W×H)	0.09 × 0.281	mm ²
Pixel size (W×H)	0.26 × 0.271	mm ²
Pixel pitch (W×H)	0.27 × 0.281	mm ²
Driver IC	UC1682THDG(Supplier: ULTRACHIP)	---
Operating temperature	-30~70	°C
Storage temperature	-40~80	°C

EXTERNAL DIMENSIONS



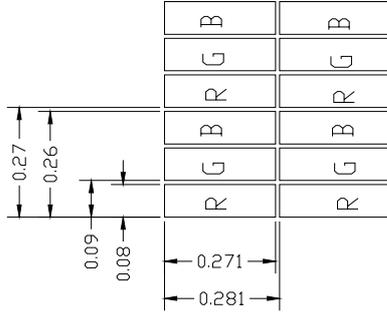
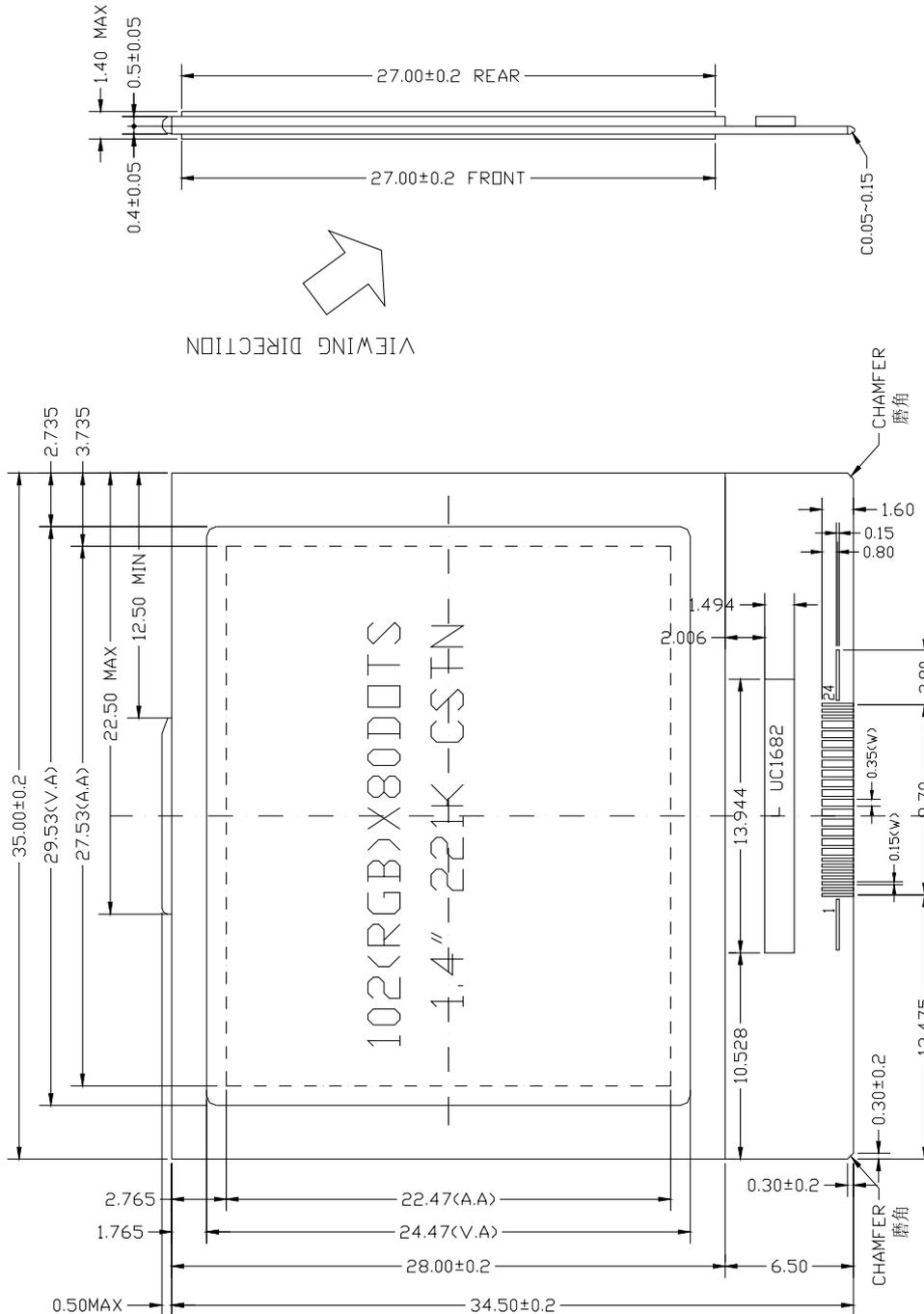


TRULY SEMICONDUCTORS LTD.	
PRODUCT NO. TSE8215	REV. SH0381 (5-4) K
DWN 蔡國平 20050307	DSN 蔡國平 20050307
CHKD 蔡國平 20050307	APPD 蔡國平 20050307
NOT IN SCALE UNIT(M)	

NOTE:
1. FPC : TSE8215FPC-E1-E
GENERAL TOLERANCE ±0.2

No:	PIN NAME
1	A
2	K
3	ESD-GND
4	SDA
5	SCL
6	/RES
7	/CS
8	CD
9	VSS
10	VDD
11	ESD-GND

PIN NO.	SYMBOL
1	ESD-GND
2	ESD-GND
3	D0
4	BIAS
5	RST
6	CS
7	TST4
8	TST4
9	VSS
10	VSS
11	VDD
12	VDD
13	VBO+
14	VBO+
15	VBI+
16	VBI+
17	VBI-
18	VBI-
19	VBO-
20	VBO-
21	VLC
22	VLC
23	VLC
24	ESD-GND

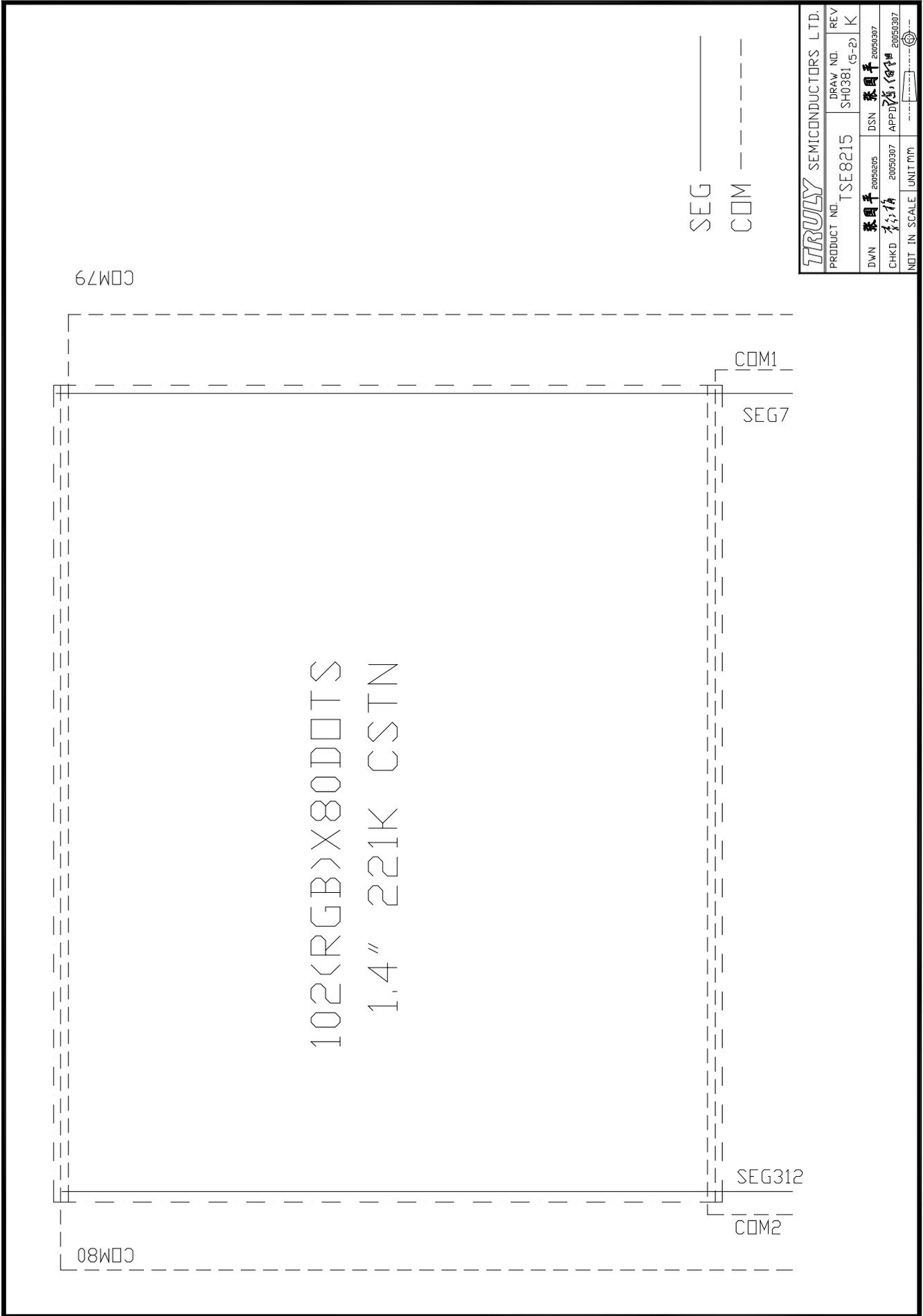


PIXEL DETAIL

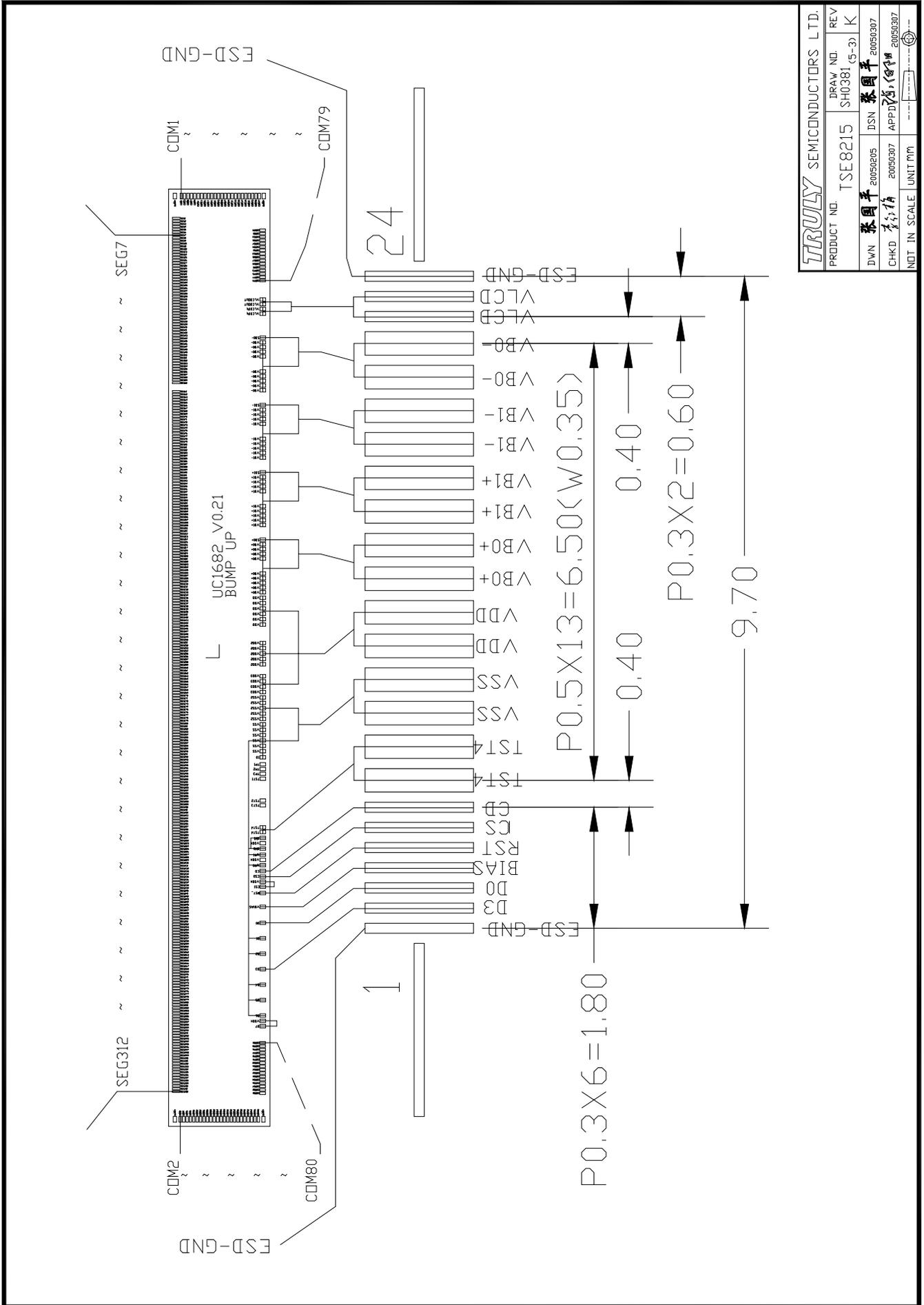
NO.	CONTENT	DATE	1/80 DUTY CYCLE	TRULY SEMICONDUCTORS LTD.
A			1/9 BIAS	PRODUCT NO. TSE8215
M			9.9 D.V.	DRAW. NO. SH0381
E			12:00 D.CLOCK	REV. K
N	FPC	20050901		DSN 20050205
D				APPD 20050307
				UNIT:MM

NOTES:

1. OPERATING TEMPERATURE: -30°C TO 70°C
 2. STORAGE TEMPERATURE: -40°C TO 80°C
 3. DISPLAY MODE: CSTN TRANSMISSIVE 221K COLOR
 4. DRIVE IC: UC1682THDG
 5. COLOR FILTER ON COM(R) GLASS.
- TOLERANCE OF SEGMENTS, TIE DGE OF GLASS: ±0.2MM



TRULY SEMICONDUCTORS LTD.			
PRODUCT NO.	TSE8215	DRAW. NO.	SH0381 (5-2)
DWN	蔡國平 20050205	REV	K
CHKD	蔡國平 20050307	DSN	蔡國平 20050307
UNIT P/N	APPD	UNIT P/N	20050307
NDT IN SCALE			



TRULY SEMICONDUCTORS LTD.			
PRODUCT NO.	TSE8215	DRAW. NO.	SH0381 (5-3)
DWN	张园平	DSN	20050205
CHKD	张园平	APPD	张园平
NOT IN SCALE	UNIT:MM	REV	K
		20050307	20050307

■ ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit
Power supply voltage	V_{DD}	-0.3	4.0	V
Input voltage	V_{IN}	-0.4	$V_{DD}+0.5$	V
Operating temperature	T_{OPR}	-30	+70	°C
Storage temperature	T_{STG}	-40	+80	°C
High temperature high humidity	Up to 45°C, 95%RH (72 hours)			

■ ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	V_{DD}	2.7	2.8	2.9	V
Input high voltage	V_{IH}	$0.8V_{DD}$	V_{DD}	V_{DD}	V
Input low voltage	V_{IL}	0	0	$0.2V_{DD}$	V
Output high voltage	V_{OH}	$0.8V_{DD}$	V_{DD}	V_{DD}	V
Output low voltage	V_{OL}	0	0	$0.2V_{DD}$	V

■ BACKLIGHT CHARACTERISTICS

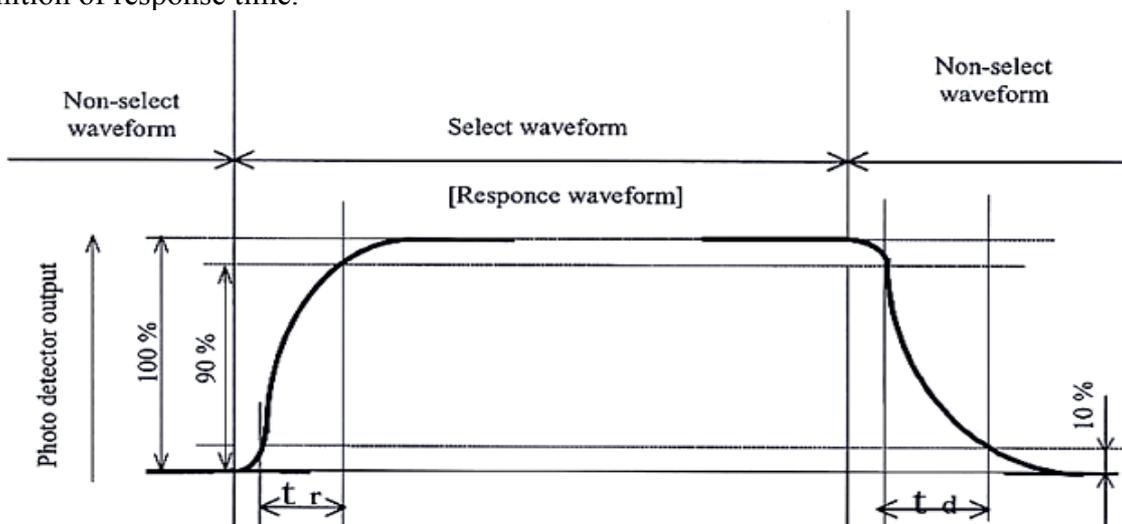
Item	Value					Remark
LED Part Number	MSL-518SW-N15					
Number of LED	1					
Backlight type	LED					
LED arrangement	Parallel					
LED color rank	B2 rank					
	x	0.296	0.287	0.330	0.330	
	y	0.276	0.295	0.339	0.318	
LED luminance intensity	T rank					
	Condition	Min.	Typ.	Max.		
	If=20mA	720	860	1000	mcd	

Item	Value			Unit
	Min	Typ	Max	
Backlight current	-	15	20	mA
Backlight voltage	3.1	3.3	3.5	V
White pattern power consumption	-	0.767	0.920	mA
Checker pattern power consumption	-	0.707	0.848	mA
50% grey pattern power consumption	-	0.743	0.892	mA
Standby mode power consumption	-	40	48	μ A
Backlight power consumption (on)	-	16.890	20.268	mA

■ ELECTRO-OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit	Remarks	Note
Response time	Tr	Ta=-20°C	-	1900	2200	ms	-	1
	Tf		-	2600	3000	ms		
	Tr	Ta=25°C	-	102	150	ms		
	Tf		-	131	170	ms		
Threshold voltage	Vth	Ta=25°C	-	1.454	-	V		-
Operating voltage	Vop		-	10.21	-	V		-
Contrast ratio	Cr		30	40	-	-		2
Luminance uniformity	δ WHITE		80	88	-	%		4
Module brightness	Lv		120	150	-	cd/ m ²	-	
Viewing angle range	θ		Cr ≥ 2	45	60	-	deg	∅ = 90°
		45		60	-	deg	∅ = 270°	
		25		40	-	deg	∅ = 0°	
		43		58	-	deg	∅ = 180°	
CIE (x, y) chromaticity	Red	x	θ = 0° φ = 0°	0.465	0.515	0.565	25°C	-
		y		0.260	0.310	0.360		
	Green	x		0.253	0.303	0.353		
		y		0.492	0.542	0.592		
	Blue	x		0.096	0.146	0.196		
		y		0.091	0.141	0.191		
	White	X		0.226	0.276	0.326		
		y		0.274	0.324	0.374		

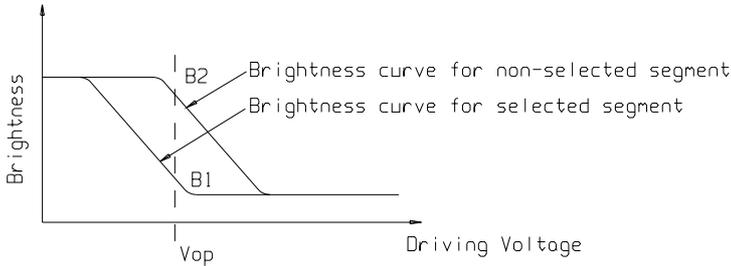
Note1: Definition of response time.



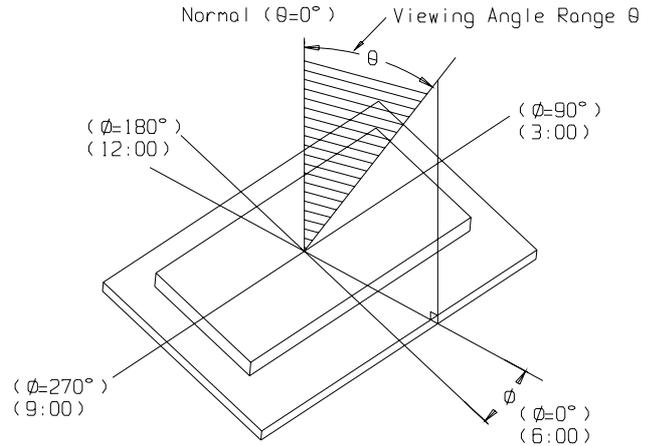
tr: time required to switch from OFF state to ON state. This duration is measured between 10% and 90% of display maximum brightness.
 tf: time required to switch from ON state to OFF state. This duration is measured between 90% and 10% of display maximum brightness.

Note2: Definition of contrast ratio Cr.

$$Cr = \frac{\text{Brightness of non-selected segment}(B2)}{\text{Brightness of selected segment}(B1)}$$



Note3: Definition of viewing angle range “θ” .



This direction is defined by two angles:

φ : azimuth angle (φ ∈ [0; 360])

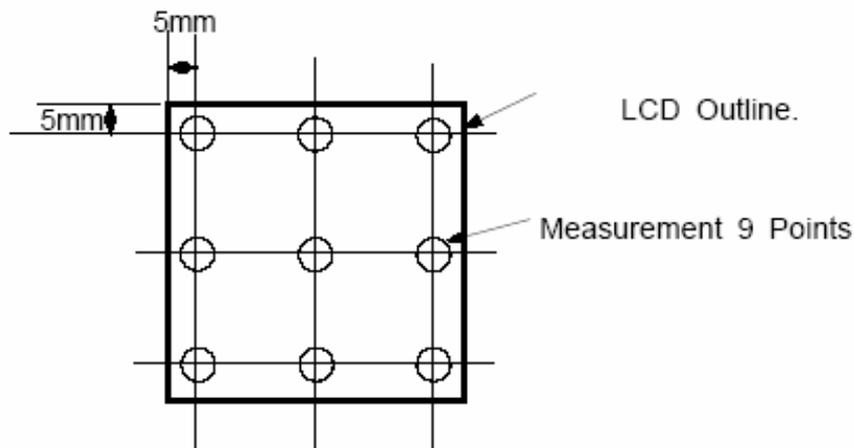
θ.: incidence angle (θ ∈ [0; +90])

φ = 0 on the right side of the LCD.

θ = 0 at normal incidence, i.e. when looking at the display in the perpendicular direction.

Note4: The uniformity in surface luminance, δ WHITE is determined by measuring luminance at each test position 1 through 9, and then dividing the maximum luminance of 9 points luminance by minimum luminance of 9 points luminance.

$$\delta \text{ WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels}(P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9)}{\text{Maximum Surface Luminance with all white pixels}(P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9)}$$



■ INTERFACE DESCRIPTION

Pin NO.	Symbol	Function
1	A	Backlight LED + (anode).
2	K	Backlight LED - (cathode).
3	ESD-GND	Connected to ground.
4	SDA	Serial data.
5	SCL	Serial clock.
6	/RES	Reset signal input pin. (Hardware reset, must meet keeping low level 20 milliseconds, and high level 150 milliseconds at least.)
7	/CS	Chip select input pin.
8	CD	Command or data select control pin.
9	VSS	Ground.
10	VDD	Power supply for LCD.
11	ESD-GND	Connected to ground.

■ CIRCUIT BLOCK DIAGRAM

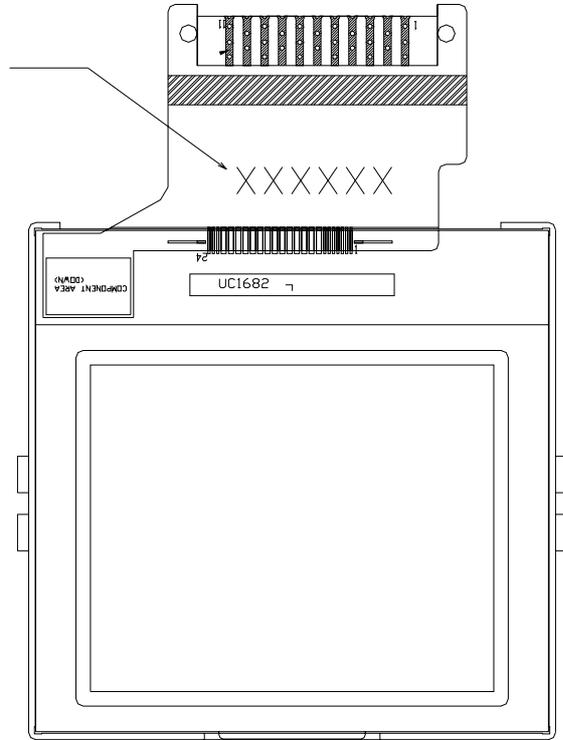
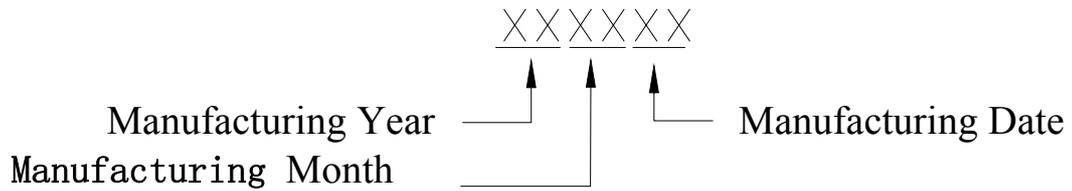
Please refer to Page 8.

■ OPERATING PRINCIPLES & METHODS

Note: Please refer to UC1682 data sheet for more details.

■ DATE CODE**DATE CODE: LCD MANUFACTURING DATE CODE**

LCD MANUFACTURING DATA CODE

**DATE CODE NOTE:**

■ RELIABILITY

No.	Test Item	Test Condition	Inspection after test
1	High Temperature Storage	$80 \pm 2^{\circ}\text{C}/70$ hours	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Sealleak; 3.Non-display; 4.missing segments; 5.Glass crack; 6.Current Idd is twice higher than initial value. Polarizers & B/L may fail in item2,item5 and item6 test, but only this failure is allowable items. The test condition is acceptable at set assembly condition.
2	Low Temperature Storage	$-40 \pm 2^{\circ}\text{C}/70$ hours	
3	High Temperature Operating	$70 \pm 2^{\circ}\text{C}/70$ hours	
4	Low Temperature Operating	$-30 \pm 2^{\circ}\text{C}/70$ hours	
5	Temperature Cycle	$-30 \pm 2^{\circ}\text{C} \sim 25 \sim 70 \pm 2^{\circ}\text{C} \times 48$ cycles (30min.) (5min.) (30min.)	
6	Damp Proof Test	$45^{\circ}\text{C} \times 95\% \text{RH}/72$ hours	
7	Vibration Test	Frequency: 10Hz~55Hz~10Hz Amplitude: 1.5mm, X, Y, Z direction for total 3hours (Packing condition)	
8	Drooping test	Drop to the ground from 1.5m height, one time every side of mobile phone.	
9	ESD test	Voltage: $\pm 15\text{KV}$ R: 330Ω C: 150pF Air discharge, 10time	
10	Solar radiation(UV)	10 cycles of 1 day; 20 hours: $I=0.68\text{W}/\text{m}^2/\text{nm}$ at 340nm, $T=+55^{\circ}\text{C}$ 4 hours: $I=0\text{W}/\text{m}^2/\text{nm}$ at 340 nm, $T=+35^{\circ}\text{C}$	

Remark:

- 1.The test samples should be applied to only one test item.
- 2.Sample size for each test item is 5~10pcs.
- 3.For Damp Proof Test, Pure water(Resistance > 10MΩ) should be used.
- 4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.
- 5.EL evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.
- 6.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.
- 7.Please use automatic switch menu(or roll menu) testing mode when test operating mode.

■ INSPECTION CRITERIA

TRULY® OUTGOING QUALITY STANDARD	PAGE 1 OF 4
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	MDS Product
<p>This specification is made to be used as the standard acceptance/rejection criteria for Color mobile phone LCM.</p> <p>1 Sample plan</p> <p>Sampling plan according to GB/T2828.1-2003/ISO 2859-1: 1999 and ANSI/ASQC Z1.4-1993, normal level 2 and based on:</p> <p>Major defect: AQL 0.4</p> <p>Minor defect: AQL 1.0</p> <p>2. Inspection condition</p> <p>Viewing distance for cosmetic inspection is about 30cm with bare eyes, and under an environment of 20~40W light intensity, all directions for inspecting the sample should be within 45° against perpendicular line.</p> <p>3. Definition of inspection zone in LCD.</p> <div data-bbox="453 1158 976 1388" data-label="Diagram"> </div> <p>Zone A: character/Digit area</p> <p>Zone B: viewing area except Zone A (ZoneA+ZoneB=minimum Viewing area)</p> <p>Zone C: Outside viewing area (invisible area after assembly in customer's product)</p> <p>Fig.1 Inspection zones in an LCD.</p> <p>Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble for quality and assembly of customer's product.</p>	

TRULY[®] OUTGOING QUALITY STANDARD	PAGE 2 OF 4
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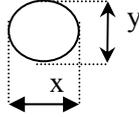
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	MDS Product
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4. Inspection standards

4.1 Major Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
4.1.1	All functional defects	1) No display 2) Display abnormally 3) Missing vertical, horizontal segment 4) Short circuit 5) Back-light no lighting, flickering and abnormal lighting.	Major
4.1.2	Missing	Missing component	
4.1.3	Outline dimension	Overall outline dimension beyond the drawing is not allowed.	

4.2 Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects																					
4.2.1	Clear Spots	For dark/white spot, size Φ is defined as $\Phi = \frac{(x+y)}{2}$ 	Minor																					
	Black and white Spot defect Pinhole, Foreign Particle, Dirt under polarizer	1. <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="width: 20%;">Zone</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>Size(mm)</th> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.1$</td> <td colspan="2" style="text-align: center;">Ignore</td> <td rowspan="4" style="text-align: center; vertical-align: middle;">Ignore</td> </tr> <tr> <td>$0.10 < \Phi \leq 0.15$</td> <td colspan="2" style="text-align: center;">2</td> </tr> <tr> <td>$0.15 < \Phi \leq 0.20$</td> <td colspan="2" style="text-align: center;">1</td> </tr> <tr> <td>$\Phi > 0.20$</td> <td colspan="2" style="text-align: center;">0</td> </tr> </tbody> </table>		Zone	Acceptable Qty			Size(mm)	A	B	C	$\Phi \leq 0.1$	Ignore		Ignore	$0.10 < \Phi \leq 0.15$	2		$0.15 < \Phi \leq 0.20$	1		$\Phi > 0.20$	0	
Zone	Acceptable Qty																							
Size(mm)	A	B	C																					
$\Phi \leq 0.1$	Ignore		Ignore																					
$0.10 < \Phi \leq 0.15$	2																							
$0.15 < \Phi \leq 0.20$	1																							
$\Phi > 0.20$	0																							
	Dim Spots	2. <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="width: 20%;">2. Zone</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>Size(mm)</th> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.1$</td> <td colspan="2" style="text-align: center;">Ignore</td> <td rowspan="4" style="text-align: center; vertical-align: middle;">Ignore</td> </tr> <tr> <td>$0.10 < \Phi \leq 0.15$</td> <td colspan="2" style="text-align: center;">2</td> </tr> <tr> <td>$0.15 < \Phi \leq 0.20$</td> <td colspan="2" style="text-align: center;">1</td> </tr> <tr> <td>$\Phi > 0.20$</td> <td colspan="2" style="text-align: center;">0</td> </tr> </tbody> </table>	2. Zone	Acceptable Qty			Size(mm)	A	B	C	$\Phi \leq 0.1$	Ignore		Ignore	$0.10 < \Phi \leq 0.15$	2		$0.15 < \Phi \leq 0.20$	1		$\Phi > 0.20$	0		Minor
2. Zone	Acceptable Qty																							
Size(mm)	A	B	C																					
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$0.10 < \Phi \leq 0.15$	2																							
$0.15 < \Phi \leq 0.20$	1																							
$\Phi > 0.20$	0																							
	Circle shaped and dim edged defects																							

OUTGOING QUALITY STANDARD	PAGE 3 OF 4
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TITLE: FUNCTIONAL TEST & INSPECTION CRITERIA	MDS Product
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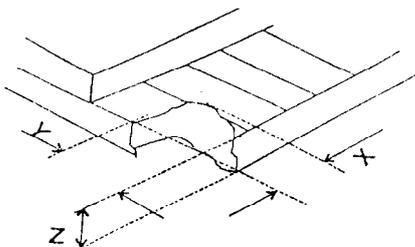
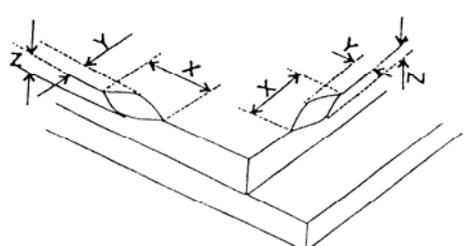
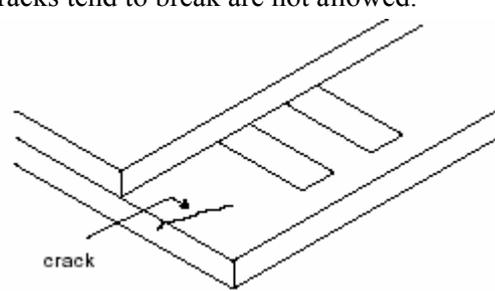
4.2. Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects																																	
4.2.2	Line defect Black line, White line, Foreign material under polarizer,	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: center;">Size(mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th rowspan="2" style="text-align: center;">L(Length)</th> <th rowspan="2" style="text-align: center;">W(Width)</th> <th colspan="3" style="text-align: center;">Zone</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Ignore</td> <td style="text-align: center;">$W \leq 0.02$</td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;">$L \leq 2.0$</td> <td style="text-align: center;">$0.02 < W \leq 0.03$</td> <td colspan="3" style="text-align: center;">2</td> </tr> <tr> <td style="text-align: center;">$L > 2.0$</td> <td style="text-align: center;">$0.02 < W \leq 0.03$</td> <td colspan="3" style="text-align: center;">0</td> </tr> <tr> <td></td> <td style="text-align: center;">$0.03 < W$</td> <td colspan="3" style="text-align: center;">Spot</td> </tr> </tbody> </table>	Size(mm)		Acceptable Qty			L(Length)	W(Width)	Zone			A	B	C	Ignore	$W \leq 0.02$	Ignore			$L \leq 2.0$	$0.02 < W \leq 0.03$	2			$L > 2.0$	$0.02 < W \leq 0.03$	0				$0.03 < W$	Spot			Minor
Size(mm)		Acceptable Qty																																		
L(Length)	W(Width)	Zone																																		
		A	B	C																																
Ignore	$W \leq 0.02$	Ignore																																		
$L \leq 2.0$	$0.02 < W \leq 0.03$	2																																		
$L > 2.0$	$0.02 < W \leq 0.03$	0																																		
	$0.03 < W$	Spot																																		
4.2.3	Polarizer scratch	<p>If the Polarizer scratch can be seen after mobile phone cover assembling or in the operating condition, judge by the line defect of 4.2.2.</p> <p>If the Polarizer scratch can be seen only in non-operating condition or some special angle, judge by the following.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: center;">Size(mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th rowspan="2" style="text-align: center;">L(Length)</th> <th rowspan="2" style="text-align: center;">W(Width)</th> <th colspan="3" style="text-align: center;">Zone</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Ignore</td> <td style="text-align: center;">$W \leq 0.02$</td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;">$L \leq 2.0$</td> <td style="text-align: center;">$0.02 < W \leq 0.03$</td> <td colspan="3" style="text-align: center;">2</td> </tr> <tr> <td style="text-align: center;">$L > 2.0$</td> <td style="text-align: center;">$0.02 < W \leq 0.03$</td> <td colspan="3" style="text-align: center;">0</td> </tr> <tr> <td></td> <td style="text-align: center;">$0.03 < W$</td> <td colspan="3" style="text-align: center;">Spot</td> </tr> </tbody> </table>	Size(mm)		Acceptable Qty			L(Length)	W(Width)	Zone			A	B	C	Ignore	$W \leq 0.02$	Ignore			$L \leq 2.0$	$0.02 < W \leq 0.03$	2			$L > 2.0$	$0.02 < W \leq 0.03$	0				$0.03 < W$	Spot			Minor
Size(mm)		Acceptable Qty																																		
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4.2.4	Polarize Air bubble	Air bubbles between glass & polarizer <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Size(mm) 2. Zone</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$\Phi \leq 0.2$</td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;">$0.20 < \Phi \leq 0.30$</td> <td colspan="3" style="text-align: center;">2</td> </tr> <tr> <td style="text-align: center;">$0.30 < \Phi \leq 0.50$</td> <td colspan="3" style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">$0.50 < \Phi$</td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table>	Size(mm) 2. Zone	Acceptable Qty			A	B	C	$\Phi \leq 0.2$	Ignore			$0.20 < \Phi \leq 0.30$	2			$0.30 < \Phi \leq 0.50$	1			$0.50 < \Phi$	0			Minor										
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TRULY® OUTGOING QUALITY STANDARD	PAGE 4 OF 4
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TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	MDS Product
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4.3. Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects						
4.3.5	Glass defect	(i) Chips on corner  <table border="1" style="margin: 10px auto;"> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">Z</td> </tr> <tr> <td style="text-align: center;">≤ 2.0</td> <td style="text-align: center;">$\leq S$</td> <td style="text-align: center;">Disregard</td> </tr> </table> <p>Notes: S=contact pad length Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal.</p>	X	Y	Z	≤ 2.0	$\leq S$	Disregard	Minor
		X	Y	Z					
		≤ 2.0	$\leq S$	Disregard					
(ii) Usual surface cracks  <table border="1" style="margin: 10px auto;"> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">Z</td> </tr> <tr> <td style="text-align: center;">≤ 3.0</td> <td style="text-align: center;"><Inner border line of the seal</td> <td style="text-align: center;">Disregard</td> </tr> </table>	X	Y	Z	≤ 3.0	<Inner border line of the seal	Disregard	Minor		
X	Y	Z							
≤ 3.0	<Inner border line of the seal	Disregard							
(iii) Crack Cracks tend to break are not allowed. 	Major								
4.3.6	Parts alignment	1) Not allow IC and FPC/heat-seal lead width is more than 50% beyond lead pattern. 2) Not allow chip or solder component is off center more than 50% of the pad outline.	Minor						
4.3.7	SMT	According to the <Acceptability of electronic assemblies> IPC-A-610C class 2 standard. Component missing or function defect are Major defect, the others are Minor defect.							

■ PRECAUTIONS FOR USING LCD MODULES

Handling Precautions

- (1) The display panel is made of glass. Do not subject it to a mechanical shock by dropping it or impact.
- (2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.
- (3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- (4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- (5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents
 - Isopropyl alcohol
 - Ethyl alcohol
- (6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.
 - Water
 - Ketone
 - Aromatic solvents
- (7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
- (8) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
- (9) Do not attempt to disassemble or process the LCD module.
- (10) NC terminal should be open. Do not connect anything.
- (11) If the logic circuit power is off, do not apply the input signals.
- (12) To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - Be sure to ground the body when handling the LCD modules.
 - Tools required for assembling, such as soldering irons, must be properly grounded.
 - To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
 - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

Storage Precautions

When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags (avoid high temperature / high humidity and low temperatures below 0°C). Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

Others

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.

- Exposed area of the printed circuit board.
- Terminal electrode sections.

■ USING LCD MODULES

Liquid Crystal Display Modules

LCD is composed of glass and polarizer. Pay attention to the following items when handling.

(1) Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.

(2) Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.).

(3) N-hexane is recommended for cleaning the adhesives used to attach front/rear polarizers and reflectors made of organic substances which will be damaged by chemicals such as acetone, toluene, ethanol and isopropyl alcohol.

(4) When the display surface becomes dusty, wipe gently with absorbent cotton or other soft material like chamois soaked in petroleum benzin. Do not scrub hard to avoid damaging the display surface.

(5) Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading.

(6) Avoid contacting oil and fats.

(7) Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming in contact with room temperature air.

(8) Do not put or attach anything on the display area to avoid leaving marks on.

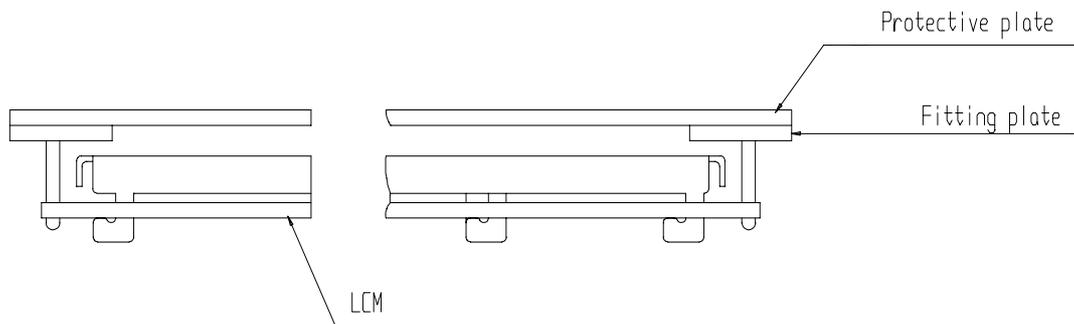
(9) Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

(10) As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring.

Installing LCD Modules

The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to the following items when installing the LCM.

(1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



(2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ± 0.1 mm.

Precaution for Handling LCD Modules

Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

(1) Do not alter, modify or change the shape of the tab on the metal frame.

(2) Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.

(3) Do not damage or modify the pattern writing on the printed circuit board.

(4) Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.

(5) Except for soldering the interface, do not make any alterations or modifications with a soldering iron.

(6) Do not drop, bend or twist LCM.

Electro-Static Discharge Control

Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC.

- (1) Make certain that you are grounded when handling LCM.
- (2) Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential.
- (3) When soldering the terminal of LCM, make certain the AC power source for the soldering iron does not leak.
- (4) When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.
- (5) As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.
- (6) To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended.

Precaution for soldering to the LCM

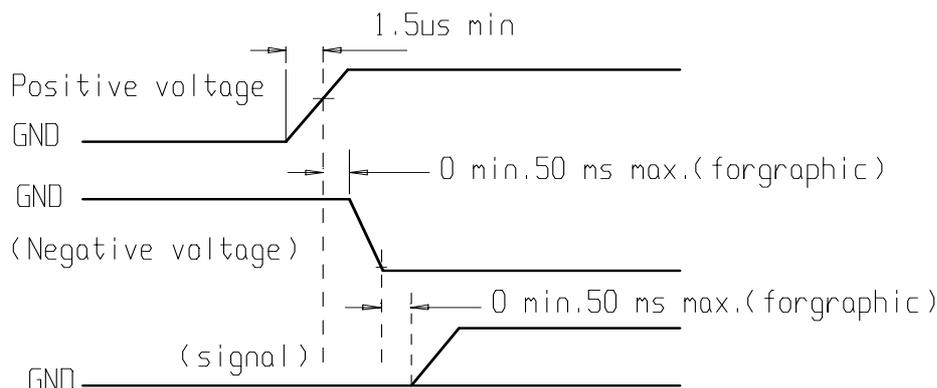
- (1) Observe the following when soldering lead wire, connector cable and etc. to the LCM.
 - Soldering iron temperature : $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$.
 - Soldering time : 3-4 sec.
 - Solder : eutectic solder.

If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

- (2) When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.
- (3) When remove the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

Precautions for Operation

- (1) Viewing angle varies with the change of liquid crystal driving voltage (VO). Adjust VO to show the best contrast.
- (2) Driving the LCD in the voltage above the limit shortens its life.
- (3) Response time is greatly delayed at temperature below the operating temperature range. However, this does not mean the LCD will be out of the order. It will recover when it returns to the specified temperature range.
- (4) If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.
- (5) Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit. Therefore, it must be used under the relative condition of 40°C , 50% RH.
- (6) When turning the power on, input each signal after the positive/negative voltage becomes stable.



Storage

When storing LCDs as spares for some years, the following precaution is necessary.

- (1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for the dessicant.
- (2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C.
- (3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped.

Safety

- (1) It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
- (2) If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

Limited Warranty

Unless agreed between TRULY and customer, TRULY will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with TRULY LCD acceptance standards (copies available upon request) for a period of one year from date of shipments. Cosmetic/visual defects must be returned to TRULY within 90 days of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of TRULY limited to repair and/or replacement on the terms set forth above. TRULY will not be responsible for any subsequent or consequential events.

Return LCM under warranty

No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

- Broken LCD glass.
- PCB eyelet is damaged or modified.
- PCB conductors damaged.
- Circuit modified in any way, including addition of components.
- PCB tampered with by grinding, engraving or painting varnish.
- Soldering to or modifying the bezel in any manner.

Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet, conductors and terminals.

■ PRIOR CONSULT MATTER

WE WILL ENFORCE OF CHANGING MATERIAL, METHOD, PROCESS AND OTHERS FOR THIS PRODUCT AFTER PRIOR CONSULTATION.

IF YOU HAVE DOUBTS ABOUT CONDITION OF RELIABILITY, WE WOULD CONFER WITH YOU.

■ FACTORY

FACTORY NAME: TRULY SEMICONDUCTORS LTD.

FACTORY ADDRESS: Truly Industrial Area, ShanWei City,GuangDong,China

FACTORY PHONE: 86-0660-3380061 **FAX:** 86-0660-3371772