



TRI-T COMPANY LIMITED

SPECIFICATION FOR COG MODULE

ORDER NO : TMGG12232A-05

MODULE NO.: TMGG12232A-SN-LED05-W/FFC50.0

DOC.REVISION A00

Customer Approval:

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	NAME	SIGNATURE	DATE
PREPARED BY	KOWK SHING FU		08 MAY 2008
CHECKED BY	FU SZE HOI		08 MAY 2008
APPROVED BY	FU SZE HOI		08 MAY 2008



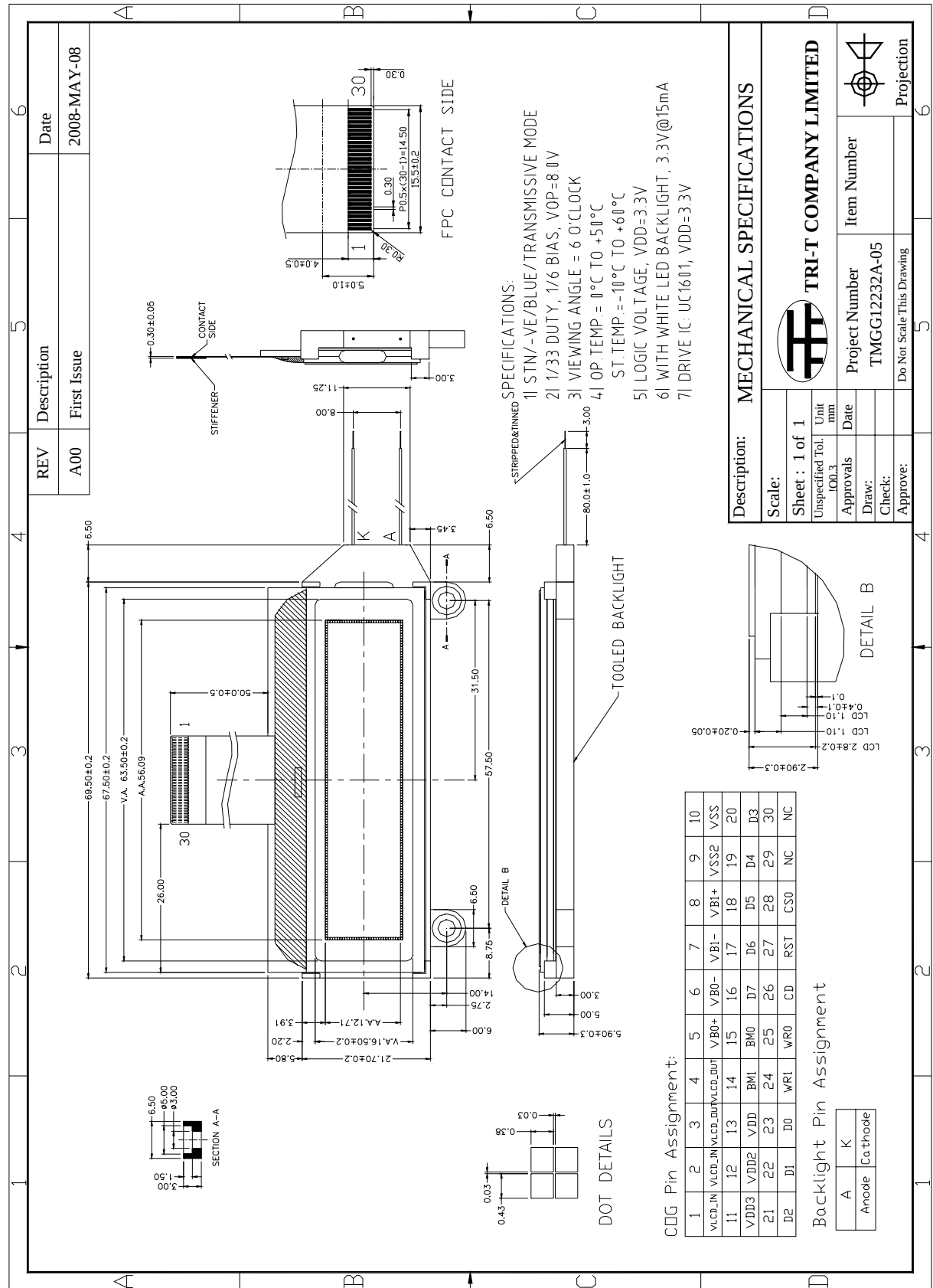
Version	DATE	DESCRIPTION	CHANGED BY
A00	08 MAY 2008	First issue	



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1. DIMENSIONAL OUTLINE





2.FUNCTIONS & FEATURES

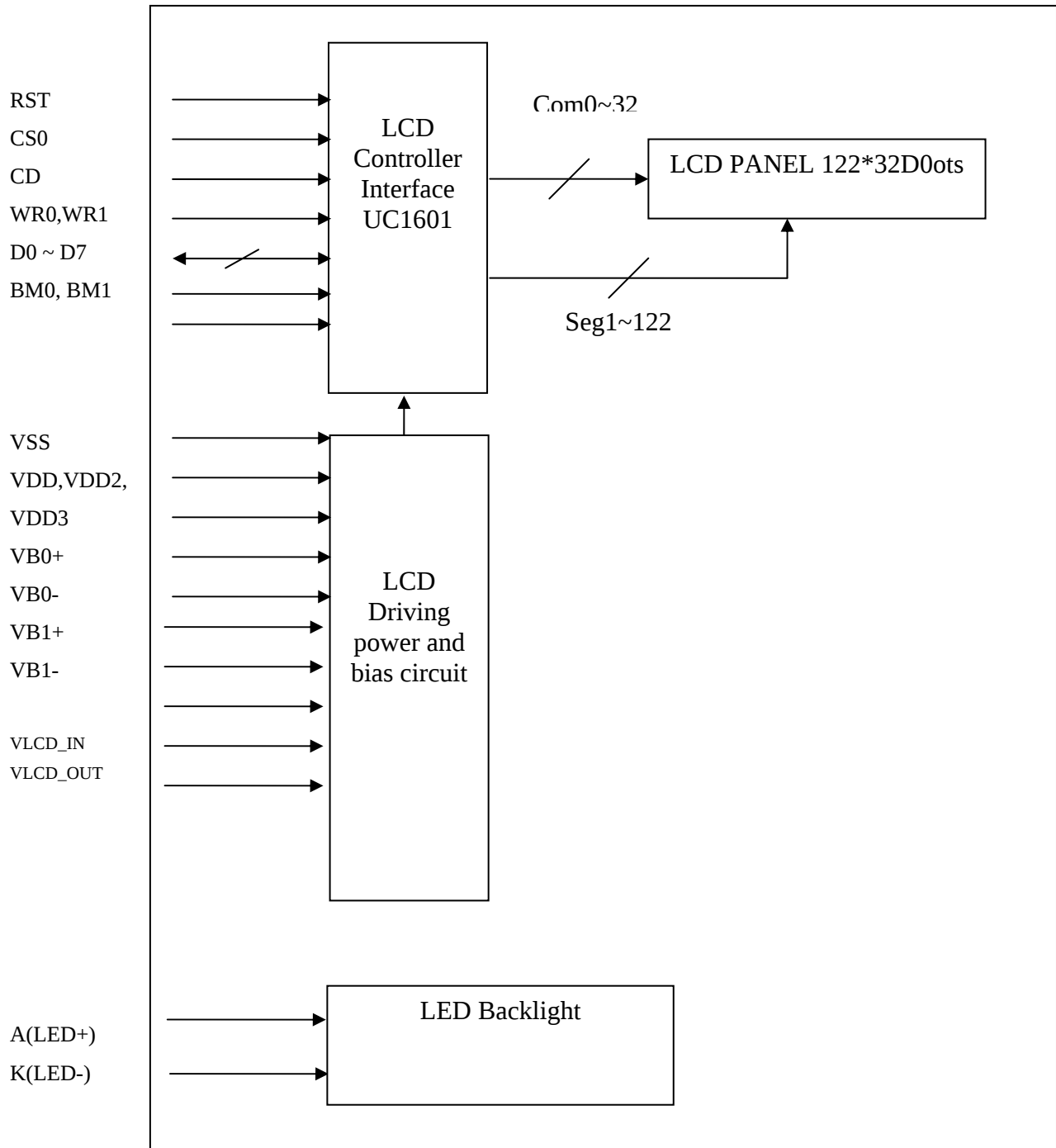
2-1. Format	: 122*32 dots
2-2. LCD Mode	: STN, Negative, Blue, Transmissive
2-3. Viewing Direction	: 6 o'clock
2-4. Driving Scheme	: 1/33 Duty cycle, 1/6 Bias
2-5. Single Supply Voltage	: Power supply voltage range (V_{DD}): 2.7~3.6V
2-6. Low current sleep mode	
2-7. 255 level of Internal Contrast Control	
2-8. Parallel or Serial Interface	
2-9. Scrolling function	
2-10. On-chip DC-DC Converter	
2-11. RoHS Compliance	

3.MECHANICAL SPECIFICATIONS

3-1. Module size	: 76.00 mm(L) x 34.00 mm(W) (FPC length not included)
3-2. Viewing area	: 63.50 mm(L) x 16.50 mm(W)
3-3. Active Area	: 56.09 mm(L) x 12.71 mm(W)
3-4. Dot pitch	: 0.46 mm(L) x 0.41 mm(W)
3-5. Dot size	: 0.43 mm(L) x 0.38 mm(W)



4.BLOCK DIAGRAM





5. PIN DESCRIPTION

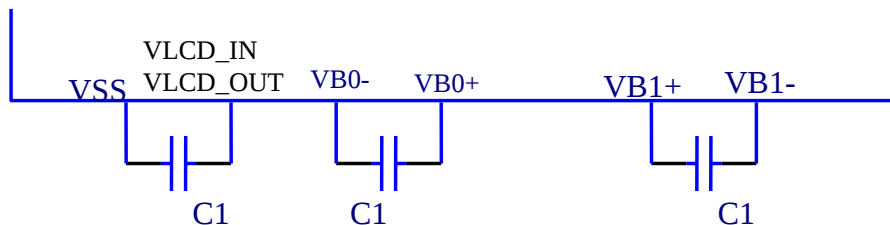
Pin no.	Symbol	Function
1	VLCD_IN	Internal DC/DC converter input/output pins. Connect VLCD_IN & VLCD_OUT pins together, need to connect a 1uF capacitor between VSS and this pin for voltage decoupling
2	VLCD_IN	
3	VLCD_VOUT	
3	VLCD_VOUT	
4	VB0+	LCD bias voltage are generated internally. Connect a 1uF capacitors between VB0+ and VB0-, VB1+ and VB1-.
5	VB0-	
6	VB1-	
7	VB1+	
8	VSS	Power supply for logic, 0V
9	VSS2	Power supply for DC/DC converter, 0V
11	VDD3	Power supply for DC/DC converter, 3.3V
12	VDD2	Power supply for DC/DC converter, 3.3V
13	VDD	Power supply for logic, 3.3V
14	BM1	Bus Mode: BM1: BM0 = 1:0, 8080 type parallel I/O BM1: BM0 = 1:1, 6800 type parallel I/O BM1: BM0 = 0:1, 4 wires SPI serial I/O BM1: BM0 = 0:0, 3 wires SPI serial I/O
15	BM0	
16	D7	Bi-direction bus for serial or parallel interface. In serial mode, D0 =SCK, D3=SDA, any unused pin must be connected to VSS
17	D6	
18	D5	
19	D4	
20	D3	
21	D2	
22	D1	
23	D0	
24	WR1	These lines control the read/write function, it depends on whether it is 8080 or 6800 I/O. type in serial I/O, connected these pins to VSS
25	WR0	
26	CD	Display/control data select “H”:display data ; “L”:control data
27	RST	External reset pin, low active
28	CS0	Chip select pin
29	NC	No connection
30	NC	No connection



6. POWER SUPPLY

6-1. DC-DC Voltage Converter

The built in DC-DC voltage converter is used to generate the internal LCD driving voltage with reference to V_{SS} from the voltage input (V_{DD}).



Remarks:

1. C1 = 1.0u~ 4.7uF
2. Boosting input from V_{DD}

7. MAXIMUM ABSOLUTE LIMIT (T=25°C)

Item	Symbol	Standard value	Unit
Power supply voltage for logic	V _{DD}	-0.3~+4.0	V
	LCD	-0.3~+12.0	
Input voltage	V _{IN}	V _{SS} -0.3~V _{DD} +0.3	V
Operating temperature	Topr	0~+50	°C
Storage temperature	Tstg	-10~+60	°C

Note: Voltage greater than above may damage the module

8. ELECTRICAL CHARACTERISTICS

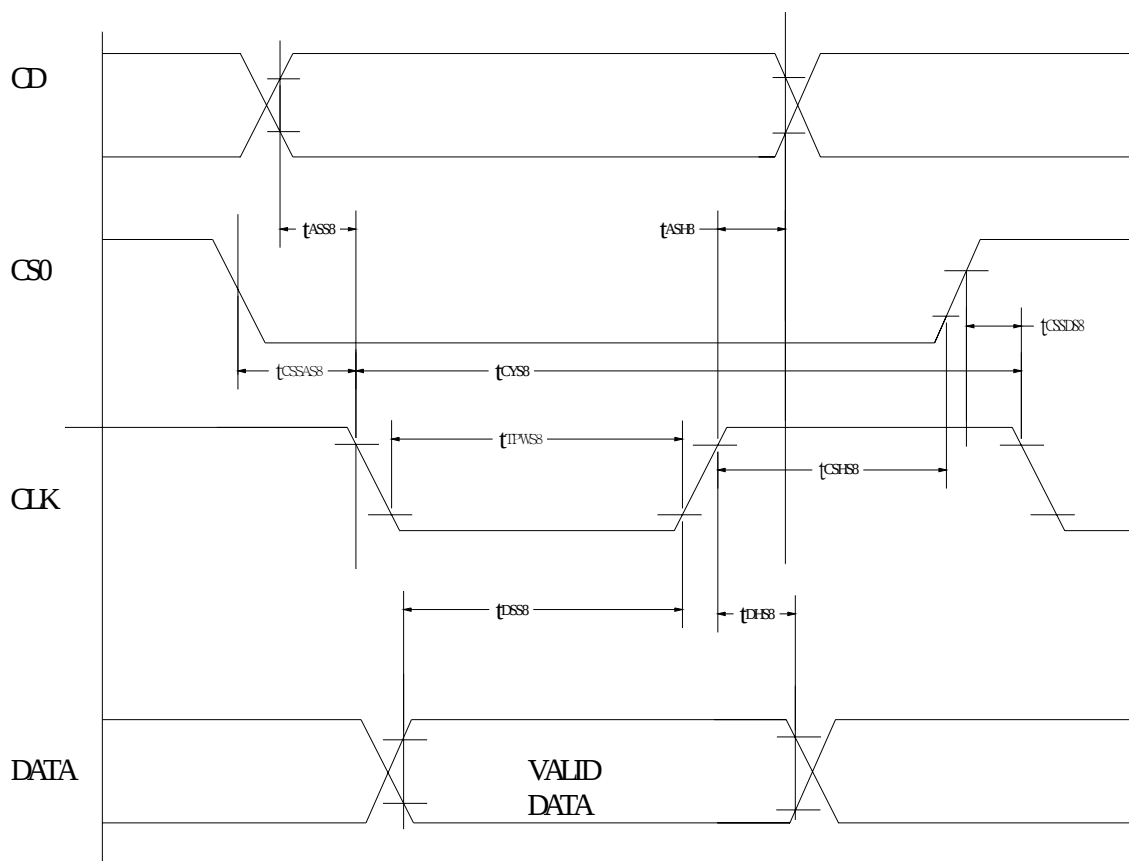
8-1. DC Characteristics (V_{DD}=3.0~3.6, Ta=-25°C)

Symbol	Parameter	Min	Typ	Max	Unit	Test condition
V _{DD}	Logic Circuit supply voltage	3.0	3.3	3.6	V	Recommend operating voltage
I _{cc}	Current consumption	-	270	400	uA	
V _{LCD}	LCD driving voltage generator output	-	8.0	8.2	V	Recommend LCD voltage
V _D	LCD data voltage	0.8	-	1.32	V	
V _{IL}	Input logic low	-	-	0.2V _{DD}	V	
V _{IH}	Input logic high	0.8V _{DD}	-	-	V	
V _{OL}	Output logic low	-	-	0.2V _{DD}	V	
V _{OH}	Output logic high	0.8V _{DD}	-	-	uA	
I _{IL}	Input leakage current	-	-	1.5	uA	



8-2. Serial Interface Timing Characteristics

Symbol	Signal	Description	Min	Max	Unit
tASS8	CD	Address setup time	0	-	ns
tAHS8	CD	Address hold time	40	-	ns
tCYS8	CLK	System cycle time	135	-	ns
tLPWS8	CLK	Low pulse width	65	-	ns
tHPWS8	CLK	High pulse width	65	-	ns
TDSS8 TDHS8	DATA	Data setup time Data hold time	30 10	-	ns
tCSSAS8 tCSSDS8 tCSHS8	CS0	Chip select setup time	10 10 20	-	ns





9.BACKLIGHT SPECIFICATIONS

9-1.Absolute maximum rating

Item	Symbol	Ratings	Unit
Peak forward current	Ifp	25	mA
Reverse voltage	Vr	1	V
Power dissipation	Pd	75	mW

9-2.Electrical specifications

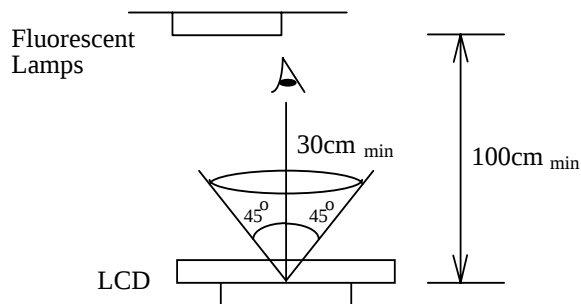
Item	Symbol	Min	Type	Max	Unit	Conditions
Luminous intensity	Lv	80	100	-	cd/m ²	IF=15mA Ta=25°C
Color Co-ordinate	x	0.27		0.33	ηm	
Color Co-ordinate	y	0.27	-	0.36	ηm	
Forward voltage	Vf	3.2	3.3	3.4	V	
Reverse current	Ir	-	-	15	mA	VR=0.8V



10. Quality Specifications

10.1 Inspection Condition

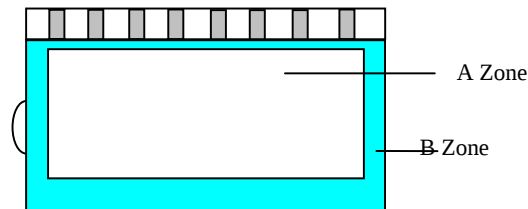
10.1.1 The inspection shall be performed by using 20W x 2 fluorescent lamps . Distance between LCD and fluorescent lamps should be 100 cm or more. Distance between LCD and inspector eyes should be 30 cm or more.



10.1.2 For transmissive displays a reflector (e.g. a white card) shall be placed behind the display.

10.1.3 Viewing direction for inspection is 45° from vertical against LCD.

10.2. Definition of Zone



A Zone: Active display area (minimum viewing area).

B Zone: Non-active display area (outside viewing area).



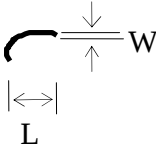
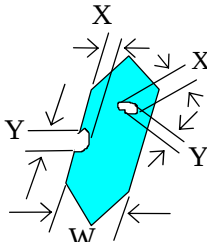
10.3 Sampling Method: MIL-STD-105E.

10.4 Inspection level: Level II, Single Sampling.

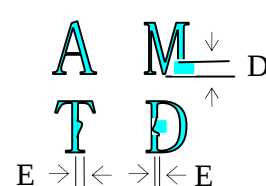
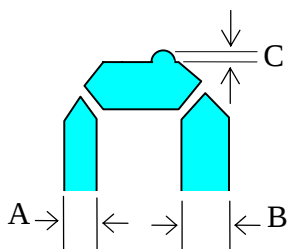
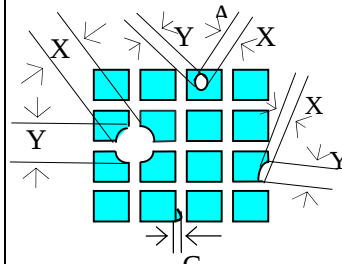
Rank	Item		Criterion	AQL
Major	1.Display state	1. Segment short circuit.	1	0.4
		2. Open circuit (missing segment)		
		3. Contrast defect (dim, ghosting)	6	
		4. Segment defect (Pin hole, etc.)		
	5. Leakage	/	Ac:0 Re: 1	
	6. No display, polarizers reverse applied			
2. Dimension	1. Dimension out of specification (incl. PIN)	2	0.4	
Minor	1. Non-display state	1. Spot, foreign material, line defect	3, 4, 5	1.0
		2. Rainbow, background color		
	2. Polarizer	1. Scratch	3, 4, 7	
		2. Bubble		
		3. Foreign material	8	
	3. Glass substrate	1. Chipped	9	
		2. Protruded, burred	10	
	4. PIN	1. Positioning	11	
		2. Epoxy coverage		
	5. Silk screen	1. Positioning	12	
2. Color				
3. Semblance defect (Refer spot, line Standards)		3, 4		
Total				1.0



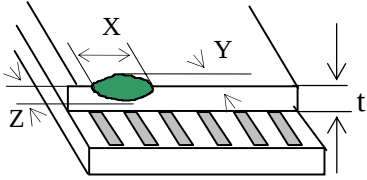
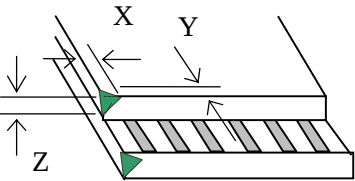
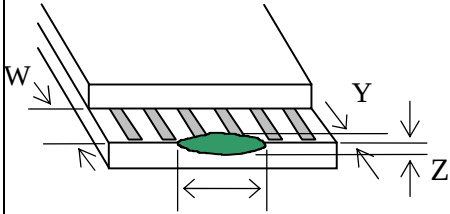
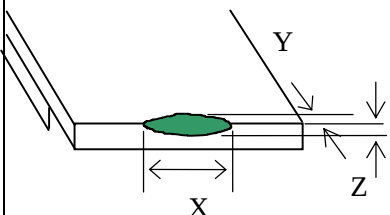
10.5 Inspection Items and Standards

No	Item	Criterion																				
1	Segment short, missing	Not exist																				
	Contrast defect	Refer to approved sample																				
2	Outside defect、 Positioning Color	Not exceed tolerance Refer to approved sample																				
3	Point defect, Black spot, dust (incl. Polarizer) $\phi = (X+Y)/2$	 <table><tr><th>Point Size</th><th>Acceptable Qty.</th></tr><tr><td>$\phi \leq 0.10$</td><td>Disregard</td></tr><tr><td>$0.10 < \phi \leq 0.20$</td><td>2</td></tr><tr><td>$0.20 < \phi \leq 0.25$</td><td>1</td></tr><tr><td>$0.25 < \phi \leq 0.30$</td><td>0</td></tr><tr><td>$\phi > 0.30$</td><td>0</td></tr></table> Unit: mm	Point Size	Acceptable Qty.	$\phi \leq 0.10$	Disregard	$0.10 < \phi \leq 0.20$	2	$0.20 < \phi \leq 0.25$	1	$0.25 < \phi \leq 0.30$	0	$\phi > 0.30$	0								
Point Size	Acceptable Qty.																					
$\phi \leq 0.10$	Disregard																					
$0.10 < \phi \leq 0.20$	2																					
$0.20 < \phi \leq 0.25$	1																					
$0.25 < \phi \leq 0.30$	0																					
$\phi > 0.30$	0																					
4	Line defect	 <table><tr><th colspan="2">Line</th><th>Acceptable Qty.</th></tr><tr><th>L</th><th>W</th><th></th></tr><tr><td>---</td><td>$0.015 \geq W$</td><td>Disregard</td></tr><tr><td>$3.0 \geq L$</td><td>$0.03 \geq W$</td><td rowspan="2">1</td></tr><tr><td>$2.0 \geq L$</td><td>$0.05 \geq W$</td></tr><tr><td>$1.0 \geq L$</td><td>$0.1 > W$</td><td>0</td></tr><tr><td>---</td><td>$0.05 < W$</td><td>Applied as point defect</td></tr></table> Unit: mm	Line		Acceptable Qty.	L	W		---	$0.015 \geq W$	Disregard	$3.0 \geq L$	$0.03 \geq W$	1	$2.0 \geq L$	$0.05 \geq W$	$1.0 \geq L$	$0.1 > W$	0	---	$0.05 < W$	Applied as point defect
Line		Acceptable Qty.																				
L	W																					
---	$0.015 \geq W$	Disregard																				
$3.0 \geq L$	$0.03 \geq W$	1																				
$2.0 \geq L$	$0.05 \geq W$																					
$1.0 \geq L$	$0.1 > W$	0																				
---	$0.05 < W$	Applied as point defect																				
5	Rainbow	Not more than two color changes across the viewing area. Background color should refer to approved sample .																				
6	Segment pattern W = Segment width $\phi = (A+B)/2$	1. Pin hole $\phi < 0.10\text{mm}$ is acceptable.  <table><tr><th>Width</th><th>Acceptable of defect</th></tr><tr><td>$W < 0.4$</td><td>$\phi \leq 1/2W$ and, $\phi \leq 0.2$</td></tr><tr><td>$W \geq 0.4$</td><td>$\phi \leq 1/3W$ and, $\phi \leq 0.25$</td></tr></table> Unit: mm	Width	Acceptable of defect	$W < 0.4$	$\phi \leq 1/2W$ and, $\phi \leq 0.2$	$W \geq 0.4$	$\phi \leq 1/3W$ and, $\phi \leq 0.25$														
Width	Acceptable of defect																					
$W < 0.4$	$\phi \leq 1/2W$ and, $\phi \leq 0.2$																					
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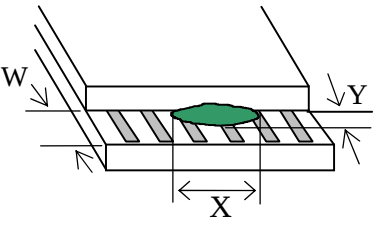
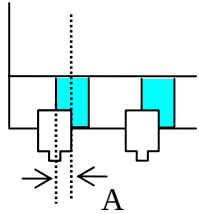
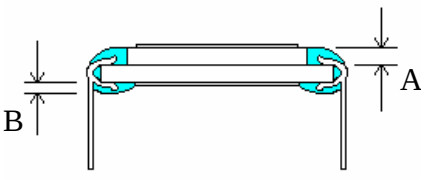


No	Item	Criterion												
		2. Segment width acceptable. $A - B < 0.20$; $D \leq 0.2$ $C \leq 0.1$ $E \leq 0.15$  3. Dot pattern <table><tr><th>Size</th><th>Acceptable Qty.</th></tr><tr><td>$\phi < 0.1$</td><td>Disregard</td></tr><tr><td>$0.10 \leq \phi \leq 0.20$</td><td>1</td></tr><tr><td>$\phi > 0.20$</td><td>0</td></tr></table> C: Shall not touch other dot(s). Unit: mm	Size	Acceptable Qty.	$\phi < 0.1$	Disregard	$0.10 \leq \phi \leq 0.20$	1	$\phi > 0.20$	0				
Size	Acceptable Qty.													
$\phi < 0.1$	Disregard													
$0.10 \leq \phi \leq 0.20$	1													
$\phi > 0.20$	0													
7	Polarizer air bubble	<table><tr><th>Size</th><th>Acceptable Qty.</th></tr><tr><td>$\phi < 0.10$ or B Zone</td><td>Disregard</td></tr><tr><td>$0.10 < \phi \leq 0.20$</td><td>2</td></tr><tr><td>$0.20 < \phi \leq 0.50$</td><td>1</td></tr><tr><td>$0.50 < \phi$</td><td>0</td></tr><tr><td>Total</td><td>2</td></tr></table> Unit: mm	Size	Acceptable Qty.	$\phi < 0.10$ or B Zone	Disregard	$0.10 < \phi \leq 0.20$	2	$0.20 < \phi \leq 0.50$	1	$0.50 < \phi$	0	Total	2
Size	Acceptable Qty.													
$\phi < 0.10$ or B Zone	Disregard													
$0.10 < \phi \leq 0.20$	2													
$0.20 < \phi \leq 0.50$	1													
$0.50 < \phi$	0													
Total	2													
8	Polarizer mis-placement	Polarizer should neither extends to glass edge nor extends into seal.												



No	Item	Criterion																								
9	Crack and chip Remark: X: Length direction Y: Short direction Z: Thickness direction t: Glass thickness a: LCD length W: Terminal Width F: seal width	1. General  <table border="1"> <thead> <tr> <th>X</th><th>Y</th><th>Z</th></tr> </thead> <tbody> <tr> <td>$\leq 5\text{mm}$</td><td>shall not reach to $1F/3$</td><td>$\leq t/2$</td></tr> </tbody> </table> 2. Corner  <table border="1"> <thead> <tr> <th>X</th><th>Y</th><th>Z</th></tr> </thead> <tbody> <tr> <td>$\leq 5\text{mm}$</td><td>shall not reach to $F/3$</td><td>$\leq t$</td></tr> </tbody> </table> 3. Crack on terminal  <table border="1"> <thead> <tr> <th>X</th><th>Y</th><th>Z</th></tr> </thead> <tbody> <tr> <td>$\leq a/10$</td><td>≤ 0.4</td><td>$\leq t$</td></tr> </tbody> </table> 4. Other than terminal  <table border="1"> <thead> <tr> <th>X</th><th>Y</th><th>Z</th></tr> </thead> <tbody> <tr> <td>$\leq a/10$</td><td>shall not reach to $F/3$</td><td>$\leq t/3$</td></tr> </tbody> </table>	X	Y	Z	$\leq 5\text{mm}$	shall not reach to $1F/3$	$\leq t/2$	X	Y	Z	$\leq 5\text{mm}$	shall not reach to $F/3$	$\leq t$	X	Y	Z	$\leq a/10$	≤ 0.4	$\leq t$	X	Y	Z	$\leq a/10$	shall not reach to $F/3$	$\leq t/3$
X	Y	Z																								
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$\leq a/10$	≤ 0.4	$\leq t$																								
X	Y	Z																								
$\leq a/10$	shall not reach to $F/3$	$\leq t/3$																								



No	Item	Criterion
10	Protruded W: Terminal Width	 Acceptable criteria: $Y \leq 1/5W$
11	Pin	1. Positioning  $A < 0.3\text{mm}$ 2 Epoxy coverage  A、B Epoxy Maximum height shall extend above front rear polarizer surface 3. No stain, rust nor discoloration of the insulating portion shall be allowed.
12	Total no. of acceptable defect	A. Zone Maximum 4 non-conformities per one unit. Defect distance: each point to be separated over 5mm B. Zone It is acceptable when it is no trouble for quality and assembly in customer's end product.



10.6 Reliability Standards

- 1 Under normal operating and storage conditions a lifetime of 50,000 hours is expected.
- 2 Reliability test condition:

Item	Condition	Time(hrs)	Assessment
High temp. storage	+60°C	240	No abnormalities in functions and appearance
Low temp. storage	-10°C	240	
Humidity	40°C / 90%RH	240	
Change of temperature	- 10°C ← 25°C → 60°C (60 min ← 5 min → 60min)	5 cycles	

3. In case of mass production, every order shall draw 10pcs. of samples to conduct a reliability test in according to the following condition:

Item	Condition	Time (hrs)
High temp. storage	+60°C	48
Low temp. storage	-10°C	48
Humidity	40°C / 90%RH	48

4. Recovery time should be 24 hours minimum.

10.7. Cautions for use

Pay attention to following points of handling the COG LCD module:

1. Take utmost care when handling as these products are made of glass. Any strong mechanical impact due to falling, etc. may cause damage(breakage or cracking).
2. Polarizer is made of soft material and is easily damaged, take utmost care when handling . The protective film attached is to prevent scratch and protect against dirt, it is recommended that this film should be kept sealing before use.



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3. Clean polarize with a soft cloth.
4. Do not touch the connection terminals of the display with bare hand, it will cause disconnection or defective insulation of terminals
5. Avoid use or extended storage at high temperature and high humidity. For extended storage, select a storage area where the temperature is $20 \pm 8^{\circ}\text{C}$ and the relative humidity is less than 65%
6. Do not expose the display to the direct sunlight or UV light.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell.
Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Limited Warranty

TRI-T modules are not consumer products, but may be incorporated by TRI-T's customers into consumer products or components thereof, TRI-T does not warrant that its modules and components are fit for any such particular purpose.

1. The liability of TRI-T is limited to repair or replacement on the terms set forth below. TRI-T will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between TRI-T and the customer, TRI-T will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with TRI-T QUALITY INSPECTION STANDARD.
2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.
3. In returning the module, they must be properly packaged; there should be detailed description of the failures or defect.