PRELIMINARY SPECIFICATION FOR LCD MODULE

ORDER NO : CL010-4042-01

MODULE NO.: CL010-4042-E-RH

DOC.REVISION A00

Customer Approval:

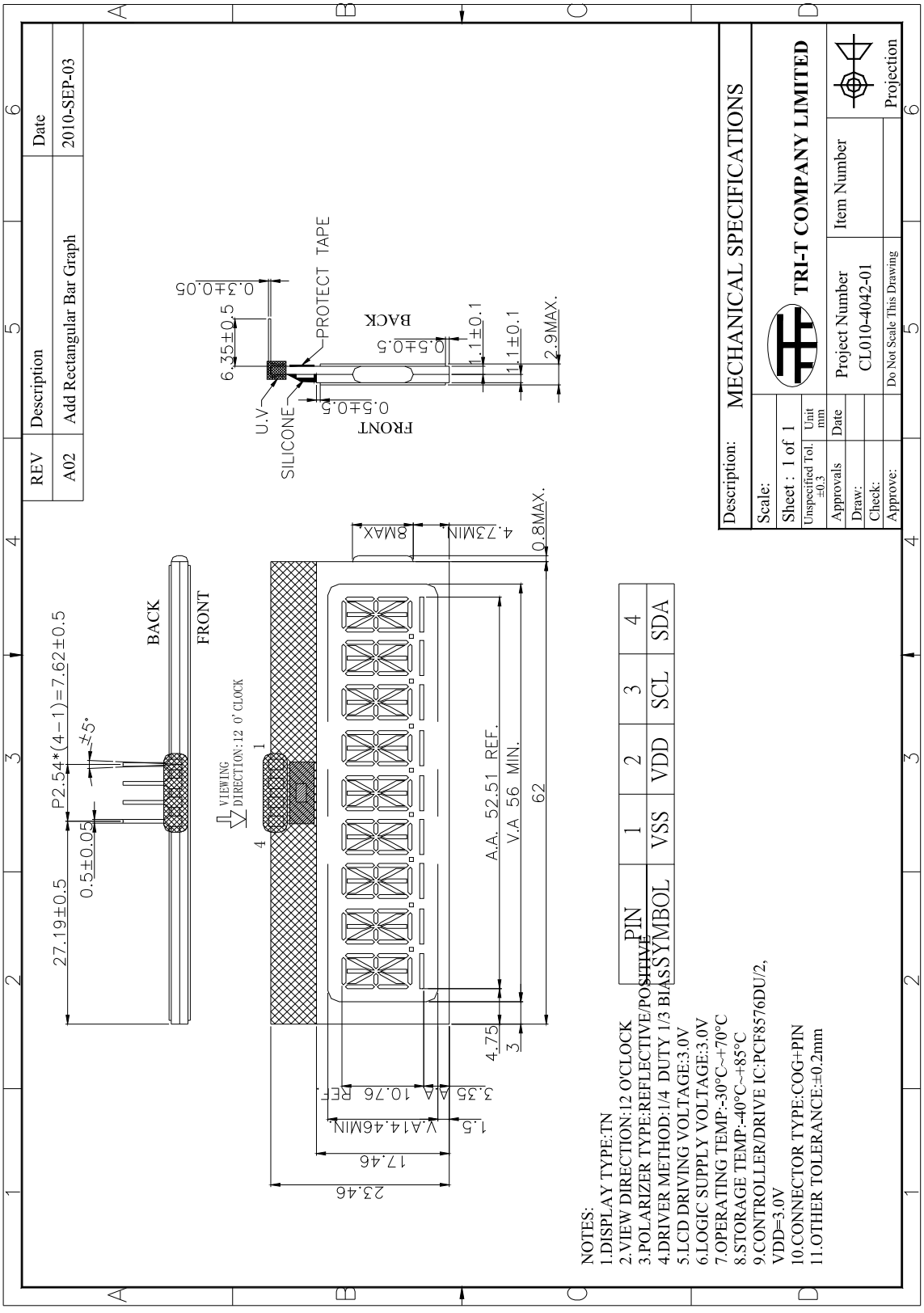
	NAME	SIGNATURE	DATE
PREPARED BY	KOWK SHING FU		16 SEP 2010
CHECKED BY	FU SZE HOI		17 SEP 2010
APPROVED BY	FU SZE HOI		17 SEP 2010

DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
A00	16 SEP 2010	First issue	

TRI-T COMPANY LIMITED

1. DIMENSIONAL OUTLINE



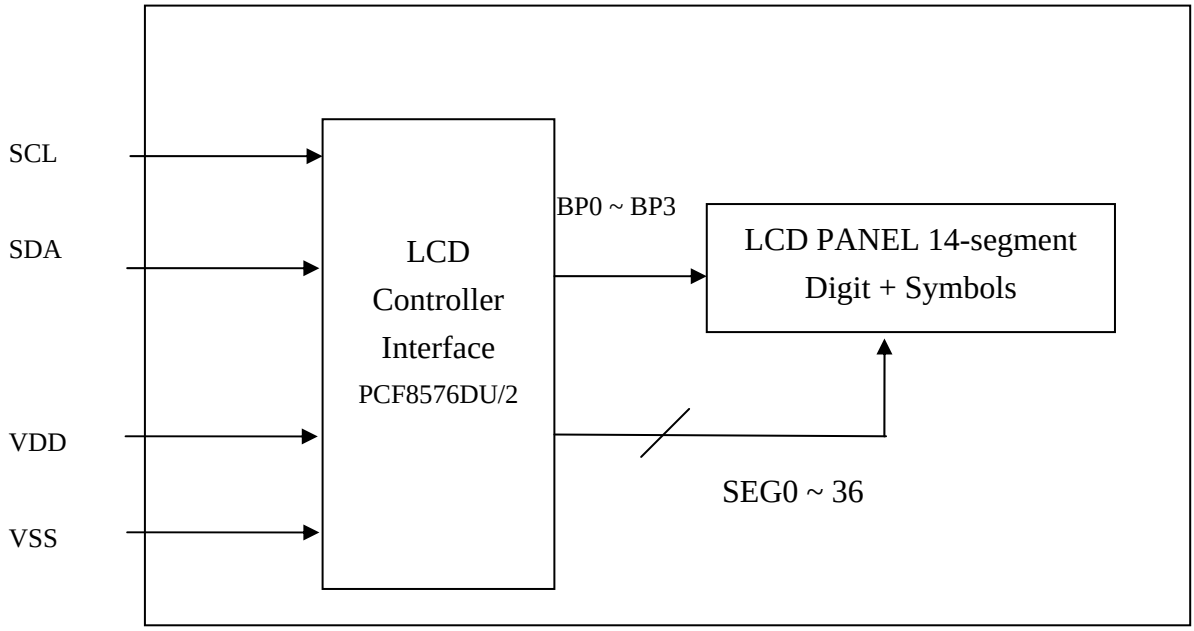
2.FUNCTIONS & FEATURES

2-1. Format	: 14 segment digits + Symbols
2-2. LCD Mode	: TN, Positive, Reflective
2-3. Viewing Direction	: 12 o'clock
2-4. Driving Scheme	: 1/4 duty, 1/3 Bias
2-5. Single Supply Voltage	: Power supply voltage range (V_{DD}): 3.0V
2-7. With Metal Pin connector	

3.MECHANICAL SPECIFICATIONS

3-1. Module size	: 62.00mm(L) * 23.46mm(W) * 2.9mm(D) max
3-2. Viewing area	: 52.51mm(L) * 10.76mm(W)

4.BLOCK DIAGRAM



5. PIN DESCRIPTION

1	VSS	Power Supply Ground (0V)
2	VDD	Power Supply (+3.0V)
3	SCL	I2C serial clock input pin
4	SDA	I2C serial data input pin

6.MAXIMUM ABSOUTE LIMIT (T=25°C)

Item	Symbol	Standard value	Unit
Power supply voltage for logic	V_{DD}	-0.5~+6.5	V
Input voltage	V_{IN}	V_{SS}+0.5 ~ V_{DD}+0.5	V
Operating temperature	Topr	-30~+70	°C
Storage temperature	Tstg	-40~+85	°C

Note: Voltage greater than above may damage the module

7.ELECTRICAL CHARACTERISTICS

7-1.DC Characteristics (V_{DD}=1.8V ~ 5.5V ,Ta=-40~+85°C)

Symbol	Parameter	Min	Typ	Max	Unit	Test condition
V_{DD}	Logic Circuit supply voltage	2.9	3.0	3.1	V	Recommend operating voltage
I_{DD}	Current Consumption	-	0.2	0.5	mA	VLCD=VSS
V_{OH}	High level output voltage	V_{DD}-0.05	-	-	V	IOH=0 mA
V_{OL}	Low level output voltage	-	-	0.05	V	IOH=0mA
V_{IH}	High level input voltage	0.7V_{DD}	-	V_{DD}	V	
V_{IL}	Low level input voltage	V_{SS}	-	0.3V_{DD}	V	
I_{OH}	High level output current	-1	-	-	mA	VOH=4V, VDD=5V
I_{OL}	Low level output current	3	-	-	mA	VOH=4V, VDD=5V
I_{ILI}	Leakage current	-1		1	uA	V=VDD or VSS
C_I	Input capacitance	-	-	7	pF	
V_{LCD}	LCD driving voltage		3.0		V	V_{LCD} – VSS, Ta=25℃

7-2.AC Characteristics (V_{DD} = 1.8 to 5.5 V; V_{SS} = 0 V; T_{amb} = -40 to +85 °C)

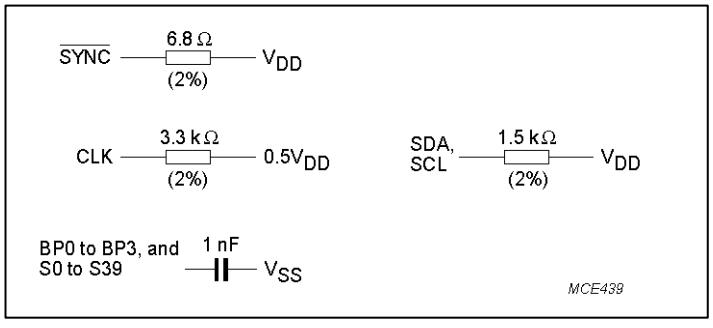
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f_{CLK}	oscillator frequency	note 1	960	1890	2640	Hz
t_{CLKH}	input CLK HIGH time		60	−	−	µs
t_{CLKL}	input CLK LOW time		60	−	−	µs
$t_{PD(SYNC)}$	SYNC propagation delay		−	30	−	ns
t_{SYNCL}	SYNC LOW time		1	−	−	µs
$t_{PD(LCD)}$	driver delays with test loads	V_{LCD} = 5 V; note 2	−	−	30	µs
Timing characteristics: I²C-bus; note 3						
f_{SCL}	SCL clock frequency		−	−	400	kHz
t_{BUF}	bus free time between a STOP and START		1.3	−	−	µs
$t_{HD;STA}$	START condition hold time		0.6	−	−	µs
$t_{SU;STA}$	set-up time for a repeated START condition		0.6	−	−	µs
t_{LOW}	SCL LOW time		1.3	−	−	µs
t_{HIGH}	SCL HIGH time		0.6	−	−	µs
t_r	SCL and SDA rise time	f_{SCL} = 400 kHz	−	−	0.3	µs
		f_{SCL} < 125 kHz	−	−	1.0	µs
t_f	SCL and SDA fall time		−	−	0.3	µs
C_B	capacitive bus line load		−	−	400	pF
$t_{SU;DAT}$	data set-up time		100	−	−	ns
$t_{HD;DAT}$	data hold time		0	−	−	ns
$t_{SU;STO}$	set-up time for STOP condition		0.6	−	−	µs
t_{SW}	tolerable spike width on bus		−	−	50	ns

Notes

1 Typical output duty factor: 50% measured at the CLK output pin.

2 Not tested in production.

3 All timing values are valid within the operating supply voltage and ambient temperature range and are referenced to V_{IL} and V_{IH} with an input voltage swing of V_{SS} to V_{DD}.



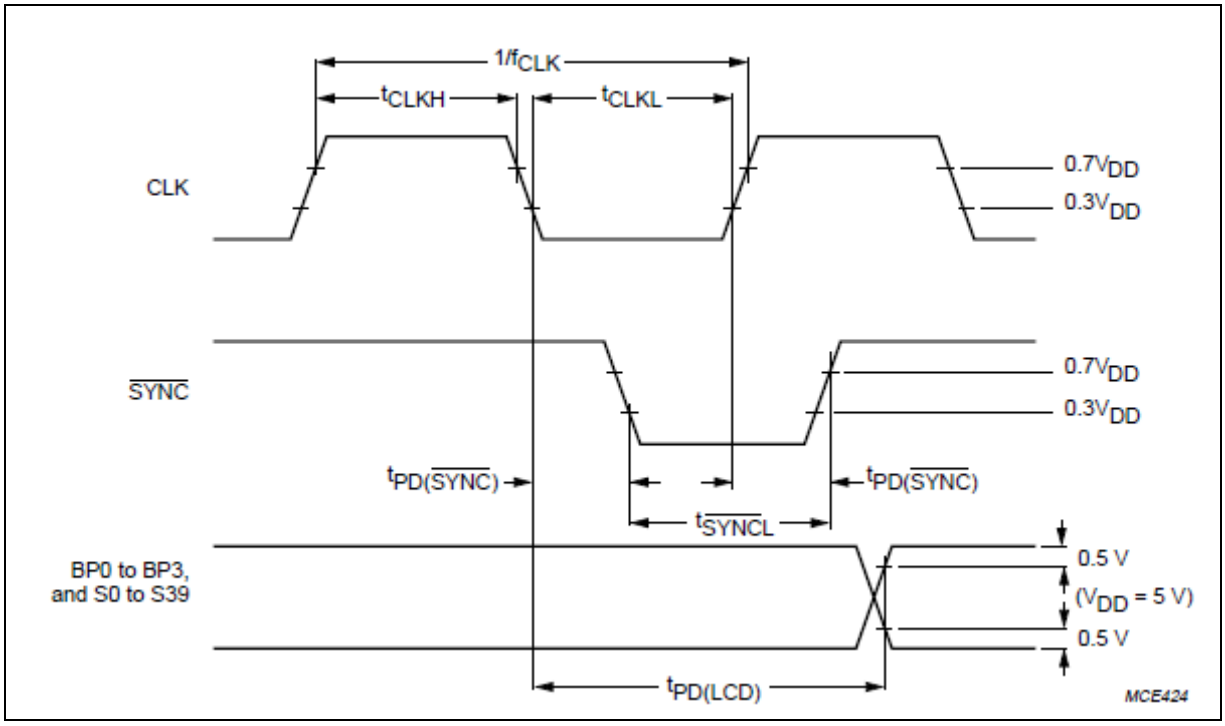


Fig. 1 Driver timing waveforms.

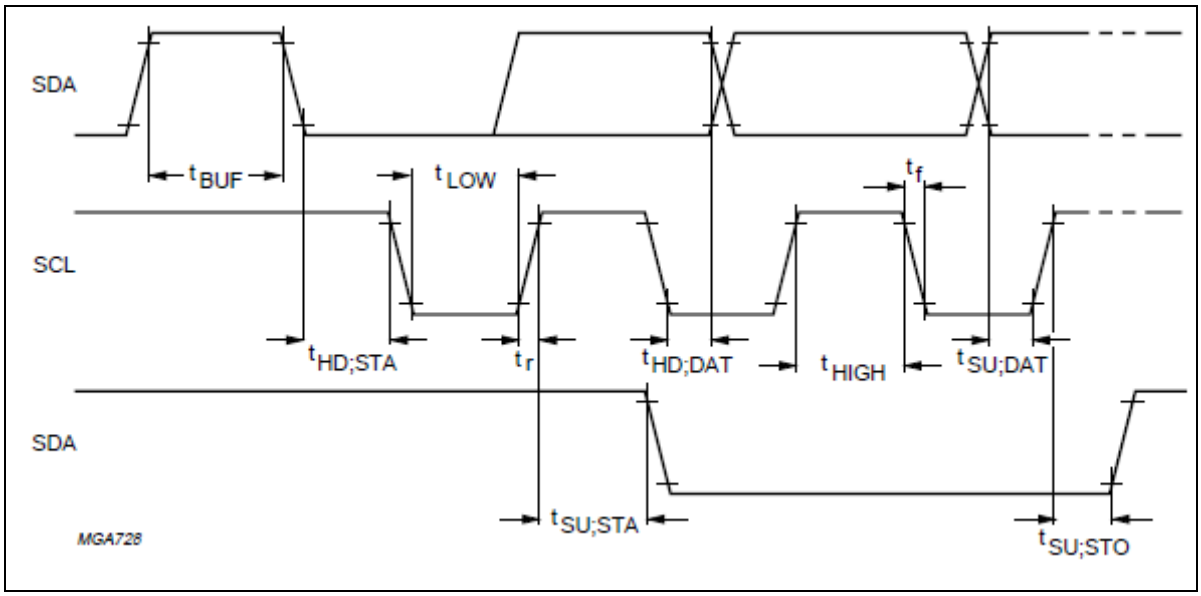
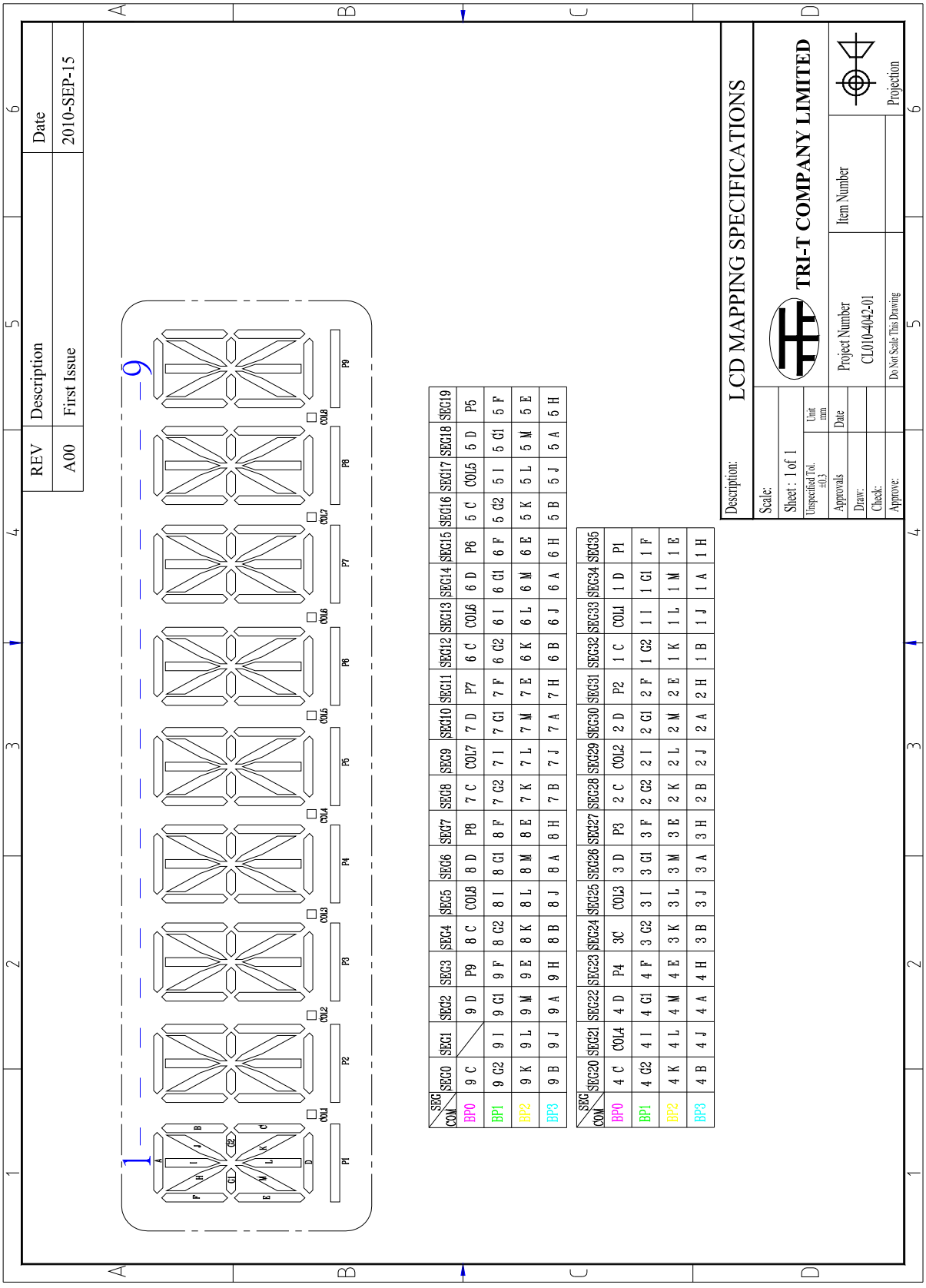


Fig. 2 I^2C-bus timing waveforms.

8.0 LCD MAPPING SPECIFICATIONS



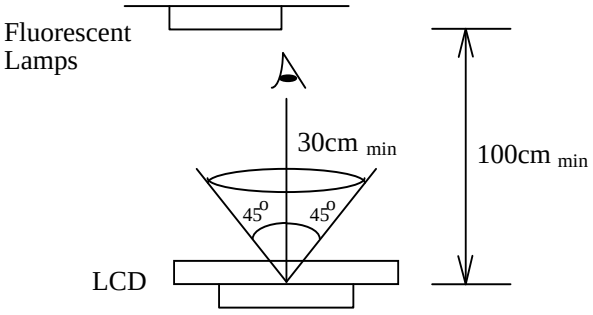
SEG / COM	SEG0	SEG1	SEG2	SEG3	SEG4	SEG5	SEG6	SEG7	SEG8	SEG9	SEG10	SEG11	SEG12	SEG13	SEG14	SEG15	SEG16	SEG17	SEG18	SEG19
BP0	9 C		9 D	P9	8 C	COL8	8 D	P8	7 C	COL7	7 D	P7	6 C	COL6	6 D	P6	5 C	COL5	5 D	P5
BP1	9 G2	9 I	9 G1	9 F	8 G2	8 I	8 G1	8 F	7 G2	7 I	7 G1	7 F	6 G2	6 I	6 G1	6 F	5 G2	5 I	5 G1	5 F
BP2	9 K	9 L	9 M	9 E	8 K	8 L	8 M	8 E	7 K	7 L	7 M	7 E	6 K	6 L	6 M	6 E	5 K	5 L	5 M	5 E
BP3	9 B	9 J	9 A	9 H	8 B	8 J	8 A	8 H	7 B	7 J	7 A	7 H	6 B	6 J	6 A	6 H	5 B	5 J	5 A	5 H

SEG / COM	SEG20	SEG21	SEG22	SEG23	SEG24	SEG25	SEG26	SEG27	SEG28	SEG29	SEG30	SEG31	SEG32	SEG33	SEG34	SEG35
BP0	4 C	COL4	4 D	P4	3C	COL3	3 D	P3	2 C	COL2	2 D	P2	1 C	COL1	1 D	P1
BP1	4 G2	4 I	4 G1	4 F	3 G2	3 I	3 G1	3 F	2 G2	2 I	2 G1	2 F	1 G2	1 I	1 G1	1 F
BP2	4 K	4 L	4 M	4 E	3 K	3 L	3 M	3 E	2 K	2 L	2 M	2 E	1 K	1 L	1 M	1 E
BP3	4 B	4 J	4 A	4 H	3 B	3 J	3 A	3 H	2 B	2 J	2 A	2 H	1 B	1 J	1 A	1 H

9. QUALITY SPECIFICATIONS

9.1 Inspection Condition

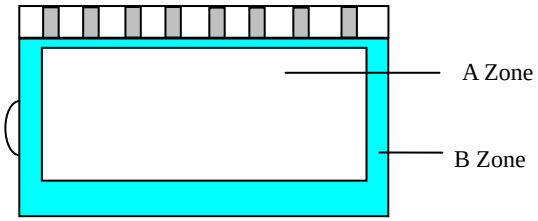
9.1.1 The inspection shall be performed by using 20W x 2 fluorescent lamps . Distance between LCD and fluorescent lamps should be 100 cm or more. Distance between LCD and inspector eyes should be 30 cm or more.



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

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

9.2. Definition of Zone



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

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

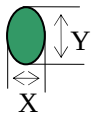
9.3 Sampling Method: MIL-STD-105E.

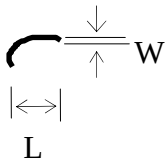
9.4 Inspection level: Level II, Single Sampling.

Rank	Item		Criterion	AQL
Major	1.Display state	1. Segment short circuit. 2. Open circuit (missing segment) 3. Contrast defect (dim, ghosting)	1	0.4
		4. Segment defect (Pin hole, etc.)	6	
		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 2. Rainbow, background color	3, 4, 5	1.0
	2. Polarizer	1. Scratch 2. Bubble 3. Foreign material	3, 4, 7	
		4. Poor fixed position	8	
	3. Glass substrate	1. Chipped	9	
		2. Protruded, burred	10	
	4. PIN	1. Positioning 2. Epoxy coverage	11	
	5. Silk screen	1. Positioning 2. Color	12	
		3. Semblance defect (Refer spot, line Standards）	3, 4	
Total				1.0

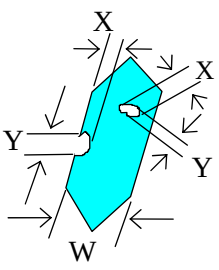
9.5 Inspection Items and Standards

<table>
<tr><th>No</th><th>Item</th><th>Criterion</th></tr>
<tr><td>1</td><td>Segment short, missing</td><td>Not exist</td></tr>
<tr><td></td><td>Contrast defect</td><td>Refer to approved sample</td></tr>
<tr><td>2</td><td>Outside defect、 Positioning
Color</td><td>Not exceed tolerance
Refer to approved sample</td></tr>
<tr><td>3</td><td>Point defect,
Black spot, dust
(incl. Polarizer)

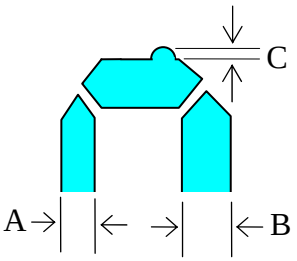
ϕ = (X+Y)/2</td><td> 

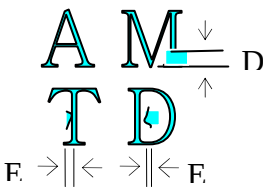
<table>
<tr><th>Point</th><th>Acceptable Qty.</th></tr>
<tr><td>Size</td><td></td></tr>
<tr><td>ϕ≤0.10</td><td>Not count</td></tr>
<tr><td>0.10<ϕ≤0.20</td><td>1</td></tr>
<tr><td>0.20<ϕ≤0.25</td><td>2</td></tr>
<tr><td>0.25<ϕ≤0.30</td><td>1</td></tr>
<tr><td>ϕ>0.30</td><td>0</td></tr>
</table>
Unit：mm</td></tr>
<tr><td>4</td><td>Line defect</td><td> 

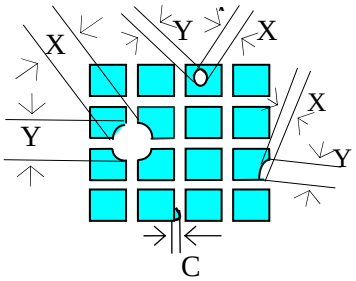
<table>
<tr><th colspan="2">Line</th><th>Acceptable Qty.</th></tr>
<tr><td>L</td><td>W</td><td></td></tr>
<tr><td>---</td><td>0.015≥W</td><td>Disregard</td></tr>
<tr><td>3.0≥L</td><td>0.03≥W</td><td rowspan="2">1</td></tr>
<tr><td>2.0≥L</td><td>0.05≥W</td></tr>
<tr><td>1.0≥L</td><td>0.1＞W</td><td>0</td></tr>
<tr><td>---</td><td>0.05<W</td><td>Applied as point defect</td></tr>
</table>
Unit: mm</td></tr>
<tr><td>5</td><td>Rainbow</td><td>Not more than two color changes across the viewing area.
Background color should refer to approved sample .</td></tr>
<tr><td>6</td><td>Segment
pattern
W = Segment width

ϕ = (A+B)/2</td><td>1. Pin hole
ϕ < 0.10mm is acceptable.
 

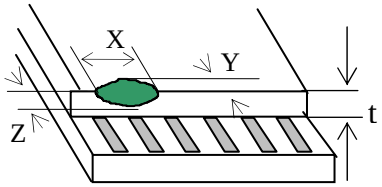
<table>
<tr><th>Width</th><th>Acceptable of defect</th></tr>
<tr><td>W<0.4</td><td>ϕ≤1/2W and, ϕ≤0.2</td></tr>
<tr><td>W≥0.4</td><td>ϕ≤1/3W and, ϕ≤0.25</td></tr>
</table>
Unit: mm</td></tr>
</table>

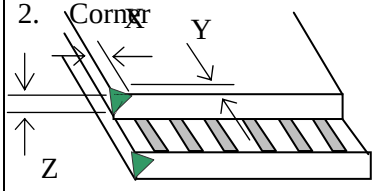
<table>
<tr><th>No</th><th>Item</th><th>Criterion</th></tr>
<tr><td></td><td></td><td>
2. Segment width acceptable.
| A - B | < 0.20 ; D≤0.2
C≤0.1 E≤0.15


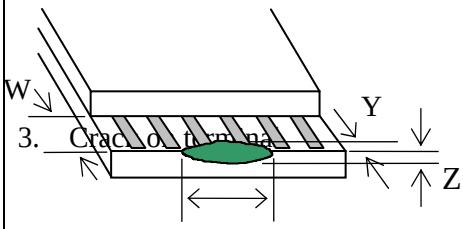


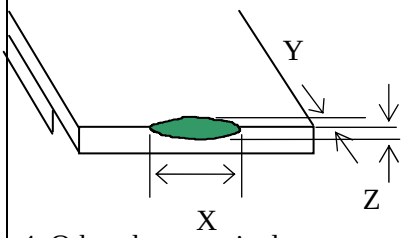
3. Dot pattern


<table>
<tr><th>Size</th><th>Acceptable Qty.</th></tr>
<tr><td>ϕ＜0.1</td><td>Disregard</td></tr>
<tr><td>0.10≤ϕ≤0.20</td><td>1</td></tr>
<tr><td>ϕ>0.20</td><td>0</td></tr>
</table>
C: Shall not touch other dot(s).
Unit: mm
</td></tr>
<tr><td>7</td><td>Polarizer air bubble</td><td>
<table>
<tr><th>Size</th><th>Acceptable Qty.</th></tr>
<tr><td>ϕ＜0.10 or B Zone</td><td>Disregard</td></tr>
<tr><td>0.10＜ϕ≤0.20</td><td>2</td></tr>
<tr><td>0.20＜ϕ≤0.50</td><td>1</td></tr>
<tr><td>0.50＜ϕ</td><td>0</td></tr>
<tr><td>Total</td><td>2</td></tr>
</table>
Unit: mm
</td></tr>
<tr><td>8</td><td>Polarizer mis-placement</td><td>Polarizer should neither extends to glass edge nor extends into seal.</td></tr>
</table>

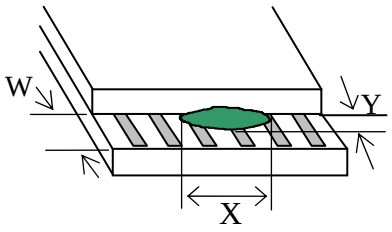
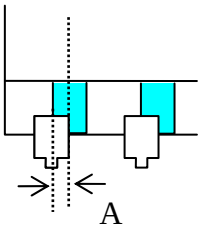
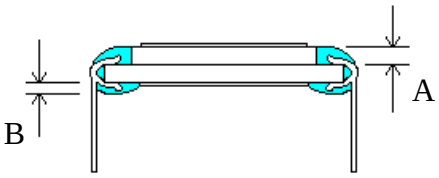
<table>
<tr><th>No</th><th>Item</th><th>Criterion</th></tr>
<tr><td>9</td><td>Crack and chip
Remark:
X: Length direction
Y: Short direction
Z: Thickness direction
t: Glass thickness
a: LCD length
W: Terminal Width
F：seal width</td><td>1. General
 

Acceptable criterion
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤5mm</td><td>shall not reach to 1F/3</td><td>≤t/2</td></tr></table>
2. Corner
 

Acceptable criterion
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤5mm</td><td>shall not reach to F/3</td><td>≤t</td></tr></table>
3. Crack on terminal
 

Acceptable criterion
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤a/10</td><td>≤0.4</td><td>≤t</td></tr></table>
 

4. Other than terminal
Acceptable criterion
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤a/10</td><td>shall not reach to F/3</td><td>≤t/3</td></tr></table></td></tr>
</table>

No	Item	Criterion
10	Protruded W: Terminal Width	 Acceptable criteria: Y ≤ 1/5W
11	Pin	1. Positioning  A＜0.3mm 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.

9.6 Reliability Standards

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	240	No abnormalities in functions and appearance
High temp. Operating	70°C	240	
Low temp. Storage	-40°C	240	
Low temp. Operating	-20°C	240	
Humidity	40°C/ 90%RH	240	
Temp. Cycle	-40°C ← 25°C →80°C (30 min ← 5 min → 30min)	10cycles	

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (20±8°C), normal humidity (below 65% RH), and in the area not exposed to direct sun light.

9-7. Precaution for using COG

COG is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isoproply alcohol, ethyl alcohol or trichlorotriflorothane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not made any modification on the PCB without consulting TRI-T.
5. 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.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: 280°C$\pm$10°C
4. Soldering time: 3 to 4 second.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

1. The viewing angle can be adjusted by varying the LCD driving voltage Vo.
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.

Operation Precautions:

1. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
2. For long-term storage over 40°C is required, the relative humidity should be kept below 60%. Avoid direct sunlight.

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 LCM, they must be properly packaged; there should be detailed description of the failures or defect.