

Specification

DM320240BECO-FSTF-06-LED05WHITE-T
Doc.- Nr.: TMTG320240B-01

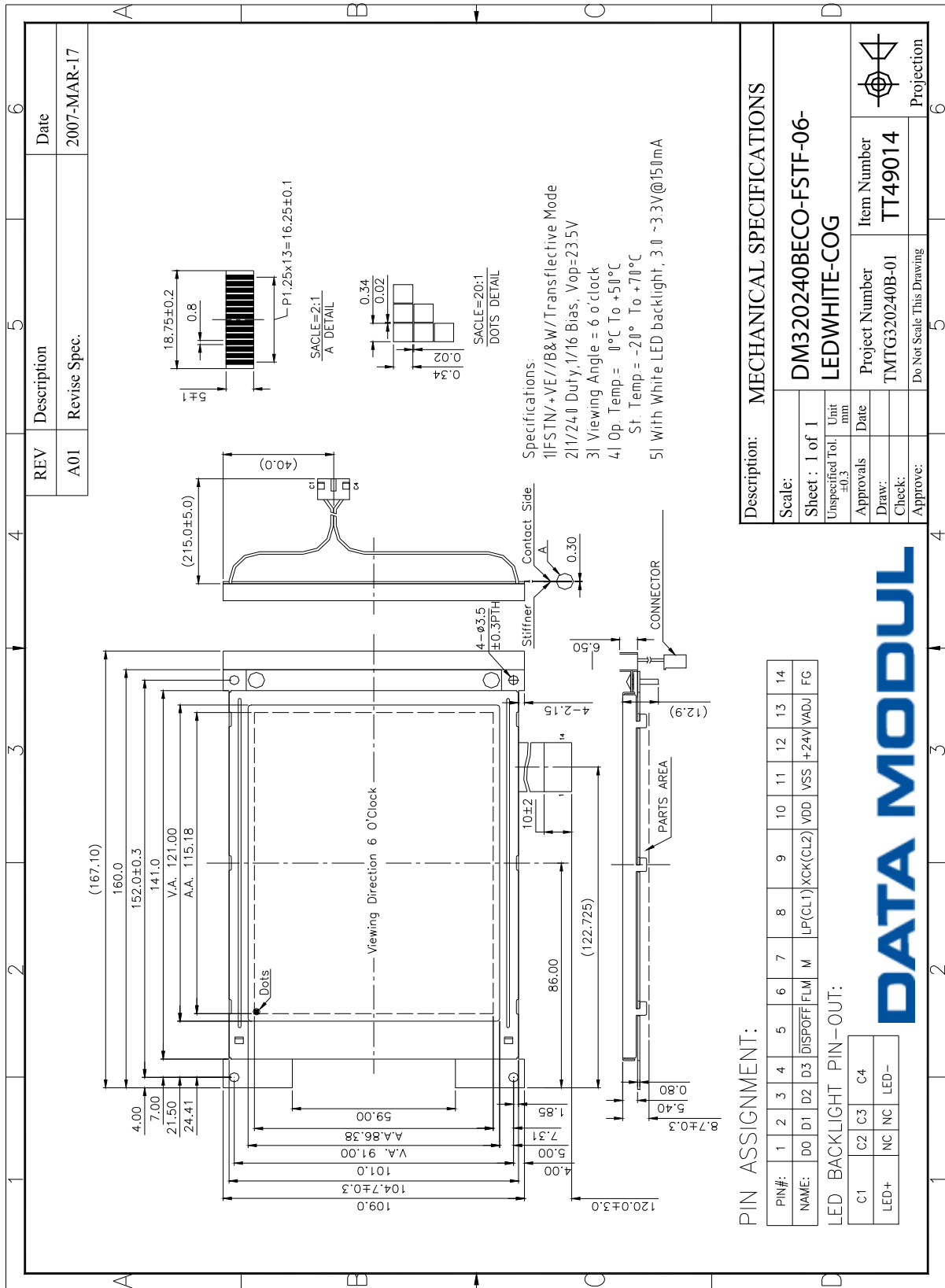
Version May 2007

DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
A00	05 MAY 2007	First issue	

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1. DIMENSIONAL OUTLINE



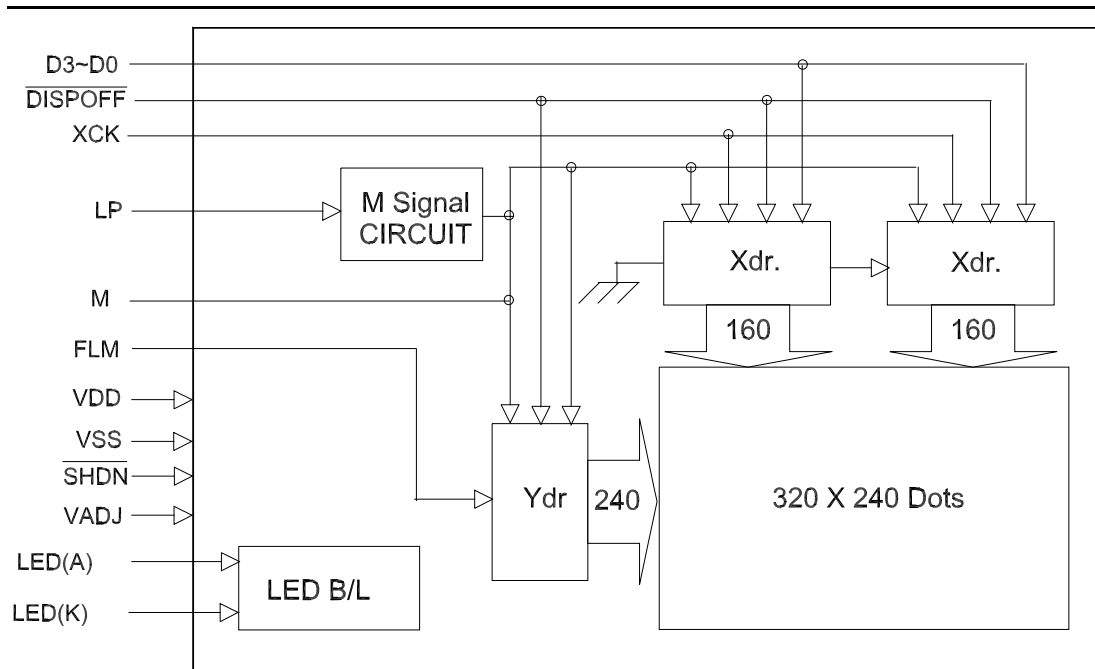
2.FUNCTIONS & FEATURES

- 2-1. Format : 320*240 dots
- 2-2. LCD Mode : FSTN/+VE/B&W/Transflective Mode + 3M
- 2-3. Viewing Direction : 6 o'clock
- 2-4. Driving Scheme : 1/240 Duty cycle, 1/16 Bias
- 2-5. Single Supply Voltage : Power supply voltage range (V_{DD}): 2.7~3.6V
- 2-6. With LED Backlight, Color : White
- 2-7. 4 Bit Display Parallel Data Interface
- 2-8. LCD Controller and DC-DC Converter not included
- 2-9. LCD Drivers: Sitronix "ST8016" & ST8024"

3.MECHANICAL SPECIFICATIONS

- 3-1. Module size : 161.0mm(L)* 113.7mm(W) (not include FPC)
- 3-2. Viewing area : 121.0mm(L)* 91.0mm(W)
- 3-3. Active area : 115.19mm(L)* 86.39mm(W)
- 3-4. Dot pitch : 0.36mm(L)*0.36mm(W)
- 3-5. Dot size : 0.345mm(L)*0.345mm(W)

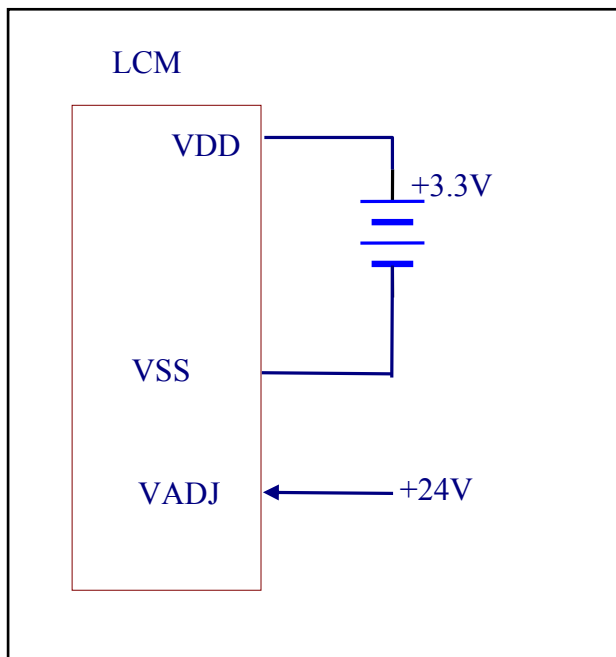
4. BLOCK DIAGRAM



5. PIN DESCRIPTION

1	D0	Display Data Bus
2	D1	
3	D2	
4	D3	
5	/DISPOFF	Display ON/OFF Control
6	FLM	Start Scan Line (First Line Marker)
7	M	Singal for AC Conversion
8	LP(CL1)	Data Latch Pulse
9	XCK(CL2)	Data Shift Clock
10	VDD	Power supply for Logic (+3.3V)
11	VSS	Power supply for Logic (0V)
12	/SHDN	NC (Option for Built-in DC/DC Converter)
13	VADJ	Power supply for LCD Contrast Adjustment
14	FG	Metal Frame Ground
15	LED(A)	Anode for LED backlight (+3.3V)
16	LED(K)	Cathode for LED backlight (0V)

6. POWER SUPPLY



VADJ is the control pin for adjusting the LCD contrast.

7. MAXIMUM ABSOLUTE LIMIT (T=25°C)

Item	Symbol	Standard value	Unit
Power supply voltage for logic	V _{DD}	-0.3~+7.0	V
Input voltage	V _{IN}	V _{SS} -0.3~V _{DD} +0.3	V
Operating temperature	T _{opr}	0~+50	°C
Storage temperature	T _{stg}	-20~+70	°C

Note: Voltage greater than above may damage the module

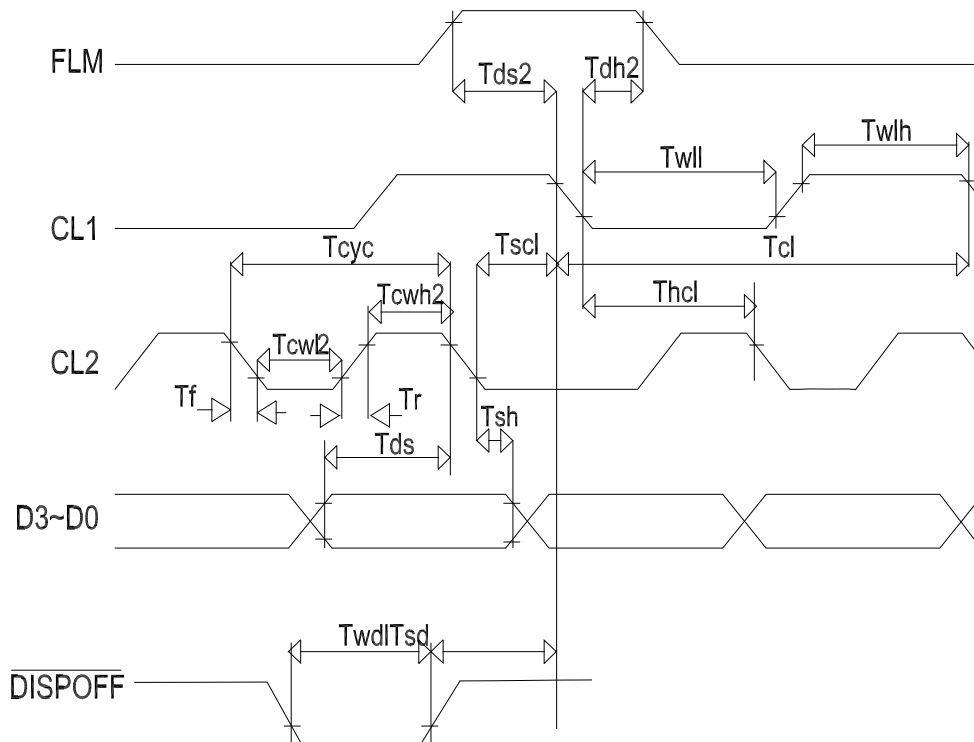
8. ELECTRICAL CHARACTERISTICS

8-1 DC Characteristics (V_{DD}=3.3V ,T_a=+25°C)

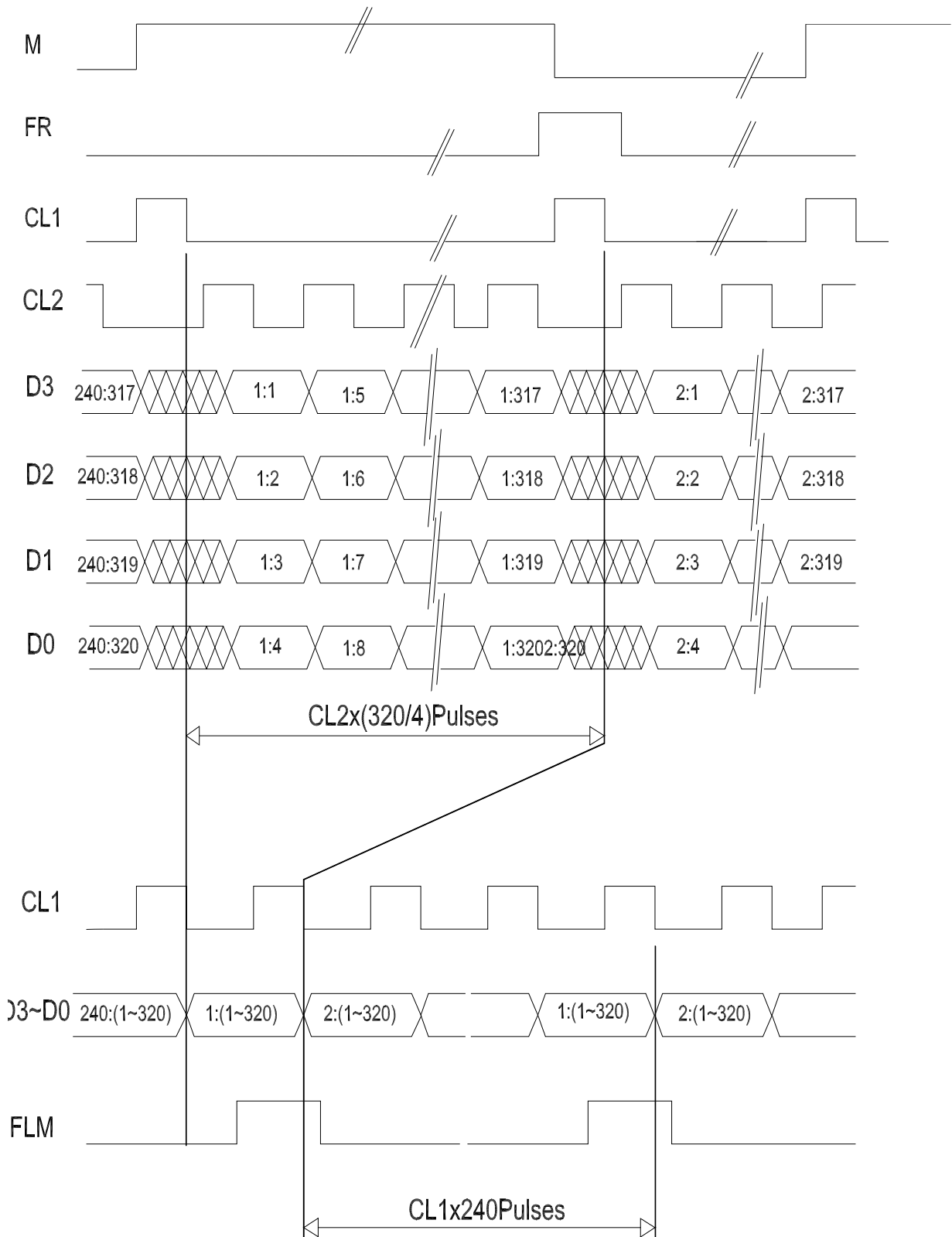
Item	Symbol	Min	Typ	Max	Unit	Applicable terminal	Test condition
Operating voltage	V _{DD}	2.7	3.3	5.5	V	VDD	V _{DD} =3.3V
Supply current	I _{DD}	-	15	50	mA	VDD	
Input voltage	V _{IL}	-0.3	-	0.2*V _D	V	LP, XCK,FLM,D0~D3, /DISPOFF	
	V _{IH}	0.8*VDD	-	V _{DD}	V		
I/O lead current	I _{LI}	-	-	-10	μA		
Input low current	I _{IL}	-20	-50	-100	μA	RS, R/W, D0~D7	
LCD driving voltage	V _{LCD}	-	24	35	V	V _{ADJ}	
LCD driving current	I _{lcd}	-	15	-	mA	V _{ADJ}	

8-2 . AC Characteristics and Time Chart

Item	Symbol	Standard Value			Unit	Conditions
		Min.	Typ.	Max.		
CL1 Cycle Time	Tcl	330	-	-	ns	
CL1 Pulse Width"H"	Twlh	51	-	-	ns	
CL1 Pulse Width"L"	Twll	320	-	-	ns	
CL2 Cycle Time(*1)	Tcyc	125	-	-	ns	Tr,Tf<=11 ns
CL2 Pulse Width"H"	Tcwh2	51	-	-	ns	
CL2 Pulse Width"L"	Tcwl2	51	-	-	ns	
CL1 - CL2 Fall Time	Thcl	51	-	-	ns	
CL2 - CL1 Fall Time	Tscl	51	-	-	ns	
Data Setup Time	Tds	30	-	-	ns	
Data Hold Time	Tsh	40	-	-	ns	
FR Setup time	Tscl	30	-	-	ns	
FR Hold timeTdh250--ns	Tds	50	-	-	ns	
DISPOFF removal time	Tsd	100	-	-	ns	
DISPOFF"L"Pulse width	Twd	1.2	-	-	μs	
Input Wave Form Rise/Fall Time	Tr	-	-	50	ns	(*2)
	Tf	-	-	50	ns	(*2)



8-3 . Timing Diagram



9. BACKLIGHT SPECIFICATIONS

9-1. Absolute maximum rating

Item	Symbol	Ratings	Unit
Peak forward current	Ifp	250	mA
Reverse voltage	Vr	5	V
Power dissipation	Pd	900	mW

9-2. Electrical specifications

Item	Symbol	Min	Type	Max	Unit	Conditions
Luminous intensity	Lv	-	150	-	cd/m ²	IF=150mA Ta=25°C
Color Co-ordiante	x	0.270	-	0.320	-	
Color Co-ordiante	y	0.290	-	0.360	-	
Forward voltage	Vf	-	3.3	3.6	V	
Reverse current	Ir	-	35	-	mA	VR=0.8V

10 .Relation Between Data and Display

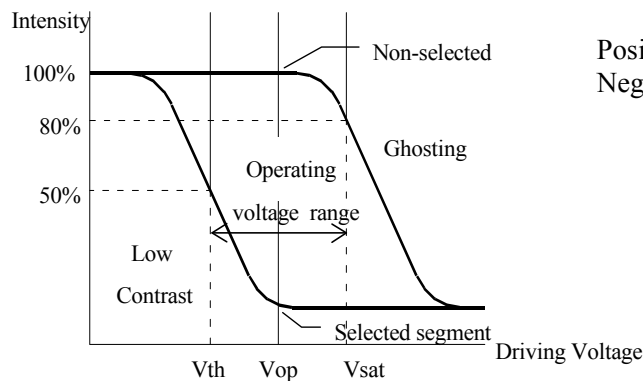
1:1	1:2	1:3	1:4	...	1:317	1:318	1:319	1:320
2:1				...		2:318	2:319	2:320
3:1				...			3:319	3:320
4:1				...				4:320
.				...				
.				...				
.				...				
237:1				...				237:320
238:1	238:2			...			238:319	238:320
239:1	239:2	239:3		...		239:318	239:319	239:320
240:1	240:2	239:4		...	240:317	240:318	240:319	240:320

11. ELECTRO-OPTICAL CHARACTERISTICS

Item		Temp	Unit	Standard Value			Note
				Min	Typ	Max	
Operating Voltage	Vop	25°C	V		24		
Frame Frequency	f	25°C	Hz	64	75	100	(1)
Response Time	Ton	25°C	msec	-	200	300	(2)
	Toff	25°C		-	250	350	
Contrast Ratio($\theta=30^\circ$)	CR	25°C		-	15	-	
Viewing Angle(CR>2)	Φ	25°C	Deg	20	30	-	

Contrast Ratio Definition

$$\text{Contrast Ratio} = \left\{ \frac{\text{Non-selected segment intensity}}{\text{Selected segment intensity}} \right\}^n$$

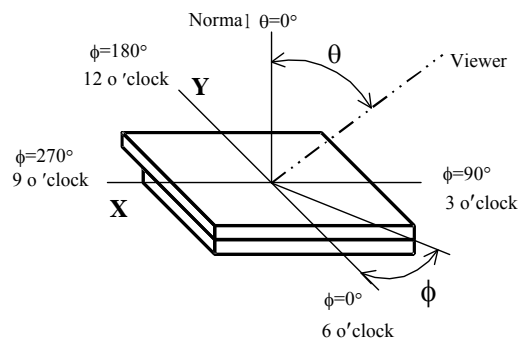


Positive mode: $n = 1$
 Negative mode: $n = -1$

Viewing Angle Definition

θ : Angle between Viewer Direction and Normal.
 ($-90^\circ \leq \theta \leq 90^\circ$)

ϕ : Angle between Projection of Viewer Direction to X-Y plane and Y axis.
 ($0^\circ \leq \phi \leq 360^\circ$)



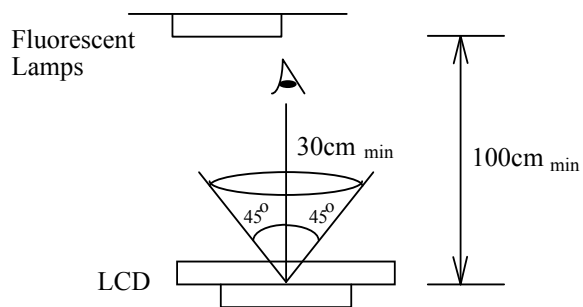
Measuring Condition

1. Driving Voltage: Same as Vop.
2. Driving Frequency: Same as Frame Frequency.

12. Quality Specifications

12.1 Inspection Condition

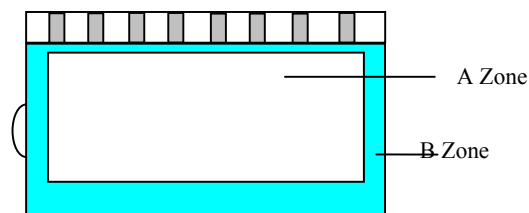
12.1.1 The inspection shall be performed by using 20W x 2 fluorescent lamps . Distance between LCD and fluorescent lamps should be 100 cm or more. Distance between LCD and inspector eyes should be 30 cm or more.



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

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

12.2. Definition of Zone



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

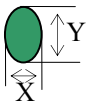
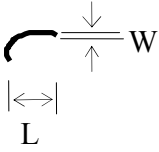
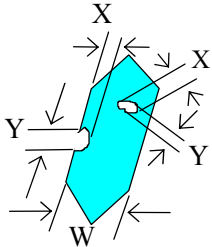
B Zone: Non-active display area (outside viewing area).

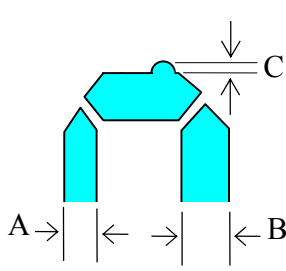
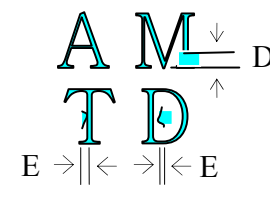
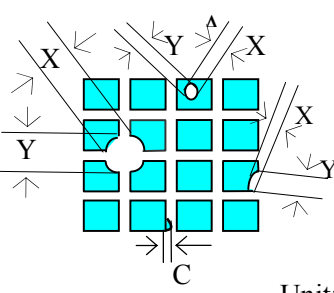
12.3 Sampling Method: MIL-STD-105E.

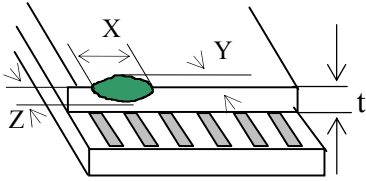
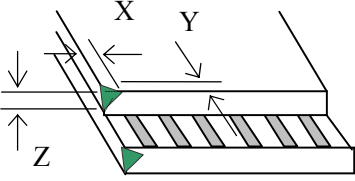
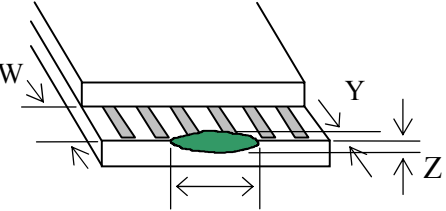
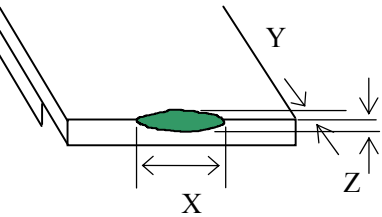
12.4 Inspection level: Level II, Single Sampling.

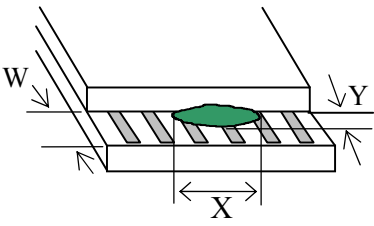
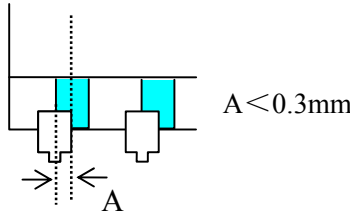
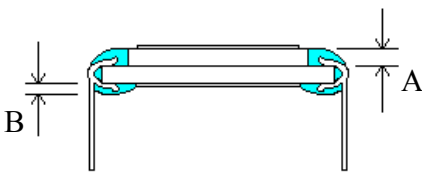
Rank	Item		Criterion	AQL	
Major	1. Display state	1. Segment short circuit.	1	0.4	
		2. Open circuit (missing segment)			
		3. Contrast defect (dim, ghosting)			
	2. Dimension	4. Segment defect (Pin hole, etc.)	6	/	Ac:0 Re: 1
		5. Leakage			
		6. No display, polarizers reverse applied			
Minor	1. Non-display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

12.5 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 border="1" data-bbox="916 728 1342 1019"> <thead> <tr> <th>Point Size</th> <th>Acceptable Qty.</th> </tr> </thead> <tbody> <tr> <td>$\phi \leq 0.10$</td> <td>2</td> </tr> <tr> <td>$0.10 < \phi \leq 0.20$</td> <td>1</td> </tr> <tr> <td>$0.20 < \phi \leq 0.25$</td> <td>0</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> </tbody> </table> <p>Unit: mm</p>	Point Size	Acceptable Qty.	$\phi \leq 0.10$	2	$0.10 < \phi \leq 0.20$	1	$0.20 < \phi \leq 0.25$	0	$0.25 < \phi \leq 0.30$	0	$\phi > 0.30$	0								
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$0.25 < \phi \leq 0.30$	0																					
$\phi > 0.30$	0																					
4	Line defect	 <table border="1" data-bbox="860 1146 1394 1408"> <thead> <tr> <th colspan="2">Line</th> <th>Acceptable Qty.</th> </tr> <tr> <th>L</th> <th>W</th> <th></th> </tr> </thead> <tbody> <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> </tbody> </table> <p>Unit: mm</p>	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
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$1.0 \geq L$	$0.1 > W$	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 $\phi = (A+B)/2$	<p>1. Pin hole</p> <p>$\phi < 0.10\text{mm}$ is acceptable.</p>  <table border="1" data-bbox="938 1715 1386 1845"> <thead> <tr> <th>Width</th> <th>Acceptable of defect</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>Unit: mm</p>	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, $\phi \leq 0.25$														
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No	Item	Criterion												
		<p>2. Segment width acceptable.</p> $ A - B < 0.20 ; \quad D \leq 0.2$ $C \leq 0.1 \quad E \leq 0.15$ <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p>3. Dot pattern</p> <div style="display: flex; justify-content: space-around; align-items: center;">  <table border="1" style="border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Size</th> <th>Acceptable Qty.</th> </tr> </thead> <tbody> <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> </tbody> </table> </div> <p style="text-align: right;">C: Shall not touch other dot(s). Unit: mm</p>	Size	Acceptable Qty.	$\phi < 0.1$	Disregard	$0.10 \leq \phi \leq 0.20$	1	$\phi > 0.20$	0				
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$\phi > 0.20$	0													
7	Polarizer air bubble	<table border="1" style="border-collapse: collapse; text-align: center; margin: auto;"> <thead> <tr> <th>Size</th> <th>Acceptable Qty.</th> </tr> </thead> <tbody> <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> </tbody> </table> <p style="text-align: center;">Unit: mm</p>	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	<p>Crack and chip</p> <p>Remark:</p> <p>X: Length direction</p> <p>Y: Short direction</p> <p>Z: Thickness direction</p> <p>t: Glass thickness</p> <p>a: LCD length</p> <p>W: Terminal Width</p> <p>F: seal width</p>	<p>1. General</p> <div style="display: flex; align-items: center; justify-content: space-around;">  <div style="text-align: right;"> <p>Acceptable criterion</p> <table border="1" style="border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 33%;">X</th> <th style="width: 33%;">Y</th> <th style="width: 33%;">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> </div> </div> <p>2. Corner</p> <div style="display: flex; align-items: center; justify-content: space-around;">  <div style="text-align: right;"> <p>Acceptable criterion</p> <table border="1" style="border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 33%;">X</th> <th style="width: 33%;">Y</th> <th style="width: 33%;">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> </div> </div> <p>3. Crack on terminal</p> <div style="display: flex; align-items: center; justify-content: space-around;">  <div style="text-align: right;"> <p>Acceptable criterion</p> <table border="1" style="border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 33%;">X</th> <th style="width: 33%;">Y</th> <th style="width: 33%;">Z</th> </tr> </thead> <tbody> <tr> <td>$\leq a/10$</td> <td>≤ 0.4</td> <td>$\leq t$</td> </tr> </tbody> </table> </div> </div> <p>4. Other than terminal</p> <div style="display: flex; align-items: center; justify-content: space-around;">  <div style="text-align: right;"> <p>Acceptable criterion</p> <table border="1" style="border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 33%;">X</th> <th style="width: 33%;">Y</th> <th style="width: 33%;">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> </div> </div>	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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No	Item	Criterion
10	Protruded W: Terminal Width	 <p>Acceptable criteria: $Y \leq 1/5W$</p>
11	Pin	<p>1. Positioning</p>  <p>2 Epoxy coverage</p>  <p>A、 B Epoxy Maximum height shall extend above front rear polarizer surface</p> <p>3. No stain, rust nor discoloration of the insulating portion shall be allowed.</p>
12	Total no. of acceptable defect	<p>A. Zone</p> <p>Maximum 4 non-conformities per one unit. Defect distance: each point to be separated over 5mm</p> <p>B. Zone</p> <p>It is acceptable when it is no trouble for quality and assembly in customer's end product.</p>

12.6 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	+70°C	240	No abnormalities in functions and appearance
Low temp. storage	-20°C	240	
Humidity	40°C / 90%RH	240	
Change of temperature	- 20°C ← 25°C → 70°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	+80°C	48
Low temp. storage	-30°C	48
Humidity	40°C / 90%RH	48

4. Recovery time should be 24 hours minimum.

12.7. Cautions for use

Pay attention to following points of handling the TAB 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.

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

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

1. The liability of Data Modul is limited to repair or replacement on the terms set forth below. Data Modul 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 Data Modul and the customer, Data Modul will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with Data Modul's 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.



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