

DISPLAY Elektronik GmbH

DATA SHEET

**2,2" TFT
MODULE**

DEM 240320A TMH-PW-N

Product Specification

Version: 6.1.1

17.01.2012

REVISION HISTORY:				
Revision	Date	Description	Written By	Approved By
1.0	15-Jun-2007	New Release	XH	MH
2.0	28-Apr.-2008	1. Change the command table and add the IC version in item 6.0. 2. Correct the location of lot number.	XH	MH
3.0	8-May.-2008	1. Updated the module drawing. 2. Modify item 10.0.	XH	MH
4.0	15-May.-2008	1. Correct the pin assignment 2. Update the pin description	XH	MH
5.0	21-May.-2008	Change the interface description	XH	MH
5.1.1	05.05.2009	Changed IC and TFT-Panel	XH	MH
6.0	12.01.2012	Changed TFT-Panel and Backlight	SS	MH
6.1.1	17.01.2012	Correct Backlight Specifications	SS	MH

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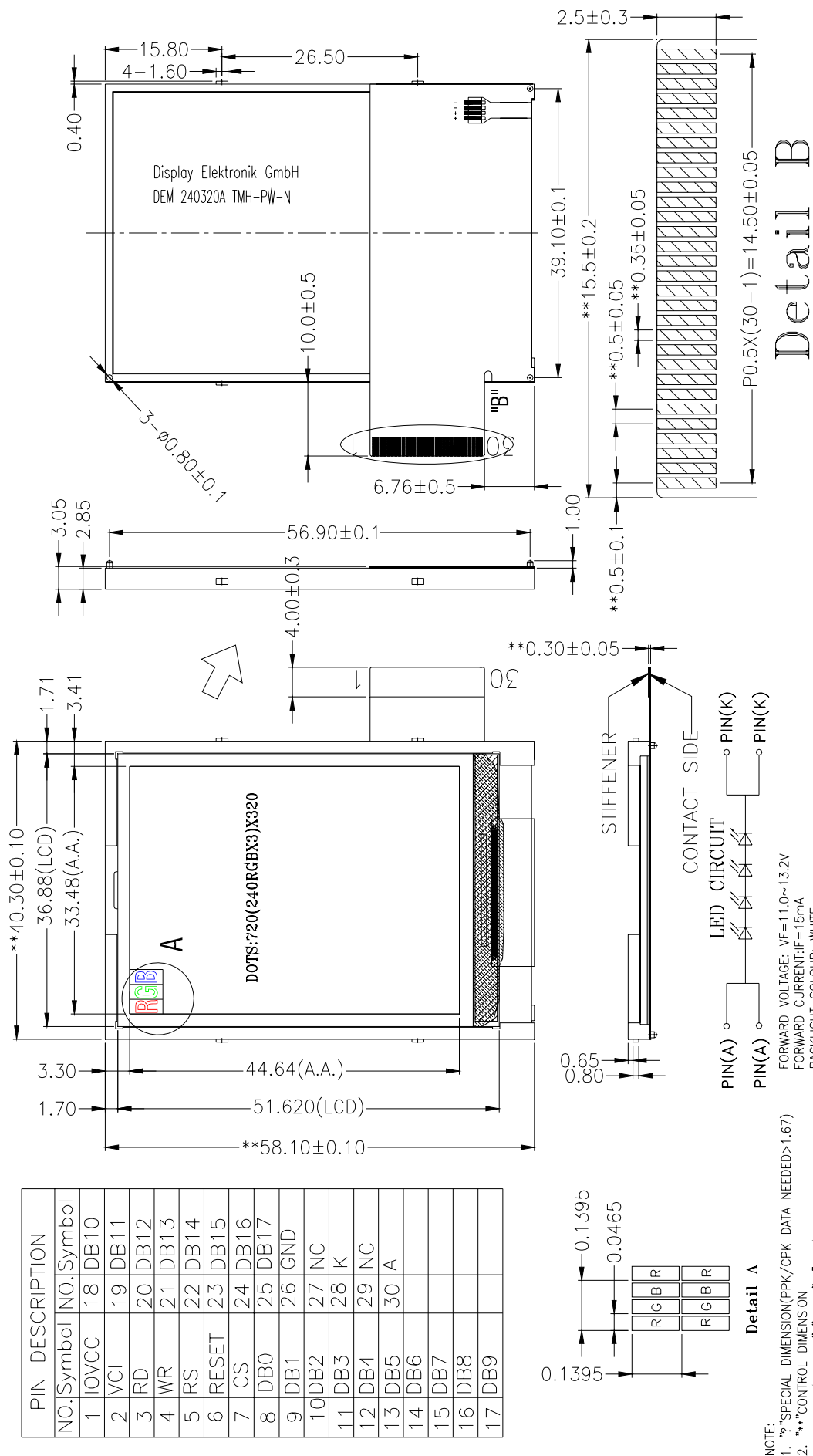
1.0 GENERAL SPECIFICATION

Item	Contents	Unit
LCD Type	2.2" a-Si TFT Active-Matrix Transmissive	-
Module outer dimension	40.30 x 58.10 x 3.05(max.)	mm
Pixel Size	0.1395(RGB) x 0.1395(V)	mm
Active display area	33.48 x 44.64	mm
Number of dots	240(RGB) x 320	dots
Viewing direction	12:00	O'clock
Color-filter-array	RGB Stripe	-
Number Of Colors	262k	-
Backlight	LED White Backlight, Long-Lifetime	-
Drive IC	HX8347-D (Himax)	-
Interface type	16-bit 8080-Mode.	See Note
Operating temperature	-20 ~ 70	°C
Storage temperature	-30 ~ 80	°C
Weight	~ 10	g

Note: Below interfaces can be custom-made according to different applications:

- 8/9/18-bit MPU parallel interface, 16-bit 68-system parallel interface
- 3/4-wire serial data transfer interface
- 6, 16, 18 – bit (RGB) interface.

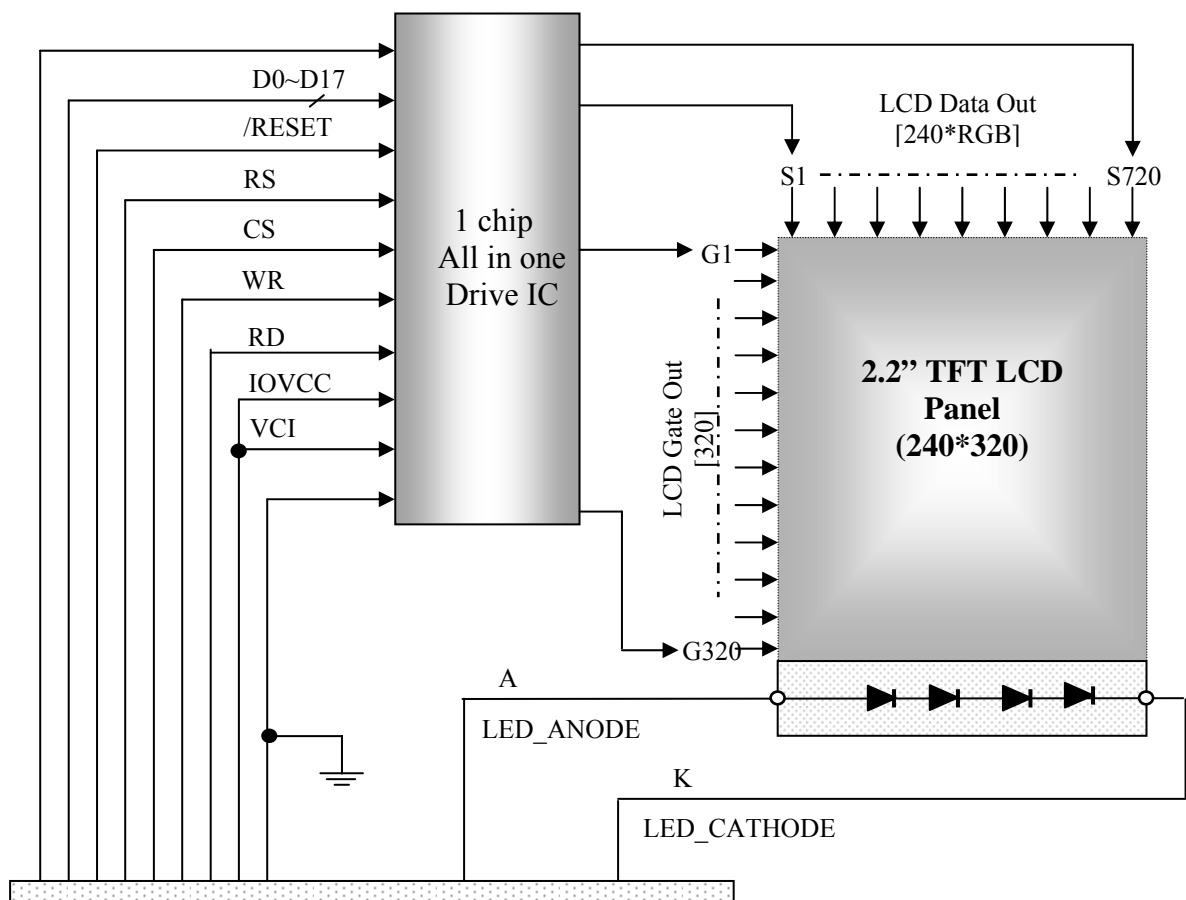
2.0 OUTLINE DRAWING



3.0 INTERFACE PIN DESCRIPTION

Pin No.	Symbol	Function
1	IOVCC	Logic power supply.
2	VCI	Power supply.
3	RD	Read strobe signal.
4	WR	Write strobe signal.
5	RS	Register selection input When RS = "low", instruction register . When RS = "high" . data register .
6	RESET	Reset signal.
7	CS	Chip select signal. Low active.
8 ~ 25	DB0 ~ DB17	Data Bus.
26	GND	Power ground.
27	NC	No connection.
28	K	Cathode of the backlight power supply.
29	NC	No connection.
30	A	Anode of the backlight power supply.

4.0 BLOCK DIAGRAM



5.0 OPERATING PRINCIPLE & DRIVING METHOD

5.1 Please refer to HX8347-D(Ver01) datasheet for more details.

5.2 Instruction Description (based on IC spec ver as stated in 6.1 where the product is designed). This instruction description is for reference only. Customer is encouraged to always refer to the latest IC specification.

Register No.	Register	W/R	Upper Code	Lower Code								Comment
			D[17:8]	D7	D6	D5	D4	D3	D2	D1	D0	
R00h	Himax ID	R	-	0	1	0	0	0	1	1	1	
R01h	Display Mode control	W/R	-	DP_S TB(0)	DP_S TB_S(0)	-	-	SCROL (0)	IDMON (0)	INVON (0)	PTLON (0)	
R02h	Column address start 2	W/R	-	SC[15:8] (8'b0000_0000)								
R03h	Column address start 1	W/R	-	SC[7:0] (8'b0000_0000)								
R04h	Column address end 2	W/R	-	EC[15:8] (8'b0000_0000)								
R05h	Column address end 1	W/R	-	EC[7:0] (8'b1110_1111)								
R06h	Row address start 2	W/R	-	SP[15:8] (8'b0000_0000)								
R07h	Row address start 1	W/R	-	SP[7:0] (8'b0000_0000)								
R08h	Row address end 2	W/R	-	EP[15:8] (8'b0000_0001)								
R09h	Row address end 1	W/R	-	EP[7:0] (8'b0011_1111)								
R0Ah	Partial area start row 2	W/R	-	PSL[15:8] (8'b0000_0000)								
R0Bh	Partial area start row 1	W/R	-	PSL[7:0] (8'b0000_0000)								
R0Ch	Partial area end row 2	W/R	-	PEL[15:8] (8'b0000_0001)								
R0Dh	Partial area end row 1	W/R	-	PEL[7:0] (8'b0011_1111)								
R0Eh	Vertical Scroll Top fixed area 2	W/R	-	TFA[15:8] (8'b0000_0000)								
R0Fh	Vertical Scroll Top fixed area 1	W/R	-	TFA[7:0] (8'b0000_0000)								
R10h	Vertical Scroll height area 2	W/R	-	VSA[15:8] (8'b0000_0001)								
R11h	Vertical Scroll height area 1	W/R	-	VSA[7:0] (8'b0100_0000)								
R12h	Vertical Scroll Button area 2	W/R	-	BFA[15:8] (8'b0000_0000)								
R13h	Vertical Scroll Button area 1	W/R	-	BFA [7:0] (8'b0000_0000)								
R14h	Vertical Scroll Start address 2	W/R	-	VSP [15:8] (8'b0000_0000)								
R15h	Vertical Scroll Start address 1	W/R	-	VSP [7:0] (8'b0000_0000)								
R16h	Memory Access control	W/R	-	MY(0)	MX(0)	MV(0)	ML(0)	BGR(0)	-	-	-	
R17h	COLMOD	W/R	-	CSEL[3:0] (4b'0110)				-	IFPF[2:0] (3b'110)			
R18h	OSC Control 2	W/R	-	I/PI_RADJ1[3:0] (3b'0011)				N/P_RADJ0[3:0] (4b'0100)				*
R19h	OSC Control 1	W/R	-	-	-	-	-	-	-	-	OSC_EN(0)	
R1Ah	Power Control 1	W/R	-	-	-	-	-	-	BT[2:0] (001)			
R1Bh	Power Control 2	W/R	-	-	-	VRH[5:0] (01_1011) 4.8V						
R1Ch	Power Control 3	W/R	-	-	-	-	-	-	AP[2:0] (011)			
R1Dh	Power Control 4	W/R	-	-	I/PI_FS0[2:0] (100)			-	N/P_FS0[2:0] (100)			
R1Eh	Power Control 5	W/R	-	-	I/PI_FS1[2:0] (100)			-	N/P_FS1[2:0] (100)			
R1Fh	Power Control 6	W/R	-	GASEN(1)	VCOMG(0)	-	PON(0)	DK(1)	XDK(0)	DDVDH_TRI(0)	STB(1)	
R22h	SRAM Write Control	W/R	SRAM Write									
R23h	VCOM Control 1	W/R	-	VMF[7:0] (1000_0000)								
R24h	VCOM Control 2	W/R	-	VMH[7:0] (0111_0001)								
R25h	VCOM Control 3	W/R	-	VML[7:0] (0010_1111)								
R26h	Display Control 1	W/R	-	--	-	-	-	ISC[3:0] (0001)				
R27h	Display Control 2	W/R	-	PT[1:0] (10)		PTV[1:0] (10)		-	-	PTG(1)	REF(1)	

Register No.	Register	W/R	Upper Code	Lower Code								Comment
			D[17:8]	D7	D6	D5	D4	D3	D2	D1	D0	
R28h	Display Control 3	W/R	-	-	-	GON(1)	DTE(0)	D[1:0] (00)		-	-	
R29h	Frame Rate control 1	W/R	-	I/PI_RTIN[3:0](0010)				N/P_RTIN[3:0](0010)				
R2Ah	Frame Rate Control 2	W/R	-	-	-	I/PI_DIV[1:0](00)		-	-	N/P_DIV[1:0](00)		
R2Bh	Frame Rate Control 3	W/R	-	N/P_DUM[7:0] (8b'0001_1100)								
R2Ch	Frame Rate Control 4	W/R	-	I/PI_DUM[7:0] (8b'0001_1100)								
R2Dh	Cycle Control 1	W/R	-	GDON[7:0] (8'b0000_1101)								
R2Eh	Cycle Control 2	W/R	-	GDOF[7:0] (8'b0111_0000)								
R2Fh	Display inversion	W/R	-	-	I/PI_NW[2:0](3b'001)			-	N/P_NW[2:0] (3b'001)			
R31h	RGB interface control 1	W/R	-	-	-	-	-	-	-	RCM[1:0](00)		
R32h	RGB interface control 2	W/R	-	-	-	-	-	DPL (0)	HSPL (0)	VSPL (0)	EPL (0)	
R33h	RGB interface control 3	W/R	-	HBP[7:0]								
R34h	RGB interface control 4	W/R	-	HBP[9:8]			VBP[5:0]					
R36h	Panel Characteristic	W/R	-	-	-	-	-	SS_P anel	GS_Pan el	REV_Pa nel	BGR_P anel	
R38h	OTP Control 1	W/R	-	OTP_PTM[1:0]		OTP_VARDJ[1:0]		OTP_POR	OTP_OTPEN	OTP_PP ROG	OTP_P WE	
R39h	OTP Control 2	W/R	-	-	-	-	-	-	OTP_YA 2	OTP_YA 1	OTP_Y A0	
R3Ah	OTP Control 3	W/R	-	-	-	-	OTP_X A4	OTP_X A3	OTP_X A2	OTP_XA 1	OTP_X A0	
R3Ch	CABC Control 1	W/R	-	DBV[7:0](8'h00)								
R3Dh	CABC Control 2	W/R	-	-	-	BCTRL (0)	-	DD (0)	BL (0)	-	-	
R3Eh	CABC Control 3	W/R	-	-	-	-	-	-	-	C1 (0)	C0 (0)	
R3Fh	CABC Control 4	W/R	-	CMB[7:0](8'h00)								
R40h	r1 Control (1)	W/R	-	-	-	VRP0[5:0] (6'b00_0001)						
R41h	r1 Control (2)	W/R	-	-	-	VRP1[5:0] (6'b00_1110)						
R42h	r1 Control (3)	W/R	-	-	-	VRP2[5:0] (6'b01_0001)						
R43h	r1 Control (4)	W/R	-	-	-	VRP3[5:0] (6'b01_1010)						
R44h	r1 Control (5)	W/R	-	-	-	VRP4[5:0] (6'b01_1000)						
R45h	r1 Control (6)	W/R	-	-	-	VRP5[5:0] (6'b10_0100)						
R46h	r1 Control (7)	W/R	-	PRP0[6:0] (7'b001_0101)								
R47h	r1 Control (8)	W/R	-	PRP1[6:0] (7'b110_0101)								
R48h	r1 Control (9)	W/R	-	-	-	-	PKP0[4:0] (5'b0_1011)					
R49h	r1 Control (10)	W/R	-	-	-	-	PKP1[4:0] (5'b1_100)					
R4Ah	r1 Control (11)	W/R	-	-	-	-	PKP2[4:0] (5'b1_1001)					
R4Bh	r1 Control (12)	W/R	-	-	-	-	PKP3[4:0] (5'b1_1010)					
R4Ch	r1 Control (13)	W/R	-	-	-	-	PKP4[4:0] (5'b1_1000)					
R50h	r1 Control (18)	W/R	-	-	-	VRN0[5:0] (6'b01_1011)						
R51h	r1 Control (19)	W/R	-	-	-	VRN1[5:0] (6'b10_0111)						
R52h	r1 Control (20)	W/R	-	-	-	VRN2[5:0] (6'b10_0101)						
R53h	r1 Control (21)	W/R	-	-	-	VRN3[5:0] (6'b10_1110)						
R54h	r1 Control (22)	W/R	-	-	-	VRN4[5:0] (6'b11_0001)						
R55h	r1 Control (23)	W/R	-	-	-	VRN5[5:0] (6'b11_1110)						
R56h	r1 Control (24)	W/R	-	PRN0[6:0] (7'b001_1010)								
R57h	r1 Control (25)	W/R	-	PRN1[6:0] (7'b110_1010)								
R58h	r1 Control (26)	W/R	-	-	-	PKN0[4:0] (5'b0_0111)						
R59h	r1 Control (27)	W/R	-	-	-	PKN1[4:0] (5'b0_0101)						
R5Ah	r1 Control (28)	W/R	-	-	-	PKN2[4:0] (5'b0_0110)						
R5Bh	r1 Control (29)	W/R	-	-	-	PKN3[4:0] (5'b0_1011)						
R5Ch	r1 Control (30)	W/R	-	-	-	PKN4[4:0] (5'b1_0100)						
R5Dh	r1 Control (35)	W/R	-	CGMN1[1:0] (11)		CGMN0[1:0](00)		CGMP1[1:0](11)		CGMP0[1:0](00)		
R60h	TE Control	W/R	-	-	-		TE_m ode (0)	TEOE (0)		-	-	
RE4h	Power saving 1	W/R	-	EQ_S1[7:0]								
RE5h	Power saving 2	W/R	-	EQ_S2[7:0]								
RE6h	Power saving 3	W/R	-	EQ_S3[7:0]								
RE7h	Power saving 4	W/R	-	EQ_S4[7:0]								

Register No.	Register	W/R	Upper Code	Lower Code								Comment
			D[17:8]	D7	D6	D5	D4	D3	D2	D1	D0	
RE8h	Source OP control Normal	W/R	-	OPON_N[7:0]								
RE9h	Source OP control_IDLE	W/R	-	OPON_I[7:0]								
REAh	Power control internal use (1)	W/R	-	STBA[15:8]								
REBh	Power control internal use (2)	W/R	-	STBA[7:0]								
RECh	Source control internal use (1)	W/R	-	PTBA[15:8]								
REDh	Source control internal use (2)	W/R	-	PTBA[7:0]								
RFFh	Page select	W/R	-	-	-	-	-	-	-	PAGE_SEL[1:0] (00)		

Table 8. 2 List Table of Command Set page 0

Register No.	Register	W/R	Upper Code	Lower Code								Comment
			D[17:8]	D7	D6	D5	D4	D3	D2	D1	D0	
RC3h	CABC Control 5	W/R	-	0	PWMDIV[2:0](000)			1	1	INPLUS (1)	1	
RC5h	CABC Control 6	W/R	-	PWM_PERIOD[7:0] (43d)								
RC7h	CABC Control 7	W/R	-	-	DIM_FRAME[6:0] (20)							
RCBh	Gain select register 0	W/R	-	-	DBG0[6:0](40)							
RCCh	Gain select register 1	W/R	-	-	DBG1[6:0](3C)							
RCDh	Gain select register 2	W/R	-	-	DBG2[6:0](38)							
RCEh	Gain select register 3	W/R	-	-	DBG3[6:0](34)							
RCFh	Gain select register 4	W/R	-	-	DBG4[6:0](33)							
RD0h	Gain select register 5	W/R	-	-	DBG5[6:0](32)							
RD1h	Gain select register 6	W/R	-	-	DBG6[6:0](2B)							
RD2h	Gain select register 7	W/R	-	-	DBG7[6:0](24)							
RD3h	Gain select register 8	W/R	-	-	DBG8[6:0](22)							
RFFh	Page select	W/R	-	-	-	-	-	-	-	PAGE_SEL[1:0] (00)		

Table 8. 2 List Table of Command Set page 1

6.0 ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Typ.	Max	Unit
Supply voltage 1	V _{DC}	-0.3	-	4.6	V
Supply voltage 2	VCC1A	-0.3	-	4.6	V
Supply voltage 3	VGH	-0.3		18.5	V
Supply voltage 4	VGL	-16.5		0	V
Input voltage	V _{IN}	-0.3	-	VCC1A+0.5	V
Operating temperature	T _{OP}	-20	-	70	°C
Storage temperature	T _{ST}	-30	-	80	°C

7.0 ELECTRICAL CHARACTERISTICS

Item	Symbol	Min	Typ.	Max	Unit	Remarks
Supply voltage 1	V _{DC}	2.3	2.8	3.3	V	
Supply voltage 2	VCC1A	1.65	1.8	3.3	V	
Supply voltage 3	VGH	-	15	-	V	
Supply voltage 4	VGL	-	-10	-	V	
Common electrode voltage	Vcomh	2.5	-	4.5	V	
Common electrode voltage	Vcoml	-2		0	V	
Input high voltage	VIH	0.7*VCC1A	-	VCC1A	V	
Input low voltage	VIL1	GND	-	0.3*VCC1A	V	

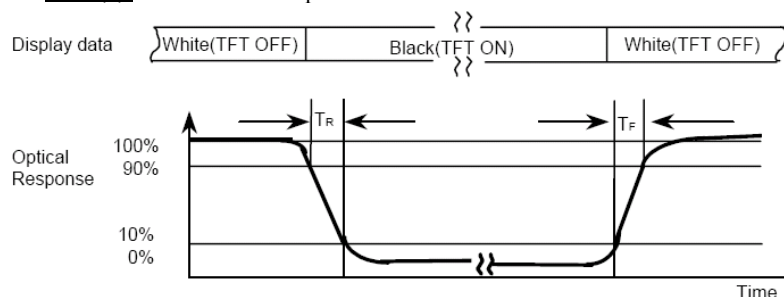
8.0 BACKLIGHT SPECIFICATIONS

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
Forward voltage	Vf	11	12.8	13.2	V	If = 15 mA
Forward Current	If	-	15	-	mA	
Reverse Voltage	Vr	-	-	5	V	
Reverse current	Ir	-	-	15	μA	Vr = 3.0V
Chromaticity coordinates	X	0.26	-	0.31	-	
	Y	0.26	-	0.31	-	
Luminance (BLU only)	Lv	-	3200	-	cd/m ²	If = 15 mA
Uniformity	Δ	80	85	-	%	Min/max*100%
Half-Brightness Life Time	50000 Hours					

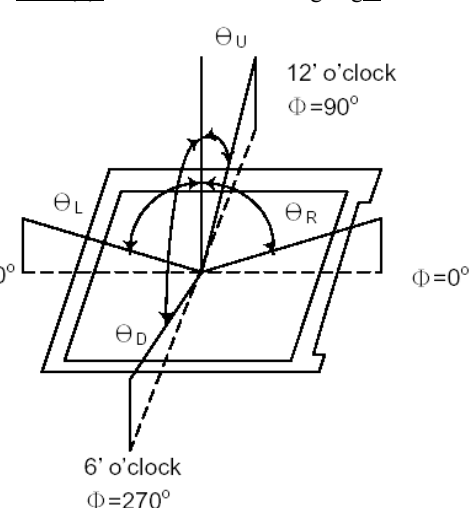
9.0 OPTICAL CHARACTERISTICS (Ta=25°C)

No	Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
1	Response Time	Rise	Tr	$\theta = \phi = 0^\circ$	-	10	-	ms	(1)
		Fall	Tf	$\theta = \phi = 0^\circ$	-	20	-	ms	
2	Contrast Ratio		CR	$\theta = \phi = 0^\circ$	-	300	-	-	(2)
3	Viewing Angle (CR ≥ 10)	Right		$\phi = 0^\circ$	-	45		Deg	(3)
		Left		$\phi = 180^\circ$	-	45		Deg	
		Upper		$\phi = 90^\circ$	-	35		Deg	
		Lower		$\phi = 270^\circ$	-	15		Deg	
4	Color Chromaticity (CIE1931)	Red	Rx	$\theta = \phi = 0^\circ$	0.616	0.646	0.676	-	(4)
			Ry		0.291	0.321	0.351	-	
		Green	Gx		0.268	0.398	0.328	-	
			Gy		0.543	0.573	0.603	-	
		Blue	Bx		0.104	0.134	0.164	-	
			By		0.103	0.133	0.163	-	
		White	Wx		0.270	0.300	0.330	-	
			Wy		0.304	0.334	0.364	-	
5	Luminance of white (Center point of LCM)	L			250	tbd	-	Cd/m ²	(5)

Note (1): Definition of Response Time



Note (3): Definition of Viewing angle



Note (2): Definition of Contrast Ratio

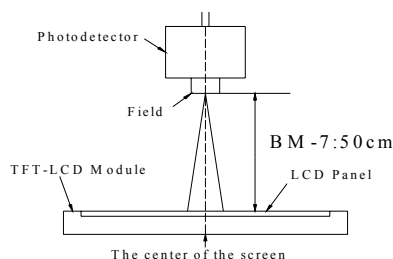
CR = Brightness at all pixels "White" / Brightness at all pixels "Black"

Note (4): Measured at center point vertically with backlight on.

Note(5): After stabilizing and leaving the panel alone at a given temperature for 30 min, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. 30 min after lighting the back-light. This should be measured in the center of screen.

Environment condition: Ta=25±2°C

Back-Light On condition



10.0 STANDARD SPECIFICATION FOR RELIABILITY

10.1 Standard specification of Reliability Test

Standard Specification of Reliability Test				
No	Test Item	Content of Test	Test Condition	Applicable Standard
1	High temperature storage	Endurance test applying the high storage temperature for a long time.	80+/-3 °C 240 hrs	-----
2	Low temperature storage	Endurance test applying the low storage temperature for a long time.	-30+/-3 °C 240 hrs	-----
3	High temperature operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70+/-3 °C 240 hrs	-----
4	Low temperature operation	Endurance test applying the electric stress under low temperature for a long time.	-20+/-3 °C 240 hrs	-----
5	High temperature / Humidity operation	Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time.	40 °C, 90 %RH 120 hrs	MIL-202E-103B JIS-C5023
6	Temperature cycle	Endurance test applying the low and high temperature cycle. <div><div><div>-20°C</div><div>30min.</div></div><div><div>25°C</div><div>5min.</div></div><div><div>70°C</div><div>30min.</div></div><div><div>↔</div><div>↔</div><div>↔</div></div><div>←-----→</div><div>1 cycle</div></div>	-20°C / 70°C 10 cycles	-----
Mechanical Test				
7	Drop Test	Endurance test applying the drop during transportation.	Packed, 100cm free fall (6 sides, 1 corner, 3edges)	----

Remarks:

- 1) For operation test, above specification is applicable when test pattern is changing during entire operation test.
- 2) Inspections after reliability tests are performed when the display temperature resumes back to room temperature.
- 3) It is a normal characteristic that some display abnormality can be seen during reliability test. If the display abnormality can resume back to normal condition at room temperature within 24hours, there is no permanent destruction over the display. The display still possesses its functionality after reliability tests.

10.2 Failure Judgment Criteria

After the reliability tests above, test sample shall be let return to room temperature and humidity for at least 4 hours before final tests are carried out.

Criterion Item	Failure Judgment Criteria
Electrical characteristic	Electrical short and open.
Mechanical characteristic	Out of mechanical specification
Optical characteristic	Out of the Appearance Standard

11.0 QUALITY ASSURANCE**11.1 Acceptable Quality Level (AQL)**

Each lot should satisfy the quality level defined as follows:

- a) Inspection method: MIL-STD-105E Level II normal one time sampling
- b) AQL level

Category	AQL	Definition
Major	0.25%	Functional defective as product
Minor	1.00%	Satisfy all functions as product but not satisfy cosmetic standard

11.2 Cosmetic Screening Criteria

No	Defect	Judgment Criteria	Category
1	Spots/Dust /Bubble (Round type)	Size, d (mm)	Minor
		$d \leq 0.15$	
		$0.15 < d \leq 0.20$	
		$d > 0.20$	
2	Dust/Scratches/ Black streak (Line type)	Width, W (mm)	Minor
		Length, L (mm)	
		Acceptable quantity in active area	
		$W \leq 0.02$	
		$W \leq 0.03$	
3	Allowable density	$L \leq 1.0$	Minor
		$L \leq 2.0$	
4	Rainbow	$W \leq 0.05$	Major
		$W > 0.05$	
5	Display condition	Disregard	Major
		Disregard	
6	No display or missing display	Acceptable quantity in active area	Major
		Disregard	

12.0 PRECAUTIONS FOR USING LCD MODULE**Handling Precautions**

- i. The display panel is made of glass and polarizer. Do not subject it to mechanical shock by dropping or impact which may cause chipping especially on the edges.
- ii. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- iii. 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 Isopropyl alcohol or ethyl alcohol. Avoid using solvents like acetone (ketene), water, toluene, ethanol to clean the polarizer surface.
- iv. 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.
- v. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- vi. Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion.
- vii. 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.
- viii. NC terminal should be open. Do not connect anything.
- ix. If the logic circuit power is off, do not apply the input signals.
- x. Avoid contacting oil and fats.
- xi. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizers. After products are tested at low temperature they must be warmed up in a container before coming in contact with room temperature air.
- xii. Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading.

Electro-Static Discharge Control

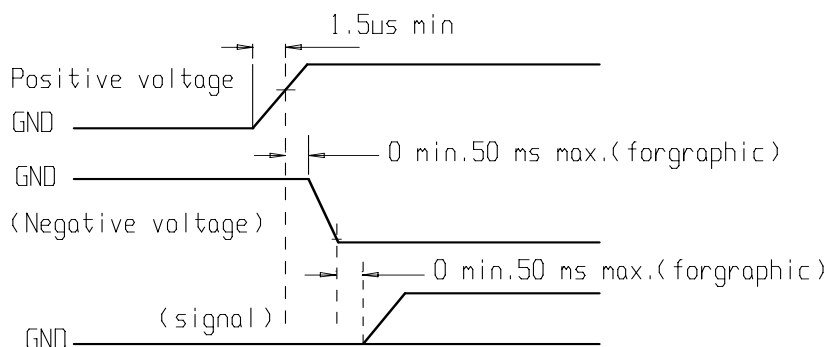
- xiii. Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC.
- xiv. Be sure to ground the body when handling the LCD modules. Tools required for assembling, such as soldering irons, must be properly grounded.
- xv. To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. 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.
- xvi. 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.
- xvii. When soldering the terminal of LCM, make certain the AC power source for the soldering iron does not leak.

Precaution for soldering to the LCM

- xviii. Observe the following when soldering lead wire, connector cable and etc. to the LCD module.
- xix. Soldering iron temperature: 300 ~ 350°C.
- xx. Soldering time: ≤ 3 sec.
- xxi. Solder: eutectic solder.
- xxii. Above is a recommended approach. Due to different solder composition and processing method, it is recommended that customer to study and fine tuning their soldering process parameters accordingly.
- xxiii. 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.

Precautions for Operation

- xxiv. Viewing angle varies with the change of liquid crystal driving voltage (V_O). Adjust V_O to show the best contrast.
- xxv. Driving the LCD in the voltage above the limit shortens its lifetime.
- xxvi. Response time is greatly delayed at temperature below the operating temperature range. However, it will recover when it returns to the specified temperature range.
- xxvii. 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.
- xxviii. When turning the power on, input each signal after the positive/negative voltage becomes stable.

**Storage**

- xxix. When storing LCDs as spares for some years, the following precautions are necessary.
- xxx. Store them in a sealed polyethylene bag. If properly sealed, there is no need for desiccant.
- xxxi. Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C.
- xxxii. Environmental conditions:
 - Do not leave them for more than 168hrs. at 60°C.
 - Should not be left for more than 48hrs. at -20°C.

Safety

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

13.0 ROHS COMPLIANT PRODUCT**Standard of specific chemical substance**

1. Cadmium and Cadmium Compounds	Less than 100ppm
2. Hexavalent Chromium Compounds	Less than 1000ppm
3. Lead and Lead Compounds	Less than 1000ppm
4. Mercury and Mercury Compounds	Less than 1000ppm
5. Polybrominated Biphenyls (PBBs)	Less than 1000ppm
6. Polybrominated Diphenyl ethers (PBDEs)	Less than 1000ppm

14.0 LIMITED WARRANTY

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