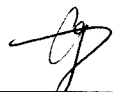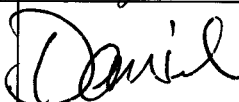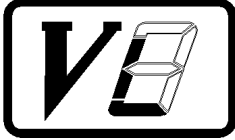DOCUMENT NUMBER AND REVISION
VL-PS-BCD12864-01 REV. C
(BCD12864)

DOCUMENT TITLE:
PRELIMINARY SPECIFICATION
OF
LCD MODULE TYPE
MODULE NUMBER: BCD12864-01

DEPARTMENT	NAME	SIGNATURE	DATE
PREPARED BY	PHILIP CHENG		2005/5/3
CHECKED BY	DANIEL POON		2005/5/3
APPROVED BY	CYRUS CHEUNG		2005/5/3

DISTRIBUTION LIST: MARKETING

DOCUMENT   REVISION   HISTORY 1:

DOCUMENT REVISION FROM TO		DATE	DESCRIPTION	CHANGED BY	CHECKED BY
	A	2004.11.22	First Release.	PHILIP CHENG	DANIEL POON
A	B	2004.12.17	Item 1 was updated: (Page 4, point 3) Color was updated and remark was added	PHILIP CHENG	DANIEL POON
B	C	2005.05.03	Items 1 to 5 were updated: 1.)(Page 10, table 5) Supply voltage (LCD), supply current(Logic & LCD), supply current (LCD), and note 2 were updated. 2.)(Page 15, point 7.3) "Vreset=-24V, Vselect=-24V" were changed to "Vreset=Vselect= -23V". 3.)(Page 16, table 8) T-reset(ms), and T-select(ms) were updated. 4.)(Page 18, table 9) Condition of scanning time was changed from " VDD=5V, VLCD=-24V, @25°C" to " VDD=5V, VLCD=-23V, @25°C". 5.)(Page 18, point 11) Remark were updated.	PHILIP CHENG	DANIEL POON

CONTENTS

VARITRONIX LIMITED

Preliminary Specification
of
LCD Module Type
Model No.: BCD12864-01

1. Technology Description

BCD (Bi-stable Cholesteric Display) is a sunlight readable reflective LCD with extremely low power consumption characteristics. Due to the non-volatile memory feature of the technology, zero power is required to retain the image of the display. Energy is only required to change the displayed image. No backlighting is required, only ambient lighting from the surrounding is required. Readability when under direct sunlight is excellent and good contrast from viewing at very wide angles are possible.

2. Typical Applications

This module is intended for general purpose graphic and character display applications. Suggested uses include instrumentation, remote control, electronic product or price label, point of sale display, general purpose indoor or outdoor signage and information display.

3. General Description

- Passive matrix bistable cholesteric display, reflective LCD graphic module
- Color: Blue/White
- Display resolution: 128 x 64
- Viewing angle: all angles (for inclinations of <70°, CR > 3)
- "DRAGON DRIVE" SA3086 80-Channel Segment/Column Drivers or equivalent
- Driving scheme: Special BCD driving scheme
- Logic voltage: 3V ~ 5V
- The module does not contain polarizer and the customer is recommended to add a UV cut filter (98% blocking of 380nm and lower spectral components)
- The module is licensed by Kent Display Systems

Remark: Colors available: Blue/White, Red/Amber, DarkGreen/LightGreen, Black/Monochrome (i.e., Black/Green & Black/Yellow), Super bright series (i.e., Pink/Peach & Orange/Yellow) is also available.

4. Mechanical Specifications

The mechanical detail is shown in Fig. 1 and summarized in Table 1 below.

Table 1

Parameter	Specifications	Unit
Outline dimensions	78.0(W) x 70.0(H) x 10.0 MAX. (D)	mm
Viewing area	62.0(W) x 44.0(H)	mm
Active area	56.27(W) x 38.35(H)	mm
Display format	128(Horizontal) x 64 (Vertical)	dots
Dot size	0.39(W) x 0.55(H)	mm
Dot spacing	0.05(W) x 0.05(H)	mm
Dot pitch for characters	0.44(W) x 0.60(H)	mm
Weight:	53	grams

Figure 1: Module Specification

TITLE: PRELIMINARY SPECIFICATION OF MODULE

PROJECT NO: BCD12864

Display Type	Graphic Display ,reflective, BCD, Blue / White
Display Resolution	128x64
Viewing Angle	All angle
Mux ratio and bias	1/64, 1/7
LCD Controller/Driver	SA3086
Logic Voltage (V)	3V - 5V
LCD Driving Voltage	TBD
Operation Temperature	-20℃ to +70℃
Storage Temperature	-30℃ to +80℃

TOLERANCE UNLESS OTHERWISE SPECIFIED:	X.X ±0.3 X.XX ±0.1 ANGULAR±1°
DIMENSIONS IN MM	
MATERIAL: N/A	FINISH: N/A
SCALE: DO NOT ON SCALE	OVERALL THK: N/A

THIRD ANGLE PROJECTION

	NAME	SIGN	DATE
DRAWN:	CHAN KAM FAI		04.09.02
CHECKED:	DANIEL POON		
APPROVED:	K.P.HO		

ITEM NO.: BCD12864-01

DESCRIPTION:

FILE NO: MODULE BCD12864-01 REV: 0

SHEET 1 OF 1

VARITRONIX LIMITED

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| VLCD | GND | VDD | M | DOFF | FLM | LP-C | LP-S | XCK | D0 | D1 | D2 | D3 | NC | NC | NC |

LCD:BCD12864
128 X 64 DOTS

* OR EQUIVALENT
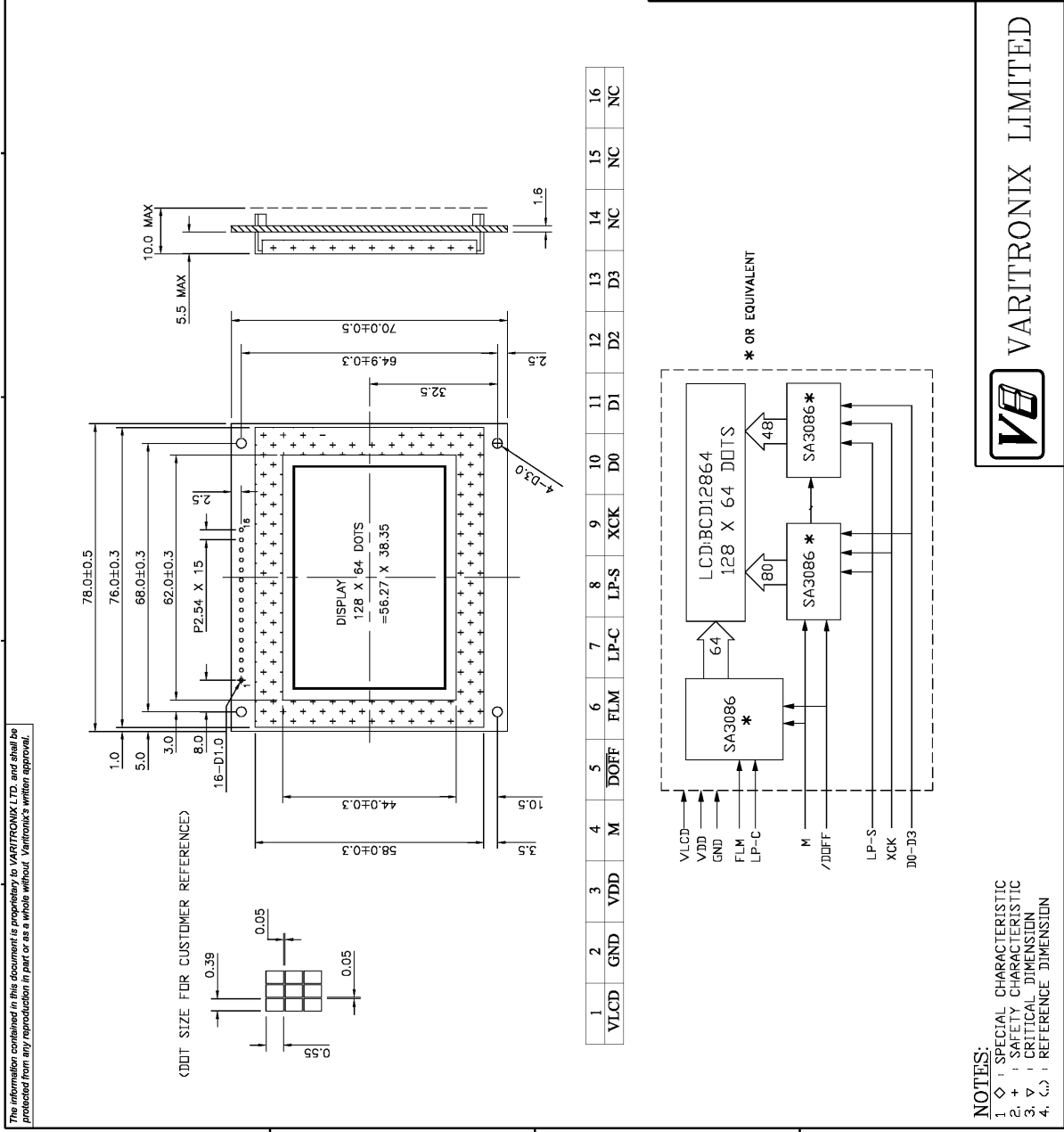
NOTES:
1. ◇ : SPECIAL CHARACTERISTIC
2. + : SAFETY CHARACTERISTIC
3. ▽ : CRITICAL DIMENSION
4. ⌂ : REFERENCE DIMENSION

FLM

M

DOFF

LP-C

VLCD

VDD

GND

Bias
Circuit

V1
V4
V2
V3

SA3086

M

DISPOFFB

CL1

V5,VEE

V12

V43

D4_DR

64

BCD-12864
GRAPHIC LCD DISPLAY

128 X 64 DOTS

80

48

SA3086

M DISPOFFB V5, VEE V12 V43 CL1 CL2 D1_SID~ D4_DR

SA3086

M DISPOFFB V5, VEE V12 V43 CL1 CL2 D1_SID ~ D4_DR

LP-S

XCK

4

4

D0~

D3

Figure 2: Block Diagram

5. Interface Signals

Table 2

Pin No.	Symbol	Description
1	VLCD	Power supply for LCD drive.
2	GND	Ground (0V)
3	VDD	Power supply for logical "High" input port (+5V±10%, +3V±10%)
4	M	Alternate signal input pin for LCD driving. Normal frame inversion signal is input in to this pin.
5	$\overline{\text{DOFF}}$	Control input pin to fix the driver output (SC1~SC80) to V0 level, during "Low" value input. LCD becomes non-selected by V0 level output from every output of segment drivers and every output of common drivers.
6	FLM	Frame pulse
7	LP-C	LP-C (or CL1) is used as shifting clock of common output data.
8	LP-S	LP-S (or CL1) is used for latching the shift register contents at the falling edge of this clock pulse. CL1 pulse "High" level initializes power-down function block.
9	XCK	XCK (or CL2). Clock pulse input for the bi-directional shift register.
10	D0	These pins are used as 4-bit data input pin.
11	D1	
12	D2	
13	D3	
14	NC	No connection.
15	NC	No connection.
16	NC	No connection.

6. Absolute Maximum Ratings

6.1 Electrical Maximum Ratings-For IC Only

Table 3

Parameter	Symbol	Min.	Max.	Unit
Power Supply voltage (Logic)	VDD-GND	-0.3	+7.0	V
Power Supply voltage (LCD drive)	VDD-VLCD	0	+30	V
Input voltage	Vin	-0.3	VDD +0.3	V

Note: The modules may be destroyed if they are used beyond the absolute maximum ratings.
All voltage values are referenced to GND = 0V.

6.2 Environmental Condition

Table 4

Item	Operating Temperature (Topr)		Storage Temperature (Tstg)		Remark
	Min.	Max.	Min.	Max.	
Ambient Temperature	-20°C	+70°C	-30°C	+80°C	Dry
Humidity	95% max. RH for Ta $\leq$ 40°C < 95% RH for Ta > 40°C				no condensation
Vibration (IEC 68-2-6) cells must be mounted on a suitable connector	Frequency: 10 ~ 55 Hz Amplitude: 0.75 mm Duration: 20 cycles in each direction.				3 directions
Shock (IEC 68-2-27) Half-sine pulse shape	Pulse duration: 11 ms Peak acceleration: 981 m/s^2 = 100g Number of shocks: 3 shocks in 3 mutually perpendicular axes.				3 directions

7. Electrical Specifications

7.1 Typical Electrical Characteristics

At Ta = 25 °C, VDD = +3V ~ +5V±10%, GND=0V.

<u>Table 5</u>

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Supply voltage (Logic)	VDD-GND			2.7	-	5.5	V
Supply voltage (LCD)	VDD-VLCD	Ta=25°C, VDD =5V, Note1.		-	28	-	V
Input signal voltage low	V_{IL}			0	-	0.2 VDD	V
Input signal voltage high	V_{IH}			0.8 VDD	-	VDD	V
Supply current (Logic & LCD)	IDD	VDD=3V		-	3.6	-	mA
		VDD=5V		-	10	-	mA
Supply current (LCD)	ILCD	Image update	Burst current (Note 2)	-	120	-	μA
			Driving current	-	50	-	μA

Note 1: There is tolerance in optimum LCD driving voltage during production and it will be within the specified range.

Note 2: Burst current is transient surge (<200ms) at start of image refresh.

7.2 Timing Specifications

At Ta = -20°C to +70 °C , VDD = +3V ~ +5V±10%, GND=0V.

Segment Driver Application Timing of IC: SA3086

Table 6

Characteristic	Symbol	Test Condition	(1) V_{DD} = 5V ± 10%			(2) V_{DD} = 3V ± 10%			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Clock cycle time	t_{CY}	Duty = 50%	125	-	-	250	-	-	Ns
Clock pulse width	t_{WCK}	-	45	-	-	95	-	-	
Clock rise / fall time	t_R/t_F	-	-	-	-	-	-	30	
Data set-up time	t_{DS}	-	30	-	-	65	-	-	
Data hold time	t_{DH}	-	30	-	-	65	-	-	
Clock set-up time	t_{CS}	-	80	-	-	120	-	-	
Clock hold time	t_{CH}	-	80	-	-	120	-	-	
Propagation delay time	t_{PHL}	ELB Output	-	-	60	-	-	125	
		ERB Output			60			125	
ELB, ERB set-up time	t_{PUS}	ELB Input	30	-	-	65	-	-	
		ERB Input	30			65			
DISPOFFB low pulse width	t_{WDL}	-	1.2	-	-	1.2	-	-	µs
DISPOFFB clear time	t_{CD}	-	100	-	-	100	-		Ns
M – OUT propagation delay time	t_{PD1}		-	-	1.0	-	-	1.2	µs
CL1 – OUT propagation delay time	t_{PD2}	C_L = 15pF	-	-	1.0	-	-	1.2	
DISPOFFB – OUT propagation delay time	t_{PD3}		-	-	1.0	-	-	-s	
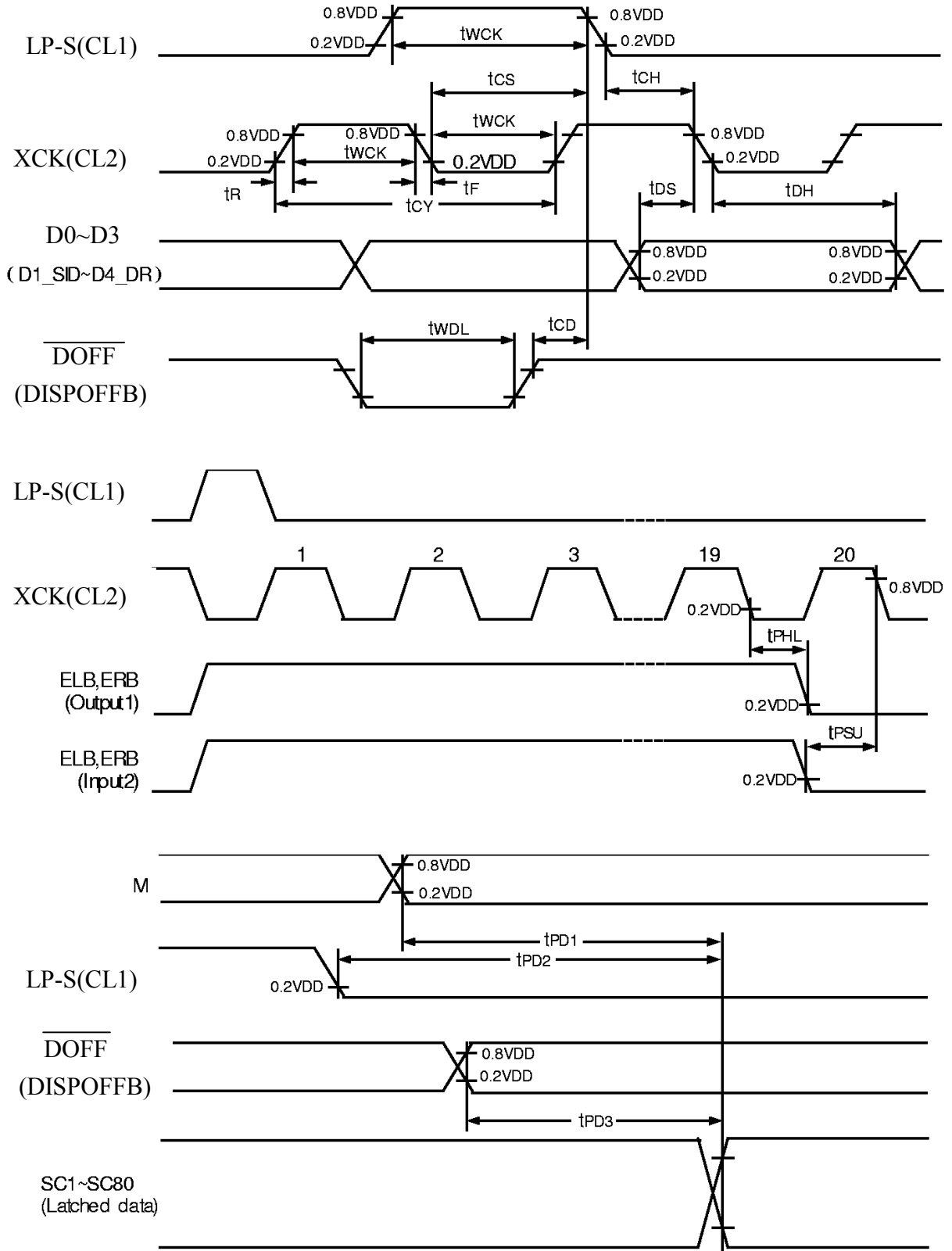
Figure 3: Diagram of Segment Driver Application Timing

At Ta = -20 °C to +70 °C , VDD = +3V ~ +5V±10%, GND=0V.

Common Driver Application Timing of IC: SA3086

Table 7

Characteristic	Symbol	Test Condition	(1) V_{DD} = 5V ± 10%			(2) V_{DD} = 3V ± 10%			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Clock cycle time	t_{CY}	Duty = 50%	250	-	-	500	-	-	ns
Clock pulse width	t_{WCK}	-	45	-	-	95	-	-	
Clock rise / fall time	t_R/t_F	-	-	-	50	-	-	50	
Data set-up time	t_{DS}	-	30	-	-	65	-	-	
Data hold time	t_{DH}	-	30	-	-	65	-	-	
DISPOFFB low pulse width	t_{WDL}	-	1.2	-	-	1.2	-	-	µs
DISPOFFB clear time	t_{CD}	-	100	-	-	100	-		ns
Output delay time	t_{DL}		-	-	200	-	-	250	
M – OUT propagation delay time	t_{PD1}		-	-	1.0			1.2	µs
CL1 – OUT propagation delay time	t_{PD2}	C_L = 15pF	-	-	1.0	-	-	1.2	
DISPOFFB – OUT propagation delay time	t_{PD3}				1.0			1.2	
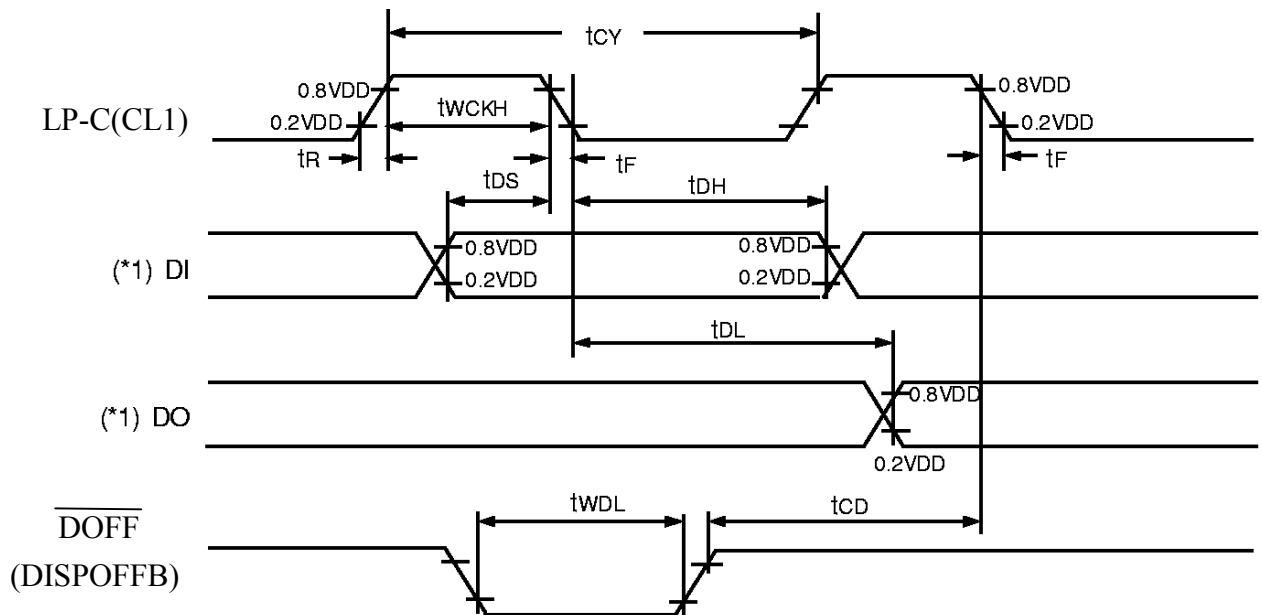
(*1) When in single-type interface mode
    DI ⇒ D2_DL(SHL="L"), D4_DR(SHL="H")
    DO ⇒ D4_DR(SHL="L"), D2_DL(SHL="H")
  When in dual-type interface mode
    DI ⇒ D2_DL and D3_DM(SHL="L"), D4_DR and D3_DM(SHL="H")
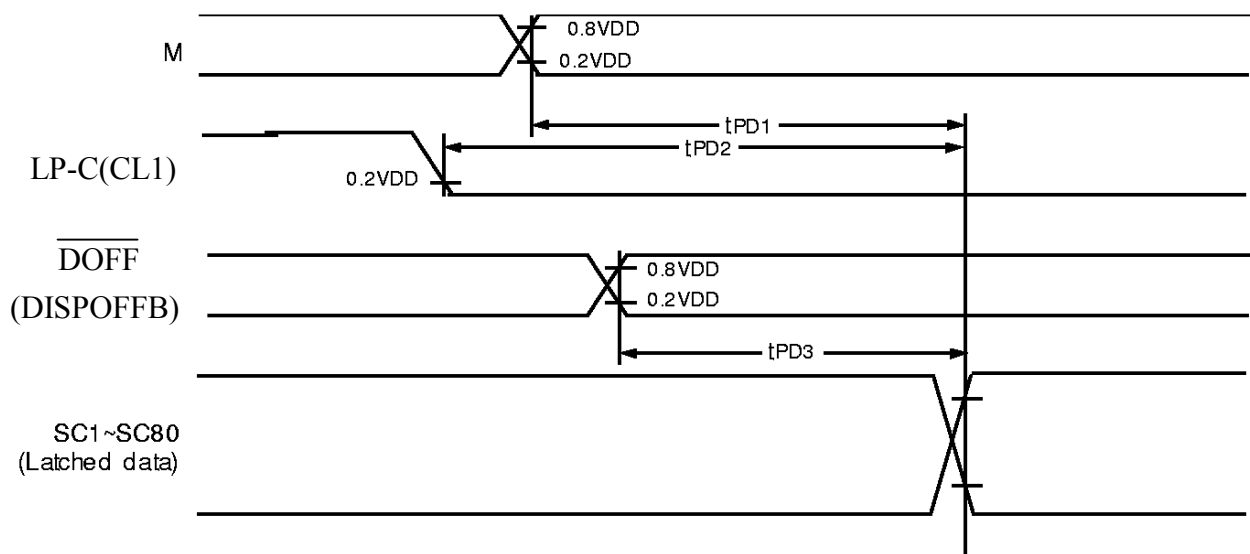   DO ⇒ D4_DR(SHL="L"), D2_DL(SHL="H")

Figure 4: Diagram of Common Driver Application Timing

7.3 Driving Scheme

The BCD technology requires a special driving scheme slightly, different to that of standard TN/STN displays. Bi-stability means that the panel retains the image after a single scan of the displayed image and power may be removed from the module. The following timing diagram illustrates the control signals required to drive the module:
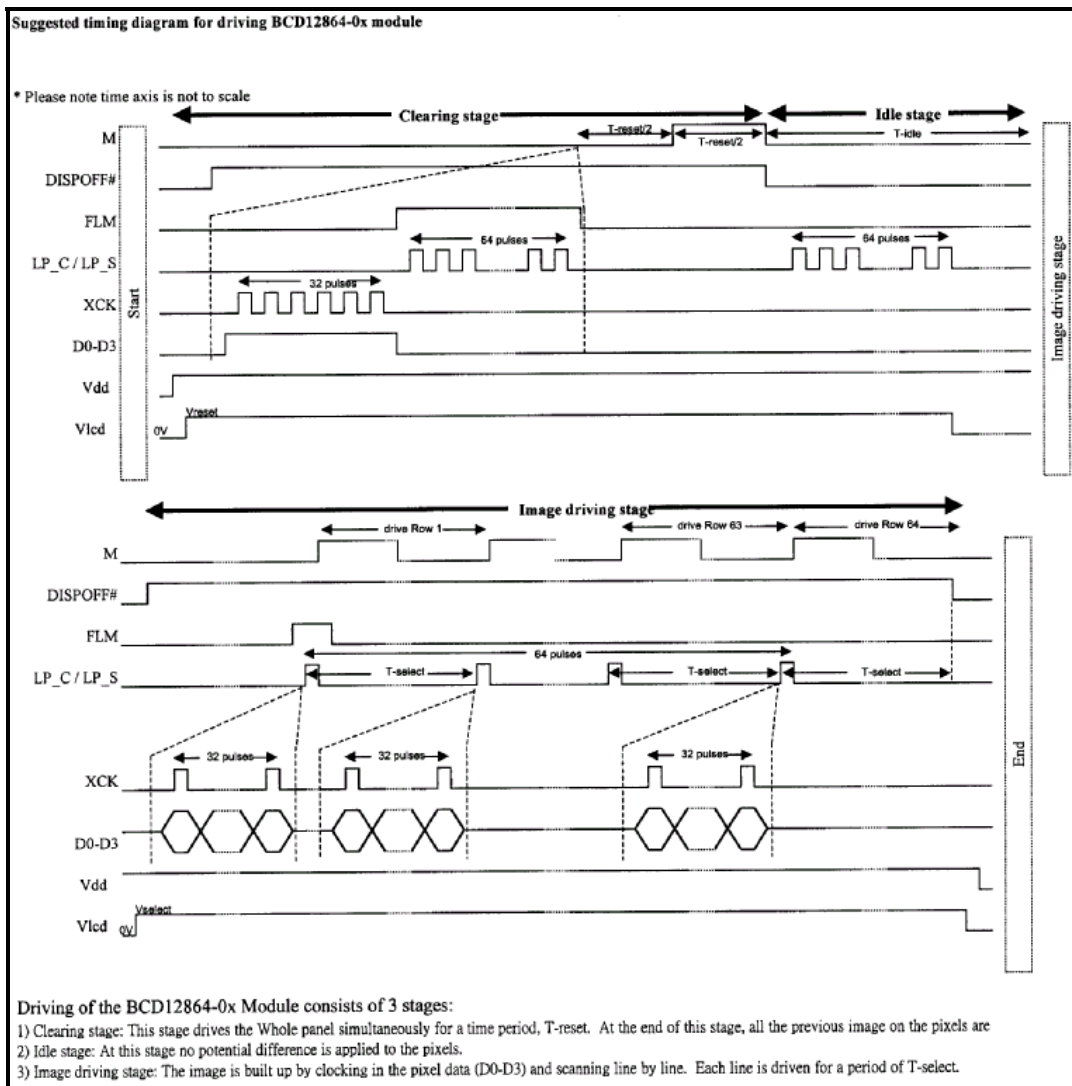

Figure 5: Timing Diagram

A set of reference parameters for the timing diagram are as follows:

Vdd = +5V, Vreset = Vselect = -23V

T-idle = 30ms

Table 8

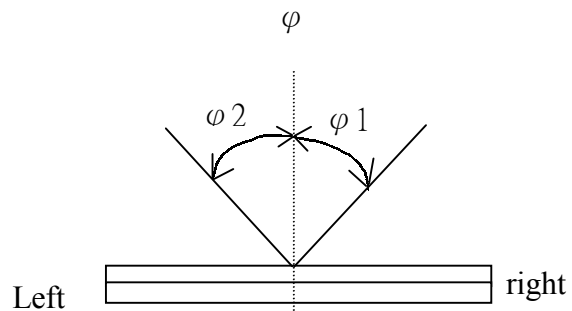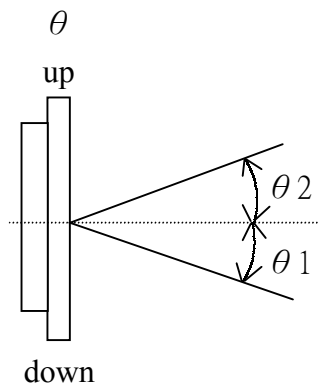| Temperature (^{o}C)	T-reset (ms)	T-select (ms)
-30	4000	2000
-25	1600	800
-20	1000	400
-15	660	220
-10	340	150
0	160	70
≥10	100	30

8. Optical Characteristics Definition

8.1 Viewing Angle

8.2 Contrast Ratio

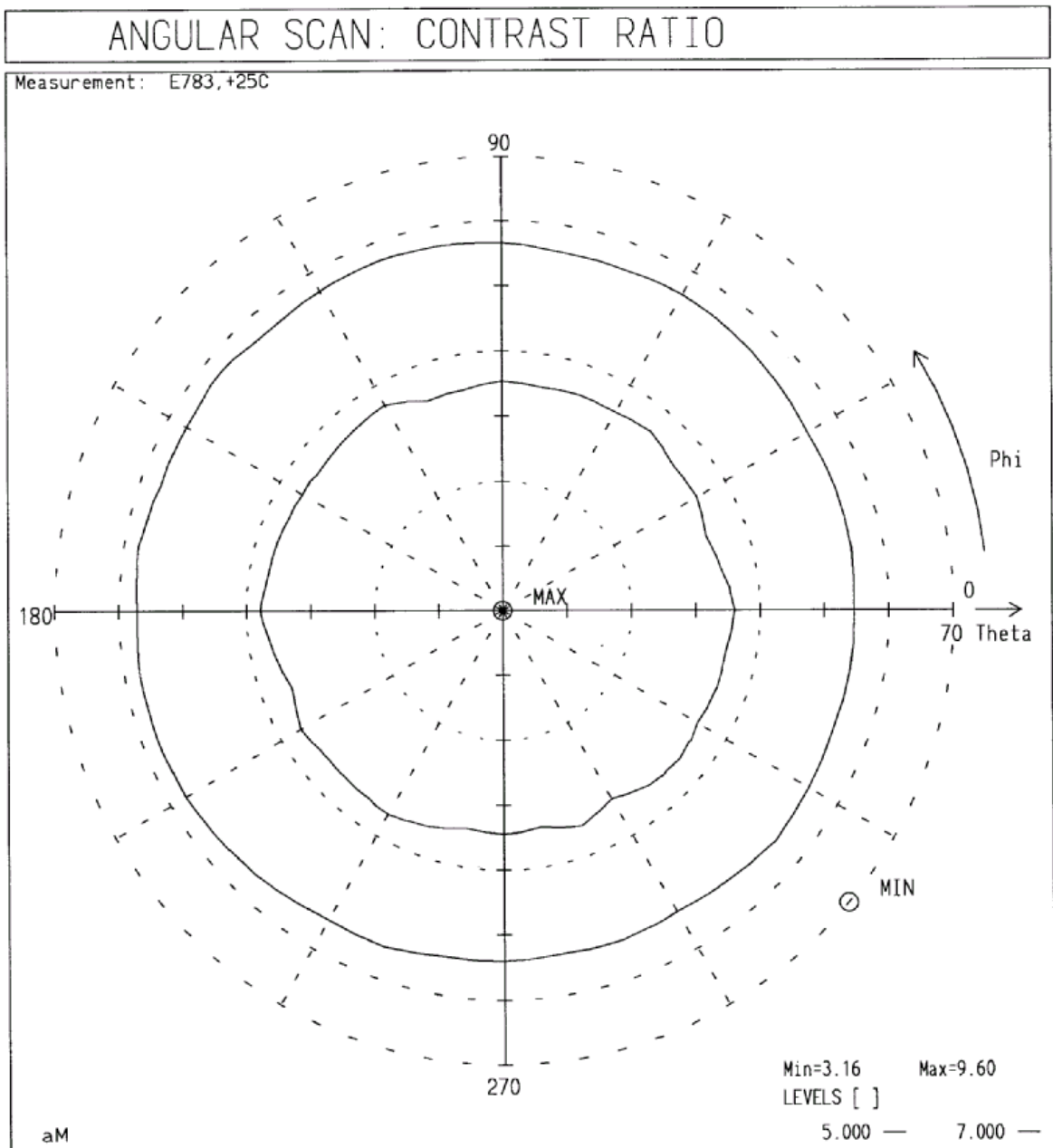B1 = pixel luminance at stable dark state

B2 = pixel luminance at stable bright state

Contrast Ratio = B2/B1

8.3 Angular Scan

The chart below shows the angular scan of the panel. As can be observed even a CR of above 3 is attainable at incident angles of greater than 70degrees.

Due to hardware limitation, the maximum measurable angle is 70°.

Figure 6: The Chart for Angular Scan: Contrast Ratio

9. Optical Characteristics at 25°C

Table 9

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
Scanning time	-	-	~2	-	sec	VDD=5V, VLCD=-23V, @25°C
Reflectance	-	-	-	33	%	-
Contrast ratio	CR	-	-	9.6	-	-
Viewing angle CR $\geqq$ 2	-	-	-	>70	degrees	-

10. LCD Cosmetic Conditions

a.) Reference document follow TBD.

b.) LCD size of the product is TBD.

11. Remark

a. Identification labels will be stuck on the module without obstructing the viewing area of display.

b. A demo kit is for BCD12864 module is available, where an MCU performs the functions of the LCD controller and interface with a flash memory (where pre-stored bitmaps can be called up). The demo kit takes a 9V power input and generates all the needed power levels for the BCD module. The images are refreshed by pushing the buttons on the side of the Kit.

"Varitronix Limited reserves the right to change this specification."
FAX:(852) 2343-9555.
URL:http://www.varitronix.com

- END -