Crystal Clear Technology

Product Specification

G32160x03xxx00

(WITH CHINESE CHARACTER OPTION)

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1.0 Table of Contents

2.0 Record of revision

Rev	Date	Item	Page	Comment	Originator	Checked By
1.0	15/09/10			Initial Release	SCChong	Azhar
2.0	22/07/11			Add Character ROM	SCChong	Azhar

3.0 General specification

Display format: Graphics 160 (w) x 32 (h) dots

Dot size: 0.57 (w) x 0.57 (h) mm

Dot pitch: 0.60 (w) x 0.60 (h) mm

View area: 99.0 (w) x 24.0 (h) mm

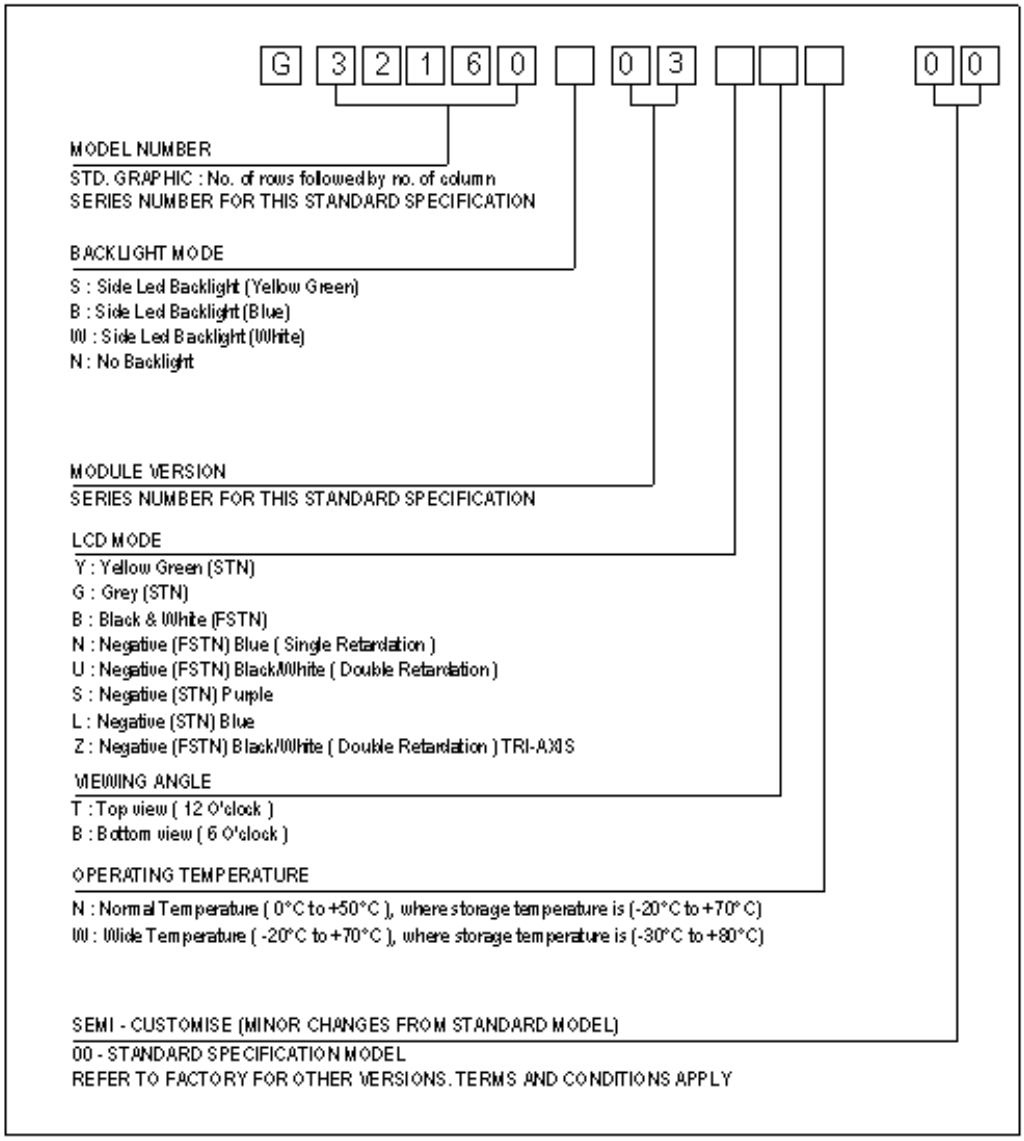
Active area: 95.97 (w) x 19.17 (h) mm

General dimensions: 122.0 (w) x 44.0 (h) x 13.6 max (t) mm

Controller/Driver: ST7920-0B and ST7921 or equivalent

Interface: Parallel

Driving method: 1/32 duty



4.0 Absolute maximum rating (at Vss = 0V, ambient temperature = 25°C)

NO	ITEM	SIMBOL	MIN	MAX	UNIT
1.	Power Supply Voltage (Logic)	V_{DD} - V_{SS}	-0.3	6.0	V
2.	Power Supply Voltage (LCD Driver)	V_{DD} – V_{EE}	-0.3	7.0	V
3.	Operating Temperature	T_{op}	Refer page 3		°C
4.	Storage Temperature	T_{st}	Refer page 3		°C

5.0 Electrical characteristics

NO	ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
1.	Power Supply Voltage (Logic)	V_{DD} – V_{SS}	-		5.0	5.5	V
2.	Power Supply Voltage (V_{LCD})	V_{DD}-V_{EE}	25°C	4.7±5%			V
3.	Input Voltage	V_{IH}	-	0.7 V_{DD}	-	V_{DD}	V
		V_{IL}		-0.3	-	0.6	
4.	Current Supply	I_{DD}	V_{DD} - V_{SS} = 5V V_{DD} – V_{EE} = 5V	-	0.8	1.0	mA

5.1 Backlight Options

NO	COLOR	FORWARD VOLTAGE (V)			FORWARD CURRENT (mA)			MIN BRIGHTNESS (cd/m2) *
		Min	Typ.	Max	Min	Typ.	Max	
1.	White	-	5.0	-	-	40	50	200

*Note : 1. Brightness measured at backlight surface.
2. On LCD surface, brightness is only about 10% to 15% of backlight brightness.
3. Backlight lifetime : For White, Green = 20K hrs *
*(Condition: If = typical current and Ta = 25ºC)

6.0 Environmental requirements

NO	ITEM	CONDITION
1.	Operating Temperature	Refer page 3
2.	Storage Temperature	Refer page 3
3.	Operating Humidity	5% to 95%RH
4.	Cycle Test	0 C @ 30 min to 50 C @ 30min for 1 cycle run for 10 cycles
5.	Lifetime	50000 HOURS (excluding backlight)

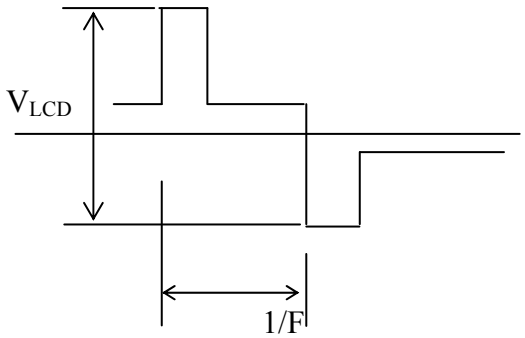
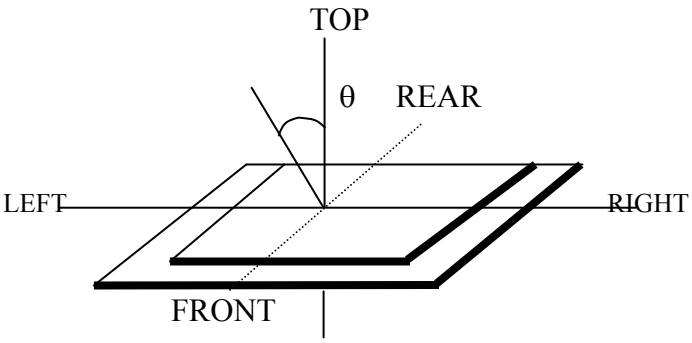
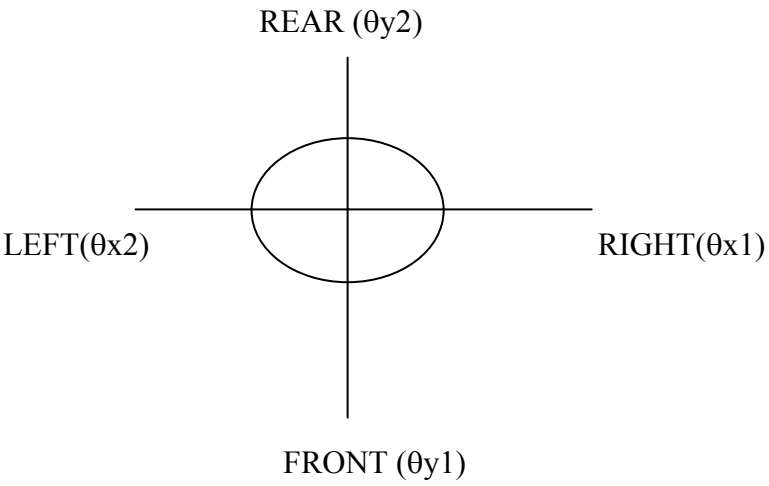
Note: The background on LCD has the possibility to be changed in different temperature range.

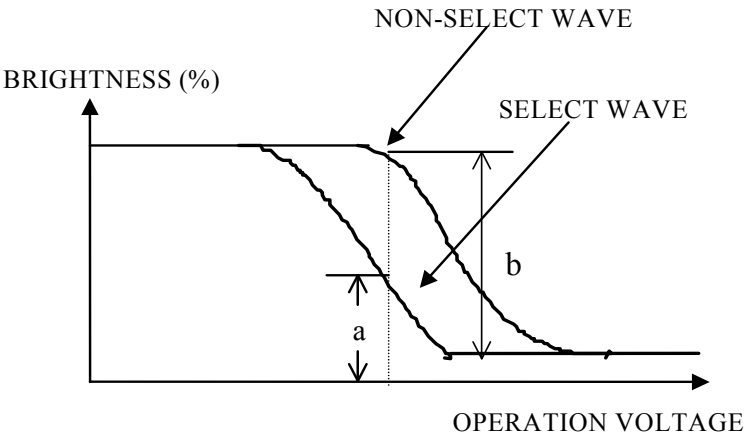
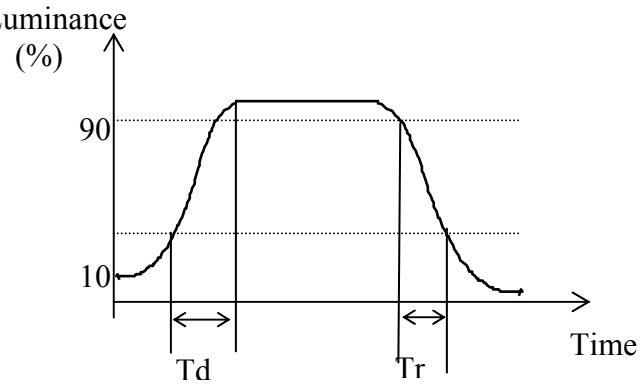
7.0 Electro-optical characteristics (at ambient temperature, Ta = 25°C)

NO	ITEM	SYMBOL	CONDITION	LCD TYPE							REF.
				STN YG	STN GREY	STN -VE BLUE/ PURPLE	FSTN +VE B/W	FSTN –VE BLUE	FSTN -VE TRUE B/W	FSTN -VE TRI AXIS	
1	Operating Voltage (Volt)	V_{LCD}	θ = 0 Cr = max	4.7 ± 5%							7.1
2	Viewing Angle (Deg)	θ x 1	CR ≥ 2 V_{LCD} = 4.7V	+25	+20	+35	+25	+35	+35	+40	7.2
		θ x 2		-25	-20	-35	-25	-35	-40	-40	
		θ y 1		-30	-25	-35	-30	-35	-35	-50	
		θ y 2		+30	+25	+35	+30	+35	+35	+30	
3	Contrast Ratio	CR	θ = 0^0 V_{LCD} =4.7V	3.0	2.3	6.0	3.0	6.0	20	20	7.3
4	Response Time (msec)	Rise Time (Tr)	θ = 0^0	200							7.4
		Decay Time (Td)	θ = 0^0	250							

Note:

1. Viewing angle data is based on bottom view product by default. Should it be a top view product, values are then swap.
2. Contrast ratio is based on typical data when using white colour as backlight.
3. Equipment Used Eldim; Ez Contrast 120R , Spot Size = 2mm

NO	CHARACTERISTICS	DEFINITIONS
7.1	***Definition of Operating Voltage (V_{LCD})***	 V_{LCD} : Operating Voltage F : Frame Frequency
7.2	***Definition of Viewing Angle***	 

7.3	***Definition of Contrast Ratio***	 Contrast Ratio = Brightness of non-selected state (b) / Brightness of selected state (a) ***Conditions*** (a) Operating Voltage: V_{LCD} (b) Temperature: 25°C (c) Viewing Angle, $\theta = 0^o$
7.4	***Response Time***	 Tr: Measured between 10% and 90% of LCD segment maximum response with $V_{ON.}$ Td: With voltage switches to zero and the instant LCD segment reaches 10% of its maximum response.

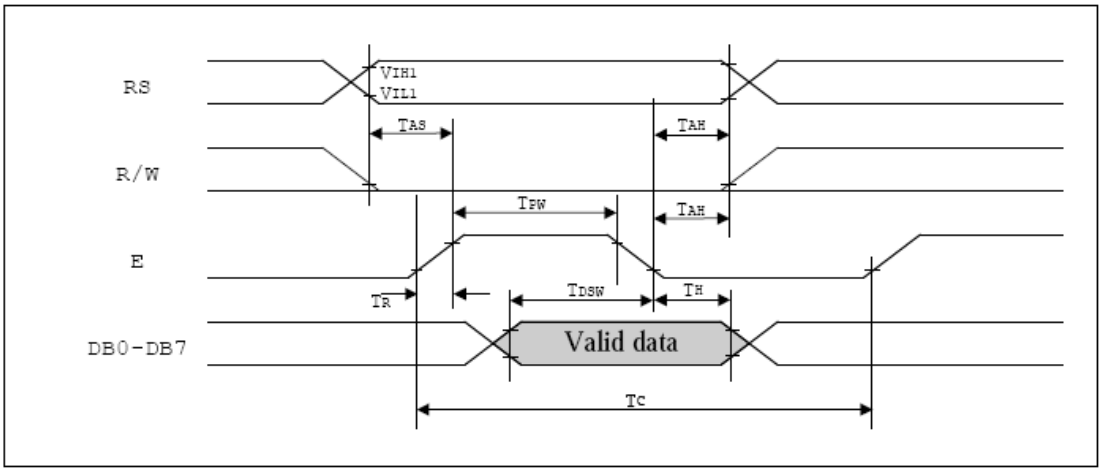
8.0 Interface

8.1	***Controller***	ST7920-0B OR EQUIVALENT	
8.2	***Display Driver***	ST7921 OR EQUIVALENT	
8.3	***Duty Cycle***	1/32	
8.4	***Pin-out Assignments***		
	Pin No	**Symbol**	**Description**
	1	V_{SS}	Ground terminal of module
	2	V_{DD}	Supply terminal of module
	3	V_{ADJ}	Power supply for Liquid Crystal Drive
	4	RS	**Parallel Mode:** Register select. 0: Select instruction register (write) or busy flag, address counter (read); 1: Select data register (write/read).
	5	R/W	**Parallel Mode:** Read/Write control. 0: Write; 1: Read.
	6	E	**Parallel Mode:** 1: Enable trigger.
	7 to 14	DB0 to DB7	Data bus line
	15	A	Backlight supply
	16	K	Backlight ground

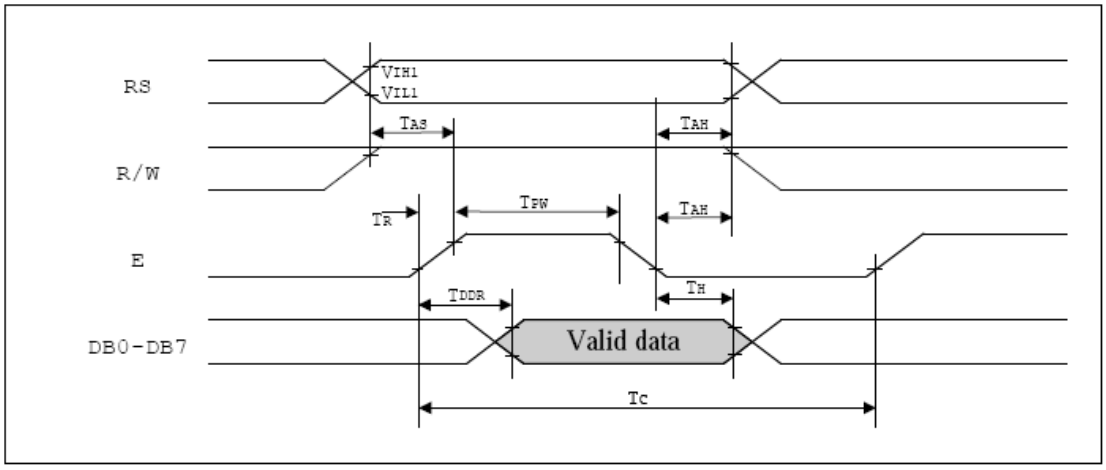
9.0 Functional Descriptions

9.1 Display Control Timing Waveform and Characteristics

9.1.1 MPU Write Data to ST7920



9.1.2 MPU Read Data from ST7920

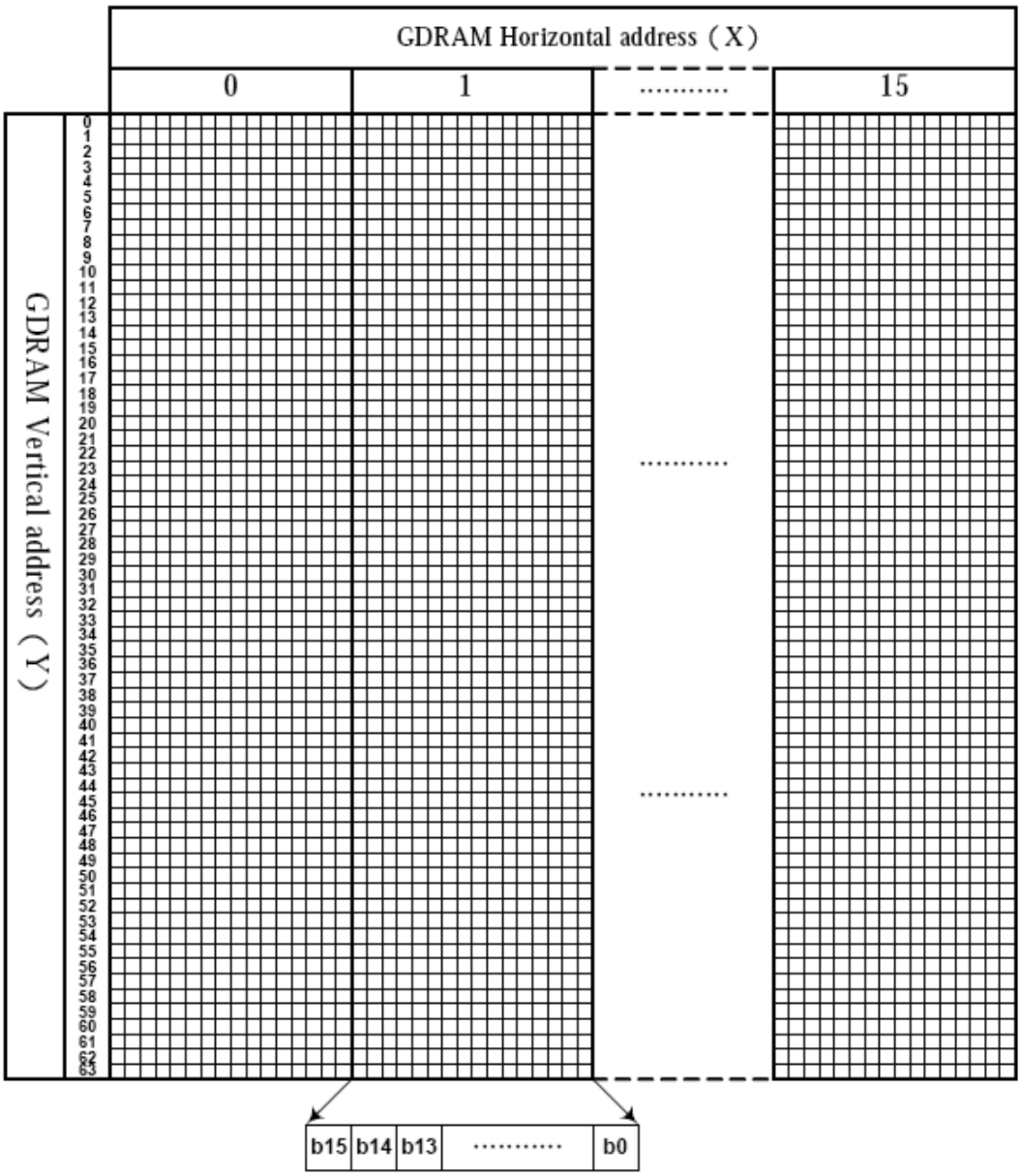


AC Characteristics (T_A = -30℃ ~ 85℃, V_{DD} = 4.5V) Parallel Mode Interface

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
Internal Clock Operation						
f_{OSC}	OSC Frequency	R = 33KΩ	480	540	600	KHz
External Clock Operation						
f_{EX}	External Frequency	-	480	540	600	KHz
	Duty Cycle	-	45	50	55	%
T_R, T_F	Rise/Fall Time	-	-	-	0.2	μs
Write Mode (Writing data from MPU to ST7920)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	140	-	-	ns
T_R, T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	10	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	20	-	-	ns
T_{DSW}	Data Setup Time	Pins: DB0 - DB7	40	-	-	ns
T_H	Data Hold Time	Pins: DB0 - DB7	20	-	-	ns
Read Mode (Reading Data from ST7920 to MPU)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	140	-	-	ns
T_R, T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	10	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	20	-	-	ns
T_{DDR}	Data Delay Time	Pins: DB0 - DB7	-	-	100	ns
T_H	Data Hold Time	Pins: DB0 - DB7	20	-	-	ns
Interface Mode with LCD Driver(ST7921)						
T_{CWH}	Clock Pulse with High	Pins: CL1, CL2	800	-	-	ns
T_{CWL}	Clock Pulse with Low	Pins: CL1, CL2	800	-	-	ns
T_{CST}	Clock Setup Time	Pins: CL1, CL2	500	-	-	ns
T_{SU}	Data Setup Time	Pin: D	300	-	-	ns
T_{DH}	Data Hold Time	Pin: D	300	-	-	ns
T_{DM}	M Delay Time	Pin: M	-1000	-	1000	ns

Timing Interface with 6800 series MPU

9.2 Relationship between GDRAM display coordinates and corresponding address



10. Instruction Set

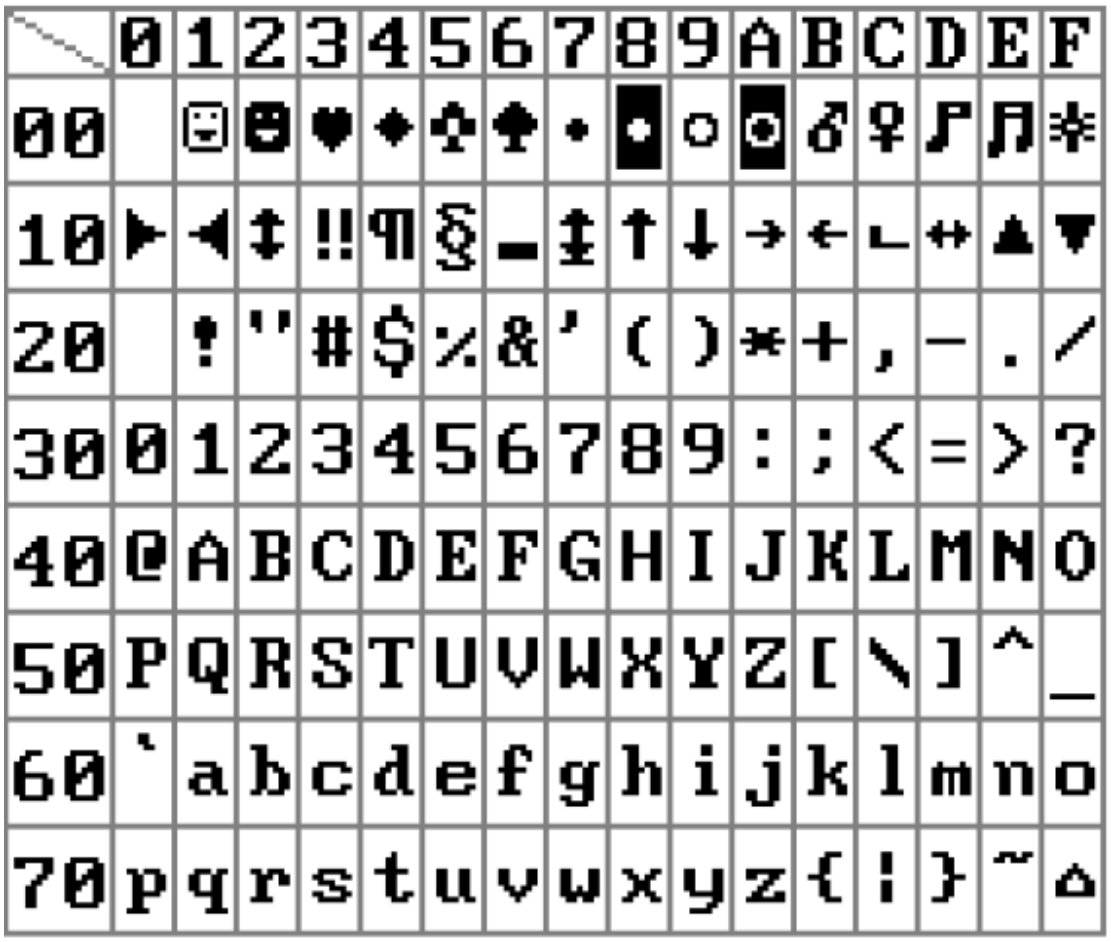
Instruction Set 1: (RE=0: Basic Instruction)

Inst.	Code										Description	Exec time (540KHZ)
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Display Clear	0	0	0	0	0	0	0	0	0	1	Fill DDRAM with "20H" and set DDRAM address counter (AC) to "00H".	1.6 ms
Return Home	0	0	0	0	0	0	0	0	1	X	Set DDRAM address counter (AC) to "00H", and put cursor to origin ：the content of DDRAM are not changed	72 us
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Set cursor position and display shift when doing write or read operation	72 us
Display Control	0	0	0	0	0	0	1	D	C	B	D=1: Display ON C=1: Cursor ON B=1: Character Blink ON	72 us
Cursor Display Control	0	0	0	0	0	1	S/C	R/L	X	X	Cursor position and display shift control; the content of DDRAM are not changed	72 us
Function Set	0	0	0	0	1	DL	X	0 RE	X	X	DL=1 8-bit interface DL=0 4-bit interface **RE=1: extended instruction** **RE=0: basic instruction**	72 us
Set CGRAM Address.	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address to address counter (AC) **Make sure that in extended instruction SR=0 (scroll or RAM address select)**	72 us
Set DDRAM Address.	0	0	1	0 AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address to address counter (AC) AC6 is fixed to 0	72 us
Read Busy Flag (BF) & AC.	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Read busy flag (BF) for completion of internal operation, also Read out the value of address counter (AC)	0 us
Write RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data to internal RAM (DDRAM/CGRAM/GDRAM)	72 us
Read RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM/GDRAM)	72 us

Instruction set 2: (RE=1: extended instruction)

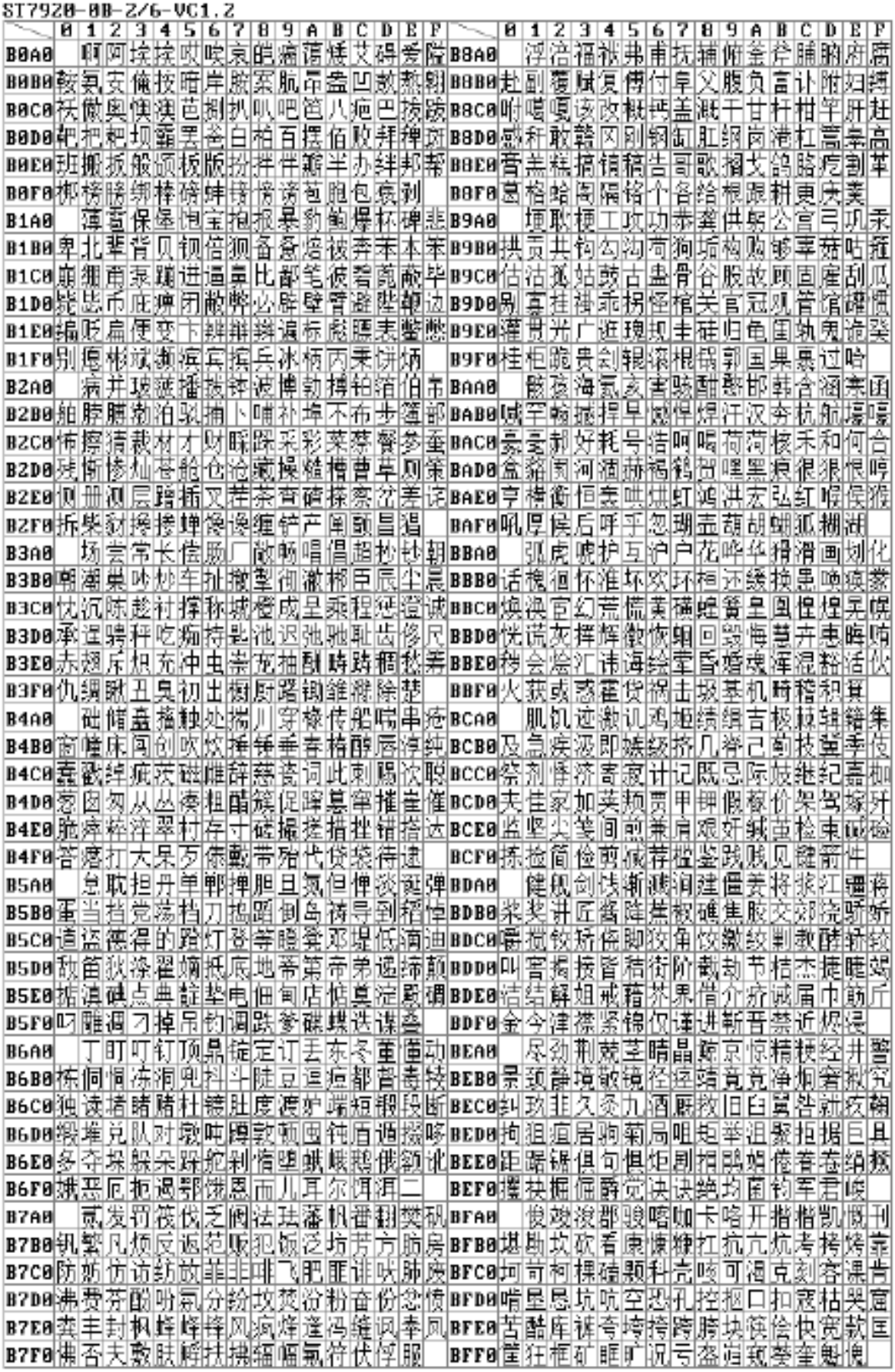
Inst.	Code										Description	Exec time (540KHZ)
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Standby	0	0	0	0	0	0	0	0	0	1	Enter standby mode, any other instruction can terminate. COM1…32 are halted.	72 us
Scroll or RAM Address. Select	0	0	0	0	0	0	0	0	1	SR	SR=1: enable vertical scroll position SR=0: enable CGRAM address **(basic instruction)**	72 us
Reverse (by line)	0	0	0	0	0	0	0	1	R1	R0	Select 1 out of 4 line (in DDRAM) and decide whether to reverse the display by toggling this instruction **R1,R0 initial value is 0,0**	72 us
Extended Function Set	0	0	0	0	1	DL	X	1 RE	G	0	DL=1 :8-bit interface DL=0 :4-bit interface **RE=1: extended instruction set** **RE=0: basic instruction set** G=1 :graphic display ON G=0 :graphic display OFF	72 us
Set Scroll Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	SR=1: AC5~AC0 the address of vertical scroll	72 us
Set Graphic Display RAM Address	0	0	1	0 0	0 AC5	0 AC4	AC3 AC3	AC2 AC2	AC1 AC1	AC0 AC0	Set GDRAM address to address counter (AC) Set the vertical address first and followed the horizontal address by consecutive writings Vertical address range: AC5…AC0 Horizontal address range: AC3…AC0	72 us

10.1 Character ROM with alphanumerical fonts (16 x 8 dots)



10.2 Character ROM with Chinese fonts (16 x 16 dots)

ST7920-0B-2/6-VC1.2

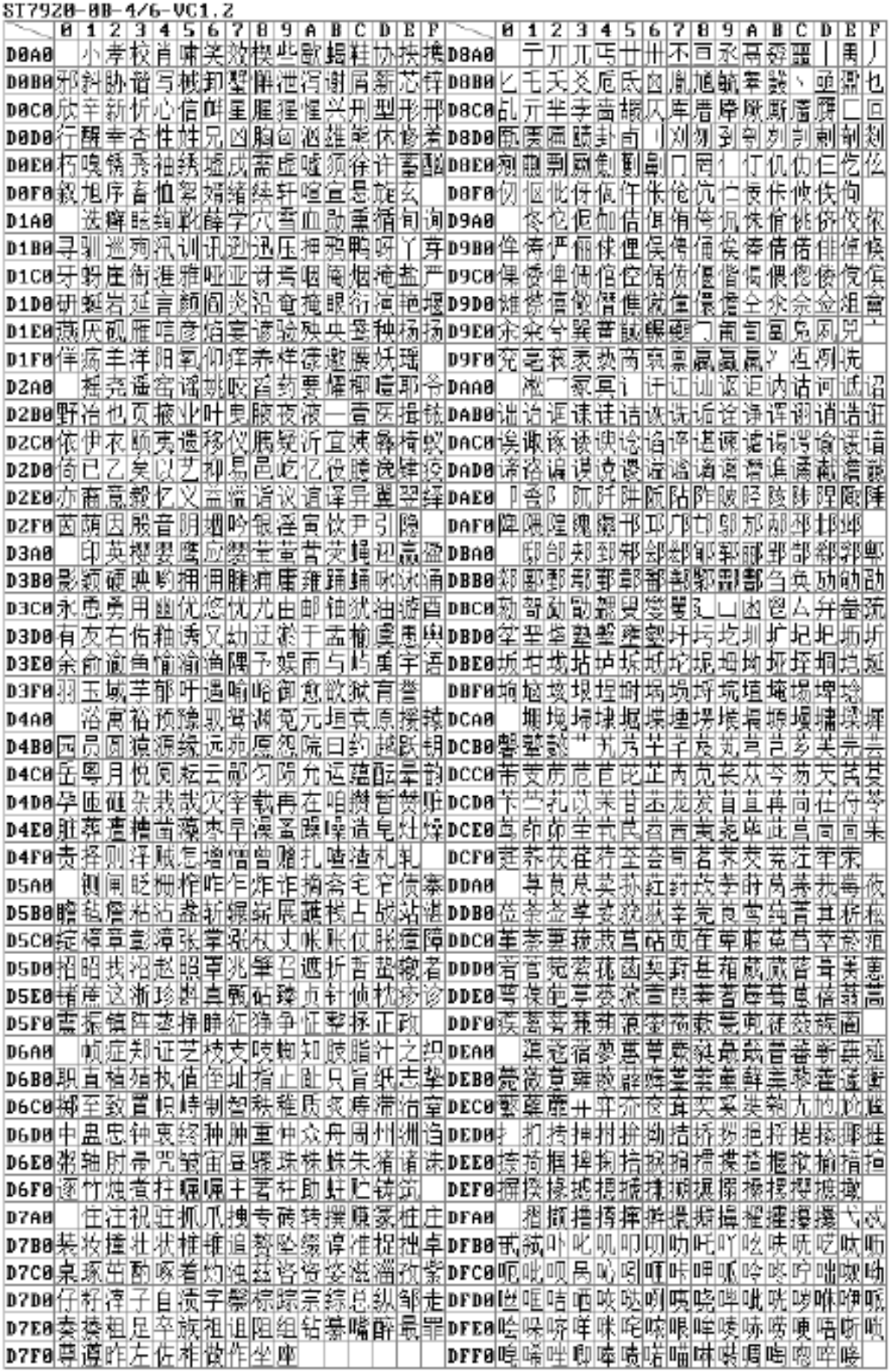


ST7920-0B-3/6-VC1.2

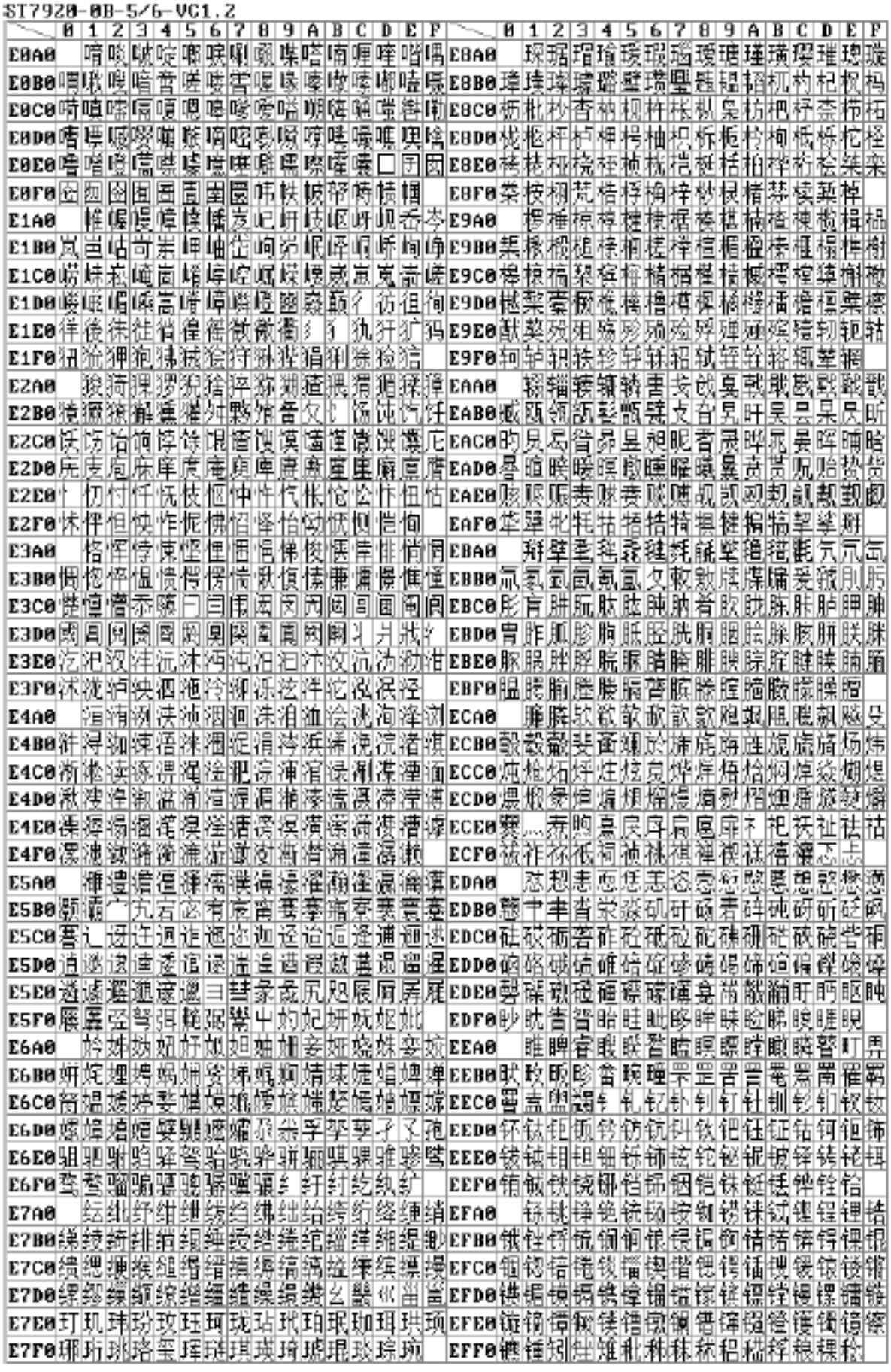
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
C0A0		愦	愧	愦	坤	昆	捆	困	括	扩	廓	阔	垃	拉	喇	蜡
C0B0	腊	辣	啦	莱	来	赖	蓝	婪	栏	拦	篮	阑	兰	澜	谰	揽
C0C0	览	懒	缆	烂	滥	琅	榔	狼	廊	郎	朗	浪	捞	劳	牢	老
C0D0	佬	姥	酪	烙	涝	勒	乐	雷	镭	蕾	磊	累	儡	垒	擂	肋
C0E0	类	泪	棱	楞	冷	厘	梨	犁	黎	篱	狸	离	漓	理	李	里
C0F0	鲤	礼	莉	荔	吏	栗	丽	厉	励	砾	历	利	傈	例	俐	
C1A0		痢	立	粒	沥	隶	力	璃	哩	俩	联	莲	连	镰	廉	怜
C1B0	涟	帘	敛	脸	链	恋	炼	练	粮	凉	梁	粱	良	两	辆	量
C1C0	晾	亮	谅	撩	聊	僚	疗	燎	寥	辽	潦	了	撂	镣	廖	料
C1D0	列	裂	烈	劣	猎	琳	林	磷	霖	临	邻	鳞	淋	凛	赁	吝
C1E0	拎	玲	菱	零	龄	铃	伶	羚	凌	灵	陵	岭	领	另	令	溜
C1F0	琉	榴	硫	馏	留	刘	瘤	流	柳	六	龙	聋	咙	笼	窿	
C2A0		隆	垄	拢	陇	楼	娄	搂	篓	漏	陋	芦	卢	颅	庐	炉
C2B0	掳	卤	虏	鲁	麓	碌	露	路	赂	鹿	潞	禄	录	陆	戮	驴
C2C0	吕	铝	侣	旅	履	屡	缕	虑	氯	律	率	滤	绿	峦	挛	孪
C2D0	滦	卵	乱	掠	略	抡	轮	伦	仑	沦	纶	论	萝	螺	罗	逻
C2E0	锣	箩	骡	裸	落	洛	骆	络	妈	麻	玛	码	蚂	马	骂	嘛
C2F0	吗	埋	买	麦	卖	迈	脉	瞒	馒	蛮	满	蔓	曼	慢	漫	
C3A0		谩	芒	茫	盲	氓	忙	莽	猫	茅	锚	毛	矛	铆	卯	茂
C3B0	冒	帽	貌	贸	么	玫	枚	梅	酶	霉	煤	没	眉	媒	镁	每
C3C0	美	昧	寐	妹	媚	门	闷	们	萌	蒙	檬	盟	锰	猛	梦	孟
C3D0	眯	醚	靡	糜	迷	谜	弥	米	秘	觅	泌	蜜	密	幂	棉	眠
C3E0	绵	冕	免	勉	娩	缅	面	苗	描	瞄	藐	秒	渺	庙	妙	蔑
C3F0	灭	民	抿	皿	敏	悯	闽	明	螟	鸣	铭	名	命	谬	摸	
C4A0		摹	蘑	模	膜	磨	摩	魔	抹	末	莫	墨	默	沫	漠	寞
C4B0	陌	谋	牟	某	拇	牡	亩	姆	母	墓	暮	幕	募	慕	木	目
C4C0	睦	牧	穆	拿	哪	呐	钠	那	娜	纳	氖	乃	奶	耐	奈	南
C4D0	男	难	囊	挠	脑	恼	闹	淖	呢	馁	内	嫩	能	妮	霓	倪
C4E0	泥	尼	拟	你	匿	腻	逆	溺	蔫	拈	年	碾	撵	捻	念	娘
C4F0	酿	鸟	尿	捏	聂	孽	啮	镊	镍	涅	您	柠	狞	凝	宁	
C5A0		拧	泞	牛	扭	钮	纽	脓	浓	农	弄	奴	努	怒	女	暖
C5B0	虐	疟	挪	懦	糯	诺	哦	欧	鸥	殴	藕	呕	偶	沤	啪	趴
C5C0	爬	帕	怕	琶	拍	排	牌	徘	湃	派	攀	潘	盘	磐	盼	畔
C5D0	判	叛	乓	庞	旁	耪	胖	抛	咆	刨	炮	袍	跑	泡	呸	胚
C5E0	培	裴	赔	陪	配	佩	沛	喷	盆	砰	抨	烹	澎	彭	蓬	棚
C5F0	硼	篷	膨	朋	鹏	捧	碰	坯	砒	霹	批	披	劈	琵	毗	
C6A0		啤	脾	疲	皮	匹	痞	僻	屁	譬	篇	偏	片	骗	飘	漂
C6B0	瓢	票	撇	瞥	拼	频	贫	品	聘	乒	坪	苹	萍	平	凭	瓶
C6C0	评	屏	坡	泼	颇	婆	破	魄	迫	粕	剖	扑	铺	仆	莆	葡
C6D0	菩	蒲	埔	朴	圃	普	浦	谱	曝	瀑	期	欺	栖	戚	妻	七
C6E0	凄	漆	柒	沏	其	棋	奇	歧	畦	崎	脐	齐	旗	祈	祁	骑
C6F0	起	岂	乞	企	启	契	砌	器	气	迄	弃	汽	泣	讫	掐	
C7A0		恰	洽	牵	扦	钎	铅	千	迁	签	仟	谦	乾	黔	钱	钳
C7B0	前	潜	遣	浅	谴	堑	嵌	欠	歉	枪	呛	腔	羌	墙	蔷	强
C7C0	抢	橇	锹	敲	悄	桥	瞧	乔	侨	巧	鞘	撬	翘	峭	俏	窍
C7D0	切	茄	且	怯	窃	钦	侵	亲	秦	琴	勤	芹	擒	禽	寝	沁
C7E0	青	轻	氢	倾	卿	清	擎	晴	氰	情	顷	请	庆	琼	穷	秋
C7F0	丘	邱	球	求	囚	酋	泅	趋	区	蛆	曲	躯	屈	驱	渠	

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
C8A0		取	娶	龋	趣	去	圈	颧	权	醛	泉	全	痊	拳	犬	券
C8B0	劝	缺	炔	瘸	却	鹊	榷	确	雀	裙	群	然	燃	冉	染	瓤
C8C0	壤	攘	嚷	让	饶	扰	绕	惹	热	壬	仁	人	忍	韧	任	认
C8D0	刃	妊	纫	扔	仍	日	戎	茸	蓉	荣	融	熔	溶	容	绒	冗
C8E0	揉	柔	肉	茹	蠕	儒	孺	如	辱	乳	汝	入	褥	软	阮	蕊
C8F0	瑞	锐	闰	润	若	弱	撒	洒	萨	腮	鳃	塞	赛	三	叁	
C9A0		伞	散	桑	嗓	丧	搔	骚	扫	嫂	瑟	色	涩	森	僧	莎
C9B0	砂	杀	刹	沙	纱	傻	啥	煞	筛	晒	珊	苫	杉	山	删	煽
C9C0	衫	闪	陕	擅	赡	膳	善	汕	扇	缮	墒	伤	商	赏	晌	上
C9D0	尚	裳	梢	捎	稍	烧	芍	勺	韶	少	哨	邵	绍	奢	赊	蛇
C9E0	舌	舍	赦	摄	射	慑	涉	社	设	砷	申	呻	伸	身	深	娠
C9F0	绅	神	沈	审	婶	甚	肾	慎	渗	声	生	甥	牲	升	绳	
CAA0		省	盛	剩	胜	圣	师	失	狮	施	湿	诗	尸	虱	十	石
CAB0	拾	时	什	食	蚀	实	识	史	矢	使	屎	驶	始	式	示	士
CAC0	世	柿	事	拭	誓	逝	势	是	嗜	噬	适	仕	侍	释	饰	氏
CAD0	市	恃	室	视	试	收	手	首	守	寿	授	售	受	瘦	兽	蔬
CAE0	枢	梳	殊	抒	输	叔	舒	淑	疏	书	赎	孰	熟	薯	暑	曙
CAF0	署	蜀	黍	鼠	属	术	述	树	束	戍	竖	墅	庶	数	漱	
CBA0		恕	刷	耍	摔	衰	甩	帅	栓	拴	霜	双	爽	谁	水	睡
CBB0	税	吮	瞬	顺	舜	说	硕	朔	烁	斯	撕	嘶	思	私	司	丝
CBC0	死	肆	寺	嗣	四	伺	似	饲	巳	松	耸	怂	颂	送	宋	讼
CBD0	诵	搜	艘	擞	嗽	苏	酥	俗	素	速	粟	僳	塑	溯	宿	诉
CBE0	肃	酸	蒜	算	虽	隋	随	绥	髓	碎	岁	穗	遂	隧	祟	孙
CBF0	损	笋	蓑	梭	唆	缩	琐	索	锁	所	塌	他	它	她	塔	
CCA0		獭	挞	蹋	踏	胎	苔	抬	台	泰	酞	太	态	汰	坍	摊
CCB0	贪	瘫	滩	坛	檀	痰	潭	谭	谈	坦	毯	袒	碳	探	叹	炭
CCC0	汤	塘	搪	堂	棠	膛	唐	糖	倘	躺	淌	趟	烫	掏	涛	滔
CCD0	绦	萄	桃	逃	淘	陶	讨	套	特	藤	腾	疼	誊	梯	剔	踢
CCE0	锑	提	题	蹄	啼	体	替	嚏	惕	涕	剃	屉	天	添	填	田
CCF0	甜	恬	舔	腆	挑	条	迢	眺	跳	贴	铁	帖	厅	听	烃	
CDA0		汀	廷	停	亭	庭	挺	艇	通	桐	酮	瞳	同	铜	彤	童
CDB0	桶	捅	筒	统	痛	偷	投	头	透	凸	秃	突	图	徒	途	涂
CDC0	屠	土	吐	兔	湍	团	推	颓	腿	蜕	褪	退	吞	屯	臀	拖
CDD0	托	脱	鸵	陀	驮	驼	椭	妥	拓	唾	挖	哇	蛙	洼	娃	瓦
CDE0	袜	歪	外	豌	弯	湾	玩	顽	丸	烷	完	碗	挽	晚	皖	惋
CDF0	宛	婉	万	腕	汪	王	亡	枉	网	往	旺	望	忘	妄	威	
CEA0		巍	微	危	韦	违	桅	围	唯	惟	为	潍	维	苇	萎	委
CEB0	伟	伪	尾	纬	未	蔚	味	畏	胃	喂	魏	位	渭	谓	尉	慰
CEC0	卫	瘟	温	蚊	文	闻	纹	吻	稳	紊	问	嗡	翁	瓮	挝	蜗
CED0	涡	窝	我	斡	卧	握	沃	巫	呜	钨	乌	污	诬	屋	无	芜
CEE0	梧	吾	吴	毋	武	五	捂	午	舞	伍	侮	坞	戊	雾	晤	物
CEF0	勿	务	悟	误	昔	熙	析	西	硒	矽	晰	嘻	吸	锡	牺	
CFA0		稀	息	希	悉	膝	夕	惜	熄	烯	溪	汐	犀	檄	袭	席
CFB0	习	媳	喜	铣	洗	系	隙	戏	细	瞎	虾	匣	霞	辖	暇	峡
CFC0	侠	狭	下	厦	夏	吓	掀	锨	先	仙	鲜	纤	咸	贤	衔	舷
CFD0	闲	涎	弦	嫌	显	险	现	献	县	腺	馅	羡	宪	陷	限	线
CFE0	相	厢	镶	香	箱	襄	湘	乡	翔	祥	详	想	响	享	项	巷
CFF0	橡	像	向	象	萧	硝	霄	削	哮	嚣	销	消	宵	淆	晓	

ST7920-0B-4/6-VC1.2

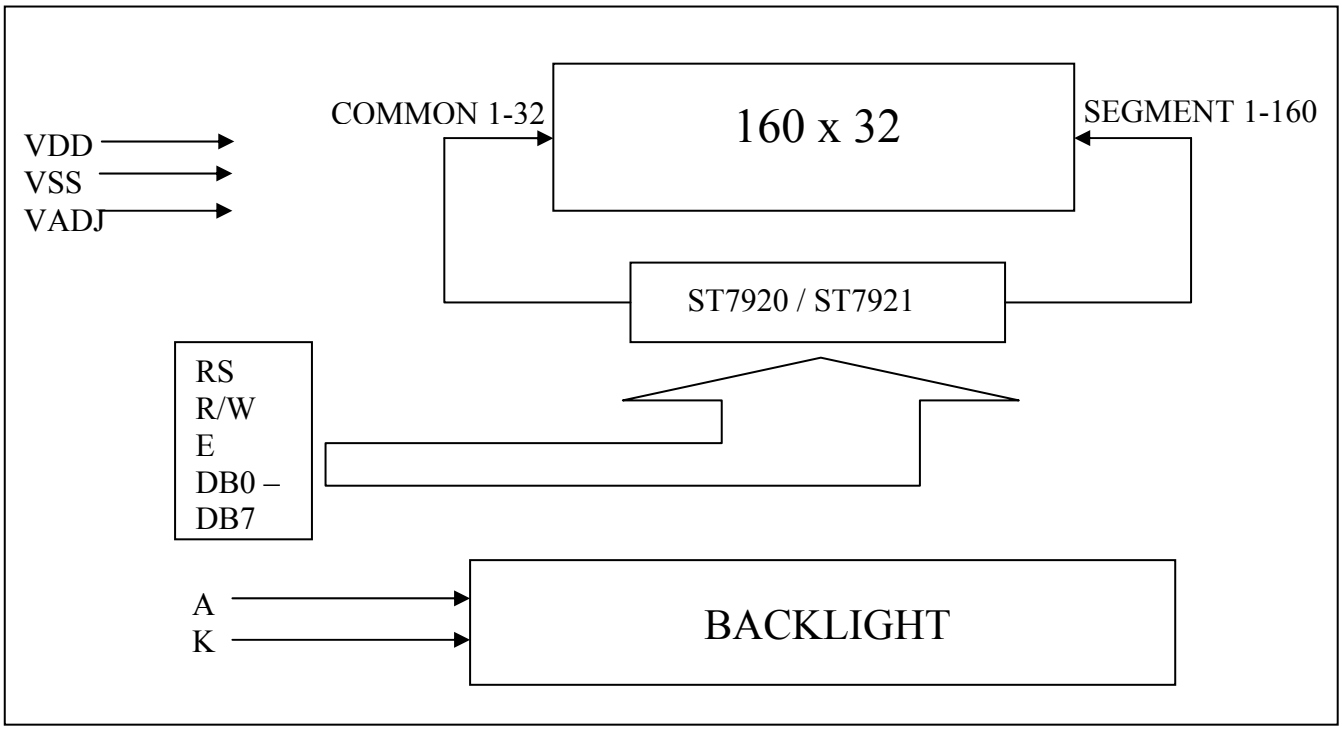


ST7920-0B-5/6-VC1.2

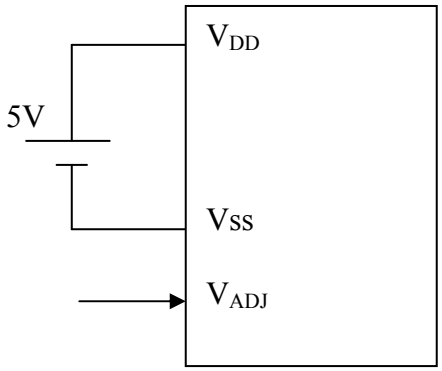


ST7920-0B-6/6-VC1.2

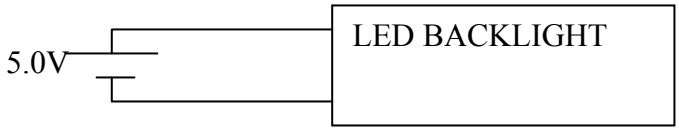
11. Block Diagram and Power Supply



Block Diagram



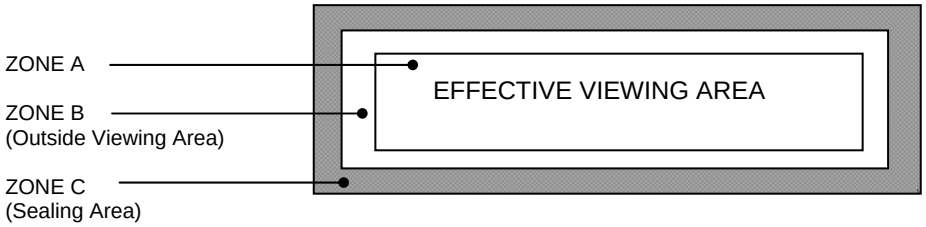
Where V_{DD}-V_{ADJ} = LCD Driving voltage



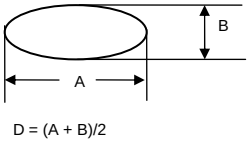
Power Supply

12.0 Quality Assurance

12.1 ZONE DEFINITION



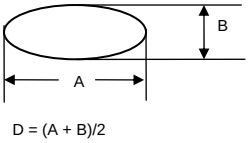
12.1.1 Black Spot, White Spot and Foreign Material

Defect Category	Defect Description	Criterion				Drawing Specification
Black Spot, White Spot and Foreign Material	Black Spot, White Spot and Foreign Material	Zone / Dimension	Acceptable No.			
			A	B	C	
		D ≤ 0.10mm	NC	NC	NC	
		0.10<D ≤ 0.20mm	3	3	NC	
		0.20 < D ≤ 0.30mm	1	2	NC	
		D > 0.30 mm	0	0	NC	
		NC: No count D: Mean Diameter of Defect				

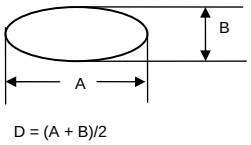
12.1.2 Line Shape and Scratches

Defect Category	Defect Description	Criterion					Drawing Specification
Line shape and scratches	Line shape and scratches	Zone /Dimension		Acceptable No.			
		X	Y	A	B	C	
		-	<0.01mm	NC	NC	NC	
		< 2 mm	< 0.02mm	1	1	NC	
		<1 mm	< 0.0 2mm	1	2	NC	

12.1.3 Pin Hole

Defect Category	Defect Description	Criterion	Drawing Specification
Pin Hole	Pin hole / void at light up segment	D ≤ 0.20mm within 1 part/segment	

12.1.4 Polarizer Bubble/Foreign Material

<table>
<tr><th>Defect Category</th><th>Defect Description</th><th>Criterion</th><th>Drawing Specification</th></tr>
<tr><td></td><td>Polarizer bubble / Foreign material</td><td>
<table>
<tr><td rowspan="2">Zone / Dimension</td><td colspan="3">Acceptable No.</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>D ≤ 0.15mm</td><td>NC</td><td>NC</td><td>NC</td></tr>
<tr><td>0.15 < D ≤ 0.30mm</td><td>3</td><td>5</td><td>NC</td></tr>
<tr><td>0.30 < D ≤ 0.50mm</td><td>2</td><td>3</td><td>NC</td></tr>
<tr><td>0.50 < D ≤ 1.0mm</td><td>0</td><td>1</td><td>NC</td></tr>
<tr><td colspan="4">NC: No count
D: Mean Diameter of Defect
Accept - if air bubble at the seal area does not propagate into effective viewing area</td></tr>
</table>
</td><td> 

D = (A + B)/2</td></tr>
</table>

Note: Total defects shall not exceed five

13. Precaution for using LCM

1. Liquid Crystal Display (LCD)

LCD is made up of glass, organic sealant, organic fluid and polymer based polarizers. The following precautions should be taken when handling.

b) Keep the temperature within the range of use and storage. Excessive temperature and humidity could cause polarization degredation, polarizer peel off or bubble.

c) Do not contact the exposed polarizer with anything harder than HB pencil lead. To clean dust off the display surface, wipe gently with cotton, chamois or other soft material soaked in petroleum benzin.

d) Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or colour fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.

e) Glass can be easily chipped or cracked from rough handling, especially at corners and edges.

f) Do not drive LCD with DC voltage.

2. Liquid Crystal Display Modules.

2.1 Mechanical Considerations

LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modification. The following should be noted.

a) Do not tamper in any way with the tabs on the metal frame.

b) Do not modify the PCB by drilling extra holes, changing its outline, moving its component or modifying its pattern.

c) Do not touch the elastomer connector, especially insert a backlight panel (for example, EL)

d) When mounting a LCM make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.

a) Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels.

2.2 Static Electricity

LCM contains CMOS LSI's and the same precaution for such devices should apply, namely

a) The operator should be grounded whenever he/she comes into contact with the module. Never 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.

b) The modules should be kept in antistatic bags or other containers to static for storage.

c) Only properly grounded soldering irons should be used.

d) If an electric screwdriver is used, it should be well grounded and shielded from commutator spark.

e) The normal static prevention measures should be observed for work clothes and working benches, the latter conductive (rubber) mat is recommended.

f) Since dry air is inductive to statics, a relative humidity of 50-60% is recommended.

2.3 Soldering

a) Solder only to the I/O terminals.

b) Use only soldering irons with proper grounding and no leakage.

c) Soldering temperature: 280 °C

d) Soldering time: 3 to 4 sec

e) Use eutectic solder with resin flux fill.

f) If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed afterwards.

2.4 Operation

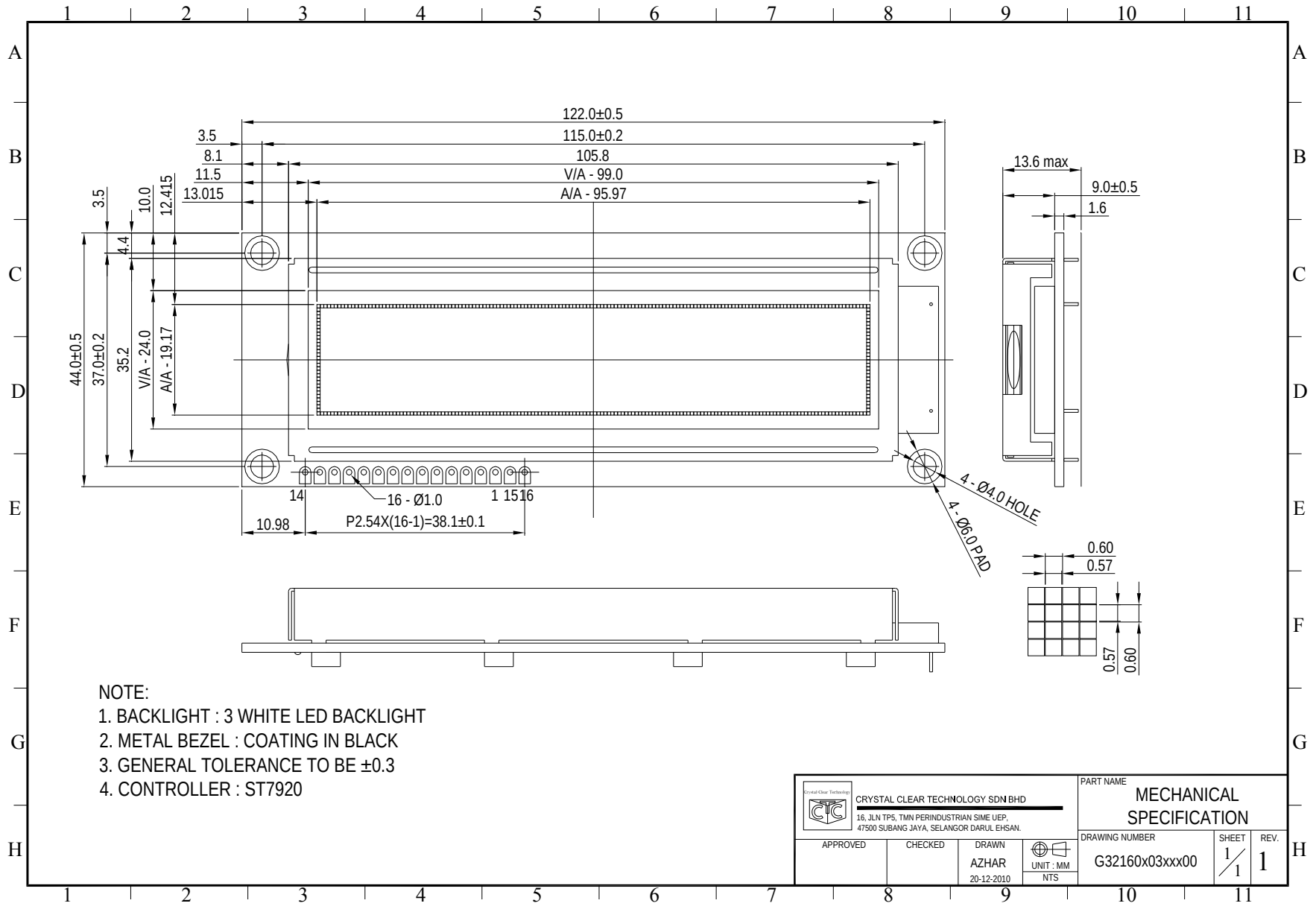
a) The contras can be adjusted by varying the LCD driving voltage V0
b) Driving voltage should be kept within specified range, excess voltage shortens display life.
c) Response time increases with decrease in temperature.
d) Display may turn black or dark blue at temperature above its operational range, this is (however not pressing on the viewing area) may cause the segments to appear "fractured".
e) Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear "fractured".

2.5 Storage

If any fluid leaks out of the damage glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.

2.6 Limited Warranty

Unless otherwise agreed between Crystal Clear Technology and customer, Crystal Clear Technology will replace or repair any of its LCD and LCM which is found to be defective electrically and visually when inspected in accordance with Crystal Clear Technology acceptance standards, for a period of one year from date of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of Crystal Clear Technology is limited to repair and/or replacement on the terms set forth above. Crystal Clear Technology will not responsible for any subsequent or consequential events.



NOTE:
1. BACKLIGHT : 3 WHITE LED BACKLIGHT
2. METAL BEZEL : COATING IN BLACK
3. GENERAL TOLERANCE TO BE ±0.3
4. CONTROLLER : ST7920

CRYSTAL CLEAR TECHNOLOGY SDN BHD 16, JLN TP5, TMN PERINDUSTRIAN SIME UEP, 47500 SUBANG JAYA, SELANGOR DARUL EHSAN.				PART NAME	MECHANICAL SPECIFICATION
APPROVED	CHECKED	DRAWN AZHAR 20-12-2010	UNIT : MM NTS	DRAWING NUMBER G32160x03xxx00	SHEET 1/1 REV. 1

Crystal Clear Technology
16 Jalan TP5—Taman Perindustrian Sime UEP
47600 Subang Jaya—Selangor DE
Malaysia