



1. Brand name: WINSTAR DISPLAY Co.,Ltd.

2. Display Type: H→Character Type, G→Graphic Type  
X→TAB Type, C→Color Type, P→PLED

3. Display Function: 16 words, 2 lines.

4. Model's serial no.

5. Backlight Type:  
N→Without backlight  
B→EL, Blue  
D→EL, Green  
W→EL, White  
Y→LED, Yellow Green  
A→LED, Amber  
R→LED, Red  
G→LED, Green  
T→LED, White  
P→LED, Blue  
F→CCFL, White



6. LCD Mode:  
B→TN Positive, Gray  
N→TN Negative,  
G→STN Positive, Gray  
Y→STN Positive,  
Yellow Green  
M→STN Negative, Blue  
F→FSTN Positive  
T→FSTN Negative

7. LCD Polarizer Type  
/Temperature range  
/Viewing direction  
A→Reflective, N.T., 6:00  
D→Reflective, N.T., 12:00  
G→Reflective, W.T., 6:00  
J→Reflective, W.T., 12:00  
B→Transflective, N.T., 6:00  
E→Transflective, N.T., 12:00  
H→Transflective, W.T., 6:00  
K→Transflective, W.T., 12:00  
C→Transmissive, N.T., 6:00  
F→Transmissive, N.T., 12:00  
I→Transmissive, W.T., 6:00  
L→Transmissive, W.T., 12:00  
\* N.T. : Normal temperature  
\* W.T. : Wide temperature

8. IC Font :  
JS / JP/ JN/JT: English/ Japanese  
EN/ EE/ EU/ EP/ET:  
English/ European  
ES/ EC : English/ European  
C P: English/ Cyrillic  
HS/HP: Hebrew  
MG: Mexico

9. Special Code :  
V : Negative Voltage generator on board  
T : Negative Voltage generator and Temperature compensation generator on board  
TS: Touch Screen  
E : Edge LED backlight



## COLOR TYPE LCM

Display Format Char.xline	Model No.	Outline Dimension (WxH)mm	Effective Viewing Area (WxH)mm	Dot Size (WxH)mm	Dot Pitch (WxH)mm	Driving Method (Duty)	Process Color					Backlight Page			Built-in Controller	Page
							STN COLOR					CCFL				
320x240	WC320x240A	154.6x114.8	118.8x89.38	0.09x0.33	0.12x0.36	1/240	O					O			NO	P13

## CHARACTER TYPE LCM

Display Format Char.xline	Model No.	Outline Dimension (WxH)mm	Effective Viewing Area (WxH)mm	Character Size (WxH)mm	Dot Size (WxH)mm	Driving Method (Duty)	Process Color					Backlight Page			Page
							TN	STN GRAY	STN YELLOW	STN BLUE	FSTN B&W	NONE	LED	EL	
8x2	WH0802A	58.0x32.0	38.0x16.0	2.96x5.56	0.56x0.66	1/16	O	O	O	O		O	O	O	P14
8x2	WH0802C	56x24	36.1x15.1	4.91x3.0	0.56x0.57	1/16	O	O	O			O		O	P15
12x2	WH1202A	55.7x32.0	46.0x14.5	2.65x5.50	0.45x0.60	1/16	O	O	O	O		O	O	O	P16
16x1	WH1601A	80.0x36.0	66.0x16.0	3.07x6.56	0.55x0.75	1/16	O	O	O	O		O	O	O	P17
16x1	WH1601B	85.0x28.0	66.0x16.0	3.07x6.56	0.55x0.75	1/16	O	O	O	O		O	O	O	P18
16x1	WH1601L	122.0x33.0	99.0x13.0	4.84x8.06	0.92x1.10	1/16	O	O	O	O		O	O	O	P19
16x2	WH1602A	84.0x44.0	66.0x16.0	2.95x5.55	0.55x0.65	1/16	O	O	O	O		O	O	O	P20
16x2	WH1602B	80.0x36.0	66.0x16.0	2.96x5.56	0.55x0.65	1/16	O	O	O	O		O	O	O	P21
16x2	WH1602C	85.0x36.0	66.0x16.0	2.96x5.56	0.55x0.65	1/16	O	O	O	O		O	O	O	P22
16x2	WH1602D	85.0x30.0	66.0x16.0	2.96x5.56	0.55x0.65	1/16	O	O	O	O		O	O	O	P23
16x2	WH1602J	80.0x36.0	66.0x16.0	2.96x5.55	0.55x0.65	1/16	O	O	O	O		O	O	O	P24
16x2	WH1602L	122.0x44.0	99.0x24.0	4.84x9.66	0.92x1.10	1/16	O	O	O	O	O	O	O	O	P25
16x2	WH1602M	85.0x32.6	66.0x16.0	2.96x5.56	0.55x0.65	1/16	O	O	O	O		O	O	O	P26
16x2	WH1602O	85.0x25.2	66.0x16.0	2.95x5.95	0.55x0.65	1/16	O	O	O	O	O	O	O	O	P27
16x2	WH1602P	85.0x25.2	66.0x16.0	2.95x5.55	1.55x0.65	1/16	O	O	O	O	O	O	O	O	P28
16x2	WP1602A	84.0x44	66.0x16.0	2.9x5.5	0.5x0.6	1/16	PLED Yellow Green								P29
16x4	WH1604A	87.0x60.0	62.0x26.0	2.95x4.75	0.55x0.55	1/16	O	O	O	O		O	O	O	P30
16x4	WH1604B	70.6x60.0	60.0x32.6	2.95x4.75	0.55x0.55	1/16	O	O	O	O		O		O	P31
20x2	WH2002A	116.0x37.0	85.0x18.6	3.2x5.55	0.6x0.65	1/16	O	O	O	O		O	O	O	P32
20x2	WH2002D	89.0x21.5	75.0x15.0	2.95x5.15	0.55x0.6	1/16		O	O				O		P33
20x2	WH2002L	180.0x40.0	149.0x23.0	6.0x9.66	1.12x1.12	1/16	O	O	O	O		O	O	O	P34
20x2	WH2002M	146.0x43.0	123.0x23.0	4.84x9.22	0.92x1.10	1/16	O	O	O	O		O	O	O	P35
20x2	WP2002A	113x41.4	79x17	3.15x5.5	0.55x0.6	1/16	PLED								P36
20x4	WH2004A/B	98.0x60.0	77.0x25.2	2.95x4.75	0.55x0.55	1/16	O	O	O	O		O	O	O	P37
20x4	WH2004D	77.0x47.0	60.0x22.0	2.30x4.03	0.42x0.46	1/16	O	O	O	O		O	O	O	P38
20x4	WH2004L	146.0x62.5	123.5x43.0	4.84x9.22	0.92x1.10	1/16	O	O	O	O		O	O	O	P39
24x2	WH2402A	118.0x36.0	94.5x16.0	3.2x5.55	0.60x0.65	1/16	O	O	O	O		O	O	O	P40
40x2	WH4002A	182.0x33.5	154.4x16.5	3.2x5.55	0.60x0.65	1/16	O	O	O	O		O	O	O	P41
40x4	WH4004A	190.0x54.0	147.0x29.5	2.78x4.89	0.50x0.55	1/16	O	O	O	O		O	O	O	P42

## GRAPHIC TYPE LCM

Display Format Char.xline	Model No.	Outline Dimension (WxH)mm	Effective Viewing Area (WxH)mm	Dot Size (WxH)mm	Dot Pitch (WxH)mm	Driving Method (Duty)	Process Color				Backlight Page				Built-in Controller	Page
							STN GRAY	STN YELLOW	STN BLUE	FSTN B&W	NONE	LED	EL	CCFL		
80x32	WX8032A	44.0x30.0	40.0x17.4	0.45x0.45	0.48x0.48	1/32				O	O		O		SED1520	P43
122x32	WG12232A/C	84.0x44.0	60.0x18.0	0.40x0.45	0.44x0.49	1/32	O	O	O	O	O	O			SED1520	P44
122x32	WG12232B/G	65.4x29.1	54.8x19.0	0.36x0.41	0.40x0.45	1/32	O	O			O	O			SED1520	P45
122x32	WG12232D	59.0x29.3	52.0x15.0	0.345x0.345	0.375x0.375	1/32	O	O		O	O	O			SED1520	P46
122x32	WG12232E/J	80.0x36.0	60.0x18.0	0.40x0.45	0.44x0.49	1/32	O	O	O	O	O	O			SED1520	P47
128x64	WG12864A	93.0x70.0	72.0x40.0	0.48x0.48	0.52x0.52	1/64	O	O	O	O	O	O	O		KS0108	P48
128x64	WG12864B	75.0x52.7	60.0x32.6	0.40x0.40	0.43x0.43	1/64	O	O	O	O	O	O			KS0108	P49
128x64	WG12864C	78.0x70.0	62.0x44.0	0.42x0.58	0.44x0.60	1/64	O	O	O	O	O	O			KS0108	P50



**GRAPHIC TYPE LCM**

Display Format Char.xline	Model No.	Outline Dimension (WxH)mm	Viewing Effective Area (WxH)mm	Dot Size (WxH)mm	Dot Pitch (WxH)mm	Driving Method (Duty)	Process Color				Backlight Page				Built-in Controller	Page
							STN GRAY	STN YELLOW	STN BLUE	FSTN B&W	NONE	LED	EL	CCFL		
128x64	WG12864D	78.0x70.0	62.0x44.0	0.42x0.58	0.44x0.60	1/64	0	0	0	0	0	0	0	T6963C	P51	
128x64	WG12864E	54.0x50.0	43.5x29.0	0.28x0.35	0.32x0.39	1/64	0	0	0	0	0	0	0	KS0108	P52	
128x64	WG12864F	87.0x70.0	72.0x40.0	0.48x0.48	0.52x0.52	1/64	0	0	0	0	0	0	0	T6963C	P53	
128x64	WG12864G	78.0x70.0	62.0x44.0	0.42x0.58	0.44x0.60	1/64	0	0	0	0	0	0	0	T6963C	P54	
128x64	WG12864I	80.0x70.0	72.0x40.0	0.48x0.48	0.52x0.52	1/64	0	0	0	0	0	0	0	KS0108	P55	
128x64	WG12864J	93.0x70.0	72.0x40.0	0.48x0.48	0.52x0.52	1/32	0	0	0	0	0	0	0	ST7920	P56	
128x64	WG12864K	113x53	72.0x40.0	0.48x0.48	0.52x0.52	1/64	0	0	0	0	0	0	0	KS0108	P57	
128x64	WX12864A	35.0x24.22	29.58x17.98	0.18x0.23	0.2x0.25	1/64	0	0	0	0	0	0	0	KS0713	P58	
128x64	WX12864AP1	34.0x65.6	29.58x17.98	0.18x0.23	0.2x0.25	1/64	0	0	0	0	0	0	0	KS0713	P59	
128x64	WX12864C	56.0x42.5	52.0x33.5	0.35x0.40	0.37x0.42	1/64	0	0	0	0	0	0	0	KS0713	P60	
128x64	WX12864CP1	56.0x84.0	52x36	0.35x0.4	0.37x0.42	1/64	0	0	0	0	0	0	0	KS0713	P61	
128x64	WX12864G	90.5x50.0	67.0x40.0	0.42x0.5	0.46x0.55	1/64	0	0	0	0	0	0	0	SED1565	P62	
128x64	WX12864I	55.0x30.0	51.0x23.5	0.32x0.32	0.35x0.35	1/64	0	0	0	0	0	0	0	LH155BA	P63	
128x64	WO12864A	93x70.0	68.5x35.3	0.48x0.48	0.52x0.52	1/64	OLED				0	0	0	0	T6963C	P64
128x128	WG128128A	85.0x100.0	62.0x62.0	0.40x0.40	0.34x0.34	1/128	0	0	0	0	0	0	0	T6963C	P65	
128x128	WG128128B	72.5x69.9	50.0x49.0	0.32x0.32	0.35x0.35	1/128	0	0	0	0	0	0	0	LC7981	P66	
144x32	WG14432A	85.0x36.0	66.0x16.0	0.38x0.38	0.42x0.42	1/32	0	0	0	0	0	0	0	ST7920	P67	
160x32	WG16032A	85.2x55.0	72.0x22.0	0.4x0.56	0.44x0.61	1/32	0	0	0	0	0	0	0	SED1520	P68	
160x80	WG16080A	93.0x70.0	72.0x40.0	0.48x0.48	0.52x0.52	1/80	0	0	0	0	0	0	0	LC7981	P69	
160x128	WG160128B	129.0x102.0	101.0x82.0	0.56x0.56	0.60x0.60	1/128	0	0	0	0	0	0	0	T6963C	P70	
160x128	WG160128C	150.0x112.0	101.0x82.0	0.56x0.56	0.60x0.60	1/128	0	0	0	0	0	0	0	T6963C	P71	
160x160	WG160160A	89.2x85.0	62.0x62.0	0.34x0.34	0.38x0.38	1/160	0	0	0	0	0	0	0	NO	P72	
160x160	WG160160B	85.0x100.0	62.0x62.0	0.34x0.34	0.38x0.38	1/160	0	0	0	0	0	0	0	LC7981	P73	
160x160	WX160160A	69.0x69.5	60.0x60.0	0.33x0.33	0.35x0.35	1/160	0	0	0	0	0	0	0	NO	P74	
192x32	WG19232B	116.0x37.0	84x18.6	0.38x0.46	0.42x0.5	1/32	0	0	0	0	0	0	0	ST7920	P75	
202x32	WG20232A	146.0x43.0	123.0x23.0	0.57x0.57	0.59x0.59	1/32	0	0	0	0	0	0	0	SED1520	P76	
240x64	WG24064A	180.0x65.0	133.0x39.0	0.49x0.49	0.53x0.53	1/64	0	0	0	0	0	0	0	T6963C	P77	
240x64	WG24064B	180.0x65.0	133.0x39.0	0.49x0.49	0.53x0.53	1/64	0	0	0	0	0	0	0	LC7981	P78	
240x64	WG24064C	180.0x65.0	133.0x39.0	0.49x0.49	0.53x0.53	1/64	0	0	0	0	0	0	0	T6963C	P79	
240x64	WG24064E	180x72.0	131.0x38.0	0.5x0.5	0.53x0.53	1/64	0	0	0	0	0	0	0	T6963C	P80	
240x64	WG24064R	180x65	133x39	0.49x0.49	0.51x0.53	1/64	0	0	0	0	0	0	0	RA8802	P81	
240x128	WG240128A	170x103.5	132.0x76.0	0.47x0.47	0.50x0.50	1/128	0	0	0	0	0	0	0	T6963C	P82	
240x128	WG240128B	144.0x104.0	114.0x64.0	0.43x0.43	0.45x0.45	1/128	0	0	0	0	0	0	0	T6963C	P83	
240x128	WG240128D	144.0x104.0	114.0x64.0	0.43x0.43	0.45x0.45	1/128	0	0	0	0	0	0	0	LC7981	P84	
240x128	WG240128E	144.0x104.0	114.0x64.0	0.43x0.43	0.45x0.45	1/128	0	0	0	0	0	0	0	T6963C	P85	
240x128	WG240128F	170.0x93.6	128.0x75.0	0.43x0.43	0.45x0.45	1/128	0	0	0	0	0	0	0	NO	P86	
240x128	WG240128R	140x82	114x64	0.43x0.43	0.45x0.45	1/128	0	0	0	0	0	0	0	RA8802	P87	
240x160	WX240160A	78.85x56.7	57.58x38.38	0.22x0.22	0.24x0.24	1/160	0	0	0	0	0	0	0	NO	P88	
240x160	WX240160B	74.6 x56.1	62.2 x43.5	0.23x0.23	0.24x0.24	1/160	0	0	0	0	0	0	0	NO	P89	
320x240	WG320240A	166.8x109.0	122.0x92.0	0.34x0.34	0.36x0.36	1/240	0	0	0	0	0	0	0	NO	P90	
320x240	WG320240B	166.8x109.0	122.0x92.0	0.34x0.34	0.36x0.36	1/240	0	0	0	0	0	0	0	SED1335	P91	
320x240	WG320240C	148.02x120.24	120.04x92.14	0.34x0.34	0.36x0.36	1/240	0	0	0	0	0	0	0	SED1335	P92	
320x240	WG320240D	142.0 x 96.0	104.0 x79.3	0.27x0.27	0.30x0.30	1/240	0	0	0	0	0	0	0	0	P93	
320x240	WG320240E	143x98	104x79.3	0.28x0.28	0.3x0.3	1/240	0	0	0	0	0	0	0	0	P94	
320x240	WX320240A	92.2x73.3	81.4x62.2	0.22x0.22	0.24x0.24	1/240	0	0	0	0	0	0	0	0	P95	
320x240	WX320240C	94.7x71.7	81.4x61.0	0.225x0.225	0.24x0.24	1/240	0	0	0	0	0	0	0	SED1335	P96	
320x240	WX320240F	94.7x71.7	81.4x61.0	0.225x0.225	0.24x0.24	1/240	0	0	0	0	0	0	0	0	P97	
480x280	WG480128B	241.2X99.0	209.4X61.7	0.39x0.39	0.42x0.42	1/128	0	0	0	0	0	0	0	SED1335	P98	
480x320	WX480320A	156.0x94.9	120.2x81.8	0.22x0.22	0.24x0.24	1/320	0	0	0	0	0	0	0	0	P99	
640x480	WX640480A	197.0x145.0	153.0x115.7	0.217x0.217	0.237x0.237	1/240	0	0	0	0	0	0	0	0	P100	

**INVERTER FOR EL PANEL**

Part NO	Input DC	Output DC	Input Current	EL area	Operating Temp	Storage Temp	Page
WIEL 1	5V ± 10%	90Vrms ±15%	95mA MAX	84cm <sup>2</sup>	-20°C ~ 70°C	-30°C ~ 80°C	102
WIEL 2	5V ± 10%	80Vrms ±15%	60mA MAX	30~80cm <sup>2</sup>	-20°C ~ 70°C	-30°C ~ 80°C	102
WIEL 3	5V ± 10%	120Vrms ±15%	100mA MAX	100~260cm <sup>2</sup>	-20°C ~ 70°C	-30°C ~ 80°C	103

**INVERTER FOR CCFL LAMP**

Part NO	Input DC	NoLoad operating Volt	Input Current	Frequency	Operating Temp	Storage Temp	page
WICCFL1	5V ± 10%	650Vrms	0.45A MAX	370 KHz ± 5%	-10°C ~ 80°C	-20°C ~ 85°C	104
WICCFL2	12V ± 10%	750Vrms	0.30A MAX	370 KHz ± 5%	-10°C ~ 80°C	-20°C ~ 85°C	104
WICCFL3	5V ± 10%	750Vrms	0.32A MAX	45.0 KHz ± 5%	-10°C ~ 80°C	-20°C ~ 85°C	104
WICCFL4	5V ± 10%	950Vrms	0.35A MAX	38.0 KHz ± 5%	-10°C ~ 80°C	-20°C ~ 85°C	105
WICCFL5	12V ± 10%	850Vrms	0.35A MAX	38.0 KHz ± 5%	-10°C ~ 80°C	-20°C ~ 85°C	105
WICCFL6	5V ± 10%	1000Vrms	0.41A MAX	34.0 KHz ± 5%	-10°C ~ 80°C	-20°C ~ 85°C	105
WICCFL8	24V ± 10%	940Vrms	0.09A MAX	56.0 KHz ± 5%	-10°C ~ 80°C	-20°C ~ 85°C	106
WICCFL12	5.0 ± 10%	1200Vrms	0.50A MAX	370 KHz ±5%	-10°C ~ 80°C	-20°C ~ 85°C	107
WICCFL13	12.0V ±10%	900Vrms	0.5A MAX	370 KHz ±5%	-10°C ~ 80°C	-20°C ~ 85°C	107

LED ( Light Emitted Diode )									
DESCRIPTION	<p>LED is a general and common type of back light.</p> <p>There are two types of back light structure:</p> <p>1. Direct lighting: LED is placed under LCD and light goes through directly.</p> <p>2. Edge lighting: LED is placed at the edge of light guide under LCD.</p>								
CHARACTERISTICS	<ul style="list-style-type: none"> <li>• The same contents of both lighting types:               <ol style="list-style-type: none"> <li>1. Low voltage DC power to drive.</li> <li>2. Very long life time.</li> <li>3. As the number of dice increases, the power consumption and heat increase accordingly.</li> <li>4. No noise occurrence.</li> </ol> </li> <li>• Direct lighting type:               <ol style="list-style-type: none"> <li>1. High brightness.</li> <li>2. Used for small-size LCM.</li> </ol> </li> <li>• Edge lighting type:               <ol style="list-style-type: none"> <li>1. Thin.</li> <li>2. Less consumption of power, low brightness.</li> <li>3. LED'S are mounted around edge of</li> </ol> </li> </ul>								
CONSTRUCTION	<ul style="list-style-type: none"> <li>• Direct lighting type:</li> </ul> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> </div> <div style="text-align: center;"> </div> </div>								
Life Characteristics	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><b>Electrical Characteristics(Reference Data)</b></p> <p>forward current derating curve</p> </div> <div style="width: 45%;"> <p><b>Wave Length vs Relative Light Intensity</b></p> </div> </div>								
APPLICATION	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th>Large Type</th> <th>Middle Type</th> <th>Small Type</th> <th>Thin Type</th> </tr> </thead> <tbody> <tr> <td>good</td> <td>good</td> <td>very good</td> <td>very good</td> </tr> </tbody> </table>	Large Type	Middle Type	Small Type	Thin Type	good	good	very good	very good
Large Type	Middle Type	Small Type	Thin Type						
good	good	very good	very good						
LUMINOUS INTENSITY	<p>Module: 5~ 50(cd/m<sup>2</sup>)</p> <p>LED only: 30~ 400(cd/m<sup>2</sup>)</p>								
EMITTED COLOR	Yellow, Yellow Green, Green, Amber, Red								
DRIVING VOLTAGE	DC 2.1v Or 4.2v								
LIFETIME	100,000hrs								
THICKNESS	<p>Direct Lighting Type: 4.5mm-5.5mm</p> <p>Edge Lighting Type: 1-3mm</p>								
TEMPERATURE RANGE	<p>-20°C ~ 70°C</p> <p>-20°C ~ 70°C</p>								



	EL (Electro Luminescent)				CCFL (Cold Cathode Fluorescent Lamps)			
DESCRIPTION	The EL lamp is a thin structure type of illumination. It is formed by organic thick membrane, high conductive fluorescence substance, transparent electrode and use AC power to drive.				CCFL has very wide applications. it needs AC power to drive. This backlight is very bright and the brightness is even. Its lifetime & brightness are both better than EL backlight. If white light, low power consumption and long life time is required, CCFL is definitely the choice.			
CHARACTERISTICS	1.Uniform brightness 2.Low electric current, power consumption, and heat generation. 3.Thinner and lighter 4.Typical of colors are plenty(especially for white and blue and green) 5.Need's DC/AC inverter				<ul style="list-style-type: none"> <li>• Long life time.</li> <li>• High brightness.</li> <li>• Low heat generation .</li> <li>• Need's DC/AC inverter</li> </ul> <ul style="list-style-type: none"> <li>• Uniform brightness</li> <li>• Emitted color is white</li> </ul>			
CONSTRUCTION								
Life Characteristics								
APPLICATION	Large Type	Middle Type	Small Type	Thin Type	Large Type	Middle Type	Small Type	Thin Type
	good	good	good	very good	very good	very good	good	good
LUMINOUS INTENSITY	Module:10~30(cd/m <sup>2</sup> ) EL only: 40~150(cd/m <sup>2</sup> )				Module:50~100(cd/m <sup>2</sup> ) CCFL only: 500~800(cd/m <sup>2</sup> )			
EMITTED COLOR	White, Blue, Green				White			
DRIVING VOLTAGE	AC 100V/ 400Hz				AC 1,000V Max/ 80kHz			
LIFETIME	3,000--8,000hrs				15,0 00 hrs			
THICKNESS	0.3--0.7mm				Direct lighting type: 5mm Edge lighting type:3mm			
TEMPERATURE RANGE	Operating 0°C~ +50°C Storage -20°C~ +60°C				0°C~ +50°C -20°C~ +60°C			

## Touch panel

### DESCRIPTION

The touch panel is an input device employing a material of transparent electrodes formed on glass-film transparent board. Since the keyboard itself is transparent, the touch panel can be placed directly on top of a display device.

### FEATURE

- The film is situated on the top side, making input possible with a lightly touch.
- Having a fingertip, stylus or other pen touch a key switch on the panel causes the upper and lower electrodes contact each other, leading to the entry of the key information.
- Film and glass combination structure resulting in high transitivity.

### STRUCTURE

- A transparent electrode is formed uniformly over the entire effective surface on the film and glass of a touch panel (see fig 1).

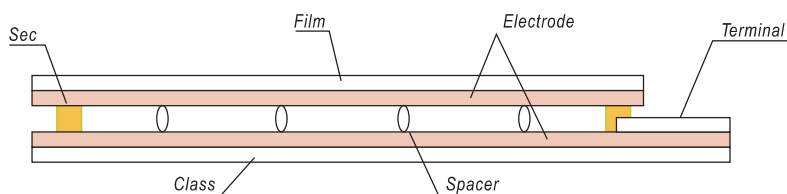


Fig 1

### APPLICATION

- |                  |                      |
|------------------|----------------------|
| 1. MONITOR       | 4. DATA BANK         |
| 2. PDA           | 5. REMOTE CONTROLLER |
| 3. CONTROL BOARD | 6. WATCH             |

### ANNOTATE

- The touch panel has as numerous push-button switches as the keys arranged in a matrix (see fig 2). To locate the x and y coordinates, voltage  $v_x$  taken from the y electrode and voltage  $v_y$  taken from the x electrode are converted into digital data and assigned coordinates (see fig 3).

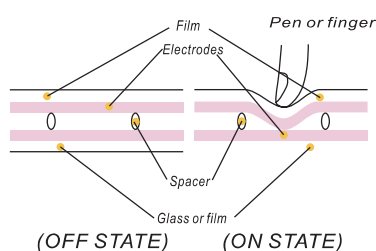


Fig2

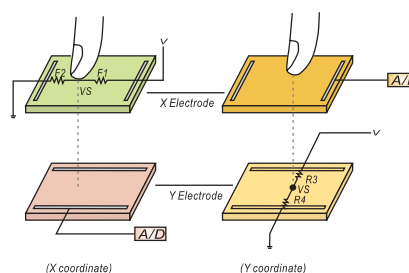
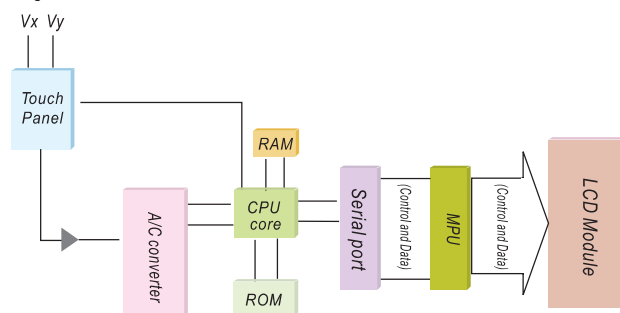


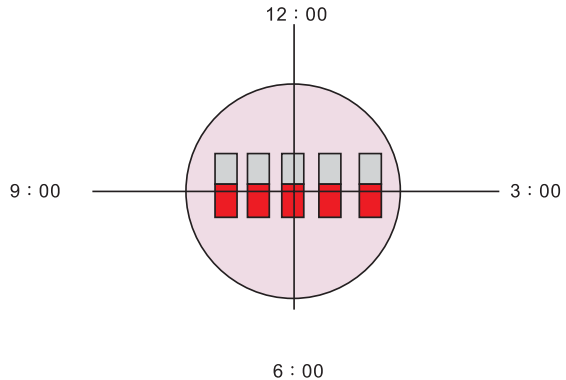
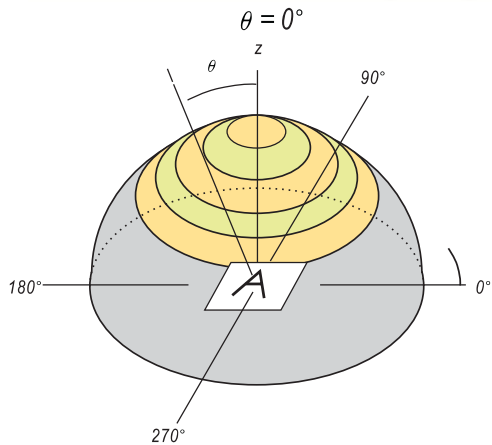
Fig3

- A block diagram of the configuration

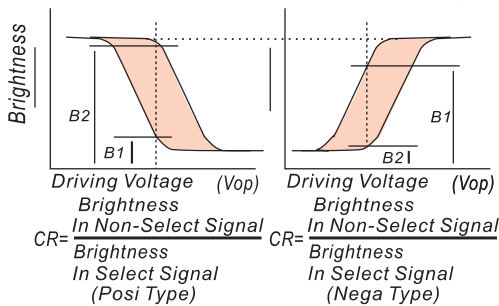




**Definition of Viewing Angle and  $\psi$**



**\*Definition of Contrast ratio(CR)**

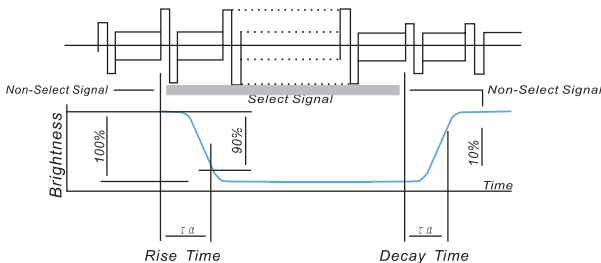


B1 : Brightness Select Signal

B2 : Brightness In Non-Select Signal

Conditions: 25°C

**Definition of Optical response time**



\*RESPONSE TIME( $T_R, T_F$ )

Test Condition  
 operation voltage:vop  
 viewing angle:0  
 frame frequency:70 hz  
 applying waveform:1/n duty and 1/a bias

in case of negative type.  
 wave from of changing brightness becomes reverse.  
 (non select signals:0 ,select signals:100)

**Optical characteristics**

TN TYPE

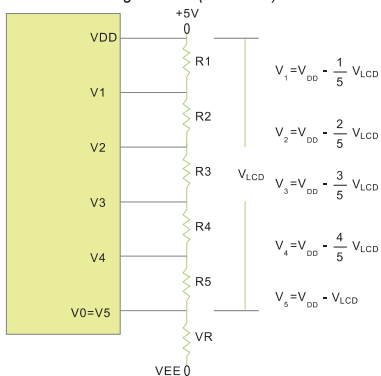
Item	Sym.	Condition	Min.	Typ.	Max.	Unit
Viewing Angle(v)	$\theta$	$CR \geq 2.0$	10	-	30	deg.
Viewing Angle(h)	$\psi$	$CR \geq 2.0$	-15	-	15	deg.
Contrast Ratio	$C_R$	-	-	2	-	-
Response Time	$T_r$	-	-	100	150	ms
Response Time	$T_f$	-	-	100	150	ms

STN TYPE

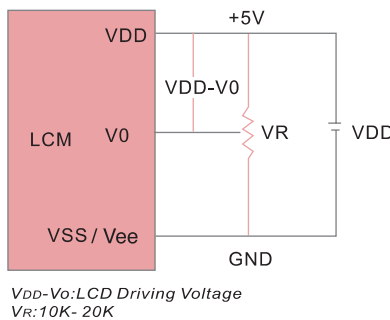
Item	Sym.	Condition	Min.	Typ.	Max.	Unit
Viewing Angle(v)	$\theta$	$CR \geq 2.0$	10	-	105	deg.
Viewing Angle(h)	$\psi$	$CR \geq 2.0$	-30	-	30	deg.
Contrast Ratio	$C_R$	-	-	3	-	-
Response Time	$T_{on}$	-	-	200	300	ms
Response Time	$T_{off}$	-	-	200	300	ms

**Power supply for lcd module**

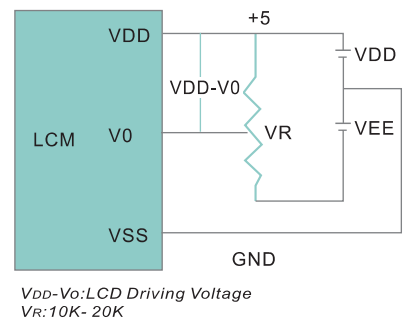
1.LCD Driving Source(1/5 Bias)



2. Single Supply Voltage Types with internal N.V.

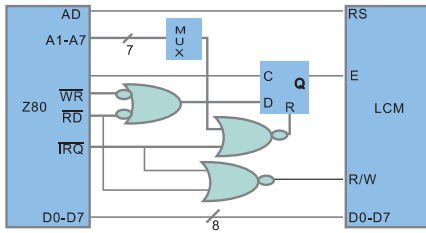


3.Dual Supply Voltage Types

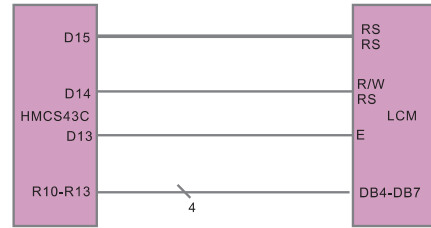


## Interface To MPU

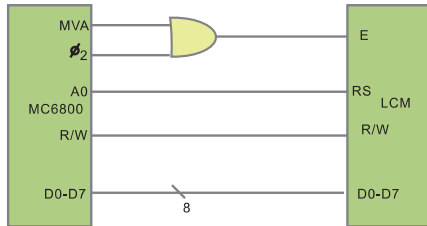
1. Interface to Z-80 CPU



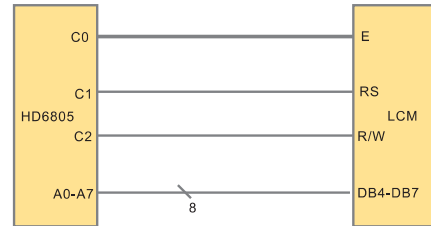
3. Interface to 4-BIT CPU(HMCS43C)



2. Interface to MC6800 CPU



4. Interface to HD6805 MP



## LED BACKLIGHT (Full array and Edge type)

1. There are five usages of LED B/L in character type modules.

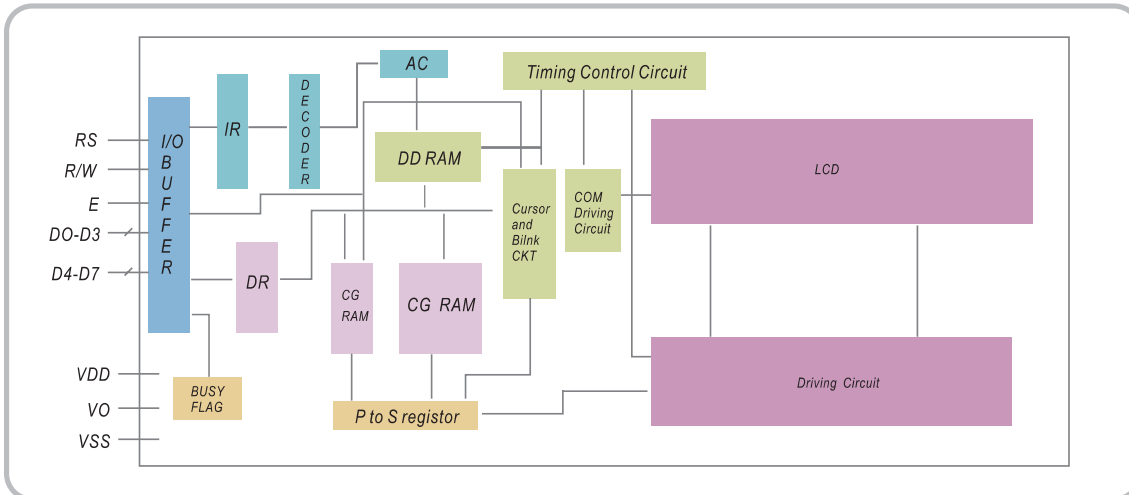
- ① Lighting the LED through a limiting current resistance (RA) which we already included in our LCM by external voltage of 5v to J1 and J2 between pin1 and pin2.
- ② Providing 5v by pin15 and pin16 of the interface to light the LED, J15 and J16 short,  $RA \approx 3 \sim 7 \Omega$
- ③ Providing 4.2v by pin15 and pin16 of the interface to light the LED through a limiting current resistance which we already included in our LCM.

\*RA=limiting current resistance.(on the module)

2. EL backlight only driving by A and K.

3. CCFL backlight only driving by CCFL B/C connector

## CHARACTER IC BLOCK DIAGRAM



\*Data Register (DR): DR is a register used for temporary storage of the data read/write from/into DD RAM and CG RAM.

\*Instruction Register (IR): IR is a register available for storing the instruction codes and address information of display data (DD) RAM and character generator (CG) RAM.

\*Busy Flag (BF): when the busy flag is "1", it shows that LCM is in internal operation and it can not accept the next instruction.

\*Character Generator (CG) ROM: this ROM generates character pattern from 8-bit character code and provides 192 character patterns.

\*Character Generator (CG) RAM: this RAM allows the user to rewrite the character patterns freely according to the program.

\*Address Counter (AC): this address counter is used to give the address information of DD RAM and CG RAM.

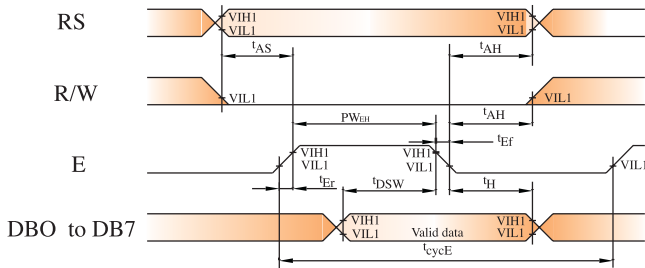
\*Display Data (DD) RAM: this display data RAM is used to store the display data expressed by 8-bit character code. the capacity is 80x8 bits and data for 80 characters can be storage.

\*cursor and blink control circuit: this circuit generates the cursor and Blink.

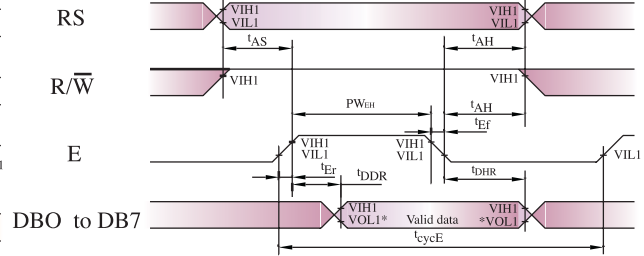




### Write Operation



### Read Operation



NOTE: \*VOL1 is assumed to be 0.8v at 2 MHz operation.

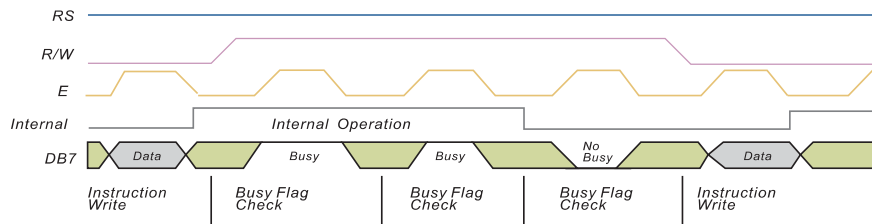
(Writing data from MPU to LCM)

ITEM	SYMBOL	LIMIT (MIN.)	LIMIT (MAX.)	UNIT
Enable Cycle Time	$t_{CYCE}$	666	-	nS
Enable Pulse Width (high Level)	$PW_{EH}$	300	-	nS
Enable Rise/fall Time	$t_{Er}, t_{Ef}$	-	25	nS
Address Set-up Time (rs, r/w, e)	$t_{AS}$	40	-	nS
Address Hold Time	$t_{AH}$	10	-	nS
Data Set-up Time	$t_{DSW}$	100	-	nS
Data Hold Time	$t_H$	10	-	nS

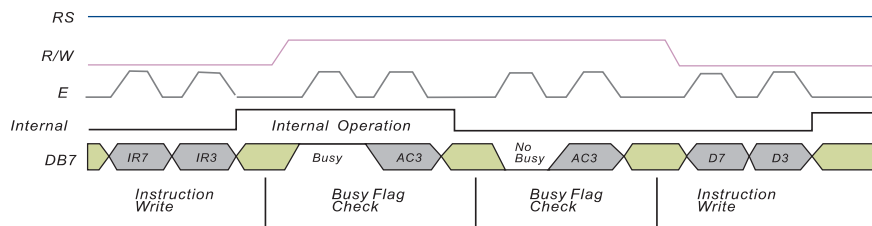
(Reading data from LCM to MPU)

ITEM	SYMBOL	LIMIT (MIN.)	LIMIT (MAX.)	UNIT
Enable Cycle Time	$t_{CYCE}$	666	-	nS
Enable Pulse Width (high Level)	$PW_{EH}$	300	-	nS
Enable Rise/fall Time	$t_{Er}, t_{Ef}$	-	25	nS
Address Set-up Time (rs, r/w, e)	$t_{AS}$	40	-	nS
Address Hold Time	$t_{AH}$	10	-	nS
Data Set-up Time	$t_{DDR}$	-	190	nS
Data Hold Time	$t_{DHR}$	20	-	nS

### 8-bit busy flag check timing



### 4-bit busy check timing



(note) ir 7, ir 3: instruction 7th bit, 3rd bit; ac3: address counter 3 rd bit



Command	Code											Description	Execution Time
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0			
Clear Display	0	0	0	0	0	0	0	0	0	0	1	Clear the display and return the cursor to the home position (address 0).	82 $\mu$ s - 1.64ms
Return Home	0	0	0	0	0	0	0	0	0	1	*	Return the cursor to the home position (address 0), also return a shifted display to the home position. DDRAM contents remain unchanged.	40 $\mu$ s - 1.6ms
Entry Mode Set	0	0	0	0	0	0	0	0	1	I/D	S	Set the cursor's move direction and enable/disable the display.	40 $\mu$ s
Display On/off Control	0	0	0	0	0	0	1	D	C	B		Turn the display ON/OFF(D), or the cursor ON/OFF(C), and blink of the character at the cursor position(B).	40 $\mu$ s
Cursor & Display Shift	0	0	0	0	0	1	S/C	R/L	*	*		Move the cursor and shift the display without changing the DD RAM contents.	40 $\mu$ s
Function Set	0	0	0	0	1	DL	N	F	*	*		Set the data width(DL), the number of lines in display(L), and the character font(F).	40 $\mu$ s
Set CGRAM Address	0	0	0	1	ACG							Set the CG RAM address. CG RAM data can be read or altered after making this setting.	40 $\mu$ s
Set DDRAM Address	0	0	1	ADD							Set the DD RAM address. Data may be written or read after making this setting.	40 $\mu$ s	
Read Busy Flag & Address	0	1	BF	AC							Read the busy flag(BF) indicating that an internal operation is being performed and read the address counter contents.	1 $\mu$ s	
Write Data to CG or DD RAM	1	0	Write Data									Write data into DD RAM or CG RAM.	43 $\mu$ s
Read Data from CG or DDRAM	1	1	Read Data									Read data from DD RAM or CG RAM.	43 $\mu$ s
	I/D=1:Increment      I/D=0:Decrement S=1:Accompanies Display Shift. S/C=1:Display Shift    S/C=0:Cursor Move R/L=1:Shift To The Right. R/L=0:Shift To The Left. DL=1:8 Bits              DL=0:4 Bits N=1:2 Lines              N=0:1 Line F=1:5x10 Dots          F=0:5x7 Dots BF=1:Busy BF=0:Can Accept Data											DD RAM:Display data RAM CG RAM:Character generator RAM ACG:CG RAM Address ADD:DD RAM Address Corresponds to cursor address. AC:Address counter Used for both DD and CG RAM address.	

"\*": don't care  
fosc: 270 KHZ



Always initialize by setting the software. (character type LCM)  
 Refer to figures 1 and 2 for the procedures on 8-bit and 4-bit initializations, respectively.

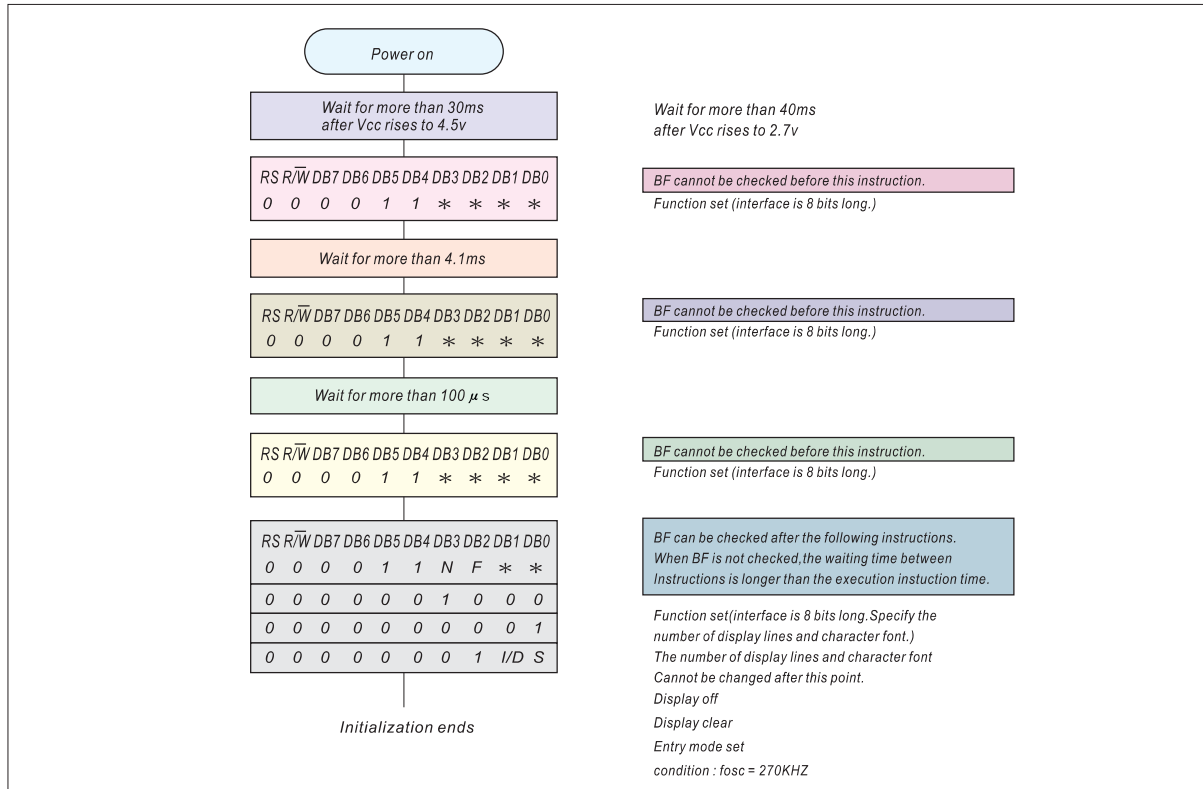


Figure 1 8-bit interface

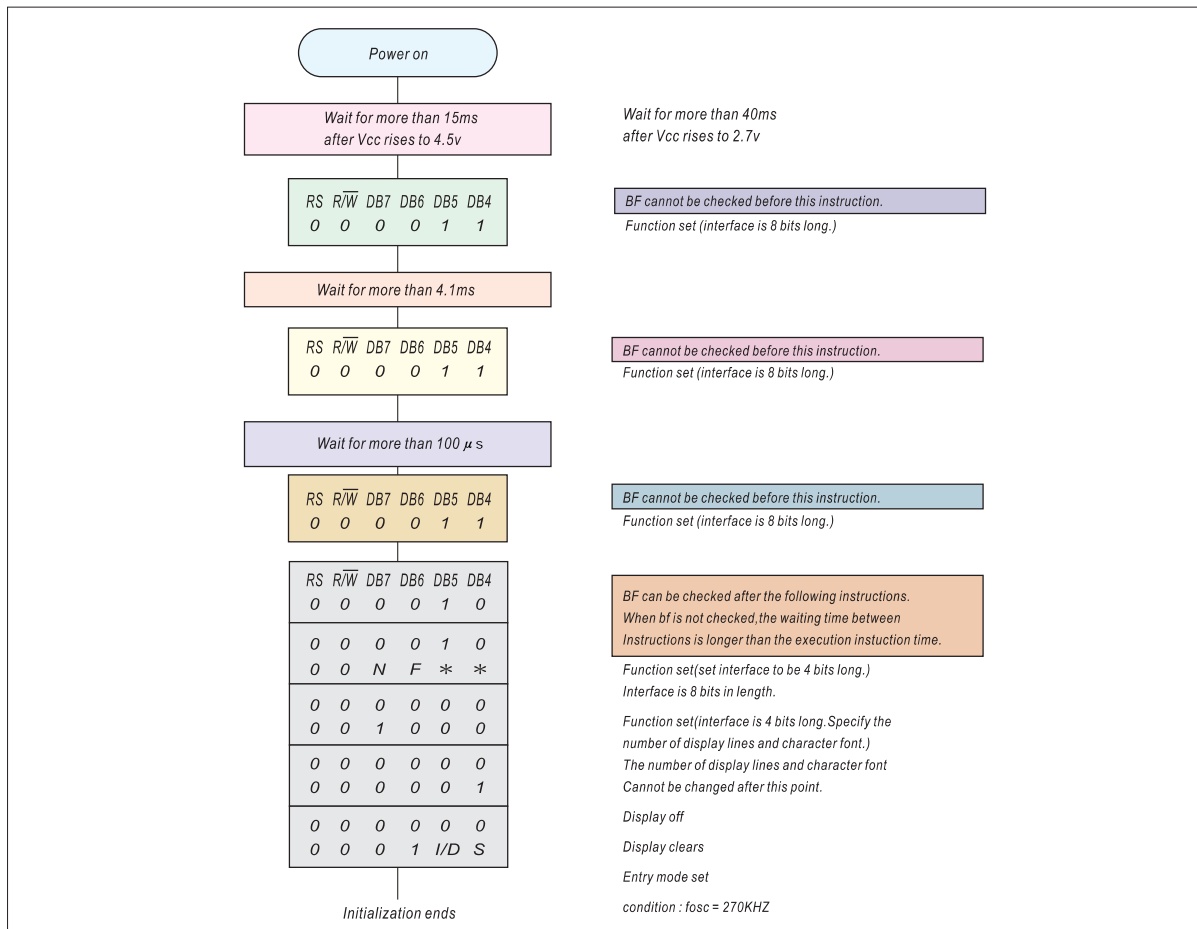


Figure 2 4-bit interface



### JS. JP.JT. JN Font

Upper 4 bit Lower 4 bit	LLLL	LLLH	LLHL	LLHH	LHLH	LHLL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH		
CG RAM (1)			0	a	P	'	f				—	3	e	o	p		
CG RAM (2)			!	1	A	O	a	9	Q	a	i		J	T	y	o	
CG RAM (3)			"	2	B	R	b	r				7	4	3	q		
CG RAM (4)			#	3	O	S	O	s				4	7	T	e	o	
CG RAM (5)			\$	4	D	T	d	t				\	I	t	h	v	a
CG RAM (6)			%	5	E	U	e	u				.	7	4	3	q	
CG RAM (7)			&	6	F	V	f	v				7	4	3	q		
CG RAM (8)			'	7	O	U	o	u				7	4	3	q		
CG RAM (1)			(	8	H	K	h	k				4	0	8	7	x	
CG RAM (2)			)	9	I	V	i	v				o	7	4	3	q	
CG RAM (3)			*	:	J	Z	j	z				o	7	4	3	q	
CG RAM (4)			+	:	K	K	(					a	7	4	3	q	
CG RAM (5)			,	<	L	N	l	n				o	7	4	3	q	
CG RAM (6)			—	=	M	n	)					u	z	\	o	t	+
CG RAM (7)			.	>	N	n	?					a	7	4	3	q	
CG RAM (8)			/	?	O	o	t					u	z	\	o	t	+

### EE. EU. EP.ET. EN Font

Upper 4 bit Lower 4 bit	LLLL	LLLH	LLHL	LLHH	LHLH	LHLL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH					
CG RAM (1)			±		0	a	P	'	f			e	3	e	a		7	4	3	q
CG RAM (2)			≡	!	1	A	O	a	9	Q	a	i		J	T	y	o			
CG RAM (3)			7	"	2	B	R	b	r	e	e	6	°	o	3	e	o			
CG RAM (4)			7	#	3	O	S	O	s	a	s	o	'	P	T	e	a			
CG RAM (5)			(	\$	4	D	T	d	t	a	a	o	'	e	P	Z	o			
CG RAM (6)			(	%	5	E	U	e	u	a	a	o	'	e	P	Z	o			
CG RAM (7)			)	&	6	F	V	f	v	a	a	o	'	e	P	Z	o			
CG RAM (8)			)	'	7	O	U	o	u	a	a	o	'	e	P	Z	o			
CG RAM (1)			(	8	H	K	h	k	x	a	a	o	'	e	P	Z	o			
CG RAM (2)			(	)	9	I	V	i	v	a	a	o	'	e	P	Z	o			
CG RAM (3)			*	*	:	J	Z	j	z	e	o	a	z	7	4	3	q			
CG RAM (4)			J	+	:	K	K	(	C	i	a	a	o	'	e	P	Z	o		
CG RAM (5)			≡	,	<	L	N	l	i	n	o	*		J	4	3	q			
CG RAM (6)			o	—	=	M	n	)	i	3	3	*		4	3	q				
CG RAM (7)			#	.	>	N	n	?	a	o	a	o	'	e	P	Z	o			
CG RAM (8)			#	/	?	O	o	t	a	a	o	'	e	P	Z	o				

### ES. EC Font ST

Upper 4 bit Lower 4 bit	LLLL	LLLH	LLHL	LLHH	LHLH	LHLL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH					
CG RAM (1)			0	a	P	'	f					B	W	4	2	K				
CG RAM (2)			!	1	A	O	a	9	Q	a	i		7	4	3	q				
CG RAM (3)			"	2	B	R	b	r				e	6	e	u	l	K			
CG RAM (4)			#	3	O	S	O	s				4	7	T	e	o	K			
CG RAM (5)			\$	4	D	T	d	t				o	a	i	u	g	'	K	a	
CG RAM (6)			%	5	E	U	e	u				a	a	i	e	B	'	K	a	
CG RAM (7)			&	6	F	V	f	v				u	o	a	n	'	K	a		
CG RAM (8)			'	7	O	U	o	u				u	o	a	n	'	K	a		
CG RAM (1)			(	8	H	K	h	k	x	a	a	o	'	e	P	Z	o			
CG RAM (2)			)	9	I	V	i	v				o	7	4	3	q				
CG RAM (3)			*	:	J	Z	j	z				o	7	4	3	q				
CG RAM (4)			+	:	K	K	(					o	7	4	3	q				
CG RAM (5)			,	<	L	N	l	n				o	7	4	3	q				
CG RAM (6)			—	=	M	n	)					u	z	\	o	t	+			
CG RAM (7)			.	>	N	n	?					u	z	\	o	t	+			
CG RAM (8)			/	?	O	o	t					u	z	\	o	t	+			

### CP Font CT

Upper 4 bit Lower 4 bit	LLLL	LLLH	LLHL	LLHH	LHLH	LHLL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH					
CG RAM (1)			0	a	P	'	f					B	W	4	2	K				
CG RAM (2)			!	1	A	O	a	9	Q	a	i		7	4	3	q				
CG RAM (3)			"	2	B	R	b	r				e	6	e	u	l	K			
CG RAM (4)			#	3	O	S	O	s				4	7	T	e	o	K			
CG RAM (5)			\$	4	D	T	d	t				o	a	i	u	g	'	K	a	
CG RAM (6)			%	5	E	U	e	u				a	a	i	e	B	'	K	a	
CG RAM (7)			&	6	F	V	f	v				u	o	a	n	'	K	a		
CG RAM (8)			'	7	O	U	o	u				u	o	a	n	'	K	a		
CG RAM (1)			(	8	H	K	h	k	x	a	a	o	'	e	P	Z	o			
CG RAM (2)			)	9	I	V	i	v				o	7	4	3	q				
CG RAM (3)			*	:	J	Z	j	z				o	7	4	3	q				
CG RAM (4)			+	:	K	K	(					o	7	4	3	q				
CG RAM (5)			,	<	L	N	l	n				o	7	4	3	q				
CG RAM (6)			—	=	M	n	)					u	z	\	o	t	+			
CG RAM (7)			.	>	N	n	?					u	z	\	o	t	+			
CG RAM (8)			/	?	O	o	t					u	z	\	o	t	+			