AZ DISPLAYS, INC.

COMPLETE LCD SOLUTIONS

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

PART NUMBER: ACM1002A Series

REVISED: MARCH 14, 2006

General Specification

Table 1

Item	Standard Value	Unit
Character Format	☐Dot-Graphic ■Character ☐Digits ☐_____ ■with ICON	Dots
Module Dimension	38.0(W) *25.5(H) *1.8(T)	mm
Viewing Area	34.0(W) * 14.0(H)	mm
Dot Size	0.5(W) *0.75(H)	mm
Dot Pitch	0.55(W) * 0.8(H)	mm
Character Size	2.7(W) * 5.55(H)	
Character Pitch	3.2(W) * 6.25(H)	
Driving	1/18duty, 1/5bias	
View Direction	6H ■ 12H ☐ Other: ☐_____	
Polarizer Type	☐TN, Positive ☐TN, Negative ☐HTN, Positive ☐HTN, Negative ☐STN, Yellow-Green ■STN, Gray ☐STN, Blue ☐FSTN, Positive ☐FSTN, Negative ☐Color STN ☐FM LCD	
Display Mode	☐Transmissive ☐Reflective ■Transflective ☐Anti-Glare	
Driver IC	PCF2119_RU/2（PHILIPS）	
Interface	6800 ☐ 8080☐ I^2C ■	
DC/DC Converter	Internal ■ External ☐	
Operation Temperature	-20℃—+70℃	
Storage Temperature	-30℃—+80℃	

ELECTRICAL CHARACTERISTICS

Absolute Maxium Ratings

No	ITEM	Symbol	Min.	Typ.	Max.	Unit
1	OPERATING TEMPERATURE	T_{OP}	-20	-	70	℃
2	STORAGE TEMPERATURE	T_{ST}	-30	-	80	℃
3	SUPPLY VOLTAGE FOR LOGIC	V_{DD}	V_{SS}	-	6.5	V
4	SUPPLY VOLTAGE FOR LCD	V_{LCD}	V_{SS}	-	7.5	V
5	INPUT VOLTAGE	V_{IN}	V_{SS}	-	V_{DD}+0.5	V
6	STATIC ELECTRICITY	Be sure that you are grounded when handing LCM				

Electrical Characteristics

(Ta=25℃, V_{DD}=5.0V) Table 4

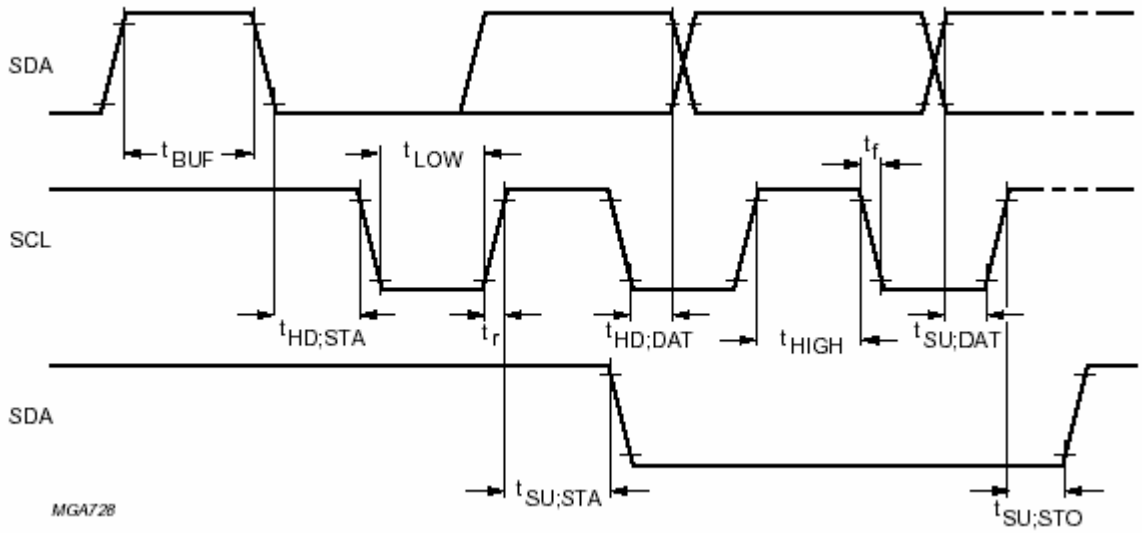
No	Item	Symbol	Condition	Min.	Typ.	Max.	Unit
1	Supply Voltage For Logic	V_{DD}-V_{SS}	/	/	5.0	/	V
2	Supply Voltage For LCD Driver	V_{DD}-V_o (V_{LCD})	/	/	5.0	/	V
3	Input High Voltage	V_{IH}	H level	0.7V_{DD}	/	V_{DD}	V
4	Input Low Voltage	V_{IL}	L level	VSS	/	0.3V_{DD}	V
5	Supply Current For Logic	I_{DD}	/	/	/	1	mA

Interface Pin Function

NO	SYMBOL	LEVEL	FUNCTION
1	SCL	I	I2C-bus serial clock input
2	SDA	I	I2C-bus serial data input
3	V_{DD}	Power Supply	Logic supply voltage.
4	V_{SS}	Power Supply	Ground
5	V_{LCD}	VO	This input is used for the generation of the LCD bias levels.
6	RESET	I	The external reset is active HIGH

Timing Characteristics

1. I2C-bus timing diagram.



Timing characteristics: I2C-bus interface: note 2

f_{SCL}	SCL clock frequency		-	-	400	kHz
t_{LOW}	SCL clock low period		1.3	-	-	ms
t_{HIGH}	SCL clock high period		0.6	-	-	ms
$t_{SU;DAT}$	data set-up time		100	-	-	ns
$t_{HD;DAT}$	data hold time		0	-	-	ns
t_r	SCL, SDA rise time	notes 1 and 3	$15 + 0.1C_B$	-	300	ns
t_f	SCL, SDA fall time	notes 1 and 3	$15 + 0.1C_B$	-	300	ns
C_B	capacitive bus line load		-	-	400	pF
$t_{SU;STA}$	set-up time for a repeated START condition		0.6	-	-	ms
$t_{HD;STA}$	START condition hold time		0.6	-	-	ms
$t_{SU;STO}$	set-up time for STO condition		0.6	-	-	ms
t_{SW}	tolerable spike width on bus		-	-	50	ns
t_{BUF}	bus free time between STOP and START condition		1.3	-	-	ms

Notes：

1. Tested on a sample basis.
2. All timing values are valid within the operating supply voltage and ambient temperature range and are referenced toV_{IL} and V_{IH} with an input voltage swing of V_{SS} to V_{DD}.
3. C_B = total capacitance of one bus line in pF.

Electro-optical Characteristics

No	Item		Symbol	Condition	Min	Typ	Max	Unit	Drive
1	Contrast Ratio		C_R	T_a=23±3℃ $\theta_1=\theta_2=\theta_3=\theta_4=0$	4.0	5.0	-	-	V_{op}=5.0V 1/18Duty 1/5 Bias f=100H_Z
2	Response time	Rise	T_r		-	160	200	ms	
		Down	T_f		-	130	180	ms	
3	Viewing Angle Range	6H ϕ=270	θ_1	T_a=23±3℃ C_r=2	70			Deg	
		12H ϕ=90	θ_2		30				
		3H ϕ=0	θ_3		60				
		9H ϕ=180	θ_4		60				
4	LCD Driving Voltage		V_{OP}	T_a=23±3℃	-	5.0	-	V	

Commands

The display control instructions control the internal state of the PCF2119_RU/2 （PHILIPS）
Instruction is received from MPU to PCF2119_RU/2（PHILIPS）for the splay control. The following table shows various instructions.

X: Don't care Table 6

Instruction	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
H = 0 or 1											
Function set	0	0	0	0	1	DL	0	M	SL	H	sets interface Data Length (DL) and number of display lines (M); single line/MUX 1 : 9 (SL), extended instruction set control (H)
Read busy flag and address counter	0	1	BF	AC							reads the Busy Flag (BF) indicating internal operating is being performed and reads address counter contents
Read data	1	1	read data								reads data from CGRAM or DDRAM
Write data	1	0	write data								writes data from CGRAM or DDRAM
H = 0											
Clear display	0	0	0	0	0	0	0	0	0	1	clears entire display and sets DDRAM address 0 in address counter
Return home	0	0	0	0	0	0	0	0	1	0	sets DDRAM address 0 in address counter; also returns shifted display to original position; DDRAM contents remain unchanged
Entry mode set	0	0	0	0	0	0	0	1	I/D	S	sets cursor move direction and specifies shift of display; these operations are performed during data write and read
Display control	0	0	0	0	0	0	1	D	C	B	sets entire display on/off (D), cursor

											on/off (C) and blink of cursor position character (B); D = 0 (display off) puts chip into the power-down mode
Cursor/display shift	0	0	0	0	0	1	S/C	R/L	0	0	moves cursor and shifts display without changing DDRAM contents
Set CGRAM address	0	0	0	1	ACG						sets CGRAM address; bit 6 is to be set by the command 'set DDRAM address'; look at the description of the commands
Set DDRAM address	0	0	1	ADD							sets DDRAM address
H = 1											
Reserved	0	0	0	0	0	0	0	0	0	1	do not use
Screen configuration	0	0	0	0	0	0	0	0	1	L	set screen configuration
Display configuration	0	0	0	0	0	0	0	1	P	Q	set display configuration
Icon control	0	0	0	0	0	0	1	IM	IB	DM	section mode (IM), icon blink (IB), direct mode(DM)
Temperature control	0	0	0	0	0	1	0	0	TC1	TC2	set temperature coefficient (TCx)
Set HVgen stages	0	0	0	1	0	0	0	0	S1	S0	set internal HVgen stages (S1,S0 = 11 not allowed)
Set V_{LCD}	0	0	1	V	voltage						store V_{LCD} in register V_A or V_B (V)

Table7 Explanations of symbols used in Table 6

BIT	STATE	
	LOGIC 0	LOGIC 1
I/D	decrement	increment
S	display freeze	display shift
D	display off	display on
C	cursor off	cursor on
B	cursor character blink off: character at cursor position does not blink	cursor character blink on: character at cursor position blinks
S/C	cursor move	display shift
R/L	left shift	right shift
DL	4 bits	8 bits
H	use basic instruction set	use extended instruction set
L (no impact, if M = 1 or SL = 1)	left/right screen: standard connection (as in PCF2114)	left/right screen: mirrored connection (as in PCF2116)
	1st 16 characters of 32: columns are from 1 to 80	1st 16 characters of 32: columns are from 1 to 80
	2nd 16 characters of 32: columns are from 1 to 80	2nd 16 characters of 32: columns are from 80 to 1
P	r column data: left to right (as in PCF2116); column data is displayed from 1 to 80	column data: right to left; column data is displayed from 80 to 1
Q	row data: top to bottom (as in PCF2116); row data is displayed from 1 to 16 and icon row data is in 17 and 18 in single line mode (SL = 1)	row data: bottom to top; row data is displayed from 16 to 1 and icon row data is in 18 and 17 in single line mode (SL = 1)

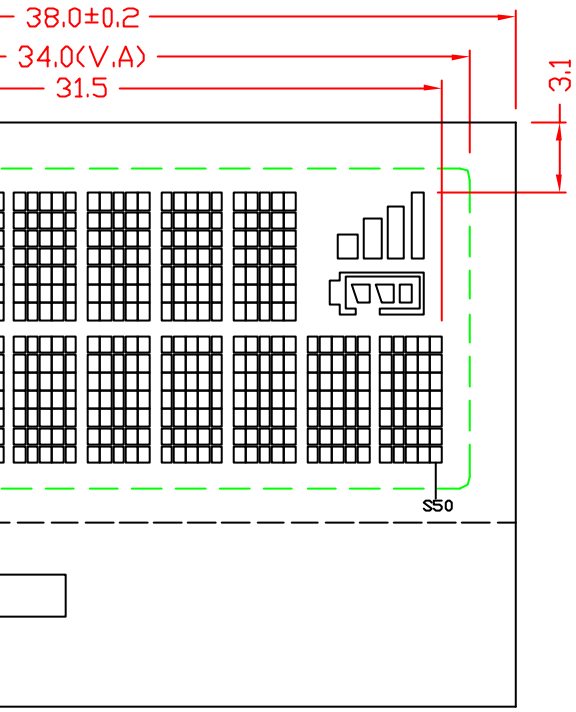
	row data is displayed from 1 to 8 and icon row data in 17	row data is displayed from 8 to 1 and icon row data in 17
IM	character mode; full display	icon mode; only icons displayed
IB	icon blink disabled	icon blink enabled
DM	direct mode disabled	direct mode enabled
V	set VA	set VB
M (no impact, if SL = 1)	1-line by 32 display	2-line by 16 display
SL	MUX 1 : 18 (1X32 or 2X16 character display)	MUX 1 : 9 (1X16 character display)
C_0	last control byte; see Table 5	another control byte follows after data/command

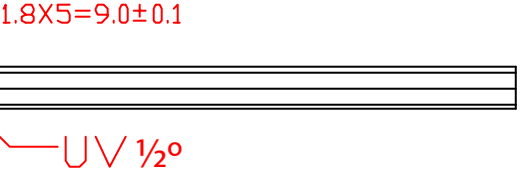
Table 8 Explanation of TC1 and TC2 used in Table 6

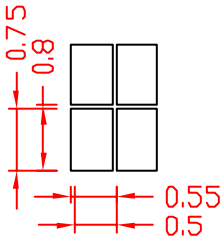
TC1	TC2	DESCRIPTION
0	0	VLCD temperature coefficient 0
1	0	VLCD temperature coefficient 1
0	1	VLCD temperature coefficient 2
1	1	VLCD temperature coefficient 3; for ranges for TC see Chapter 14

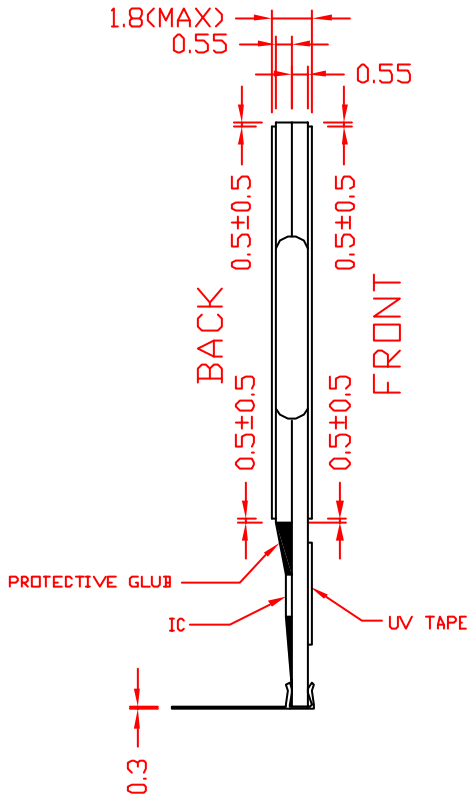
Table 9 Explanation of S1 and S2 used in Table 6

S1	S2	DESCRIPTION
0	0	set internal HVgen stages to 1 (2 * voltage multiplier)
0	1	set internal HVgen stages to 2 (3 * voltage multiplier)
1	0	set internal HVgen stages to 3 (4 * voltage multiplier)
1	1	do not use









3	4	5	6
VDD	VSS	VLCD	RESET

DISPLAY MODE:
STN;GRAY;TRANSFLECTIVE;POSITIVE
VIEWING DIRECTION: 6:00
DRIVER IC: PCF2119X
CONNECTOR:PINNING
DRIVING METHOD: 1/18DUTY 1/5 BIAS
OPERATING TEMPERATURE:-20°~+70°C
STORAGE TEMPERATURE: -30°~+80°C
* LOGIC VOLTAGE: 5.0V, VLCD: 5.0V

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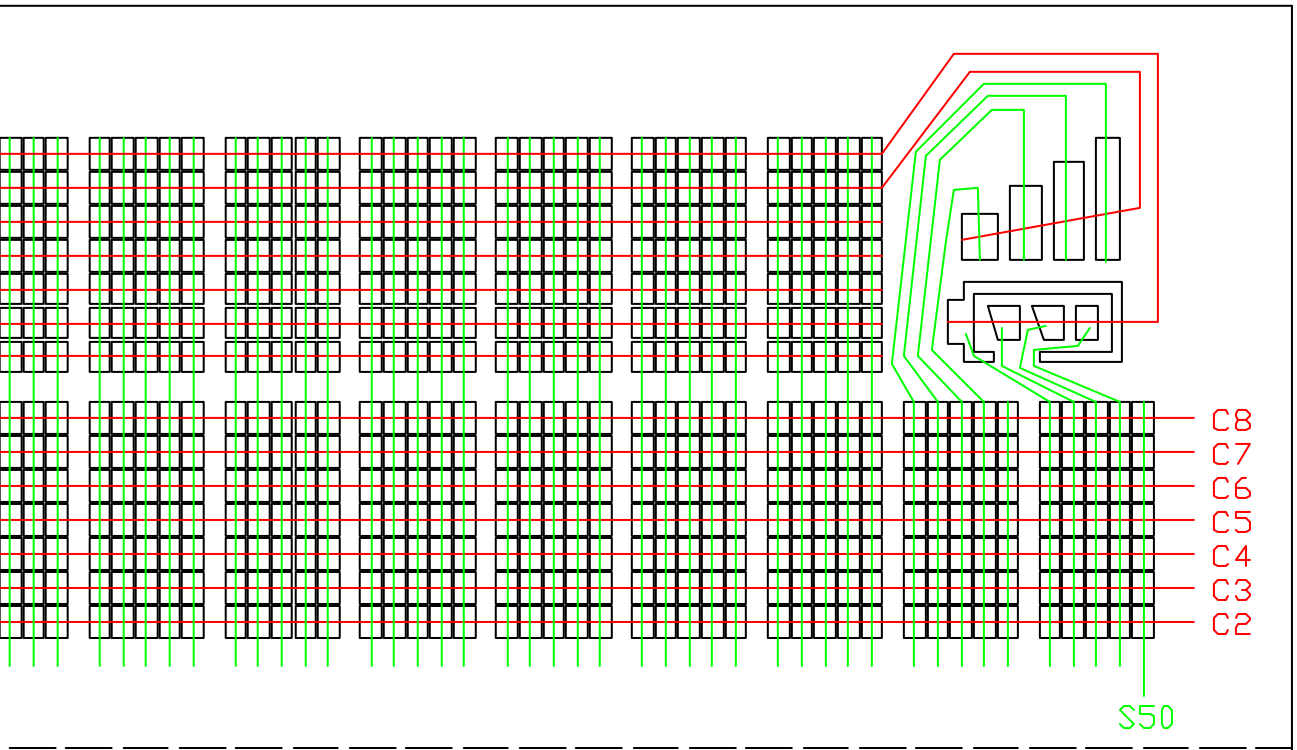
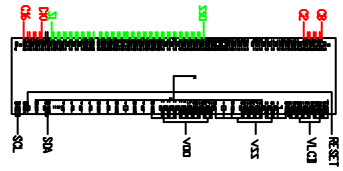
						SHEET 1 OF 3	





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VDD VSS VLCD RESET

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C.

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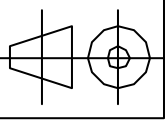
UNITS: mm

SHEET 2 OF 3



CUSTOMER APPROVAL:

C.

ACM1002A SERIES

UNITS: mm

SHEET 3 OF 3