

AZ DISPLAYS, INC.

COMPLETE LCD SOLUTIONS

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

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PART NUMBER:

AG2412D Series

General Specifications

Item	☒ Standard Value	Unit
Display Pattern	☒ Dot-Graphic ☐ Character ☐ Digits ☐ with ICON	Dots
Color	☒ Mono. ☐ Grayscale ☐ _____	
Module Dimension	170.0(W)X93.0(H)X15.8(D)(Max)	mm
Viewing Area	129.0(W)X75.0(H)	mm
Active Area	119.97(W)X63.97(H)	mm
Character Size	/	mm
Character Pitch	/	mm
DOT Size	0.47(W)X0.47(H)	mm
DOT Pitch	0.50(W)X0.50(H)	mm
LCD Type	☐ TN, Positive ☐ TN, Negative ☐ HTN, Positive ☐ HTN, Negative ☐ STN, Yellow-Green ☐ STN, Gray ☒ STN, Blue ☐ FSTN, Positive ☐ FSTN, Negative ☐ Color STN ☐ FM LCD	
Polarizer Type	☐ Transflective ☒ Transmissive ☐ Reflective ☐ Anti-Glare	
View Direction	☐ 6H ☒ 12H ☐ _____	
LCD Controller & Driver	T6963C OR EUQUIVALENT	
LCD Driving Method	1/128duty, 1/12bias	
Interface Type	☐ I ² C ☐ 4-wire Serial ☐ 3-wire Serial ☐ 6800 ☒ 8080 ☐ 4-bit ☐ _____	
Backlight Type	☒ LED ☐ Bottom ☒ Single Side ☐ Dual Side ☐ EL ☐ CCFL ☐ _____	
Backlight Color	☐ Yellow-Green ☒ White ☐ Amber ☐ Blue ☐ Red ☐ _____	
EL/CCFL Driver type	/	
DC-DC Converter	☐ Build-in ☒ External	
Operation Temperature	-20 ~ 60	°C
Storage Temperature	-30 ~ 70	°C

Electrical-optical Specifications

Absolute Maximum Ratings

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage For Logic	$V_{DD} - V_{SS}$	$T_a = 25^{\circ}\text{C}$	-0.3	-	7.0	V
Supply Voltage	V_{EE}	$T_a = 25^{\circ}\text{C}$	$V_{DD} - 30$	-	$V_{DD} + 0.3$	V
Supply Voltage For Lcd Driver	V_{LCD}	$T_a = 25^{\circ}\text{C}$	$V_{EE} - 0.3$	-	$V_{DD} + 0.3$	V
Input Voltage	V_I	$T_a = 25^{\circ}\text{C}$	-0.3	-	$V_{DD} + 0.3$	V
Operating temperature	T_o	-	-20	-	60	$^{\circ}\text{C}$
Storage temperature	T_s	-	-30	-	70	$^{\circ}\text{C}$

Note: Operating Temperature and Storage Temperature can be found in 1.General Specifications.

Electrical-optical Characteristics

No.	Item		Symbol	Condition	Min.	Typ.	Max.	Unit
1	Contrast Ratio		Cr	Ta=25°C V _{LCD} =12.7V	3.0	3.4		-
2	Threshold voltage		Vth	Ta=25°C	1.88	1.904		V
3	Saturation voltage		Vsat	Ta=25°C		2.044	2.07	V
4 5	Response time	Rise time	Tr	Ta=25°C		148	200	ms
		Fall time	Tf	Ta=25°C		209	250	ms
		On time	T _{ON}	Ta=25°C		172	230	ms
		Off time	T _{OFF}	Ta=25°C		240	280	ms
6	Viewing Angle	6H	θ 1	Cr = 2 Ta=25°C		30		Deg
7		12H	θ 2			50		Deg
8		3H	θ 3			50		Deg
9		9H	θ 4			50		Deg
10	Frame frequency		FR	/	50	70	85	Hz
11	Clock Oscillation Frequency		fosc	/	/	6.0	/	Mhz

LED back light Electrical/Optical characteristics

$T_a = 25^{\circ}\text{C}$

ITEM	SYMBOL	CONDITION	MIN.	TYP E	MAX.	UNIT
Forward current	I_f	$V_f = 4.2\text{ V}$ White	60	90	200	mA

Luminous Intensity	I _v	V _f =4.2 V White	120	180	/	Cd/m ²
Luminous Tolerance	/	/	/	/	20	%
Chromaticity coordinate	X	V _f =4.2 V White	0.287	0.31	0.330	/
Chromaticity coordinate	Y	V _f =4.2 V White	0.276	0.32	0.339	/

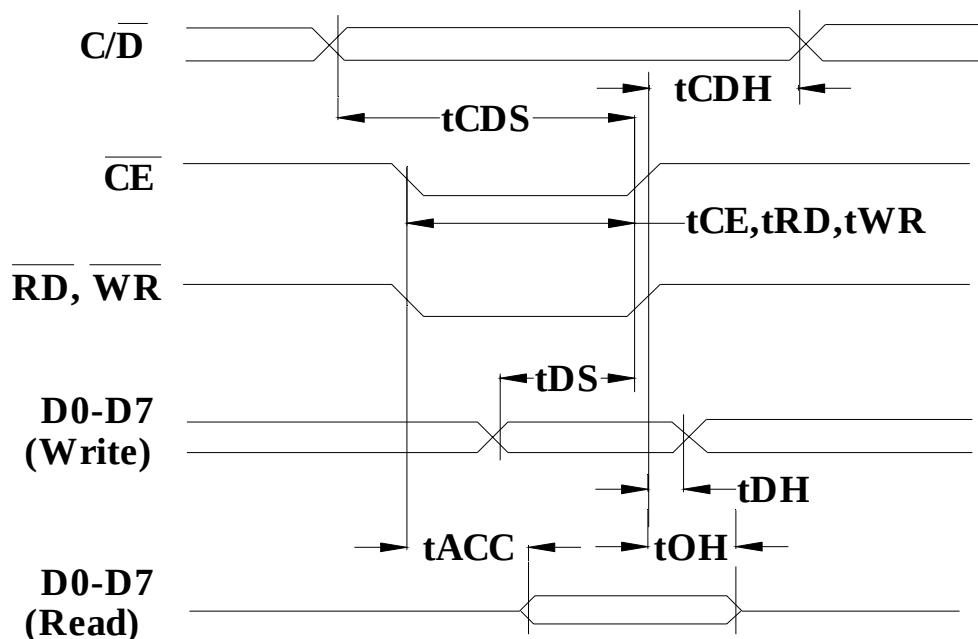
Note:

6.3 Electrical Characteristics

No	Item	Symbol	Condition	Min.	Typ.	Max.	Unit
1	Supply Voltage for Logic	V _{DD} -V _S _S	-	4.5	5.0	5.5	V
2	Supply Voltage for LCD Driver	V _{DD} -V _O (V _{LCD})	Ta=25±3°C	16.9	17.2	17.5	V
3	Supply Current for Logic	I _{DD}	Ta=25±3°C V _{DD} =5.0V	-	11.0	24.0	mA
4	Input High Voltage	V _{IH}	-	V _{DD} -2. 2	/	V _{DD}	V
5	Input Low Voltage	V _{IL}	-	0	/	0.8	V
6	Output High Voltage	V _{OH}	-	V _{DD} -0.3	-	V _{DD}	V
7	Output Low Voltage	V _{OL}	-	V _{SS}	-	0.3	V

6.4 Timming Characteristics

(1) System Bus Read/Write Characteristics



(V_{DD} = 4.5 V to 5.5 V, Ta = -10 to 70°C)

Item	Symbol	Condition	Rating		Units
			Min	Max	
C/D Set Up Tme	tCDS		100	—	ns
C/D Hold Time	tCDH		10	—	ns
CE,RD, WR Pulse Width	tce, trd, tWR		80	—	ns
Data Set Up Time	tDS		80	—	ns
Data Hold Time	tDH		40	—	ns
Access Time	tACC		—	150	
Output Hold Time	tOH		10	50	ns

Instruction Description

Table of T6963C Commands

Command	CODE	D1	D2	Function
(1) REGISTER SET	00100001 00100010 00100100	X address Data Low address	Y address 00H High address	Cursor pointer set Offset register set Address pointer set
(2) CONTROL WORD SET	01000000 01000001 01000010 01000011	Low address Columns Low address Columns	High address 00H High address 00H	Text home address set Text area set Graphic home address set Graphic area set
(3) MODE SET	1000X000 1000X001 1000X011 1000X100 10000XXX 10001XXX	- - - - - -	- - - - - -	"OR" mode "EXOR" mode "AND" mode "Text attribute" mode Internal CG ROM mode External CG ROM mode
(4) DISPLAY MODE	10010000 1001XX10 1001XX11 100101XX 100110XX 100111XX	- - - - - -	- - - - - -	Display Off Cursor on, blink off Cursor on, blink on Text on, graphic off Text off, graphic on Text on, graphic on
(1) CURSOR PATTERN SELECT	10100000 10100001 10100010 10100011 10100100 10100101 10100110 10100111	- - - - - - - -	- - - - - - - -	1 line cursor 2 lines cursor 3 lines cursor 4 lines cursor 5 lines cursor 6 lines cursor 7 lines cursor 8 lines cursor
(2) DATA AUTO READ/WRITE	10110000 10110001 10110010	- - -	- - -	Data auto write set Data auto read set Auto reset
(7) DATA READ WRITE	11000000 11000001 11000010 11000011 11000100 11000101	Data - Data - Data -	- - - - - -	Data write and ADP increment Data read and ADP increment Data write and ADP decrement Data read and ADP decrement Data write and ADP non variable Data write and ADP non variable
(8) SCEEN PEEK	11100000	-	-	Screen peek
(9) SCEEN COPY	11101000			Screen copy
(10) BIT SET/RESET	11110XXX 11111XXX 1111X000 1111X001 1111X010	- - - - -	- - - - -	Bit reset Bit set Bit 0 (LSB) Bit 1 Bit 2

	1111X011	-	-	Bit 3
	1111X100	-	-	Bit 4
	1111X101	-	-	Bit 5
	1111X110	-	-	Bit 6
	1111X111	-	-	Bit 7

(Note) X: disabled data

CHARACTER CODE MAP
ROM code 0101

LSB MSB	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		!	"	#	\$	%	&	'	(	)	*	+	,	-	=	/
1	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
2	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
3	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
4	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
5	P	q	r	s	t	u	v	w	x	y	z	{		}	~	
6	5	ü	é	â	ä	å	ä	5	è	ë	ë	i	ï	i	ä	ä
7	É	æ	Æ	ö	ö	ö	ü	ü	9	ö	ü	ç	£	¥	℞	℟

Interface Description

Pin No.	Symbol	Level	Function Description
1	FG	/	FRAME GROUND
2	Vss	/	GROUND (0V)
3	Vdd	+5.0 V	Power supply for logic (+)
4	Vee	-12.2 V	LCD Drive Voltage (-)
5	/WR	H/L	Write Signal
6	/RD	H/L	Read Signal
7	/CE	H/L	Chip Enable
8	C/D	H/L	Command/Data
9	NC	/	No connected
10	/RST	H/L	Reset
11	DB0	H/L	Data Input/Output(LSB)
12	DB1	H/L	Data Input/Output
13	DB2	H/L	Data Input/Output
14	DB3	H/L	Data Input/Output
15	DB4	H/L	Data Input/Output
16	DB5	H/L	Data Input/Output
17	DB6	H/L	Data Input/Output
18	DB7	H/L	Data Input/Output(MSB)
19	FS	H/L	H:6X8 Character Font L:8X8 Character Font
20	RV	/	Reverse data in

Block Diagram

