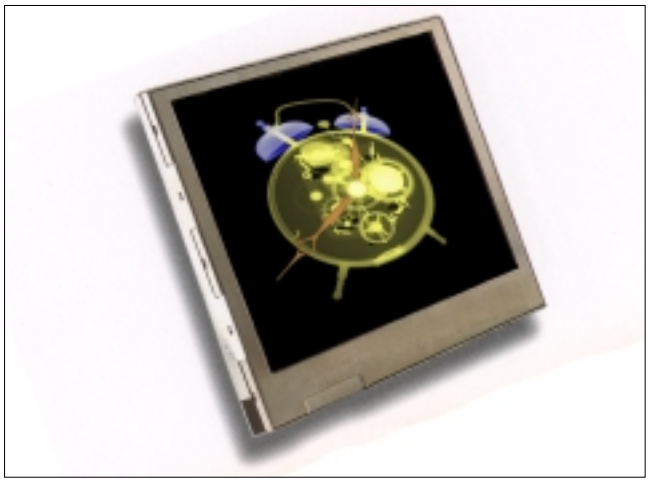

AND-TFT-35DM

3.5" TFT LCD
LCD Color Monitor

The AND-TFT-35DM is a compact full color TFT LCD module, that is suitable for applications such as a portable television (NTSC/PAL), camcorder, video phone application and other electronics products which require high quality flat panel displays. This device consists of a twisted nematic (TN) liquid crystal cell, that incorporates a TFT-array that has 600 x 234 pixels on a 3.5 inch diagonal screen, X and Y drivers, an LSI controller, and a built-in CCFL backlight.

Features

- Controller IC is not necessary
- Compatible with NTSC or PAL system
- High Resolution: 140,400 (600 x 234)
- High Brightness
- Optimum Viewing Direction: 6 o'clock
- Up/Down and Left/Right Image Reversion
- Accepts Analog RGB input
- Requires external chroma decoder to accept composite video card

Mechanical Characteristics

Item	Specification	Unit
Screen Size	3.5 inch diagonal	inch
Outline Dimensions	83.7 (H) x 68.6 (V) x 6.2 (D)	mm
Active Area	71.7 (H) x 52.4 (V)	mm
Input Signal	NTSC/PAL	–
Sub Pixel No.	600 (H) x 234 (V)	–
Sub Pixel Arrangement	Delta	–
Dot Pitch	0.119 (H) x 0.224 (V)	mm
Weight	60	g

Absolute Maximum Rating

Item			Symbol	Conditions	Absolute Maximum Rating		Unit
					Min.	Max.	
Supply Voltage	for Source Driver		DV_{EE}, AV_{EE} OV_{EE},VP+	Ta = 25°C	0	+16.0	V
	for Gate Driver	H Level	V_{CC}	Ta = 25°C	0	+26.0	V
		L Level	V_{BBA},V_{BBC}	Ta = 25°C	-7.0	+20.0	V
	for Controller		V_{DD}	Ta = 25°C	0	+6.5	V
DC Bias Voltage for Common Electrode			Vcom	Ta = 25°C	+2	+6.0	V
Analog Input Signals			V_B, V_R, V_G	–	0	+12	V
Digital Input Signals				–	-0.5	+5.5	V
Digital Output Signals				–	-0.5	+5.5	V
Operating Temperature			Top	–	-10	+60	°C
Storage Temperature			Tstg	–	-30	+80	°C
Humidity (No condensation of water)			–	+60°C	–	95%	RH

Electrical Specification

Item		Symbol	Conditions	Specifications			Units
				Min.	Typ.	Max.	
Current Consumption	for Video Circuit	ICC		–	0.19	–	W
	for Backlight Lamp	IBL		–	0.9	–	W
	Supply Voltage	IDD	V_{DD} = +5V	–	5.7	–	mA

(Ta = RT, VSS = 0V)

Recommended Operating Conditions

Item			Symbol	Conditions	Specifications			Unit
					Min.	Typ.	Max.	
Supply Voltage	for Source Driver		DV_{EE}, AV_{EE} OV_{EE},VP+	Ta = 25°C	13.5	14.0	14.5	V
	for Gate Driver	H Level	V_{CC}	Ta = 25°C	19.0	20.0	24.0	V
		L Level	V_{BBA}, V_{BBC}	Ta = 25°C	-5.5	-5.0	-4.0	
	for Controller		V_{DD}	Ta = 25°C	4.7	5.0	5.3	V
Digital Input Voltage (1)		H Level		Ta = 25°C	2.4	4.0	5.0	V
		L Level		Ta = 25°C	-0.3	–	0.8	
Voltage(2)		H Level		Ta = 25°C	0.0	–	.55	V
		L Level		Ta = 25°C	2.4	4.0	5.0	
DC Bias Voltage			V_{COM}	compatible	+2.0	+3.4	+12.0	V
Analog Input Voltage		Amplitude	V_B, V_R, V_G	Ta = 25°C	+1.12	–	+6.0	V
		DC Component		Ta = 25°C	+4.0	+6.0	+8.0	

Note 1: CSY

Optical Specifications

Item		Symbol	Conditions	Specifications			Unit
				Min.	Typ.	Max.	
Luminance		LUM		–	200	–	cd/m^2
Contrast Ratio (1)		CR	Luminance when LCD is White / Luminance when LCD is Black	80	120	–	–
Reflectance		R		–	3.0	–	%
Viewing Angle	Horizontal	ϕ	CR>10	±45	±55	–	deg
	Vertical	ϕ (to 12 o'clock)		-10	-15	–	deg
		ϕ (to 6 o'clock)		30	35	–	deg
Response Time	Rise	Tr	θ =0°	–	–	30	ms
	Fall	Tf	ϕ =0°	–	–	50	ms
Lamp Life		Time	–	10,000	–	–	hr.

Note 1: Luminance when LCD is White / Luminance when LCD is Black

Contrast Ratio is measured in optimum common electrode voltage

Power Consumption

Parameter	Conditions	Typ.	Unit
Current for V_{CC}	V_{CC} = +20V	2.3	mA
Current for V_{BBA}	V_{BBA} = -5V	2.1	mA
Current for V_{BBC}	V_{BBC} = -5V	0.05	mA
Current for DV_{EE}	DV_{EE} = +14V	0.54	mA
Current for AV_{EE}	AV_{EE} = +14V	3.0	mA

Parameter	Conditions	Typ.	Unit
Current for OV_{EE}	OV_{EE} = +14V	4.0	mA
Current for V_{DD}	V_{DD} = +5V	5.7	mA
LCD Panel Power Consumption	–	0.19	W
Backlight Power Consumption	–	0.9	W
Total Power Consumption	–	1.09	W

Input/Output Timing

Paramenter		Symbol	Min	Typ	Max	Unit	Remarks
Horizontal Sync Output Pulse	Width	T_{HO}	4.2	4.7	5.2	µs	
	Phase Difference	T_{HP}	0	2	–	µs	
	Rising Time	T_{HR}	–	–	0.5	µs	
	Falling Time	T_{HF}	–	–	0.5	µs	
Vertical Sync Output Pulse	Width	T_{VO}	–	4H	–	µs	H=1/15.75KHz
	Phase Difference	T_{VPO}	–	1H	–	µs	odd field
	Phase Difference	T_{VPE}	–	1.5H	–	µs	even field
	Rising Time	T_{VR}	–	–	2	µs	
	Frequency	f_{FRP}	7.67	7.87	8.07	KHz	
Polarity Alternating Signal	Delay time	T_{FD}	–	–	4	µs	
	Falling time	T_{VF}	–	–	2	µs	

Interface Pin Assignment

Pin No.	Symbol	Function	Input/Output	Remarks
1	V_{COM}	Common electrode voltage	Input	Should be adjusted accurately to get the best contrast ratio
2	V_{BBA}	Supply voltage for level shifter (low level)	Input	–5V (Typ.)
3	NC	No connection	–	+5V (Typ.)
4	V_{BBC}	Supply voltage for panel	Input	–5V (Typ.)
5	V_{SS}	Ground for panel	Input	
6	V_{CC}	Supply voltage for level shifter (high level)	Input	+20V (Typ.)
7	V_{PIN}	Pulse high level for level shifter (high level)	Input	Must be more positive than V_{MIN}. (1)
8	V_{MIN}	Pulse low level for level shifter (low level)	Input	Must be more positive than V_{MIN}. (1)
9	FRP	Control signal for video inversion	Output	
10	$\overline{VSY}$	Vertical sync.	In/Out	
11	$\overline{HSY}$	Horizontal sync.	In/Out	
12	C_{SYNC}	Composite sync.	Input	
13	PD	Phase detector	Output	Output (0~5V range) from phase detector loop which is included in source driver
14	OSC	Clock input for LC oscillator	Input	OSC should be around 9.45 MhZ, 0-5V input
15	V_{DD}	Supply voltage for logic circuit	Input	+5V (Typ.)
16	CKC	Control Pin for select I/O signal	Input	Pin 16 (CKC) can select the function for Pin 11 ($\overline{HSY}$) and Pin 10 ($\overline{VSY}$). (2)
17	UD	Up/Down control	Input	Up/Down shift
18	LR	Left/Right shift control	Input	Left/Right shift
19	NP	NTSC/PAL selector	Input	Hi (+5V) for NTSC; Low (0V) for PAL
20	V_B	Video Input B	Input	
21	V_G	Video Input G	Input	
22	V_R	Video Input R	Input	
23	GND	Ground for high voltage logic	Input	
24	GND	Ground for logic	Input	
25	DV_{EE}	Voltage supply for source driver high logic	Input	Equal to +14V
26	C_{COM}	Reference for sample and hold	Input	+5V (Typ.)
27	AV_{EE}	Voltage supply for sample and hold	Input	Equal to +14V
28	GND	Ground	Input	
29	OV_{EE}	Voltage supply for operation amplifier	Input	Equal to +14V
30	VP+	Pre-charge high level	Input	Equal to +14V

Note 1:

Pin	Symbol	Min	Typical	Max	Unit
7	V_{PIN}	12	13	14	V
8	V_{MIN}	5	6	7	V

Note 2: Pin 16(CKC) can select the function for Pin11 ($\overline{HSY}$) and Pin 10($\overline{VSY}$).

CKC	$\overline{HSY}$	CSY	$\overline{VSY}$
Hi	$\overline{HSY}$ Output	CSY Input	$\overline{VSY}$ Output
Low	External $\overline{HSY}$ Input	External Clock Input	External $\overline{VSY}$ Input

Dimensional Outline