MN83951

TFT LCD Panel Controller

■ Overview

The MN83951 is a timing controller for displaying an analog video signal on a TFT color liquid crystal display panel in such applications as LCD television sets and video cameras.

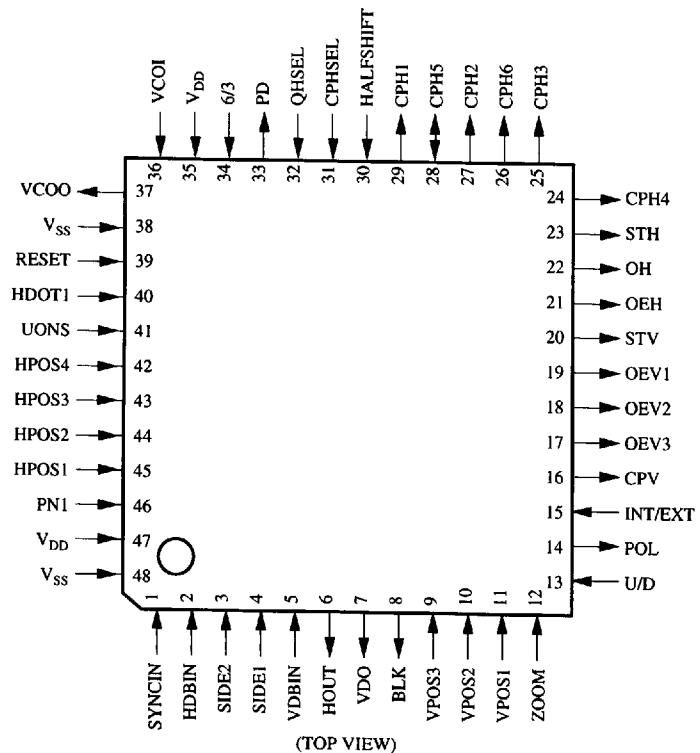
■ Features

- Support for both composite color sync input and separate color sync input
- Horizontal and vertical position adjustment functions
  - Horizontal: 4 bits (range: approximately 4 μs)
  - Vertical: 3 bits (range: 7 H)
- Wide panel support
  - Three side blackout modes
  - Simple ZOOM mode (Support for both normal and reverse scans)
- Support for both single- and two-sided source driver configurations
- Support for both PAL and NTSC systems (decimation mode only for PAL)
- Support for underside on screen display(UONS)
- ON/OFF function for shifting output timing by half a pixel clock cycle

■ Applications

- LCD television sets and video cameras

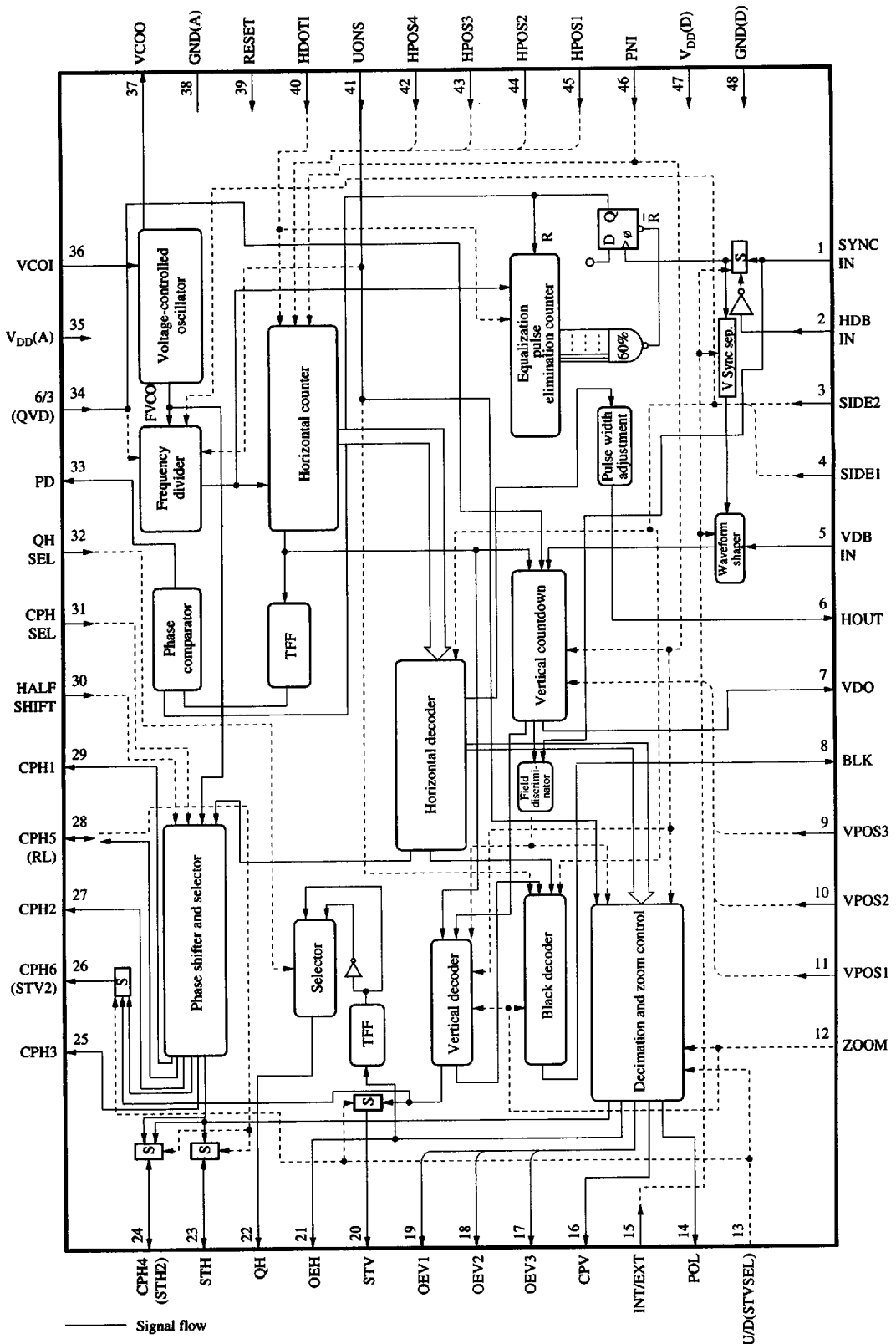
■ Pin Assignment



(TOP VIEW)
QFH048-P-0707

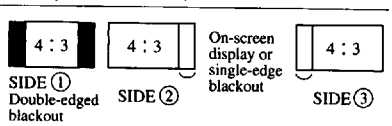
Never leave V_{DD} and V_{SS} pins open.

■ Block Diagram

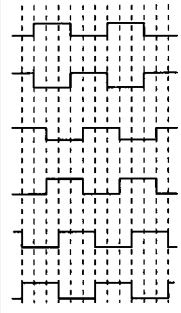


Note: The above is a bottom view.

■ Pin Descriptions

Pin No.	Internal Resistor	Symbol	Pin Name	I/O	Function Description
1	None	SYNC IN	Composite color sync input	I	• Composite color sync signal (Sync "H" level)
2	None	HDBIN	Horizontal sync input	I	• (Sync "L" level)
3	PD	SIDE2	Side blackout SIDE2 0 1 0 1	I	
4	PD	SIDE1	control pins SIDE1 0 0 1 1	I	
			Normal ① ② ③		
5	None	VDB IN	Vertical sync input	I	• (Sync "L" level)
6	—	HOUT	Horizontal sync output	O	• This pin provides the horizontal sync signal obtained by removing the equalization and the cut pulses for vertical synchronization from the composite color sync signal.
7	—	VDO	Vertical sync output	O	• The pulse from this pin falls with the horizontal sync pulse of pin 6 following a falling edge of pin 5 pulse and rises after 3-H pulse width.
8	—	BLK	Black signal output	O	• In the side blackout and underside on screen (UONS) modes, this pin provides "H" level pulses synchronized with the black and on-screen timing.
9	PD	VPOS3	Vertical display position selection	I	These pins control the position of the STV rising edge after the VDO falling edge. NTSC • 12H+(7–VPOS1–2 × VPOS2–4 × VPOS3)H In the ZOOM mode, the interval is 31 H. PAL • 24H+(7–VPOS1–2 × VPOS2–4 × VPOS3)H In the ZOOM mode, the interval is 35 H.
10	PD	VPOS2	(These change the STV position.)	I	
11	PD	VPOS1		I	
12	PD	ZOOM	Zoom control ("H" level selects ZOOM mode.)	I	NTSC • The controller selects two scan lines every 3H. PAL • The controller deactivates decimation and simultaneously selects two scan lines at (6n+1) H.
13	PU	U/D	Scan direction control ("H" level selects normal scan.)	I	• In the ZOOM mode, the controller switches pulses of OEV1 - OEV3. • When HALFSHIFT is at "H" level, this pin functions as STVSEL.

■ Pin Descriptions (continued)

Pin No.	Internal Resistor	Symbol	Pin Name	I/O	Function Description
14	—	POL	Pulses switching image polarity and opposing voltage	O	• Pulses sent to chroma IC for controlling image polarity and opposing electrode. The level changes at the rising edge of OEH.
15	PU	INT/EXT	Internal/external synchronization selection	I	• "H" level selects composite color sync mode; "L" level, separate color sync mode.
16	—	CPV	Gate driver clock pulses	O	• Clock pulses for shift registers inside gate driver ICs
17 18 19	— — —	OEV3 OEV2 OEV1	Gate driver output stage enable pulses (Selective stage output: "H" level for VgL; "L" level for VgH)	O O O	• "H" level output from these pins forces the gate driver IC output buffers to VgL. • These pins are used during PAL decimation and in the ZOOM mode. • "L" level input from pin 39 (RESET) forces all three pins to "H" level.
20	—	STV	Gate driver scan start pulses	O	• These pulses start the shift registers inside the gate driver ICs. They are 1 H wide and change levels at the falling edge of CPV.
21	—	OEH	Source driver output stage enable pulses	O	• These pulses determine the timing with which the source drivers write image data to the LCD panel. The period is 1 H; the pulse width, 8 µs.
22	—	QH	Color data switching pulses to source drivers	O	• This pin controls switching of color data to source driver ICs. Pin 32 controls the order.
23	—	STH	Source driver start pulses	O	• These pulses start the shift registers inside the source driver ICs. They are 1 CPH wide and change levels at the falling edge of CPH1.
24	—	CPH4	Source driver clock pulses 4/Source driver start pulses 2	O	 (1) When pins 30 and pins 34 are both "L" level, the controller delivers clock pulses only to CPH1 - CPH3 and drives CPH4 - CPH6 at "L" level. (2) When pins 30 and pins 34 are both "H" level, the controller alternates the CPH1 - CPH3 outputs between the CPH1 - CPH3 and CPH4 - CPH6 phase clock patterns every 1 H.
25	—	CPH3	Source driver clock pulses 3	O	
26	—	CPH6	Source driver clock pulses 6/Source driver start pulses 2	O	
27	—	CPH2	Source driver clock pulses 2	O	
28	—	CPH5	Source driver clock pulses 5/STH switching signal	I/O	
29	—	CPH1	Source driver clock pulses 1	O	

■ Pin Descriptions (continued)

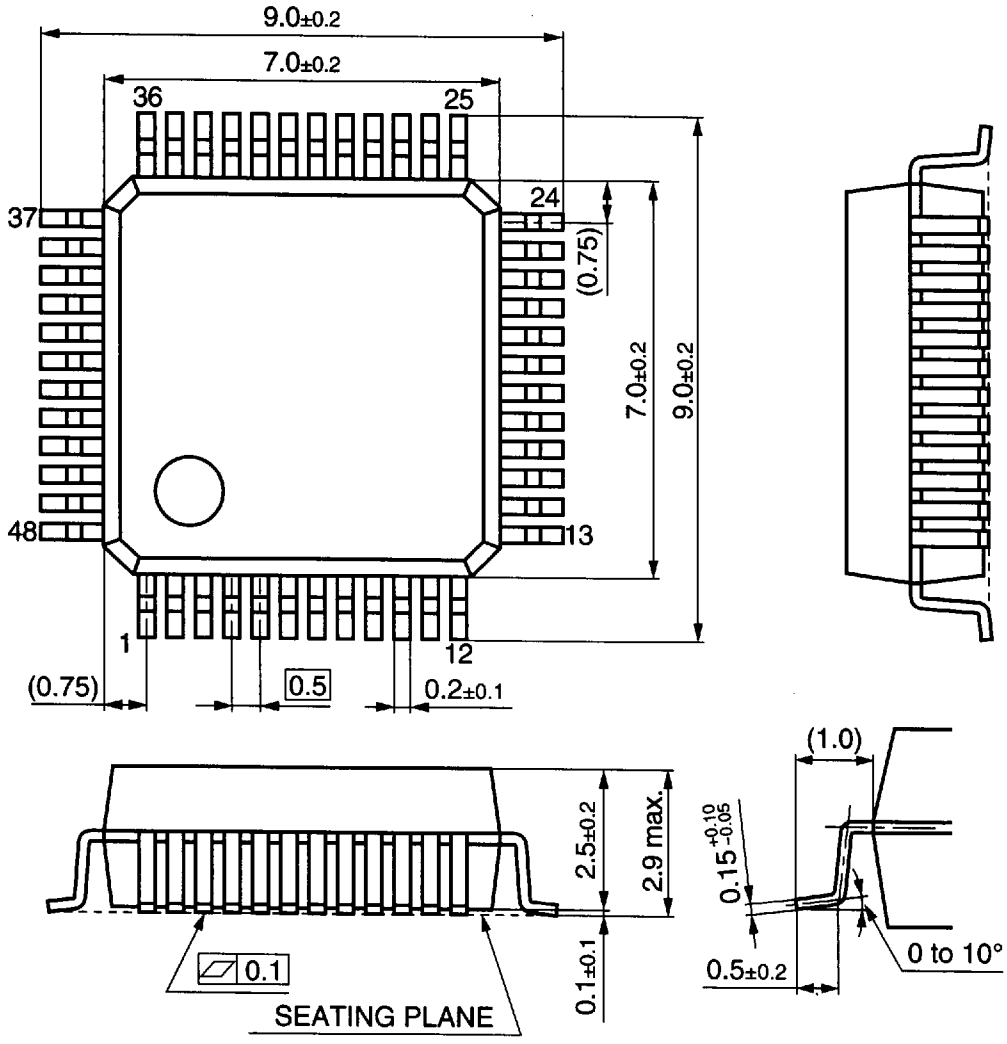
Pin No.	Internal Resistor	Symbol	Pin Name	I/O	Function Description
30	PD	HALF SHIFT	Controlling timing shift of half a pixel clock cycle ("H" level selects shifting.)	I	• The pin provides a means of shift output timing for alternate lines by half a pixel clock cycle to drive a delta panel layout.
31	PD	CPH SEL	CPH pulse phase switching	I	• When the frequency divider is six–that is, pin 34 is at "H" level–this pin switches between the CPH1 - CPH3 and CPH4 - CPH6 phase clock patterns.
32	PD	QH SEL	QH output switching	I	• This pin determines the order in which the color data switching pulses (QH from pin 22) to the source driver ICs.
33	—	PD	Phase comparator output	O	• This pin provides output from the phase comparator using an edge trigger.
34	None	6/3 (QVD)	Frequency divider doubler ("H" level input doubles the divider ratio from 3 to 6.)	I	• This pin determines the frequency divider ratio to CPH from FVCO, the fundamental frequency for the voltage-controlled oscillator: 6 for "H" level input and 3 for "L" level input. • When pin 30 is at "H" level, this pins serves as the QVD input pin.
35	—	$V_{DD\,(A)}$	Power supply for analog circuits: 3 V	—	• This is the power supply for the voltage-controlled oscillator, clock frequency divider, and CPH generator.
36	—	VCO I	VCO input	I	• Oscillator signal input for VCO
37	—	VCO O	VCO output	O	• Oscillator signal output for VCO
38	—	$GND_{(A)}$	Ground for analog circuits	—	• This is the ground for the voltage-controlled oscillator, clock frequency divider, and CPH generator.
39	PU	RESET	Reset ("L" level input selects RESET mode.)	I	• This signal resets internal counters, flip-flops, and other components. The pull-up resistance is between 50 kΩ and 500 kΩ.
40	PU	HDOTI	Switching number of panel dots in the horizontal direction	I	• In combination with pins 30 and 34, this pin controls the horizontal frequency divider ratio to match the number of panel dots in the horizontal direction. • For delta layouts, dot counts of 480, 600, 960, and 1200 are supported. • For striped layouts, dot counts of 960 and 1200 are supported.
41	PD	UONS	Controlling underside on screen (UONS) mode ("H" level selects UONS mode.)	I	• This mode switches the bottom 30 lines to an on-screen display mode.

■ Pin Descriptions (continued)

Pin No.	Internal Resistor	Symbol	Pin Name	I/O	Function Description
42 to 45	PD	HPOS4 to HPOS1	Horizontal pixel position (STH position)	I	These pins determine the lag between the rising edge of the SYNC IN signal and the STH rising edge: (assuming that the synchronization separation delay is 1.1 µs) • NTSC: 7.3µs+(15–HPOS1–2 × HPOS2 –4 × HPOS3–3 × HPOS4) × 0.3125µs • PAL: 8.0µs+(15–HPOS1–2 × HPOS2 –4 × HPOS3–3 × HPOS4) × 0.3125µs
46	PD	PN1	PAL/NTSC switch ("L" level selects NTSC mode.)	I	• "H" level input selects PAL mode with decimation at the rate of one line in eight. 1st: (8n+2) H, 2nd: (8n+5) H
47	—	V_{DD}	Power supply for digital circuits: 3 V	—	• Power supply for digital circuits
48	—	GND	Ground for digital circuits	—	• Ground for digital circuits

■ Package Dimensions (Unit:mm)

QFH048-P-0707



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