

# MN5814

## TFT AV Panel Controller IC

### ■ Overview

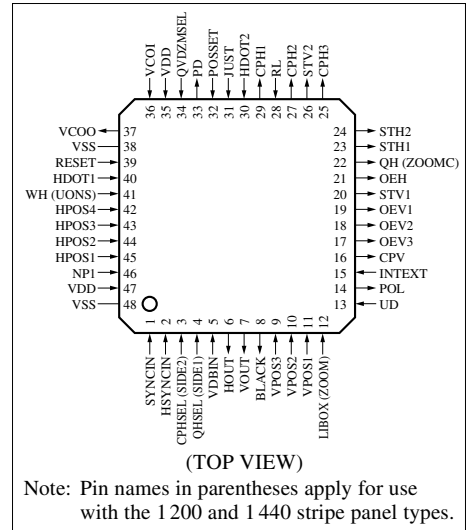
The MN5814 is a TFT LCD panel timing controller IC.

### ■ Features

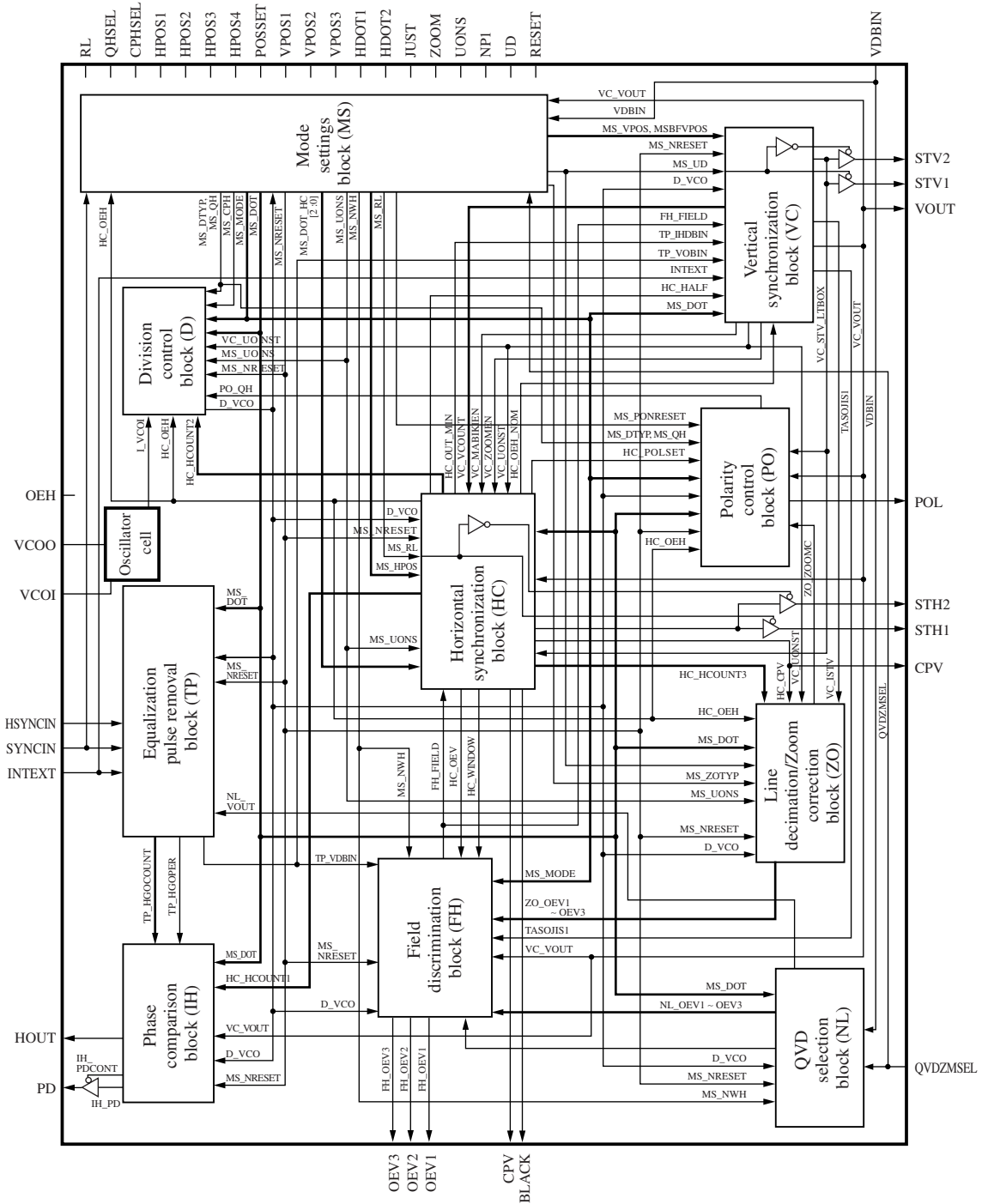
- Supports both composite sync and separate sync signal video inputs.
- Horizontal and vertical position adjustment function
  - Horizontal: 5 bits (Adjustment range: 9.38  $\mu$ s)
  - Vertical: 4 bits (Adjustment range: 14 H)
- Supports multiple panel types
  - From 2.5-type to 7-type wide-screen panels
  - For wide-screen panels:
    - Display with black side bands (3 modes)
    - Just-fit display
    - Zoom (2 modes)
- Switching between PAL and NTSC (PAL: decimation only)
- Underside on-screen display (UONS)
- An optimal zooming mode is possible according to the display panel through 2-zooming mode of ZOOM1 and ZOOM2.
- UONS display at arbitrary positions is possible by the black side control pins.
  - Also provides full-screen black side display.

### ■ Applications

- TFT LCD panels



■ Block Diagram



## ■ Pin Descriptions

Pin No.	Pin Name	I/O	Description
1	SYNCIN	I	Composite sync input
2	HSYNCIN	I	Horizontal sync input (separate)
3	CPHSEL (SIDE2)	I	In 1 440 or 1 200-stripe mode: Black side and just-fit control In 960-stripe mode: Disabled In 480 or 960-delta mode: CPH pulse phase switching
4	QHSEL (SIDE1)	I	In 1 440 or 1 200-stripe mode: Black side and just-fit control In 960-stripe mode: Disabled In 480 or 960-delta mode: QH pulse phase switching
5	VDBIN	I	Vertical sync input (separate)
6	HOUT	O	Horizontal sync output
7	VOUT	O	Vertical sync output
8	BLACK	O	Black signal output
9	VPOS3	I	Vertical display position switching (STV1 and STV2 position switching)
10	VPOS2	I	
11	VPOS1	I	
12	LTBOX (ZOOM)	I	High: Zoom or letterbox display In 1 440 or 1 200-mode: Zoom display control In 480 or 960-delta or 960-stripe mode: Letterbox display control
13	UD	I	Up/down scan direction switching (STV1 and STV2 output switching)
14	POL	O	Video, opposite electrode reversal signal
15	INTEXT	I	Composite/separate input switching
16	CPV	O	Gate driver IC clock
17	OEV3	O	Gate driver IC output stage enable pulse signals
18	OEV2	O	
19	OEV1	O	
20	STV1	O	Gate driver IC start pulse 1
21	OEH	O	Source driver IC output stage enable pulse signal
22	QH (ZOOMC)	O	In 480 or 960-delta mode: Color arrangement switching pulse In 1 200 or 1 440-mode: Zoom control pulse In 960 stripe mode: Fixed low-level output
23	STH1	O	Source driver IC start pulse 1
24	STH2	O	Source driver IC start pulse 2
25	CPH3	O	Source driver IC clock 3
26	STV2	O	Source driver IC start pulse 2
27	CPH2	O	Source driver IC clock 2
28	RL	I	Left/right scan direction switching (STH1 and STH2 output switching)

## ■ Pin Descriptions (continued)

Pin No.	Pin Name	I/O	Description
29	CPH1	O	Source driver IC clock 1
30	HDOT2	I	Display pixel count mode switch 2
31	JUST	I	In 1 200 or 1 440-mode: Just-fit display switching In 960-mode: Stripe/delta control
32	POSSET	I	Horizontal/vertical display position offset switching
33	PD	O	Phase comparator output
34	QVDZMSEL	I	In 480 or 960-delta or stripe mode: QVD input In 1 200 or 1 400-mode: Zoom 1/zoom 2 display switching OEV pulse control in zoom mode
35	VDD	I	Power supply (VDD)
36	VCOI	I	VCO input (system clock input)
37	VCOO	O	VCO output
38	VSS	I	Ground (GND)
39	RESET	I	System reset
40	HDOT1	I	Display pixel count mode switching 1
41	WH (UONS)	I	In 1 200 or 1 440-mode: "Under on-screen" display control In 480 or 960-delta or stripe mode: WH (write/hold) control
42	HPOS4	I	Horizontal display position switching signals (STH1 and STH2 position switching)
43	HPOS3	I	
44	HPOS2	I	
45	HPOS1	I	
46	NP1	I	NTSC/PAL switching
47	VDD	I	Power supply (VDD)
48	VSS	I	Ground (GND)

## ■ Electrical Characteristics

### 1. Absolute Maximum Ratings at $V_{SS} = 0$ V

Parameter	Symbol	Rating	Unit
Supply voltage	$V_{DD}$	- 0.3 to +4.6	V
Input pin voltage	$V_I$	- 0.3 to $V_{DD}+0.3$	V
Output pin voltage	$V_O$	- 0.3 to $V_{DD}+0.3$	V
Output current (HL2 pins)	$I_O$	$\pm 6$	mA
Output current (HL4 pins)	$I_O$	$\pm 12$	mA
Power dissipation	$P_D$	330	mW
Operating temperature	$T_{opr}$	-40 to +85	$^{\circ}\text{C}$
Storage temperature	$T_{stg}$	-55 to +150	$^{\circ}\text{C}$

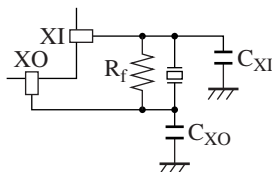
Note) 1. HL2 pins: QH, CPV, OEH, OEV1 to OEV3, POL, STH1, STH2, STV1, STV2, HOUT, VOUT, BLACK

HL4 pins: PD, CPH1 to CPH3

- The absolute maximum ratings are limit values for stresses applied to the chip so that the chip will not be destroyed. Operation is not guaranteed within these ranges.
- All the VDD and VSS pins must be connected externally to the corresponding power or ground.
- The power dissipation rating applies at  $T_{opr} = 85^{\circ}\text{C}$  when the MN5814 is mounted on a glass-epoxy printed circuit board. The actual value differs depending on the printed circuit board used and the thermal conditions in the end product.

### 2. Recommended Operating Conditions at $V_{SS} = 0$ V

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Supply voltage	$V_{DD}$		2.7	3.3	3.6	V
Ambient temperature	$T_a$		-40	—	85	$^{\circ}\text{C}$
Input rise time	$t_r$		0	—	100	ns
Input fall time	$t_f$		0	—	100	ns
Oscillator frequency	$f_{osc1}$	30 MHz Xtal	—	30	—	MHz
Recommended values for external capacitors	$C_{XI90}$ $C_{XO90}$	$V_{DD} = 3.3$ V, with an external feedback resistor	—	33	—	pF
			—	10 (25 MHz to 40 MHz)	—	
Recommended values for external resistors	$R_f90$	$V_I = V_{DD}$ or $V_{SS}$ , $V_{DD} = 3.3$ V	—	2.2	—	k $\Omega$



Note) Since the oscillator characteristics differ depending on the oscillator element used and the external capacitor conditions, consult the manufacturer of the oscillator element to determine the optimal oscillator circuit.

### ■ Electrical Characteristics (continued)

3. Electrical Characteristics at  $V_{DD} = 2.7 \text{ V to } 3.6 \text{ V}$ ,  $V_{SS} = 0 \text{ V}$ ,  $f_{TEST} = 30 \text{ MHz}$ ,  $T_a = -40^\circ\text{C to } +85^\circ\text{C}$

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Quiescent supply current	$I_{DDs}$	$V_1$ (pulled-up pins) = OPEN, $V_1$ (pulled-down pins) = OPEN, $V_1$ (XI) = $V_{DD}^*$ , With either the $V_{DD}$ or the $V_{SS}$ level applied simultaneously to all of the other input pins and I/O pins in the high-impedance state.	—	—	500	$\mu\text{A}$
Operating supply current	$I_{DDO}$	$V_1 = V_{DD}$ or $V_{SS}$ , $f = 30 \text{ MHz}$ , $V_{DD} = 3.3 \text{ V}$ , outputs open	—	15	30	mA

#### 1) CMOS input level Schmitt trigger pins: RESET, VDBIN, SYNCIN, HSYNCIN

Input threshold voltage	VT+	$V_{DD} = 2.7 \text{ V to } 3.6 \text{ V}$	—	1.85	$V_{DD} \times 0.7$	V
	VT-		$V_{DD} \times 0.3$	1.45	—	
Input leakage current	$I_{LI}$	$V_1 = V_{DD}$ or $V_{SS}$	—	—	$\pm 5$	$\mu\text{A}$

#### 2) CMOS input level pins with built-in pull-up resistor: RL, UD, HDOT1, HDOT2, INTEXT

High-level input voltage	$V_{IH}$		$V_{DD} \times 0.7$	—	$V_{DD}$	V
Low-level input voltage	$V_{IL}$		0	—	$V_{DD} \times 0.3$	V
Pull-up resistor	$R_{IH}$	$V_1 = 0 \text{ V}$	33	100	318	k $\Omega$
Input leakage current	$I_{LIH}$	$V_1 = V_{DD}$	—	—	$\pm 10$	$\mu\text{A}$

#### 3) CMOS input level pins with built-in pull-down resistor:

NP1, HPOS1 to HPOS4, JUST, UONS, VPOS1 to VPOS3, ZOOM, QHSEL, CPHSEL, POSSET, QVDZMSEL

High-level input voltage	$V_{IH}$		$V_{DD} \times 0.7$	—	$V_{DD}$	V
Low-level input voltage	$V_{IL}$		0	—	$V_{DD} \times 0.3$	V
Pull-down resistor	$R_{IL}$	$V_1 = V_{DD}$	33	100	318	k $\Omega$
Input leakage current	$I_{LIL}$	$V_1 = V_{SS}$	—	—	$\pm 10$	$\mu\text{A}$

#### 4) Push-pull output pins: QH, CPV, OEH, OEV1 to OEV3, POL, HOUT, VOUT, BLACK

High-level output voltage	$V_{OH}$	$I_{OH} = -1.9 \text{ mA}$ , $V_1 = V_{DD}$ or $V_{SS}$	$V_{DD} - 0.6$	—	—	V
Low-level output voltage	$V_{OL}$	$I_{OL} = 1.9 \text{ mA}$ , $V_1 = V_{DD}$ or $V_{SS}$	—	—	0.4	V

#### 5) Push-pull output pins: CPH1 to CPH3

High-level output voltage	$V_{OH}$	$I_{OH} = -3.8 \text{ mA}$ , $V_1 = V_{DD}$ or $V_{SS}$	$V_{DD} - 0.6$	—	—	V
Low-level output voltage	$V_{OL}$	$I_{OL} = 3.8 \text{ mA}$ , $V_1 = V_{DD}$ or $V_{SS}$	—	—	0.4	V

Note) \*: The  $I_{DDs}$  associated with the  $V_{DD}$  applied to the oscillator pin XI shall be taken from a power supply separate from the measured power supply.

■ Electrical Characteristics (continued)

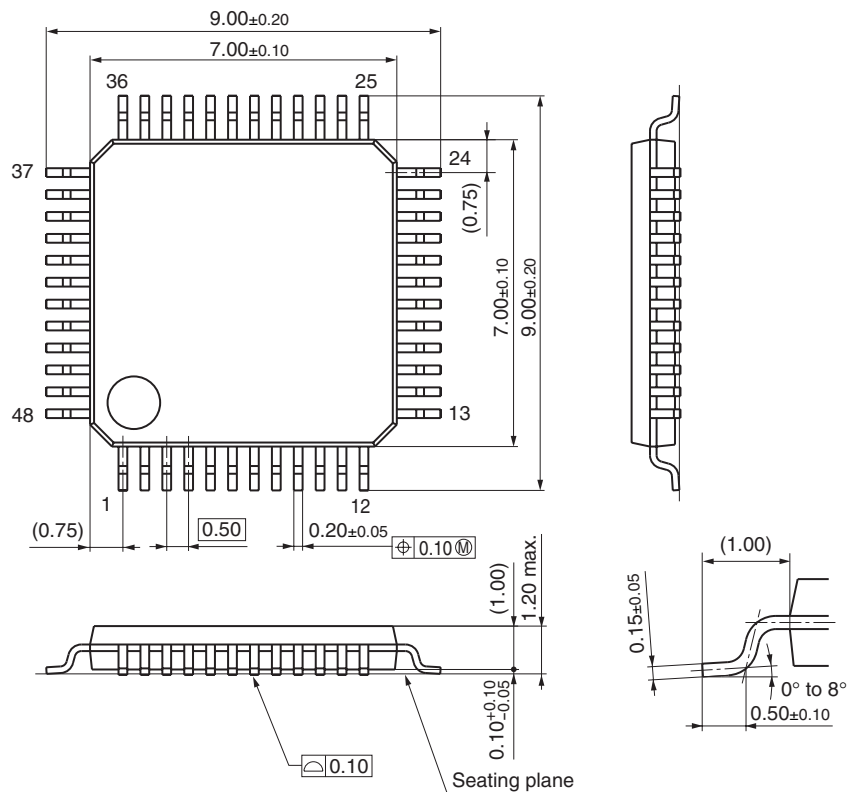
3. Electrical Characteristics at  $V_{DD} = 2.7\text{ V to }3.6\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $f_{TEST} = 30\text{ MHz}$ ,  $T_a = -40^\circ\text{C to }+85^\circ\text{C}$  (continued)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
6) Tristate output pins: STH1, STH2, STV1, STV2						
High-level output voltage	$V_{OH}$	$I_{OH} = -1.9\text{ mA}$ , $V_I = V_{DD}\text{ or }V_{SS}$	$V_{DD} - 0.6$	—	—	V
Low-level output voltage	$V_{OL}$	$I_{OL} = 1.9\text{ mA}$ , $V_I = V_{DD}\text{ or }V_{SS}$	—	—	0.4	V
Output leakage current	$I_{LO}$	$V_O = \text{High-impedance state}$ , $V_I = V_{DD}\text{ or }V_{SS}$ , $V_O = V_{DD}\text{ or }V_{SS}$	—	—	$\pm 5$	$\mu\text{A}$

7) Tristate output pins: PD						
High-level output voltage	$V_{OH}$	$I_{OH} = -3.8\text{ mA}$ , $V_I = V_{DD}\text{ or }V_{SS}$	$V_{DD} - 0.6$	—	—	V
Low-level output voltage	$V_{OL}$	$I_{OL} = 3.8\text{ mA}$ , $V_I = V_{DD}\text{ or }V_{SS}$	—	—	0.4	V
Output leakage current	$I_{LO}$	$V_O = \text{High-impedance state}$ , $V_I = V_{DD}\text{ or }V_{SS}$ , $V_O = V_{DD}\text{ or }V_{SS}$	—	—	$\pm 5$	$\mu\text{A}$

■ Package Dimensions (Units: mm)

- TQFP048-P-0707B (Lead-free package)



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