1 PRODUCT OVERVIEW

SAM87 PRODUCT FAMILY

Samsung's SAM87 family of 8-bit single-chip CMOS microcontrollers offers a fast and efficient CPU, a wide range of integrated peripherals, and various mask-programmable ROM sizes. Important CPU features include:

— Efficient register-oriented architecture
— Selectable CPU clock sources
— Release by interrupt of Idle and Stop power-down modes
— Built-in basic timer circuit with watchdog function

A sophisticated interrupt structure recognizes up to eight interrupt levels. Each level can have one or more interrupt sources and vectors. Fast interrupt processing (within a minimum six CPU clocks) can be assigned to specific interrupt levels.

KS88C8216/C8224/P8224/C8316/C8324/P8324 MICROCONTROLLERS

The KS88C8216/C8316 microcontroller has 16 K bytes of on-chip program memory and the KS88C8224/C8324 has 24 K bytes. Both chips have a 272-byte general-purpose internal register file. The interrupt structure has seven interrupt sources with seven interrupt vectors. The CPU recognizes six interrupt priority levels.

Using a modular design approach, the following peripherals were integrated with the SAM87 core to make the KS88C8216/C8224/P8224/C8316/C8324/P8324 microcontrollers suitable for use in color television and other types of screen display applications:

— Four programmable I/O ports (26 pins total: 18 general-purpose I/O pins; 8 n-channel, open-drain output pins)
— 2-bit A/D converter (4-bit resolution)
— 14-bit PWM output (one channels: push-pull type)
— Basic timer (BT) with watchdog timer function
— One 8-bit timer/counter (T0) with interval timer
— One 8-bit general-purpose timer/counter (TA) with prescalers
— On-screen display (OSD) with a wide range of programmable features, including halftone control signal output

The KS88C8216/C8224 and the KS88C8316/C8324 are available in a versatile 42-pin SDIP package.

OTP

The KS88C8216/C8224 microcontroller is also available in OTP (One Time Programmable) version, KS88P8224. The KS88C8316/C8324 microcontroller is also available in OTP (One Time Programmable) version, KS88P8324. KS88P8224/P8324 microcontroller has an on-chip 24K-byte one-time-programmable EPROM instead of masked ROM. The KS88P8224 is comparable to KS88C8216/C8224, both in function and in pin configuration. Also, the KS88P8324 is comparable to KS88C8316/C8324, both in function and in pin configuration.

FEATURES

CPU

- SAM87 CPU core

Memory

- 16-Kbyte (KS88C8216/C8316) or 24-Kbyte (KS88C8224/C8324) internal program memory
- 272-byte general-purpose register area

Instruction Set

- 78 instructions
- IDLE and STOP instructions added for power-down modes

Instruction Execution Time

- 750 ns (minimum) with an 8-MHz CPU clock

Interrupts

- 7 interrupt sources with 7 vectors
- 6 interrupt levels
- Fast interrupt processing for select levels

General I/O

- Four I/O ports (26 pins total)
- Six open-drain pins for up to 6-volt loads
- Two open-drain pins for up to 5-volt loads

8-Bit Basic Timer

- Three selectable internal clock frequencies
- Watchdog or oscillation stabilization function

Timer/Counters

- One 8-bit timer/counter (T0) with three internal clocks and interval timer mode.
- One general-purpose 8-bit timer/counters with interval timer mode (timer A)

A/D Converter

- Two analog input pins; 4-bit resolution
- 3.125 µs conversion time (8-MHz CPU clock)

Pulse Width Modulation Module

- 14-bit PWM with one-channel output (push-pull type)
- PWM counter and data capture input pin
- Frequency: 5.859 kHz to 23.437 kHz with a 6-MHz CPU clock

On-Screen Display (OSD)

- Video RAM: 252 × 12 bits
- Character generator ROM: 256 × 18 × 16 bits (256 display characters: fixed: 2, variable: 254)
- 252 display positions (12 rows × 21 columns)
- 16-dot × 18-dot character resolution
- 16 different character sizes
- Eight character colors
- Vertical direction fade-in/fade-out control
- Eight colors for character and frame background
- Halftone control signal output; selectable for individual characters
- Synchronous polarity selector for H-sync and V-sync input

Oscillator Frequency

- 5-MHz to 8-MHz external crystal oscillator
- Maximum 8-MHz CPU clock

Operating Temperature Range

- – 20°C to + 85°C

Operating Voltage Range

- 4.5 V to 5.5 V

Package Type

- 42-pin SDIP

BLOCK DIAGRAM

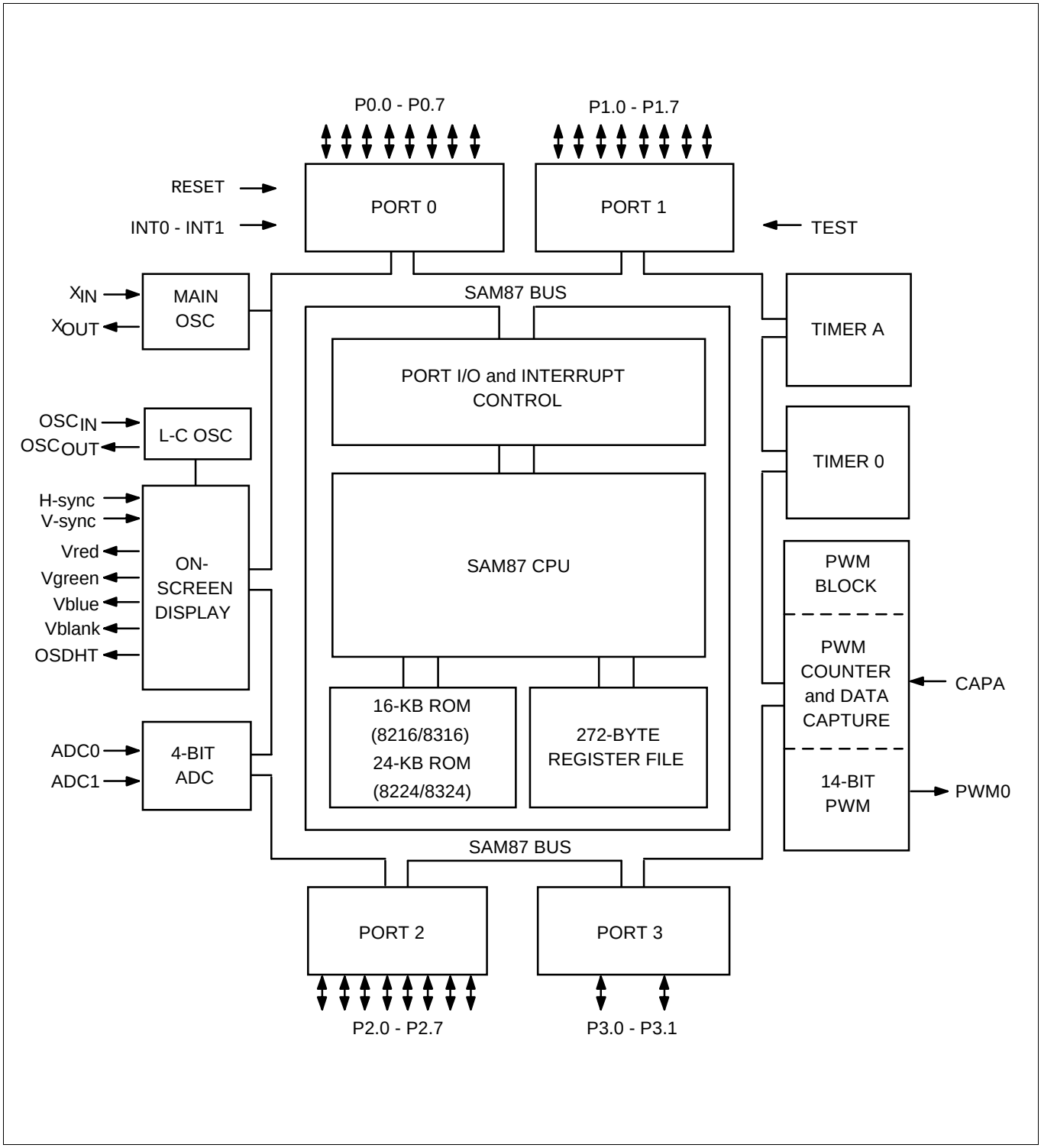

Figure 1–1. Block Diagram

PIN ASSIGNMENTS

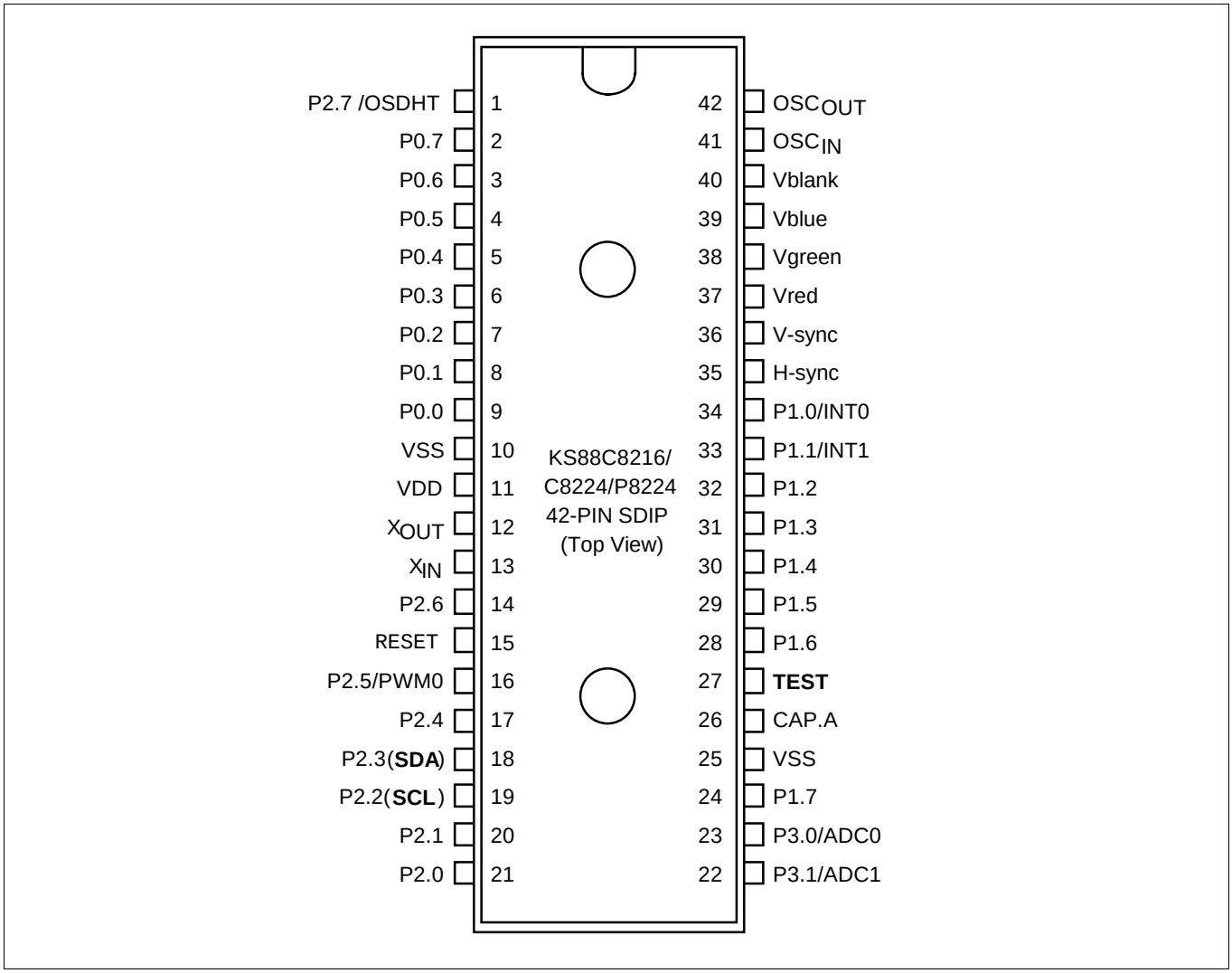

Figure 1–2. KS88C8216/C8224/P8224 Pin Assignment Diagram

PIN ASSIGNMENTS

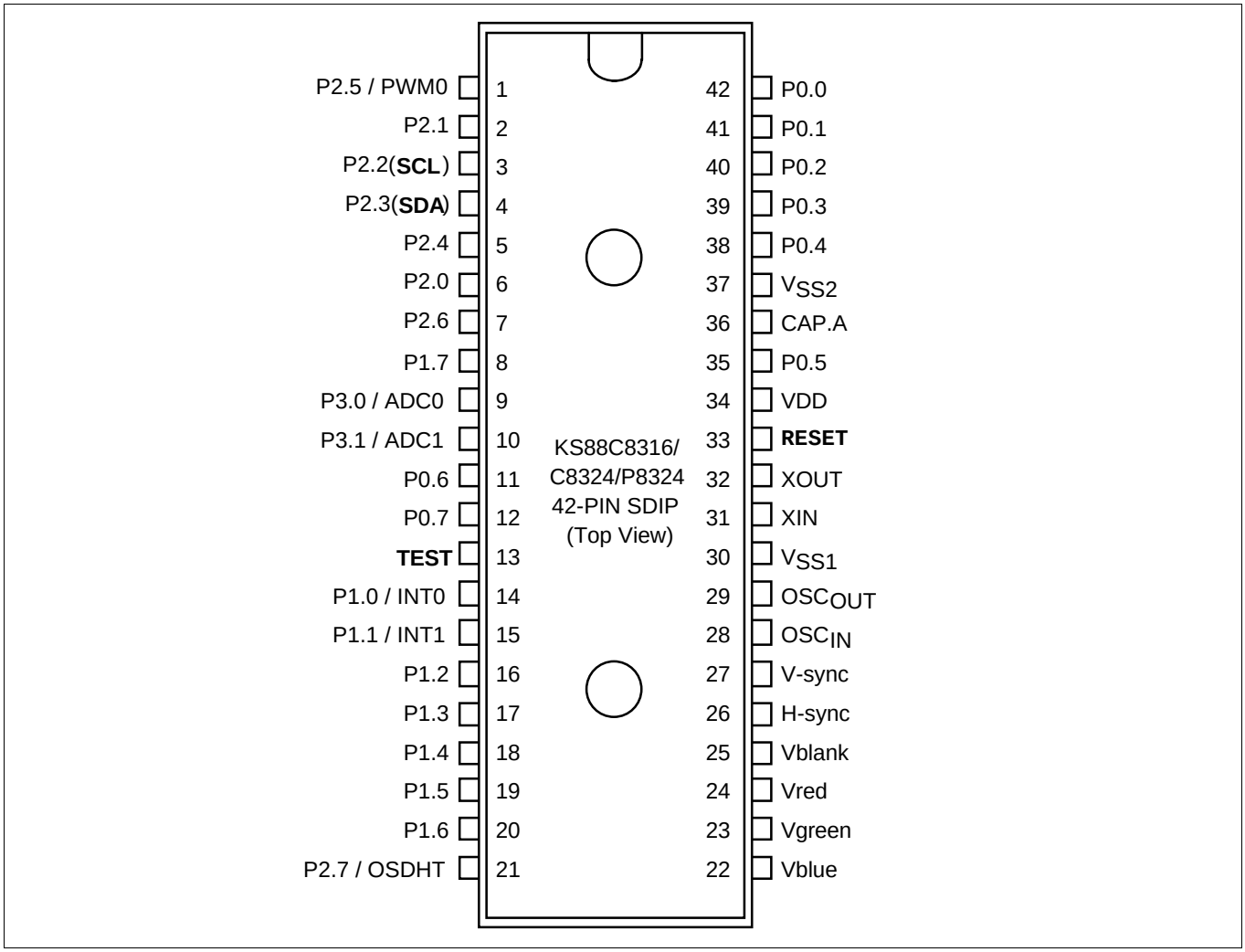

Figure 1–3. KS88C8316/C8324/P8324 Pin Assignment Diagram

Table 1–1. KS88C8216/C8224 Pin Descriptions

Pin Name	Pin Type	Pin Description	Circuit Type	Pin Numbers	Share Pins
P0.0–P0.7	I/O	General I/O port (8-bit), configurable for digital input or push-pull output.	3	2–9	
P1.0–P1.1	I/O	General I/O port (2-bit), configurable for digital input or n-channel open-drain output. P1.0–P1.1 can withstand up to 6-volt loads. Multiplexed for alternative use as external interrupt inputs INT0–INT1.	7	33–34	INT0–INT1
P1.2–P1.5		General I/O port (4-bit), configurable for digital input or n-channel open-drain output. P1.0–P1.1 can withstand up to 6-volt loads. High current port (10mA).	5	29–32	
P1.6–P1.7		General I/O port (4-bit), configurable for digital input or push-pull output.	3	24, 28	
P2.0–P2.4, P2.6	I/O	General I/O port (6-bit). I/O mode or n-channel open-drain, push-pull output mode is software configurable. Pins can withstand up to 5-volt loads. P2.2: OTP SCLK, P2.3: OTP SDA	2	14 17–21	
P2.5, P2.7		General I/O port (2-bit). I/O mode or n-channel open-drain, push-pull output mode is software configurable. Pins can withstand up to 5-volt loads. Each pin has an alternative function. P2.5: PWM0 (14-bit PWM output) P2.7: OSDHT (Halftone signal output)	2	1, 16	PWM0 OSDHT
P3.0–P3.1	I/O	General I/O port (2 bits), configurable for digital input or n-channel open-drain output. Multiplexed for alternative use as external interrupt inputs ADC0–ADC1.	6	22–23	ADC0 ADC1
PWM0	O	Output pin for 14-bit PWM0 circuit	2	16	P2.5
ADC0–ADC1	I	Analog inputs for 4-bit A/D converter	6	22, 23	P3.0–P3.1
INT0–INT1	I	External interrupt input pins	7	33, 34	P1.0–P1.1
OSDHT	0	Halftone control signal output for OSD	2	1	P2.7
Vblue, Vgreen Vred, Vblank	O	Digital blue, green, red, and video blank signal outputs for OSD	4	37–40	–
H-sync	I	H-sync input for OSD	8	36	–
V-sync		V-sync input for OSD		35	
OSC_{IN}, OSC_{OUT}	I, O	L-C oscillator pins for OSD clock frequency generation	–	41, 42	–
TEST	I	**Vdd**: Normal Operation Mode, **0V**: Test Mode and OTP Write Mode	–	27	–
XIN, XOUT	I, O	System clock pins	–	12, 13	–
RESET	I	System reset input pin, Factory test mode is activated when 12V is applied	1	15	–
VDD, VSS	–	Power supply pins	–	10, 11, 25, 27	–
CAPA	I	Input for capture A module	8	26	–

Table 1–1. KS88C8316/C8324 Pin Descriptions

Pin Name	Pin Type	Pin Description	Circuit Type	Pin Numbers	Share Pins
P0.0–P0.7	I/O	General I/O port (8-bit), configurable for digital input or push-pull output.	3	11–12, 35, 38–42	
P1.0–P1.1	I/O	General I/O port (2-bit), configurable for digital input or n-channel open-drain output. P1.0–P1.1 can withstand up to 6-volt loads. Multiplexed for alternative use as external interrupt inputs INT0–INT1.	7	14–15	INT0–INT1
P1.2–P1.5		General I/O port (4-bit), configurable for digital input or n-channel open-drain output. P1.2–P1.5 can withstand up to 6-volt loads. High current port (10mA).	5	16–19	
P1.6–P1.7		General I/O port (2-bit), configurable for digital input or push-pull output.	3	20, 8	
P2.0–P2.4, P2.6	I/O	General I/O port (6-bit). I/O mode or n-channel open-drain, push-pull output mode is software configurable. Pins can withstand up to 5-volt loads. P2.2: OTP serial clock pin P2.3: OTP serial data pin	2	2–7	
P2.5, P2.7		General I/O port (2-bit). I/O mode or n-channel open-drain, push-pull output mode is software configurable. Pins can withstand up to 5-volt loads. Each pin has an alternative function. P2.5: PWM0 (14-bit PWM output) P2.7: OSDHT (Halftone signal output)	2	1, 21	PWM0 OSDHT
P3.0–P3.1	I/O	General I/O port (2 bits), configurable for digital input or n-channel open-drain output. P3.0–P3.1 can withstand up to 5-volt loads. Multiplexed for alternative use as external interrupt inputs ADC0–ADC1.	6	9–10	ADC0 ADC1
PWM0	O	Output pin for 14-bit PWM0 circuit	2	1	P2.5
ADC0–ADC1	I	Analog inputs for 4-bit A/D converter	6	9,10	P3.0–P3.1
INT0–INT1	I	External interrupt input pins	7	14,15	P1.0–P1.1
OSDHT	O	Halftone control signal output for OSD	2	21	P2.7
Vblue, Vgreen Vred, Vblank	O	Digital blue, green, red, and video blank signal outputs for OSD	4	22–25	–
H-sync	I	H-sync input for OSD	8	26	–
V-sync		V-sync input for OSD		27	
OSC_{IN}, OSC_{OUT}	I, O	L-C oscillator pins for OSD clock frequency generation	–	28,29	–
TEST	I	**0V**: Normal Operation Mode, **Vdd**: Test Mode and OTP Write Mode	–	13	–
XIN, XOUT	I, O	System clock pins	–	31,32	–
RESET	I	System reset input pin, Factory test mode is activated when 12V is applied	1	33	–
VDD, VSS	–	Power supply pins	–	13	–
CAPA	I	Input for capture A module	8	26	–