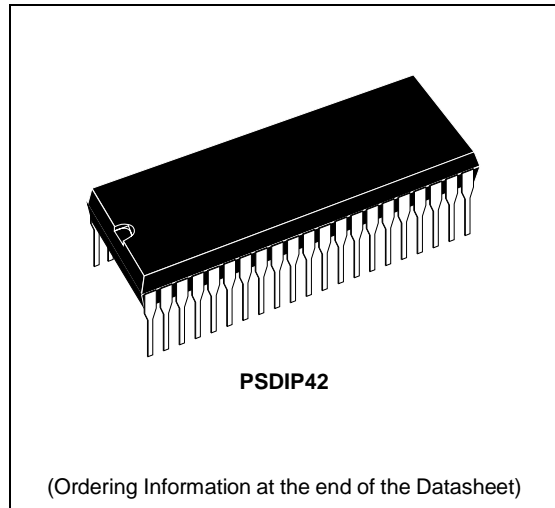


**48K ROM HCMOS MCUs WITH
ON SCREEN DISPLAY AND A/D CONVERTER**

FUNCTIONAL DESCRIPTION

- Register oriented 8/16 bit CORE with RUN, WFI and HALT modes
- Minimum instruction cycle time: 500ns (12MHz internal)
- 16 to 48K bytes of ROM, 256 to 768 bytes of RAM, 224 general purpose registers available as RAM, accumulators or index registers (Register File)
- 42-lead Shrink DIP package
- Interrupt handler and Serial Peripheral Interface as standard features
- 31 fully programmable I/O pins
- 34 character x15 rows software programmable On Screen Display module with colour, italic, underline, flash, transparent and fringe attribute options
- 16 bit Timer with 8 bit Prescaler, able to be used as a Watchdog Timer
- 16-bit programmable Slice Timer with 8-bit prescaler
- 4 channel Analog to Digital Converter, with integral sample and hold, fast 5.75µs conversion time, 6-bit guaranteed resolution
- Rich Instruction Set and 14 Addressing modes
- Division-by-Zero trap generation
- Versatile Development tools, including assembler, linker, C-compiler, archiver, graphic oriented debugger and hardware emulators
- Real Time Operating System
- Windowed EPROM parts available for prototyping and pre-production development phases



DEVICE SUMMARY

| Device | ROM | RAM | PACKAGE |
|----------|-----|-----|---------|
| ST9293J7 | 48K | 768 | PSDIP42 |
| ST9293J5 | 32K | 640 | PSDIP42 |
| ST9293J3 | 24K | 512 | PSDIP42 |
| ST9293J1 | 16K | 256 | PSDIP42 |

1.1 GENERAL DESCRIPTION

The ST9293 is a ROM member of the ST9 family of microcontrollers, completely developed and produced by SGS-THOMSON Microelectronics using a proprietary n-well HCMOS process.

The ROM parts are fully compatible with their EPROM versions, which may be used for the prototyping and pre-production phases of development, and can be configured as standalone microcontrollers with 48K/32K/24K/16 bytes of on-chip ROM.

The nucleus of the ST9293 is the advanced Core which includes the Central Processing Unit (CPU), the Register File, a 16-bit Timer/Watchdog with 8-bit Prescaler, a Serial Peripheral Interface supporting S-bus, I²C-bus and IM-bus Interface, plus two 8-bit I/O ports. The Core has independent memory and register buses allowing a high degree of pipelining to add to the efficiency of the code execution speed of the extensive instruction set. The powerful I/O capabilities demanded by microcontroller applications are fulfilled by the ST9293 with up to 31/41 I/O lines dedicated to digital Input/Output.

These lines are grouped into up to six I/O Ports and can be configured on a bit basis under software

control to provide timing, status signals, timer inputs and outputs, analog inputs, external interrupts and serial or parallel I/O.

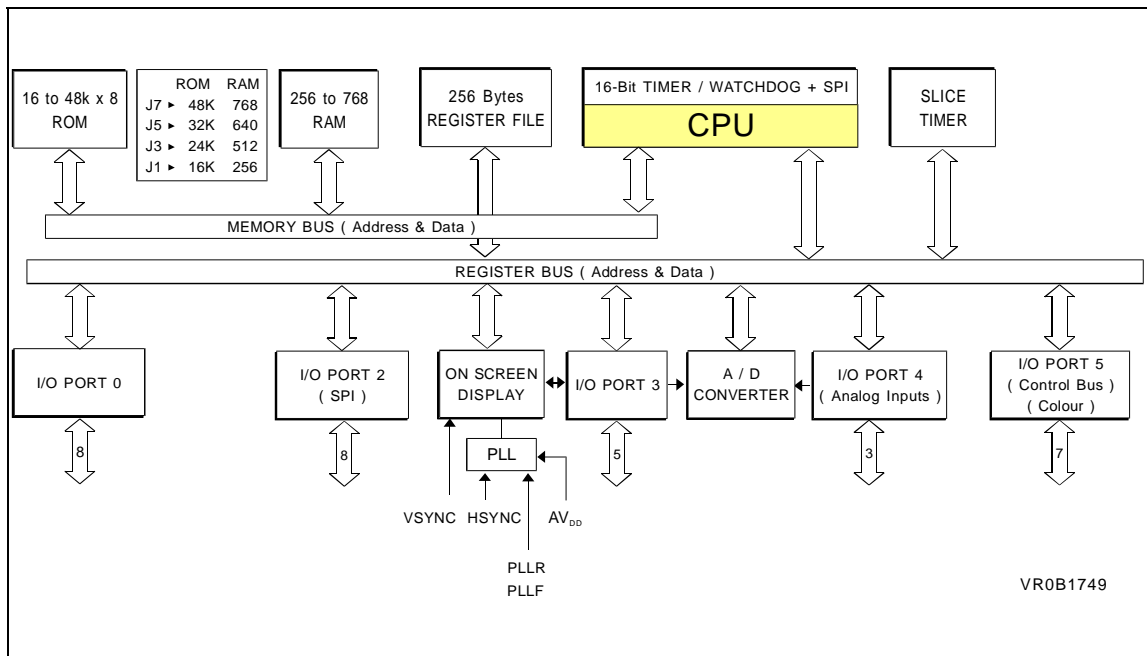
Three basic memory spaces are available to support this wide range of configurations: Program Memory, Data Memory and the Register File, which includes the control and status registers of the on-chip peripherals.

The 16-bit Slice Timer with an 8-bit Prescaler and 6 operating modes allows simple use for waveform-generation and measurement, PWM functions and many other system timing functions.

The human interface is provided by the On Screen Display module, this can produce up to 8 lines of up to 34 characters from a ROM defined 128 character set. The 9x13 character can be modified by 4 different pixel sizes, with character rounding, and formed into words with colour and format attributes.

In addition there is a 4 channel Analog to Digital Converter with integral sample and hold, fast 5.5µs conversion time and 6-bit guaranteed resolution.

Figure 1-1. ST9293 Block Diagram



1.2 PIN DESCRIPTION

VS_{YNC}. *Vertical Synch.* Vertical video synchronisation input to OSD. Positive or negative polarity.

HS_{YNC}. *Horizontal Synch.* Horizontal video synchronisation input to OSD. Positive or negative polarity.

PLL_F. *PLL Filter input.* Filter input for the OSD for PLL feed-back.

PLL_R. *PLL Resistor connection pin.* For resistor connection to select the PLL gain adjust.

RE_{SET}. *Reset (input, active low).* The ST9 is initialised by the Reset signal. With the deactivation of RE_{SET}, program execution begins from the Program memory location pointed to by the vector contained in program memory locations 00h and 01h.

OSC_{IN}, OSC_{OUT}. *Oscillator (input and output).* These pins connect a parallel-resonant crystal (24MHz maximum), or an external source to the on-chip clock oscillator and buffer. OSC_{IN} is the input of the oscillator inverter and internal clock generator; OSC_{OUT} is the output of the oscillator inverter.

AV_{DD}. Analog V_{DD} of PLL. This pin must be tied to V_{DD} externally to the ST9293.

V_{DD}. Main Power Supply Voltage (5V±10%)

V_{SS}, V_{SS2}. Digital Circuit Ground, these pins must be connected together externally to the ST9293.

P0.0-P0.7, P2.0-P2.7, P3.3-P3.7, P4.5-P4.7, P5.0-P5.6 *I/O Port Lines (Input/Output, TTL or CMOS compatible).* 31 lines grouped into I/O ports, bit programmable under program control as general purpose I/O or as Alternate functions (see next section).

P3.3 and P3.4 are true 12V open drain outputs when set in output mode.

1.2.1 I/O Port Alternate Functions.

Each pin of the I/O ports of the ST9293 may assume software programmable Alternative Functions as shown in the Pin Configuration Drawings. Table 1 shows the Functions allocated to each I/O Port pin.

Table 1-1. ST9293 I/O Port Alternate Function Summary

| I/O PORT Port.bit | Name | Function | Alternate Function | Pin Assignment |
|----------------------|------|----------|----------------------|-------------------|
| | | | | 9293J |
| P0.0 | | I/O | | 12 |
| P0.1 | | I/O | | 11 |
| P0.2 | | I/O | | 10 |
| P0.3 | | I/O | | 9 |
| P0.4 | | I/O | | 8 |
| P0.5 | | I/O | | 7 |
| P0.6 | | I/O | | 6 |
| P0.7 | | I/O | | 5 |
| P2.0 | INT6 | I | External Interrupt 6 | 39 |
| P2.1 | INT7 | I | External Interrupt 7 | 40 |
| P2.2 | INT0 | I | External Interrupt 0 | 41 |

PIN DESCRIPTION (Continued)

Table 1-2. ST9293 I/O Port Alternate Function Summary

| I/O PORT Port.bit | Name | Function | Alternate Function | Pin Assignment |
|----------------------|-------|----------|-------------------------------|-------------------|
| | | | | 9293J |
| P2.3 | INT3 | I | External Interrupt 3 | 42 |
| P2.4 | WDOUT | O | T/WD Output | 1 |
| P2.4 | EXTRG | I | External A/D Trigger | 1 |
| P2.5 | SDO | O | MSPI Serial Data Output | 2 |
| P2.6 | INT2 | I | External Interrupt 2 | 3 |
| P2.6 | SCK | O | SPI Serial Clock | 3 |
| P2.7 | SDO | O | SPI Serial Data Output | 4 |
| P2.7 | SDI | I | SPI Serial Data Input | 4 |
| P3.3 | | O | (12V Open Drain Output) | 34 |
| P3.3 | SLOUT | O | Slice Timer Output | 34 |
| P3.4 | | O | (12V Open Drain Output) | 35 |
| P3.4 | SLIN | I | Slice Timer Input | 35 |
| P3.5 | INT4 | I | Schmitt Triggered Input Only | 36 |
| P3.6 | WDIN | I | T/WD Input | 37 |
| P3.6 | AIN4 | I | A/D Analog Input 4 | 37 |
| P3.7 | NMI | I | Non-Maskable Interrupt | 38 |
| P4.5 | AIN5 | I | A/D Analog Input 5 | 27 |
| P4.6 | AIN6 | I | A/D Analog Input 6 | 28 |
| P4.7 | AIN7 | I | A/D Analog Input 7 | 29 |
| P5.0 | | I/O | | 14 |
| P5.1 | | I/O | | 15 |
| P5.2 | | I/O | | 16 |
| P5.3 | FB | O | Fast Blanking OSD output | 17 |
| P5.4 | B | O | Blue Video Colour OSD output | 18 |
| P5.5 | G | O | Green Video Colour OSD output | 19 |
| P5.6 | R | O | Red Video Colour OSD output | 20 |

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