

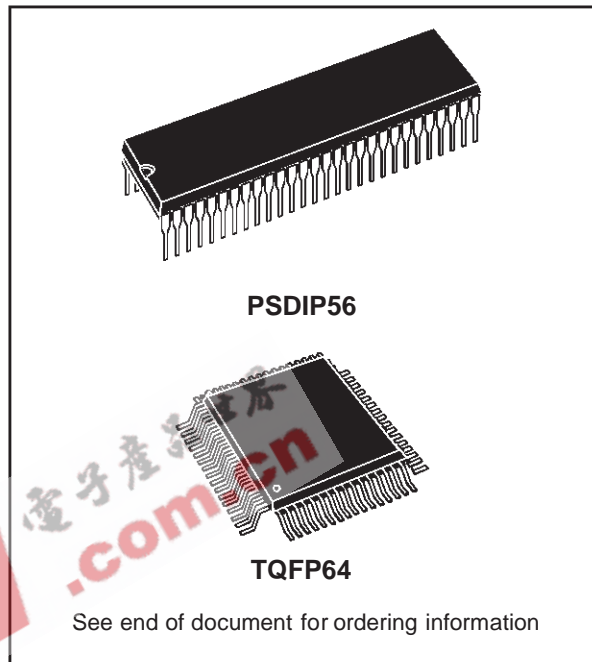


# ST92195B

## 32-64K ROM HCMOS MCU WITH ON-SCREEN-DISPLAY AND TELETEXT DATA SLICER

DATA BRIEFING

- Register File based 8/16 bit Core Architecture with RUN, WFI, SLOW and HALT modes
- 0°C to +70°C operating temperature range
- Up to 24 MHz. operation @ 5V±10%
- Min. instruction cycle time: 165ns at 24 MHz.
- 32, 48, 56 or 64 Kbytes ROM
- 256 bytes RAM of Register file (accumulators or index registers)
- 256 bytes of on-chip static RAM
- 2, 6 or 8 Kbytes of TDSRAM (Teletext and Display Storage RAM)
- 28 fully programmable I/O pins
- Serial Peripheral Interface
- Flexible Clock controller for OSD, Data Slicer and Core clocks running from a single low frequency external crystal.
- Enhanced display controller with 26 rows of 40/80 characters
  - Serial and Parallel attributes
  - 10x10 dot matrix, 512 ROM characters, definable by user
  - 4/3 and 16/9 supported in 50/60Hz and 100/120 Hz mode
  - Rounding, fringe, double width, double height, scrolling, cursor, full background color, half-intensity color, translucency and half-tone modes
- Teletext unit, including Data Slicer, Acquisition Unit and up to 8 Kbytes RAM for data storage
- VPS and Wide Screen Signalling slicer (on some devices)
- Integrated Sync Extractor and Sync Controller
- 14-bit Voltage Synthesis for tuning reference voltage
- Up to 6 external interrupts plus one Non-Maskable Interrupt
- 8 x 8-bit programmable PWM outputs with 5V open-drain or push-pull capability
- 16-bit watchdog timer with 8-bit prescaler
- One 16-bit standard timer with 8-bit prescaler
- 4-channel A/D converter; 5-bit guaranteed



- Rich instruction set and 14 addressing modes
- Versatile development tools, including Assembler, Linker, C-compiler, Archiver, Source Level Debugger and hardware emulators with Real-Time Operating System available from third parties
- Pin-compatible EPROM and OTP devices available

### Device Summary

| Device     | Program Memory | TDS RAM | VPS/WSS | Package            |
|------------|----------------|---------|---------|--------------------|
| ST92195B1  | 32K ROM        | 2K      | Yes     | PSDIP56/<br>TQFP64 |
| ST92195B2  | 32K ROM        | 6K      | No      |                    |
| ST92195B3  | 32K ROM        | 6K      | Yes     |                    |
| ST92195B4  | 48K ROM        | 6K      | Yes     |                    |
| ST92195B5  | 48K ROM        | 8K      | Yes     |                    |
| ST92195B6  | 56K ROM        | 8K      | Yes     |                    |
| ST92195B7  | 64K ROM        | 8K      | Yes     |                    |
| ST92T195B7 | 64K OTP        | 8K      | Yes     |                    |
| ST92E195B7 | 64K EPROM      | 8K      | Yes     | CSDIP56<br>/CQFP64 |

Rev. 2.5

# 1 GENERAL DESCRIPTION

## 1.1 INTRODUCTION

The ST92195B microcontroller is developed and manufactured by STMicroelectronics using a proprietary n-well HCMOS process. Its performance derives from the use of a flexible 256-register programming model for ultra-fast context switching and real-time event response. The intelligent on-chip peripherals offload the ST9 core from I/O and data management processing tasks allowing critical application tasks to get the maximum use of core resources. The ST92195B MCU supports low power consumption and low voltage operation for power-efficient and low-cost embedded systems.

### 1.1.1 ST9+ Core

The advanced Core consists of the Central Processing Unit (CPU), the Register File and the Interrupt controller.

The general-purpose registers can be used as accumulators, index registers, or address pointers. Adjacent register pairs make up 16-bit registers for addressing or 16-bit processing. Although the ST9 has an 8-bit ALU, the chip handles 16-bit operations, including arithmetic, loads/stores, and memory/register and memory/memory exchanges.

Two basic addressable spaces are available: the Memory space and the Register File, which includes the control and status registers of the on-chip peripherals.

### 1.1.2 Power Saving Modes

To optimize performance versus power consumption, a range of operating modes can be dynamically selected.

**Run Mode.** This is the full speed execution mode with CPU and peripherals running at the maximum clock speed delivered by the Phase Locked Loop (PLL) of the Clock Control Unit (CCU).

**Wait For Interrupt Mode.** The Wait For Interrupt (WFI) instruction suspends program execution until an interrupt request is acknowledged. During WFI, the CPU clock is halted while the peripheral and interrupt controller keep running at a frequen-

cy programmable via the CCU. In this mode, the power consumption of the device can be reduced by more than 95% (Low power WFI).

**Halt Mode.** When executing the HALT instruction, and if the Watchdog is not enabled, the CPU and its peripherals stop operating and the status of the machine remains frozen (the clock is also stopped). A reset is necessary to exit from Halt mode.

### 1.1.3 I/O Ports

Up to 28 I/O lines are dedicated to digital Input/Output. These lines are grouped into up to five I/O Ports and can be configured on a bit basis under software control to provide timing, status signals, timer and output, analog inputs, external interrupts and serial or parallel I/O.

### 1.1.4 TV Peripherals

A set of on-chip peripherals form a complete system for TV set and VCR applications:

- Voltage Synthesis
- VPS/WSS Slicer
- Teletext Slicer
- Teletext Display RAM
- OSD

### 1.1.5 On Screen Display

The human interface is provided by the On Screen Display module, this can produce up to 26 lines of up to 80 characters from a ROM defined 512 character set. The character resolution is 10x10 dot. Four character sizes are supported. Serial attributes allow the user to select foreground and background colors, character size and fringe background. Parallel attributes can be used to select additional foreground and background colors and underline on a character by character basis.

### 1.1.6 Teletext and Display Storage RAM

The internal Teletext and Display storage RAM can be used to store Teletext pages as well as Display parameters.

**INTRODUCTION (Cont'd)****1.1.7 Teletext, VPS and WSS Data Slicers**

The three on-board data slicers using a single external crystal are used to extract the Teletext, VPS and WSS information from the video signal. Hardware Hamming decoding is provided.

**1.1.8 Voltage Synthesis Tuning Control**

14-bit Voltage Synthesis using the PWM (Pulse Width Modulation)/BRM (Bit Rate Modulation) technique can be used to generate tuning voltages for TV set applications. The tuning voltage is output on one of two separate output pins.

**1.1.9 PWM Output**

Control of TV settings can be made with up to eight 8-bit PWM outputs, with a maximum frequency of 23,437Hz at 8-bit resolution (INTCLK = 12 MHz). Low resolutions with higher frequency operation can be programmed.

**1.1.10 Serial Peripheral Interface (SPI)**

The SPI bus is used to communicate with external devices via the SPI, or I<sup>2</sup>C bus communication standards. The SPI uses a single data line for data input and output. A second line is used for a synchronous clock signal.

**1.1.11 Standard Timer (STIM)**

The ST92195B has one Standard Timer (STIM0) that includes a programmable 16-bit down counter and an associated 8-bit prescaler with Single and Continuous counting modes.

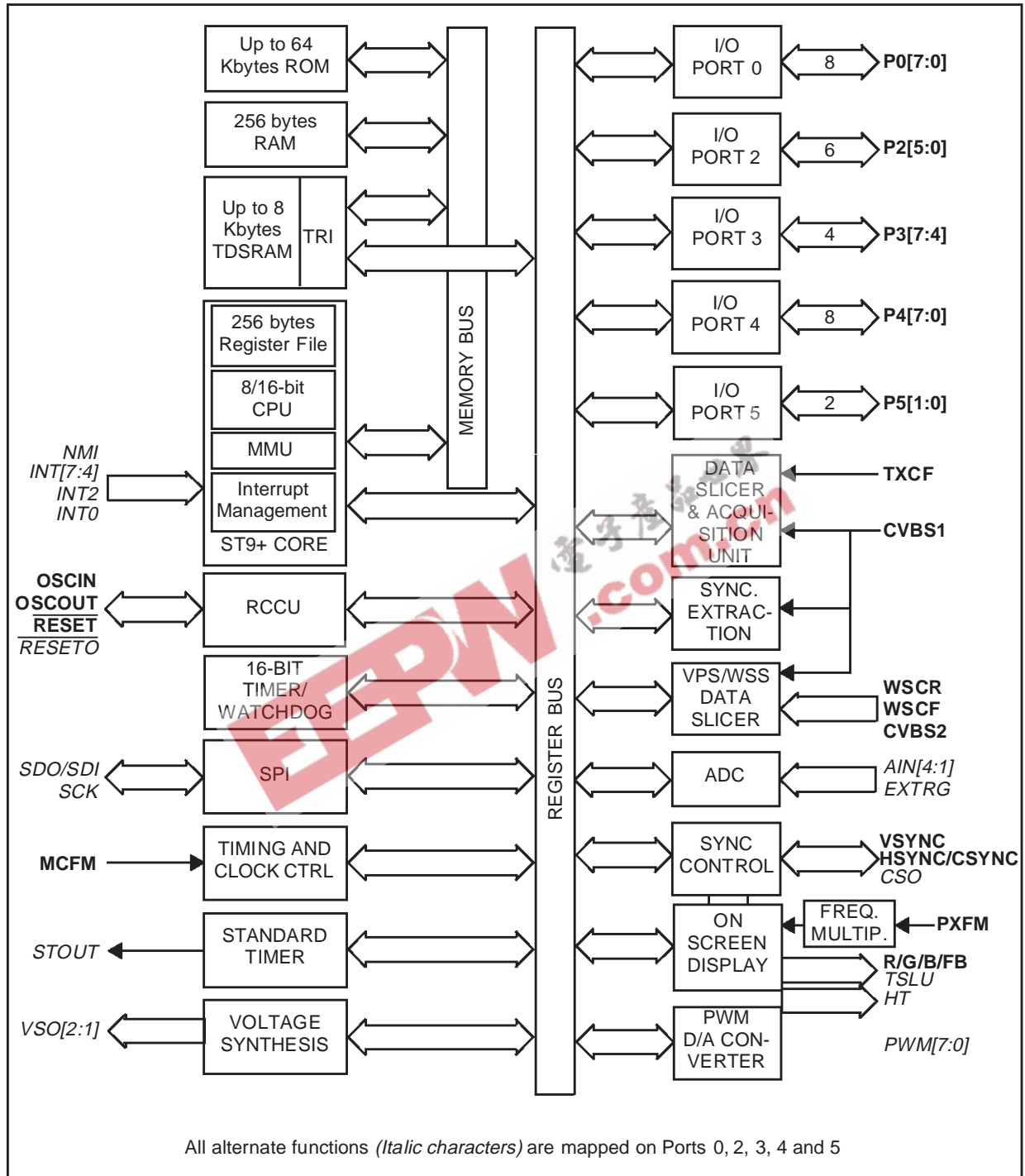
**1.1.12 Analog/Digital Converter (ADC)**

In addition there is a 4-channel Analog to Digital Converter with integral sample and hold, fast 5.75 $\mu$ s conversion time and 6-bit guaranteed resolution.

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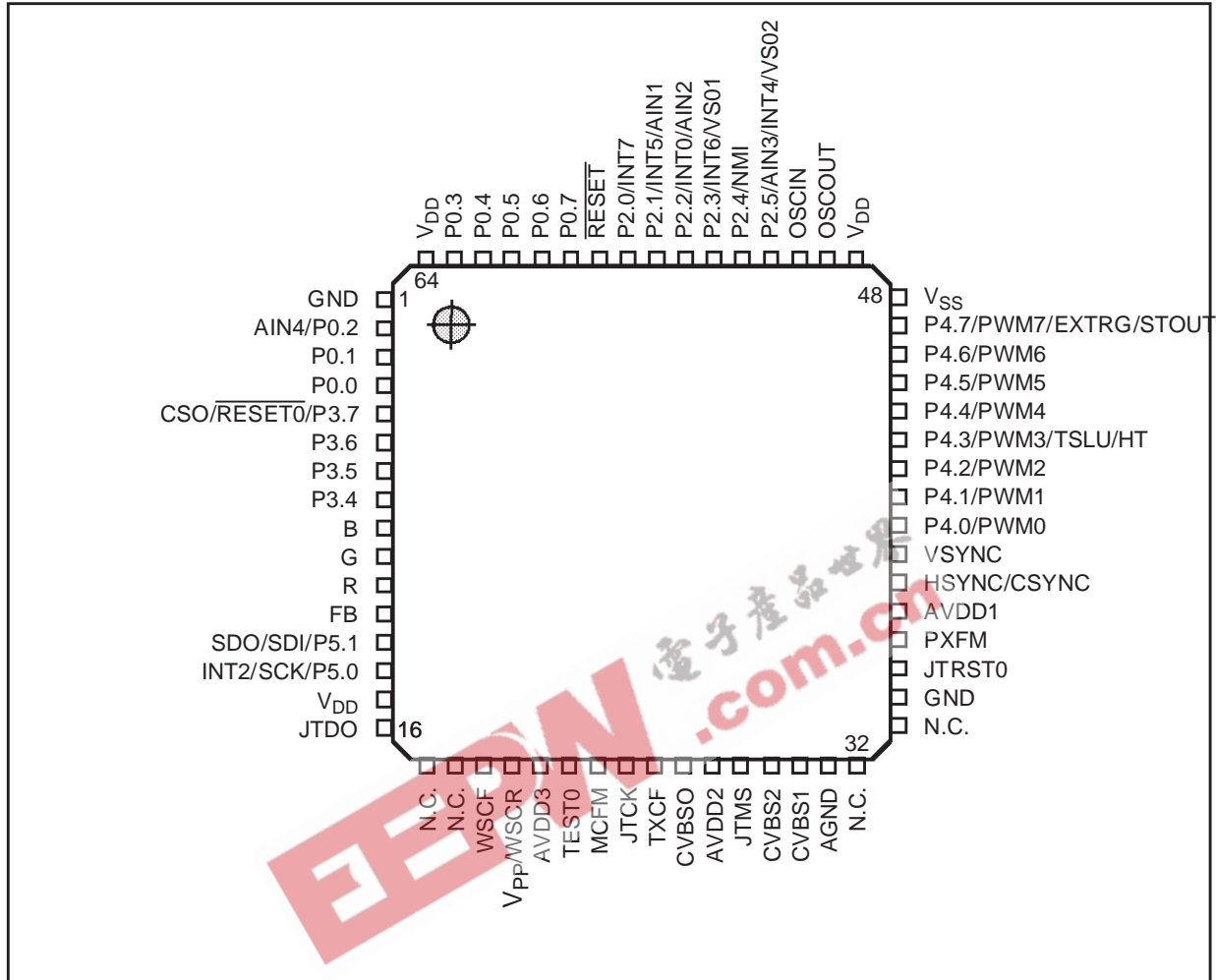
INTRODUCTION (Cont'd)

Figure 1. ST92195B Block Diagram



1.2 PIN DESCRIPTION

Figure 2. 64-Pin Package Pin-Out



N.C. = Not connected

## ST92195B - GENERAL DESCRIPTION

### PIN DESCRIPTION (Cont'd)

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

**R/G/B** *Red/Green/Blue*. Video color analog DAC outputs.

**FB** *Fast Blanking*. Video analog DAC output.

**V<sub>DD</sub>** Main power supply voltage (5V±10%, digital)

**WSCF, WSCR** Analog pins for the VPS/WSS slicer. These pins must be tied to ground or not connected.

**V<sub>PP</sub>**: On EPROM/OTP devices, the WSCR pin is replaced by V<sub>PP</sub> which is the programming voltage pin. V<sub>PP</sub> should be tied to GND in user mode.

**MCFM** Analog pin for the display pixel frequency multiplier.

**OSCIN, OSCOUT** *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. OSCIN is the input of the oscillator inverter and internal clock generator; OSCOUT is the output of the oscillator inverter.

**VSYNC** *Vertical Sync*. Vertical video synchronisation input to OSD. Positive or negative polarity.

**HSYNC/CSYNC** *Horizontal/Composite sync*. Horizontal or composite video synchronisation input to OSD. Positive or negative polarity.

**PXFM** Analog pin for the Display Pixel Frequency Multiplier

**AVDD3** Analog V<sub>DD</sub> of PLL. This pin must be tied to V<sub>DD</sub> externally.

**GND** Digital circuit ground.

**AGND** Analog circuit ground (must be tied externally to digital GND).

**CVBS1** Composite video input signal for the Teletext slicer and sync extraction.

**CVBS2** Composite video input signal for the VPS/WSS slicer. Pin AC coupled.

**AVDD1, AVDD2** Analog power supplies (must be tied externally to AVDD3).

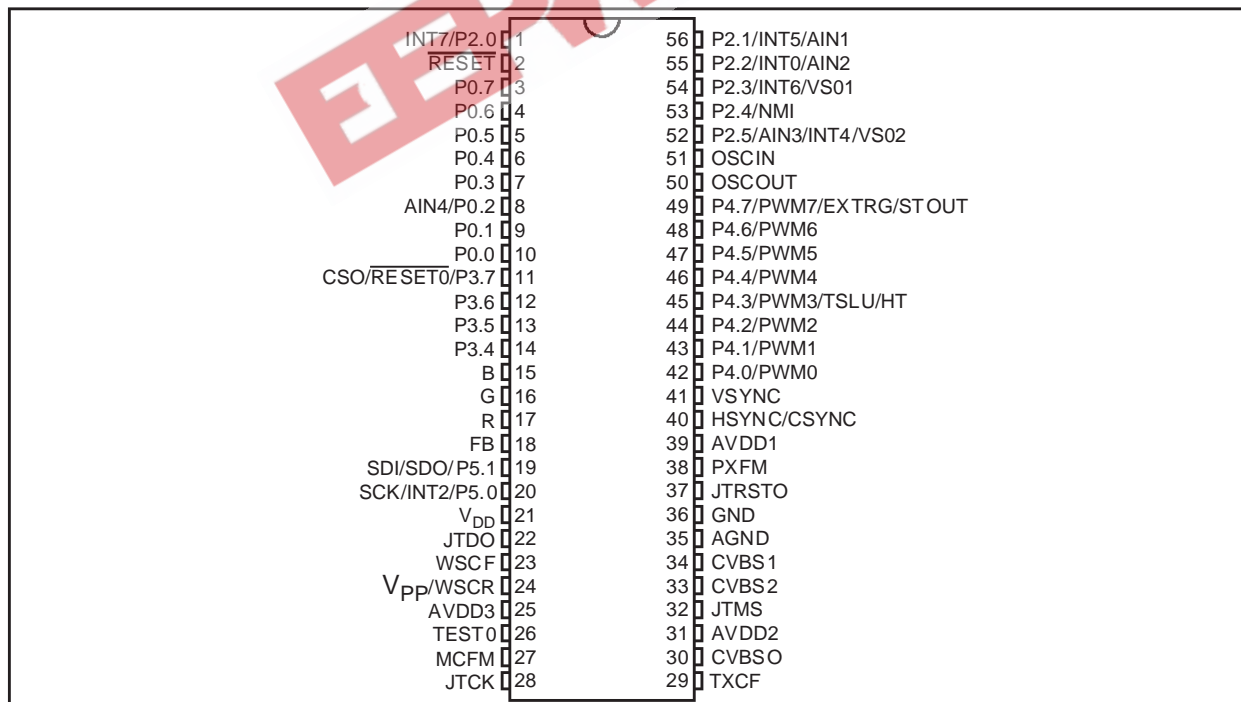
**TXCF** Analog pin for the Teletext slicer line PLL.

**CVBS0, JTDO, JTCK** Test pins: leave floating.

**TEST0** Test pins: must be tied to AVDD2.

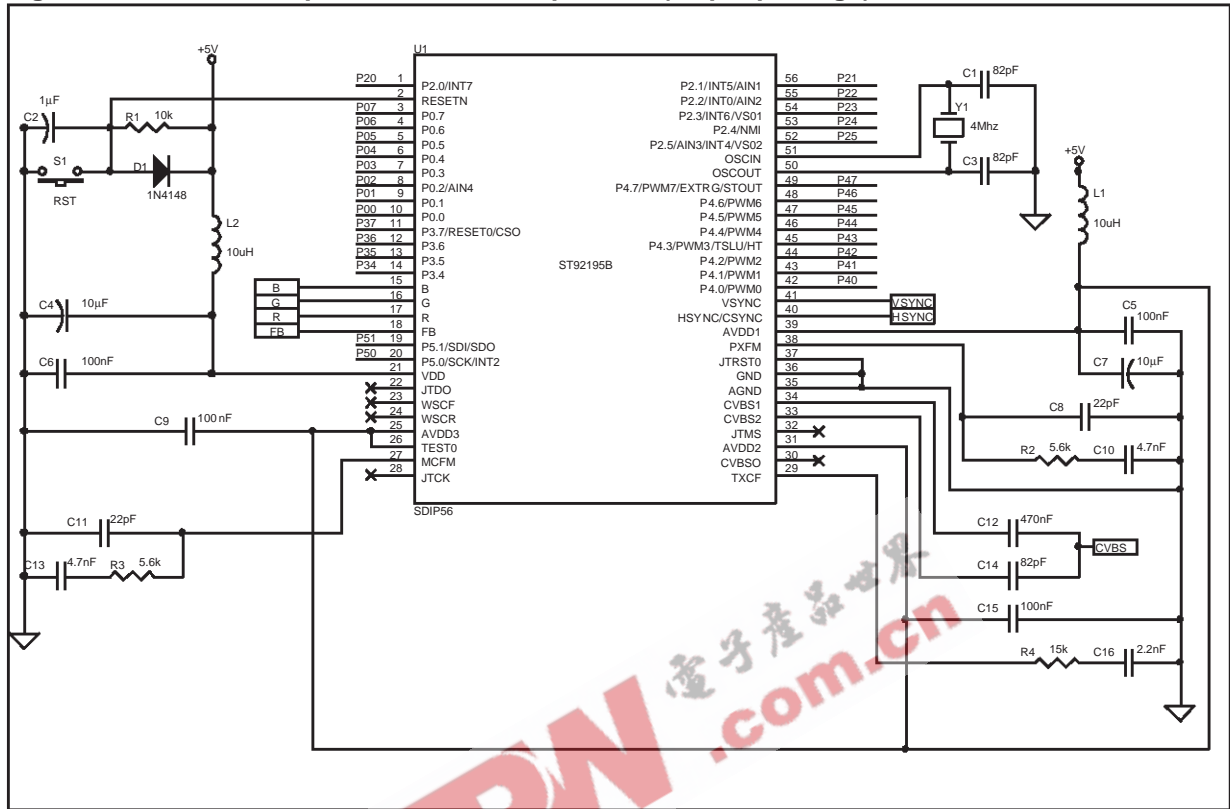
**JTRST0** Test pin: must be tied to GND.

Figure 3. 56-Pin Package Pin-Out



PIN DESCRIPTION (Cont'd)

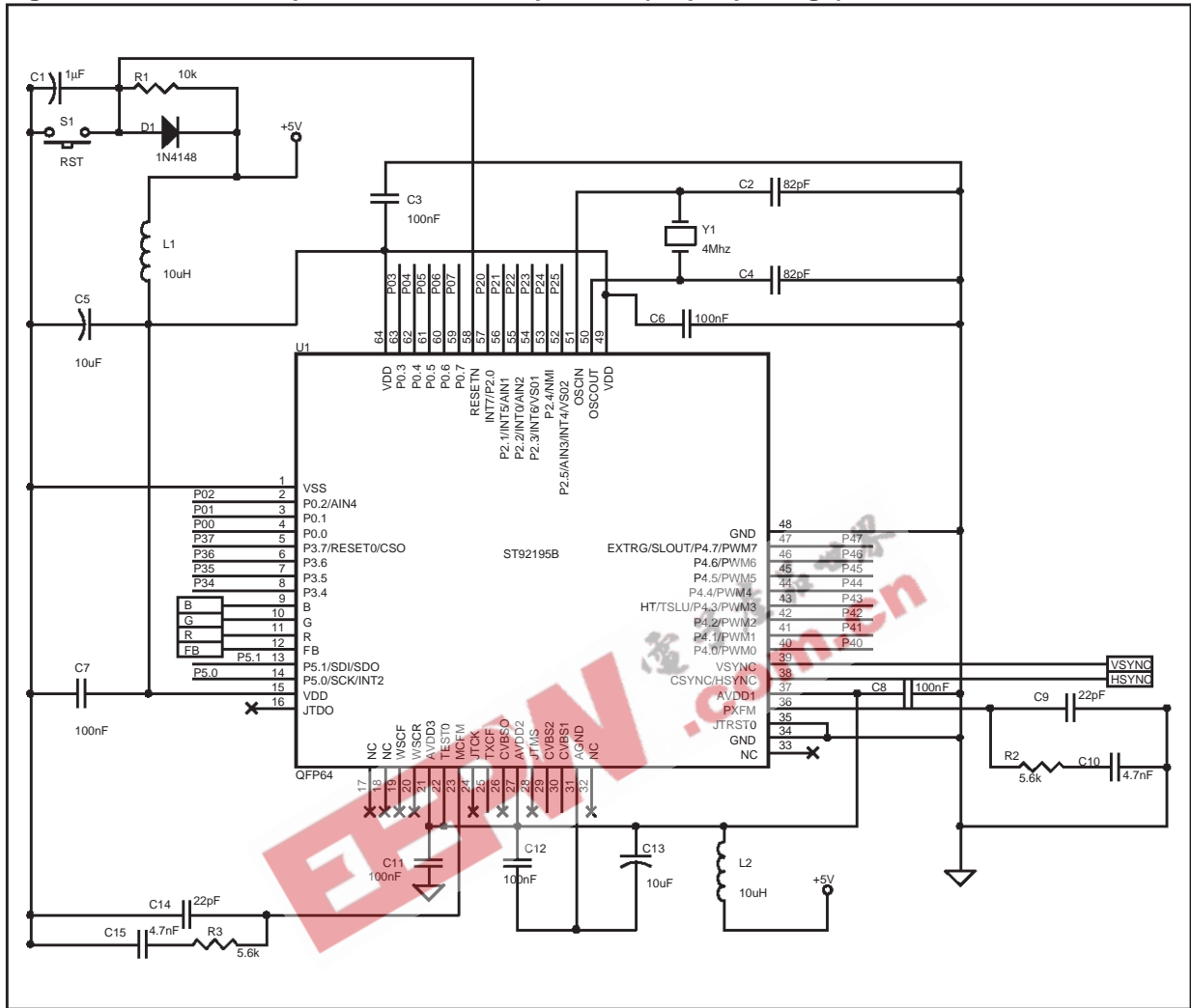
Figure 4. ST92195B Required External components (56-pin package)



# ST92195B - GENERAL DESCRIPTION

## PIN DESCRIPTION (Cont'd)

Figure 5. ST92195B Required External Components (64-pin package)





**PIN DESCRIPTION** (Cont'd)

**P0[7:0], P2[5:0], P3[7:4], P4[7:0], P5[1:0]**  
I/O Port Lines (Input/Output, TTL or CMOS compatible).

28 lines grouped into I/O ports, bit programmable as general purpose I/O or as Alternate functions (see I/O section).

**Important:** Note that open-drain outputs are for logic levels only and are not true open drain.

**1.2.1 I/O Port Alternate Functions.**

Each pin of the I/O ports of the ST92195B may assume software programmable Alternate Functions (see Table 1).

**Table 1. ST92195B I/O Port Alternate Function Summary**

| Port Name | General Purpose I/O  | Pin No. |        | Alternate Functions |                             |                              |
|-----------|--|---------|--------|---------------------|-----------------------------|------------------------------|
|           |  | TQFP64  | SDIP56 |                     |                             |                              |
| P0.0      | All ports useable for general purpose I/O (input, output or bidirectional) | 4       | 10     |                     | I/O                         |                              |
| P0.1      |  | 3       | 9      |                     | I/O                         |                              |
| P0.2      |  | 2       | 8      | AIN4                | I                           | A/D Analog Data Input 4      |
| P0.3      |  | 63      | 7      |                     | I/O                         |                              |
| P0.4      |  | 62      | 6      |                     | I/O                         |                              |
| P0.5      |  | 61      | 5      |                     | I/O                         |                              |
| P0.6      |  | 60      | 4      |                     | I/O                         |                              |
| P0.7      |  | 59      | 3      |                     | I/O                         |                              |
| P2.0      |  | 57      | 1      | INT7                | I                           | External Interrupt 7         |
| P2.1      |  | 56      | 56     | AIN1                | I                           | A/D Analog Data Input 1      |
|           |  |         |        | INT5                | I                           | External Interrupt 5         |
| P2.2      |  | 55      | 55     | INT0                | I                           | External Interrupt 0         |
|           |  |         |        | AIN2                | I                           | A/D Analog Data Input 2      |
| P2.3      |  | 54      | 54     | INT6                | I                           | External Interrupt 6         |
|           |  |         |        | VSO1                | O                           | Voltage Synthesis Output 1   |
| P2.4      |  | 53      | 53     | NMI                 | I                           | Non Maskable Interrupt Input |
| P2.5      |  | 52      | 52     | AIN3                | I                           | A/D Analog Data Input 3      |
|           |  |         |        | INT4                | I                           | External Interrupt 4         |
|           |  |         |        | VSO2                | O                           | Voltage Synthesis Output 2   |
| P3.4      |  | 8       | 14     |                     | I/O                         |                              |
| P3.5      |  | 7       | 13     |                     | I/O                         |                              |
| P3.6      |  | 6       | 12     |                     | I/O                         |                              |
| P3.7      |  | 5       | 11     | RESET0              | O                           | Internal Reset Output        |
|           |  |         |        | CSO                 | O                           | Composite Sync output        |
| P4.0      |  | 40      | 42     | PWM0                | O                           | PWM Output 0                 |
| P4.1      |  | 41      | 43     | PWM1                | O                           | PWM Output 1                 |
| P4.2      |  | 42      | 44     | PWM2                | O                           | PWM Output 2                 |
| P4.3      |  | 43      | 45     | PWM3                | O                           | PWM Output 3                 |
|           | TSLU   |         |        | O                   | Translucency Digital Output |                              |
|           | HT   |         |        | O                   | Half-tone Output            |                              |
| P4.4      | 44   | 46      | PWM4   | O                   | PWM Output 4                |                              |

## ST92195B - GENERAL DESCRIPTION

| Port Name | General Purpose I/O  | Pin No. |        | Alternate Functions |   |                                      |
|-----------|--|---------|--------|---------------------|---|--------------------------------------|
|           |  | TQFP64  | SDIP56 |                     |   |                                      |
| P4.5      | All ports useable for general purpose I/O (input, output or bidirectional) | 45      | 47     | PWM5                | O | PWM Output 5                         |
| P4.6      |  | 46      | 48     | PWM6                | O | PWM Output 6                         |
| P4.7      |  | 47      | 49     | EXTRG               | I | A/D Converter External Trigger Input |
|           |  |         |        | PWM7                | O | PWM Output 7                         |
|           |  |         |        | STOUT               | O | Standard Timer Output                |
| P5.0      |  | 14      | 20     | INT2                | I | External Interrupt 2                 |
|           |  |         |        | SCK                 | O | SPI Serial Clock                     |
| P5.1      |  | 13      | 19     | SDO                 | O | SPI Serial Data Out                  |
|           |  |         |        | SDI                 | I | SPI Serial Data In                   |

### 1.2.2 I/O Port Styles

| Pins        | Weak Pull-Up | Port Style      | Reset Values   |
|-------------|--------------|-----------------|----------------|
| P0[7:0]     | no           | Standard I/O    | BID / OD / TTL |
| P2[5,4,3,2] | no           | Standard I/O    | BID / OD / TTL |
| P2[1,0]     | no           | Schmitt trigger | BID / OD / TTL |
| P3.7        | yes          | Standard I/O    | AF / PP / TTL  |
| P3[6,5,4]   | no           | Standard I/O    | BID / OD / TTL |
| P4[7:0]     | no           | Standard I/O    | BID / OD / TTL |
| P5[1:0]     | no           | Standard I/O    | BID / OD / TTL |

#### Legend:

AF= Alternate Function, BID = Bidirectional, OD = Open Drain  
PP = Push-Pull, TTL = TTL Standard Input Levels

#### How to Read this Table

To configure the I/O ports, use the information in this table and the Port Bit Configuration Table in the I/O Ports Chapter of the datasheet.

**Port Style**= the hardware characteristics fixed for each port line.

Inputs:

- If port style = Standard I/O, either TTL or CMOS input level can be selected by software.
- If port style = Schmitt trigger, selecting CMOS or TTL input by software has no effect, the input will always be Schmitt Trigger.

**Weak Pull-Up** = This column indicates if a weak pull-up is present or not.

- If WPU = yes, then the WPU can be enabled/disabled by software
- If WPU = no, then enabling the WPU by software has no effect

**Alternate Functions (AF)** = More than one AF cannot be assigned to an external pin at the same time:

An alternate function can be selected as follows.

AF Inputs:

- AF is selected implicitly by enabling the corresponding peripheral. Exception to this are ADC analog inputs which must be explicitly selected as AF by software.

**PIN DESCRIPTION** (Cont'd)

AF Outputs or Bidirectional Lines:

– In the case of Outputs or I/Os, AF is selected explicitly by software.

**Example 1: ADC trigger digital input**

AF: EXTRG, Port: P4.7, Port Style: Standard I/O.

Write the port configuration bits (for TTL level):

P4C2.7=1

P4C1.7=0

P4C0.7=1

Enable the ADC trigger by software as described in the ADC chapter.

**Example 2: PWM 0 output**

AF: PWM0, Port: P4.0

Write the port configuration bits (for output push-pull):

P4C2.0=0

P4C1.0=1

P4C0.0=1

**Example 3: ADC analog input**

AF: AIN1, Port : P2.1, Port style: does not apply to analog inputs

Write the port configuration bits:

P2C2.1=1

P2C1.1=1

P2C0.1=1

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# ST92195B - GENERAL DESCRIPTION

## 1.3 MEMORY MAP

### Internal ROM

The ROM memory is mapped in a single continuous area starting at address 0000h in MMU segment 00h.

| Device          | Size | Start Address | End Address |
|-----------------|------|---------------|-------------|
| ST92195B1/B2/B3 | 32K  | 0000h         | 7FFFh       |
| ST92195B4/B5    | 48K  | 0000h         | BFFFh       |
| ST92195B6       | 56K  | 0000h         | DFFFh       |
| ST92195B7       | 64K  | 0000h         | FFFFh       |

### Internal RAM, 256 bytes

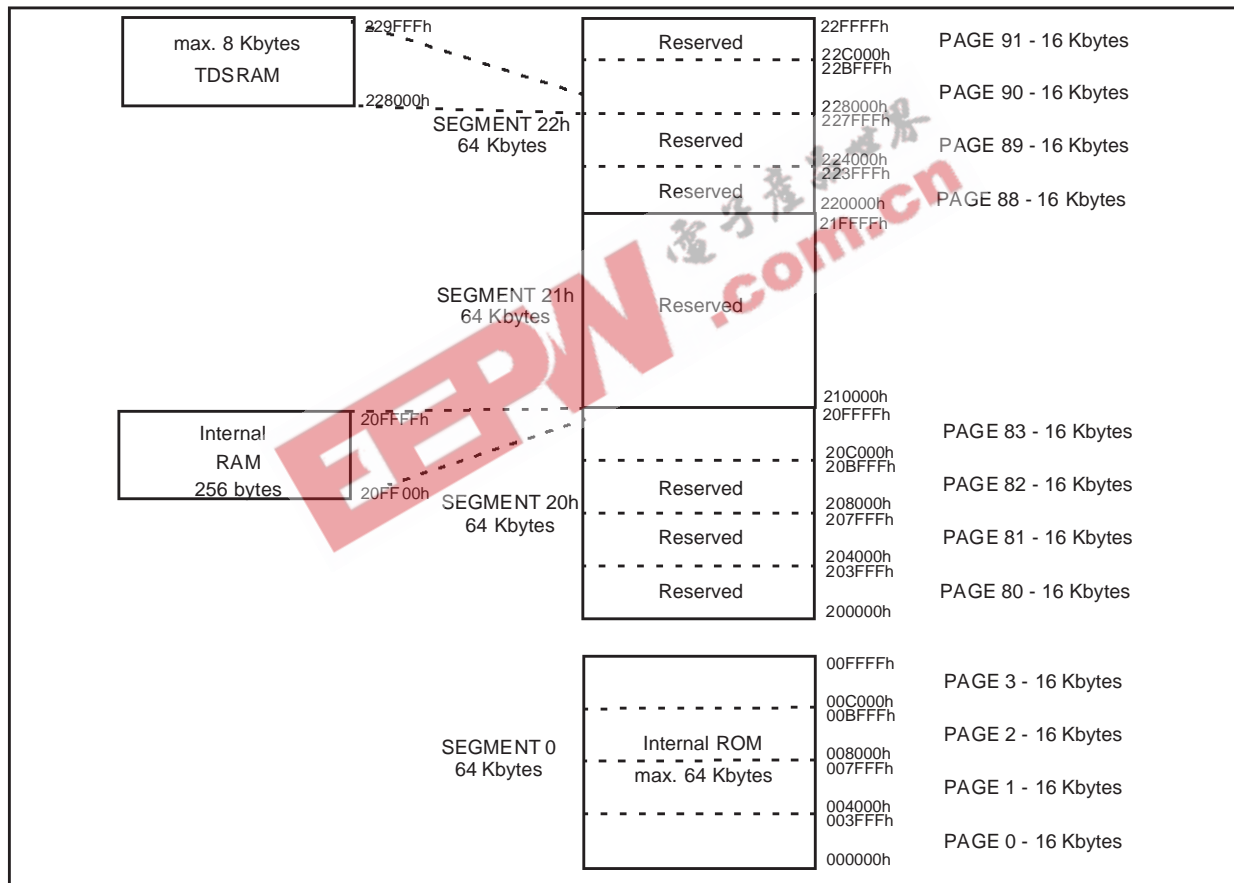
The internal RAM is mapped in MMU segment 20h; from address FF00h to FFFFh.

### Internal TDSRAM

The Internal TDSRAM is mapped starting at address 8000h in MMU segment 22h. It is a fully static memory.

| Device          | Size | Start Address | End Address |
|-----------------|------|---------------|-------------|
| ST92195B1       | 2K   | 8000h         | 87FFh       |
| ST92195B2/B3/B4 | 6K   | 8000h         | 97FFh       |
| ST92195B5/B6/B7 | 8K   | 8000h         | 9FFFh       |

Figure 6. ST92195B Memory Map



## 2 ELECTRICAL CHARACTERISTICS

### ABSOLUTE MAXIMUM RATINGS

| Symbol    | Parameter  | Value  | Unit |
|-----------|--|--|------|
| $V_{DD}$  | Supply Voltage                                     | $V_{SS} - 0.3$ to $V_{SS} + 7.0$                                       | V    |
| $V_{SSA}$ | Analog Ground                                      | $V_{SS} - 0.3$ to $V_{SS} + 0.3$                                       | V    |
| $V_{DDA}$ | Analog Supply Voltage                              | $V_{DD} - 0.3$ to $V_{DD} + 0.3$                                       | V    |
| $V_I$     | Input Voltage                                      | $V_{SS} - 0.3$ to $V_{DD} + 0.3$                                       | V    |
| $V_{AI}$  | Analog Input Voltage (A/D Converter)               | $V_{SS} - 0.3$ to $V_{DD} + 0.3$<br>$V_{SSA} - 0.3$ to $V_{DDA} + 0.3$ | V    |
| $V_O$     | Output Voltage                                     | $V_{SS} - 0.3$ to $V_{DD} + 0.3$                                       | V    |
| $T_{STG}$ | Storage Temperature                                | - 55 to + 150  | °C   |
| $I_{INJ}$ | Pin Injected Current                               | - 5 to + 5   | mA   |
|           | Maximum Accumulated Pin Injected Current In Device | - 50 to +5 0   | mA   |

**Note:** Stress above those listed as "Absolute maximum ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these conditions is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

### RECOMMENDED OPERATING CONDITIONS

| Symbol     | Parameter                         | Value |      | Unit |
|------------|-----------------------------------|-------|------|------|
|            |                                   | Min.  | Max. |      |
| $T_A$      | Operating Temperature             | 0     | 70   | °C   |
| $V_{DD}$   | Supply Voltage                    | 4.5   | 5.5  | V    |
| $V_{DDA}$  | Analog Supply Voltage (PLL)       | 4.5   | 5.5  | V    |
| $f_{OSCE}$ | External Oscillator Frequency     | 3.3   | 8.7  | MHz  |
| $f_{OSCI}$ | Internal Clock Frequency (INTCLK) |       | 24   | MHz  |

## ST92195B - ELECTRICAL CHARACTERISTICS

### DC ELECTRICAL CHARACTERISTICS

( $V_{DD} = 5V \pm 10\%$ ;  $T_A = 0$  to  $70^\circ C$ ; unless otherwise specified)

| Symbol     | Parameter                       | Test Conditions                                | Value          |              | Unit    |
|------------|---------------------------------|--|----------------|--------------|---------|
|            |                                 |  | Min.           | Max.         |         |
| $V_{IHCK}$ | Clock In high level             | External clock                                 | $0.7 V_{DD}$   |              | V       |
| $V_{ILCK}$ | Clock in low level              | External clock                                 |                | $0.3 V_{DD}$ | V       |
| $V_{IH}$   | Input high level                | TTL  | 2.0            |              | V       |
| $V_{IL}$   | Input low level                 | TTL  |                | 0.8          | V       |
| $V_{IH}$   | Input high level                | CMOS   | $0.8 V_{DD}$   |              | V       |
| $V_{IL}$   | Input low level                 | CMOS   |                | $0.2 V_{DD}$ | V       |
| $V_{IHRS}$ | Reset in high level             |  | $0.7 V_{DD}$   |              | V       |
| $V_{ILRS}$ | Reset in low level              |  |                | $0.3 V_{DD}$ | V       |
| $V_{HYRS}$ | Reset in hysteresis             |  | 0.3            |              | V       |
| $V_{IHY}$  | P2.(1:0) input hysteresis       |  | 0.9            |              | V       |
| $V_{IHVH}$ | HSYNC/VSYNC input high level    |  | $0.7 V_{DD}$   |              | V       |
| $V_{ILVH}$ | HSYNC/VSYNC input low level     |  |                | $0.3 V_{DD}$ | V       |
| $V_{HYHV}$ | HSYNC/VSYNC input hysteresis    |  | 0.5            |              | V       |
| $V_{OH}$   | Output high level               | Push-pull $I_{ld} = -0.8mA$                    | $V_{DD} - 0.8$ |              | V       |
| $V_{OL}$   | Output low level                | Push-pull $I_{d} = +1.6mA$                     |                | 0.4          | V       |
| $I_{WPU}$  | Weak pull-up current            | bidir. state<br>$V_{OL} = 3V$<br>$V_{OL} = 7V$ | 50             | 350          | $\mu A$ |
| $I_{LKIO}$ | I/O pin input leakage current   | $0 < V_{IN} < V_{DD}$                          | -10            | +10          | $\mu A$ |
| $I_{LKRS}$ | Reset pin input                 | $0 < V_{IN} < V_{DD}$                          | -10            | +10          | $\mu A$ |
| $I_{LKAD}$ | A/D pin input leakage current   | alternate funct. op. drain                     | -10            | +10          | $\mu A$ |
| $I_{LKOS}$ | OSCIN pin input leakage current | $0 < V_{IN} < V_{DD}$                          | -10            | +10          | $\mu A$ |

**AC ELECTRICAL CHARACTERISTICS**
**PIN CAPACITANCE**

 ( $V_{DD}= 5V \pm 10\%$ ;  $T_A= 0$  to  $70^\circ\text{C}$ ; unless otherwise specified)

| Symbol   | Parameter                            | Conditions | Value |     | Unit |
|----------|--------------------------------------|------------|-------|-----|------|
|          |                                      |            | min   | max |      |
| $C_{IO}$ | Pin Capacitance Digital Input/Output |            |       | 10  | pF   |

**CURRENT CONSUMPTION**

 ( $V_{DD}= 5V \pm 10\%$ ;  $T_A= 0$  to  $70^\circ\text{C}$ ; unless otherwise specified)

| Symbol     | Parameter                                 | Conditions           | Value |      |     | Unit          |
|------------|---|----------------------|-------|------|-----|---------------|
|            |   |                      | min   | typ. | max |               |
| $I_{DD1}$  | Run Mode Current                          | notes 1,2; all On    |       | 70   | 100 | mA            |
| $I_{DDA1}$ | Run Mode Analog Current (pin $V_{DDA}$ )  | Timing Controller On |       | 35   | 50  | mA            |
| $I_{DD2}$  | HALT Mode Current                         | notes 1,4            |       | 10   | 100 | $\mu\text{A}$ |
| $I_{DDA2}$ | HALT Mode Analog Current (pin $V_{DDA}$ ) | notes 1,4            |       | 40   | 100 | $\mu\text{A}$ |

**Notes:**

- Port 0 is configured in push-pull output mode (output is high). Ports 2, 3, 4 and 5 are configured in bi-directional weak pull-up mode resistor. The external CLOCK pin (OSCIN) is driven by a square wave external clock at 8 MHz. The internal clock prescaler is in divide-by-1 mode.
- The CPU is fed by a 24 MHz frequency issued by the Main Clock Controller. VSYNC is tied to  $V_{SS}$ . HSYNC is driven by a 15625Hz clock. All peripherals working including Display.
- The CPU is fed by a 24 MHz frequency issued by the Main Clock Controller. VSYNC is tied to  $V_{SS}$ . HSYNC is driven by a 15625Hz clock. The TDSRAM interface and the Slicers are working; the Display controller is not working.
- VSYNC and HSYNC tied to  $V_{SS}$ . External CLOCK pin (OSCIN) is hold low. All peripherals are disabled.

**EXTERNAL INTERRUPT TIMING TABLE (rising or falling edge mode)**

 ( $V_{DD}= 5V \pm 10\%$ ;  $T_A= 0$  to  $70^\circ\text{C}$ ; unless otherwise specified)

| Symbol    | Parameter              | Conditions | Value |     | Unit |
|-----------|------------------------|------------|-------|-----|------|
|           |                        |            | min   | max |      |
| $T_{wLR}$ | low level pulse width  | $T_pC+12$  | 95    |     | ns   |
| $T_{wHR}$ | high level pulse width | $T_pC+12$  | 95    |     | ns   |

 $T_pC$  is the INTCLK clock period.

## ST92195B - ELECTRICAL CHARACTERISTICS

### AC ELECTRICAL CHARACTERISTICS (Cont'd)

#### SPI TIMING TABLE

( $V_{DD}= 5V \pm 10\%$ ;  $T_A= 0$  to  $70^\circ\text{C}$ ;  $C_{load}= 50\text{pF}$ )

| Symbol     | Parameter                | Condition                 | Value   |        | Unit |
|------------|--------------------------|---------------------------|---------|--------|------|
|            |                          |                           | min     | max    |      |
| $T_{sDI}$  | Input Data Set-up Time   |                           | tbd     |        | ns   |
| $T_{hDI}$  | Input Data Hold Time (1) | OSCIN/2 as internal Clock | 1INTCLK | +100ns | ns   |
| $T_{dOV}$  | SCK to Output Data Valid |                           |         | tbd    | ns   |
| $T_{hDO}$  | Output Data Hold Time    |                           | tbd     |        | ns   |
| $T_{wSKL}$ | SCK Low Pulse Width      |                           | tbd     |        | ns   |
| $T_{wSKH}$ | SCK High Pulse Width     |                           | tbd     |        | ns   |

(1)  $T_{pC}$  is the OSCIN clock period;  $T_{pMC}$  is the "Main Clock Frequency" period.

#### SKEW CORRECTOR TIMING TABLE

( $V_{DD}= 5V \pm 10\%$ ,  $T_A= 0$  to  $70^\circ\text{C}$ , unless otherwise specified)

| Symbol     | Parameter            | Conditions                            | max Value | Unit |
|------------|----------------------|---------------------------------------|-----------|------|
| $T_{jskw}$ | Jitter on RGB output | 36 MHz Skew corrector clock frequency | 5*        | ns   |

(\*) The OSD jitter is measured from leading edge to leading edge of a single character row on consecutive TV lines. The value is an envelope of 100 fields



## ST92195B - ELECTRICAL CHARACTERISTICS

### AC ELECTRICAL CHARACTERISTICS (Cont'd)

#### OSD DAC CHARACTERISTICS (ROM DEVICES ONLY)

( $V_{DD}$ = 5V +/-10%,  $T_A$ = 0 to 70°C, unless otherwise specified).

| Symbol | Parameter                  | Conditions              | Value |         |       | Unit |
|--------|----------------------------|-------------------------|-------|---------|-------|------|
|        |                            |                         | min   | typical | max   |      |
|        | Output impedance: FB,R,G,B |                         | 300   | 500     | 700   | Ohm  |
|        | Output voltage: FB,R,G,B   | Clod= 20pF<br>RL = 100K |       |         |       |      |
|        | code= 111                  |                         |       | 1.000   | 1.250 | V    |
|        | code= 011                  |                         |       | 0.450   | 0.500 | V    |
|        | code= 000                  |                         |       | 0.025   | 0.080 | V    |
|        | FB= 1                      |                         | 2.4   | 2.7     | 3.4   | V    |
|        | FB= 0                      |                         | 0     | 0.025   | 0.080 | V    |
|        | Global voltage accuracy    |                         |       |         | +/-5  | %    |

#### OSD DAC CHARACTERISTICS (EPROM AND OTP DEVICES ONLY)

( $V_{DD}$ = 5V +/-10%,  $T_A$ = 0 to 70°C, unless otherwise specified).

| Symbol | Parameter                  | Conditions              | Value        |         |       | Unit |
|--------|----------------------------|-------------------------|--------------|---------|-------|------|
|        |                            |                         | min          | typical | max   |      |
|        | Output impedance: FB,R,G,B |                         | 300          | 500     | 700   | Ohm  |
|        | Output voltage: FB,R,G,B   | Clod= 20pF<br>RL = 100K |              |         |       |      |
|        | code= 111                  |                         |              | 1.100   | 1.400 | V    |
|        | code= 011                  |                         |              | 0.600   | 0.800 | V    |
|        | code= 000                  |                         |              | 0.200   | 0.350 | V    |
|        | FB= 1                      |                         | $V_{DD}-0.8$ |         |       | V    |
|        | FB= 0                      |                         |              |         | 0.400 | V    |
|        | Global voltage accuracy    |                         |              |         | +/-5  | %    |

## ST92195B - ELECTRICAL CHARACTERISTICS

### AC ELECTRICAL CHARACTERISTICS (Cont'd)

#### A/D CONVERTER, EXTERNAL TRIGGER TIMING TABLE

( $V_{DD}= 5V \pm 10\%$ ;  $T_A= 0$  to  $70^\circ\text{C}$ ; unless otherwise specified)

| Symbol                                 | Parameter              | OSCIN divide by 2; min/max | OSCIN divide by 1; min/max | Value          |     | Unit          |
|--|------------------------|----------------------------|----------------------------|----------------|-----|---------------|
|  |                        |                            |                            | min            | max |               |
| $T_{low}$                              | Pulse Width            |                            |                            | 1.5<br>INTCLK  |     | ns            |
| $T_{high}$                             | Pulse Distance         |                            |                            |                |     | ns            |
| $T_{ext}$                              | Period/fast Mode       |                            |                            | 78+1<br>INTCLK |     | $\mu\text{s}$ |
| $T_{str}$                              | Start Conversion Delay |                            |                            | 0.5            | 1.5 | INTCLK        |
| Core Clock issued by Timing Controller |                        |                            |                            |                |     |               |
| $T_{low}$                              | Pulse Width            |                            |                            |                |     | ns            |
| $T_{high}$                             | Pulse Distance         |                            |                            |                |     | ns            |
| $T_{ext}$                              | Period/fast Mode       |                            |                            |                |     | $\mu\text{s}$ |
| $T_{str}$                              | Start Conversion Delay |                            |                            |                |     | ns            |

#### A/D CONVERTER. ANALOG PARAMETERS TABLE

( $V_{DD}= 5V \pm 10\%$ ;  $T_A= 0$  to  $70^\circ\text{C}$ ; unless otherwise specified)

| Parameter                  | Value   |           |          | Unit<br>(**)  | Note  |
|----------------------------|---------|-----------|----------|---------------|-------|
|                            | typ (*) | min       | max      |               |       |
| Analog Input Range         |         | $V_{SS}$  | $V_{DD}$ | V             |       |
| Conversion Time Fast/Slow  |         | 78/138    |          | INTCLK        | (1,2) |
| Sample Time Fast/Slow      |         | 51.5/87.5 |          | INTCLK        | (1)   |
| Power-up Time              |         | 60        |          | $\mu\text{s}$ |       |
| Resolution                 | 8       |           |          | bits          |       |
| Differential Non Linearity | 1.5     |           | 2.5      | LSBs          | (4)   |
| Integral Non Linearity     | 2       |           | 3        | LSBs          | (4)   |
| Absolute Accuracy          | 2       |           | 3        | LSBs          | (4)   |
| Input Resistance           |         |           | 1.5      | Kohm          | (3)   |
| Hold Capacitance           |         |           | 1.92     | pF            |       |

Notes: (\*) The values are expected at 25 Celsius degrees with  $V_{DD}= 5V$

(\*\*) 'LSBs', as used here, as a value of  $V_{DD}/256$

(1) @ 24 MHz external clock

(2) including Sample time

(3) it must be considered as the on-chip series resistance before the sampling capacitor

(4)  $\text{DNL ERROR} = \max \{ [V(i) - V(i-1)] / \text{LSB} - 1 \}$   $\text{INL ERROR} = \max \{ [V(i) - V(0)] / \text{LSB} - i \}$

$\text{ABSOLUTE ACCURACY} = \text{overall max conversion error}$

### 3 GENERAL INFORMATION

#### 3.1 PACKAGE MECHANICAL DATA

Figure 7. 56-Pin Shrink Plastic Dual In Line Package, 600-mil Width

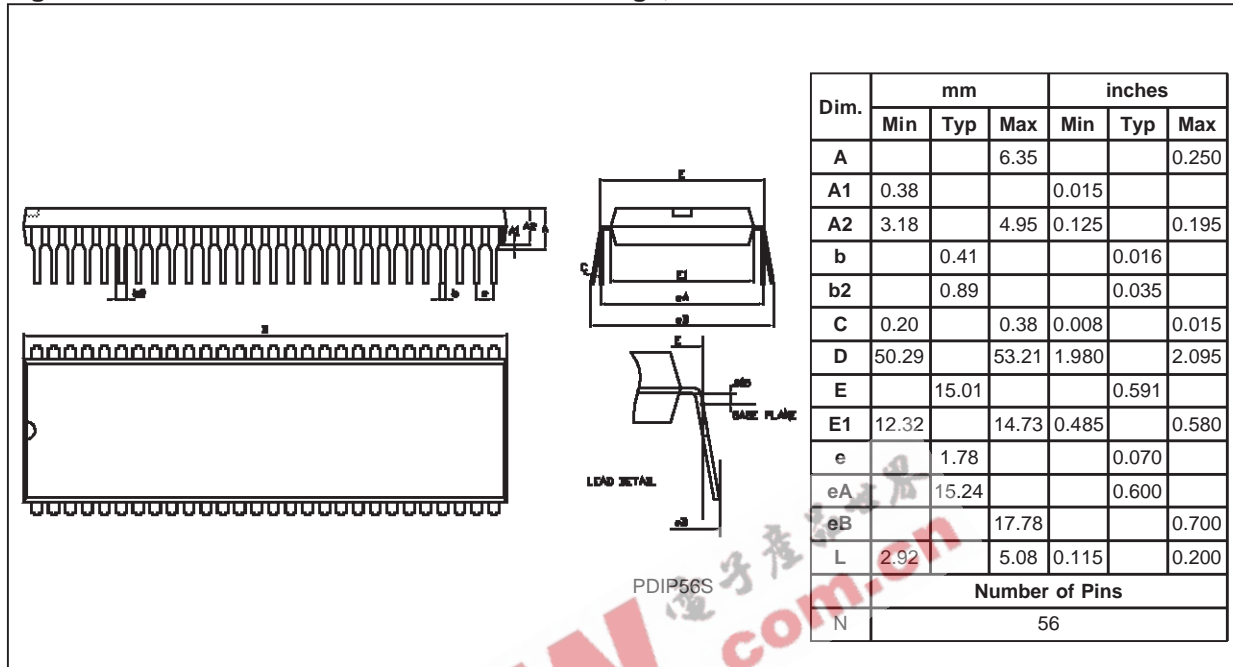
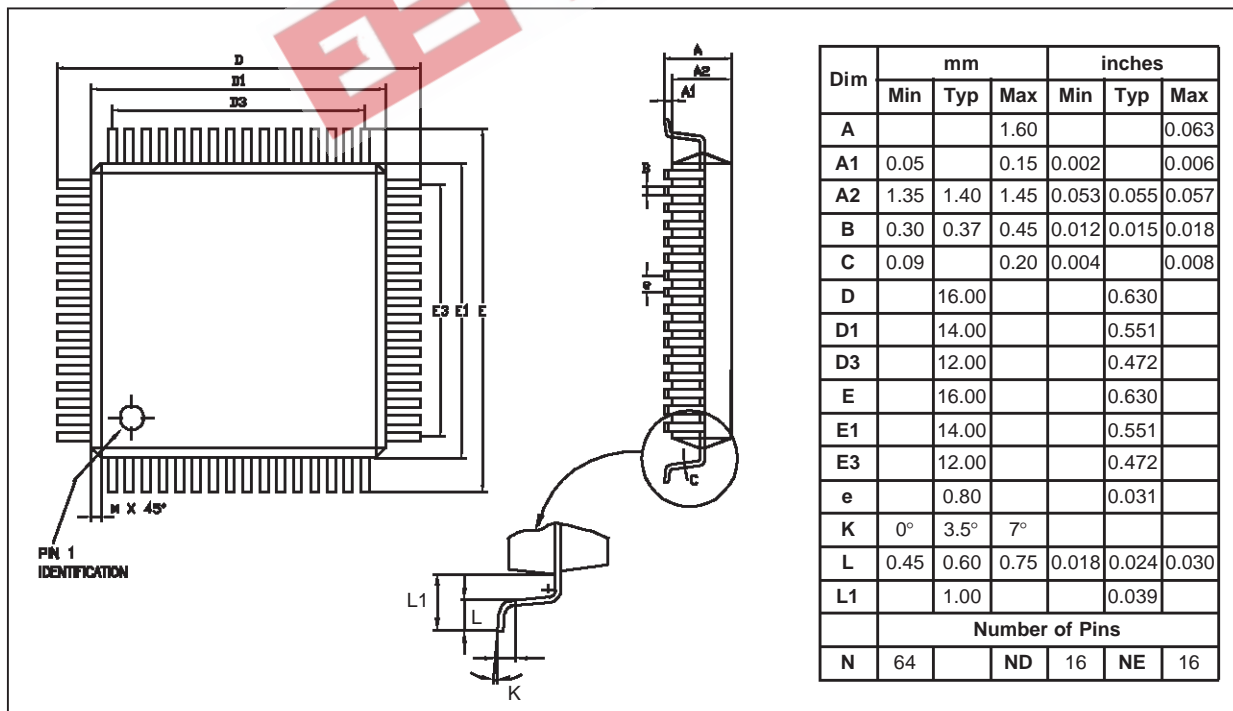


Figure 8. 64-Pin Thin Quad Flat Package



# ST92195B - GENERAL INFORMATION

## PACKAGE MECHANICAL DATA (Cont'd)

Figure 9. 56-Pin Shrink Ceramic Dual In Line Package, 600-mil Width

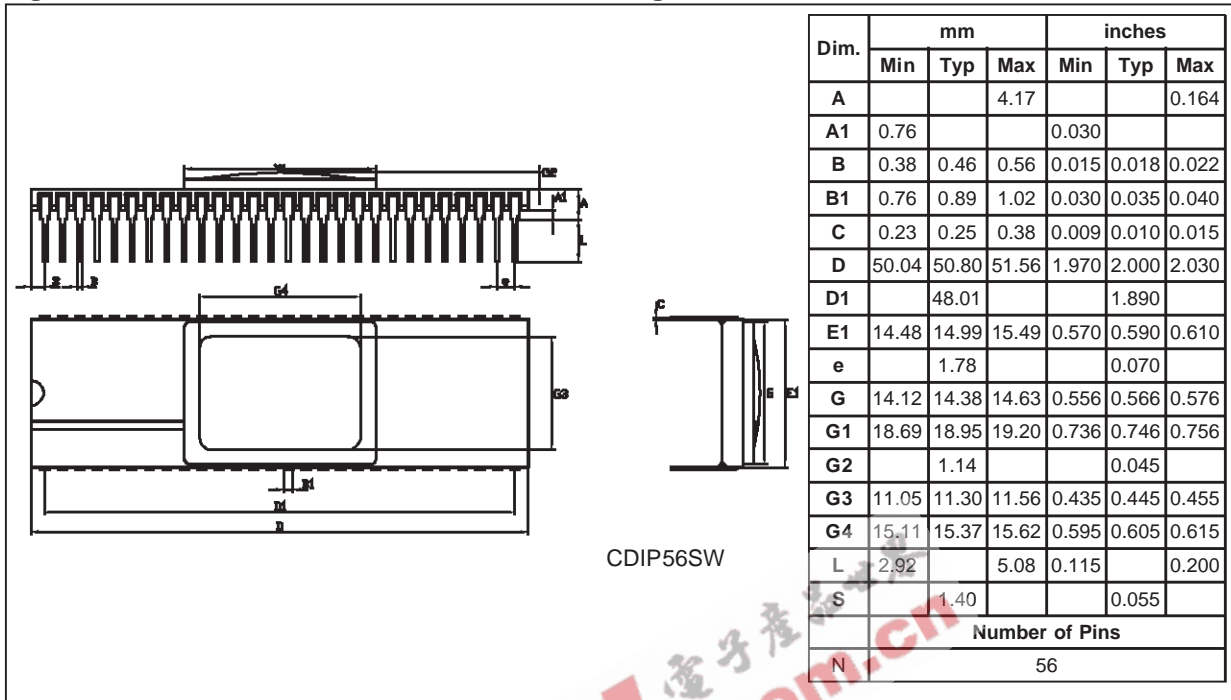
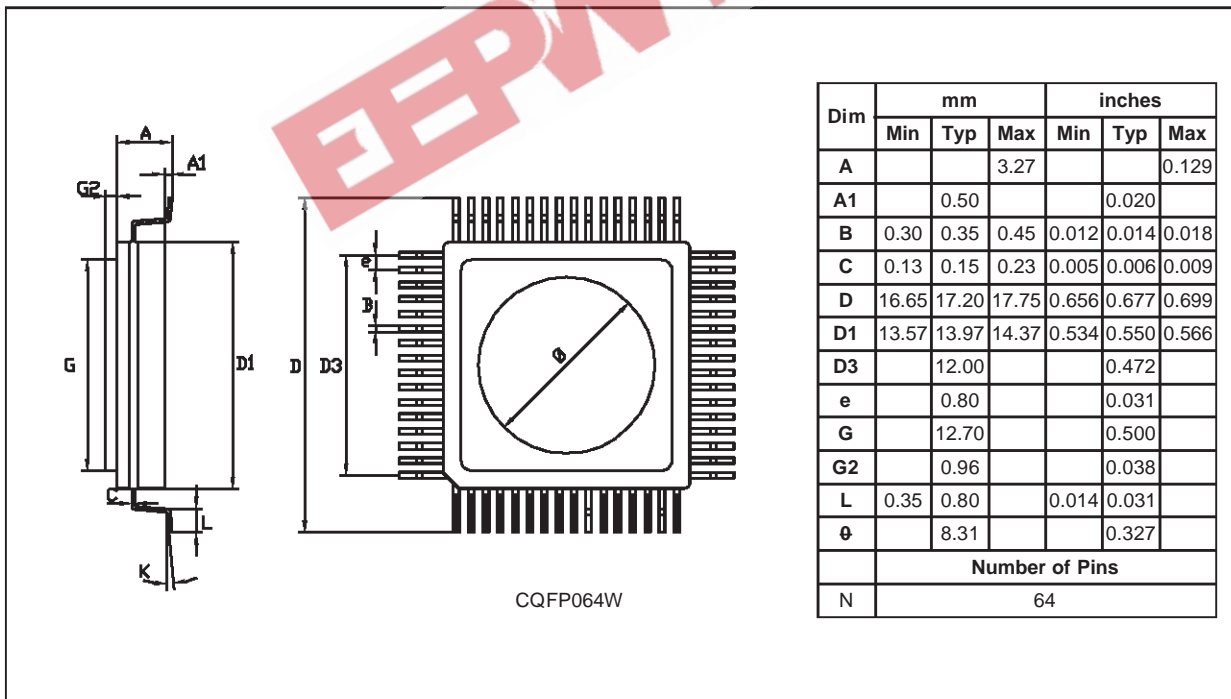


Figure 10. 64-Pin Ceramic Quad Flat Package



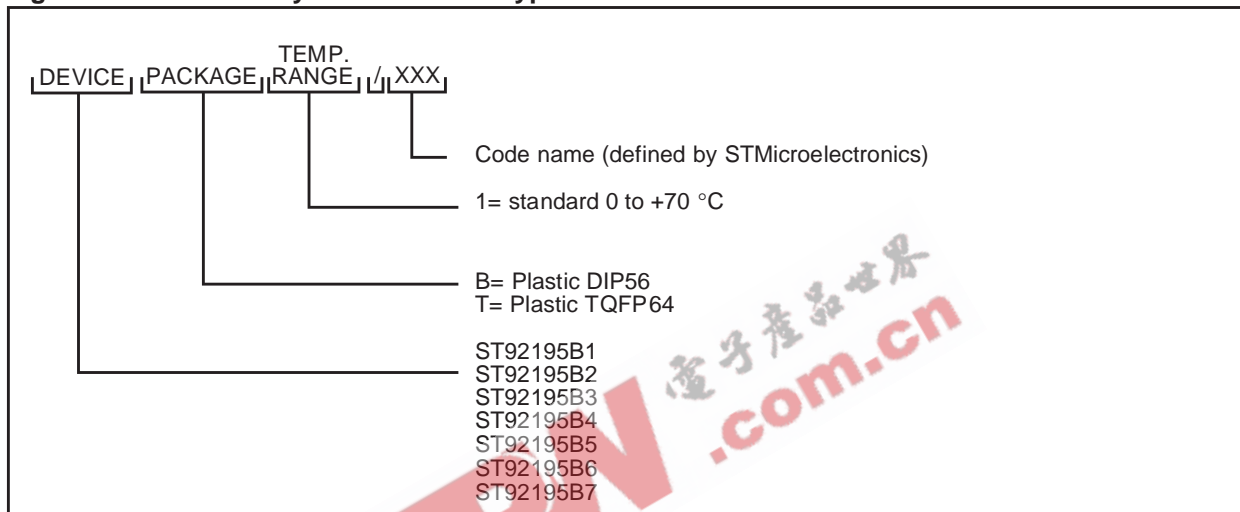
**3.2 ORDERING INFORMATION**

Each device is available for production in a user programmable version (OTP) as well as in factory coded version (ROM). OTP devices are shipped to customer with a default blank content FFh, while ROM factory coded parts contain the code sent by customer. The common EPROM versions for debugging and prototyping features the maximum memory size and peripherals of the family. Care must be taken to only use resources available on the target device.

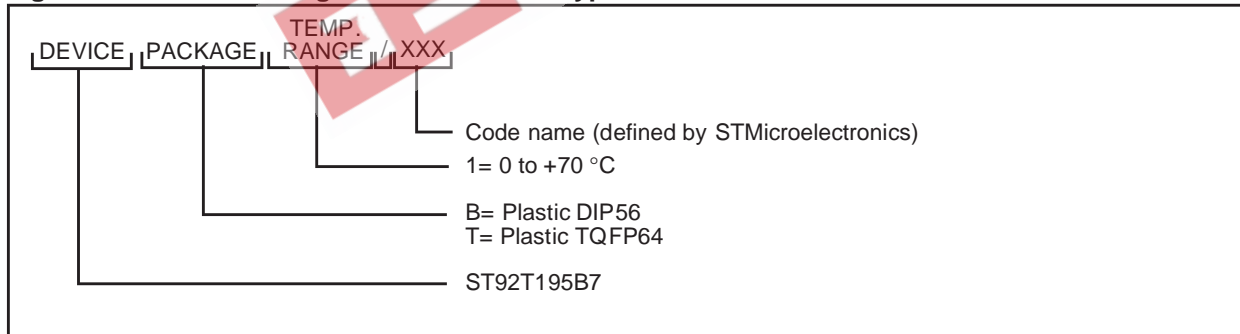
**3.2.1 Transfer Of Customer Code**

Customer code is made up of the ROM contents and the list of the selected options (if any). The ROM contents are to be sent on diskette, or by electronic means, with the hexadecimal file generated by the development tool. All unused bytes must be set to FFh.

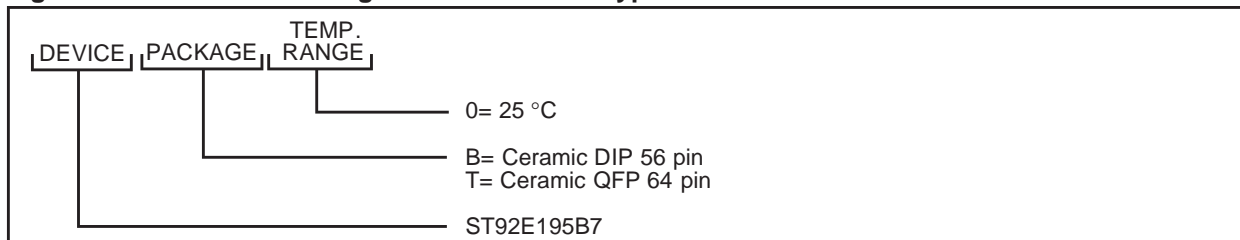
**Figure 11. ROM Factory Coded Device Types**



**Figure 12. OTP User Programmable Device Types**



**Figure 13. EPROM User Programmable Device Types**



## ST92195B - GENERAL INFORMATION

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### Notes:

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