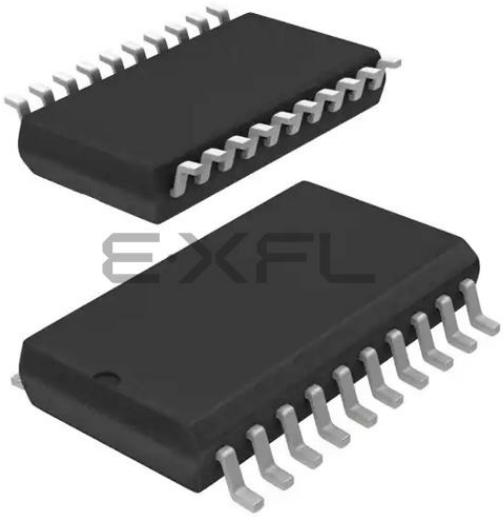

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"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Obsolete
Core Processor	ST6
Core Size	8-Bit
Speed	8MHz
Connectivity	-
Peripherals	LVD, POR, WDT
Number of I/O	12
Program Memory Size	4KB (4K x 8)
Program Memory Type	OTP
EEPROM Size	-
RAM Size	64 x 8
Voltage - Supply (Vcc/Vdd)	3V ~ 6V
Data Converters	A/D 8x8b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	20-SOIC (0.295", 7.50mm Width)
Supplier Device Package	20-SO
Purchase URL	https://www.e-xfl.com/product-detail/stmicroelectronics/st62t20cm6

Table of Contents

1 INTRODUCTION

The ST6208C, 09C, 10C and 20C devices are low cost members of the ST62xx 8-bit HCMOS family of microcontrollers, which is targeted at low to medium complexity applications. All ST62xx devices are based on a building block approach: a common core is surrounded by a number of on-chip peripherals.

The ST62E20C is the erasable EPROM version of the ST62T08C, T09C, T10C and T20C devices, which may be used during the development phase for the ST62T08C, T09C, T10C and T20C target devices, as well as the respective ST6208C, 09C, 10C and 20C ROM devices.

OTP and EPROM devices are functionally identical. OTP devices offer all the advantages of user programmability at low cost, which make them the ideal choice in a wide range of applications where frequent code changes, multiple code versions or last minute programmability are required.

The ROM based versions offer the same functionality, selecting the options defined in the programmable option bytes of the OTP/EPROM versions in the ROM option list (See Section 11.6 on page 96).

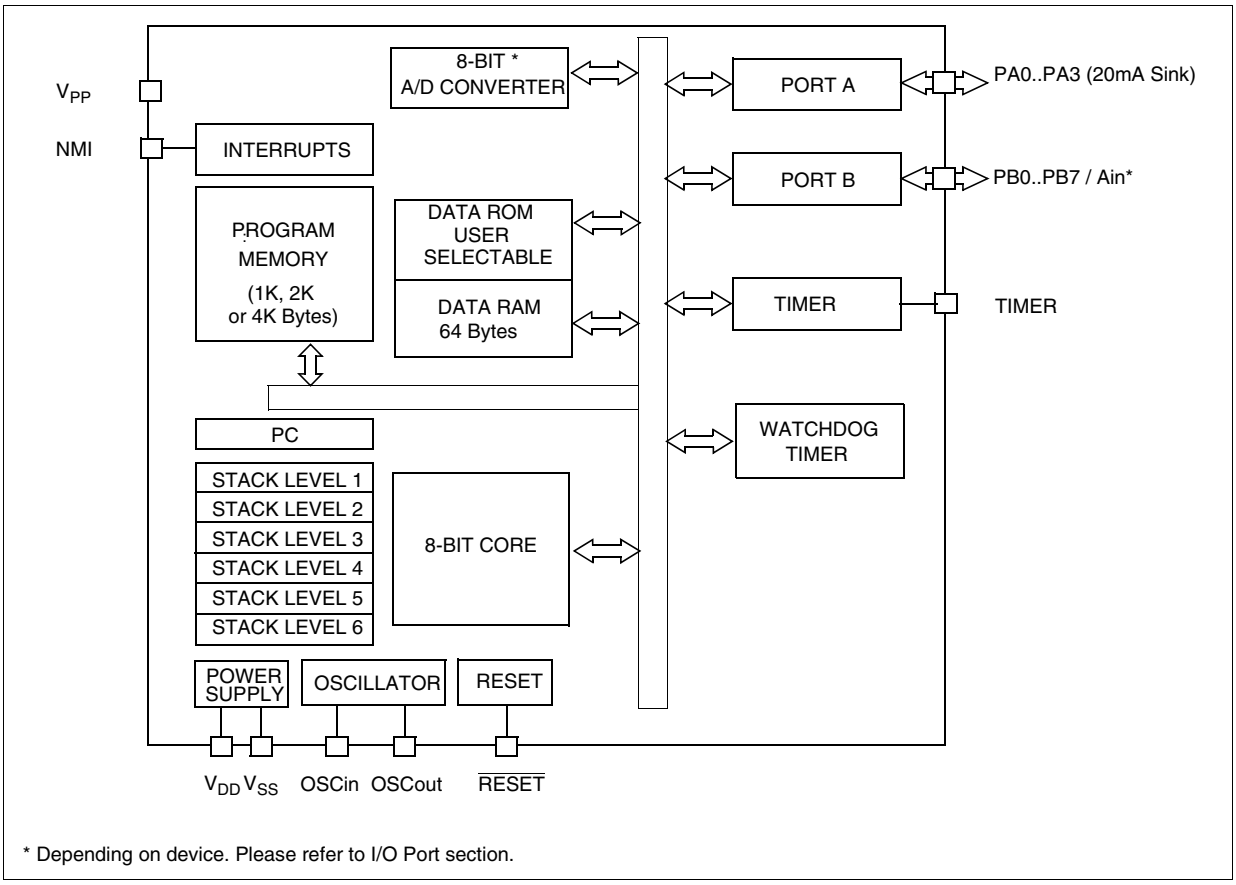
The ST62P08C/P09C/P10C/P20C are the **F**actory **A**dvanced **S**ervice **T**echnique ROM (FASTROM) versions of ST62T08C, T09C, T10C and T20C OTP devices.

They offer the same functionality as OTP devices, but they do not have to be programmed by the customer (See Section 11 on page 90).

These compact low-cost devices feature a Timer comprising an 8-bit counter with a 7-bit programmable prescaler, an 8-bit A/D Converter with up to 8 analog inputs (depending on device) and a Digital Watchdog timer, making them well suited for a wide range of automotive, appliance and industrial applications.

For easy reference, all parametric data are located in Section 11 on page 90.

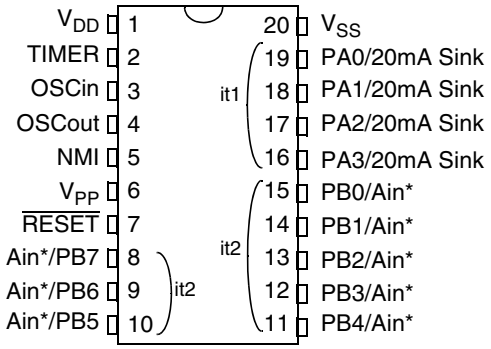
Figure 1. Block Diagram



* Depending on device. Please refer to I/O Port section.

2 PIN DESCRIPTION

Figure 2. 20-Pin Package Pinout



itX associated interrupt vector
* Depending on device. Please refer to I/O Port section.

Table 1. Device Pin Description

Pin n°	Pin Name	Type	Main Function (after Reset)	Alternate Function
1	V_{DD}	S	Main power supply	
2	TIMER	I/O	Timer input or output	
3	OSCin	I	External clock input or resonator oscillator inverter input	
4	OSCout	O	Resonator oscillator inverter output or resistor input for RC oscillator	
5	NMI	I	Non maskable interrupt (falling edge sensitive)	
6	V_{PP}		Must be held at Vss for normal operation, if a 12.5V level is applied to the pin during the reset phase, the device enters EPROM programming mode.	
7	$\overline{\text{RESET}}$	I/O	Top priority non maskable interrupt (active low)	
8	PB7/Ain*	I/O	Pin B7 (IPU)	Analog input
9	PB6/Ain*	I/O	Pin B6 (IPU)	Analog input
10	PB5/Ain*	I/O	Pin B5 (IPU)	Analog input
11	PB4/Ain*	I/O	Pin B4 (IPU)	Analog input
12	PB3/Ain*	I/O	Pin B3 (IPU)	Analog input
13	PB2/Ain*	I/O	Pin B2 (IPU)	Analog input
14	PB1/Ain*	I/O	Pin B1 (IPU)	Analog input
15	PB0/Ain*	I/O	Pin B0 (IPU)	Analog input
16	PA3/ 20mA Sink	I/O	Pin A3 (IPU)	
17	PA2/ 20mA Sink	I/O	Pin A2 (IPU)	
18	PA1/ 20mA Sink	I/O	Pin A1 (IPU)	

Pin n°	Pin Name	Type	Main Function (after Reset)	Alternate Function
19	PA0/ 20mA Sink	I/O	Pin A0 (IPU)	
20	V_{SS}	S	Ground	

Legend / Abbreviations for Table 1**:**

* Depending on device. Please refer to Section 7 "I/O PORTS" on page 37.

I = input, O = output, S = supply, IPU = input with pull-up

The input with pull-up configuration (reset state) is valid as long as the user software does not change it. Refer to Section 7 "I/O PORTS" on page 37 for more details on the software configuration of the I/O ports.

3 MEMORY MAPS, PROGRAMMING MODES AND OPTION BYTES

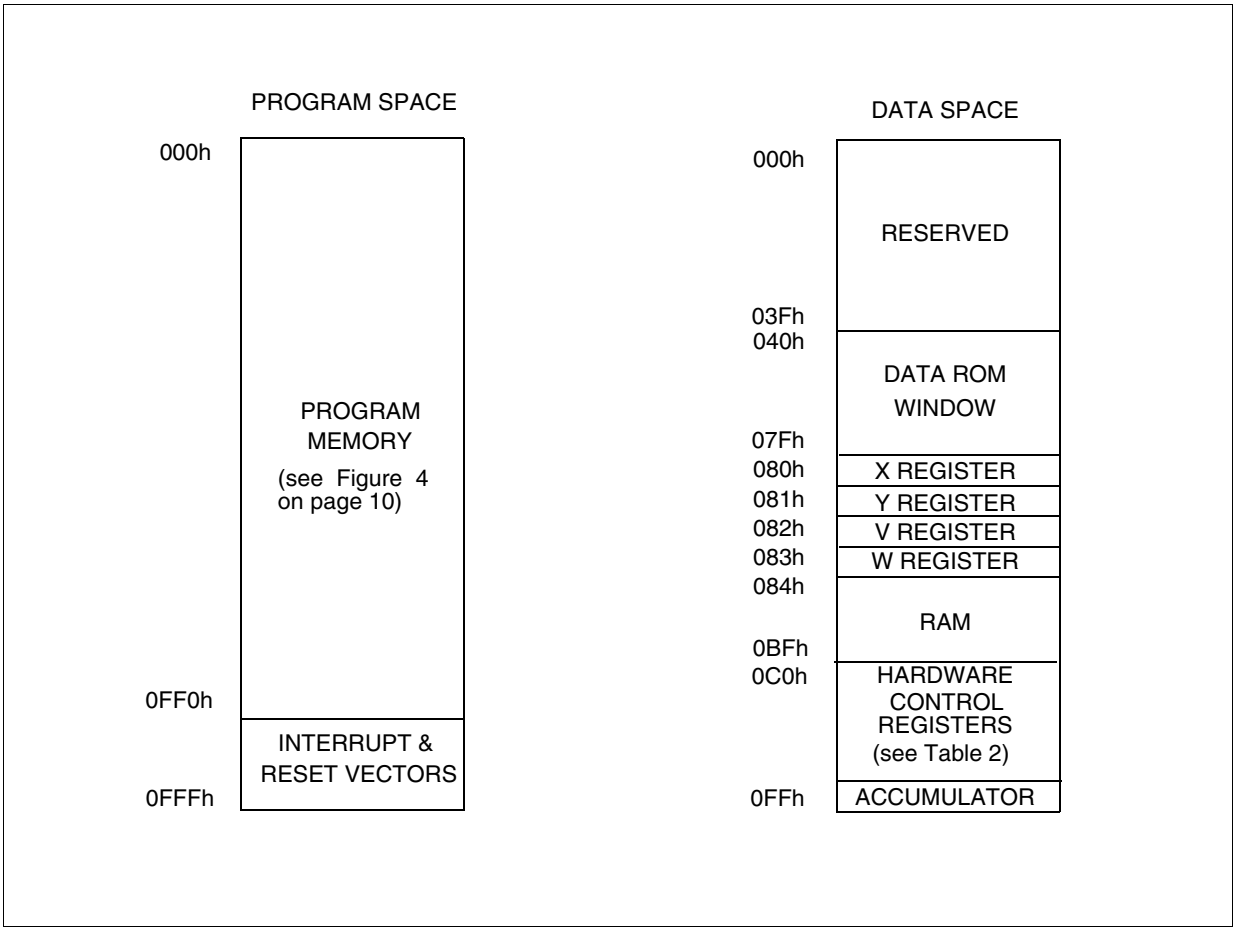
3.1 MEMORY AND REGISTER MAPS

3.1.1 Introduction

The MCU operates in three separate memory spaces: Program space, Data space, and Stack space. Operation in these three memory spaces is described in the following paragraphs.

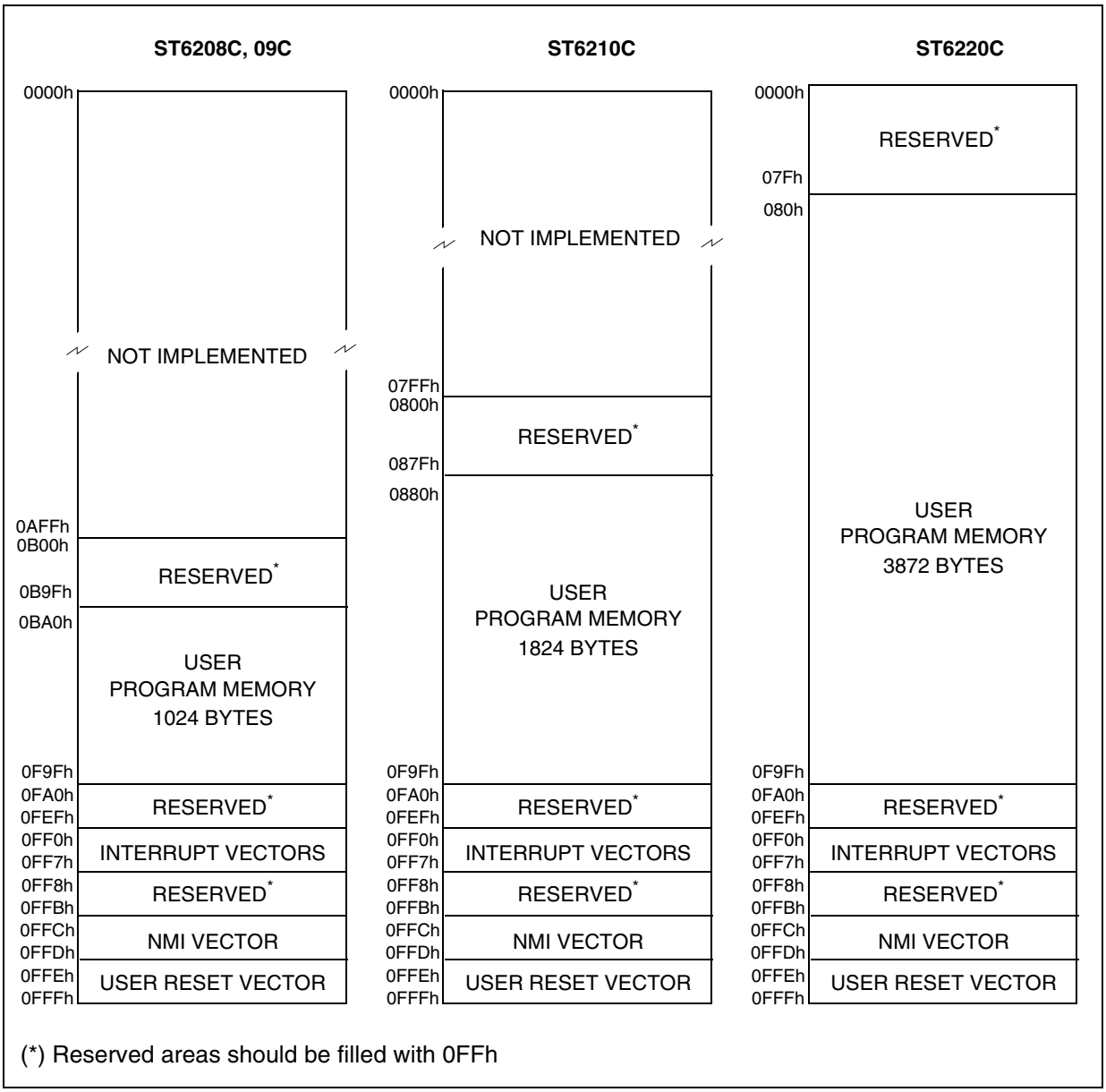
Briefly, Program space contains user program code in OTP and user vectors; Data space contains user data in RAM and in OTP, and Stack space accommodates six levels of stack for subroutine and interrupt service routine nesting.

Figure 3. Memory Addressing Diagram



MEMORY MAP (Cont'd)

Figure 4. Program Memory Map



(*) Reserved areas should be filled with 0FFh

CPU REGISTERS (Cont'd)

The 12-bit length allows the direct addressing of 4096 bytes in Program Space.

However, if the program space contains more than 4096 bytes, the additional memory in program space can be addressed by using the Program ROM Page register.

The PC value is incremented after reading the address of the current instruction. To execute relative jumps, the PC and the offset are shifted through the ALU, where they are added; the result is then shifted back into the PC. The program counter can be changed in the following ways:

– JP (Jump) instruction	PC = Jump address
– CALL instruction	PC = Call address
– Relative Branch Instruction	PC = PC +/- offset
– Interrupt	PC = Interrupt vector
– Reset	PC = Reset vector
– RET & RETI instructions	PC = Pop (stack)
– Normal instruction	PC = PC + 1

Flags (C, Z). The ST6 CPU includes three pairs of flags (Carry and Zero), each pair being associated with one of the three normal modes of operation: Normal mode, Interrupt mode and Non Maskable Interrupt mode. Each pair consists of a CARRY flag and a ZERO flag. One pair (CN, ZN) is used during Normal operation, another pair is used during Interrupt mode (CI, ZI), and a third pair is used in the Non Maskable Interrupt mode (CNMI, ZNMI).

The ST6 CPU uses the pair of flags associated with the current mode: as soon as an interrupt (or a Non Maskable Interrupt) is generated, the ST6 CPU uses the Interrupt flags (or the NMI flags) instead of the Normal flags. When the RETI instruction is executed, the previously used set of flags is restored. It should be noted that each flag set can only be addressed in its own context (Non Maskable Interrupt, Normal Interrupt or Main routine). The flags are not cleared during context switching and thus retain their status.

C : Carry flag.

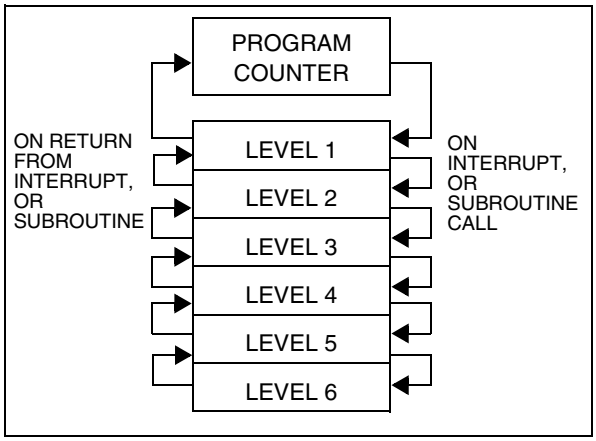
This bit is set when a carry or a borrow occurs during arithmetic operations; otherwise it is cleared. The Carry flag is also set to the value of the bit tested in a bit test instruction; it also participates in the rotate left instruction.
0: No carry has occured
1: A carry has occured

Z : Zero flag
This flag is set if the result of the last arithmetic or logical operation was equal to zero; otherwise it is cleared.
0: The result of the last operation is different from zero
1: The result of the last operation is zero

Switching between the three sets of flags is performed automatically when an NMI, an interrupt or a RETI instruction occurs. As NMI mode is automatically selected after the reset of the MCU, the ST6 core uses the NMI flags first.

Stack. The ST6 CPU includes a true LIFO (Last In First Out) hardware stack which eliminates the need for a stack pointer. The stack consists of six separate 12-bit RAM locations that do not belong to the data space RAM area. When a subroutine call (or interrupt request) occurs, the contents of each level are shifted into the next level down, while the content of the PC is shifted into the first level (the original contents of the sixth stack level are lost). When a subroutine or interrupt return occurs (RET or RETI instructions), the first level register is shifted back into the PC and the value of each level is popped back into the previous level.

Figure 8. Stack manipulation



Since the accumulator, in common with all other data space registers, is not stored in this stack, management of these registers should be performed within the subroutine.

Caution: The stack will remain in its "deepest" position if more than 6 nested calls or interrupts are executed, and consequently the last return address will be lost.

It will also remain in its highest position if the stack is empty and a RET or RETI is executed. In this case the next instruction will be executed.

5.5 INTERRUPT RULES AND PRIORITY MANAGEMENT

- A Reset can interrupt the NMI and peripheral interrupt routines
- The Non Maskable Interrupt request has the highest priority and can interrupt any peripheral interrupt routine at any time but cannot interrupt another NMI interrupt.
- No peripheral interrupt can interrupt another. If more than one interrupt request is pending, these are processed by the processor core according to their priority level: vector #1 has the highest priority while vector #4 the lowest. The priority of each interrupt source is fixed by hardware (see Interrupt Mapping table).

5.6 INTERRUPTS AND LOW POWER MODES

All interrupts cause the processor to exit from WAIT mode. Only the external and some specific interrupts from the on-chip peripherals cause the processor to exit from STOP mode (refer to the “Exit from STOP“ column in the Interrupt Mapping Table).

5.7 NON MASKABLE INTERRUPT

This interrupt is triggered when a falling edge occurs on the NMI pin regardless of the state of the GEN bit in the IOR register. An interrupt request on NMI vector #0 is latched by a flip flop which is automatically reset by the core at the beginning of the NMI service routine.

5.8 PERIPHERAL INTERRUPTS

Different peripheral interrupt flags in the peripheral control registers are able to cause an interrupt when they are active if both:

– The GEN bit of the IOR register is set

– The corresponding enable bit is set in the peripheral control register.

Peripheral interrupts are linked to vectors #3 and #4. Interrupt requests are flagged by a bit in their corresponding control register. This means that a request cannot be lost, because the flag bit must be cleared by user software.

5.10 INTERRUPT HANDLING PROCEDURE

The interrupt procedure is very similar to a call procedure, in fact the user can consider the interrupt as an asynchronous call procedure. As this is an asynchronous event, the user cannot know the context and the time at which it occurred. As a result, the user should save all Data space registers which may be used within the interrupt routines. The following list summarizes the interrupt procedure:

When an interrupt request occurs, the following actions are performed by the MCU automatically:

– The core switches from the normal flags to the interrupt flags (or the NMI flags).
– The PC contents are stored in the top level of the stack.
– The normal interrupt lines are inhibited (NMI still active).
– The internal latch (if any) is cleared.
– The associated interrupt vector is loaded in the PC.

When an interrupt request occurs, the following actions must be performed by the user software:

– User selected registers have to be saved within the interrupt service routine (normally on a software stack).
– The source of the interrupt must be determined by polling the interrupt flags (if more than one source is associated with the same vector).
– The RETI (RETurn from Interrupt) instruction must end the interrupt service routine.

After the RETI instruction is executed, the MCU returns to the main routine.

Caution: When a maskable interrupt occurs while the ST6 core is in NORMAL mode and during the execution of an “ldi IOR, 00h” instruction (disabling all maskable interrupts): if the interrupt request occurs during the first 3 cycles of the “ldi” instruction (which is a 4-cycle instruction) the core will switch to interrupt mode BUT the flags CN and ZN will NOT switch to the interrupt pair CI and ZI.

5.10.1 Interrupt Response Time

This is defined as the time between the moment when the Program Counter is loaded with the interrupt vector and when the program has jump to the interrupt subroutine and is ready to execute the code. It depends on when the interrupt occurs while the core is processing an instruction.

Figure 18. Interrupt Processing Flow Chart

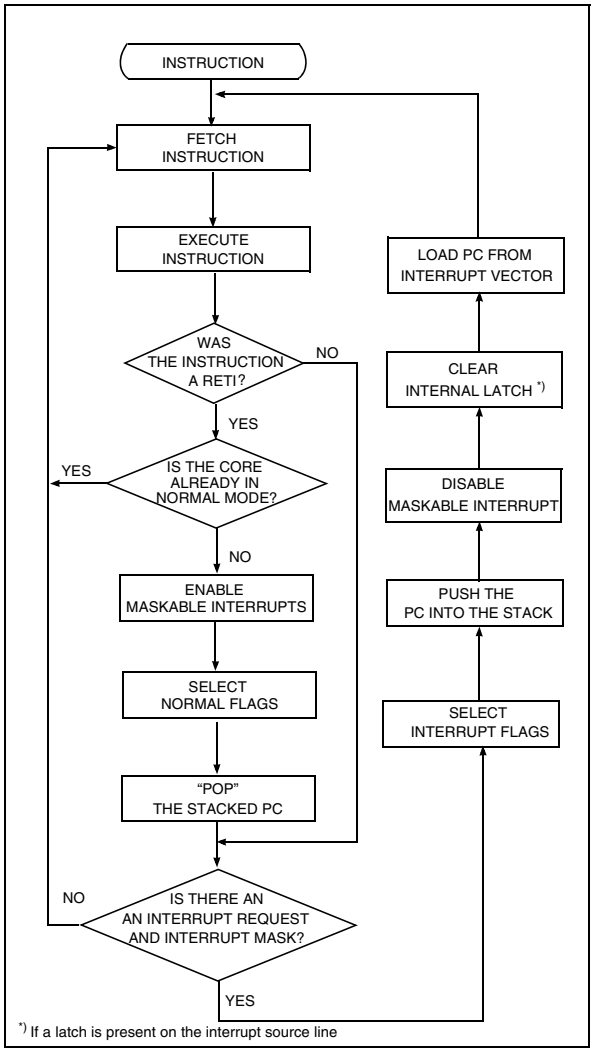


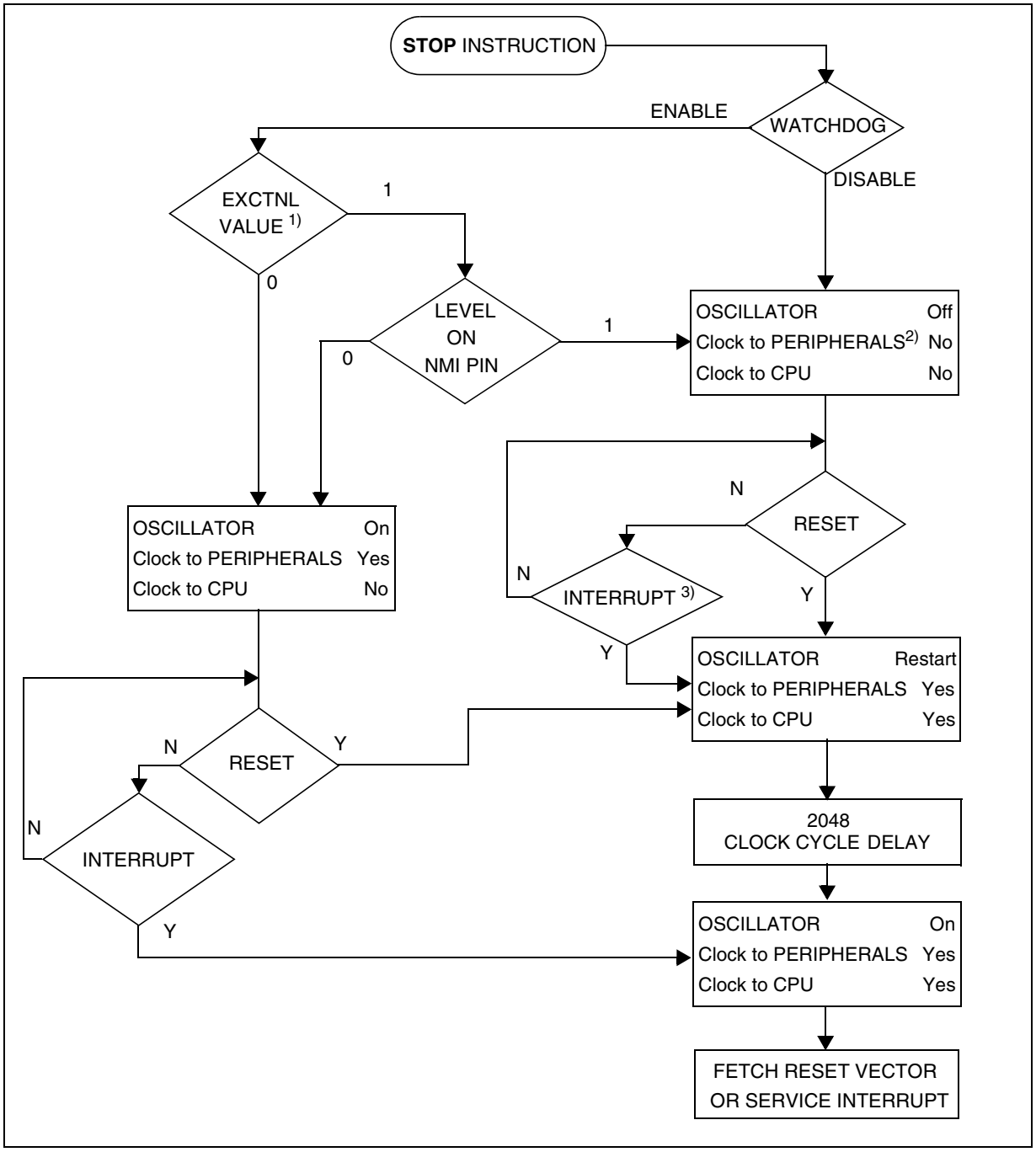
Table 7. Interrupt Response Time

Minimum	6 CPU cycles
Maximum	11 CPU cycles

One CPU cycle is 13 external clock cycles thus 11 CPU cycles = 11 x (13 /8M) = 17.875 µs with an 8 MHz external quartz.

STOP MODE (Cont'd)

Figure 22. STOP Mode Flowchart



Notes:

1. EXCTNL is an option bit. See option byte section for more details.

2. Peripheral clocked with an external clock source can still be active.

3. Only some specific interrupts can exit the MCU from STOP mode (such as external interrupt). Refer to the Interrupt Mapping table for more details.

I/O PORTS (Cont'd)

7.2.5 Instructions NOT to be used to access Port Data registers (SET, RES, INC and DEC)

DO NOT USE READ-MODIFY-WRITE INSTRUCTIONS (SET, RES, INC and DEC) ON PORT DATA REGISTERS IF ANY PIN OF THE PORT IS CONFIGURED IN INPUT MODE.

These instructions make an implicit read and write back of the entire register. In port input mode, however, the data register reads from the input pins directly, and not from the data register latches. Since data register information in input mode is used to set the characteristics of the input pin (interrupt, pull-up, analog input), these may be unintentionally reprogrammed depending on the state of the input pins.

As a general rule, it is better to only use single bit instructions on data registers when the whole (8-bit) port is in output mode. In the case of inputs or of mixed inputs and outputs, it is advisable to keep a copy of the data register in RAM. Single bit instructions may then be used on the RAM copy, after which the whole copy register can be written to the port data register:

```
SET bit, datacopy
LD a, datacopy
LD DRA, a
```

7.2.6 Recommendations

1. Safe I/O State Switching Sequence

Switching the I/O ports from one state to another should be done in a sequence which ensures that no unwanted side effects can occur. The recommended safe transitions are illustrated in Figure 24 The Interrupt Pull-up to Input Analog transition (and vice-vesra) is potentially risky and should be avoided when changing the I/O operating mode.

2. Handling Unused Port Bits

On ports that have less than 8 external pins connected:

– Leave the unbonded pins in reset state and do not change their configuration.

– Do not use instructions that act on a whole port register (INC, DEC, or read operations). Unavailable bits must be masked by software (AND instruction). Thus, when a read operation performed on an incomplete port is followed by a comparison, use a mask.

3. High Impedance Input

On any CMOS device, it is not recommended to connect high impedance on input pins. The choice of these impedance has to be done with respect to the maximum leakage current defined in the datasheet. The risk is to be close or out of specification on the input levels applied to the device.

7.3 LOW POWER MODES

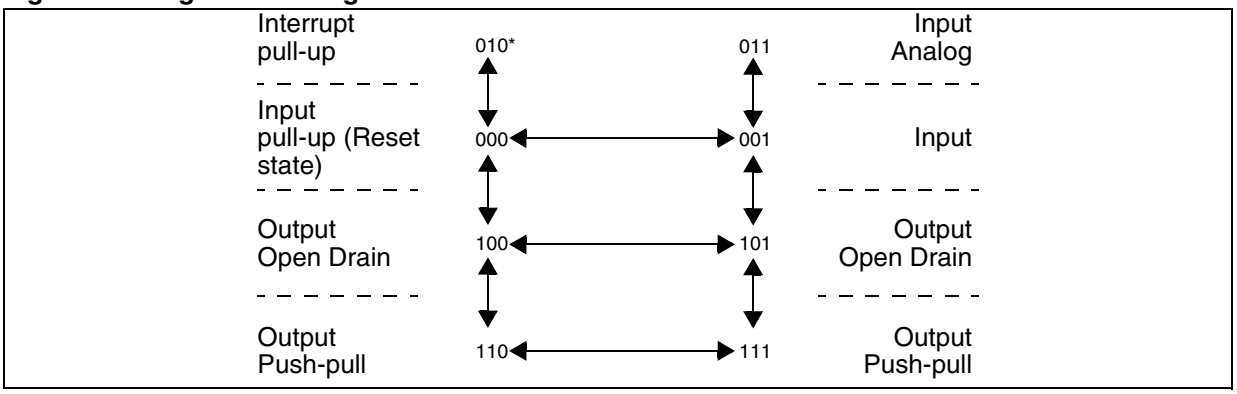
The WAIT and STOP instructions allow the ST62xx to be used in situations where low power consumption is needed. The lowest power consumption is achieved by configuring I/Os in output push-pull low mode.

Mode	Description
WAIT	No effect on I/O ports. External interrupts cause the device to exit from WAIT mode.
STOP	No effect on I/O ports. External interrupts cause the device to exit from STOP mode.

7.4 INTERRUPTS

The external interrupt event generates an interrupt if the corresponding configuration is selected with DDR, DR and OR registers (see Table 9) and the GEN-bit in the IOR register is set.

Figure 24. Diagram showing Safe I/O State Transitions



Note *. xxx = DDR, OR, DR Bits respectively

A/D CONVERTER (Cont'd)

8.3.5 Low Power Modes

Mode	Description
WAIT	No effect on A/D Converter. ADC interrupts cause the device to exit from Wait mode.
STOP	A/D Converter disabled.

Note: The A/D converter may be disabled by clearing the PDS bit. This feature allows reduced power consumption when no conversion is needed.

8.3.6 Interrupts

Interrupt Event	Event Flag	Enable Bit	Exit from Wait	Exit from Stop
End of Conversion	EOC	EAI	Yes	No

Note: The EOC bit is cleared only when a new conversion is started (it cannot be cleared by writing 0). To avoid generating further EOC interrupt, the EAI bit has to be cleared within the ADC interrupt subroutine.

8.3.7 Register Description

A/D CONVERTER CONTROL REGISTER (ADCR)

Address: 0D1h - Read/Write (Bit 6 Read Only, Bit 5 Write Only)

Reset value: 0100 0000 (40h)

7							0
EAI	EOC	STA	PDS	ADCR 3	OSC OFF	ADCR 1	ADCR 0

Bit 7 = **EAI** *Enable A/D Interrupt.*
0: ADC interrupt disabled
1: ADC interrupt enabled

Bit 6 = **EOC** *End of conversion. Read Only*
When a conversion has been completed, this bit is set by hardware and an interrupt request is generated if the EAI bit is set. The EOC bit is automatically cleared when the STA bit is set. Data in the data conversion register are valid only when this bit is set to "1".
0: Conversion is not complete
1: Conversion can be read from the ADR register

Bit 5 = **STA***: Start of Conversion. Write Only.*
0: No effect
1: Start conversion

Note: Setting this bit automatically clears the EOC bit. If the bit is set again when a conversion is in progress, the present conversion is stopped and a new one will take place. This bit is write only, any attempt to read it will show a logical zero.

Bit 4 = **PDS** *Power Down Selection.*

0: A/D converter is switched off
1: A/D converter is switched on

Bit 3 = **ADCR3 Reserved**, must be cleared.

Bit 2 = **OSCOFF** *Main Oscillator off.*

0: Main Oscillator enabled
1: Main Oscillator disabled

Note: This bit does not apply to the ADC peripheral but to the main clock system. Refer to the Clock System section.

Bits 1:0 = **ADCR[1:0] Reserved**, must be cleared.

A/D CONVERTER DATA REGISTER (ADR)

Address: 0D0h - Read only

Reset value: xxxx xxxx (xxh)

7							0
ADR7	ADR6	ADR5	ADR4	ADR3	ADR2	ADR1	ADR0

Bits 7:0 = **ADR[7:0]***: 8 Bit A/D Conversion Result.*

Table 16. ADC Register Map and Reset Values

Address (Hex.)	Register Label	7	6	5	4	3	2	1	0
0D0h	**ADR** Reset Value	ADR7 0	ADR6 0	ADR5 0	ADR4 0	ADR3 0	ADR2 0	ADR1 0	ADR0 0
0D1h	**ADCR** Reset Value	EAI 0	EOC 1	STA 0	PDS 0	ADCR3 0	OSCOFF 0	ADCR1 0	ADCR0 0

9 INSTRUCTION SET

9.1 ST6 ARCHITECTURE

The ST6 architecture has been designed for maximum efficiency while keeping byte usage to a minimum; in short, to provide byte-efficient programming. The ST6 core has the ability to set or clear any register or RAM location bit in Data space using a single instruction. Furthermore, programs can branch to a selected address depending on the status of any bit in Data space.

9.2 ADDRESSING MODES

The ST6 has nine addressing modes, which are described in the following paragraphs. Three different address spaces are available: Program space, Data space, and Stack space. Program space contains the instructions which are to be executed, plus the data for immediate mode instructions. Data space contains the Accumulator, the X, Y, V and W registers, peripheral and Input/Output registers, the RAM locations and Data ROM locations (for storage of tables and constants). Stack space contains six 12-bit RAM cells used to stack the return addresses for subroutines and interrupts.

Immediate. In immediate addressing mode, the operand of the instruction follows the opcode location. As the operand is a ROM byte, the immediate addressing mode is used to access constants which do not change during program execution (e.g., a constant used to initialize a loop counter).

Direct. In direct addressing mode, the address of the byte which is processed by the instruction is stored in the location which follows the opcode. Direct addressing allows the user to directly address the 256 bytes in Data Space memory with a single two-byte instruction.

Short Direct. The core can address the four RAM registers X, Y, V, W (locations 80h, 81h, 82h, 83h) in short-direct addressing mode. In this case, the instruction is only one byte and the selection of the location to be processed is contained in the opcode. Short direct addressing is a subset of direct addressing mode. (Note that 80h and 81h are also indirect registers).

Extended. In extended addressing mode, the 12-bit address needed to define the instruction is obtained by concatenating the four least significant bits of the opcode with the byte following the opcode. The instructions (JP, CALL) which use extended addressing mode are able to branch to any address in the 4 Kbyte Program space.

Extended addressing mode instructions are two bytes long.

Program Counter Relative. Relative addressing mode is only used in conditional branch instructions. The instruction is used to perform a test and, if the condition is true, a branch with a span of -15 to +16 locations next to the address of the relative instruction. If the condition is not true, the instruction which follows the relative instruction is executed. Relative addressing mode instructions are one byte long. The opcode is obtained by adding the three most significant bits which characterize the test condition, one bit which determines whether it is a forward branch (when it is 0) or backward branch (when it is 1) and the four least significant bits which give the span of the branch (0h to Fh) which must be added or subtracted from the address of the relative instruction to obtain the branch destination address.

Bit Direct. In bit direct addressing mode, the bit to be set or cleared is part of the opcode, and the byte following the opcode points to the address of the byte in which the specified bit must be set or cleared. Thus, any bit in the 256 locations of Data space memory can be set or cleared.

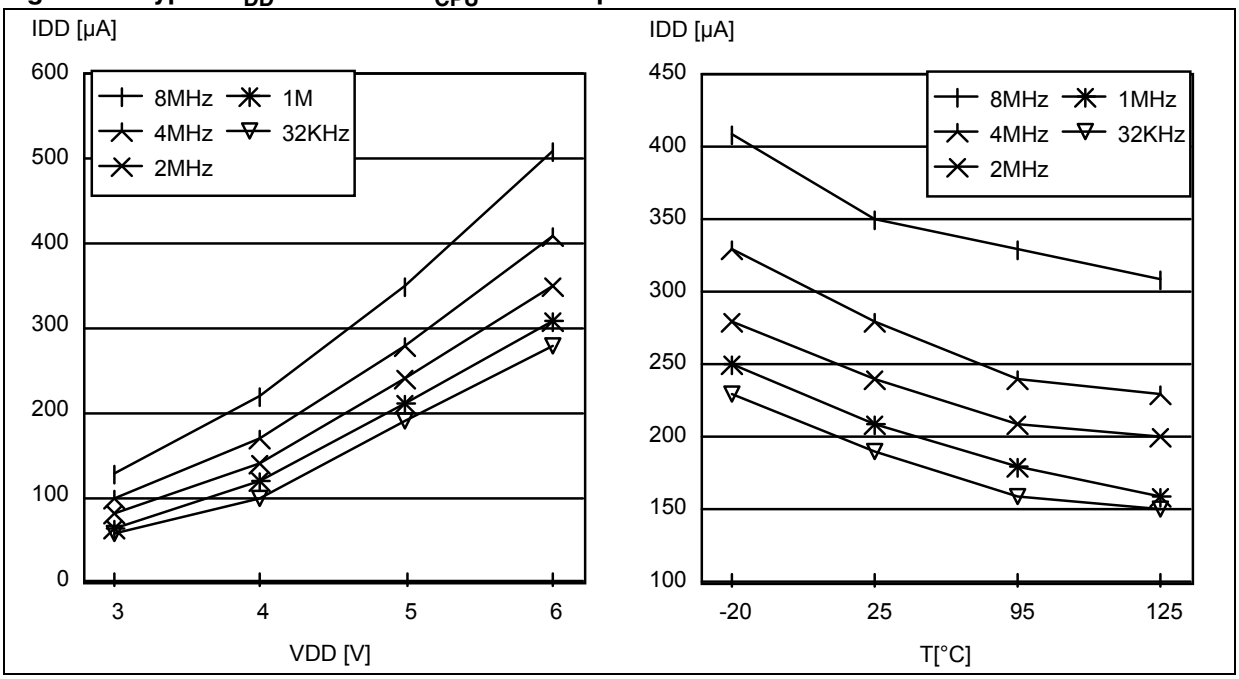
Bit Test & Branch. Bit test and branch addressing mode is a combination of direct addressing and relative addressing. Bit test and branch instructions are three bytes long. The bit identification and the test condition are included in the opcode byte. The address of the byte to be tested is given in the next byte. The third byte is the jump displacement, which is in the range of -127 to +128. This displacement can be determined using a label, which is converted by the assembler.

Indirect. In indirect addressing mode, the byte processed by the register-indirect instruction is at the address pointed to by the content of one of the indirect registers, X or Y (80h, 81h). The indirect register is selected by bit 4 of the opcode. Register indirect instructions are one byte long.

Inherent. In inherent addressing mode, all the information necessary for executing the instruction is contained in the opcode. These instructions are one byte long.

SUPPLY CURRENT CHARACTERISTICS (Cont'd)

Figure 46. Typical I_{DD} in WAIT vs f_{CPU} and Temperature for ROM devices



SUPPLY CURRENT CHARACTERISTICS (Cont'd)

10.4.3 STOP Mode

Symbol	Parameter	Conditions	Typ [1]	Max	Unit
I_{DD}	Supply current in STOP mode [2] (see Figure 47 & Figure 48)	OTP devices	0.3	10 [3] 20 [4]	µA
		ROM devices	0.1	2 [3] 20 [4]	

Notes:

1. Typical data are based on V_{DD}=5.0V at T_A=25°C.
2. All I/O pins in input with pull-up mode (no load), all peripherals in reset state, OSG and LVD disabled, option bytes programmed to 00H. Data based on characterization results, tested in production at V_{DD} max. and f_{CPU} max.
3. Maximum STOP consumption for -40°C<Ta<90°C
4. Maximum STOP consumption for -40°C<Ta<125°C

Figure 47. Typical I_{DD} in STOP vs Temperature for OTP devices

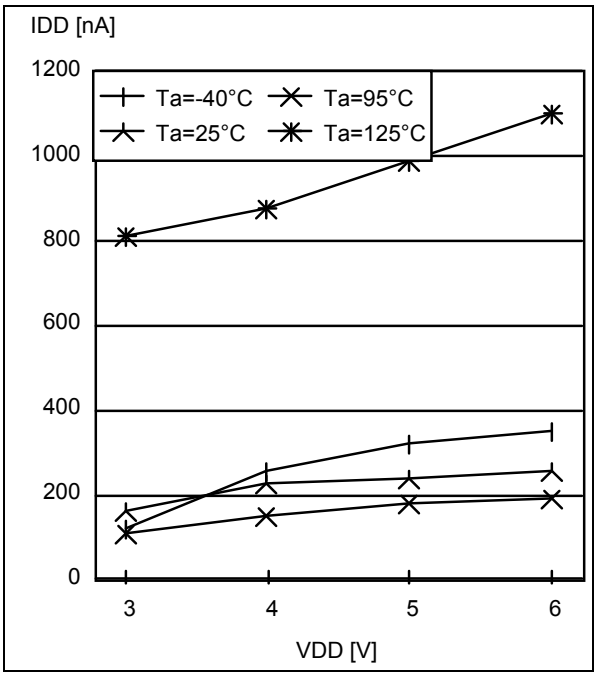
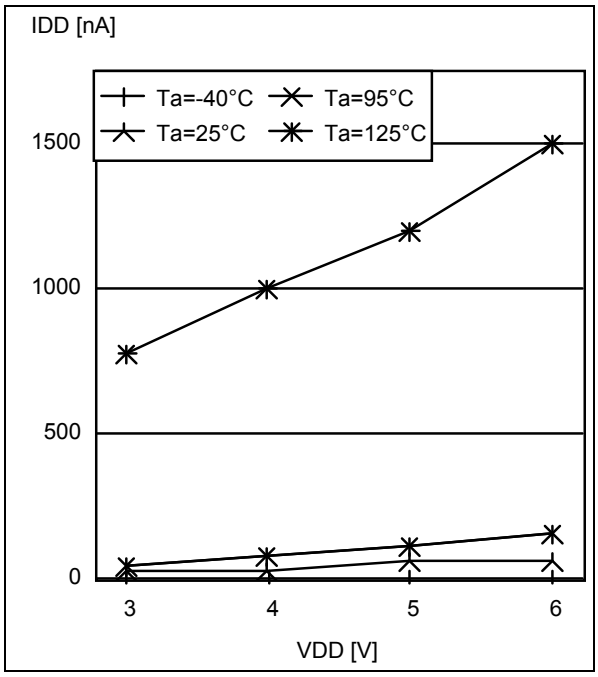


Figure 48. Typical I_{DD} in STOP vs Temperature for ROM devices



10.7 EMC CHARACTERISTICS

Susceptibility tests are performed on a sample basis during product characterization.

10.7.1 Functional EMS

(Electro Magnetic Susceptibility)

Based on a simple running application on the product (toggling 2 LEDs through I/O ports), the product is stressed by two electro magnetic events until a failure occurs (indicated by the LEDs).

- **ESD**: Electro-Static Discharge (positive and negative) is applied on all pins of the device until a functional disturbance occurs. This test conforms with the IEC 1000-4-2 standard.
- **FTB**: A Burst of Fast Transient voltage (positive and negative) is applied to V_{DD} and V_{SS} through a 100pF capacitor, until a functional disturbance occurs. This test conforms with the IEC 1000-4-4 standard.

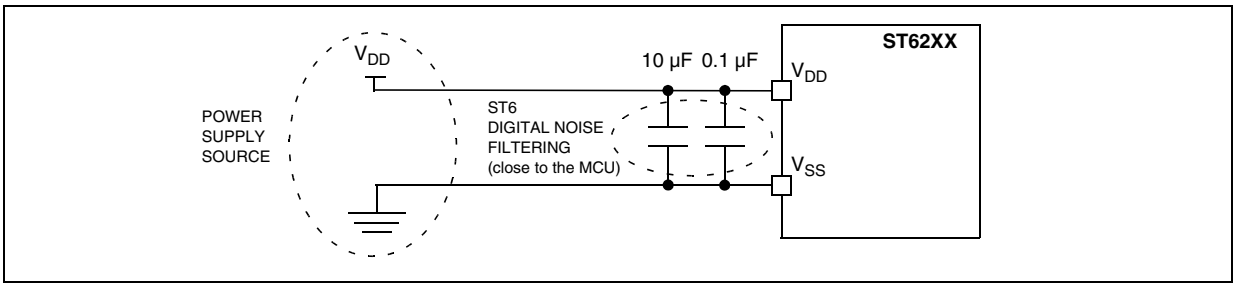
A device reset allows normal operations to be resumed.

Symbol	Parameter	Conditions	Neg [1]	Pos [1]	Unit
V_{FESD}	Voltage limits to be applied on any I/O pin to induce a functional disturbance	V_{DD}=5V, T_A=+25°C, f_{OSC}=8MHz conforms to IEC 1000-4-2	-2	2	kV
V_{FFTB}	Fast transient voltage burst limits to be applied through 100pF on V_{DD} and V_{DD} pins to induce a functional disturbance	V_{DD}=5V, T_A=+25°C, f_{OSC}=8MHz conforms to IEC 1000-4-4	-2.5	3	

Notes:

1. Data based on characterization results, not tested in production.
2. The suggested 10 µF and 0.1 µF decoupling capacitors on the power supply lines are proposed as a good price vs. EMC performance tradeoff. They have to be put as close as possible to the device power supply pins. Other EMC recommendations are given in other sections (I/Os, RESET, OSCx pin characteristics).

Figure 56. EMC Recommended Star Network Power Supply Connection [2]



EMC CHARACTERISTICS (Cont'd)

10.7.3 ESD Pin Protection Strategy

To protect an integrated circuit against Electro-Static Discharge the stress must be controlled to prevent degradation or destruction of the circuit elements. The stress generally affects the circuit elements which are connected to the pads but can also affect the internal devices when the supply pads receive the stress. The elements to be protected must not receive excessive current, voltage or heating within their structure.

An ESD network combines the different input and output ESD protections. This network works, by allowing safe discharge paths for the pins subjected to ESD stress. Two critical ESD stress cases are presented in Figure 59 and Figure 60 for standard pins.

Standard Pin Protection

To protect the output structure the following elements are added:

– A diode to V_{DD} (3a) and a diode from V_{SS} (3b)

– A protection device between V_{DD} and V_{SS} (4)

To protect the input structure the following elements are added:

– A resistor in series with the pad (1)

– A diode to V_{DD} (2a) and a diode from V_{SS} (2b)

– A protection device between V_{DD} and V_{SS} (4)

Figure 59. Positive Stress on a Standard Pad vs. V_{SS}

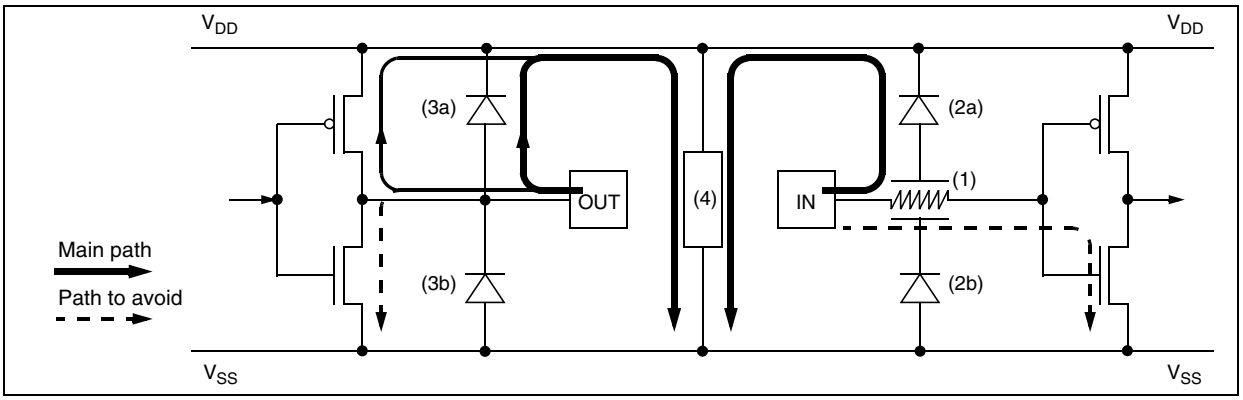
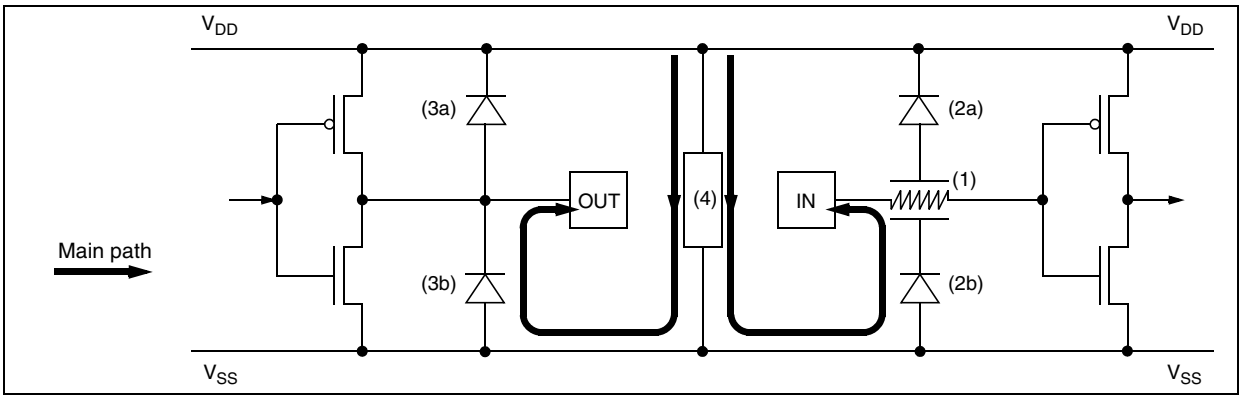


Figure 60. Negative Stress on a Standard Pad vs. V_{DD}



I/O PORT PIN CHARACTERISTICS (Cont'd)

Figure 65. Typical V_{OH} at V_{DD} = 5V

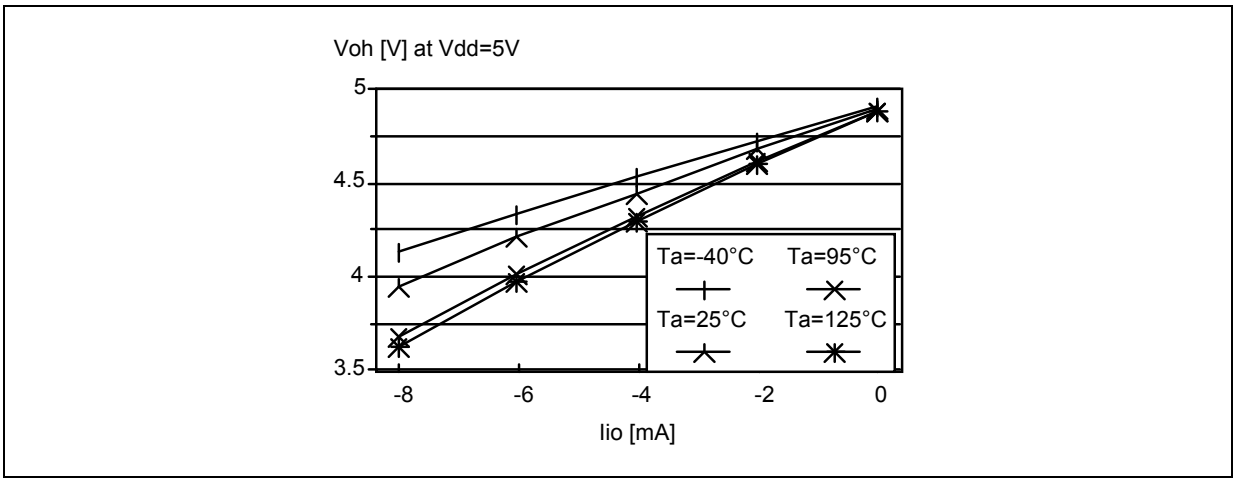


Figure 66. Typical V_{OL} vs V_{DD} (standard I/Os)

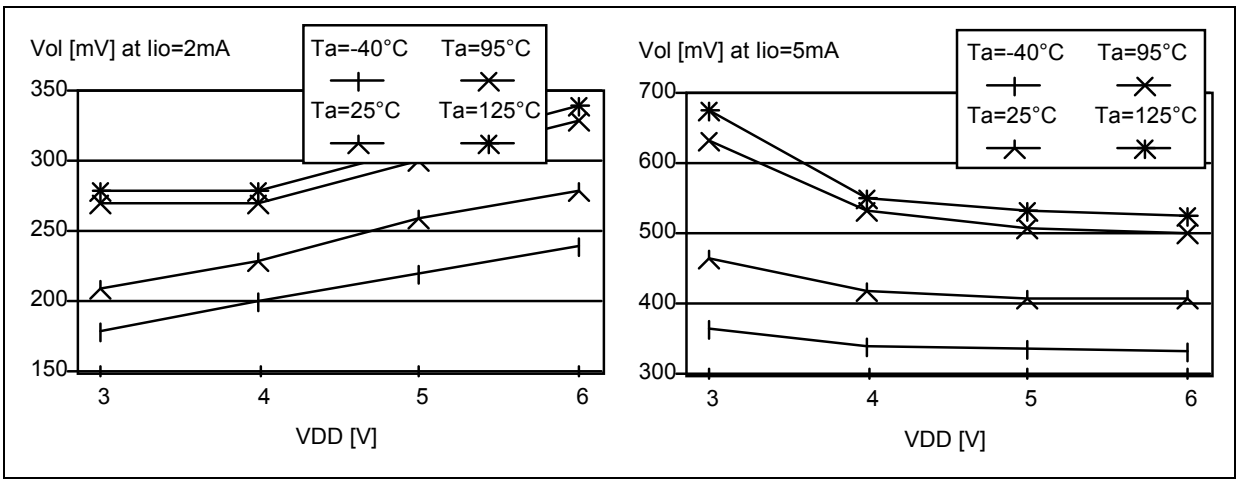
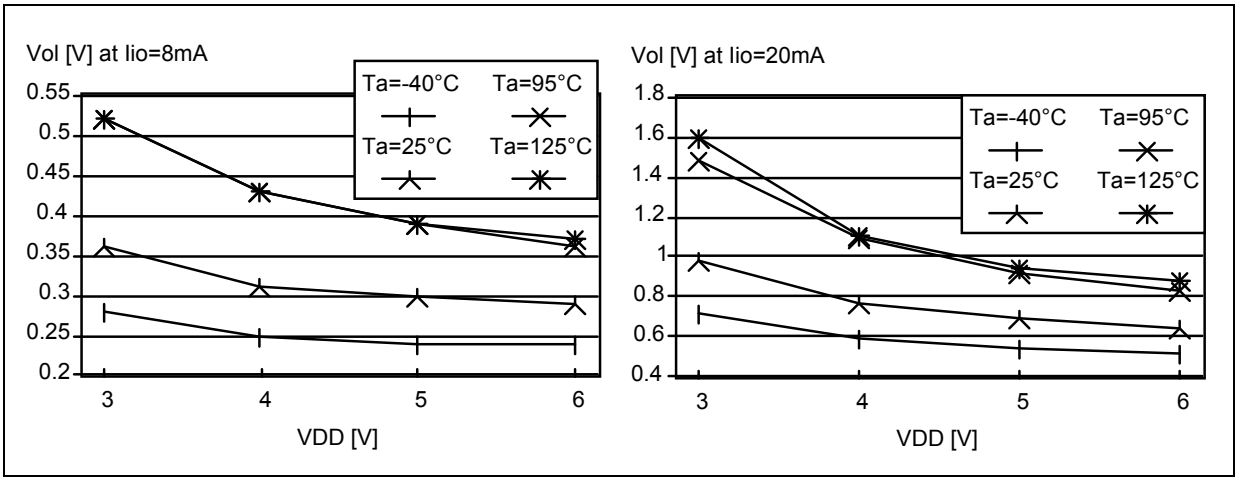


Figure 67. Typical V_{OL} vs V_{DD} (high-sink I/Os)



DEVELOPMENT TOOLS (Cont'd)

STMicroelectronics Tools

Four types of development tool are offered by ST, all of them connect to a PC via a parallel or serial port: see Table 27 and Table 28 for more details.

Table 27. STMicroelectronics Tool Features

	Emulation Type	Programming Capability	Software Included
ST6 Starter Kit	Device simulation (limited emulation as interrupts are not supported)	Yes (DIP packages only)	MCU CD ROM with: – Rkit-ST6 from Raisonance – ST6 Assembly toolchain – WGDB6 powerful Source Level Debugger for Win 3.1, Win 95 and NT – Various software demo versions. – Windows Programming Tools for Win 3.1, Win 95 and NT
ST6 HDS2 Emulator	In-circuit powerful emulation features including trace/ logic analyzer	No	
ST6 EPROM Programmer Board	No	Yes	

Table 28. Dedicated STMicroelectronics Development Tools

Supported Products	ST6 Starter Kit	ST6 HDS2 Emulator	ST6 Programming Board
ST6208C, ST6209C, ST6210C and ST6220C	ST622XC-KIT	Complete: ST62GP-EMU2 Dedication board: ST62GP-DBE	ST62E2XC-EPB

IDENTIFICATION	DESCRIPTION
AN913	PWM GENERATION WITH ST62 16-BIT AUTO-RELOAD TIMER
AN914	USING ST626X SPI AS UART
AN1016	ST6 USING THE ST623XB/ST628XB UART
AN1050	ST6 INPUT CAPTURE WITH ST62 16-BIT AUTO-RELOAD TIMER
AN1127	USING THE ST62T6XC/5XC SPI IN MASTER MODE
GENERAL	
AN683	MCUS - 8/16-BIT MICROCONTROLLERS (MCUS) APPLICATION NOTES ABSTRACTS BY TOPICS
AN886	SELECTING BETWEEN ROM AND OTP FOR A MICROCONTROLLER
AN887	MAKING IT EASY WITH MICROCONTROLLERS
AN898	EMC GENERAL INFORMATION
AN899	SOLDERING RECOMMENDATIONS AND PACKAGING INFORMATION
AN900	INTRODUCTION TO SEMICONDUCTOR TECHNOLOGY
AN901	EMC GUIDE-LINES FOR MICROCONTROLLER - BASED APPLICATIONS
AN902	QUALITY AND RELIABILITY INFORMATION
AN912	A SIMPLE GUIDE TO DEVELOPMENT TOOLS
AN1181	ELECTROSTATIC DISHARGE SENSITIVITY MEASUREMENT