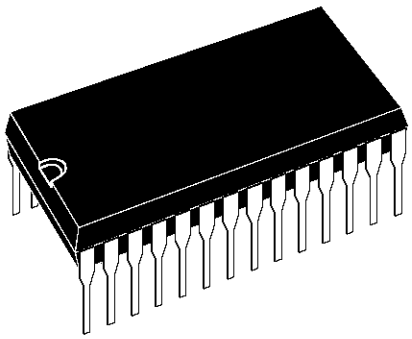
SGS-THOMSON MICROELECTRONICS

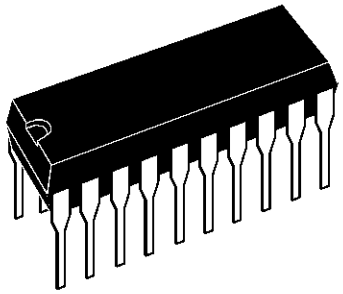
ST6210Bx3-ST6215Bx3
ST6220Bx3-ST6225Bx3

8-BIT HCMOS MCUs WITH A/D CONVERTER WITH AUTOMOTIVE TEMPERATURE RANGE

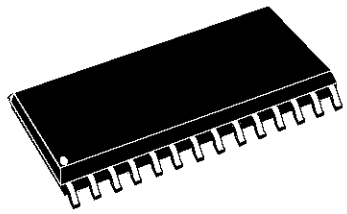
- 3.0 to 6.0V Supply Operating Range
- 4 MHz Maximum Clock Frequency
- -40 to +125°C Operating Temperature Range
- Run, Wait, Stop Modes
- 5 different interrupt vectors
- Look-up table capability in ROM
- User ROM: 1828 bytes (ST6210B, 15B)
3876 bytes (ST6220B, 25B)
- Data ROM: User selectable size
(in program ROM)
- Data RAM: 64 bytes
- ROM readout Protection
- PDIP20, PSO20 (ST6210B, 20B) packages
- PDIP28, PSO28 (ST6215B, 25B) packages
- 12/20 fully software programmable I/O as:
  - Input with pull-up resistor
  - Input without pull-up resistor
  - Input with interrupt generation
  - Open-drain or push-pull outputs
  - Analog Inputs
- 4 I/O lines can sink up to 15mA for direct LED or TRIAC driving
- 8 bit counter with a 7-bit programmable prescaler
- Digital Watchdog and Oscillator Safe Guard
- 8 bit A/D Converter with up to 8 (ST6210B, 20B) and up to 16 (ST6215B, 25B) analog inputs
- On-chip clock oscillator driven by Quartz Crystal, Ceramic resonator or RC network
- Power-on Reset
- One external not maskable interrupt
- 9 powerful addressing modes
- The development tool of the ST621xB, 2xB microcontrollers consists of the ST626x-EMU emulation and development system connected via an RS232 serial line to an MS-DOS PC



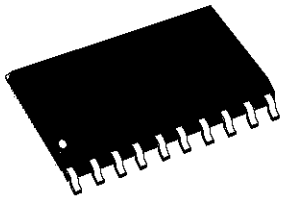
PDIP28



PDIP20



PSO28



PSO20

(Ordering Information at the end of the datasheet)

INTRODUCTION

ROM devices of the ST62X1B and ST622XB family are available in extended Automotive temperature range -40°, 125° (Suffix 3). All the functionnalities remain the same as in Consumer (Suffix 1) and Industrial (Suffix 6) temperature ranges while electrical characteristics are redefined.

No OTP device are available for this range of temperature.

THE READER IS ASKED TO REFER TO THE DATASHEET OF ST621XB AND ST622XB FOR COMPLETE FUNCTIONNAL DESCRIPTION.

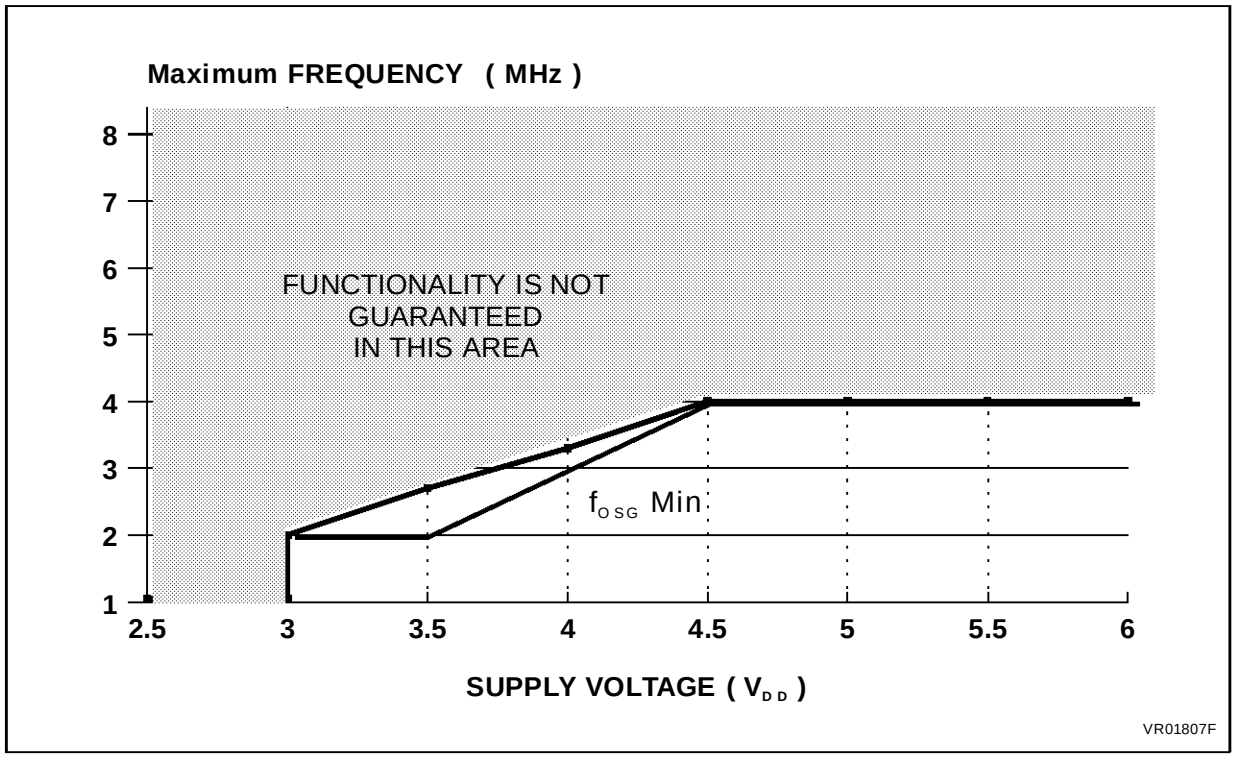
RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
T_A	Operating Temperature	3 Suffix Version	-40		125	°C
V_{DD}	Operating Supply Voltage	f_{OSC}= 2MHz f_{INT} = 2MHz	3.0		6.0	V
		f_{OSC}= 4MHz f_{INT} = 4MHz	4.5		6.0	V
f_{INT}	Internal Frequency (3)	V_{DD} = 3V; OSG disabled V_{DD}= 4.5V;OSG disabled	0 0		2.0 4.0	MHz MHz
I_{INJ+}	Pin Injection Current (positive) Digital Input (1) Analog Inputs(2)	V_{DD} = 4.5 to 5.5V			+5	mA
I_{INJ-}	Pin Injection Current (negative) Digital Input (1) Analog Inputs	V_{DD} = 4.5 to 5.5V			-5	mA

Notes :

1. A current of ± 5mA can be forced on each pin of the digital section without affecting the functional behaviour of the device. For a positive current injected into one pin, a part of this current (~ 10%) can be expected to flow from the neighbouring pins.
2. If a total current of +1 mA is flowing into the single analog channel or if the total current flowing into all the analog inputs is of 1mA, all the resulting conversions are shifted by +1 LSB. If a total positive current is flowing into the single analog channel or if the total current flowing into all the analog inputs is of 5mA, all the resulting conversions are shifted by +2 LSB.
3. An internal frequency above 1MHz is recommended for reliable A/D results.

Maximum Operating FREQUENCY (Fmax) Versus SUPPLY VOLTAGE (V_{DD})



The shade area is outside the ST6210B/15B operating range, device functionality is not guaranteed.

DC ELECTRICAL CHARACTERISTICS

(T_A = -40 to +125°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
V_{IL}	Input Low Level Voltage TIMER,NMI,RESET pins				V_{DD} x 0.3	V
V_{IH}	Input High Level Voltage TIMER,NMI,RESET pins		V_{DD} x 0.7			V
V_{Hys}	Hysteresis Voltage (4) All Inputs	V_{DD}= 5V V_{DD}= 3V		1 0.5		V
V_{OL}	Low Level Output Voltage TIMER pin	I_{OL} = + 5.0mA			0.2 x VDD	V
V_{OH}	High Level Output Voltage TIMER pin	I_{OH} = – 5.0mA	V_{DD} x 0.65			V
R_{PU}	Pull-up TIMER, NMI pins		50	100	200	kΩ
I_{IL} I_{IH}	Input Leakage Current(1) TIMER, NMI pins	V_{IN}= V_{SS} V_{IN}= V_{DD}		0.1	1.0	µA
I_{IL} I_{IH}	Input Leakage Current RESET pin	V_{IN}=V_{DD}; Watchdog Res. V_{IN}=V_{DD}; No Watch. Res. V_{IN}=V_{SS}; External Res.	 -8	 -16	1 10 -30	mA µA µA
I_{DD}	Supply Current in RESET Mode	V_{RESET}= V_{SS} f_{OSC}= 4MHz			3.5	mA
	Supply Current in RUN Mode (2)	V_{DD} = 5.0V f_{INT}=4MHz V_{DD} = 5.0V f_{INT}=f_{LFAO} V_{DD} = 3.0V f_{INT}=2MHz			3.5 TBD TBD	mA
	Supply Current in WAIT Mode (3)	V_{DD}= 5.0V f_{INT}=4MHz V_{DD} = 5.0V f_{INT}=f_{LFAO} V_{DD}= 3.0V f_{INT}=2MHz			1.50 TBD TBD	mA
	Supply Current in STOP Mode (3)	I_{LOAD}= 0mA V_{DD}= 5.0V			20	µA

Notes :

1. Only when pull-ups are not inserted
2. All peripherals running
3. A/D Converter in Stand-by
4. Hysteresis voltage between switching levels

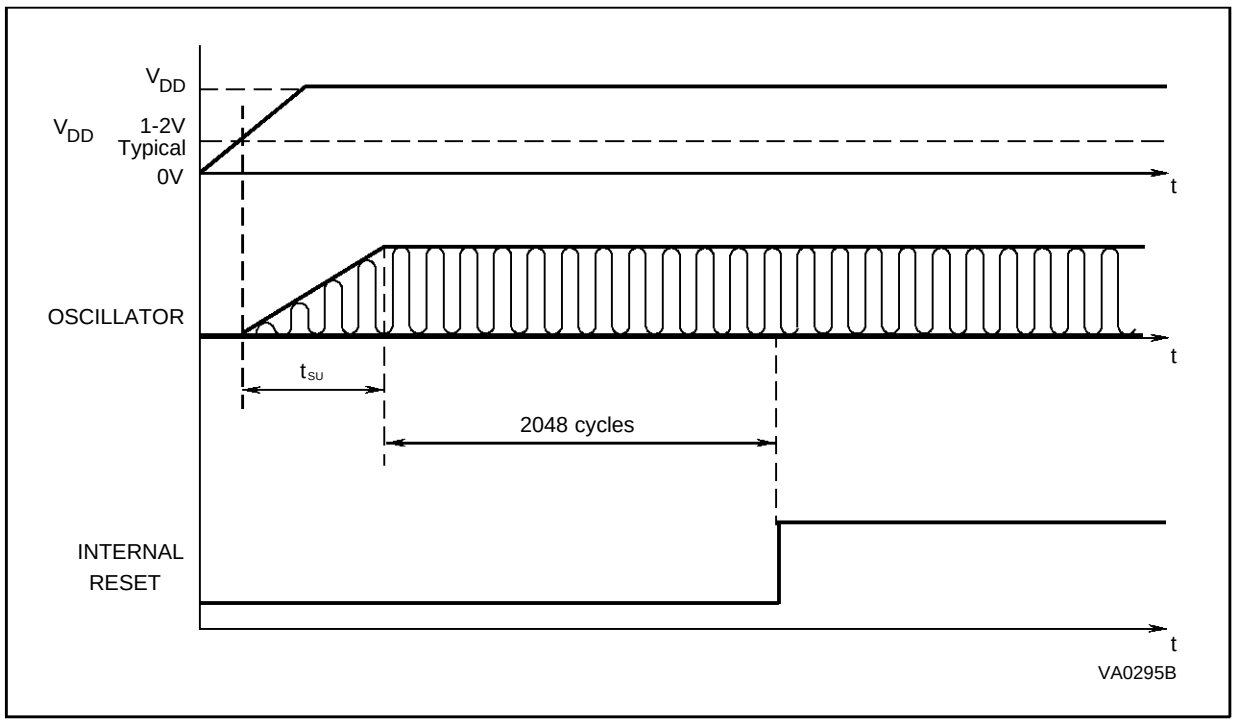
AC ELECTRICAL CHARACTERISTICS

(T_A = -40 to +125°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
f_{OSC}	Oscillator Frequency	V_{DD} = 3.0V; OSG disabled V_{DD} = 4.5V; OSG disabled			2 4	MHz
f_{OSG}	Internal frequency with OSG enabled	V_{DD} = 3.0V; F_{OSC}=2MHz V_{DD} = 4.5V; F_{OSC}=4MHz	2 4			MHz
f_{LFAO}	Low Frequency Auxiliary Oscillator		200	400	800	kHz
t_{SU}	Oscillator Start-up Time at Power On (2)	Ceramic Resonator C_{L1} = C_{L2} = 22pF		5	100	ms
t_{SUS}	Oscillator STOP mode Recovery Time (2)	4MHz Ceramic Resonator CL1=C_{L2}=22pF		0.2	100	
		4MHz Quartz CL1=C_{L2}=22pF		10	100	
t_{REC}	Supply Recovery Time (1)		100			
T_{WR}	Minimum Pulse Width (V_{DD} = 5V) RESET pin NMI pin		 100 100			ns
C_{IN}	Input Capacitance	All Inputs Pins			10	pF
C_{OUT}	Output Capacitance	All Outputs Pins			10	pF

Note:
1. Period for which V_{DD} has to be connected at 0V to allow internal Reset function at next power-up.
2. See Figure 38. This value is highly dependent on the Ceramic Resonator or Quartz Crystal used in the application.

Figure 38. Power On Reset



I/O PORT CHARACTERISTICS

(T_A= -40 to +125°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
V_{IL}	Input Low Level Voltage	I/O Pins			0.3x V_{DD}	V
V_{IH}	Input High Level Voltage	I/O Pins	0.7x V_{DD}			V
V_{OL}	Low Level Output Voltage	V_{DD}= 5.0V I_{OL}= 10µA , All I/O Pins I_{OL}= 3mA , Standard I/O I_{OL}= 7mA I_{OL}= 15mA			0.1 0.8 0.8 1.3	V
V_{OH}	High Level Output Voltage	I_{OH}= – 10µA I_{OH}= – 3mA, V_{DD}= 5.0V I_{OH}= – 1.0mA, V_{DD}= 3.0V	V_{DD}-0.1 3.5 2.0			V

TIMER CHARACTERISTICS

(T_A = -40 to +85°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
t_{RES}	Resolution		$\frac{12}{f_{INT}}$			s
f_{IN}	Input Frequency on TIMER Pin	Stop Mode Run and Wait Modes			2 $\frac{f_{INT}}{8}$	MHz MHz
t_W	Pulse Width at TIMER Pin	V_{DD} = 3.0V V_{DD} = 4.5V V_{DD} = 5.5V	1 250 250			µs ns ns

A/D CONVERTER CHARACTERISTICS

(T_A= -40 to +125°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Res	Resolution			8		Bit
A_{TOT}	Total Accuracy (1) (2)	f_{OSC} > 1.2MHz			æ2	LSB
		f_{OSC} > 32kHz	To be defined			
t_C	Conversion Time	fOSC = 4MHz		140		µs
V_{AN}	Conversion Range		V_{SS}		V_{DD}	V
ZIR	Zero Input Reading	Conversion result when $V_{IN} = V_{SS}$	00			Hex
FSR	Full Scale Reading	Conversion result when $V_{IN} = V_{DD}$			FF	Hex
AD_I	Analog Input Current During Conversion	V_{DD}= 4.5V			1.0	µA
AC_{IN}(3)	Analog Input Capacitance			2	5	pF
ASI	Analog Source Impedance	Analog Channel switched just before conversion start (4)			30	kΩ

Notes:

1. Noise at V_{DD}, V_{SS} <10mV
2. With oscillator frequencies less than 1MHz, the A/D Converter accuracy is decreased.
3. Excluding Pad Capacitance.
4. ASI can be increased as long as the load of the A/D Converter input capacitor is ensured before conversion start.

ORDERING INFORMATION TABLE

Sales Type	ROM x8	I/O	Additonal Features	Temperature Range	Package
ST6210BB3/XXX	2K Bytes	12	A/D CONVERTER	-40 to +125°C	PDIP20
ST6210BM3/XXX				-40 to +125°C	PSO20
ST6215BB3/XXX		20	A/D CONVERTER	-40 to +125°C	PDIP28
ST6215BM3/XXX				-40 to +125°C	PSO28
ST6220BB3/XXX	4K Bytes	12	A/D CONVERTER	-40 to +125°C	PDIP20
ST6220BM3/XXX				-40 to +125°C	PSO20
ST6225BB3/XXX		20	A/D CONVERTER	-40 to +125°C	PDIP28
ST6225BM3/XXX				-40 to +125°C	PSO28

Note: /XXX is a 3 alphanumeric character code added to the generic sales type on receipt of a ROM code and valid options.

ST6210B, ST6215B , ST6220B, ST6225B MICROCONTROLLER OPTION LIST

Customer . . . . . .
Address . . . . . .
. . . . . .
Contact . . . . . .
Phone No . . . . . .
Reference . . . . . .

SGS-THOMSON Microelectronics references
Device: [ ] ST6210B [ ] ST6215B [ ] ST6220B [ ] ST6225B

Package: [ ] Dual in Line Plastic [ ] Small Outline Plastic
In this case, select conditioning
[ ] Standard (Stick)
[ ] Tape & Reel

Temperature Range: [ ] 0°C to + 70°C [ ] – 40°C to + 85°C [ ] – 40°C to + 125°C
Special Marking: [ ] No
[ ] Yes "_ _ _ _ _ _ _ _ _ _ "
Authorized characters are letters, digits, '.', '–', '/' and spaces only.
Maximum character count DIP20 - DIP28: 10
SO20 - SO28:8
Oscillator Source Selection: [ ] Crystal/Resonator
[ ] RC Network
Watchdog Selection: [ ] Software Activation (STOP mode available)
[ ] Hardware Activation (no STOP mode)
OSG: [ ] Enabled
[ ] Disabled
Input pull-up selection on NMI pin : [ ] Yes [ ] No
Input pull-up selection on TIMER pin : [ ] Yes [ ] No
ROM Readout Protection: Please contact your local SGS-THOMSON Sales Office

Comment :
Supply Operating Range in the application: [ ] 3.0V to 6.0V
[ ] 4.5V to 6.0V
Notes . . . . . .
. . . . . .
Signature . . . . . .
Date . . . . . .

Notes: