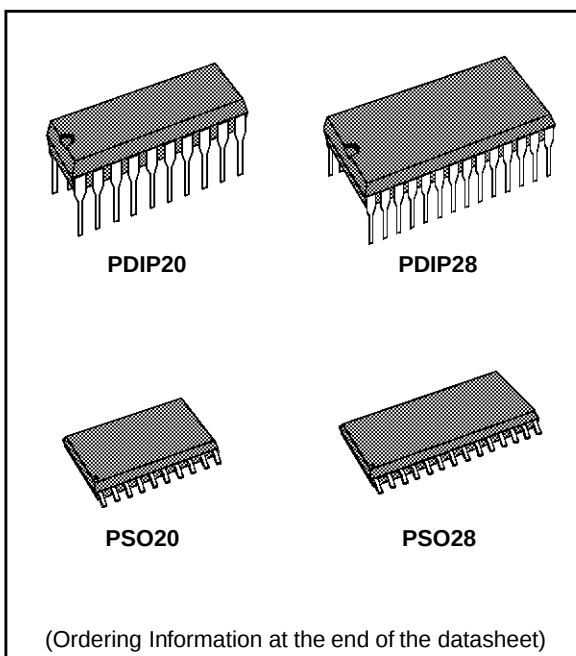


8-BIT OTP/EPROM HCMOS MCUs WITH A/D CONVERTER

- 3.0 to 6.0V Supply Operating Range
- 8 MHz Maximum Clock Frequency
- -40 to +85°C Operating Temperature Range
- Run, Wait & Stop Modes
- 5 different interrupt vectors
- Look-up table capability in EPROM
- User ROM: 1828 bytes (ST62T10, T15)
3876 bytes (ST62x20, x25)
- Data ROM: User selectable size
(in program ROM)
- Data RAM: 64 bytes
- PDIP20, PSO20 (ST62T10, T20) packages
- PDIP28, PSO28 (ST62T15, T25) packages
- FDIP20, CSO20 (ST62E20) packages
- FDIP28, CSO28 (ST62E25) 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 20mA for direct LED or TRIAC driving
- 8 bit counter with a 7-bit programmable prescaler (Timer)
- Digital Watchdog
- 8 bit A/D Converter with up to 8 (ST62T10, ST62x20) and up to 16 (ST62T15, ST62x25) analog inputs
- On-chip clock oscillator
- Power-on Reset
- One external not maskable interrupt
- 9 powerful addressing modes
- The ST62E20, E25 are the EPROM versions, the ST62T10, T15, T20, T25 are the OTP versions, fully compatible with ROM versions ST6210, 15, 20, 25.

Device Summary page 3/15



EPROM PACKAGES

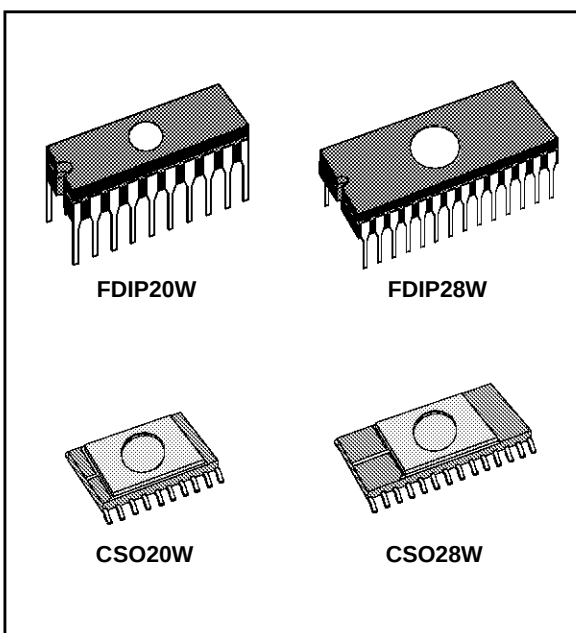


Figure 1. ST62T10,ST62x20 Pin Configuration

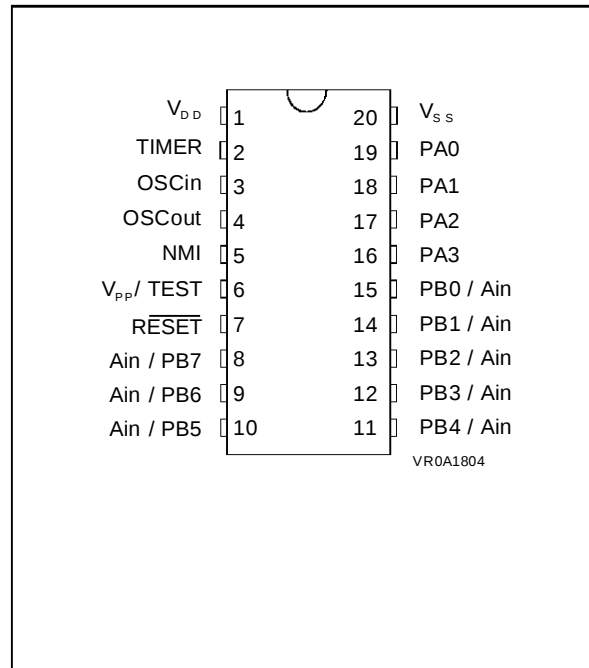


Figure 2. ST62T15,ST62x25 Pin Configuration

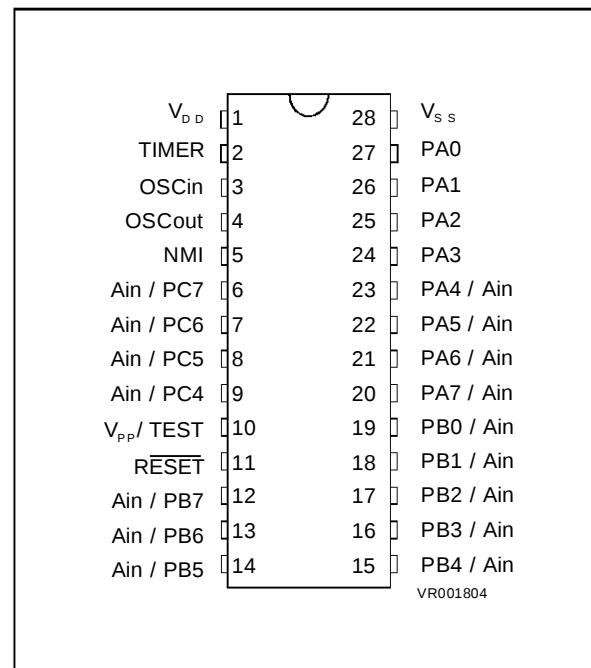
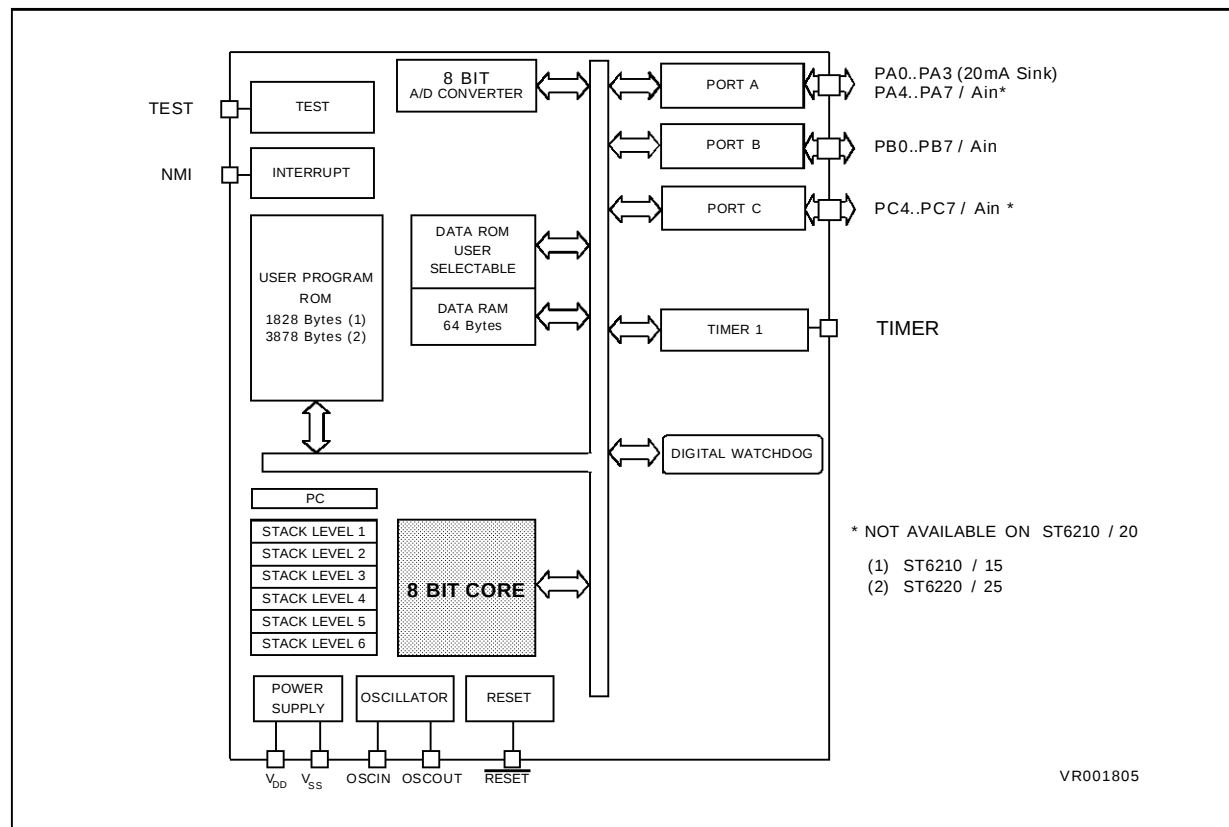


Figure 3. ST62T10,T15,x20,x25 Block Diagram



GENERAL DESCRIPTION

The ST62T10, T15, T20, T25, E20 and E25 micro-controllers are members of the 8-bit HCMOS ST62xx family, a series of devices oriented to low-medium complexity applications. They are OTP/EPROM versions of the ST6210B, ST6215B, ST6220B and ST6225B devices respectively.

All ST62xx members are based on a building block approach: a common core is associated with a combination of on-chip peripherals (macrocells). The macrocells of the ST6220, E25 and OTP ST62T10, T15, T20, T25 are: the Timer peripheral that includes an 8-bit counter with a 7-bit software programmable prescaler, the digital watchdog (DWD), an 8-bit A/D Converter with up to 8 (ST6210, 20) or 16 (ST6215, 25) analog inputs. Thanks to these peripherals, these devices are well suited for automotive, appliance and industrial applications.

ST62E20, E25 are user programmable and erasable devices. They are best suited for development.

ST62T10, T15, T20, T25 are One Time Programmable devices (OTP). These offer the best cost/flexibility trade-off for prototyping and preseries as well as most low to medium volume applications.

The EPROM ST62E20, E25 and OTP ST62T10, T15, T20, T25 are downward compatible with the ROM ST621XB/2XB. They include the same functionalities and blocks as these ROM devices with the following exceptions: no RC network, no Oscillator Safe Guard (OSG), no external STOP Mode Control, no readout protection and no option byte.

DEVICE SUMMARY

Device	UV-EPROM	OTP ROM	I/O Pins	Emulated Device
ST62T10		2k	12	ST6210
ST62T15		2k	20	ST6215
ST62T20		4k	12	ST6220
ST62T25		4k	20	ST6225
ST62E20	4k		12	ST6210 ST6220
ST62E25	4k		20	ST6215 ST6225

PIN DESCRIPTION

V_{DD} and V_{SS}. Power is supplied to the MCU using these two pins. V_{DD} is power and V_{SS} is the ground connection.

OSCIN and OSCOUT. These pins are internally connected with the on-chip oscillator circuit. A quartz crystal, a ceramic resonator or an external clock signal can be connected between these two pins in order to allow the correct operation of the MCU with various stability/cost trade-offs. The OSCIN pin is the input pin, the OSCOUT pin is the output pin.

RESET. The active low $\overline{\text{RESET}}$ pin is used to restart the microcontroller to the beginning of its program.

TEST/V_{PP}. The TEST must be held at V_{SS} for normal operation. If TEST pin is connected to a +12.5V level during the reset phase, the EPROM programming Mode is entered.

NMI. The NMI pin provides the capability for asynchronous applying an external not maskable interrupt to the MCU. The NMI is falling edge sensitive. NMI pin is not internally connected to an on-chip pull-up resistor which is available as a mask option for ROM devices. The pull-up resistor has to be provided externally.

TIMER. This is the timer I/O pin. In input mode it is connected to the prescaler and acts as external timer clock or as control gate for the internal timer clock. In the output mode the timer pin outputs the data bit when a time-out occurs. TIMER pin is not internally connected to an on-chip pull-up resistor which is available as a mask option for ROM devices. The pull-up resistor has to be provided externally.

PA0-PA3, PA4-PA7(*). These 8 lines are organized as one I/O port (A). Each line may be configured under software control as inputs with or without internal pull-up resistors, interrupt generating inputs with pull-up resistors, open-drain or push-pull outputs. PA0-PA3 can also sink 20mA for direct led driving while PA4-PA7 can be programmed as analog inputs for the A/D converter. (*) PA4-PA7 are not available on ST62T10, ST62x20.

PB0-PB7. These 8 lines are organized as one I/O port (B). Each line may be configured under software control as inputs with or without internal pull-up resistors, interrupt generating inputs with pull-up resistors, open-drain or push-pull outputs and as analog inputs for the A/D converter.

PC4-PC7(*). These 4 lines are organized as one I/O port (C). Each line may be configured under software control as inputs with or without internal pull-up resistors, interrupt generating inputs with pull-up resistors, open-drain or push-pull outputs and as analog inputs for the A/D converter.

(*) PC4-PC7 are not available on ST62T10, ST62x20.

ST62T10, T15, T20, T25, E20 and E25, OTP/EPROM DESCRIPTION

The ST62E20 EPROM device emulates the ST6210B and ST6220B ROM devices. The ST62E25 EPROM device emulates the ST6215B and ST6225B ROM devices.

Care must be taken when emulating the 2K ROM devices to start the program at the correct address (see Memory Map for 2K Devices)

EPROM parts are programmed using any programming equipment supporting it and validated by SGS-THOMSON. Once erased, the device can be reprogrammed.

The ST62T10, T15, T20, T25 OTP devices are the counterparts of the ST6210B, 15B, 20B, 25B ROM devices. OTP (One Time Programmable) parts are low cost devices which have to be programmed like EPROM devices. Unlike EPROM devices, OTPs cannot be erased once programmed.

From a user point of view, once programmed, these OTP and EPROM products have the same software and hardware features as the ROM ST621XB/2XB versions, except :

- No internal pull-up resistor available on pin NMI
- No internal pull-up resistor available on pin TIMER
- No RC network
- No Oscillator Safe Guard (OSG)
- No External STOP Mode Control
- No Readout protection

Other than these exceptions, ST62T10, T15, T20, T25 and ST62E20, E25 are fully compatible with the ST6210B, 15B, 20B, 25B equivalents, this datasheet thus provides only information specific to the EPROM based devices.

THE READER IS ASKED TO REFER TO THE DATASHEET OF THE ST6210, 15, 20, 25 ROM DEVICE FOR FURTHER DETAILS.

EPROM Programming Mode

An additional mode is used to configure the part for programming of the EPROM, this is set by a 12.5V voltage applied to the TEST/V_{PP} pin. The programming of the OTP and EPROM parts is described in the User Manual of the EPROM Programming board.

EPROM ERASING

The EPROM of the windowed package of the ST62E20, E25 may be erased by exposure to Ultra Violet light.

The erasure characteristic of the ST62E20, E25 is such that erasure begins when the memory is exposed to light with a wave lengths shorter than approximately 4000Å. It should be noted that sunlights and some types of fluorescent lamps have wavelengths in the range 3000-4000Å. It is thus recommended that the window of the ST62E20, E25 packages be covered by an opaque label to prevent unintentional erasure problems when testing the application in such an environment.

The recommended erasure procedure of the ST62E20, E25 EPROM is the exposure to short wave ultraviolet light which have a wave-length 2537Å. The integrated dose (i.e. U.V. intensity x exposure time) for erasure should be a minimum of 15W-sec/cm². The erasure time with this dosage is approximately 15 to 20 minutes using an ultra-violet lamp with 12000µW/cm² power rating. The ST62E20, E25 should be placed within 2.5cm (1Inch) of the lamp tubes during erasure.

Table 1. OTP Memory Map

ST62T10, ST62T15 (2K ROM Devices)

Device Address	Description
0000h-087Fh	Reserved ⁽¹⁾
0880h-0F9Fh	User ROM
0FA0h-0FEFh	Reserved ⁽¹⁾
0FF0h-0FF7h	Interrupt Vectors
0FF8h-0FFBh	Reserved ⁽¹⁾
0FFCh-0FFDh	NMI Interrupt Vector
0FFEh-0FFFh	Reset Vector

Notes :

1. Reserved Areas should be filled with FFh

ST62T20, ST62T25 (4K ROM Devices)

Device Address	Description
0000h-007Fh	Reserved ⁽¹⁾
0080h-0F9Fh	User ROM
0FA0h-0FEFh	Reserved ⁽¹⁾
0FF0h-0FF7h	Interrupt Vectors
0FF8h-0FFBh	Reserved ⁽¹⁾
0FFCh-0FFDh	NMI Interrupt Vector
0FFEh-0FFFh	Reset Vector

Notes :

1. Reserved Areas should be filled with FFh

ELECTRICAL CHARACTERISTICS**Absolute Maximum Ratings**

This product contains devices to protect the inputs against damage due to high static voltages, however it is advised to take normal precaution to avoid application of any voltage higher than maximum rated voltages.

For proper operation it is recommended that V_I and V_O must be higher than V_{SS} and smaller V_{DD} . Reliability is enhanced if unused inputs are connected to an appropriated logic voltage level (V_{DD} or V_{SS}).

Power Considerations. The average chip-junction temperature, T_J , in Celsius can be obtained from :

$$T_J = T_A + PD \times R_{thJA}$$

Where: T_A = Ambient Temperature.

R_{thJA} = Package thermal resistance (junction-to ambient).

PD = $P_{int} + P_{port}$.

P_{int} = $I_{DD} \times V_{DD}$ (chip internal power).

P_{port} = Port power dissipation (determined by the user).

Symbol	Parameter	Value	Unit
V_{DD}	Supply Voltage	-0.3 to 7.0	V
V_I	Input Voltage	$V_{SS} - 0.3$ to $V_{DD} + 0.3$	V
V_O	Output Voltage	$V_{SS} - 0.3$ to $V_{DD} + 0.3$	V
V_{PP}	OTP/EPROM Programming Voltage	13	V
I_O	Current Drain per Pin Excluding V_{DD} & V_{SS}	± 10	mA
I_{VDD}	Total Current into V_{DD} (source)	50	mA
I_{VSS}	Total Current out of V_{SS} (sink)	50	mA
T_J	Junction Temperature	150	°C
T_{STG}	Storage Temperature	-60 to 150	°C

Note : Stresses 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	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
T_A	Operating Temperature	1 Suffix Version 6 Suffix Version	0 -40		70 85	°C
V_{DD}	Operating Supply Voltage		3.0		6.0	V
V_{PP}	Programming Voltage		12	12.5	13	V
F_{OSC}	Oscillator Frequency	$4.5 < V_{DD} < 6.0V$ $V_{DD} = 3.5V$ $V_{DD} = 3.0V$	0.01 0.01 0.01		8.0 4.0 2.0	MHz
AV_{DD} AV_{SS}	Analog Supply Voltage ⁽¹⁾	$V_{SS} \leq AV_{SS} < AV_{DD} \leq V_{DD}$	V_{SS}		V_{DD}	V
I_{INJ+}	Pin Injection Current (positive) Digital Input Analog Inputs ⁽²⁾	$V_{DD} = 4.5$ to $5.5V$			+5	mA
I_{INJ-}	Pin Injection Current (negative) Digital Input Analog Inputs ⁽³⁾	$V_{DD} = 4.5$ to $5.5V$			-5	mA

Notes :

1. An oscillator frequency above 1MHz is recommended for reliable A/D results.

2. A current of $\pm 5mA$ 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 ($\sim 10\%$) can be expected to flow from the neighbouring pins.

3. 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.

DC ELECTRICAL CHARACTERISTICS(T_A = -25 to +85°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
V _{IL}	Input Low Level Voltage	RESET Pin V _{DD} =5V V _{DD} =3V			1.6 1	V
V _{IH}	Input High Level Voltage	RESET Pin V _{DD} =5V V _{DD} =3V	3.4 2			V
I _{IL} I _{IH}	Input Leakage Current	RESET Pin V _{IN} =V _{DD} ⁽¹⁾ V _{IN} =V _{DD} ⁽²⁾ V _{IN} =V _{SS}	-8	-16	10 1 -30	μA mA μA
V _{IL}	Input Low Level Voltage	NMI, TIMER V _{DD} =5V V _{DD} =3V			0.3xV _{DD}	V
V _{IH}	Input High Level Voltage	NMI, TIMER V _{DD} =5V V _{DD} =3V	0.7xV _{DD}			V
V _{OL}	Low Level Output Voltage	TIMER, I _{OL} =5.0mA V _{DD} =5V			0.2xV _{DD}	V
V _{OH}	High Level Output Voltage	TIMER, I _{OL} =-5.0mA V _{DD} =5V	0.65V _{DD}			V
I _{IL} I _{IH}	Input Leakage Current	TIMER V _{IN} =V _{DD} or V _{SS} V _{IN} =5.0V V _{IN} =3.9V		0.1 0.1	1.0 1.0	μA
I _{DD}	Supply Current in RESET Mode	V _{RESET} =V _{SS} f _{OSC} =8MHz			3.5	mA
	Supply Current in RUN Mode	f _{OSC} =8MHz I _{LOAD} =0mA V _{DD} =5.0V			3.5	mA
	Supply Current in WAIT Mode	f _{OSC} =8MHz ⁽⁴⁾ I _{LOAD} =0mA V _{DD} =5.0V			1.5	mA
	Supply Current in STOP Mode ⁽³⁾	I _{LOAD} =0mA V _{DD} =5.0V			10	μA

Notes :

1. No Watchdog Reset Activated.
2. Reset generated by Watchdog.
3. When the Watchdog function is activated the STOP instruction is deactivated. WAIT instruction is automatically executed.
4. Timer and A/D in OFF state.

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

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
f _{OSC}	Oscillator Frequency	V _{DD} = 3.0V V _{DD} = 4.5V V _{DD} = 5.5V	0.01 0.01 0.01		2 8 8	MHz
t _{ILH}	Interrupt Pin Maximum Pulse Width	V _{DD} = 3.0V V _{DD} = 4.5V V _{DD} = 5.5V			no limit	μs
t _{SU}	Oscillator Start-up Time			5	10	ms
t _{SR}	Supply Rise Time		0.01		100	ms
t _{REC}	Supply Recovery Time		100			ms
T _{WNMI}	Minimum Pulse Width	NMI Pin V _{DD} =5V	100			ns
T _{WRES}	Minimum Pulse Width	RESET Pin	100			ns
C _{IN}	Input Capacitance	All Inputs Pins			10	pF
C _{OUT}	Output Capacitance	All outputs Pins			10	pF

I/O PORTS CHARACTERISTICS(T_A = - 40 to + 85 °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} = 5mA , Standard I/O I _{OL} = 10mA , PA0-PA3 I _{OL} = 20mA , PA0-PA3			0.1 0.8 0.8 1.3	V
V _{OH}	High Level Output Voltage	I _{OH} = -10μA I _{OH} = -5mA, V _{DD} = 5.0V I _{OH} = -1.5mA, V _{DD} = 3.0V	V _{DD} -0.1 3.5 2.0			V
I _{IL} I _{IH}	Input Leakage Current	V _{in} = V _{DD} or V _{SS} V _{DD} = 3.0V V _{DD} = 5.5V		0.1 0.1	1.0 1.0	μA
R _{PU}	Pull-up Resistor	V _{in} = 0V	50	100	200	KΩ

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

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
t _{RES}	Resolution		$\frac{12}{f_{osc}}$			second
f _{IN}	Input Frequency on TIMER Pin	V _{DD} = 3.0V V _{DD} = 4.5V			$\frac{f_{osc}}{4}$	MHz
t _w	Pulse Width at TIMER Pin	V _{DD} = 3.0V V _{DD} = 4.5V V _{DD} = 5.5V	1 125 125			μs ns ns

A/D CONVERTER CHARACTERISTICS(T_A = -40 to +85 °C unless otherwise specified)

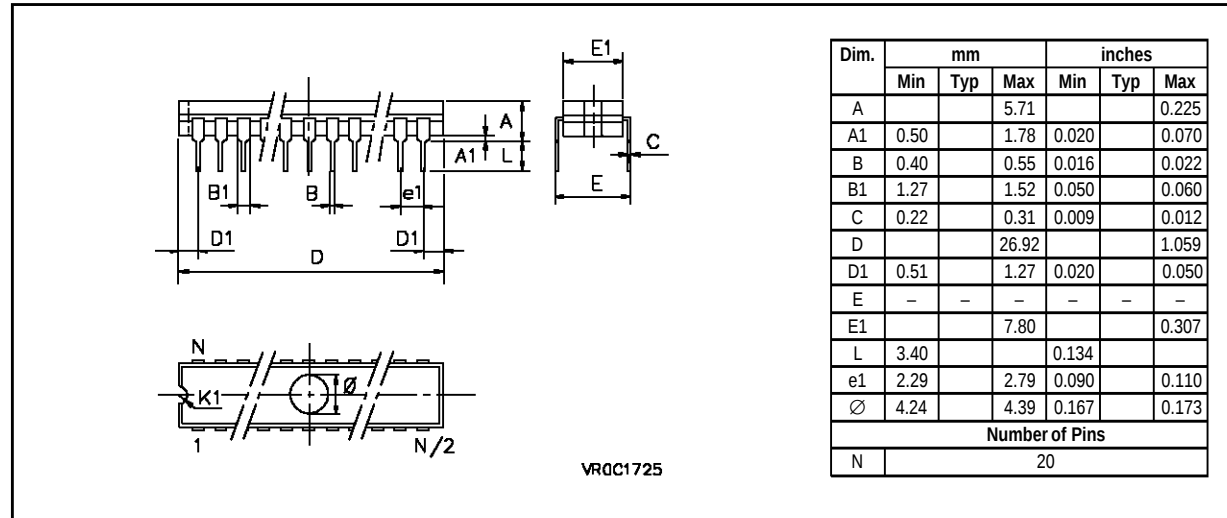
Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Res	Resolution			8		Bit
A _{TOT}	Total Accuracy	f _{OSC} > 1.2MHz f _{OSC} > 32kHz			±2 ±4	LSB
t _C ⁽¹⁾	Conversion Time	f _{OSC} = 8MHz		70		μs
V _{AN}	Conversion Range		AV _{SS}		AV _{DD}	V
ZIR	Zero Input Reading	Conversion result when V _{in} = AV _{SS}	00			Hex
FSR	Full Scale Reading	Conversion result when V _{in} = AV _{DD}			FF	Hex
AV _{SS} ⁽²⁾ AV _{DD}	Analog Reference		V _{SS}		V _{DD}	V
AD _I	Analog Input Current During Conversion	V _{DD} = 4.5V			1.0	μA
AC _{IN} ⁽³⁾	Analog Input Capacitance				2	pF
ASI	Analog Source Impedance				30	KΩ
SSI	Analog Reference Supply Impedance				2	KΩ

Notes:

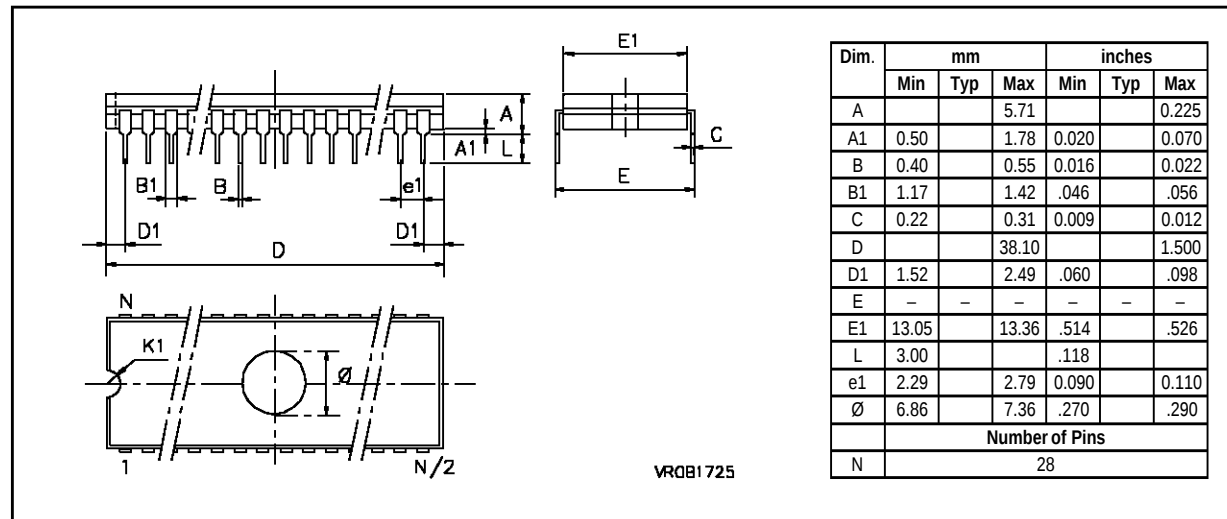
1. With oscillator frequencies less than 1MHz, the A/D Converter accuracy is decreased. It is recommended not to use the A/D with f_{OSC} < 1MHz.
2. In ST6210, ST6215, ST6220 and ST6225 AV_{SS} and AV_{DD} are internally connected to digital V_{SS} and V_{DD}.
3. Excluding Pad Capacitance.

PACKAGE MECHANICAL DATA

20-Lead Frit Seal Ceramic Dual in Line Package, 300-Mil Width

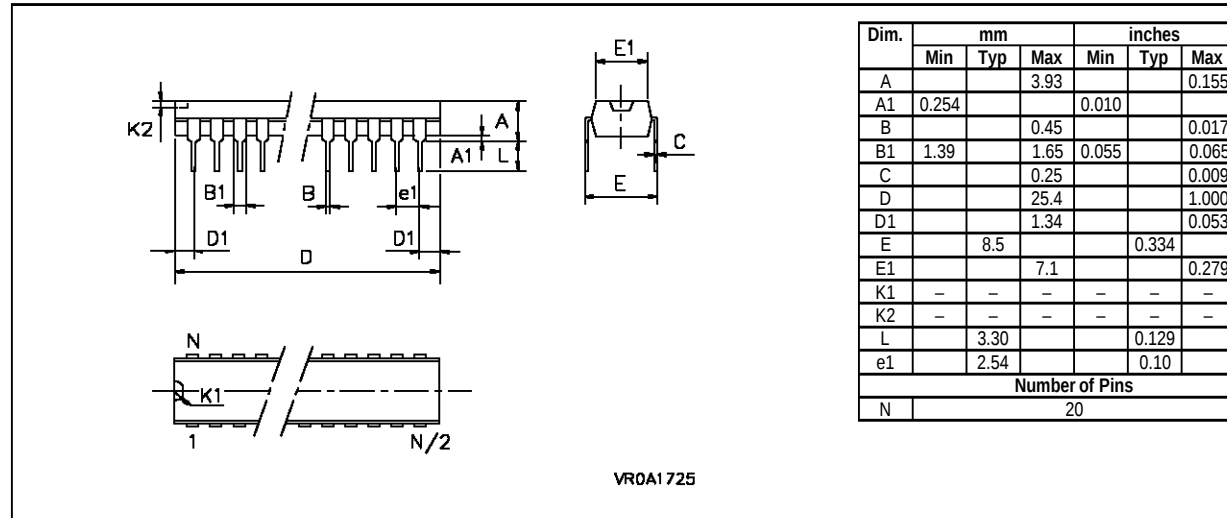


28-Lead Frit Seal Ceramic Dual in Line Package, 600-Mil Width

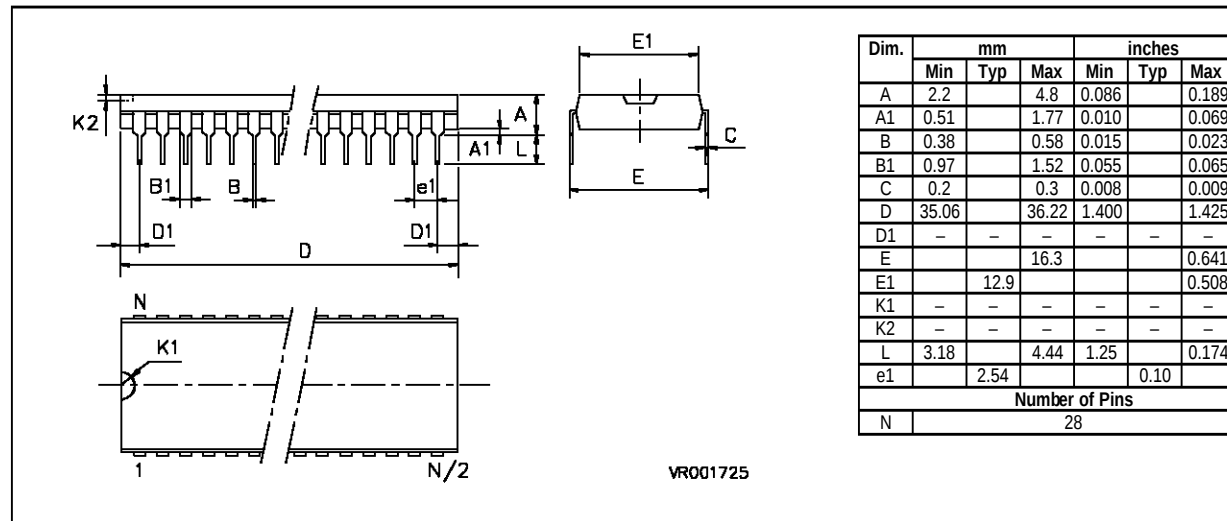


PACKAGE MECHANICAL DATA (Continued)

20-Pin Dual in Line Plastic, 300-Mil Width

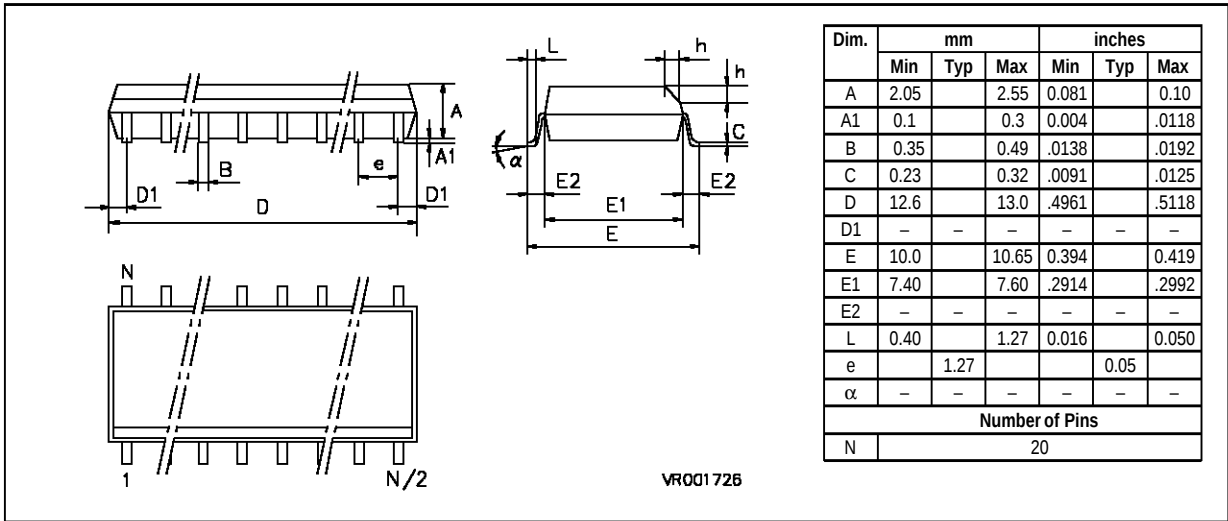


28-Pin Dual in Line Plastic, 600-Mil Width

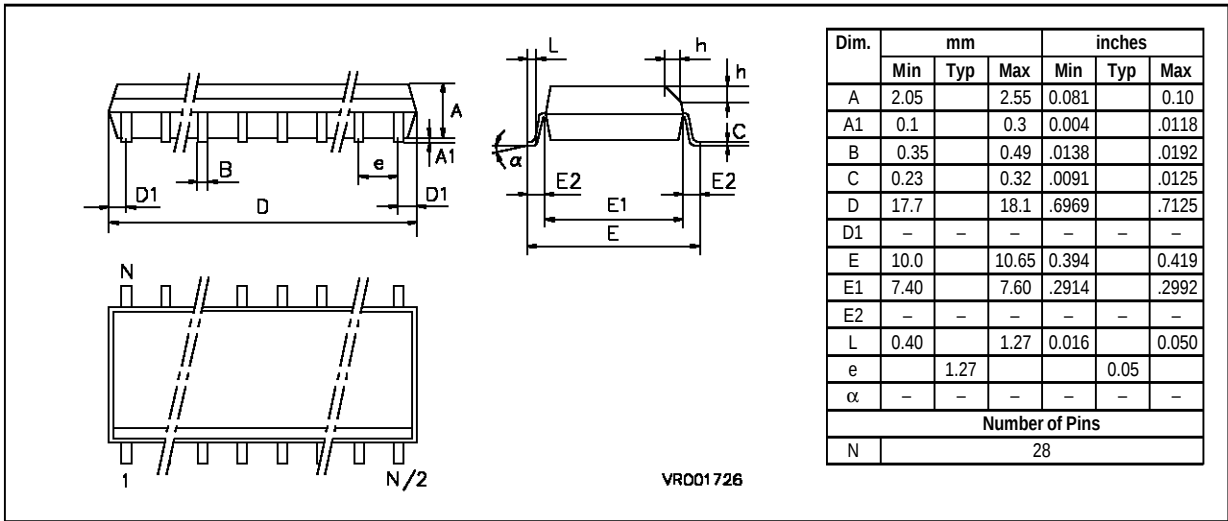


PACKAGES MECHANICAL DATA (Continued)

20-Lead Small Outline Plastic, 300-Mil Width

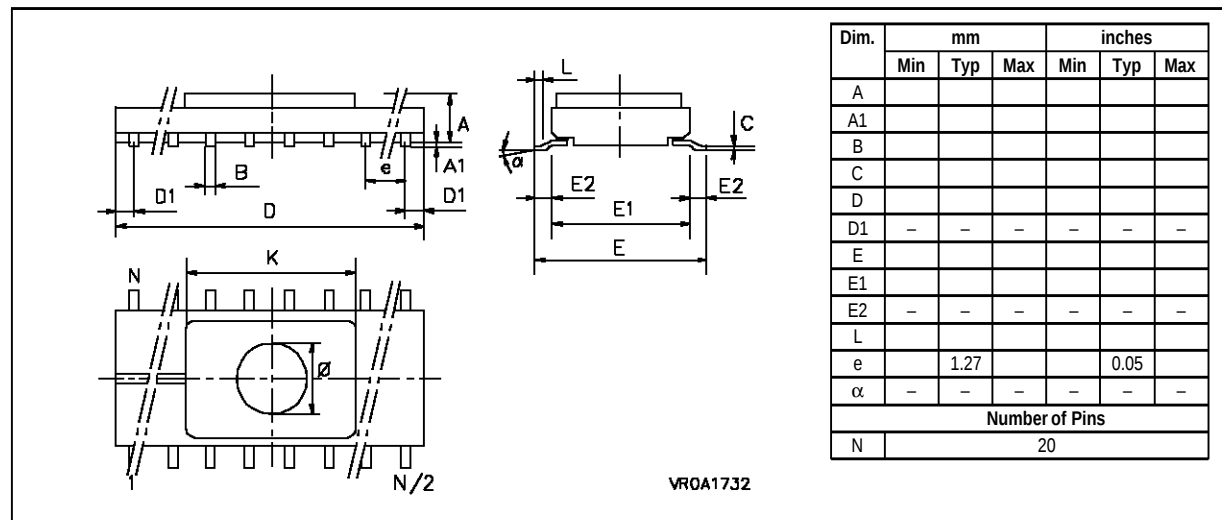


28-Lead Small Outline Plastic, 300-Mil Width

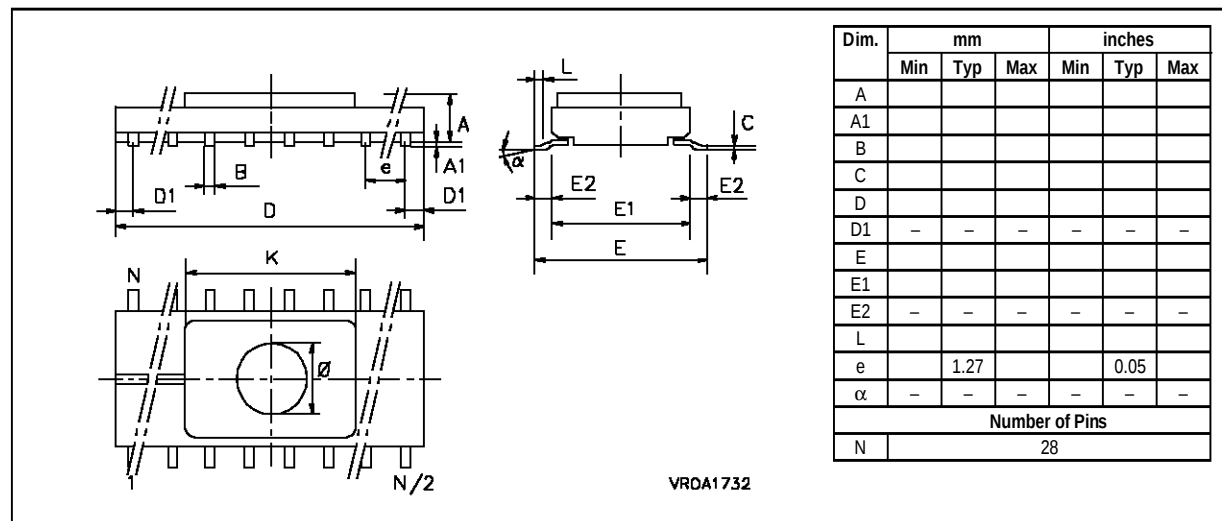


PACKAGES MECHANICAL DATA (Continued)

20-Lead Small Outline Ceramic, 300-Mil Width



28-Lead Small Outline Ceramic, 300-Mil Width



ORDERING INFORMATION TABLE

Sales Type	OTP/ EPROM	I/O	Additional Features	Temperature Range	Package
ST62T10B6/HWD ST62T10B6/SWD	OTP 2K Bytes	12	Hardware WatchDog Software WatchDog	-40 to +85°C	PDIP20
ST62T10M6/HWD ST62T10M6/SWD			Hardware WatchDog Software WatchDog		PSO20
ST62T15B6/HWD ST62T15B6/SWD		20	Hardware WatchDog Software WatchDog	-40 to +85°C	PDIP28
ST62T15M6/HWD ST62T15M6/SWD			Hardware WatchDog Software WatchDog		PSO28
ST62T20B6/HWD ST62T20B6/SWD	OTP 4K Bytes	12	Hardware WatchDog Software WatchDog	-40 to +85°C	PDIP20
ST62T20M6/HWD ST62T20M6/SWD			Hardware WatchDog Software WatchDog		PSO20
ST62T25B6/HWD ST62T25B6/SWD		20	Hardware WatchDog Software WatchDog	-40 to +85°C	PDIP28
ST62T25M6/HWD ST62T25M6/SWD			Hardware WatchDog Software WatchDog		PSO28
ST62E20F1/HWD ST62E20F1/SWD	EPROM 4K Bytes	12	Hardware WatchDog Software WatchDog	0 to +70°C	FDIP20
ST62E20S1/HWD ST62E20S1/SWD			Hardware WatchDog Software WatchDog		CSO20
ST62E25F1/HWD ST62E25F1/SWD		20	Hardware WatchDog Software WatchDog	0 to +70°C	FDIP28
ST62E25S1/HWD ST62E25S1/SWD			Hardware WatchDog Software WatchDog		CSO28

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