

BL22P64 SPECIFICATION

8-bit OTP MCU

V1.3



Shanghai Belling Co., Ltd.



1. PRODUCT OVERVIEW

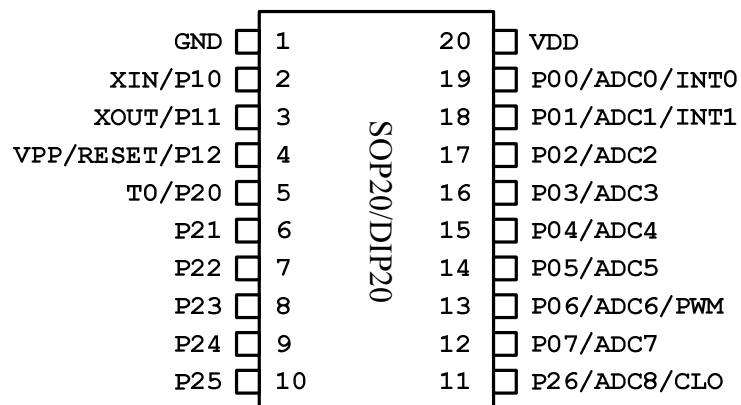
BL22P64 can be used for dedicated control functions in a variety of applications, such as induction cooker, microwave oven, soybean milk maker and so on.

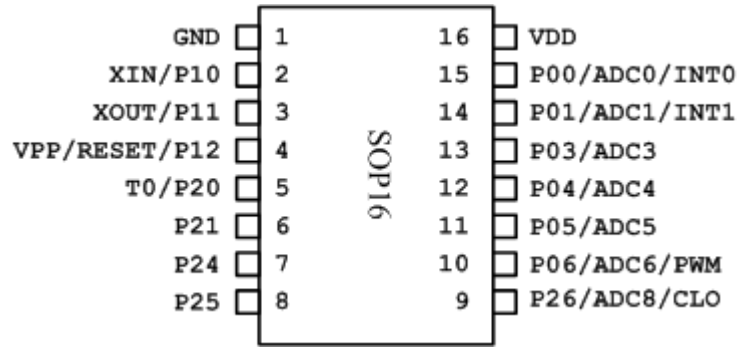
A dual address/data bus architecture and bit-configurable I/O ports provide a flexible programming environment for applications with varied memory and I/O requirements. Timer/counter, A/D converter and PWM are designed for measure and control.

2. FEATURES

- 8-bit CISC core (compatible with Motorola HC05)
- 4K byte OTP ROM
- 208 byte RAM
- Three configurable I/O ports (18 pins)
- One 8-bit PWM output
- One 8-bit timer/counter with time interval mode
- A/D converter with nine input channels and 10-bit resolution
- Four interrupt sources (two external interrupt, timer interval interrupt, PWM interrupt)
- WATCH DOG
- 3V LVR
- Four configurable clock circuit:
 - Crystal/Ceramic oscillator (400K-4MHz)
 - External RC oscillator
 - 3.2MHz(VDD=5V) internal RC oscillator
 - 0.5MHz(VDD=5V) internal RC oscillator
- Operating Voltage: 2.7-5.5V
- Operating temperature: -40-85°C
- Package Types: SOP20/DIP20/SOP16
- 4KV EMC

3. PIN ASSIGNMENTS



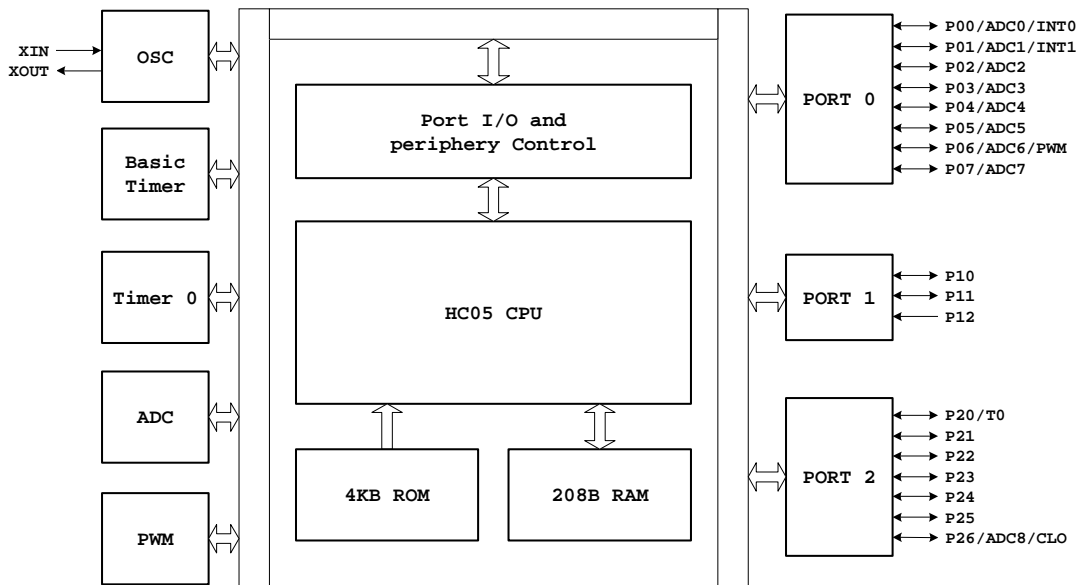


4. PIN DESCRIPTIONS

Pin name	In/Out	Pin Description	Share Description
GND	-	ground	-
P10	I/O	Bit-programmable I/O port for Schmitt trigger input or push-pull, open-drain output. Pull-up resistors or pull-down resistors are assignable by software.	XIN
P11	I/O		XOUT
P12	IN	Schmitt trigger input port	RESET/VPP
P20	I/O	Bit-programmable I/O port for Schmitt trigger input or push-pull, open-drain output. Pull-up resistors are assignable by software.	T0
P21	I/O		-
P22	I/O		-
P23	I/O		-
P24	I/O		-
P25	I/O		-
P26	I/O		ADC8/CLO
P00	I/O	Bit-programmable I/O port for Schmitt trigger input or push-pull output. Pull-up resistors are assignable by software.	ADC0/INT0
P01	I/O		ADC1/INT1
P02	I/O		ADC2
P03	I/O		ADC3
P04	I/O		ADC4
P05	I/O		ADC5
P06	I/O		ADC6/PWM
P07	I/O	ADC7	
VDD	-	Voltage input	-

5. FUNCTION DESCRIPTIONS

5.1 BLOCK DIAGRAM



Block Diagram

5.2 ADDRESS SPACES

\$0000-\$002F: Control registers

\$0030-\$00FF: RAM (208 bytes)

\$0100-\$0FFF: Reserved

\$1000-\$1FFF: OTP ROM (4096 bytes)

5.3 CONTROL REGISTERS

Control Registers

Register name	Address	R/W	Reset Value
TOCNT	\$00	R	0000 0000
TODATA	\$01	R/W	1111 1111
TOCON	\$02	R/W	00-- 0-00
MCR	\$03	R/W	---- ---R
BTCN	\$0C	R/W	0000 1000
BTCNT	\$0D	R	0000 0000
P0	\$10	R/W	0000 0000
P1	\$11	R/W	---- -000
P2	\$12	R/W	-000 0000
P0CONH	\$16	R/W	0000 0000
P0CONL	\$17	R/W	0000 0000
P0PND	\$18	R/W	---- 0000
P1CON	\$19	R/W	00-- 0000
P2CONH	\$1A	R/W	-000 0000
P2CONL	\$1B	R/W	0000 0000
PWMDATA	\$22	R/W	0000 0000
PWMCON	\$23	R/W	00-0 0000
ADCON	\$27	R/W	0000 1000



ADDATAH	\$28	R	XXXX XXXX
ADDATAL	\$29	R	---- --XX

NOTE:

● - : Not used; X: Undefined; R: Determined by OPBIT[2]

5.3.1 T0CNT (TIMER 0 Counter Register)

T0CNT is a 8-bit counter register of Timer 0. T0CNT is read only.

5.3.2 T0DATA (TIMER 0 Data Register)

T0DATA is a 8-bit Data Register to set match data of Timer 0. When the counter value is identical to the value written to T0DATA, generates a Timer 0 match interrupt.

5.3.3 T0CON (TIMER 0 Control Register)

Timer 0 Control Register, is used to select the Timer 0 operating mode.

.7-.6 T0PS[1:0] Timer 0 input clock selection

00: Fsys/4096

01: Fsys/256

10: Fsys/8

11: Fsys

(NOTE: Fsys is system frequency which is half of oscillator's)

.5-.4 Not used

.3 T0CLR Timer 0 counter clear bit. Value is "0" when read.

0: No effect

1: Clear the Timer 0 counter (when write) 0

.2 Not used

.1 T0E Timer 0 interrupt enable bit

0: Disable T0 interrupt

1: Enable T0 interrupt

.0 T0F Timer 0 interrupt pending bit

0: No T0 interrupt pending (when read)

0: Clear T0 pending bit (when write)

1: Interrupt is pending (when read)

1: No effect (when write)

5.3.4 MCR (Miscellaneous Control Register)

MCR is used to control LVR. The reset value is determined by OPBIT[2].

.7-.1 Not used

.0 LVRE LVR enable bit

0: LVR disable

1: LVR enable

5.3.5 BTCON (Basic Timer Control Register)

BTCON, is used to select the input clock frequency, to clear the basic timer counter and frequency dividers, and to control the watchdog timer.

.7-.4 WDTE[3:0] Watchdog timer enable bits



- 1010: Disable watchdog function
- Other value: Enable watchdog function
- (NOTE: Watchdog function is enable when reset.)
- .3-.2 BTPS[1:0] Basic timer input clock selection bits
 - 00: Fsys/4096
 - 01: Fsys/1024
 - 10: Fsys/256
 - 11: Fsys/128
- .1 BTCLR Basic timer counter clear bits. Value is "0" when read.
 - 0: No effect
 - 1: Clear basic timer counter
- .0 DVCLR Divider clear bit for basic timer and timer 0. Value is "0" when read.
 - 0: No effect
 - 1: Clear both dividers

5.3.6 BTCNT (Basic Timer Counter)

BTCNT is a 8-bit basic timer counter, and read only. BTCNT can be cleared by writing a "1" to BTCLR (BTCON.1).

5.3.7 P0 (PORT 0 Data Register)

P0 is data register for Port 0.

5.3.8 P1 (PORT 1 Data Register)

P1 is data register for Port 1.

5.3.9 P2 (PORT 2 Data Register)

P2 is data register for Port 2.

5.3.10 P0CONH (Port 0 Control Register (High Byte))

- .7-.6 P07C[1:0] P07 Configuration Bits
 - 00: Schmitt trigger input; pull-up enable
 - 01: Schmitt trigger input
 - 10: Push-pull output
 - 11: A/D converter input (ADC7)
- .5-.4 P06C[1:0] P06 Configuration Bits
 - 00: Schmitt trigger input; pull-up enable
 - 01: PWM output
 - 10: Push-pull output
 - 11: A/D converter input (ADC6)
- .3-.2 P05C[1:0] P05 Configuration Bits
 - 00: Schmitt trigger input; pull-up enable
 - 01: Schmitt trigger input
 - 10: Push-pull output
 - 11: A/D converter input (ADC5)
- .1-.0 P04C[1:0] P04 Configuration Bits



- 00: Schmitt trigger input; pull-up enable
- 01: Schmitt trigger input
- 10: Push-pull output
- 11: A/D converter input (ADC4)

5.3.11 P0CONL (Port 0 Control Register (Low Byte))

- .7-.6 P03C[1:0] P03 Configuration Bits
 - 00: Schmitt trigger input
 - 01: Schmitt trigger input; pull-up enable
 - 10: Push-pull output
 - 11: A/D converter input (ADC3)
- .5-.4 P02C[1:0] P02 Configuration Bits
 - 00: Schmitt trigger input
 - 01: Schmitt trigger input; pull-up enable
 - 10: Push-pull output
 - 11: A/D converter input (ADC2)
- .3-.2 P01C[1:0] P01 Configuration Bits
 - 00: Schmitt trigger input / INT1 input
 - 01: Schmitt trigger input; pull-up enable / INT1 input
 - 10: Push-pull output
 - 11: A/D converter input (ADC1)
- .1-.0 P00C[1:0] P00 Configuration Bits
 - 00: Schmitt trigger input / INT0 input
 - 01: Schmitt trigger input; pull-up enable / INT0 input
 - 10: Push-pull output
 - 11: A/D converter input (ADC0)

5.3.12 P0PND (Port 0 Interrupt Pending Register)

- .7-.4 Not used
- .3 INT1E INT1 Interrupt Enable Bit
 - 0: INT1 disable
 - 1: INT1 enable
- .2 INT1F INT1 Pending Bit
 - 0: No interrupt pending (when read)
 - 0: Pending bit clear (when write)
 - 1: Interrupt is pending (when read)
 - 1: No effect (when write)
- .1 INT0E INT0 Interrupt Enable Bit
 - 0: INT0 disable
 - 1: INT0 enable
- .0 INT0F INT0 Pending Bit
 - 0: No interrupt pending (when read)
 - 0: Pending bit clear (when write)
 - 1: Interrupt is pending (when read)
 - 1: No effect (when write)



5.3.13 P1CON (Port 1 Control Register)

- .7 P11OD P11 Open-drain Enable Bit
 - 0: P11 as a push-pull output
 - 1: P11 as a n-channel open-drain output
- .6 P10OD P10 Open-drain Enable Bit
 - 0: P11 as a push-pull output
 - 1: P11 as a n-channel open-drain output
- .5-.4 Not used
- .3-.2 P11C[1:0] P11 Configuration Bits
 - 00: Schmitt trigger input
 - 01: Schmitt trigger input; pull-up enable
 - 10: Push-pull output
 - 11: Schmitt trigger input; pull-down enable
- .1-.0 P10C[1:0] P10 Configuration Bit
 - 00: Schmitt trigger input
 - 01: Schmitt trigger input; pull-up enable
 - 10: Push-pull output
 - 11: Schmitt trigger input; pull-down enable

(NOTE: When system clock comes from crystal/ceramic oscillator or external RC oscillator, P10 and P11 must be set as input and pull-up disable)

5.3.14 P2CONH (Port 2 Control Register (High Byte))

- .7 Not used
- .6-.4 P26C[2:0] P26 Configuration Bits
 - 000: Schmitt trigger input; pull-up enable
 - 001: Schmitt trigger input
 - 01x: A/D converter input (ADC8)
 - 100: Open-drain output
 - 101: Open-drain output; pull-up enable
 - 110: Open-drain output
 - 111: CLO output
- .3-.2 P25C[1:0] P25 Configuration Bits
 - 00: Schmitt trigger input; pull-up enable
 - 01: Schmitt trigger input
 - 10: Push-pull output
 - 11: Open-drain output
- .1-.0 P24C[1:0] P24 Configuration Bits
 - 00: Schmitt trigger input; pull-up enable
 - 01: Schmitt trigger input
 - 10: Push-pull output
 - 11: Open-drain output

5.3.15 P2CONL (Port 2 Control Register (Low Byte))

- .7-.6 P23C[2:0] P23 Configuration Bits



- 00: Schmitt trigger input; pull-up enable
- 01: Schmitt trigger input
- 10: Push-pull output
- 11: Open-drain output
- .5-.4 P22C[2:0] P22 Configuration Bits
 - 00: Schmitt trigger input; pull-up enable
 - 01: Schmitt trigger input
 - 10: Push-pull output
 - 11: Open-drain output
- .3-.2 P21C[1:0] P21 Configuration Bits
 - 00: Schmitt trigger input; pull-up enable
 - 01: Schmitt trigger input
 - 10: Push-pull output
 - 11: Open-drain output
- .1-.0 P20C[1:0] P20 Configuration Bits
 - 00: Schmitt trigger input; pull-up enable
 - 01: Schmitt trigger input
 - 10: Push-pull output
 - 11: T0 match output

5.3.16 PWMDATA (PWM Data Register)

PWMDATA determines the duty of output clock generated by 8-bit PWM circuit.

5.3.17 PWMCON (PWM Control Register)

- .7-.6 PWMPS[1:0] PWM Input Clock Selection Bits
 - 00: Fsys/64
 - 01: Fsys/8
 - 10: Fsys/2
 - 11: Fsys
- .5 Not used
- .4 PWMDRS PWMDATA Reload Interval Selection Bit
 - 0: Reload from 8-bit up counter overflow
 - 1: Reload from 6-bit up counter overflow
- .3 PWMCLR PWM Counter Clear Bit. Value is "0" when read.
 - 0: No effect
 - 1: Clear the PWM counter (when write)
- .2 PWMCE PWM Counter Enable Bit
 - 0: Stop counter
 - 1: Start (Resume countering)
- .1 PWMIE PWM Overflow Interrupt Enable Bit (8-Bit Overflow)
 - 0: Disable interrupt
 - 1: Enable interrupt
- .0 PWMIF PWM Overflow Interrupt Pending Bit
 - 0: No interrupt pending (when read)
 - 0: Clear pending bit (when write)



- 1: Interrupt is pending (when read)
- 1: No effect (when write)

5.3.18 ADCON (A/D Control Register)

.7-.4 ADCH[3:0] A/D Input Pin Selection Bits

- 0000: ADC0
- 0001: ADC1
- 0010: ADC2
- 0011: ADC3
- 0100: ADC4
- 0101: ADC5
- 0110: ADC6
- 0111: ADC7
- 1000: ADC8
- 1001: GND (for test)
- 1010: GND (for test)
- 1011: GND (for test)
- 1100: GND (for test)
- 1101: VDD (for test)
- 1110: VDD/4 (for test)
- 1111: VDD/2 (for test)

.3 EOC A/D End-of-Conversion Status Bit, read only

- 0: A/D conversion is in progress
- 1: A/D conversion complete

.2-.1 ADPS[1:0] Clock Source Selection Bit

- 00: Fsys/8
- 01: Fsys/4
- 10: Fsys/2
- 11: Fsys

.0 ADCE Conversion Start Bit. Value is "0" when read.

- 0: No meaning
- 1: A/D conversion start

5.3.19 ADDATAH (A/D Data Register(High 8-bit))

5.3.20 ADDATAL (A/D Data Register(Low 2-bit))

ADDATAH and ADDATAL are used to storage conversion data of A/D.

5.4 OPBIT

OPBIT is a special byte in OTP ROM and used to configure some initial functions for BL22P64. OPBIT is set when OTP written.

.7 ENCR

- 0: OTP read protection
- 1: OTP can be read

.3 P12F



- 0: P12 as normal I/O pin
- 1: P12 as external reset input pin
- .2 LVREO
 - 0: LVR disable
 - 1: LVR enable
- .0-1 OSC/RC
 - 00: Crystal/ceramic oscillator (400K-4MHz) as system clock
 - 01: External RC oscillator as system clock
 - 10: Internal RC oscillator(0.5MHz) as system clock
 - 11: Internal RC oscillator(3.2MHz) as system clock

6. ELECTRICAL DATA

6.1 Absolute Maximum Ratings

($T_A=25^\circ\text{C}$)

Parameter	Symbol	Condition	Rating	Unit
Supply voltage	V_{DD}	-	-0.3 to +6.5	V
Input voltage	V_I	All ports	-0.3 to $V_{DD}+0.5$	V
Output voltage	V_O	All output ports	-0.3 to $V_{DD}+0.5$	V
Output current high	I_{OH}	One I/O pin active	-25	mA
		All I/O pin active	-80	mA
Output current low	I_{OL}	One I/O pin active	+30	mA
		All I/O pin active	+150	mA
Operating temperature	T_A	-	-40 to +85	$^\circ\text{C}$
Storage temperature	T_{STG}	-	-65 to +150	$^\circ\text{C}$

6.2 DC Electrical Characteristics

($T_A=25^\circ\text{C}$ $V_{DD}=2.7-5.5\text{V}$)

Parameter	Sym.	Condition	Min	Typ	Max	Unit
Input high voltage	V_{IH}	P0,P1,P2 $V_{DD}=2.7-5.5\text{V}$	$0.8V_{DD}$	-	V_{DD}	V
Input low voltage	V_{IL}	P0,P1,P2 $V_{DD}=2.7-5.5\text{V}$	0	-	$0.2V_{DD}$	V
Output high voltage	V_{OH}	$I_{OH}=-10\text{mA}$ P0,P1,P2 $V_{DD}=4.5-5.5\text{V}$	$V_{DD}-1.5$	$V_{DD}-0.4$	-	V
Output low voltage	V_{OL}	$I_{OL}=25\text{mA}$ P0,P1,P2 $V_{DD}=4.5-5.5\text{V}$	-	0.5	2.0	V
Input high leakage current	I_{IH}	All input $V_{IN}=V_{DD}$	-	-	1	μA
Input low leakage current	I_{IL}	All input $V_{IN}=0$	-	-	1	μA



Pull-up resistors	R _{PU}	P0,P1,P2	VDD=2.7-5.5V	15	30	100	KΩ
Pull-down resistors	R _{PD}	P0,P1,P2	VDD=2.7-5.5V	15	30	100	KΩ
Dynamic working current	I _{DD}	4MHz clock	VDD=4.5-5.5V	-	5	10	mA
Standby working current	I _{STD1}	STOP mode LVR disable	VDD=4.5-5.5V	-	0.1	1	uA
	I _{STD2}	STOP mode LVR enable	VDD=4.5-5.5V	-	10	20	

6.3 LVR Characteristics

(T_A=25°C VDD=2.7-5.5V)

Parameter	Sym.	Condition	Min	Typ	Max	Unit
Low voltage reset	V _{LVR}	-	2.7	3.0	3.3	V

6.4 A/D Converter Characteristics

(T_A=25°C VDD=5.0V)

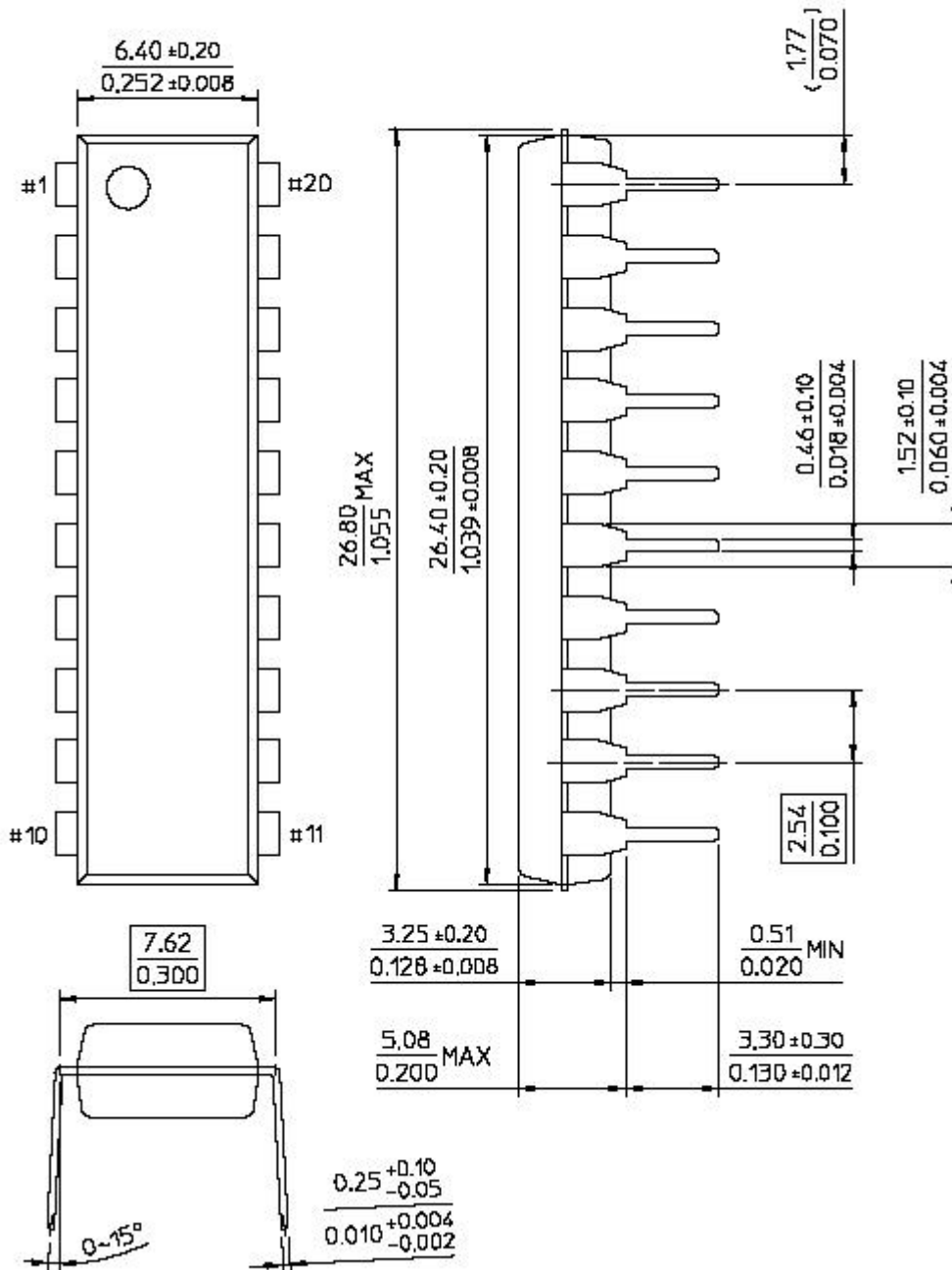
Parameter	Sym.	Condition	Min	Typ	Max	Unit
Total accuracy	-	VDD=5V fosc=4MHz	-	-	±3	LSB
Integral linearity error	ILE	VDD=5V fosc=4MHz	-	-	±2	LSB
Differential linearity error	DLE	VDD=5V fosc=4MHz	-	-	±1	LSB
Offset error of top	EOT	VDD=5V fosc=4MHz	-	±1	±3	LSB
Offset error of bottom	EOB	VDD=5V fosc=4MHz	-	-	-	-
Conversion time	t _{CON}	VDD=5V fosc=4MHz	-	25	-	us
Analog input voltage	V _{IAN}	-	VSS	-	VDD	V
Analog input impedance	R _{AN}	-	2	-	-	MΩ
Analog input current	I _{ADIN}	VDD=5V	-	-	10	uA
Analog block current	I _{ADC}	VDD=5V	-	1	3	mA
		VDD=5V power down mode	-	0.1	0.5	uA



7. Package Dimensions

DIP20

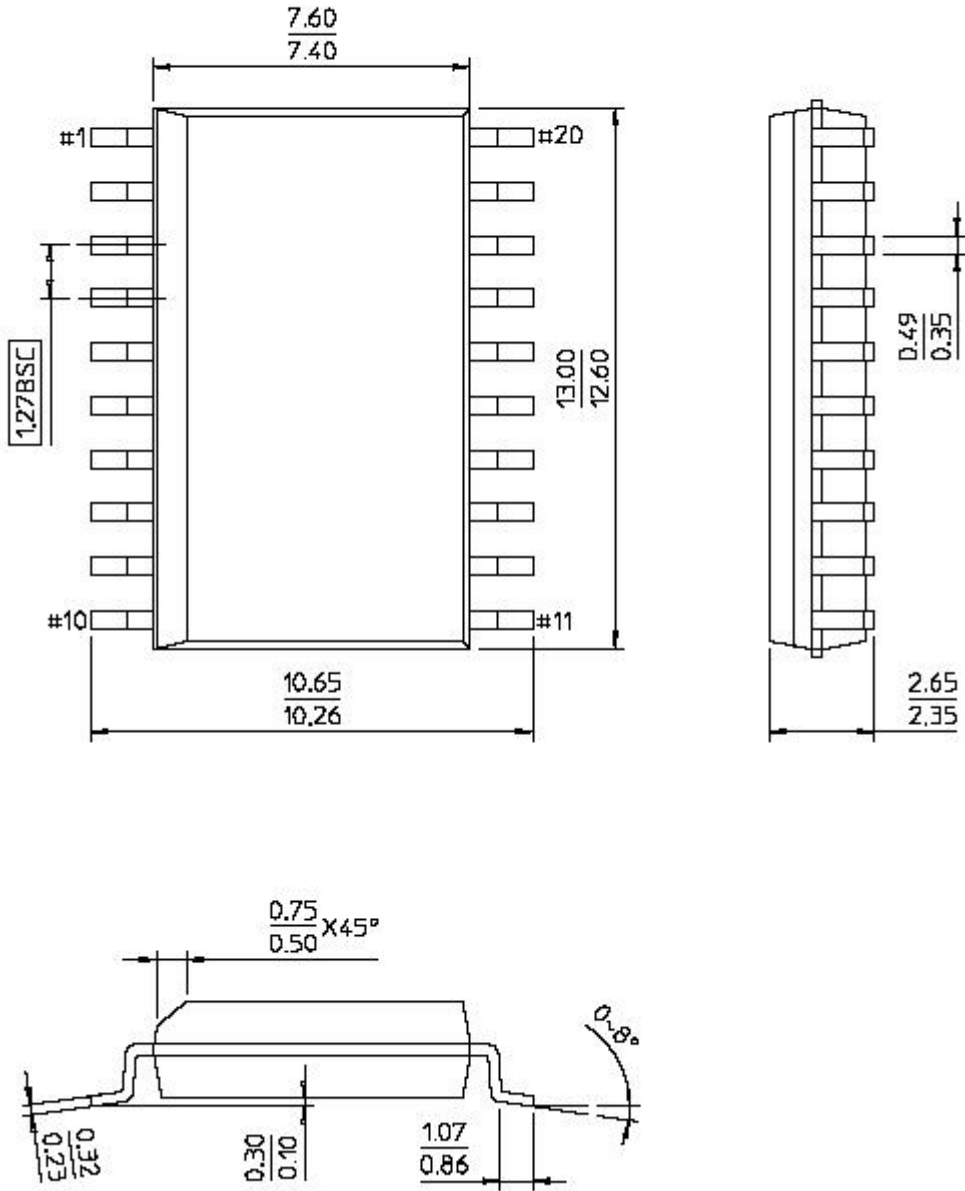
Dimensions in Millimeters/inches





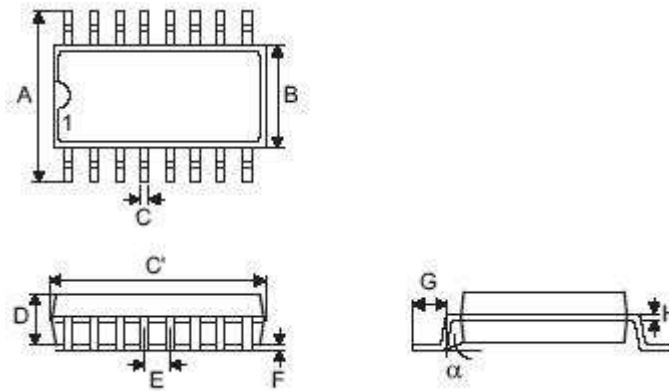
SOP20

Dimensions in Millimeters





SOP16 (150mil)



Symbol	Dimensions in mil			Dimensions in millimeter		
	Max.	Nom.	Min.	Max.	Nom.	Min.
A	238	-	244	6.05	-	6.20
B	150	-	157	3.80	-	4.00
C	14	-	19	0.36	-	0.48
C'	386	-	398	9.80	-	10.10
D	53	-	62	1.35	-	1.57
E	-	50	-	-	1.27	-
F	4	-	-	0.10	-	-
G	22	-	32	0.56	-	0.82
H	4	-	12	0.10	-	0.30
α	0°	-	8°	0°	-	8°