



深圳市宇芯科技发展有限公司
Shenzhen Yuxin Technology Development Co., Ltd.

YX5Q Series Datasheet

深圳市宇芯科技发展有限公司

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1, 概述

YX5Q系列产品为多功能单芯片CMOS语音合成4位微控制器, 提供4通道的语音/Midi合成功能, 语音合成方式采用先进的高音质ADPCM算法, 最高采样率可达CD音质44.1kHz, 且硬件有16阶的音量控制。提供PWM输出和DAC输出两种声音输出方式选择。PWM输出为12bit数字音频输出用于直接驱动喇叭,DAC输出为12bit模拟音频输出需要外接放大电路后驱动喇叭,内建16阶音量调节,使用RISC精简指令集架构,1MHz 或 2MHz指令频率。(使用两通道以上需选择 2MHz)共有43条指令,除了少数指令需要2-3个时序,大多数指令都是1个时序即可完成,可以很方便的以程控来完成不同的应用。利用精准的 $\pm 0.5\%$ 内阻震荡,客户可以不需外加震荡电阻,提供待机模式(Halt mode),和慢速模式(Slow mode),可降低功耗。

2, 功能

宽广的工作电压: 2.0V ~ 5.5V

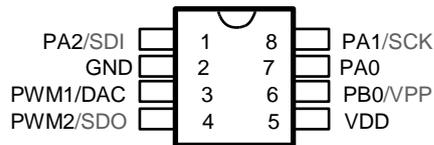
共有6个OTP母体, RAM容量: 248*4bits, 程序代码和文件共用ROM容量, 秒数容量封装如下:

产品编号 (OTP)	语音长度 (秒) @6kHz,4bit	ROM 容量 (10-bit)	封装(PACKAGE)
YX5Q020A	20.0	48k x 10	SOP8,SOP16
YX5Q040A	40.0	96k x 10	SOP8,SOP16
YX5Q060A	60.0	144k x 10	SOP8,SOP16,SSOP24
YX5Q092A	92.0	224k x 10	SOP8,SOP16,SSOP24
YX5Q172A	172.0	416k x 10	SOP8,SOP16,SSOP24
YX5Q342A	342.0	832k x 10	SOP28

3, 脚位描述

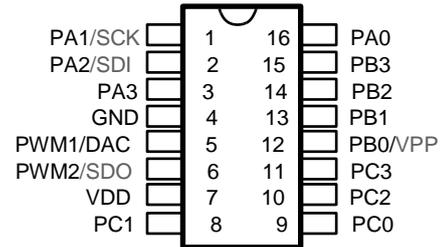
Pad Name	ATTR.	Description
Vpp	Power	Positive high power for programming.
VDD#	Power	Positive power.
GND#	Power	Negative power.
PA1/SCK	I/O	Bit 1 for Port A, or serial clock input at programming mode.
PA2/SDI	I/O	Bit 2 for Port A, or serial data input at programming mode.
PA0/PA3	I/O	Bit 0/3 for Port A.
PB0/VPP	I/O	Bit0 for Port B, or Positive high power for programming.
PB1~3	I/O	Bit 0~3 for Port B.
PC0~3	I/O	Bit 0~3 for Port C.
PD0~3	I/O	Bit 0~3 for Port D.
PE0~3	I/O	Bit 0~3 for Port E.
PWM1/DAC	O	PWM1 output or DAC output.
PWM2/SDO	O	PWM2 output, or serial data output at programming mode.

4, 封装管脚图

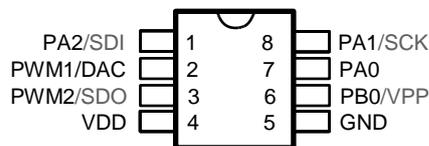


(YX5PXXXXA_SOP8脚位兼容YX5PXXXXB_SOP8)

YX5P020A-SOP8 (150mil)
YX5P040A-SOP8 (150mil)
YX5P060A-SOP8 (150mil)
YX5P092A-SOP8 (150mil)
YX5P172A-SOP8 (150mil)

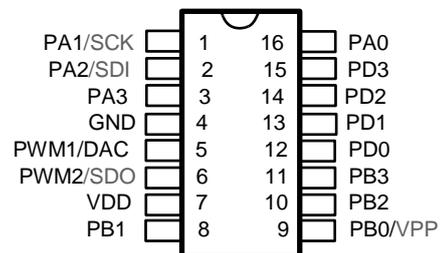


YX5P020A-SOP16(150mil)
YX5P040A-SOP16(150mil)
YX5P060A-SOP16(150mil)
YX5P092A-SOP16(150mil)
YX5P172A-SOP16(150mil)

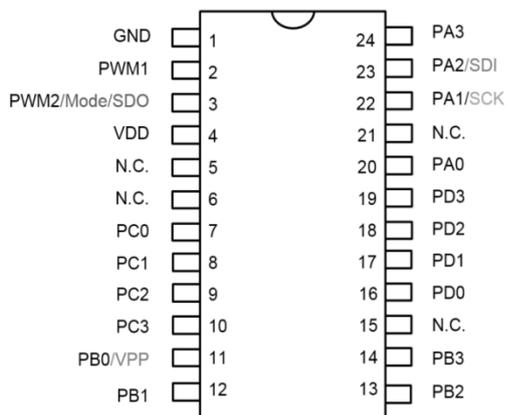


(YX5QXXXXA_SOP8脚位兼容YX3PXXXXB_SOP8)

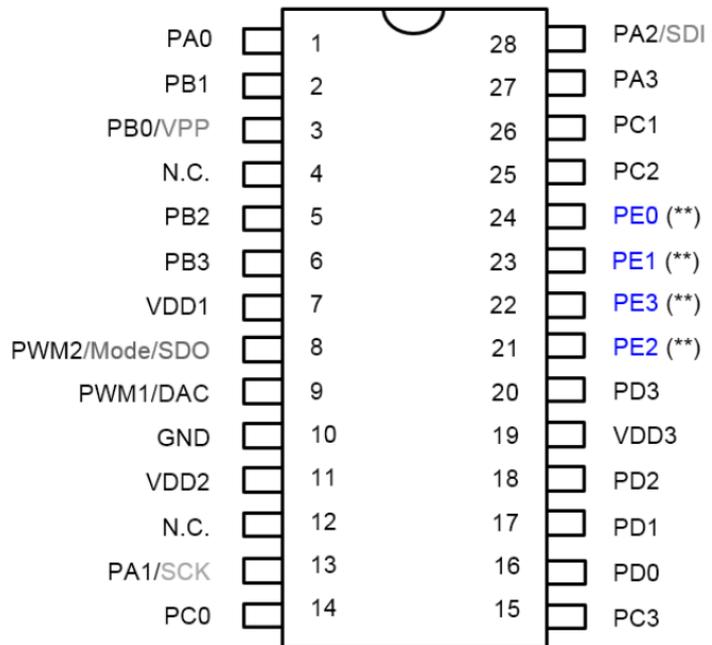
YX5Q020A-SOP8 (150mil)
YX5Q040A-SOP8 (150mil)
YX5Q060A-SOP8 (150mil)
YX5Q092A-SOP8 (150mil)
YX5Q172A-SOP8 (150mil)



517P0A0724-SOP16(150mil)



YX5Q060A-SSOP24 (150mil)
YX5Q092A-SSOP24 (150mil)
YX5Q172A-SSOP24 (150mil)



* YX5Q342A-SOP28 (300mil)



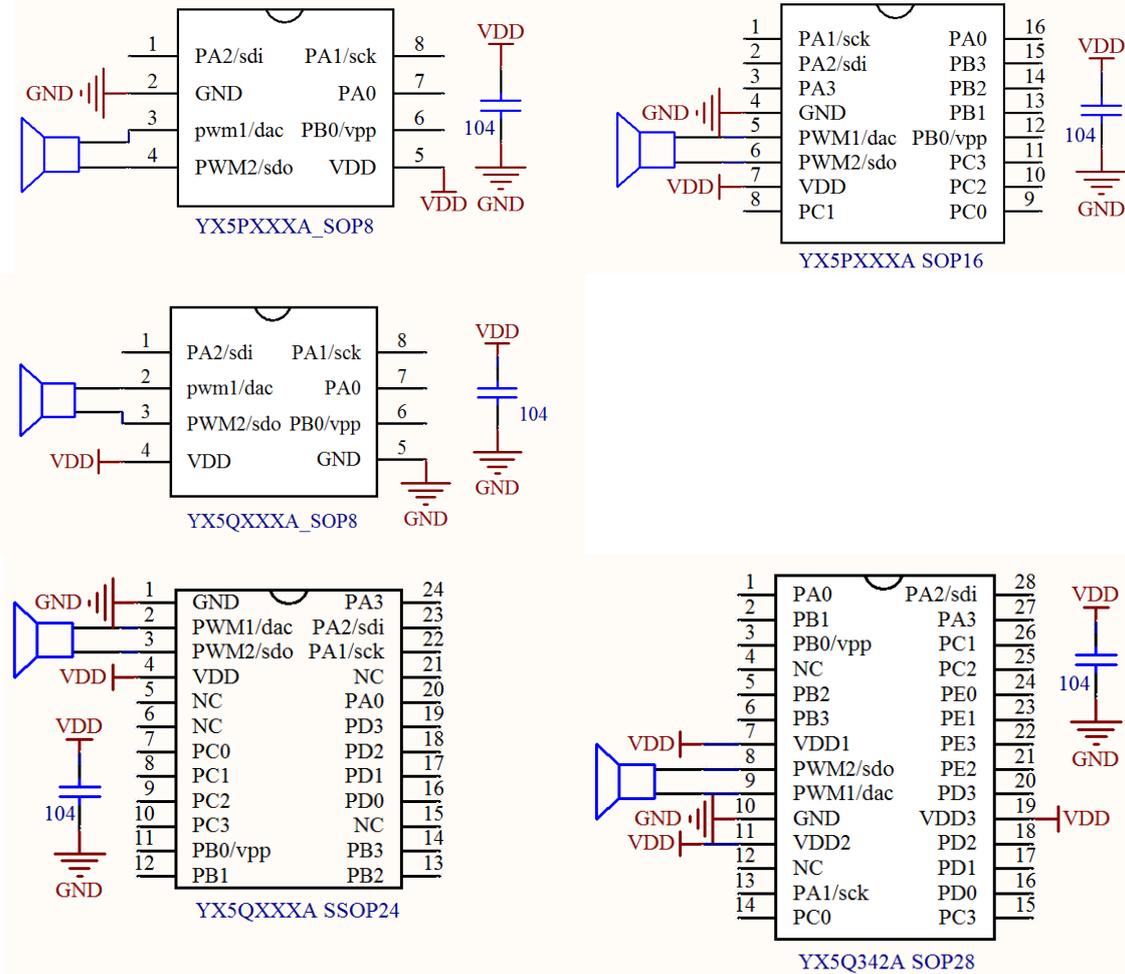
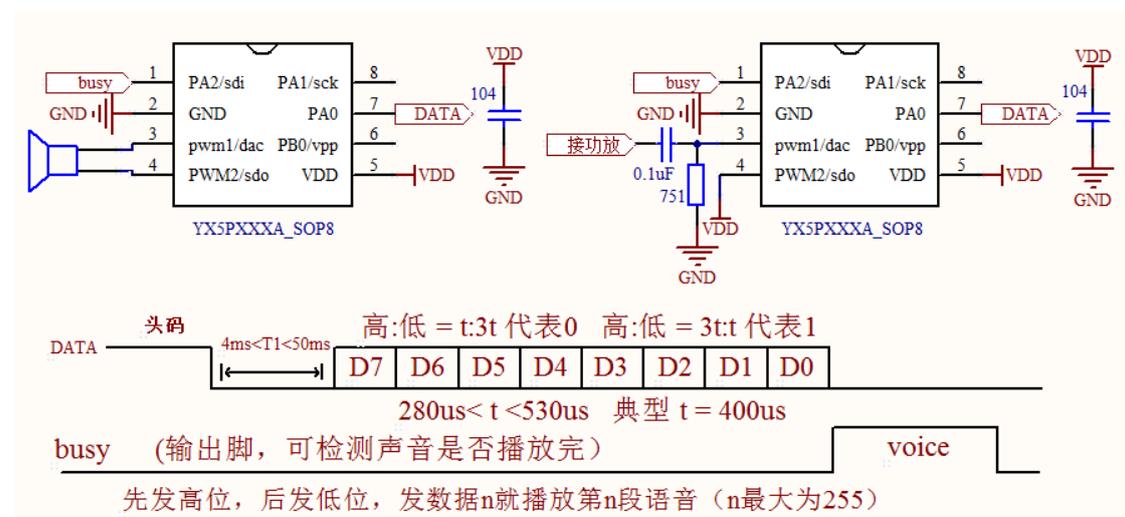
5, 极限参数

Symbol	Parameter	Rated Value	Unit
Vdd - Vss	Supply voltage	-0.5 ~ +6.0	V
Vin	Input voltage	Vss-0.3V ~ Vdd+0.3	V
Top	Operating Temperature	-20 ~ +70	°C
Tst	Storage Temperature	-40 ~ +125	°C

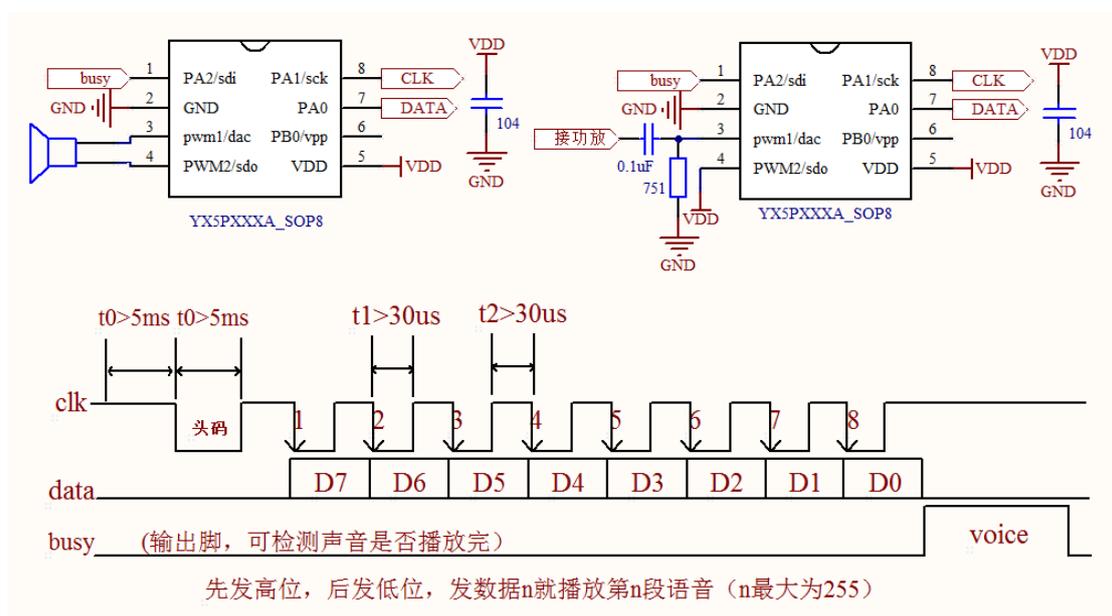
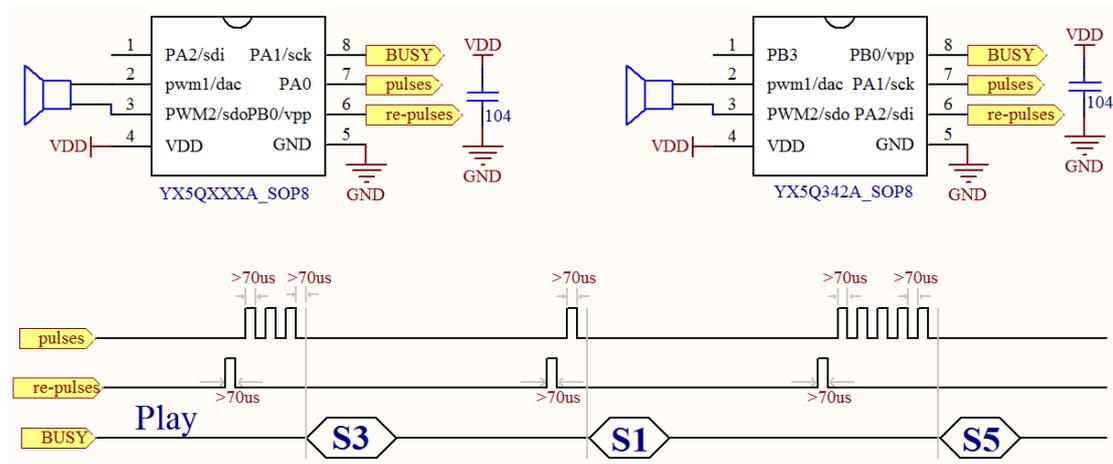
6, 直流特性

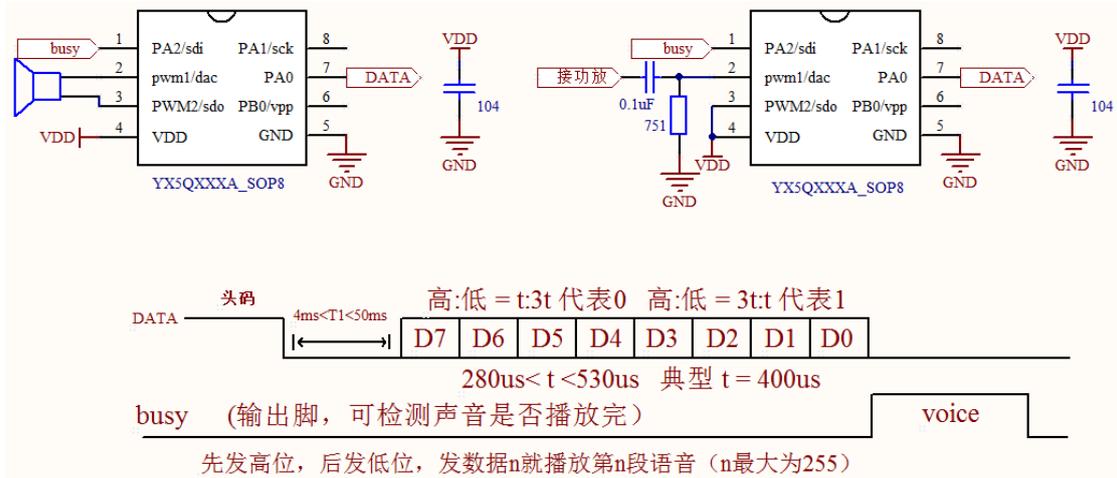
Symbol	Parameter	VDD	Min.	Typ.	Max.	Unit	Condition	
VDD	Operating voltage		2.0	3	5.5	V	1MHz & 2MHz	
Isb	Halt mode	3		1.2		uA	Sleep, no loading	
		4.5		1.5				
Isl	Slow mode	3		30		uA	1ms interrupt, no load	
		4.5		35				
Iop	Operating mode	3		0.8		mA	1MHz, no loading	
		4.5		0.9				
		3		1.0		mA	2MHz, no loading	
		4.5		1.1				
Iil	Input current (Internal pull-high)	Weak (1.2M ohms)	3		2.5		uA	Vil=0v
			4.5		6.0			
		Strong (100K ohms)	3		30		uA	
			4.5		70			
Ioh	Output high current	3		-7		mA	Voh=2.0V	
		4.5		-11			Voh=3.5V	
Iol	Output low current (Normal current)	3		11		mA	Vol=1.0V	
		4.5		19				
	Output low current (Large current)	3		23		mA		
		4.5		36				
I _{PWM}	PWM output current (Normal)	3		60		mA	Load=8 ohms	
		4.5		100				
	PWM output current (Ultra)	3		80		mA	Load=8 ohms	
		4.5		125				
I _{DAC}	DAC output current	3		1.40		mA	Half scale	
		4.5		1.60				
ΔF/F	Frequency deviation by voltage drop	3		-0.5		%	$\frac{F_{osc}(3.0v)-F_{osc}(2.4v)}{F_{osc}(3v)}$	
		4.5		0.5			$\frac{F_{osc}(4.5v)-F_{osc}(3.0v)}{F_{osc}(4.5v)}$	
ΔF/F	Frequency lot deviation	3	-0.5		0.5	%	$\frac{F_{max}(3.0v)-F_{min}(3.0v)}{F_{max}(3.0v)}$	
Fosc	Oscillation Frequency	-	0.95	1	1.05	MHz	VDD=2.0~5.5V	
			1.90	2	2.10			

7, 典型电路应用

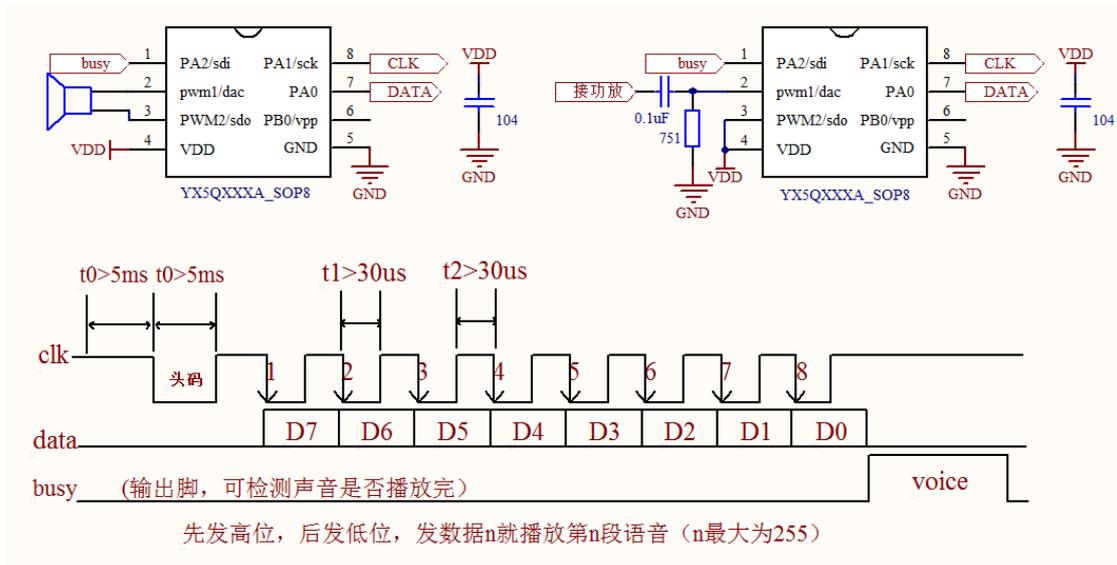
例 (1) 最小系统应用电路(PWM) (YX5PXXXXA_SOP8脚位兼容YX5PXXXXJ_SOP8)

例 (2) YX5PXXXXA_SOP8一线串行通信模式 (脚位兼容YX5PXXXXJ_SOP8)


***注意: 一线串行通信模式发完8位数据之后, 数据端(DATA脚)维持低电平, 不能为高电平**

例 (3) YX5PXXXXA_SOP8 二线串行通信模式, (脚位兼容YX5PXXXXJ_SOP8)

例 (4) YX5QXXXXA 发脉冲数控制 (脚位兼容YX3P系列)


例 (5) YX5QXXXA_SOP8 一线串行通信模式


***注意: 一线串行通信模式发完8位数据之后, 数据端(DATA脚)维持低电平, 不能为高电平**

例 (6) YX5QXXXA_SOP8 二线串行通信模式


- ◆ 语音芯片工作电压尽量与MCU主控芯片电压相同。
- ◆ 如果单独做外接放大电路(DAC)模式, PWM2脚悬空, 或接高电平。
- ◆ 如果是做兼容模式(既可直推喇叭又可外接功放)外接功放时, PWM2脚一定要接高电平。
- ◆ layout 时104或105滤波电容尽量靠近语音芯片VDD脚。



8, MCU通信 程序范例

8.1 一线串口通信

```
/*  
MCU:STC15W402AS 系统频率 12MHz  
*/  
  
#include <STC15.H>  
#include <intrins.h>  
#define uchar unsigned char  
#define uint unsigned int  
  
sbit dat=P1^0; //语音IC-PA0  
sbit busy=P1^2; //语音IC-PA2  
  
void Delay400us() // @12MHz  
{  
    unsigned char i, j;  
  
    i = 5;  
    j = 168;  
    do  
    {  
        while (--j);  
    } while (--i);  
}  
  
void Delay1ms() // @12MHz  
{  
    unsigned char i, j;  
  
    i = 12;  
    j = 169;  
    do  
    {  
        while (--j);  
    } while (--i);  
}  
  
void Delay20ms() // @12MHz  
{  
    unsigned char i, j, k;  
  
    _nop_();
```



```
_nop_();
i = 1;
j = 234;
k = 113;
do
{
    do
    {
        while (--k);
    } while (--j);
} while (--i);
}

void Delay1000ms()    //@12MHz
{
    unsigned char i, j, k;

    _nop_();
    _nop_();
    i = 46;
    j = 153;
    k = 245;
    do
    {
        do
        {
            while (--k);
        } while (--j);
    } while (--i);
}

void start()
{
    dat=1;
    Delay1ms();
    dat=0;
    Delay1ms();Delay1ms();Delay1ms();Delay1ms();Delay1ms();
}

void dat0()
{
    dat=1;
    Delay400us();
}
```



```
    dat=0;
    Delay400us();Delay400us();Delay400us();
}

void dat1()
{
    dat=1;
    Delay400us();Delay400us();Delay400us();
    dat=0;
    Delay400us();
}

void send_byte(uchar addr)
{
    uchar i;
    start();
    for(i=0;i<8;i++)
    {
        if(addr&0x80)
            dat1();
        else
            dat0();
        addr<<=1;
    }
}

void main()
{
    uchar k;
    Delay100ms();
    while(1)
    {
        for(k=1;k<255;k++)
        {
            send_byte(k);
            Delay20ms();
            while(busy);
        }
    }
}
```



8.2 二线串口通信

```
/******  
MCU:STC15W402AS    系统频率12MHz  
*****/  
  
#include <STC15.H>  
#include <intrins.h>  
  
sbit sda=P1^0; //语音IC-PA0  
sbit clk=P1^1; //语音IC-PA1  
sbit busy=P1^2; //语音IC-PA2  
  
void Delay50us()      //@12MHz  
{  
    unsigned char i;  
  
    _nop_();  
    _nop_();  
    i = 147;  
    while (--i);  
}  
  
void Delay1ms()      //@12MHz  
{  
    unsigned char i, j;  
  
    i = 12;  
    j = 169;  
    do  
    {  
        while (--j);  
    } while (--i);  
}  
  
void Delay10ms()     //@12MHz  
{  
    unsigned char i, j;  
  
    i = 117;  
    j = 184;  
    do  
    {  
        while (--j);  
    } while (--i);  
}
```



```
}

void Delay1000ms()    //@12MHz
{
    unsigned char i, j, k;

    _nop_();
    _nop_();
    i = 46;
    j = 153;
    k = 245;
    do
    {
        do
        {
            while (--k);
        } while (--j);
    } while (--i);
}

void send_byte(unsigned char addr)
{
    unsigned char i;
    clk=1;
    Delay1ms();Delay1ms();Delay1ms();Delay1ms();Delay1ms();Delay1ms();
    clk=0;
    Delay1ms();Delay1ms();Delay1ms();Delay1ms();Delay1ms();Delay1ms();
    clk=1;
    Delay50us();
    for(i=0;i<8;i++)
    {
        if(addr&0x80)
            sda=1;
        else
            sda=0;
        clk=0;
        Delay50us();
        clk=1;
        Delay50us();
        addr<<=1;
    }
}

void main()
```



```
{  
    Delay1000ms();  
    while(1)  
    {  
        unsigned char k;  
        for(k=0;k<200;k++)  
        {  
            send_byte(k);  
            Delay10ms();  
            while(busy);  
        }  
    }  
}
```



8.3 脉冲数二线串行通信

```
/*  
MCU:STC15W402AS 系统频率12MHz  
*/  
  
#include <STC15.H>  
#include <intrins.h>  
sbit res=P1^1; //语音芯片第6脚  
sbit pul=P1^0; //语音芯片第7脚  
sbit busy=P1^2; //语音芯片第8脚  
  
void Delay100us() // @12MHz  
{  
    unsigned char i, j;  
  
    i = 2;  
    j = 39;  
    do  
    {  
        while (--j);  
    } while (--i);  
}  
  
void Delay1000ms() // @12MHz  
{  
    unsigned char i, j, k;  
  
    _nop_();  
    _nop_();  
    i = 46;  
    j = 153;  
    k = 245;  
    do  
    {  
        do  
        {  
            while (--k);  
        } while (--j);  
    } while (--i);  
}  
  
void reset()  
{  
    pul=0;
```



```
    res=0;
    Delay100us();
    res=1;
    Delay100us();
    res=0;
    Delay100us();
}

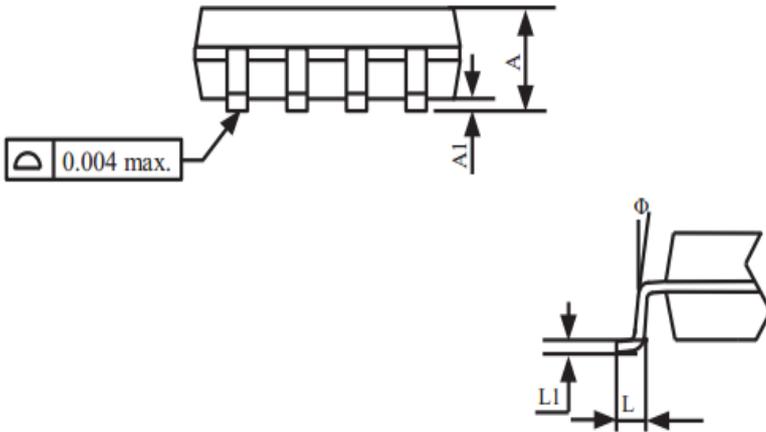
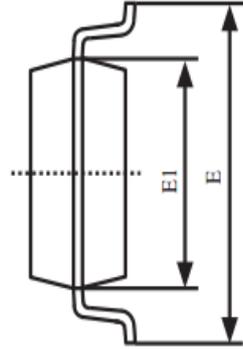
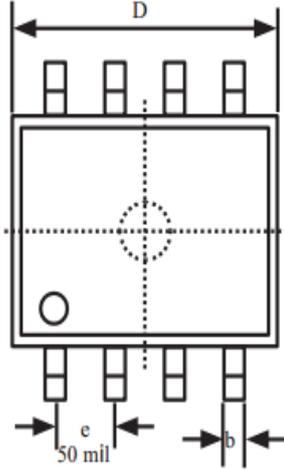
void send(unsigned char m)
{
    for(;m>0;m--)
    {
        pul=1;
        Delay100us();
        pul=0;
        Delay100us();
    }
}

void main()
{
    unsigned char k;
    pul=0;
    res=0;
    Delay100ms();
    while(1)
    {
        for(k=1;k<125;k++)
        {
            reset();
            send(k);
            Delay100us();
            while(busy);
        }
    }
}
```

9. 封装尺寸

9.1 SOP8封装尺寸图 (150mil)

单位: (inch)

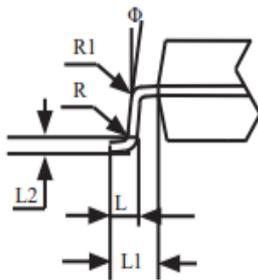
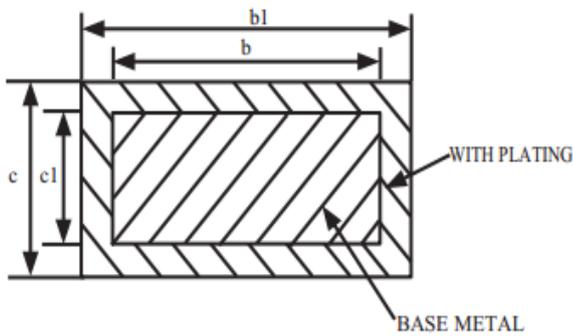
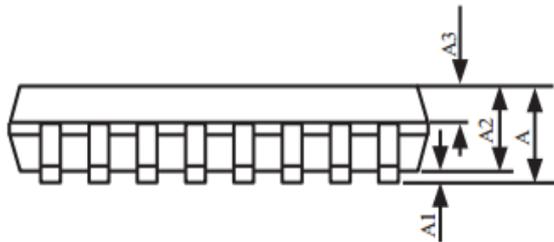
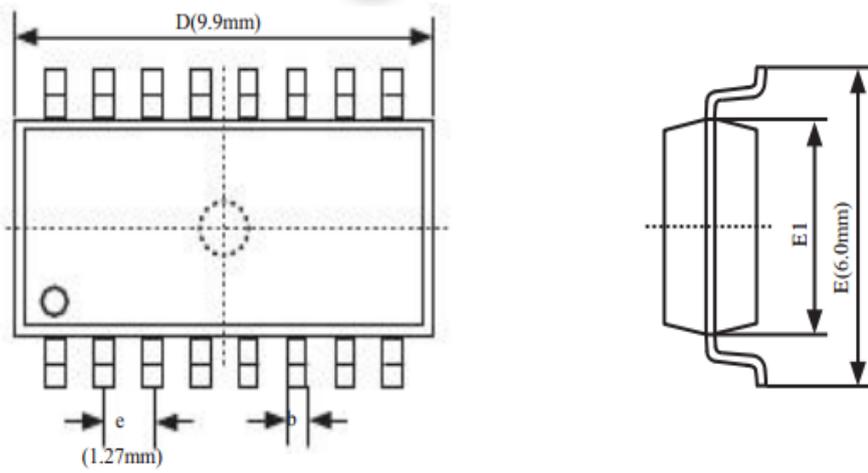


一般尺寸			
(测量单位 = INCH)			
符号	MIN.	NOM.	MAX.
A	0.053	-	0.069
A1	0.004	-	0.010
b	-	0.016	-
D	0.189	-	0.196
E	0.228	-	0.244
E1	0.150	-	0.157
e	0.050		
L	0.016	-	0.050
L1	0.008		
Φ	0 ⁰	-	8 ⁰

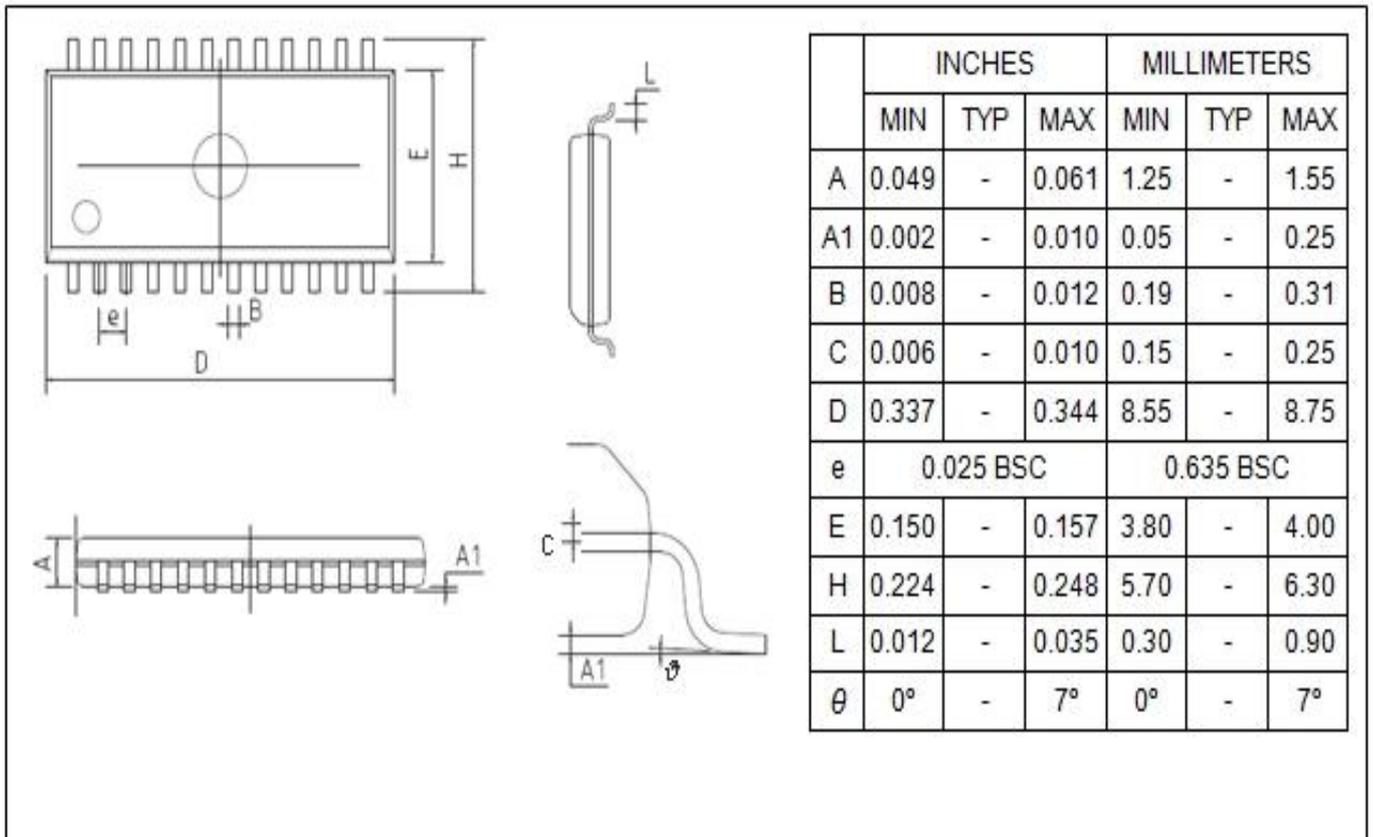
UNIT: INCH, 1 inch = 1000 mil

9.2 SOP16封装尺寸图 (150mil)

单位: (mm)



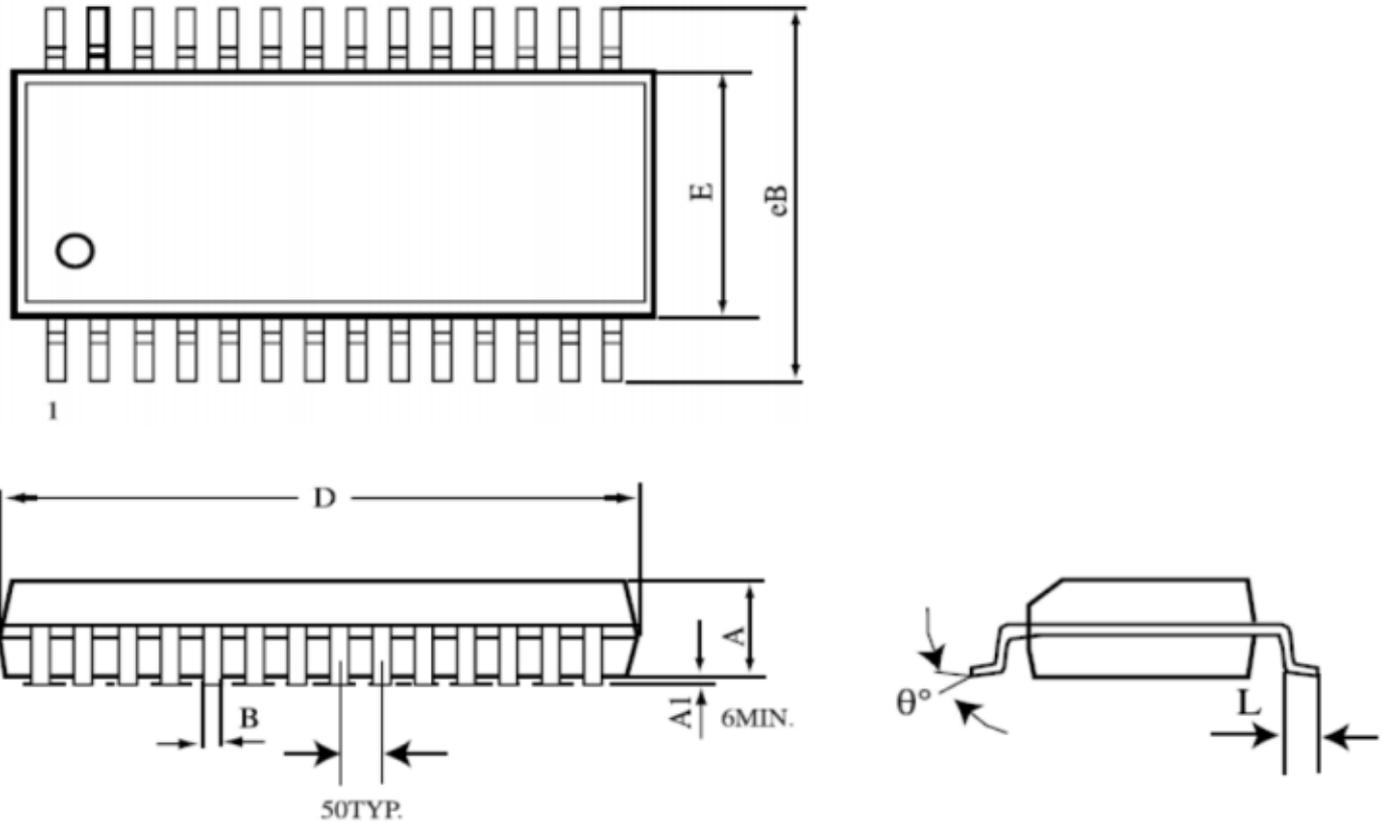
COMMON DIMENSIONS			
(UNITS OF MEASURE = MILLMETER)			
SYMBOL	MIN	NOM	MAX
A	1.35	1.60	1.75
A1	0.10	0.15	0.25
A2	1.25	1.45	1.65
A3	0.55	0.65	0.75
b1	0.36	-	0.49
b	0.35	0.40	0.45
c	0.16	-	0.25
c1	0.15	0.20	0.25
D	9.80	9.90	10.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27		
L	0.45	0.60	0.80
L1	1.04		
L2	0.25		
R	0.07	-	-
R1	0.07	-	-
Φ	6 ⁰	8 ⁰	10 ⁰

9.3 SSOP24封装尺寸图 (150mil)


Note: For 24-pin SSOP IC, 50 units per tube.

9.4 SOP28封装尺寸图 (300mil)

单位: (mil&mm)



Sym.	Dimension in mils			Dimension in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	90	92	94	2.286	2.337	2.388
A1	6	---	---	0.152	---	---
B	12	16	20	0.305	0.406	0.508
D	703	705	707	17.856	17.907	17.958
E	293	295	297	7.442	7.493	7.544
eB	406	410	414	10.312	10.414	10.516
L	25	---	---	0.635	---	---
θ°	0°	4°	8°	0°	4°	8°