深圳市宇芯科技发展有限公司
SHENZHEN YUXIN TECHNOLOGY CO.,LTD.

YX5P Series Datasheet

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Revision History

Version	Date	Description	Modified Page
1.0	2010/12/10	Formal release.	-
1.1	2010/12/11	1. The OSC pad is set as PD2 when YX5A uses external OSC pad. 2. External OSC pad “PD2/OSC” is connected to V_{REG} pad.	5 11
1.2	2011/1/05	1. Add Chinese description for Chapter 1 & 2. 2. External OSC pad “PX#/OSC” is connected to V_{REG} pad.	3, 4, 5 11, 15
1.3	2011/10/24	1. Add YX5P185A, YX5P345A, YX5P520A application circuit. 2. Add YX5P185A, YX5P345A, YX5P520A die pad diagram. 3. Add YX5P185A, YX5P345A, YX5P520A COB pin assignment. .	16, 17 18, 19 19, 20
1.4	2012/11/25	1. Add YX5P185A, YX5P345A, YX5P520A package information 2. Modify ORDERING INFORMATION 3.Add YX5P055 SOP16/DIP16	21,25

1. 概述

YX5P系列产品为多功能单芯片CMOS语音合成4位微控制器，是宇芯科技为了支持 YX5A, YX5B, YX5C 系列 MaskROM 产品所专门开发的嵌入式EPROM架构的OTP IC (One Time Programmable)。提供4信道的语音/Tone/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。提供两种声音输出方式可供选择，一种PWM输出和一种DAC输出。使用RISC精简指令集架构，共有48条指令，除了少數指令需要2个时序，大多數指令都是1个时序即可完成，可以很方便的以程控來完成不同的应用。利用精准的+/-1%内阻震荡，客户可以不需外加震荡电阻，但是弹性的预留一个OSC脚位可以外接震荡电阻，当只使用内阻震荡时，此脚可以当作一般I/O脚使用。提供待机模式(Halt mode)，可大幅度的节省功耗；另外还提供慢速模式(Slow mode)，可以降低功耗。

2. 功能

- 宽广的工作电压： 2.0V ~ 5.5V。*(同 MaskROM IC 的工作电压范围2.0V ~ 5.5V)*
- 4-bit RISC 精简指令集架构的微控制器，共有48条指令。
- 共有6个OTP母体，ROM容量，秒數和I/O脚數如下：

產品編號 **(OTP)**	語音長度 (秒) **@6kHz**	**ROM** 容量 **(10-bit)**	**I/O** 腳數
YX5P025A	25.0	64k x 10	15 (PA, PB, PC, PD0~2)
YX5P055A	55.0	136k x 10	15 (PA, PB, PC, PD0~2)
YX5P085A	85.0	208k x 10	15 (PA, PB, PC, PD0~2)
YX5P185A	185.0	448k x 10	20 (PA, PB, PC, PD, PE)
YX5P345A	345.0	832k x 10	20 (PA, PB, PC, PD, PE)
YX5P520A	518.3	1248k x 10	24 (PA, PB, PC, PD, PE, PF)

YX5A系列 MaskROM IC 的实际容量，秒數和I/O脚數如下：

產品編號 **(MaskROM)**	語音長度 (秒) **@6kHz**	**ROM** 容量 **(10-bit)**	**I/O** 腳數
YX5A003A	3.3	12k x 10	8 (PA, PB)
YX5A005A	5.0	16k x 10	8 (PA, PB)
YX5A008A	8.3	24k x 10	8 (PA, PB)
YX5A011A	11.7	32k x 10	8 (PA, PB)
YX5A018A	18.3	48k x 10	8 (PA, PB)
YX5A025A	25.0	64k x 10	8 (PA, PB)
YX5A035A	35.0	88k x 10	8 (PA, PB)
YX5A045A	45.0	112k x 10	8 (PA, PB)
YX5A055A	55.0	136k x 10	8 (PA, PB)
YX5A065A	65.0	160k x 10	8 (PA, PB)

YX5B系列 MaskROM IC 的实际容量，秒數和I/O脚數如下：

產品編號 (MaskROM)	語音長度 (秒) @6kHz	ROM 容量 (10-bit)	I/O 腳數
YX5B005A	5.0	16k x 10	15 (PA, PB, PC, PD0~2)
YX5B008A	8.3	24k x 10	15 (PA, PB, PC, PD0~2)
YX5B011A	11.7	32k x 10	15 (PA, PB, PC, PD0~2)
YX5B018A	18.3	48k x 10	15 (PA, PB, PC, PD0~2)
YX5B025A	25.0	64k x 10	15 (PA, PB, PC, PD0~2)
YX5B035A	35.0	88k x 10	15 (PA, PB, PC, PD0~2)
YX5B045A	45.0	112k x 10	15 (PA, PB, PC, PD0~2)
YX5B055A	55.0	136k x 10	15 (PA, PB, PC, PD0~2)
YX5B065A	65.0	160k x 10	15 (PA, PB, PC, PD0~2)
YX5B075A	75.0	184k x 10	15 (PA, PB, PC, PD0~2)
YX5B085A	85.0	208k x 10	15 (PA, PB, PC, PD0~2)

YX5C系列 MaskROM IC 的实际容量，秒數和I/O脚數如下：

產品編號 (MaskROM)	語音長度 (秒) @6kHz	ROM 容量 (10-bit)	I/O 腳數
YX5C112A	111.7	272k x 10	20 (PA, PB, PC, PD, PE)
YX5C132A	131.7	320k x 10	20 (PA, PB, PC, PD, PE)
YX5C158A	158.3	384k x 10	20 (PA, PB, PC, PD, PE)
YX5C185A	185.0	448k x 10	20 (PA, PB, PC, PD, PE)
YX5C225A	225.0	544k x 10	20 (PA, PB, PC, PD, PE)
YX5C265A	265.0	640k x 10	20 (PA, PB, PC, PD, PE)
YX5C305A	305.0	736k x 10	20 (PA, PB, PC, PD, PE)
YX5C345A	345.0	832k x 10	20 (PA, PB, PC, PD, PE)
YX5C450B	451.7	1088k x 10	24 (PA, PB, PC, PD, PE, PF)
YX5C520B	518.3	1248k x 10	24 (PA, PB, PC, PD, PE, PF)
YX5C640B	638.3	1536k x 10	24 (PA, PB, PC, PD, PE, PF)
YX5C720B	718.3	1728k x 10	24 (PA, PB, PC, PD, PE, PF)

- 224x4-bit RAM，分成4页，每页56x4-bit。
- 1MHz 指令频率。
- 提供慢速模式(Slow mode)，可降低功耗。(注意: 由于慢速模式的时间误差较大，不建议使用在计时的应用)
- 提供待机模式(Halt mode)，可节省功耗，静态电流(Isb)小于1uA。
- 精准的+/-1%内阻震荡；另外还提供外阻震荡选择，以便调整速度。
- 提供低压復位(LVR=1.8V)，看门狗计时(WDT)，I/O復位功能(External Reset)。
- 一个中断输入可連结到一组独立的堆栈(Stack)，并有多种中断來源可以使用。

- 15~24根弹性的I/O脚，可设定为input, output, large current output, IO, floating-type reset, pull-high reset, IR carrier output 和 large current IR carrier output 等输入输出功能。当做为输出时，可以选择为一般输出电流 (Normal Drive Current, Normal Sink Current) 或是大电流输出(Large Sink Current)，可直推高亮度LED，不需外加三级管。
- 支援Open-Drain (OD) 的双向I/O。
- IR红外线输出: 提供31kHz~58kHz可选择的红外线频率输出，并可选择高电平/低电平编码。
- 提供4信道的语音/Tone/Midi合成功能，可以单独设定每个信道为语音、Tone或Midi输出。
- 更先进的高音质ADPCM语音合成算法，可以经由简单的调整采样位數來提升音质。
- 提供256点, ADSR 和 Full-Wave 3种音色合成方法，用于进行不同Midi音色的编辑。
- 内建256阶Midi包络线控制(Envelope Control)，用于进行Midi音量的控制。
- 一组9-bit PWM纯硬件输出，可以直接驱动喇叭或蜂鸣片；一组10-bit DAC纯硬件输出，可以外加放大线路來放大音量 (通常用于多通道输出)。
- 提供大音量PWM输出，可以直接输出更大音量，输出语音不需外加三级管放大。
- 内建16阶硬件音量控制(Volume Control)，用于进行整体音量的控制。
- 支持 Quick-IO 讯号控制。
- 提供特殊的快速烧錄模式，以加快OTP烧錄时间。
- 支持特殊的ICP (In Circuit Programming) 烧錄功能，以方便客户先组装PCBA模块再进行烧錄。
- 提供可程序的Code资料保护模式。*(当Security-Bit 被烧断后，资料将无法讀取。)*
- 提供多种出货型态，以满足客户不同的应用需求。

(要进一步了解上述功能，请联系我们公司。)

1. GENERAL DESCRIPTION

The YX5P series IC is a powerful 4-bit micro-controller based sound processor. They are embedded EPROM architecture, and the OTP (One Time Programmable) ICs that are designed to support YX5A, YX5B and YX5C MaskROM products. There are 4 channels that are configured as speech, tone or midi, and all of them can be auto-played back simultaneously. By using the high fidelity ADPCM speech synthesis algorithm, it can produce outstanding quality voices. Wide range sampling rate up to 44.1kHz and different volume level are supported. It is also equipped two kinds of audio outputs with fine resolution, including a current D/A converter and a PWM direct-drive. The RISC MCU architecture is very easy to program and control, various applications can be easily implemented. There are 48 instructions, and most of them are executed in single cycle. Through +/-1% accurate internal oscillation, external Rosc is mostly unnecessary. Also an OSC pad is reserved for external oscillation, and this pad can be optioned as normal I/O when setting internal oscillation only. Furthermore, in addition to the HALT mode (sleep mode), it offers the SLOW mode to minimize power dissipation.

2. FEATURES

- Wide operating voltage range: 2.0V to 5.5V. *(Same as MaskROM products)*
- 4-bit RISC type micro-controller with 48 instructions.
- 1248Kx10-bit ROM maximum, program and voice data share the same ROM space. The voice duration, ROM size and I/O counts are shown below.

Product (OTP)	Voice Duration (sec) @6kHz	ROM Size (10-bit)	I/O
YX5P025A	25.0	64k x 10	15 (PA, PB, PC, PD0~2)
YX5P055A	55.0	136k x 10	15 (PA, PB, PC, PD0~2)
YX5P085A	85.0	208k x 10	15 (PA, PB, PC, PD0~2)
YX5P185A	185.0	448k x 10	20 (PA, PB, PC, PD, PE)
YX5P345A	345.0	832k x 10	20 (PA, PB, PC, PD, PE)
YX5P520A	518.3	1248k x 10	24 (PA, PB, PC, PD, PE, PF)

Regarding YX5A MaskROM series, the voice duration, ROM size and I/O counts are shown below.

Product (MaskROM)	Voice Duration (sec) @6kHz	ROM Size (10-bit)	I/O
YX5A003A	3.3	12k x 10	8 (PA, PB)
YX5A005A	5.0	16k x 10	8 (PA, PB)
YX5A008A	8.3	24k x 10	8 (PA, PB)
YX5A011A	11.7	32k x 10	8 (PA, PB)
YX5A018A	18.3	48k x 10	8 (PA, PB)
YX5A025A	25.0	64k x 10	8 (PA, PB)
YX5A035A	35.0	88k x 10	8 (PA, PB)

YX5A045A	45.0	112k x 10	8 (PA, PB)
YX5A055A	55.0	136k x 10	8 (PA, PB)
YX5A065A	65.0	160k x 10	8 (PA, PB)

Regarding YX5B MaskROM series, the voice duration, ROM size and I/O counts are shown below.

Product (MaskROM)	Voice Duration (sec) @6kHz	ROM Size (10-bit)	I/O
YX5B005A	5.0	16k x 10	15 (PA, PB, PC, PD0~2)
YX5B008A	8.3	24k x 10	15 (PA, PB, PC, PD0~2)
YX5B011A	11.7	32k x 10	15 (PA, PB, PC, PD0~2)
YX5B018A	18.3	48k x 10	15 (PA, PB, PC, PD0~2)
YX5B025A	25.0	64k x 10	15 (PA, PB, PC, PD0~2)
YX5B035A	35.0	88k x 10	15 (PA, PB, PC, PD0~2)
YX5B045A	45.0	112k x 10	15 (PA, PB, PC, PD0~2)
YX5B055A	55.0	136k x 10	15 (PA, PB, PC, PD0~2)
YX5B065A	65.0	160k x 10	15 (PA, PB, PC, PD0~2)
YX5B075A	75.0	184k x 10	15 (PA, PB, PC, PD0~2)
YX5B085A	85.0	208k x 10	15 (PA, PB, PC, PD0~2)

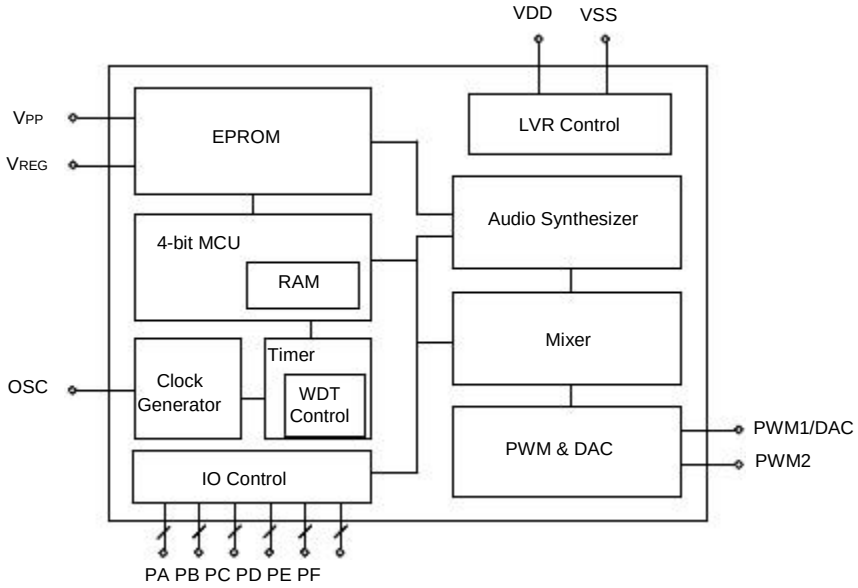
Regarding YX5C MaskROM series, the voice duration, ROM size and I/O counts are shown below.

Product (MaskROM)	Voice Duration (sec) @6kHz	ROM Size (10-bit)	I/O
YX5C112A	111.7	272k x 10	20 (PA, PB, PC, PD, PE)
YX5C132A	131.7	320k x 10	20 (PA, PB, PC, PD, PE)
YX5C158A	158.3	384k x 10	20 (PA, PB, PC, PD, PE)
YX5C185A	185.0	448k x 10	20 (PA, PB, PC, PD, PE)
YX5C225A	225.0	544k x 10	20 (PA, PB, PC, PD, PE)
YX5C265A	265.0	640k x 10	20 (PA, PB, PC, PD, PE)
YX5C305A	305.0	736k x 10	20 (PA, PB, PC, PD, PE)
YX5C345A	345.0	832k x 10	20 (PA, PB, PC, PD, PE)
YX5C450B	451.7	1088k x 10	24 (PA, PB, PC, PD, PE, PF)
YX5C520B	518.3	1248k x 10	24 (PA, PB, PC, PD, PE, PF)
YX5C640B	638.3	1536k x 10	24 (PA, PB, PC, PD, PE, PF)
YX5C720B	718.3	1728k x 10	24 (PA, PB, PC, PD, PE, PF)

- 224x4-bit RAM maximum, divided into 4 pages.
- 1MHz instruction frequency.
- SLOW mode to operate at low power consumption. *(Not suggest using in Timer/Clock application.)*
- HALT mode to save power, less than 1uA@3V standby current.

- Precisely embedded oscillator with build-in resistor (+/- 1%). External resistor to adjust system frequency is optional.
- Low voltage reset (LVR=1.8V), watch-dog reset and I/O port reset are all supported to protect the system.
- One interrupt entrance with an independent stack, multiple interrupt sources.
- Maximum 24 flexible I/Os maximum with optional function: input, output, large current output, IO, floating-type reset, pull-high reset, IR carrier output and large current IR carrier output. For the output port, users can select the normal Drive current output or large Sink current output to directly drive high brightness LED.
- Support Open-Drain (OD) bi-direction IO.
- Infrared output: optional IR carrier frequency and optional data high/low IR output supported.
- Maximum of 4 channels can play simultaneously; each channel can be arbitrarily assigned as speech, tone or midi channel based on the product spec.
- New high fidelity ADPCM speech synthesis algorithm.
- 3 kinds of 256 points, ADSR and Full-Wave instrument waveform provide outstanding midi quality for MIDI.
- 256 steps envelope control for tone and MIDI.
- High quality 9-bit PWM to directly drive speaker, or 10-bit D/A converter audio output to amplify the volume by external audio amplifier for multi-channel MIDI especially.
- Support large PWM current output.
- 16 steps volume control for audio output.
- Quick-IO control supported.
- A unique fast writing mode is provided to speed up OTP writing time.
- A special ICP *(In Circuit Programming)* writing function is supported for user to fabricate PCBA in advance.
- Programmable code protection is provided. *(When the Security-Bit is burnt down, data can't be read.)*
- Various shipping type for different application requirement.

3. BLOCK DIAGRAM



4. PAD DESCRIPTION

Pad Name	ATTR.	Description
Vpp	Power	Positive high power for programming.
V_{REG}	Power	Regulator input. Connect a 0.1uF cap to GND or keep floating.
VDD#	Power	Positive power.
GND#	Power	Negative power.
PA0/SDA	I/O	Bit 0 for Port A, or serial data input at programming mode.
PA1/SCL	I/O	Bit 1 for Port A, or serial clock input at programming mode.
PA2~3	I/O	Bit 2~3 for Port A.
PB0~3	I/O	Bit 0~3 for Port B.
PC0~3	I/O	Bit 0~3 for Port C.
PD0~1	I/O	Bit 0~1 for Port D.
PD2/OSC	I/O	Bit 2 for Port D, or External resistor for oscillator input.
PD3	I/O	Bit 3 for Port D. *(PD3 for YX5P185A, YX5P345A & YX5P520A.)*
PE0~2	I/O	Bit 0~2 for Port E. *(PE0~3 for YX5P185A, YX5P345A & YX5P520A.)*
PE3/OSC	I/O	Bit 3 for Port E, or External resistor for oscillator input.
PF0~2	I/O	Bit 0~2 for Port F. *(PF0~3 for YX5P520A only.)*
PF3/OSC	I/O	Bit 3 for Port F, or External resistor for oscillator input.
PWM1/DAC	O	PWM1 output or DAC output.
PWM2/Mode	O	PWM2 output, or select programming mode.

* YX5P025A, YX5P055A, YX5P085A: OSC pad is shared with PD2.

* YX5P185A, YX5P345A: OSC pad is shared with PE3.

* YX5P520A : OSC pad is shared with PF3.

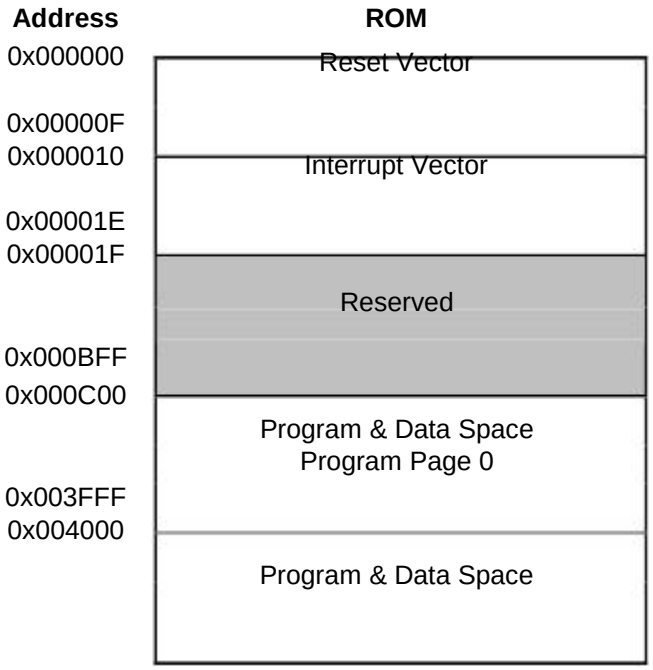
* When YX5A uses external OSC pad of PB3/OSC, the OSC pad for YX5P025A, YX5P055A and YX5P085A is set as PD2.

5. MEMORY ORGANIZATION

There are maximum 1248K words EPROM, 224 nibbles of RAM and 19 nibbles of dedicated system control register. The registers are divided into 11 nibbles of system registers and 8 nibbles of memory registers. Besides, there are several registers without address allocation, and they can only be accessed by the special instructions. One of the registers is RAM page register (PG), and the others are audio control registers.

5.1 ROM

A large program/data/voice single ROM is provided, and its structure is shown below. The reserved region contains system information and can't be utilized by users. The program page is limited by the unconditional branch instruction: JMP and CALL. Because it can only handle 14-bit length address of ROM, the program page size is 16K words.



5.2 RAM

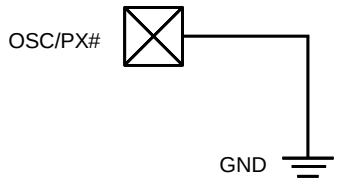
Each page of RAM contains 56 nibbles, and YX5P serial provides 224 nibbles of 4 pages. The page number (PG) register of RAM defined by the MPG instruction, and its initial value is 0. Because the memory space is shared with the memory registers (address=0x00~0x07), the address for RAM is 0x08~0x3F.

In addition to the immediate addressing mode, the indexed addressing mode is also supported. The page and address of the indexed RAM should be stored into RPT1 and RPT0 first, and users can read from or write in the XMD memory register to realize the indexed ROM access.

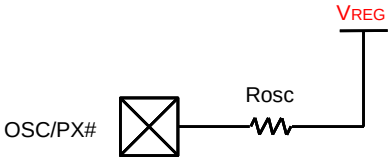
6. Clock Generator

The clock generator is a Ring oscillator, and users can select the internal resistor (INT-R) or the external resistor (EXT-R). A precise INT-R oscillator is provided, and its accuracy is up to ±1%.

For YX5P025A ~ 5P085A bodies if OSC/PD2 pad is optioned as PD2 I/O function, or for YX5P185A ~ 5P345A bodies if OSC/PE3 pad is optioned as PE3 I/O function or for YX5P520A body if OSC/PF3 is optioned as PF3 I/O function, there is only INT-R, and EXT-R is disabled. When this pad is optioned as OSC function oppositely, INT-R or EXT-R can be determined by the configurations below. And the OSC pad must be connected to V_{REG} rather than V_{DD} when using EXT-R.



INT-R Oscillator Connection



EXT-R Oscillator Connection

7. IO PORTS

There are most 24 I/O ports, designated as PAx through PFx, and x=0~3. All the I/O ports can be configured as input, output, or IO port (bi-direction). For the input port, we provide an internal pull-high register option for convenience. For the output port, users can also option its initial value as low or high according to your application circuit. Besides, users can also enable the large current option for each output port to get a larger sink current. The bi-direction IO port can be an input or output by its register value, and users can option the bi-direction IO with a pull-high resister or without a pull-high resister (Open-Drain). When the register equals 0, it is an output and can only output zero. When the register equals 1, it is a weak pull-high or floating (Open-Drain) so that it also can be considered as an input port with/without a pull-high resistor. Users also can enable the large sink current option of an IO port.

The PX0 port means the PA0, PB0, PC0, PD0, PE0 or PF0 port can also be optioned as an external reset pin or an infrared (IR) output pin. A reset port can possess a pull-high resister or not, and an IR port can be initial low or high and also large sink current or not.

The pull-high resister of all the I/O ports has two kinds of option: weak and strong. The weak one is about 850KΩ @3V for normal application and the strong one is about 480KΩ @3V usually for key matrix function. When users configure the weak or strong pull-high resister, the pull-high resisters of all I/O ports are set as the option value.

For YX5P025A ~ YX5P085A bodies, PD2 pad is shared with external OSC pad. When users enable external OSC function, PD2 function will be disabled. For YX5P185A ~ YX5P345A bodies, PE3 pad is shared with external OSC pad. When users enable external OSC function, PE3 function will be disabled. For YX5P520A body, PF3 pad is shared with external OSC pad. When users enable external OSC function, PF3 function will be disabled.

8. AUDIO SYNTHESIZER

There are 1-ch voice and 2-ch tone or 4-ch speech/Midi, and all modes are auto-played back by hardware. Different channel mode possesses different hardware structure. It provides a hardware mixer to mix the channel data. The mixer contains a mixer control register MIX. 1-ch ~ 4-ch voice and/or Midi are all configurable by programming the MIX Two audio output stages: DAC and PWM are supported.

8.1 Voice

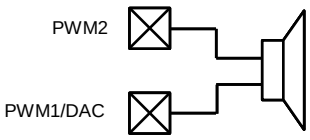
A voice channel includes a PFLG, a VPR, a voice decoder, a QIO control code generator and an 8-bit sample rate timer (TM) whose timer clock source (TCS) is fixed to 1MHz. It supports PCM and encoded ADPCM speech data.

8.2 Tone or Midi

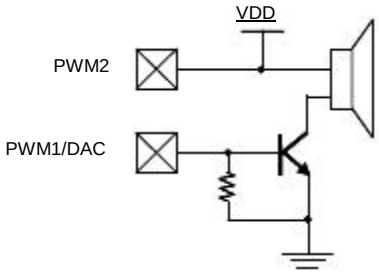
A tone channel includes a TM and an 8-bit envelope (ENV). A Midi channel includes a PFLG, a VPR, a TM, an ENV, a timbre skipper and a multiplier, which multiplies the Midi data and the envelope value held by the ENV. The timbre skipper is used to fulfill the higher octave pitch playing. The hardware multiplier is dedicated to the Midi channel, and users can't operate it by aYX instruction.

8.3 Audio Output

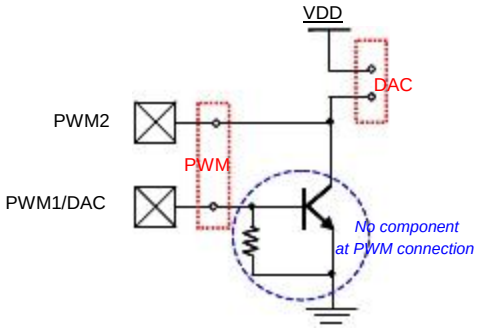
By setting the AUD register, PWM or DAC can be easily chosen as the audio output stage. Besides, it provides a pad detecting mechanism. The pad detecting mechanism detects the PWM2 pad during the reset initialization period, and sets the initial value of the audio output register as PWM if the PWM2 connection is floating, or sets the initial value of the audio output register as DAC if the PWM2 connection is high. In conclusion, connect the speaker to PWM1 and PWM2 only if using PWM, otherwise connect PWM2 to VDD if using DAC. Since the mechanism sets only the initial value of AUD, don't change the value of the AUD register if the pad detecting mechanism is adopted.



PWM Output Connection



DAC Output Connection



PWM/DAC Connection Together

When using the PWM output, we provide an option of normal PWM current or large PWM current for different customer demand. The large PWM consumes more current and makes sound louder.

8.4 Volume Control

Both PWM and DAC support 16 steps hardware volume control by the VOL register. It also provides a DAC current control (CC) option to adjust the DAC current for different BJT properties.

9. ELECTRICAL CHARACTERISTICS

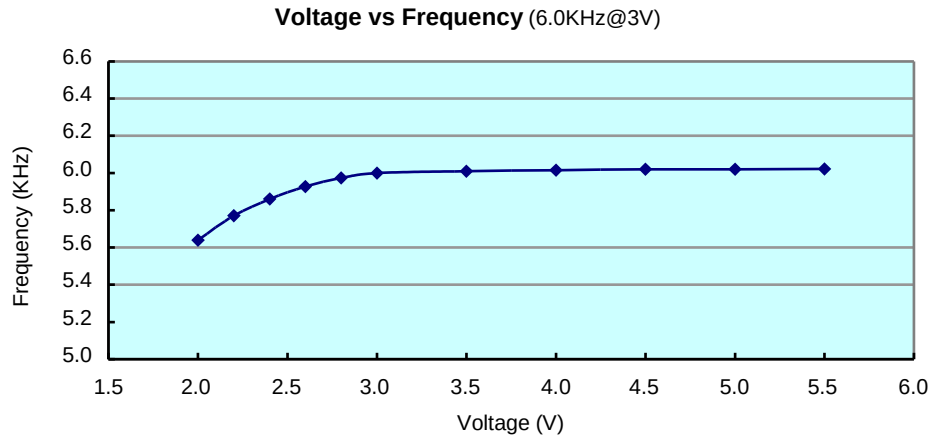
9.1 Absolute Maximum Rating

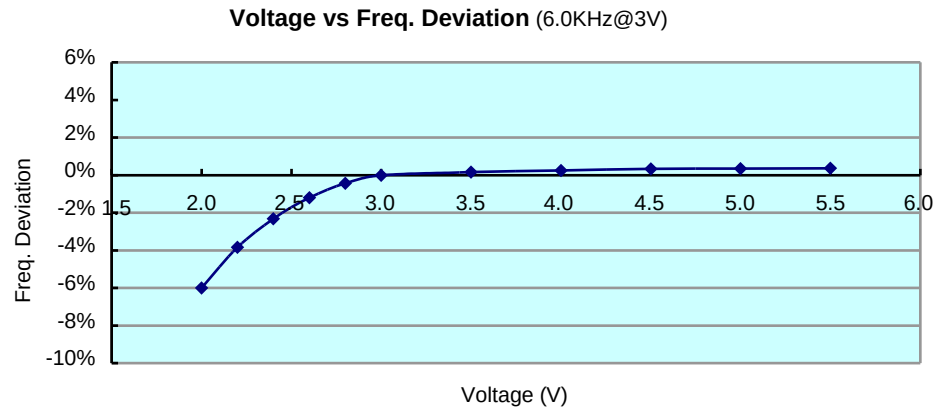
Symbol	Parameter	Rated Value	Unit
Vdd - Vss	Supply voltage	-0.5 ~ +6.0	V
Vin	Input voltage	Vss–0.3V ~ Vdd+0.3	V
Top	Operating Temperature	0 ~ +70	°C
Tst	Storage Temperature	-25 ~ +85	°C

9.2 DC Characteristics

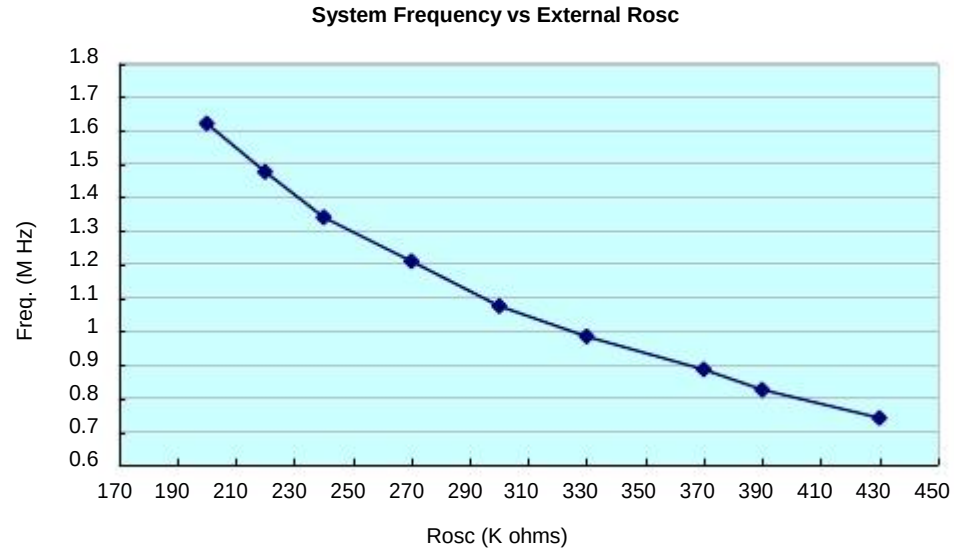
Symbol	Parameter		V_{DD}	Min.	Typ.	Max.	Unit	Condition
V_{DD}	Operating voltage			2.0	3	5.5	V	1 MHz
I_{sb}	Supply current	Halt mode	3			1	uA	Sleep, no loading
			4.5			1		
I_{sl}		Slow mode	3		150		uA	1ms interrupt, no load
			4.5		350			
I_{op}		Operating mode	3		2		mA	1MHz, no loading
			4.5		2.4			
I_{il}	Input current (Internal pull-high)	Weak (850k ohms)	3		-3.5		uA	V_{il}=0v
			4.5		-10			
		Strong (480k ohms)	3		-7			
			4.5		-20			
I_{oh}	Output high current		3		-10		mA	V_{oh}=1.0V
			4.5		-22			V_{oh}=2.2V
I_{ol}	Output low current (Normal current)		3		10		mA	V_{ol}=2.0V
			4.5		20			V_{ol}=2.5V
I_{ol}	Output low current (Large current)		3		20		mA	V_{ol}=2.0V
			4.5		40			V_{ol}=2.5V
I_{PWM}	PWM output current (Normal)		3		60		mA	Load=8 ohms
			4.5		100			
I_{PWM}	PWM output current (Large)		3		70		mA	Load=8 ohms
			4.5		117			
ΔF/F	Frequency deviation by voltage drop (1MHz)		3		2		%	$\frac{Fosc(3.0v)-Fosc(2.4v)}{Fosc(3v)}$
			4.5		0.5			$\frac{Fosc(4.5v)-Fosc(3.0v)}{Fosc(4.5v)}$
ΔF/F	Frequency lot deviation (1MHz)		3	-1		1	%	$\frac{Fmax(3.0v)-Fmin(3.0v)}{Fmax(3.0v)}$
Fosc	Oscillation Frequency		-	0.90	1	1.05	MHz	V_{DD}=2.0~5.5V

9.3 Voltage vs. Frequency





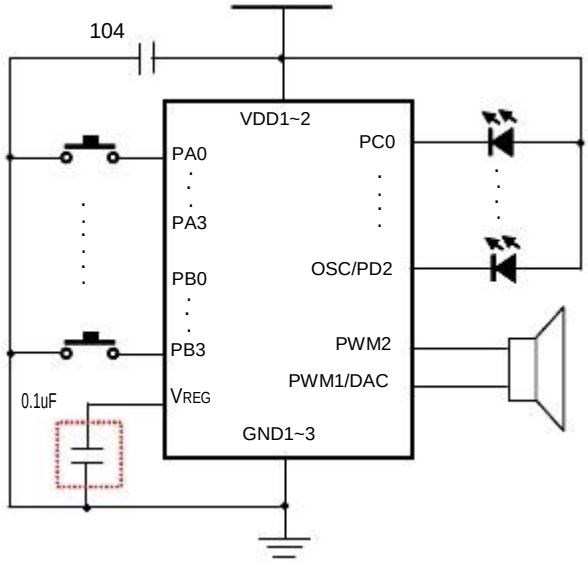
9.4 System Frequency v.s. External Rosc



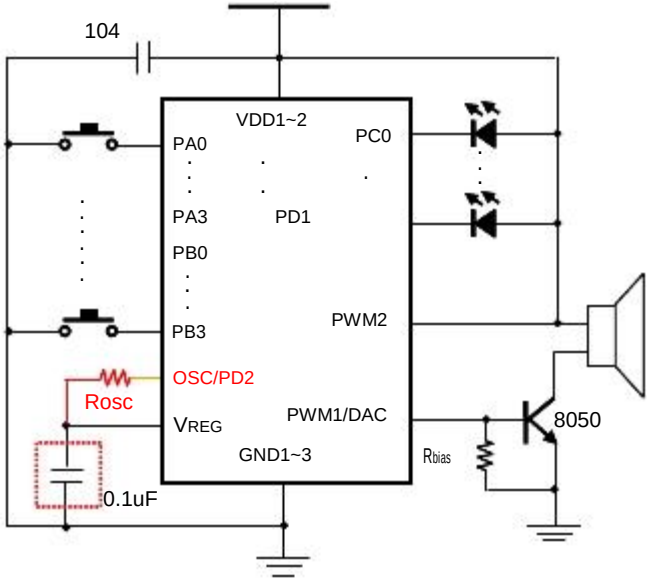
10. APPLICATION

10.1 YX5P025A, YX5P055A, YX5P085A

(1) INT-R, PWM *(OSC/PD2 is optioned as PD2 pad)*

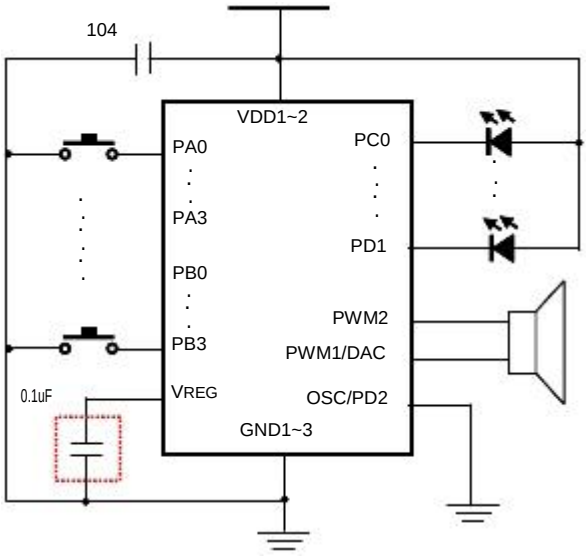


(2) EXT-R, DAC *(OSC/PD2 is optioned as OSC pad)*



Note: While using external OSC, the OSC pad must be connected to V_{REG} rather than VDD.

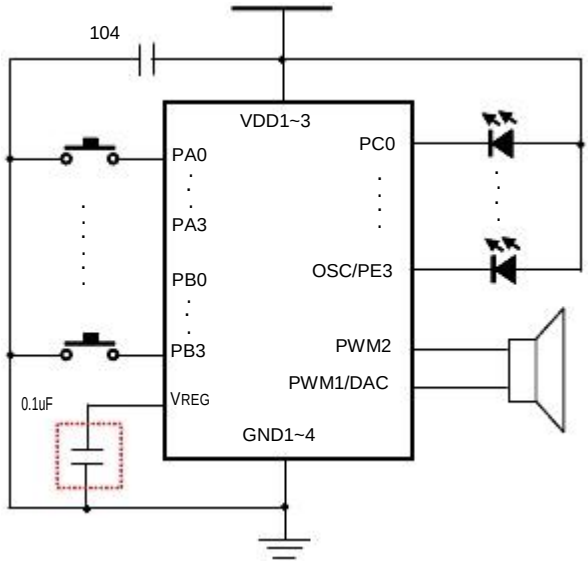
(3) INT-R, PWM *(OSC/PD2 is optioned as OSC pad)*



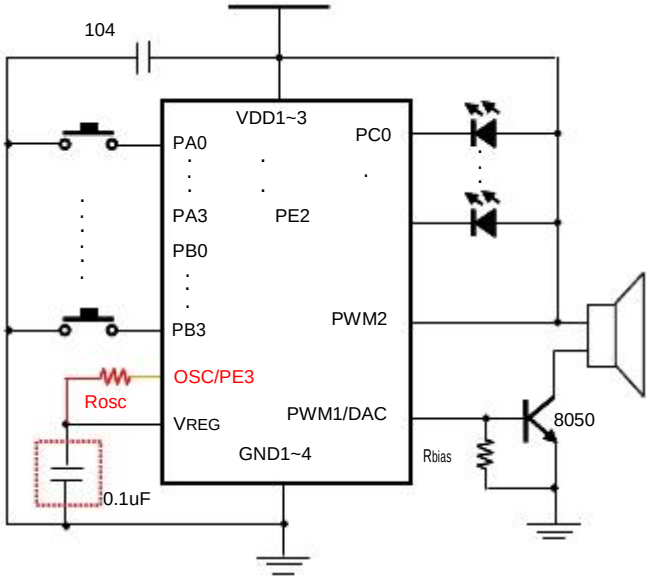
Note: At high voltage of 4.5V or higher voltage, V_{REG} maybe need to connect to GND with a 0.1uF cap for less power noise. At 3V, V_{REG} don't need to connect aYX capacitor and can be kept this pad floating to save a capacitor.

10.2 YX5P185A, YX5P345A

(1) INT-R, PWM *(OSC/PE3 is optioned as PE3 pad)*

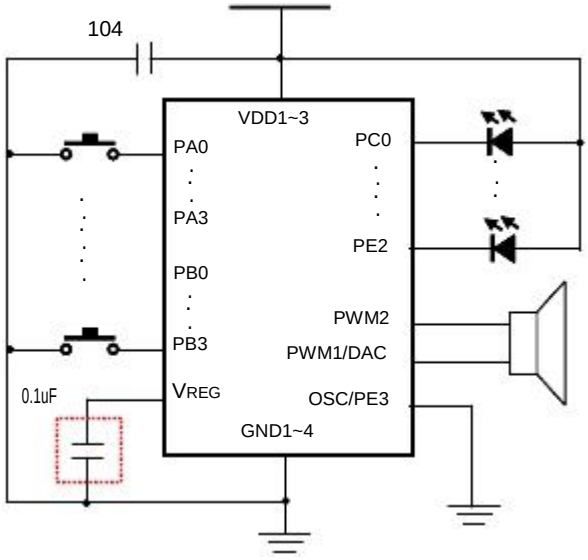


(2) EXT-R, DAC *(OSC/PE3 is optioned as OSC pad)*



Note: While using external OSC, the OSC pad must be connected to V_{REG} rather than VDD.

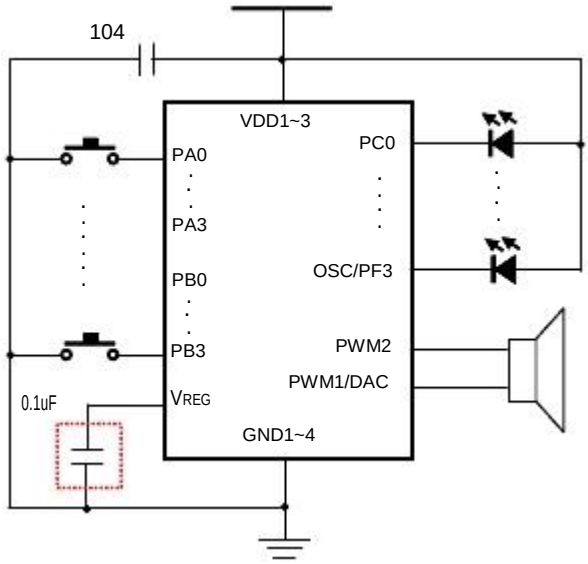
(3) INT-R, PWM *(OSC/PE3 is optioned as OSC pad)*



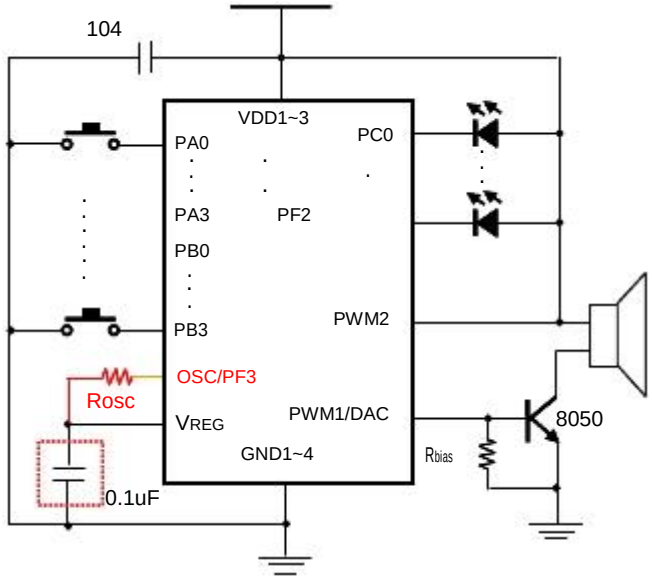
Note: At high voltage of 4.5V or higher voltage, V_{REG} maybe need to connect to GND with a 0.1uF cap for less power noise. At 3V, V_{REG} don't need to connect aYX capacitor and can be kept this pad floating to save a capacitor.

10.3 YX5P520A

(1) INT-R, PWM *(OSC/PE3 is optioned as PE3 pad)*

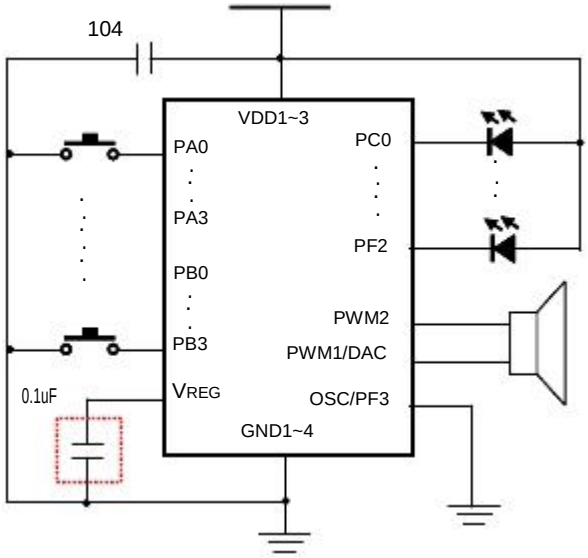


(2) EXT-R, DAC *(OSC/PE3 is optioned as OSC pad)*



Note: While using external OSC, the OSC pad must be connected to V_{REG} rather than VDD.

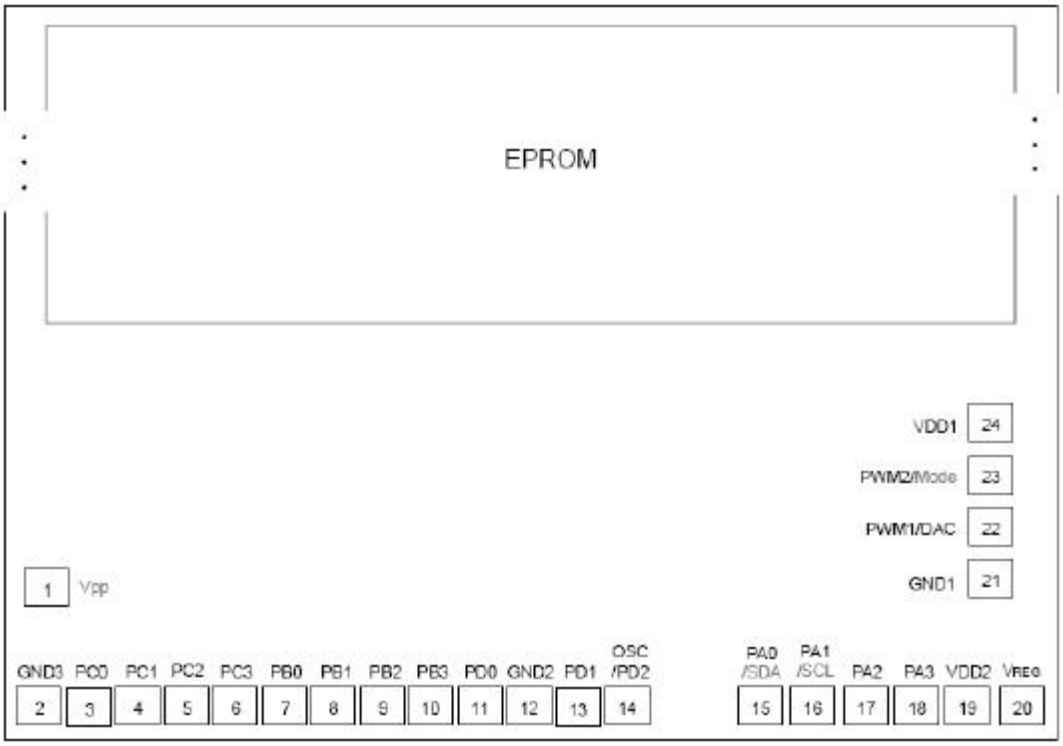
(3) INT-R, PWM *(OSC/PE3 is optioned as OSC pad)*



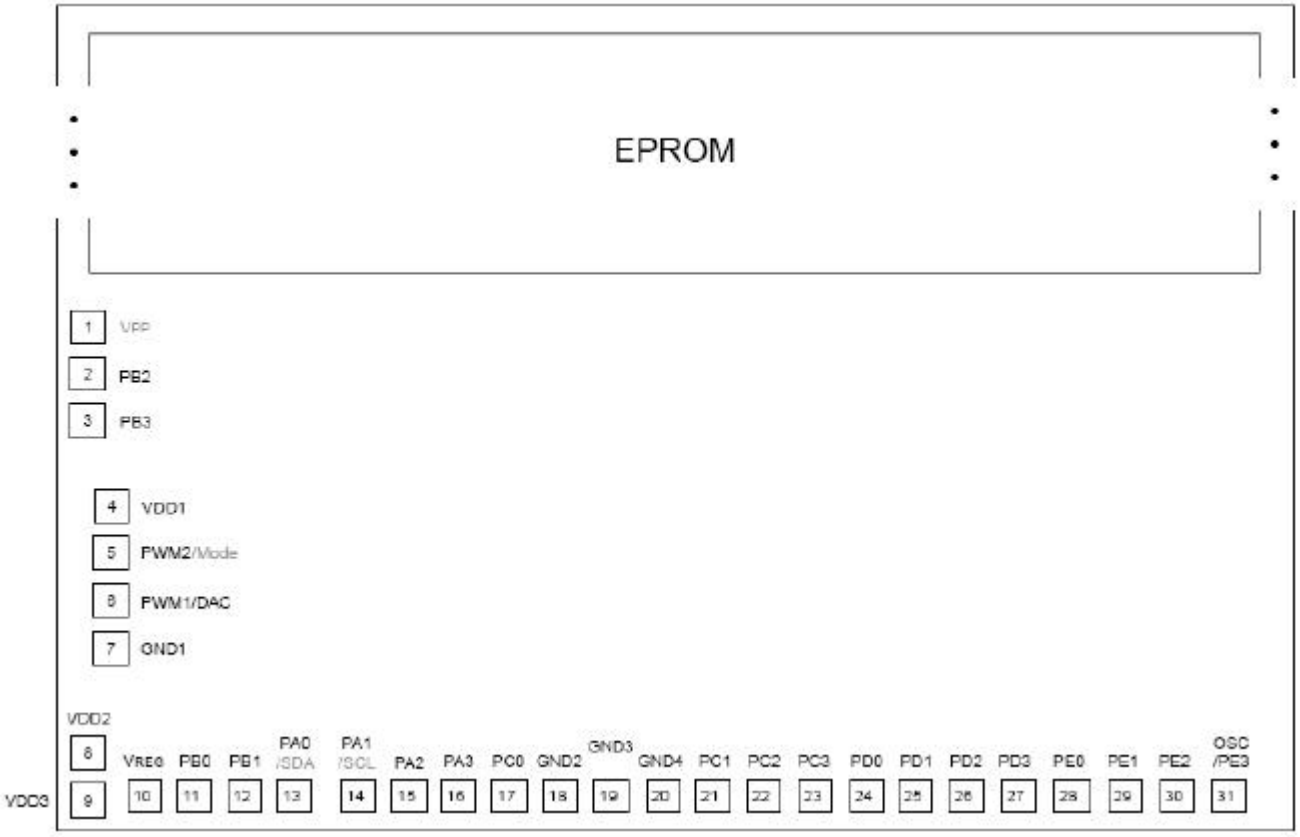
Note: At high voltage of 4.5V or higher voltage, V_{REG} maybe need to connect to GND with a 0.1uF cap for less power noise. At 3V, V_{REG} don't need to connect aYX capacitor and can be kept this pad floating to save a capacitor.

11. DIE PAD DIAGRAM

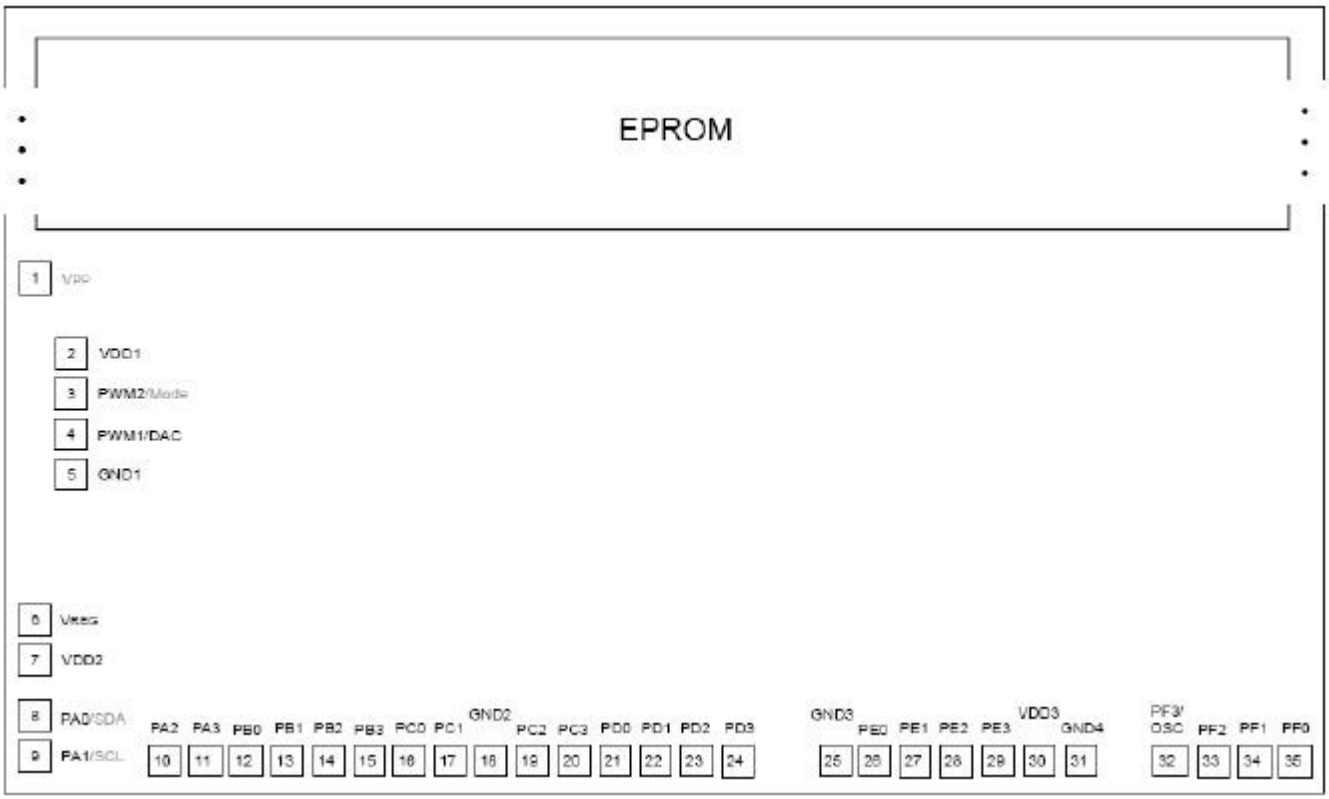
11.1 YX5P025A, YX5P055A, YX5P085A



11.2 YX5P185A, YX5P345A

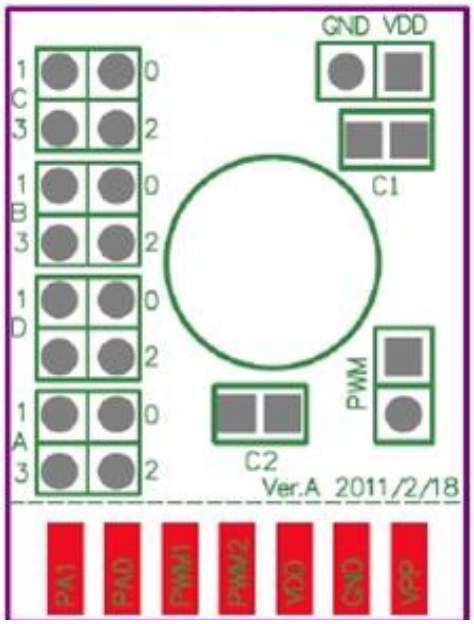


11.3 YX5P520A

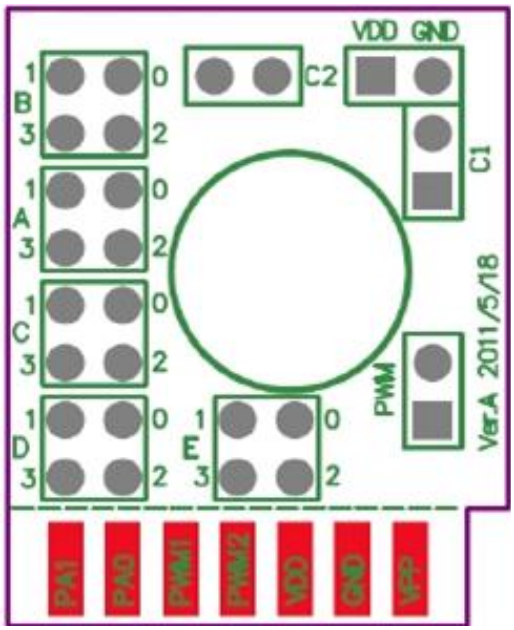


12. COB PIN ASSIGNMENT

YX5P025AB, YX5P055AB, YX5P085AB *(15 I/O)*

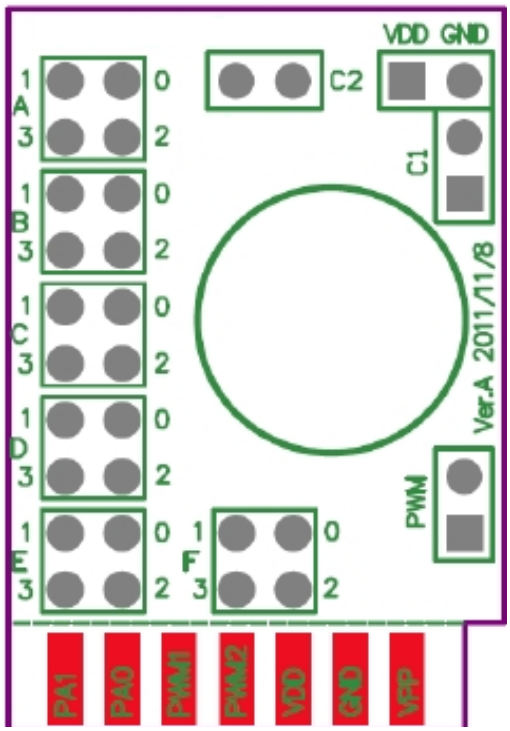


YX5P185AB, YX5P345AB *(20 I/O)*



Note: C1 is VDD power cap, C2 is Vreg cap.

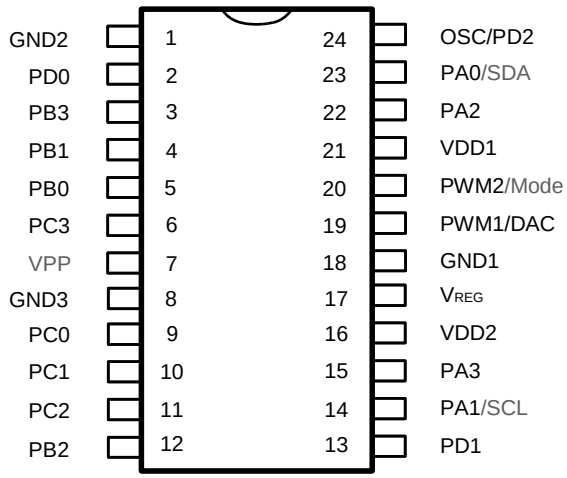
YX5P520AB *(24 I/O)*



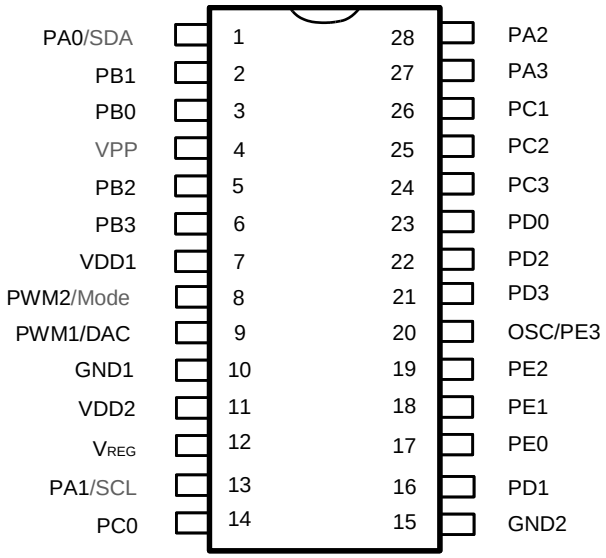
Note: C1 is VDD power cap, C2 is Vreg cap.

13. PACKAGE PIN ASSIGNMENT

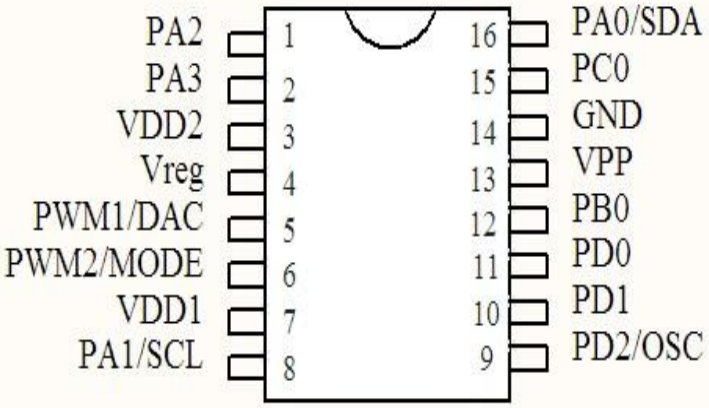
24-pin SOP (300mil)



28-pin SOP (300mil)

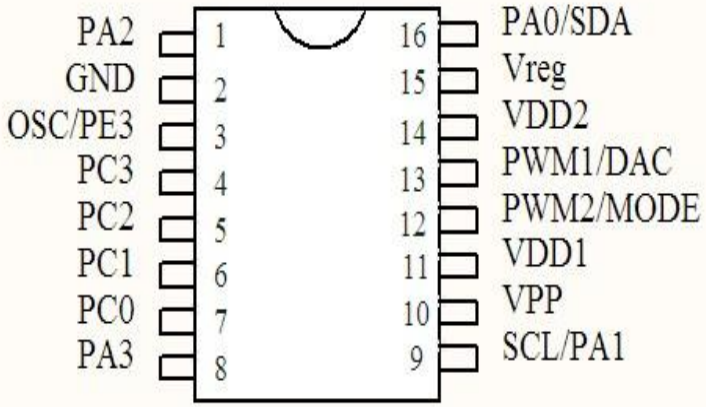


DIP16(300mil) / SOP16(150mil)



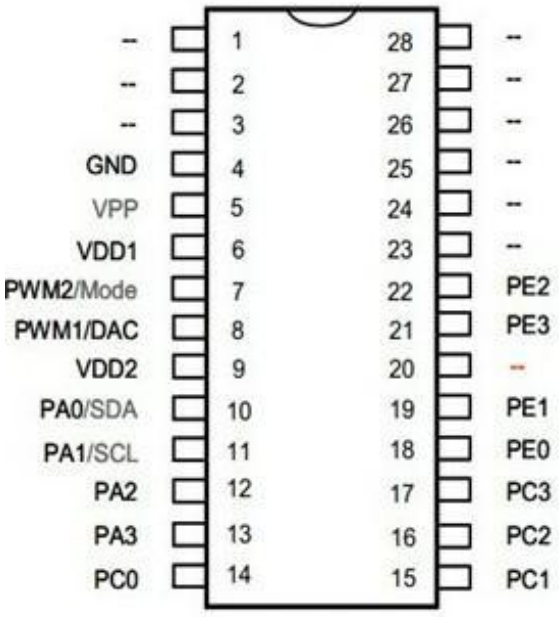
YX5P025A
YX5P055A
YX5P085A

16-pin DIP (300mil)



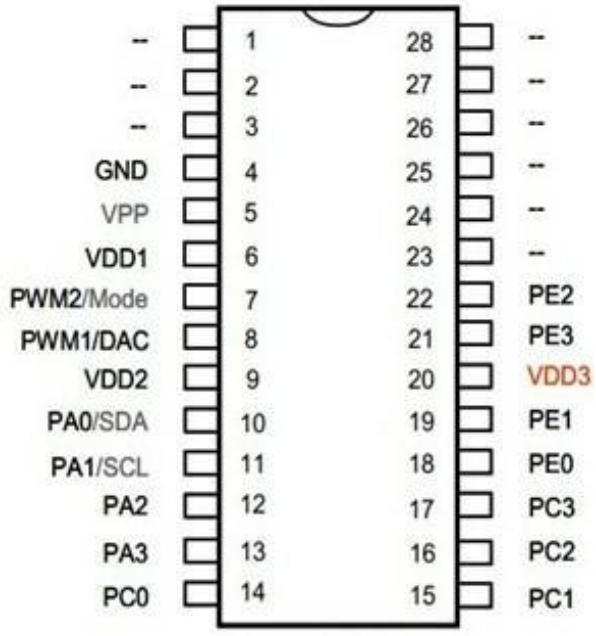
YX5P185A

28-pin SOP (300mil)



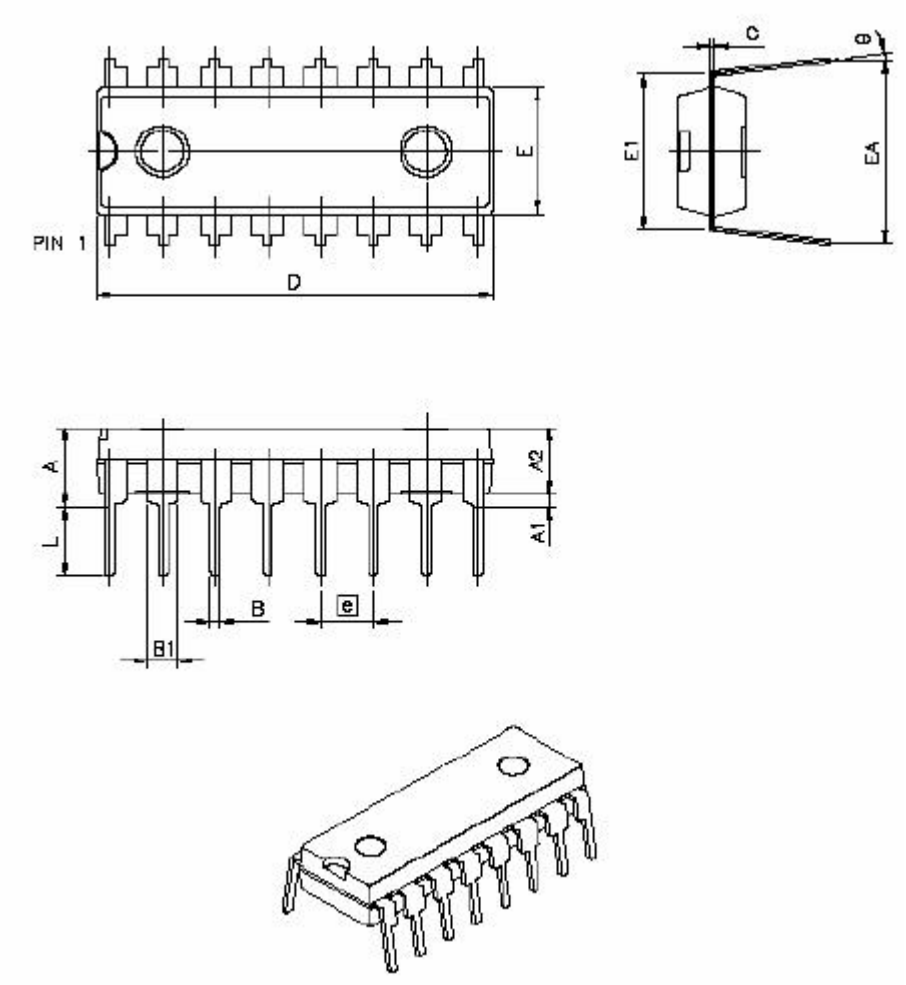
YX5P345A

28-pin SOP (300mil)



YX5P520A

14. PACKAGE DIMENSION

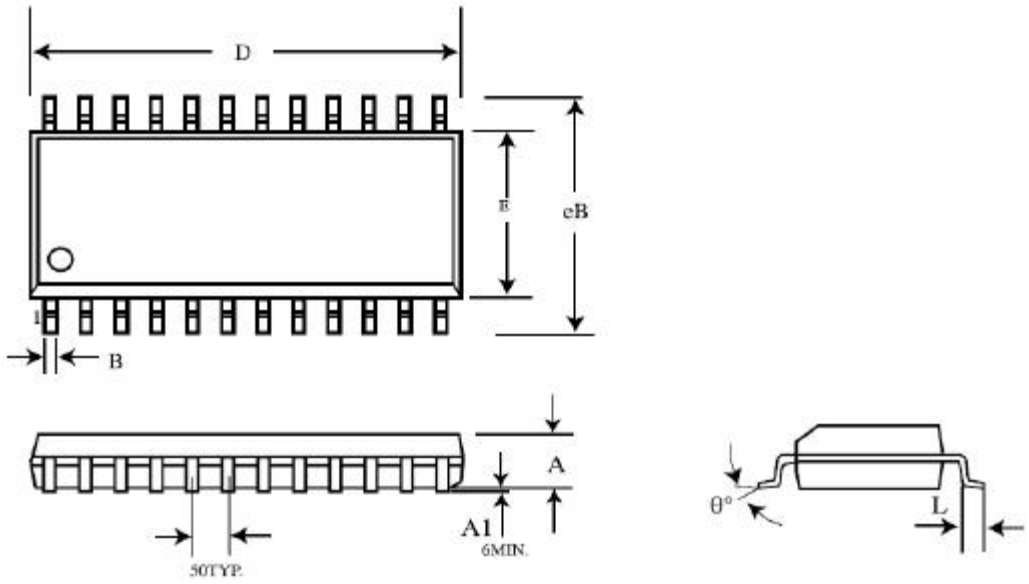


16-Pin 300mil P-DIP Package

SYMBOL	DIMENSION IN INCH	DIMENSION IN MM
A	0.170 MAX.	4.318 MAX.
A1	0.015 MIN.	0.381 MIN.
A2	0.130±0.005	3.302±0.127
B	0.018 TYP.	0.457 TYP.
B1	0.060 TYP.	1.524 TYP.
C	0.010 NOM.	0.254 NOM.
D	0.752±0.005	19.101±0.127
E	0.252±0.005	6.401±0.127
E1	0.300±0.010	7.62±0.254
EA	0.355±0.020	9.017±0.508
e	0.100 TYP.	2.540 TYP.
L	0.130±0.010	3.302±0.254
θ	0°~15°	0°~15°

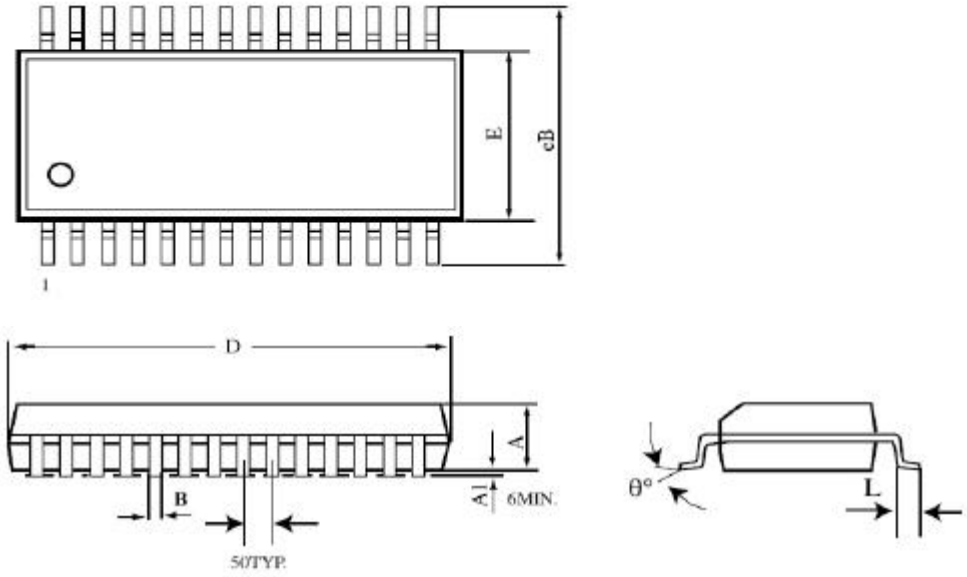
NOTE:
1.DIMENSION D & E DOES NOT INCLUDE FLASH.

24-Pin Plastic SOP (300 mil)



Sym.	Dimension in mils			Dimension in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	98	100	102	2.489	2.540	2.591
A1	6	- - -	- - -	0.152	- - -	- - -
B	12	16	20	0.305	0.406	0.508
D	606	608	610	15.392	15.443	15.494
E	298	300	302	7.569	7.620	7.671
eB	406	410	414	10.312	10.414	10.516
L	25	- - -	- - -	0.635	- - -	- - -
θ°	0°	4°	8°	0°	4°	8°

28-Pin Plastic SOP (300 mil)



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°

15. ORDERING INFORMATION

P/N	Shipping Type	Remarks
YX5P025A	Die	Empty ROM data
YX5P025A-xxxx *1	Die	Programmed ROM data
YX5P025A *1	SOP-16	Width 150 mil
YX5P025AB	DIP-16	Width 300 mil
YX5P025AS24	SOP-24	Width 300 mil
YX5P055A	SOP-16	Empty ROM data
YX5P055A-xxxx *1	DIP-16	Programmed ROM data
YX5P055AW-xxxx *1	Wafer	Programmed ROM data
YX5P055AB	COB	20.3mm x 22.1mm (20.3mm x 27.3mm w/ V-Cut)
YX5P055AS24	SOP-24	Width 300 mil
YX5P085A	Die	Empty ROM data
YX5P085A-xxxx *1	Die	Programmed ROM data
YX5P085AW-xxxx *1	DIP-16	Width 300 mil
YX5P085AB	COB	20.3mm x 22.1mm (20.3mm x 27.3mm w/ V-Cut)
YX5P085AS24	SOP-24	Width 300 mil
YX5P185A	DIP16	Width 300 mil
YX5P185A-xxxx *1	Die	Programmed ROM data
YX5P185AW-xxxx *1	Wafer	Programmed ROM data
YX5P185AB	COB	22.1mm x 22.1mm (22.1mm x 27.3mm w/ V-Cut)
YX5P185AS28	SOP-28	Width 300 mil
YX5P345A	Die	Empty ROM data
YX5P345A-xxxx *1	Die	Programmed ROM data
YX5P345AW-xxxx *1	Wafer	Programmed ROM data
YX5P345AB	COB	22.1mm x 22.1mm (22.1mm x 27.3mm w/ V-Cut)
YX5P345AS28	SOP-28	Width 300 mil
YX5P520AS28	SOP-28	Width 300 mi
YX5P520A-xxxx *1	Die	Programmed ROM data
YX5P520AW-xxxx *1	Wafer	Programmed ROM data
YX5P520AB	COB	22.1mm x 27.6mm (22.1mm x 32.5mm w/ V-Cut)