



九齊科技股份有限公司  
Nyquest Technology Co., Ltd.

DATA SHEET

# NY9UP08A

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## Learning Remote Controller with 13 I/O

**Version 1.0**

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## Revision History

<i>Version</i>	<i>Date</i>	<i>Description</i>	<i>Modified Page</i>
1.0	2019/05/30	Formal release.	-

## 1. 概述

NY9UP08A產品為學習型遙控器的4位元微控制器，為崙入EPROM以及EEPROM架構的OTP/MTP IC。NY9UP08A有13根I/O並支援T-type按鍵矩陣。大電流的紅外線埠可以無需外加元器件即能完成發射與接收功能。使用RISC精簡指令集架構，共有51條指令，可以很方便地以程式控制完成不同的應用。提供待機模式(Halt mode)，可大幅度延長電池壽命。

## 2. 功能

- + 工作電壓範圍：2.0V ~ 3.6V。
- + 4-bit RISC 精簡指令集架構的微控制器，共有51條指令。
- + 8K x 10-bit OTP ROM。
- + 1K x 8-bit MTP ROM。
- + 440 x 4-bit RAM，支援間接定址模式。
- + 2MHz 指令頻率。
- + 提供待機模式(Halt mode)，可節省功耗，靜態電流(Isb)小於1uA @3.0V。
- + 在 2.0V ~ 3.6V 工作電壓與 -20°C ~ +70°C 的環境下，具有精準的 +/-1.0% 內阻震盪。
- + 提供上電重置功能(POR=1.7V)。
- + 提供低壓復位(LVR=1.7V)、看門狗計時(WDT)。
- + 兩種中斷輸入可連結到一組獨立的堆棧(Stack)，並有多種中斷來源可以使用。
- + 13根彈性的I/O腳 (PAx, PBx, PCx, PD0)，可設定為bi-direction I/O with pull-high。
- + 支援M-type、T-type或混合型態的按鍵喚醒。
- + 紅外線埠提供 RX和TX應用，TX可選配大電流紅外線載波輸出。
- + 12位元的可讀計時器可以選擇時鐘源，提供給IR的TX載波頻率與RX學習型計數器使用。
- + 提供可程式的Code資料保護模式。(當Security-Bit 被燒斷後，資料將無法讀取。)

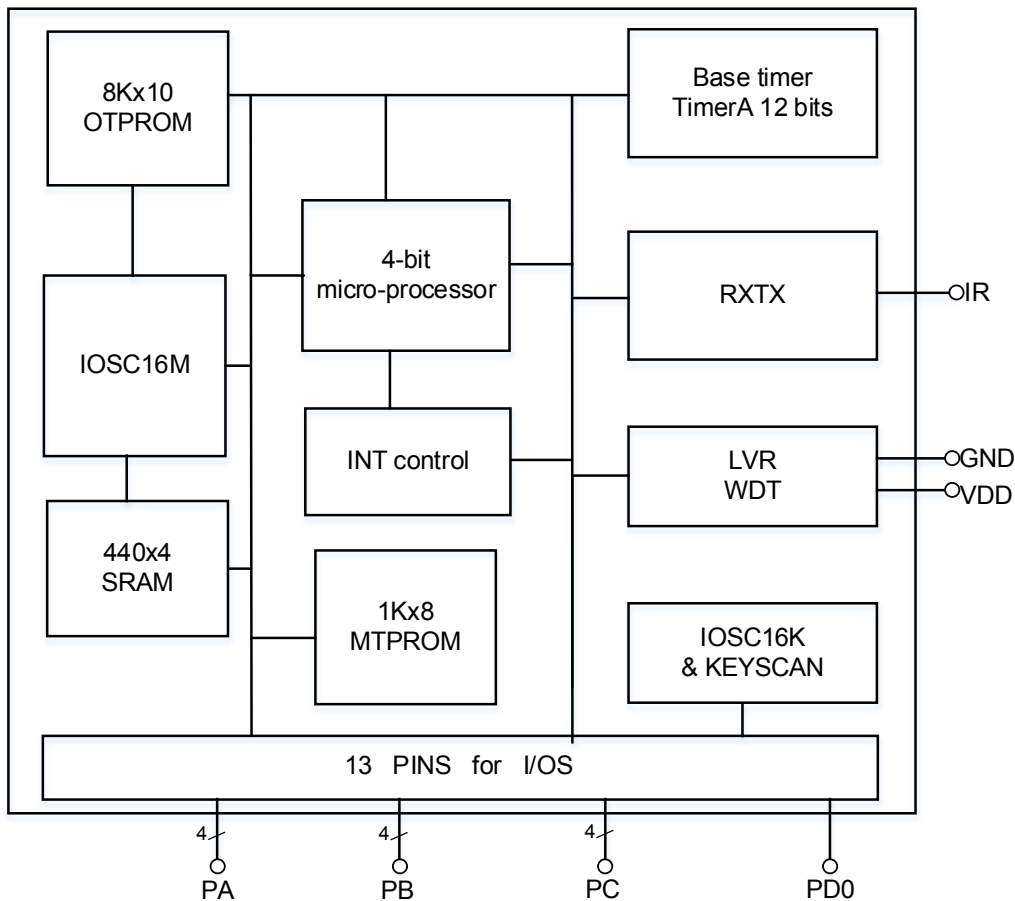
## 1. GENERAL DESCRIPTION

The NY9UP08A is a powerful 4-bit MCU with remote controller. It has 13 I/O ports and supports T-type key matrix. One large sink current IR port can fulfill transmitting and receiving function without any bipolar transistor. The RISC MCU architecture is very easy to use, and various applications can be easily implemented. There are 51 instructions, and most of them are executed in single cycle. Furthermore, it provides the HALT mode (sleep mode) to extend battery life.

## 2. FEATURES

- + Operating voltage range: 2.0V to 3.6V.
- + 4-bit RISC type micro-controller with 51 instructions.
- + 8Kx10-bit OTP ROM
- + 1Kx8-bit MTP ROM
- + 440x4-bit RAM, indirect RAM addressing mode is supported.
- + 2MHz instruction frequency.
- + HALT mode to save power, standby current <math><1\mu\text{A}</math> @3V.
- + Precisely embedded oscillator with build-in resistor, +/- 1.0% deviation in 2.0V~3.6V and -20°C~+70°C.
- + Low voltage reset (LVR=1.7V) and watch-dog reset are all supported to protect the system.
- + 2.2V LVD flag for low battery detection.
- + 2 entrances for interrupt operation with an independent stack, multiple interrupt sources.
- + 13 flexible I/Os.
- 13 I/Os of PAX, PBX, PCX and PD0 with function: bi-direction I/O with pull-high.
- + M-Type, T-type or mixed type key wakeup supported.
- + Infrared port provides RX application, and large current IR carrier output for TX.
- + 12-bit readable Timer0 with selectable timer clock source for IR TX carrier frequency and RX learning counter.
- + Programmable code protection is provided. (When the Security-Bit is burnt down, data can't be read.)

### 3. BLOCK DIAGRAM



### 4. PAD DESCRIPTION

Pad	ATT	Description
VDD	Power	Positive power.
GND	Power	Negative power.
IR	O	Infrared port (TX).
PA0/Vpp	I/O	Bit 0 for Port A, or positive high power for programming.
PA1/Mode	I/O	Bit 1 for Port A, or select programming mode.
PA2/SCL	I/O	Bit 2 for Port A, or serial clock input at programming mode.
PA3/SDA	I/O	Bit 3 for Port A, or serial data input at programming mode.
PB0~3	I/O	PA0~3, PB0~3, PC0~3, PD0: 13 bi-direction I/Os with pull-high. Port can be set as normal I/O or key scan I/O, and key scan I/O can send key scan signal under halt mode. And PA3 and PD0 can be set as no waking up function IO through option.
PC0~3	I/O	
PD0	I/O	

## 5. MEMORY ORGANIZATION

The NY9UP08A has 8K words OTP ROM, 1K bytes MTP ROM, 440 nibbles of RAM and some dedicated system control register. The registers are divided into normal system registers and 7 nibbles of Multi-function registers. The detail is shown in Figure 5-2 .

### 5.1 ROM

A program data single ROM is provided and its structure is shown below. The reserved region contains system information and can't be utilized by users.

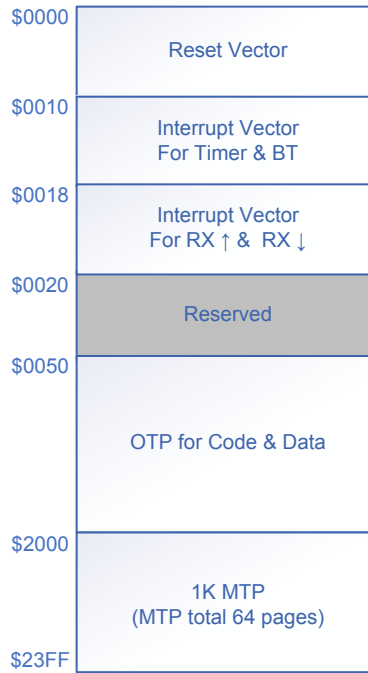


Figure 5-1 NY9UP08A ROM Map

5.2 RAM

NY9UP08A provide 440 nibbles RAM space. the address for RAM is 0x08~0x1BF. The first space from 0x08 to 0x3F is function RAM space, it only needs one-word instruction operation. And the second space from 0x40 to 0x1BF is data RAM space; the related operation is two-word instruction.

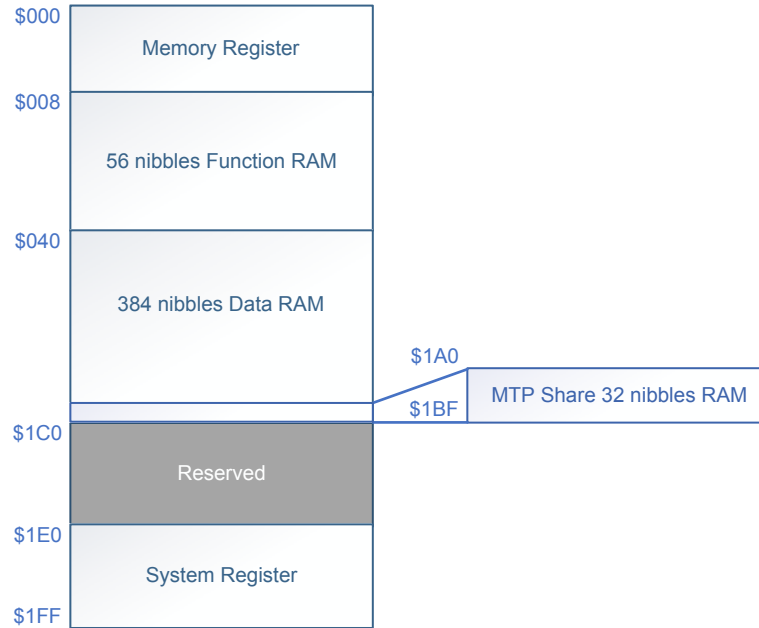


Figure 5-2 NY9UP08A RAM Map

In addition to the immediate addressing mode, the indexed addressing mode is also supported. The address of the indexed RAM should be stored into RPT2, RPT1 and RPT0 first, and users can read from or write in the XMD0 memory register to realize the indexed RAM access.

And the RAM space from \$1A0 to \$1BF is MTP page data store place which need to dump to MTP when page programming.

6. INTERNAL OSCILLATOR

The system clock is 1MHz which is fast enough for most of applications. The clock generator is a Ring oscillator, and users can only select the internal resistor oscillation (INT-R). The INT-R oscillator accuracy is up to ± 0.5%, and the deviation is ± 1.0% in the full range of 2.0V~3.6V VDD and -20°C~+70°C temperature.

## 7. SYSTEM RESET

### 7.1 System Power-On & Power-Down

After power-on, the power-on reset initialization will automatically be set out. The system takes 16ms to leave from the reset initialization procedure and enters the normal operation and the program counter (PC) will start at the reset vector to execute the desired program.

### 7.2 Low Voltage Reset & Detection (LVR & LVD)

When the system enters the normal operation, the power voltage must be kept in an effective working voltage range. If the power voltage is lower than the effective working voltage range, the system will work improperly.

To prevent the system crash, NY9UP08A supplies Low Voltage Reset (LVR) detectors. Once the LVR detector detects a harmful low voltage supply, it will cause a low voltage reset. The so-called “low voltage reset” point of the NY9UP08A IC is about 1.7V. The Low Voltage Detection (LVD) is an advanced detection of supply voltage. The LVD flag is read only and will be set to “0” if the supply voltage is lower than VLVD; otherwise, set to “1”.

### 7.3 Watch-Dog Timer (WDTR)

To recover from program malfunction, the NY9UP08A IC supports an embedded watch-dog timer reset. The WDTR function always works with the program executing. Users have to clear the WDT periodically to prevent from timing up with a reset generation. Typically, the minimum time-up period of the WDT is about 0.45s. The WDT can be cleared by instruction CWDT1 next to CWDT0 only.

## 8. I/O PORTS

The pull-high resistor of all the I/O ports is about 125KΩ @3V for key matrix function usually.

There are 13 I/O ports, designated as PAX, PBx, PCx, PD0, and x=0~3. All ports are IO (bi-direction) with pull-high, and users can set I/O functions by I/O registers. And when the chip is running, the status can be changed by I/O register control.

The table below shows the relation between them.

Category	PX register write 1	PX register write 0
PAX PBx PCx PD0 (x=0~3)	input with pull-high	output low

The pull-high resistor of all the I/O ports is about 125KΩ @3V for key matrix function usually.

PA3 and PD0 can be controlled by option to enable or disable wakeup function.



## 9. Infrared Transmitter/Receiver

The NY9UP08A provides an independent pin (IR) for infrared transmit/receiver block, which is used to send or receive infrared signal. For the function of transmitter, users can set a variety of IR carrier frequency by the given clock source (TM0CS), 8-bit duty value(TM0\_DutH, TM\_DutL) and 12-bit IR Timer0 value(TM0\_H, TM0\_M, TM0\_L). As for the detailed calculation of IR carrier frequency and applications, refer to section 3.8, IR control register. For the receiver, the external BJT is no longer needed. Users can utilize the RX falling edge flag (RXFF) or RX rising edge flag (RXRF) interrupt mechanism through register INT0/INTF0 or read received data directly through IRCTRL[3] to apply for the desired program.

## 10. POWER SAVING MODE

The relationship between power saving mode, reset & normal mode is shown below.

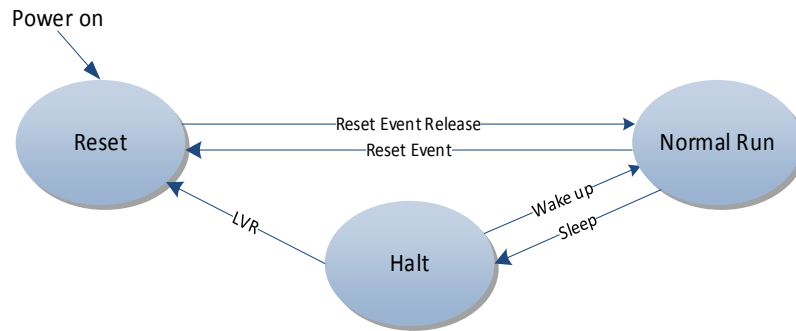


Figure 10-1 Power Saving Mode Flow Diagram

### 10.1 Halt Mode

The system enters the halt mode if the HALT command executed. The halt mode is also known as the sleep mode. As implied by the name, the IC falls asleep and the system clock is completely turned off, so all the IC functions are halted and it minimizes the power consumption.

The only way to wake-up the sleeping system is an input port wake-up. The IC keeps monitoring the input pads during the halt mode. If the input status of any input pad changes to low, the system will be woken-up. Then the succeeding instructions after the HALT instruction will be executed after the wake-up stable time (about 60us). So before executing the HALT instruction, users have to keep in mind that the input port status is high.

If the IC is waked-up from the halt mode by the occurrence of LVR, it goes into the reset procedure.

### 10.2 T-type Scan Mode

In T-type scanning application, each port (PA~PD) can be selected as scan key independently by option PXX (X=A~C, x=0~3) & PD0. It works as input with pull-high resistor and output fixed frequency low pulse in halt mode. Any of the keys touch would cause system wake-up.

Meanwhile, the frequency of key scan can be adjusted by option codes, such as about 15.625Hz, 31.25Hz, 62.5Hz and 125Hz.

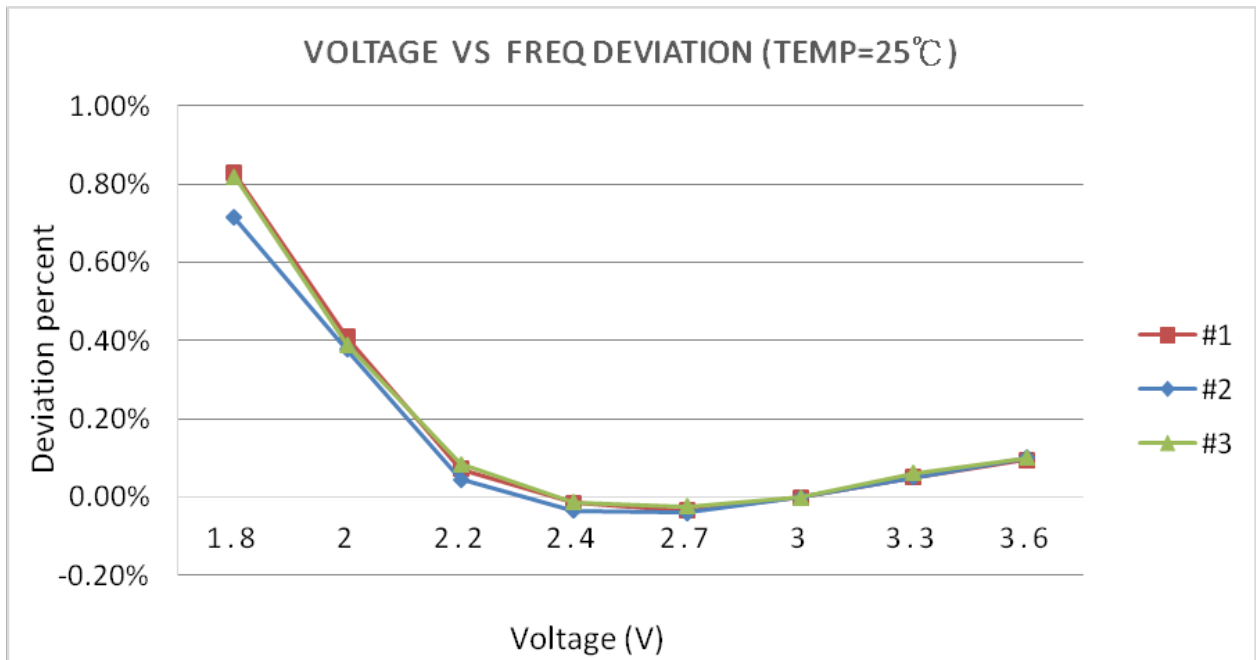
**11. ELECTRICAL CHARACTERISTICS**
**11.1 Absolute Maximum Rating**

Symbol	Parameter	Rated Value	Unit
V <sub>DD</sub> - V <sub>SS</sub>	Supply voltage	-0.3 ~ +4.0	V
V <sub>IN</sub>	Input voltage	V <sub>SS</sub> -0.3V ~ V <sub>DD</sub> +0.3	V
T <sub>OP</sub>	Operating Temperature	-20 ~ +70	°C
T <sub>ST</sub>	Storage Temperature	-40 ~ +85	°C

**11.2 DC Characteristics**
*(V<sub>DD</sub>=3.0V, T<sub>A</sub>=25°C, unless otherwise)*

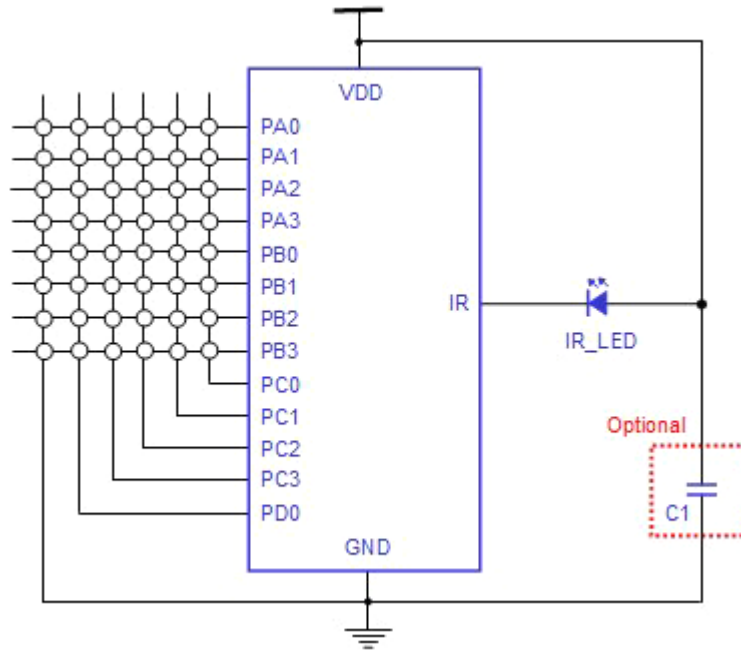
Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
V <sub>DD</sub>	Operating voltage	2.0	3	3.6	V	1 MHz
I <sub>SB</sub>	Supply current	Halt mode		1	uA	Sleep, no load
I <sub>Scan</sub>		Scan mode		2	uA	T-type key scan
I <sub>OP</sub>		Operating mode		1		mA
V <sub>IH</sub>	Input high level		0.7*V <sub>DD</sub>		V	
V <sub>IL</sub>	Input low level		0.5*V <sub>DD</sub>		V	
I <sub>IL</sub>	Input current (Internal 125KΩ pull-high)		24		uA	V <sub>IL</sub> = 0V
I <sub>OH</sub>	Output high current		-9		mA	V <sub>OH</sub> = 2.0V
I <sub>OL</sub>	Output low current		18		mA	V <sub>OL</sub> = 1.0V
I <sub>IR</sub>	IR sink current		450		mA	V <sub>IR</sub> = 1.5V
D <sub>cap</sub>	IR Capture distance		15		cm	V <sub>dd</sub> =3.0V, related to IRLED level1>5cm; level2>10cm; level3>15cm; (default) level4>20cm;
ΔF/F	Frequency lot deviation	-1.0		1.0	%	V <sub>DD</sub> : 2.0V ~ 3.6V, Temp: -20°C ~ +70°C

11.3 Voltage vs. Frequency

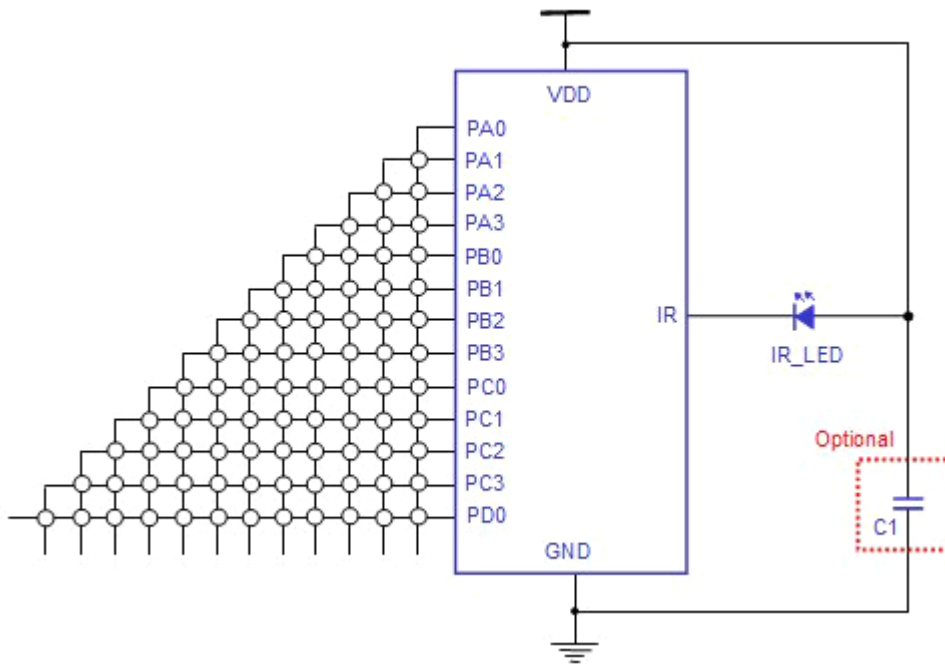


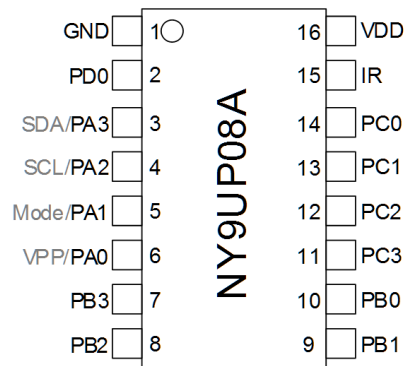
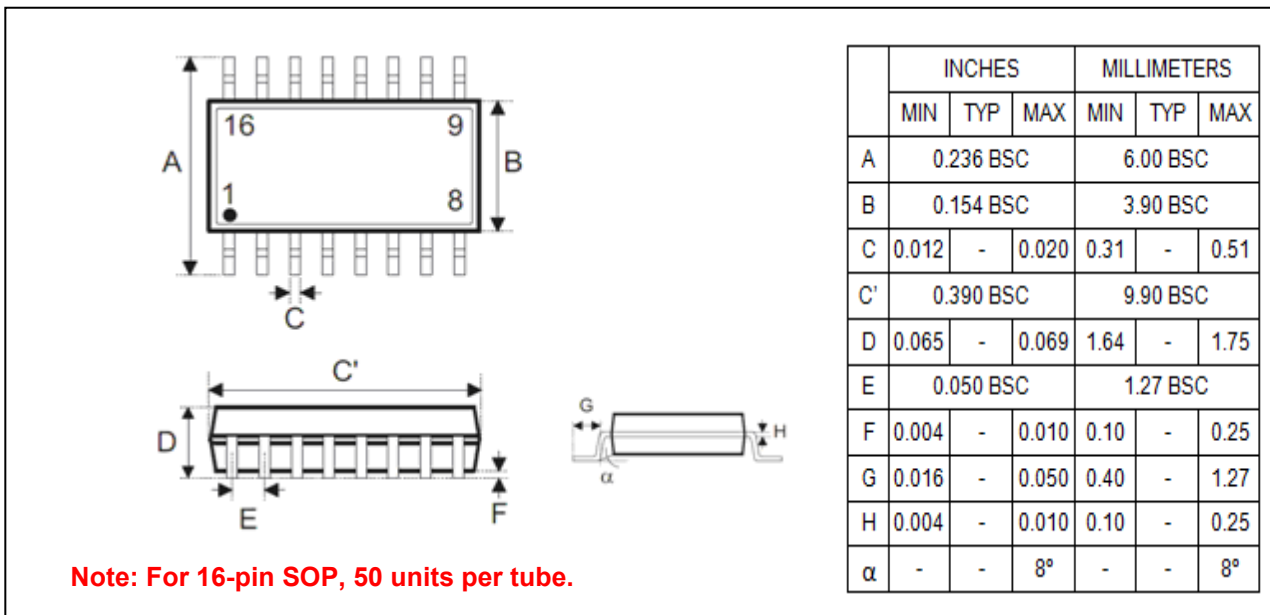
12. APPLICATION

(1) M-type Key Scan Keyboard (Matrix)



(2) T-type Key Scan Keyboard (T-Scan)



**13. PACKAGE PIN ASSIGNMENT**

**14. PACKAGE DIMENSION**

**15. ORDERING INFORMATION**

P/N	Shipping Type	Remarks
NY9UP08AW-xxxx *1	Wafer	Programmed ROM data
NY9UP08AS16	SOP-16, Width 150 mil	<u>Tape &amp; Reel</u> : 2.5K pcs per Reel <u>Tube</u> : 50 pcs per Tube

\*1 "xxxx": Code number